



United States Department of Agriculture,  
Natural Resources Conservation Service  
and Forest Service

In cooperation with  
United States Department of the Interior,  
Bureau of Indian Affairs and  
Bureau of Land Management, and  
Montana Agricultural Experiment Station

# Soil Survey of Missoula County Area, Montana Part I





# How To Use This Soil Survey

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This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, which is the color map preceding the detailed soil maps, the survey area is 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 general 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** in Part I of this survey for a general description of the soils in your area.

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 unit symbols that are in that area. Turn to the **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

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

A **State Soil Geographic Data Base (STATSGO)** is available for this survey area. This data base consists of a soils map at a scale of 1 to 250,000 and descriptions of groups of associated soils. It replaces the general soil map published in older soil surveys. The map and the data base can be used for multicounty planning, and map output can be tailored for a specific use. More information about the State Soil Geographic Data Base for this survey area, or any portion of Montana, is available at the local office of the Natural Resources Conservation Service.

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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 has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the United States Department of Agriculture, Natural Resources Conservation Service and Forest Service; the United States Department of the Interior, Bureau of Land Management and Bureau of Indian Affairs; and the Montana Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Missoula County Conservation District. Financial assistance was provided by the Forest Service, the Champion International Corporation, and the Missoula County Commissioners in cooperation with the Missoula County Conservation District, the Bureau of Land Management, the Montana Department of State Lands, and the Burlington Northern Corporation.

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

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

**Cover: Areas of Repp very gravelly loam are mainly on the high mountains in the background. These soils formed in colluvium derived from argillite and limestone. Winkler very gravelly sandy loam and Winkler gravelly loam are mainly in the forested areas on the mountains. These soils formed in colluvium derived from quartzite and argillite. Areas of Half Moon silt loam, which formed in glaciolacustrine deposits from ancient Glacial Lake Missoula, are in the foreground.**

# Contents

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## Part I

<b>Index to taxonomic units</b> .....	iv
<b>Index to map units</b> .....	v
<b>Summary of tables</b> .....	ix
<b>Foreword</b> .....	xi
How this survey was made .....	1
General nature of the survey area .....	2
History .....	2
Transportation facilities .....	3
Drainage and physiography .....	3
General geology and geologic formation .....	4
Climate .....	4
<b>General soil map units</b> .....	9
Map unit descriptions .....	9
<b>Formation and classification of the soils</b> .....	15
<b>Soil series and detailed soil map units</b> .....	23
<b>References</b> .....	135
<b>Glossary</b> .....	137

## Part II

<b>Detailed soil map unit legend</b> .....	v
<b>Summary of tables</b> .....	viii
<b>Agronomy</b> .....	7
Cropland limitations and hazards .....	7
Crop yield estimates .....	8
Land capability classification .....	9

Prime farmland and other important farmland ...	10
Erosion factors .....	11
Windbreaks and environmental plantings .....	11
<b>Range</b> .....	39
Range condition .....	40
Rangeland management .....	40
Forest land understory vegetation .....	41
<b>Forest land</b> .....	71
Woodland ordination system .....	72
Forest land management and productivity .....	73
<b>Recreation</b> .....	103
<b>Wildlife habitat</b> .....	119
Elements of wildlife habitat .....	119
Kinds of wildlife habitat .....	119
Wildlife in the Missoula County area .....	120
<b>Engineering</b> .....	123
Building site development .....	123
Sanitary facilities .....	124
Waste management .....	125
Construction materials .....	126
Water management .....	127
<b>Soil properties</b> .....	185
Engineering index properties .....	185
Physical and chemical properties .....	186
Water features .....	188
Soil features .....	189
<b>References</b> .....	285
<b>Glossary</b> .....	287

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# Index to Taxonomic Units

---

Alberton series . . . . .	24	Jimlake series . . . . .	74
Ambrant series . . . . .	25	Lantern series . . . . .	76
Aquepts . . . . .	27	Lolopeak series . . . . .	79
Aquic Haploxerolls . . . . .	27	Lubrecht series . . . . .	80
Aquic Udorthents . . . . .	28	Mitten series . . . . .	82
Aquolls . . . . .	29	Moiese series . . . . .	84
Argixerolls . . . . .	30	Orthents . . . . .	85
Auggie series . . . . .	32	Ovando series . . . . .	86
Bata series . . . . .	33	Perma series . . . . .	87
Beeskove series . . . . .	35	Perma variant . . . . .	89
Bigarm series . . . . .	37	Petty series . . . . .	91
Biglake series . . . . .	40	Phillcher series . . . . .	95
Bignell series . . . . .	41	Repp series . . . . .	96
Borohemists . . . . .	44	Rochester series . . . . .	99
Chickaman series . . . . .	44	Rumblecreek series . . . . .	100
Coerock series . . . . .	46	Selway series . . . . .	101
Courville series . . . . .	47	Sharrott series . . . . .	104
Crow series . . . . .	49	Shooflin series . . . . .	105
Desmet series . . . . .	51	Tally variant . . . . .	106
Elkner series . . . . .	52	Tevis series . . . . .	107
Evaro series . . . . .	53	Totelake series . . . . .	110
Felan series . . . . .	55	Trapps series . . . . .	112
Glaciercreek series . . . . .	58	Turrah series . . . . .	113
Glaciercreek variant . . . . .	59	Udifluents . . . . .	115
Grantsdale series . . . . .	60	Udorthents . . . . .	115
Grassvalley series . . . . .	61	Upsata series . . . . .	116
Greenough series . . . . .	64	Waldbillig series . . . . .	118
Hagstadt series . . . . .	65	Whitore series . . . . .	122
Half Moon series . . . . .	66	Wildgen series . . . . .	124
Hanaker series . . . . .	67	Winfall series . . . . .	127
Haploxerolls . . . . .	68	Winkler series . . . . .	128
Hollandlake series . . . . .	69	Xerofluents . . . . .	132
Holloway series . . . . .	71	Yourame series . . . . .	133

# Index to Map Units

---

1—Alberton very fine sandy loam, 0 to 2 percent slopes.....	25	23—Bignell gravelly loam, 8 to 30 percent slopes.....	42
2—Ambrant gravelly sandy loam, 15 to 30 percent slopes.....	26	24—Bignell-Winkler, cool, complex, 30 to 60 percent slopes.....	42
3—Ambrant-Rochester, warm-Rock outcrop complex, 30 to 60 percent slopes.....	26	25—Bignell, warm-Winkler complex, 30 to 60 percent slopes.....	43
4—Aquic Haploxerolls, 0 to 2 percent slopes.....	28	26—Borohemists, 0 to 2 percent slopes.....	44
5—Aquic Udorthents, 0 to 2 percent slopes.....	28	27—Chickaman silt loam, 8 to 30 percent slopes.....	45
6—Aquolls and Aquepts, 0 to 2 percent slopes.....	29	28—Chickaman silt loam, 30 to 60 percent slopes.....	46
7—Argixerolls-Haploxerolls complex, 0 to 4 percent slopes.....	30	29—Coerock-Rock outcrop complex, 4 to 30 percent slopes.....	47
8—Argixerolls-Haploxerolls complex, 4 to 15 percent slopes.....	31	30—Coerock-Rock outcrop complex, 50 to 80 percent slopes.....	47
9—Argixerolls-Haploxerolls complex, 15 to 30 percent slopes.....	31	31—Courville gravelly silt loam, 8 to 30 percent slopes.....	48
10—Argixerolls-Haploxerolls complex, 30 to 60 percent slopes.....	32	32—Courville-Mitten gravelly silt loams, 30 to 60 percent slopes.....	49
11—Auggie silt loam, 4 to 15 percent slopes.....	33	33—Crow silt loam, 4 to 15 percent slopes.....	50
12—Bata gravelly silt loam, cool, 2 to 8 percent slopes.....	34	34—Desmet loam, 0 to 2 percent slopes.....	51
13—Bata-Waldbillig gravelly silt loams, 4 to 30 percent slopes.....	34	35—Elkner-Ovando complex, 8 to 30 percent slopes.....	53
14—Beeskove gravelly loam, 30 to 60 percent slopes.....	36	36—Evaro gravelly loam, 8 to 30 percent slopes.....	54
15—Beeskove-Rock outcrop complex, 50 to 80 percent slopes.....	36	37—Evaro gravelly loam, 30 to 60 percent slopes.....	54
16—Bigarm gravelly loam, 0 to 4 percent slopes.....	38	38—Felan gravelly silt loam, 8 to 30 percent slopes.....	56
17—Bigarm gravelly loam, 4 to 15 percent slopes.....	38	39—Felan gravelly silt loam, 30 to 60 percent slopes.....	56
18—Bigarm gravelly loam, 15 to 30 percent slopes.....	38	40—Felan gravelly silt loam, cool, 8 to 30 percent slopes.....	57
19—Bigarm gravelly loam, 30 to 60 percent slopes.....	39	41—Felan gravelly silt loam, cool, 30 to 60 percent slopes.....	57
20—Bigarm-Rock outcrop complex, 30 to 60 percent slopes.....	39	42—Glaciercreek gravelly silt loam, 0 to 4 percent slopes.....	58
21—Biglake gravelly sandy loam, 8 to 15 percent slopes.....	40	43—Glaciercreek variant-Glaciercreek complex, 4 to 20 percent slopes.....	59
22—Biglake gravelly sandy loam, 15 to 30 percent slopes.....	41	44—Grantsdale loam, 0 to 2 percent slopes.....	61

45—Grassvalley silty clay loam, 0 to 4 percent slopes.....	62	66—Lolopeak bouldery loam, 50 to 80 percent slopes.....	79
46—Grassvalley silty clay loam, 4 to 8 percent slopes.....	62	67—Lolopeak-Rock outcrop complex, 50 to 80 percent slopes.....	80
47—Grassvalley silty clay loam, 8 to 15 percent slopes.....	63	68—Lubrecht silt loam, 4 to 15 percent slopes.....	81
48—Grassvalley silty clay loam, 15 to 30 percent slopes.....	63	69—Mitten gravelly silt loam, 30 to 60 percent slopes.....	83
49—Greenough silt loam, 4 to 15 percent slopes.....	64	70—Mitten-Sharrott, cool, complex, 15 to 40 percent slopes.....	83
50—Hagstadt silt loam, 4 to 25 percent slopes.....	65	71—Mitten-Tevis complex, 30 to 60 percent slopes.....	84
51—Half Moon silt loam, 4 to 8 percent slopes.....	67	72—Moiese gravelly loam, 0 to 2 percent slopes.....	85
52—Hanaker silt loam, 0 to 6 percent slopes.....	68	73—Orthents, 0 to 4 percent slopes.....	86
53—Hollandlake gravelly loam, 4 to 30 percent slopes.....	70	74—Ovando-Elkner-Rock outcrop complex, 30 to 60 percent slopes.....	87
54—Hollandlake-Bata complex, 4 to 30 percent slopes.....	70	75—Perma gravelly loam, 0 to 4 percent slopes.....	88
55—Hollandlake-Bata complex, 30 to 60 percent slopes.....	71	76—Perma gravelly loam, 20 to 45 percent slopes.....	89
56—Holloway gravelly silt loam, 8 to 30 percent slopes.....	72	77—Perma stony loam, 2 to 12 percent slopes.....	89
57—Holloway gravelly silt loam, 30 to 60 percent slopes.....	73	78—Perma variant stony silt loam, 2 to 8 percent slopes.....	90
58—Holloway gravelly silt loam, cool, 8 to 30 percent slopes.....	73	79—Perma variant-Perma complex, 4 to 30 percent slopes.....	91
59—Holloway gravelly silt loam, cool, 30 to 60 percent slopes.....	73	80—Petty gravelly loam, 8 to 30 percent slopes.....	92
60—Holloway-Rock outcrop complex, 50 to 80 percent slopes.....	74	81—Petty gravelly loam, 30 to 60 percent slopes.....	93
61—Jimlake gravelly silt loam, 4 to 30 percent slopes.....	76	82—Petty bouldery loam, 30 to 60 percent slopes.....	93
62—Jimlake gravelly silt loam, 30 to 60 percent slopes.....	76	83—Petty gravelly loam, cool, 8 to 30 percent slopes.....	93
63—Lantern gravelly sandy loam, 8 to 30 percent slopes.....	77	84—Petty bouldery loam, cool, 50 to 80 percent slopes.....	94
64—Lantern gravelly sandy loam, 30 to 60 percent slopes.....	78	85—Petty, cool-Rock outcrop complex, 50 to 80 percent slopes.....	94
65—Lantern-Rock outcrop complex, 50 to 80 percent slopes.....	78	86—Phillcher silt loam, 4 to 30 percent slopes.....	95

87—Phillcher-Rock outcrop complex, 50 to 80 percent slopes . . . . .	96	109—Trapps gravelly loam, 30 to 60 percent slopes . . . . .	113
88—Pits, gravel . . . . .	96	110—Turrah silty clay loam, 0 to 2 percent slopes . . . . .	114
89—Repp very gravelly loam, 30 to 60 percent slopes . . . . .	97	111—Udifluvents, 0 to 2 percent slopes . . . . .	115
90—Repp very gravelly loam, cool, 8 to 30 percent slopes . . . . .	98	112—Udorthents-Glaciercreek complex, 0 to 8 percent slopes . . . . .	116
91—Repp very gravelly loam, cool, 30 to 60 percent slopes . . . . .	98	113—Upsata gravelly fine sandy loam, 2 to 8 percent slopes . . . . .	117
92—Repp-Rock outcrop complex, 50 to 80 percent slopes . . . . .	99	114—Urban land . . . . .	117
93—Riverwash . . . . .	99	115—Waldbillig gravelly silt loam, 4 to 30 percent slopes . . . . .	118
94—Rock outcrop-Rubble land complex . . . . .	100	116—Waldbillig gravelly silt loam, 30 to 60 percent slopes . . . . .	119
95—Rumblecreek gravelly loam, 4 to 30 percent slopes . . . . .	101	117—Waldbillig-Auggie complex, 4 to 15 percent slopes . . . . .	119
96—Selway gravelly sandy loam, 8 to 30 percent slopes . . . . .	102	118—Waldbillig-Holloway gravelly silt loams, 8 to 30 percent slopes . . . . .	120
97—Selway gravelly sandy loam, 30 to 60 percent slopes . . . . .	103	119—Waldbillig-Holloway gravelly silt loams, 30 to 60 percent slopes . . . . .	120
98—Selway bouldery sandy loam, 30 to 60 percent slopes . . . . .	103	120—Waldbillig-Holloway gravelly silt loams, cool, 8 to 30 percent slopes . . . . .	121
99—Sharrott-Rock outcrop complex, 4 to 30 percent slopes . . . . .	104	121—Waldbillig-Holloway gravelly silt loams, cool, 30 to 60 percent slopes . . . . .	121
100—Shooflin silt loam, 4 to 15 percent slopes . . . . .	106	W—Water . . . . .	122
101—Tally variant sandy loam, 0 to 4 percent slopes . . . . .	107	122—Whitore gravelly clay loam, 8 to 30 percent slopes . . . . .	123
102—Tevis gravelly loam, 30 to 60 percent slopes . . . . .	108	123—Whitore gravelly clay loam, 30 to 60 percent slopes . . . . .	123
103—Tevis-Mitten complex, 8 to 30 percent slopes . . . . .	108	124—Wildgen gravelly loam, 4 to 30 percent slopes . . . . .	124
104—Tevis-Mitten-Rock outcrop complex, 45 to 70 percent slopes . . . . .	109	125—Wildgen-Winkler, cool, gravelly loams, 15 to 30 percent slopes . . . . .	125
105—Totelake gravelly loam, 2 to 8 percent slopes . . . . .	110	126—Wildgen-Winkler, cool, gravelly loams, 30 to 60 percent slopes . . . . .	125
106—Totelake gravelly loam, 8 to 30 percent slopes . . . . .	111	127—Wildgen, dry-Winkler complex, 15 to 30 percent slopes . . . . .	126
107—Totelake extremely stony loam, 2 to 8 percent slopes . . . . .	111	128—Wildgen, dry-Winkler complex, 30 to 60 percent slopes . . . . .	127
108—Trapps gravelly loam, 8 to 30 percent slopes . . . . .	112		

---

129—Winfall gravelly loam, 4 to 30 percent slopes .....	128	133—Winkler gravelly loam, cool, 30 to 60 percent slopes .....	131
130—Winkler very gravelly sandy loam, 8 to 30 percent slopes .....	129	134—Winkler-Rubble land complex, 50 to 80 percent slopes .....	131
131—Winkler very gravelly sandy loam, 30 to 60 percent slopes .....	130	135—Winkler, cool-Rock outcrop complex, 50 to 80 percent slopes.....	131
132—Winkler gravelly loam, cool, 8 to 30 percent slopes .....	130	136—Xerofluvents, 0 to 2 percent slopes.....	132
		137—Yourame gravelly loam, 4 to 30 percent slopes .....	134

# Summary of Tables

---

## Part I

Temperature and precipitation .....	5
Freeze dates in spring and fall .....	7
Growing season .....	8
Classification of the soils .....	18
Acreage and proportionate extent of the soils .....	20

## Part II (For page numbers, see "Summary of Tables" in Part II)

Classification of the soils

Acreage and proportionate extent of the soils

Main cropland limitations and hazards

Land capability and yields per acre of crops and pasture

Prime farmland

Rangeland productivity and characteristic plant communities

Understory vegetation and habitat types

Forest land management

Forest land productivity

Main forest access road limitations and hazards

Recreational development

Building site development

Sanitary facilities

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Construction materials

Water management

Engineering index properties

Physical properties of the soils

Chemical properties of the soils

Water features

Soil features

# Foreword

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This soil survey contains information that can be used in land-planning programs in the Missoula County Area, Montana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, 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.

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.

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# Soil Survey of Missoula County Area, Montana

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Fieldwork by Arial Anderson, Barry L. Dutton, W.D. Harrison, Harold E. Hunter, J.T. Parcell, Leon T. Stem, and David J. Trochlell, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service and Forest Service,  
in cooperation with the United States Department of the Interior, Bureau of Indian Affairs and Bureau of Land Management, and the Montana Agricultural Experiment Station

## 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 or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate 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 and for engineering tests. 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, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

## General Nature of the Survey Area

The survey area is in the west-central part of Montana (fig. 1). The total land area is 1,281,500 acres, or 1,929 square miles. Missoula County is about 65 miles from the northern boundary to the southern boundary and is about 60 miles from the eastern to western boundaries. The elevation is approximately 3,200 feet above sea level at the city of Missoula and ranges from 3,000 feet in the western part of the survey area, along the Clark Fork River, to 9,356 feet on Holland Peak in the northeastern part.

## History

The earliest inhabitants of the survey area were the Indians who camped in the summer while crossing the mountains to hunt buffalo. The Salish tribe occupied both sides of the Continental Divide until about the year 1700, when they were pushed westward by the Crow and Shoshone tribes.

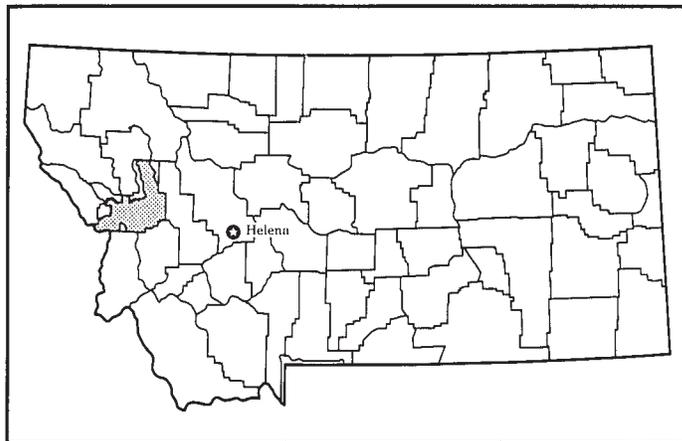


Figure 1.—Location of Missoula County Area in Montana.

In 1803, the Louisiana Purchase was negotiated with France. In 1805, Lewis and Clark began their trip through the Northwest to the Pacific Ocean. Members of the Lewis and Clark Expedition were the first Europeans documented in the area. They camped at the junction of Lolo Creek and the Bitterroot River on September 9, 1805, and they named the spot "Travellers-rest."

When the Oregon Territory was organized in 1843, it included western Montana. In December 1860, Missoula County was formed from part of Spokane County, which had been part of the Washington Territory. In 1863, Missoula County became part of the Idaho Territory. When the Montana Territory was organized in 1864, Missoula County came to include all the area west of the Continental Divide. It was one of the original nine counties in the Montana Territory.

On February 2, 1865, the Montana Territorial Legislature officially established Missoula County and named the town of Hellgate as the county seat. The original county had an area of approximately 25,250 square miles, or about 17 percent of the Montana Territory. Since then, Ravalli, Lake, Sanders, Granite, and Mineral Counties and parts of Flathead and Powell Counties have been formed from the original Missoula County.

The city of Missoula was established in 1865, when Worden and Company built a sawmill and grist mill at its present location. The new town was originally called Missoula Mills, but later the last word was dropped. In 1866, the county seat was moved from Hellgate to Missoula.

In 1883, the Northern Pacific railway was completed from Miles City to Missoula. It tied the survey area into the northwestern rail system. Until the railway was

completed, the closest outlet to eastern markets was about 275 miles away at Fort Benton on the Missouri River.

Montana was granted statehood in 1889. The University of Montana, located at Missoula, was established in 1895.

Once the railroad was completed as far west as Wallace, Idaho, logging in the survey area became a viable source of revenue. The railroad also provided an expanded market for agricultural products.

Shortly after the turn of the century, the agricultural industry began to expand rapidly. The first irrigation systems were constructed during this period. They proved that a variety of high-yield crops could be grown in areas where an adequate supply of irrigation water was available.

The population of Missoula County has increased in recent decades. In 1950, it was 35,493, but by 1992, it had grown to 82,416.

### **Transportation Facilities**

The Missoula County area is served by several county, State, and Federal highways. One major railroad also serves the county. Modern bridges span the Clark Fork, Blackfoot, and Bitterroot Rivers at several locations. Airline passenger service, both commercial and general, is available in the survey area. Bus service is also available.

### **Drainage and Physiography**

The Missoula County area is in the Northern Rocky Mountains. It is drained by the Clark Fork River and its principal drainageways, including the Bitterroot, Blackfoot, Clearwater, and Jocko Rivers and Ninemile Creek. Most of the Ninemile Creek drainageway, however, is outside the survey area.

The drainageways reflect a complex physiographic history. The Clark Fork River originates outside the survey area in the Silver Bow Mountains, about 18 miles southwest of Butte. It flows northward through the broad alluvium- and lakebed-filled Deer Lodge Valley for about 40 miles. Near Garrison, in Powell County, it abruptly turns to the northwest and flows through a relatively narrow, rock-cut valley in the eastern part of Missoula County. At Hellgate, near the city of Missoula, it flows through the wide, sediment-filled Missoula Valley for about 25 miles to the city of Huson. West of Huson, it flows through a narrow, rock-cut, gorgelike valley in the western part of Missoula County.

The Bitterroot River flows into Missoula County from the south and joins the Clark Fork River a short distance downstream from the city of Missoula. It flows through a wide, sediment-filled valley bounded by high mountains.

The Blackfoot River drains the northeastern part of Missoula County. It flows west across the wide Ovando-Helmville Valley to Clearwater Junction, where it joins its principal tributary, the Clearwater River. It then cuts through the mountains along a narrow, rock-cut canyon to join the Clark Fork River at Bonner, just east of Missoula.

Ninemile Creek drains the extreme northwestern part of Missoula County. It flows toward the southeast in a wide, sediment-laden valley separated by high mountain ridges. The southwestern ridge is known as Ninemile Divide; the northeastern ridge is not named. Ninemile Creek joins the Clark Fork River between the cities of Alberton and Huson.

The drainageways in Missoula County are generally bounded by the rugged mountain ranges that make up most of the land area.

The Garnet Range is in the eastern part of Missoula County. It rises 1,900 to 2,500 feet above the Clark Fork Valley, and the crest is between 5,414 and 6,800 feet above sea level.

The mountain range north of the Missoula Valley rises to an elevation of about 8,000 feet above sea level. North of this range, in the northern part of Missoula County, the rugged Mission and Swan Mountain Ranges rise to an elevation of nearly 10,000 feet above sea level.

The south-central part of Missoula County is bounded by the Sapphire Range. This range is south of the Clark Fork River and east of the Bitterroot River Valley. It rises 2,000 to more than 4,000 feet above the floor of the Bitterroot Valley, to an elevation of 5,000 to 7,000 feet above sea level.

The southwestern boundary of Missoula County is formed by the Bitterroot Range. This range is south of the Clark Fork Valley and west of the Bitterroot River Valley. It rises more than 6,000 feet above the valley floor. It commonly has high peaks that rise to an elevation of more than 9,000 feet above sea level.

The western and northwestern boundaries of Missoula County are formed by the Grave Creek Range and the Ninemile Range.

The mountainous areas south of the Blackfoot and Clark Fork Rivers have rounded crests and are dissected by narrow, steep-sided stream valleys that are cut in bedrock. On the higher, steeper slopes, rock outcrops are common.

The mountainous areas north of the Clark Fork and Blackfoot Rivers have been glaciated. They include the mountains north of the Missoula Valley, the Mission and Swan Ranges, the Clearwater drainageway and Clearwater Valley, and the Swan Valley. A small area of the Bitterroot Mountains was also glaciated along the border with Idaho.

During the Pleistocene stages of glaciation, the Cordillerian ice sheet dammed the mouth of the gorges of the Clark Fork River near the Idaho border. The ice formed a dam about 2,000 feet high that backed up water and formed Glacial Lake Missoula. The lake extended into Missoula County and reached a maximum elevation of about 4,200 feet above sea level, or about 1,000 feet above the present elevation of the city of Missoula. Deposits from the lakebed consist principally of silty material and fine sand. Although much of the sediment has eroded, areas of these deposits are exposed along the Clark Fork River.

### General Geology and Geologic Formation

The survey area has had a long and complex geologic history, which has resulted in a variety of rock types that were acted upon by many geomorphic processes. These rocks range in age from Precambrian, or Beltian, to recent. All of the Mesozoic sedimentary sections are missing, however. Paleozoic rocks are exposed only in the Garnet Range and in two small areas in the western part of the survey area. Most of the soils in mountainous areas are underlain by Beltian sediment. In the southeastern part of Missoula County, Beltian and Paleozoic rocks are intruded by granodiorite. Some Tertiary volcanic rock occurs locally. The major valleys in the survey area are filled with Tertiary lakebed sediment, Pleistocene silt from Glacial Lake Missoula, and recent alluvium. Pleistocene glacial deposits are in the Clearwater, Swan, and Blackfoot River drainageways.

*Precambrian deposition.*—The oldest exposed rocks in the survey area were deposited as sandy, clayey, and limy sediment in an ancient sea. This sea covered most of Montana northwest of Missoula more than 600 million years ago. As these deposits built up, heat and pressure hardened them predominantly into quartzite and argillite. The middle of the Precambrian section (Piegan Group) is composed of dolomite and sideritic limestone, argillite, and quartzite. The Precambrian rocks are among the oldest exposed sedimentary rocks in the world. They are represented by the Ravalli, Piegan, and Missoula Groups, which are commonly referred to as the "Belt rocks."

*Cambrian deposition.*—After the retreat of the Precambrian sea, another shallow sea developed southeast of Missoula. Although limestone and dolomite

are the major rock types, zones of argillite and quartzite also occur in this geologic section. The major geologic zones include the Maywood, Red Lion, Hasmark, Silverhill, and Flathead Formations.

*Cretaceous intrusion and uplift.*—Two dramatic events mark the Cretaceous period in Missoula County. About 75 million years ago, a large body of granite called the Idaho batholith was intruded beneath the southwestern part of the county. The heat of the intrusion metamorphosed local Belt rocks into gneiss and schist. Granite, gneiss, and schist are the most common rocks in the Lolo Creek area along the border with Idaho. Another area of granite (granodiorite) was intruded in the southeastern part of Missoula County, around Elk Creek and Ashby Creek.

Near the end of the Cretaceous period approximately 60 million years ago, the Rocky Mountains began their first period of active uplift. It was during this time that the survey area began to develop the landscape of high peaks and intermountain valleys that can be seen today.

### Climate

The three tables at the end of this section give climate data as recorded at Missoula and Seeley Lake, Montana, for the period 1961-90.

The total annual precipitation is 13.49 inches at Missoula and 21.44 inches at Seeley Lake. Of this, 45 percent usually falls in April through September. The growing season for most crops falls within this period. Thunderstorms occur on about 25 days each year.

The average seasonal snowfall is 52.5 inches at Missoula and 122.6 inches at Seeley Lake. At least 1 inch of snow is on the ground an average of 72 days at Missoula and 123 days at Seeley Lake.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 70 percent of the time possible in summer and 30 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 7 miles per hour, in spring.

Growing degree days, as shown in the table "Temperature and Precipitation," 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 of 40 degrees F.

TEMPERATURE AND PRECIPITATION

(Recorded in the period 1961-90 at Missoula and Seeley Lake, Montana)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with snowfall	
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	° F	° F	° F	° F	° F	Units	In	In	In	In	
MISSOULA:											
January----	29.6	14.8	22.2	50	-19	2	1.25	0.58	1.82	3	14.5
February---	36.8	20.3	28.5	56	-11	4	0.80	0.41	1.14	2	8.3
March-----	46.3	25.7	36.0	68	1	37	0.98	0.62	1.30	3	6.9
April-----	57.3	31.8	44.6	81	19	161	0.96	0.54	1.34	3	2.4
May-----	65.7	38.6	52.1	88	25	378	1.78	0.77	2.63	5	1.0
June-----	74.7	45.8	60.3	95	33	608	1.78	0.94	2.51	5	0.0
July-----	84.2	49.8	67.0	100	36	838	0.91	0.38	1.37	2	0.0
August-----	83.0	49.0	66.0	99	36	807	1.20	0.45	1.90	3	0.0
September--	70.6	40.2	55.4	92	24	464	1.12	0.37	1.74	3	0.0
October----	56.9	31.0	44.0	79	15	157	0.74	0.24	1.15	2	1.1
November---	40.4	24.0	32.2	62	0	18	0.81	0.47	1.11	2	6.0
December---	29.9	16.1	23.0	52	-17	2	1.17	0.64	1.63	3	12.3
Yearly:											
Average--	56.3	32.3	44.3	---	---	----	---	----	----	---	----
Extreme--	105	-30	---	101	-25	----	----	----	----	---	----
Total----	---	---	---	---	---	3,475	13.49	11.33	15.56	36	52.5

\* See footnote at end of table.

## TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature					Precipitation					
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with snowfall 0.10 inch or more	
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
<u>° F</u>	<u>° F</u>	<u>° F</u>	<u>° F</u>	<u>° F</u>	<u>Units</u>	<u>In</u>	<u>In</u>	<u>In</u>	<u>In</u>		
SEELEY LAKE:											
January----	30.0	9.9	20.0	49	-32	0	2.99	1.49	4.29	9	36.7
February---	37.7	14.1	25.9	56	-30	1	1.75	0.95	2.46	5	17.0
March-----	44.1	19.4	31.7	63	-15	10	1.56	0.86	2.18	5	15.0
April-----	53.8	27.0	40.4	77	10	86	1.30	0.56	1.92	4	5.0
May-----	63.2	34.3	48.8	84	21	275	1.85	0.99	2.61	5	1.0
June-----	72.2	41.1	56.7	91	29	495	2.14	0.95	3.16	5	0.0
July-----	81.3	43.0	62.2	95	30	685	1.06	0.46	1.70	3	0.0
August-----	81.2	42.0	61.6	96	30	669	1.30	0.42	2.03	4	0.0
September--	69.8	35.4	52.6	89	21	381	1.43	0.41	2.26	4	0.0
October----	57.5	29.5	43.5	79	12	147	1.30	0.46	1.99	4	1.1
November---	39.7	22.3	31.0	61	-5	12	2.04	1.14	2.83	6	15.2
December---	30.0	12.8	21.4	49	-29	0	2.72	1.58	3.73	9	31.6
Yearly:											
Average--	55.0	27.6	41.3	---	---	---	---	---	---	---	---
Extreme--	101	-45	---	97	-40	---	---	---	---	---	---
Total----	---	---	---	---	---	2,765	21.44	17.50	24.54	63	122.6

\* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

## FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1961-90 at Missoula and Seeley Lake, Montana)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
<b>MISSOULA:</b>			
Last freezing temperature in spring:			
1 year in 10 later than--	May 8	May 22	June 15
2 years in 10 later than--	May 2	May 16	June 9
5 years in 10 later than--	Apr. 19	May 6	May 27
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 20	Sept. 11	Sept. 4
2 years in 10 earlier than--	Sept. 26	Sept. 16	Sept. 9
5 years in 10 earlier than--	Oct. 9	Sept. 27	Sept. 18
<b>SEELEY LAKE:</b>			
Last freezing temperature in spring:			
1 year in 10 later than--	May 16	June 15	July 22
2 years in 10 later than--	May 11	June 7	July 14
5 years in 10 later than--	May 2	May 25	June 29
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 14	Aug. 30	Aug. 10
2 years in 10 earlier than--	Sept. 21	Sept. 5	Aug. 16
5 years in 10 earlier than--	Oct. 4	Sept. 17	Aug. 29

## GROWING SEASON

(Recorded in the period 1961-90 at Missoula and  
Seeley Lake, Montana)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
<b>MISSOULA:</b>			
9 years in 10	143	118	89
8 years in 10	153	127	97
5 years in 10	172	143	113
2 years in 10	191	160	129
1 year in 10	202	169	137
<b>SEELEY LAKE:</b>			
9 years in 10	130	86	29
8 years in 10	138	95	40
5 years in 10	153	113	60
2 years in 10	168	132	80
1 year in 10	176	141	90

# General Soil Map Units

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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 soils or miscellaneous areas making up one 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 or miscellaneous areas can be identified on the map. Likewise, areas that 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.

The general soil map units in this survey have been grouped for broad interpretive purposes. Each of the broad groups and the map units in each group are described on the following pages.

The State Soil Geographic Data Base (STATSGO) for Montana is the base for the general soil map of the Missoula County area. The map symbols are the same as those used for the STATSGO map units. In each major soil group, only two or three major soils or miscellaneous areas in the map unit are listed for the map symbol. The textures given for the soils in the groups are for the fraction less than 2 millimeters (fine earth) of the particle-size class in the control section. For more information about the general soil map units, refer to the STATSGO map for Montana.

## Map Unit Descriptions

### Dominantly Soils and Miscellaneous Areas on Flood Plains, Stream Terraces, and Alluvial Fans

#### 232—Grantsdale-Moiese-Alberton

These soils are nearly level and very deep. They formed in alluvium. Grantsdale soils are well drained

and are on stream terraces. They are loamy in the upper part and sandy in the lower part. Moiese soils are excessively drained and are sandy. They are on alluvial fans and stream terraces. Alberton soils are somewhat excessively drained and are loamy. They are on stream terraces.

#### 233—Grassvalley-Desmet-Alberton

These soils are nearly level and very deep. Grassvalley soils are well drained and are clayey. They formed in glaciolacustrine deposits on lake plains. Desmet and Alberton soils are loamy. They formed in alluvium on stream terraces. Desmet soils are well drained, and Alberton soils are somewhat excessively drained.

#### 288—Moiese-Bigarm-Xerofluvents

These soils are nearly level or gently sloping and are very deep. They formed in alluvium. Moiese soils are excessively drained and are sandy. They are on alluvial fans and stream terraces. Bigarm soils are somewhat excessively drained and are loamy. They are on stream terraces. Xerofluvents are somewhat poorly drained to well drained and are sandy or loamy. They are on flood plains and are frequently flooded.

#### 592—Urban Land-Moiese-Alberton

This unit is mostly in nearly level areas. Urban land consists of areas in which most of the soil has been covered by asphalt, concrete, or buildings and the exposed soils have been highly disturbed. Moiese and Alberton soils are very deep. They formed in alluvium. Moiese soils are excessively drained and are sandy. They are on alluvial fans and stream terraces. Alberton soils are somewhat excessively drained and are loamy. They are on stream terraces.

#### 667—Xerofluvents-Riverwash-Water

This unit is on flood plains and is frequently flooded. Xerofluvents are very deep. They are somewhat poorly drained to well drained and are loamy or sandy. They formed in alluvium. Riverwash consists of areas that are frequently reworked by water that has sandy, silty,

clayey, or gravelly sediments. These areas support little or no vegetation.

### **Dominantly Soils and Miscellaneous Areas on Mountains, Moraines, Hills, and Stream Terraces**

#### **39—Beeskove-Repp-Felan**

These soils are strongly sloping to very steep and are very deep. They are well drained, are loamy, and have numerous rock fragments. The soils formed in colluvium derived from argillite and limestone. They are on mountains. Felan soils have a surface layer that was influenced by volcanic ash.

#### **43—Bigarm-Haploxerolls-Bignell**

These soils are steep or very steep, are very deep, and have numerous rock fragments. They are on hills and mountains. Bigarm soils are somewhat excessively drained and are loamy. They formed in alluvium or colluvium. Haploxerolls are well drained to excessively drained and are sandy or loamy. They formed in alluvium. Bignell soils are well drained and are clayey. They formed in alluvium.

#### **45—Bignell-Yourame-Perma**

These soils are steep or very steep, are very deep, and have numerous rock fragments. Bignell soils are well drained and are clayey. They formed in alluvium on hills and mountains. Yourame soils are well drained and are loamy. They formed in alpine till on moraines. Perma soils are somewhat excessively drained and are loamy. They formed in alluvium on hills.

#### **46—Bignell-Crow-Greenough**

These soils are moderately sloping to very steep, very deep, and well drained. They formed in alluvium on hills and mountains. Bignell soils are clayey and have numerous rock fragments. Crow soils are clayey. Greenough soils are loamy.

#### **402—Mitten-Winkler-Tevis**

These soils are steep or very steep and are very deep. They are somewhat excessively drained, are loamy, and have numerous rock fragments. They formed in colluvium derived from argillite and quartzite on mountains. Mitten soils have a surface layer that was influenced by volcanic ash.

#### **435—Ovando-Elkner-Ambrant**

These soils are moderately steep to very steep and are very deep. They are on mountains. Ovando soils

are excessively drained, are sandy, and have numerous rock fragments. They formed in igneous colluvium. Elkner and Ambrant soils are somewhat excessively drained and are loamy. Elkner soils formed in igneous colluvium. Ambrant soils formed in colluvium derived from granite.

#### **445—Perma-Wildgen-Yourame**

These soils are moderately steep to very steep and are very deep. They are loamy and have numerous rock fragments. Perma soils are somewhat excessively drained. They formed in alluvium on hills. Wildgen and Yourame soils are well drained. They formed in alpine till on moraines.

#### **446—Perma-Hanaker**

These soils are nearly level to strongly sloping and are very deep. They are on stream terraces. Perma soils are somewhat excessively drained, are loamy, and have numerous rock fragments. They formed in alluvium. Hanaker soils are well drained and are loamy. They formed in glaciolacustrine deposits.

#### **473—Repp-Whitore-Winkler**

These soils are steep or very steep and are very deep. They are loamy and have numerous rock fragments. The soils formed in colluvium derived from argillite and limestone. They are on mountains. Repp and Whitore soils are well drained. Winkler soils are somewhat excessively drained.

#### **510—Rumblecreek-Winfall-Hollandlake**

These soils are moderately sloping to steep and are very deep. They are well drained. The soils are loamy and have numerous rock fragments. They formed in alpine till on moraines.

#### **566—Tevis-Bignell-Yourame**

These soils are strongly sloping to very steep and are very deep. They have numerous rock fragments. Tevis soils are somewhat excessively drained and are loamy. They formed in colluvium derived from argillite and quartzite. They are on mountains. Bignell soils are well drained and are clayey. They formed in alluvium on mountains. Yourame soils are well drained and are loamy. They formed in alpine till on moraines.

#### **634—Wildgen-Winfall-Rumblecreek**

These soils are strongly sloping to very steep and are very deep. They are well drained. The soils are loamy and have numerous rock fragments. They formed in alpine till on moraines.

**646—Winkler-Evaro-Tevis**

These soils are strongly sloping to very steep and are very deep. They are somewhat excessively drained, are loamy, and have numerous rocks. They are on mountains. Winkler soils formed in colluvium derived from argillite and limestone. Evaro and Tevis soils formed in colluvium derived from argillite and quartzite. Evaro soils have a surface layer that was influenced by volcanic ash.

**647—Winkler-Evaro-Rock Outcrop**

This unit is strongly sloping to very steep. It is on mountains. Winkler and Evaro soils are very deep and are somewhat excessively drained. They are loamy and have numerous rock fragments. Winkler soils formed in colluvium derived from argillite and limestone. Evaro soils formed in colluvium derived from argillite, limestone, and quartzite bedrock.

**648—Winkler-Tevis-Mitten**

These soils are moderately steep to very steep and are very deep. They are somewhat excessively drained, are loamy, and have numerous rock fragments. They are on mountains. Winkler soils formed in colluvium derived from argillite and limestone. Tevis and Mitten soils formed in colluvium derived from argillite and quartzite. Mitten soils have a surface layer that was influenced by volcanic ash.

**662—Repp-Yourame-Trapps**

These soils are moderately sloping to very steep and are very deep. They are well drained, are loamy, and have numerous rock fragments. Repp and Trapps soils formed in colluvium derived from argillite and limestone. They are on mountains. Yourame soils formed in alpine till. They are on moraines.

**684—Yourame-Greenough-Winkler**

These soils are moderately sloping to very steep and are very deep. Yourame soils are well drained, are loamy, and have numerous rock fragments. They formed in alpine till on moraines. Greenough soils are well drained and are loamy. They formed in alluvium on hills. Winkler soils are somewhat excessively drained, are loamy, and have numerous rock fragments. They formed in colluvium derived from argillite and limestone. They are on mountains.

**Dominantly Soils and Rock Outcrop on Moraines, Mountains, Cirque Basins, and Lake Plains****198—Felan-Winfall**

These soils are moderately sloping to very steep and are well drained. They are loamy and have numerous

rock fragments. Felan soils formed in colluvium derived from argillite and limestone. They are on mountains. They have a surface layer that was influenced by volcanic ash. Winfall soils formed in alpine till on moraines.

**280—Holloway-Mitten-Waldbillig**

These soils are moderately sloping to very steep and are very deep. They are loamy and have numerous rock fragments. They have a surface layer that was influenced by volcanic ash. Holloway and Mitten soils are somewhat excessively drained. They formed in colluvium derived from argillite and quartzite. They are on mountains. Waldbillig soils are well drained. They formed in alpine till on moraines.

**281—Holloway-Evaro-Mitten**

These soils are moderately sloping to very steep, very deep, and somewhat excessively drained. They are loamy and have numerous rock fragments. The soils formed in colluvium derived from argillite and quartzite. They are on mountains. They have a surface layer that was influenced by volcanic ash.

**283—Holloway-Rock Outcrop-Winkler**

This unit is strongly sloping to very steep and is on mountains. Holloway and Winkler soils are very deep and are somewhat excessively drained. They are loamy and have numerous rock fragments. They formed in colluvium derived from argillite and quartzite. Holloway soils have surface layer that was influenced by volcanic ash. The Rock outcrop consists mainly of argillite and quartzite bedrock.

**289—Jimlake-Bata-Auggie**

These soils are gently sloping to steep and are very deep. They are well drained. Jimlake and Bata soils are loamy and have numerous rock fragments. They formed in alpine till on moraines. They have a surface layer that was influenced by volcanic ash. Auggie soils are loamy. They formed in glaciolacustrine deposits on lake plains and moraines.

**322—Lantern-Chickaman-Lolopeak**

These soils are strongly sloping to very steep and are very deep. They are on mountains. Lantern and Chickaman soils are somewhat excessively drained. They formed in micaceous schist. Lantern soils are loamy and have numerous rock fragments. Chickaman soils are loamy and have a surface layer that was influenced by volcanic ash. Lolopeak soils are excessively drained, are sandy, and have numerous

rock fragments. They formed in colluvium derived from granite and gneiss. They have a surface layer that was influenced by volcanic ash.

#### **449—Petty-Lolopeak-Selway**

These soils are steep or very steep, are very deep, and have numerous rock fragments. They are on mountains. Petty soils are somewhat excessively drained and are loamy. They formed in material weathered from igneous rocks. Lolopeak soils are excessively drained and are sandy. They formed in colluvium derived from granite and gneiss. Selway soils are somewhat excessively drained and are loamy. They formed in igneous colluvium. Petty and Lolopeak soils have a surface layer that was influenced by volcanic ash. Petty and Selway soils have boulders on the surface.

#### **609—Waldbillig-Courville-Bata**

These soils are moderately sloping to very steep, very deep, and well drained. They are loamy and have numerous rock fragments. The soils formed in alpine till on moraines. They have a surface layer that was influenced by volcanic ash.

#### **610—Waldbillig-Holloway-Felan**

These soils are moderately sloping to very steep and are very deep. They are loamy and have numerous rock fragments. They have a surface layer that was influenced by volcanic ash. Waldbillig soils are well drained. They formed in alpine till and are on moraines. Holloway soils are somewhat excessively drained. They formed in colluvium derived from argillite and quartzite and are on mountains. Felan soils are well drained. They formed in colluvium derived from argillite and limestone and are on mountains.

#### **611—Waldbillig-Phillcher-Coerock**

These soils are moderately sloping to very steep, are loamy, and have numerous rock fragments. They have a surface layer that was influenced by volcanic ash. Waldbillig soils are very deep and are well drained. They formed in alpine till on moraines. Phillcher soils are very deep and are somewhat excessively drained. They formed in colluvium and alpine till derived from argillite and quartzite. They are on moraines and mountains. Coerock soils are shallow and are well drained. They formed in volcanic ash over argillite or quartzite bedrock. They are in cirque basins and on mountains.

### **Dominantly Rock Outcrop, Rubble Land, and Soils on Mountains**

#### **282—Rock Outcrop-Holloway-Phillcher**

This unit is very steep. Holloway and Phillcher soils are very deep and somewhat excessively drained. They are loamy and have numerous rock fragments. The soils formed in colluvium derived from argillite and quartzite and are on mountains. They have a surface layer that was influenced by volcanic ash. The Rock outcrop consists mainly of argillite and quartzite bedrock.

#### **351—Lolopeak-Rubble Land-Rock Outcrop**

This unit is very steep and is on mountains. Lolopeak soils are very deep and are excessively drained. They are sandy and have numerous rock fragments. They formed in colluvium derived from granite and gneiss. They have a surface layer that was influenced by volcanic ash. Areas of Rubble land consist mainly of granite and gneiss stones and boulders. The Rock outcrop consists mainly of granite and gneiss bedrock.

#### **450—Petty-Rock Outcrop**

This unit is very steep and is on mountains. Petty soils are very deep and are somewhat excessively drained. They are loamy and have numerous rock fragments. They formed in material weathered from igneous rocks and have a surface layer that was influenced by volcanic ash and is bouldery. The Rock outcrop consists mainly of granite and gneiss bedrock.

#### **483—Rock Outcrop-Coerock-Phillcher**

This unit is moderately sloping to very steep. The Rock outcrop consists mainly of argillite and quartzite bedrock. Coerock and Phillcher soils are loamy and have numerous rock fragments. They have a surface layer that was influenced by volcanic ash. Coerock soils are shallow and are well drained. They formed in volcanic ash over argillite and quartzite bedrock. They are in cirque basins and on mountains. Phillcher soils are very deep and are somewhat excessively drained. They formed in colluvium derived from argillite and quartzite. They are on mountains.

#### **485—Rock Outcrop**

This unit consists mainly of exposures of hard bedrock on mountain side slopes and ridges.

#### **487—Rock Outcrop-Holloway-Coerock**

This unit is moderately sloping to very steep. The Rock outcrop consists mainly of argillite and quartzite

bedrock. Holloway and Coerock soils are loamy and have numerous rock fragments. They have a surface layer that was influenced by volcanic ash. Holloway soils are very deep and are somewhat excessively drained. They formed in colluvium derived from argillite and quartzite. They are on mountains. Coerock soils are shallow and are well drained. They formed in volcanic ash over argillite and quartzite. They are in cirque basins and on mountains.

#### **493—Rock Outcrop-Rubble Land-Lolopeak**

This unit is very steep. It is on mountains. The Rock outcrop consists mainly of granite and gneiss bedrock. Areas of Rubble land consist mainly of granite and gneiss stones and boulders. Lolopeak soils are very

deep and are excessively drained. They are sandy and have numerous rock fragments. The soils formed in colluvium derived from granite and gneiss. They have a surface layer that was influenced by volcanic ash.

#### **496—Rock Outcrop-Evaro-Holloway**

This unit is moderately sloping to very steep. It is on mountains. The Rock outcrop consists mainly of argillite and quartzite bedrock. Evaro and Holloway soils are very deep and are somewhat excessively drained. They are loamy and have numerous rock fragments. The soils formed in colluvium derived from argillite and quartzite. They have a surface layer that was influenced by volcanic ash.



# Formation and Classification of the Soils

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This section relates the major factors of soil formation to the soils in the survey area and describes the system of soil classification. The classification and extent of the soils in this survey area are shown in the tables "Classification of the Soils" and "Acreage and Proportionate Extent of the Soils," which are at the end of this section.

## Formation of the Soils

Soil is formed by the action of soil-forming processes on material deposited or accumulated by geological forces. The characteristics of a soil at any given point depend on the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and has existed since accumulation; the plant and animal life on and in the soil; relief, or lay of the land, and the length of time the forces of soil development have acted on the soil material.

All five of these factors are important in the genesis of each soil; some have had more influence than others on a given soil.

Parent material is the unconsolidated mass from which a soil forms. It is one of the most important factors of soil formation. Many of the soils in different formations in the survey area are similar because the parent material in which the soils formed is similar. Many types of rock can make up a formational unit, and each type influences the type of soil that develops. For example, granite, limestone, schist, quartzite, or argillite can occur within a formation.

Uplifted rock units of Precambrian, Cambrian, and Cretaceous age are subject to physical and chemical weathering. The weathering creates a mantle of unconsolidated material, called residuum, over the bedrock. Soils that formed in residuum are commonly shallow. As residuum is transported downslope by gravity, the parent material becomes thicker. The depth to bedrock generally is greater in downslope areas. Parent material in downslope areas is called colluvium. Soils that formed in colluvium commonly have 50 to 80

percent rock fragments. They are commonly loam or sandy loam.

Winkler, Tevis, Mitten, Evaro, Phillcher, and Holloway soils are in areas dominated by deep quartzite and argillite colluvium. Bedrock outcrops occur randomly throughout areas of these soils. The soils, although they formed from the same type of parent material, have different morphological properties and climatic conditions. For example, Sharrott and Coerock soils are in areas where colluvium is less than 20 inches deep over bedrock.

Repp, Beeskove, Trapps, Whitore, and Felan soils are in areas of limestone or other calcareous rock. Trapps soils have a slight accumulation of clay in the subsoil. Ambrant, Ovando, Rochester, Elkner, Selway, Petty, and Lolopeak soils are in areas of very deep granite colluvium, mostly quartz monzonite and granodiorite. Chickaman and Lantern soils are in colluvial areas of schist.

*Tertiary Uplift and Erosion.*—Events during the Tertiary period left an extremely complex distribution of soils in many areas of the survey area. An arid climate dominated the area for most of the Tertiary period. Extensive erosion occurred as the mountains were uplifted. Intense rainstorms carried sediment into the valleys, but streams did not develop to transport the sediment to the ocean. The Missoula Valley contains material as much as several thousand feet thick that eroded from the local mountains.

Although an arid climate dominated the area, moist periods did occur. They enabled plant life to flourish and to stabilize the land surface. Many of the soils that formed during moist periods have a clayey subsoil. New material was deposited on some soils in subsequent drier periods. Because of the alternating climate, some areas have buried soils deposited one upon another.

During the Tertiary period, lakes occupied some valley areas and left fine-textured deposits. Tertiary volcanoes in southwestern Montana deposited ash in some areas. Slumps and mudflows also occurred. The diverse array of Tertiary materials was also subjected to faulting and deformation as the mountains continued to

uplift. The Clark Fork Valley, for example, has sediment that is tilted at many angles. Uplift that occurred later in the Tertiary period resulted in steeper slopes and the deposition of coarse, rocky material on the surface. Erosion during the late Pleistocene and Holocene epochs removed hundreds of feet of material from some of the Tertiary deposits and reshaped others.

Shooflin, Lubrecht, and Crow soils are in forested areas of clayey Tertiary deposits. Hagstadt and Greenough soils are in forested areas of silty deposits. Hagstadt and Lubrecht soils have consolidated siltstone at a depth of 20 to 40 inches. Bignell soils have a very gravelly and clayey subsoil.

Bigarm and Bigarm variant soils are loamy and gravelly and are in grassland areas. They do not have a clayey subsoil. Many types of soils, including those that are very gravelly and very clayey, are mainly in the Missoula Valley foothills. These soils are distributed so randomly and in such small units that they cannot be delineated separately. They are grouped in the Argixerolls-Haploxerolls complex.

*Pleistocene glaciation.*—About two to three million years ago, the climate became much more moist and slightly cooler. Large masses of ice collected as continental glaciers entered Montana from the north, and smaller glaciers formed on local mountain ranges. Although this period commonly is called the ice age, a number of different advances and retreats of glaciers have been identified in the Rocky Mountains. Glacial landscapes therefore have sequences of till and other sediments deposited one upon another, sometimes giving them a complexity similar to that of Tertiary landscapes. Continental glaciation possibly occurred in Missoula County when the Cordillerian ice sheet advanced through the Swan-Clearwater Valley from Bigfork to Clearwater Junction. Smaller mountain glaciers formed in the Rattlesnake Wilderness and along the Montana-Idaho border from Lolo Peak westward. Mountain glaciers also formed in the Mission and Swan Ranges and moved along the Swan and Clearwater Valleys.

Several distinctive types of deposits are associated with glaciation, including till, outwash, and lake deposits.

Glacial till generally is a heterogeneous, unsorted mixture of soil that contains many sizes and shapes of rocks. Pebbles, cobbles, stones, and boulders commonly are present. They have been subrounded by glacial transport. Very gravelly and extremely gravelly loam and silt loam commonly formed in glacial till. These materials generally have fewer rock fragments than colluvial soils, except in areas near bedrock outcrops and in alpine areas. Winfall, Courville, Bata, Rumblecreek, Hollandlake, Wildgen, and Waldbillig soils

are in areas of loamy, noncalcareous till. Jimlake and Yourame soils are in areas of loamy, calcareous till.

Till landscapes commonly have a kettle-and-mound topography that is characterized by poorly drained, wet, and depressional areas. Organic soils formed in some wet, depressional areas. In areas that are large enough to delineate, these soils are called Borohemists.

Melting glacial ice caused local streams to swell to many times their current size. These streams carried sandy, gravelly, and cobbly material that was deposited as glacial outwash fans and terraces. Water in ice-dammed lakes to the west of the survey area periodically broke through the dams. It deposited more outwash material in the survey area. Soils that formed in outwash are extremely porous and have a very low water- and nutrient-holding capacity. Outwash terraces are common along most drainageways on glacial landscapes. Glaciercreek and Upsata soils are in areas of outwash deposits. They contain numerous rock fragments. Tally variant soils and Udorthents are in areas of soils with a deep, sandy surface layer that does not contain rocks.

Swollen glacial outwash streams also had a significant effect downstream from the glaciated areas. Hundreds of feet of Tertiary sediment was removed from the Missoula Valley area during the Pleistocene epoch. The moist climate and the local fault activity also stimulated slumps and earthflows in the clayey Tertiary material.

Glaciation blocked many streams with ice and created some very large, ice-dammed lakes. Near the end of the last ice age, a lobe of the Cordillerian ice sheet blocked the Clark Fork River in northern Idaho and created Glacial Lake Missoula. The lake was 1,000 feet deep at Missoula and extended up local drainageways to an elevation of about 4,200 feet. The lake filled with water and then the ice dam broke, causing catastrophic drainage events. The pattern of the lake filling and dam breaking was repeated numerous times. Deposits from Glacial Lake Missoula are present in only a few areas today, mainly in the wider valleys. They generally are silt, clay, and fine sand and do not have rocks. The clay fraction is dominated by illite-type clay. Within till areas, especially the Swan and Clearwater Valleys, small glacial lakes formed. Half Moon and Auggie soils are in forested glacial lake deposits in Missoula County. Grassvalley and Hanaker soils are on grassland lake deposits.

*Recent events.*—In the 10,000 years since the last glaciers retreated, several events have influenced the local soils. Volcanic activity on the West Coast probably has had the most dramatic influence. Several Cascade Range volcanoes, including Glacier Peak, Mount Mazama, and Mount St. Helens, have erupted, spewing

ash across the Northwest. The Mount Mazama eruption about 6,600 years ago probably was the most significant. Although many of the local soils have been influenced by volcanic ash to some degree, at least 14 of the soils in Missoula County have a surface layer that ranges from 7 to 10 inches thick and contains volcanic ash. These soils include Mitten, Phillcher, Holloway, Chickaman, Coerock, Felan, Lolopeak, and Petty soils, which formed on a bedrock substrate; Courville, Waldbillig, Jimlake, and Bata soils, which formed in alpine till; and Glaciercreek and Upsata soils, which formed in glacial outwash.

In some areas, erosion and mass-wasting processes continue to remove soil material. In other areas, deposition increases the amount of soil material. The streams in the survey area meander on recently developed flood plains. Areas that are subject to flooding are characterized by poorly developed soils. The soils on flood plains are Xerofluvents and Udifluvents.

In landscape positions above the flood plains, several terrace levels have developed. In the wider valleys, the terraces are as much as several miles wide and are similar to the downstream terraces. They probably formed in the late Pleistocene or Holocene epochs. The texture and the content of rock fragments are highly variable, but the depth to gravel generally increases and the texture becomes finer as distance from the streams increases. Most of the prime agricultural land in the survey area is on these terraces.

Moiese, Grantsdale, Desmet, and Alberton soils and Aquic Haploxerolls are on terraces. Moiese soils are sandy and extremely gravelly. Grantsdale soils have loam in the upper part and sand and gravel in the lower part. They do not have rocks in the surface layer. Desmet and Alberton soils are very deep. They are silty or loamy and do not have rocks. Aquic Haploxerolls are loamy. They have a seasonal high water table.

Most recently, humans have influenced soil formation in the survey area. Some areas have been filled or otherwise reworked with heavy machinery, mixing the natural soil. Other areas of urban land have houses, buildings, streets, driveways, and other cultural features.

## Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from

laboratory measurements. 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 Ochrept (*Ochr*, meaning pale, 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; 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 Ustochrepts (*Ust*, meaning burnt, plus *ochrept*, the suborder of the Inceptisols that has an ustic moisture regime).

**SUBGROUP.** Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic 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 known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup. An example is Typic Ustochrepts.

**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 class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy-skeletal, mixed, frigid Typic Ustochrepts.

**SERIES.** The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

## CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alberton-----	Coarse-loamy, mixed, frigid Aridic Haploxerolls
Ambrant-----	Coarse-loamy, mixed, frigid Udic Ustochrepts
Aquic Haploxerolls-----	Aquic Haploxerolls
Aquic Udorthents-----	Aquic Udorthents
Aquepts-----	Aquepts
Aquolls-----	Aquolls
Argixerolls-----	Argixerolls
Auggie-----	Fine-silty, mixed Typic Cryoboralfs
Bata-----	Loamy-skeletal, mixed Andeptic Cryoboralfs
Beeskove-----	Loamy-skeletal, mixed, frigid Typic Eutrochrepts
Bigarm-----	Loamy-skeletal, mixed, frigid Typic Haploxerolls
Biglake-----	Sandy-skeletal, mixed, frigid Typic Haploxerolls
Bignell-----	Clayey-skeletal, mixed Typic Eutroboralfs
Borohemists-----	Borohemists
Chickaman-----	Coarse-silty, micaceous Andic Cryochrepts
Coerock-----	Medial-skeletal Lithic Cryandeps
Courville-----	Loamy-skeletal, mixed, frigid Andic Dystric Eutrochrepts
Crow-----	Fine, mixed Typic Eutroboralfs
Desmet-----	Coarse-silty, mixed, frigid Calciorthidic Haploxerolls
Elkner-----	Coarse-loamy, mixed Typic Cryochrepts
Evoro-----	Loamy-skeletal, mixed Typic Cryochrepts
Felan-----	Loamy-skeletal, mixed Andic Cryochrepts
Glaciercreek-----	Sandy-skeletal, mixed, frigid Andic Dystric Eutrochrepts
Glaciercreek variant-----	Coarse-loamy, mixed, frigid Dystric Eutrochrepts
Grantsdale-----	Coarse-silty over sandy or sandy-skeletal, mixed, frigid Calciorthidic Haploxerolls
Grassvalley-----	Fine, illitic, frigid Typic Haploxeralfs
Greenough-----	Fine-silty, mixed Typic Eutroboralfs
Hagstadt-----	Fine-silty, mixed, frigid Udic Ustochrepts
Half Moon-----	Fine-silty, mixed Typic Eutroboralfs
Hanaker-----	Fine-silty, mixed Typic Argiborolls
Haploxerolls-----	Haploxerolls
Hollandlake-----	Loamy-skeletal, mixed Typic Cryoboralfs
Holloway-----	Loamy-skeletal, mixed Andic Cryochrepts
Jimlake-----	Loamy-skeletal, mixed Andeptic Cryoboralfs
Lantern-----	Loamy-skeletal, mixed, frigid Dystric Eutrochrepts
Lolopeak-----	Sandy-skeletal, mixed Andic Cryumbrepts
Lubrecht-----	Fine, mixed Typic Eutroboralfs
Mitten-----	Loamy-skeletal, mixed, frigid Andic Dystric Eutrochrepts
Moiese-----	Sandy-skeletal, mixed, frigid Calciorthidic Haploxerolls
Orthents-----	Orthents
Ovando-----	Sandy-skeletal, mixed Typic Cryorthents
Perma-----	Loamy-skeletal, mixed Typic Haploborolls
Perma variant-----	Loamy-skeletal, mixed Typic Argiborolls
Petty-----	Loamy-skeletal, mixed Andic Cryochrepts
Phillcher-----	Loamy-skeletal, mixed Andic Cryochrepts
Repp-----	Loamy-skeletal, mixed, frigid Typic Ustochrepts
Rochester-----	Sandy-skeletal, mixed, frigid Typic Ustorthents
Rumblecreek-----	Loamy-skeletal, mixed Typic Eutroboralfs
Selway-----	Loamy-skeletal, mixed, frigid Dystric Eutrochrepts
Sharrott-----	Loamy-skeletal, mixed, frigid Lithic Ustochrepts
Shooflin-----	Very fine, montmorillonitic Typic Eutroboralfs
Tally variant-----	Sandy, mixed Typic Haploborolls
Tevis-----	Loamy-skeletal, mixed, frigid Dystric Eutrochrepts
Totelake-----	Sandy-skeletal, mixed, frigid Udic Ustochrepts
Trapps-----	Loamy-skeletal, mixed Typic Eutroboralfs
Turrah-----	Fine, mixed, frigid Cumulic Haplaquolls
Udifluvents-----	Udifluvents
Udorthents-----	Udorthents
Upsata-----	Sandy-skeletal, mixed Andic Cryochrepts
Waldbillig-----	Loamy-skeletal, mixed Andic Cryochrepts
Whitore-----	Loamy-skeletal, carbonatic Typic Cryochrepts
Wildgen-----	Loamy-skeletal, mixed, frigid Udic Ustochrepts
Winfall-----	Loamy-skeletal, mixed, frigid Dystric Eutrochrepts

CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
Winkler-----	Loamy-skeletal, mixed, frigid Udic Ustochrepts
Xerofluvents-----	Xerofluvents
Yourame-----	Loamy-skeletal, mixed Typic Eutroboralfs

## ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Alberton very fine sandy loam, 0 to 2 percent slopes-----	4,900	0.4
2	Ambrant gravelly sandy loam, 15 to 30 percent slopes-----	3,230	0.3
3	Ambrant-Rochester, warm-Rock outcrop complex, 30 to 60 percent slopes-----	3,210	0.3
4	Aquic Haploxerolls, 0 to 2 percent slopes-----	1,670	0.1
5	Aquic Udorthents, 0 to 2 percent slopes-----	1,480	0.1
6	Aquolls and Aquepts, 0 to 2 percent slopes-----	11,020	0.9
7	Argixerolls-Haploxerolls complex, 0 to 4 percent slopes-----	4,280	0.3
8	Argixerolls-Haploxerolls complex, 4 to 15 percent slopes-----	13,070	1.0
9	Argixerolls-Haploxerolls complex, 15 to 30 percent slopes-----	8,290	0.7
10	Argixerolls-Haploxerolls complex, 30 to 60 percent slopes-----	1,750	0.1
11	Argie silt loam, 4 to 15 percent slopes-----	3,960	0.3
12	Bata gravelly silt loam, cool, 2 to 8 percent slopes-----	980	*
13	Bata-Waldbillig gravelly silt loams, 4 to 30 percent slopes-----	13,980	1.1
14	Beeskove gravelly loam, 30 to 60 percent slopes-----	14,660	1.1
15	Beeskove-Rock outcrop complex, 50 to 80 percent slopes-----	1,870	0.1
16	Bigarm gravelly loam, 0 to 4 percent slopes-----	9,980	0.8
17	Bigarm gravelly loam, 4 to 15 percent slopes-----	2,760	0.2
18	Bigarm gravelly loam, 15 to 30 percent slopes-----	7,360	0.6
19	Bigarm gravelly loam, 30 to 60 percent slopes-----	18,760	1.5
20	Bigarm-Rock outcrop complex, 30 to 60 percent slopes-----	5,400	0.4
21	Biglake gravelly sandy loam, 8 to 15 percent slopes-----	330	*
22	Biglake gravelly sandy loam, 15 to 30 percent slopes-----	1,710	0.1
23	Bignell gravelly loam, 8 to 30 percent slopes-----	22,110	1.7
24	Bignell-Winkler, cool, complex, 30 to 60 percent slopes-----	2,760	0.2
25	Bignell, warm-Winkler complex, 30 to 60 percent slopes-----	3,120	0.2
26	Borochemists, 0 to 2 percent slopes-----	1,430	0.1
27	Chickaman silt loam, 8 to 30 percent slopes-----	180	*
28	Chickaman silt loam, 30 to 60 percent slopes-----	6,480	0.5
29	Coerock-Rock outcrop complex, 4 to 30 percent slopes-----	6,130	0.5
30	Coerock-Rock outcrop complex, 50 to 80 percent slopes-----	7,610	0.6
31	Courville gravelly silt loam, 8 to 30 percent slopes-----	2,610	0.2
32	Courville-Mitten gravelly silt loams, 30 to 60 percent slopes-----	1,950	0.2
33	Crow silt loam, 4 to 15 percent slopes-----	8,250	0.7
34	Desmet loam, 0 to 2 percent slopes-----	4,700	0.4
35	Elkner-Ovando complex, 8 to 30 percent slopes-----	1,640	0.1
36	Evaro gravelly loam, 8 to 30 percent slopes-----	7,110	0.6
37	Evaro gravelly loam, 30 to 60 percent slopes-----	12,600	1.0
38	Felan gravelly silt loam, 8 to 30 percent slopes-----	6,280	0.5
39	Felan gravelly silt loam, 30 to 60 percent slopes-----	24,960	2.0
40	Felan gravelly silt loam, cool, 8 to 30 percent slopes-----	2,550	0.2
41	Felan gravelly silt loam, cool, 30 to 60 percent slopes-----	6,450	0.5
42	Glaciercreek gravelly silt loam, 0 to 4 percent slopes-----	7,200	0.6
43	Glaciercreek variant-Glaciercreek complex, 4 to 20 percent slopes-----	3,110	0.2
44	Grantsdale loam, 0 to 2 percent slopes-----	7,260	0.6
45	Grassvalley silty clay loam, 0 to 4 percent slopes-----	5,190	0.4
46	Grassvalley silty clay loam, 4 to 8 percent slopes-----	2,460	0.2
47	Grassvalley silty clay loam, 8 to 15 percent slopes-----	2,550	0.2
48	Grassvalley silty clay loam, 15 to 30 percent slopes-----	1,760	0.1
49	Greenough silt loam, 4 to 15 percent slopes-----	3,550	0.3
50	Hagstadt silt loam, 4 to 25 percent slopes-----	1,820	0.1
51	Half Moon silt loam, 4 to 8 percent slopes-----	3,490	0.3
52	Hanaker silt loam, 0 to 6 percent slopes-----	3,700	0.3
53	Hollandlake gravelly loam, 4 to 30 percent slopes-----	6,250	0.5
54	Hollandlake-Bata complex, 4 to 30 percent slopes-----	19,410	1.5
55	Hollandlake-Bata complex, 30 to 60 percent slopes-----	5,070	0.4
56	Holloway gravelly silt loam, 8 to 30 percent slopes-----	11,560	0.9
57	Holloway gravelly silt loam, 30 to 60 percent slopes-----	62,540	4.9
58	Holloway gravelly silt loam, cool, 8 to 30 percent slopes-----	5,350	0.4
59	Holloway gravelly silt loam, cool, 30 to 60 percent slopes-----	3,260	0.3
60	Holloway-Rock outcrop complex, 50 to 80 percent slopes-----	20,380	1.6
61	Jimlake gravelly silt loam, 4 to 30 percent slopes-----	22,790	1.8

\* See footnote at end of table.

## ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
52	Jimlake gravelly silt loam, 30 to 60 percent slopes-----	3,810	0.3
53	Lantern gravelly sandy loam, 8 to 30 percent slopes-----	470	*
54	Lantern gravelly sandy loam, 30 to 60 percent slopes-----	4,230	0.3
55	Lantern-Rock outcrop complex, 50 to 80 percent slopes-----	1,300	0.1
56	Lolopeak bouldery loam, 50 to 80 percent slopes-----	3,580	0.3
57	Lolopeak-Rock outcrop complex, 50 to 80 percent slopes-----	3,900	0.3
58	Lubrecht silt loam, 4 to 15 percent slopes-----	3,300	0.3
59	Mitten gravelly silt loam, 30 to 60 percent slopes-----	2,960	0.2
70	Mitten-Sharrott, cool, complex, 15 to 40 percent slopes-----	2,580	0.2
71	Mitten-Tevis complex, 30 to 60 percent slopes-----	35,060	2.7
72	Moiese gravelly loam, 0 to 2 percent slopes-----	8,170	0.6
73	Orthents, 0 to 4 percent slopes-----	3,170	0.2
74	Ovando-Elkner-Rock outcrop complex, 30 to 60 percent slopes-----	5,440	0.4
75	Perma gravelly loam, 0 to 4 percent slopes-----	8,550	0.7
76	Perma gravelly loam, 20 to 45 percent slopes-----	1,980	0.2
77	Perma stony loam, 2 to 12 percent slopes-----	1,430	0.1
78	Perma variant stony silt loam, 2 to 8 percent slopes-----	840	*
79	Perma variant-Perma complex, 4 to 30 percent slopes-----	2,060	0.2
30	Petty gravelly loam, 8 to 30 percent slopes-----	4,960	0.4
31	Petty gravelly loam, 30 to 60 percent slopes-----	17,210	1.3
32	Petty bouldery loam, 30 to 60 percent slopes-----	6,650	0.5
33	Petty gravelly loam, cool, 8 to 30 percent slopes-----	7,960	0.6
34	Petty bouldery loam, cool, 50 to 80 percent slopes-----	2,610	0.2
35	Petty, cool-Rock outcrop complex, 50 to 80 percent slopes-----	2,340	0.2
36	Phillcher silt loam, 4 to 30 percent slopes-----	3,040	0.2
37	Phillcher-Rock outcrop complex, 50 to 80 percent slopes-----	6,270	0.5
38	Pits, gravel-----	780	*
39	Repp very gravelly loam, 30 to 60 percent slopes-----	19,330	1.5
30	Repp very gravelly loam, cool, 8 to 30 percent slopes-----	4,060	0.3
31	Repp very gravelly loam, cool, 30 to 60 percent slopes-----	22,080	1.7
32	Repp-Rock outcrop complex, 50 to 80 percent slopes-----	1,760	0.1
33	Riverwash-----	1,600	0.1
34	Rock outcrop-Rubble land complex-----	24,300	1.9
35	Rumblecreek gravelly loam, 4 to 30 percent slopes-----	13,310	1.0
36	Selway gravelly sandy loam, 8 to 30 percent slopes-----	1,380	0.1
37	Selway gravelly sandy loam, 30 to 60 percent slopes-----	3,440	0.3
38	Selway bouldery sandy loam, 30 to 60 percent slopes-----	2,810	0.2
39	Sharrott-Rock outcrop complex, 4 to 30 percent slopes-----	2,270	0.2
100	Shooflin silt loam, 4 to 15 percent slopes-----	6,640	0.5
101	Tally variant sandy loam, 0 to 4 percent slopes-----	1,100	*
102	Tevis gravelly loam, 30 to 60 percent slopes-----	28,200	2.2
103	Tevis-Mitten complex, 8 to 30 percent slopes-----	5,500	0.4
104	Tevis-Mitten-Rock outcrop complex, 45 to 70 percent slopes-----	3,590	0.3
105	Totelake gravelly loam, 2 to 8 percent slopes-----	10,210	0.8
106	Totelake gravelly loam, 8 to 30 percent slopes-----	2,620	0.2
107	Totelake extremely stony loam, 2 to 8 percent slopes-----	2,130	0.2
108	Trapps gravelly loam, 8 to 30 percent slopes-----	1,360	0.1
109	Trapps gravelly loam, 30 to 60 percent slopes-----	10,880	0.8
110	Turrah silty clay loam, 0 to 2 percent slopes-----	3,480	0.3
111	Udifuvents, 0 to 2 percent slopes-----	5,160	0.4
112	Udorhents-Glaciercreek complex, 0 to 8 percent slopes-----	2,110	0.2
113	Upsata gravelly fine sandy loam, 2 to 8 percent slopes-----	6,810	0.5
114	Urban land-----	6,230	0.5
115	Waldbillig gravelly silt loam, 4 to 30 percent slopes-----	42,690	3.3
116	Waldbillig gravelly silt loam, 30 to 60 percent slopes-----	1,370	0.1
117	Waldbillig-Auggie complex, 4 to 15 percent slopes-----	5,580	0.4
118	Waldbillig-Holloway gravelly silt loams, 8 to 30 percent slopes-----	29,050	2.3
119	Waldbillig-Holloway gravelly silt loams, 30 to 60 percent slopes-----	49,430	3.9
120	Waldbillig-Holloway gravelly silt loams, cool, 8 to 30 percent slopes-----	15,730	1.2
121	Waldbillig-Holloway gravelly silt loams, cool, 30 to 60 percent slopes-----	3,710	0.3
122	Whitore gravelly clay loam, 8 to 30 percent slopes-----	2,300	0.2

\* See footnote at end of table.

## ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
123	Whitore gravelly clay loam, 30 to 60 percent slopes-----	2,220	0.2
124	Wildgen gravelly loam, 4 to 30 percent slopes-----	12,240	1.0
125	Wildgen-Winkler, cool, gravelly loams, 15 to 30 percent slopes-----	8,150	0.6
126	Wildgen-Winkler, cool, gravelly loams, 30 to 60 percent slopes-----	4,580	0.4
127	Wildgen, dry-Winkler complex, 15 to 30 percent slopes-----	2,440	0.2
128	Wildgen, dry-Winkler complex, 30 to 60 percent slopes-----	3,670	0.3
129	Winfall gravelly loam, 4 to 30 percent slopes-----	12,800	1.0
130	Winkler very gravelly sandy loam, 8 to 30 percent slopes-----	15,080	1.2
131	Winkler very gravelly sandy loam, 30 to 60 percent slopes-----	88,090	6.9
132	Winkler gravelly loam, cool, 8 to 30 percent slopes-----	21,120	1.6
133	Winkler gravelly loam, cool, 30 to 60 percent slopes-----	99,070	7.7
134	Winkler-Rubble land complex, 50 to 80 percent slopes-----	8,230	0.6
135	Winkler, cool-Rock outcrop complex, 50 to 80 percent slopes-----	12,150	0.9
136	Xerofluvents, 0 to 2 percent slopes-----	15,250	1.2
137	Yourame gravelly loam, 4 to 30 percent slopes-----	4,270	0.3
W	Water-----	23,000	1.8
	Total-----	1,281,500	100.0

\* Less than 0.1 percent. The combined extent of the soils assigned an asterisk in the percent column is about 0.4 percent of the survey area.

## Soil Series and Detailed Soil Map Units

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In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each description is followed by the detailed soil map units associated with the series.

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (15). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (14). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units on the detailed soil maps in Part III 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 in Part II of this survey.

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils 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 noncontrasting, or 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, or dissimilar, 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 segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation 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 or of the underlying layers, 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 or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, 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, Holloway gravelly silt loam, 30 to 60 percent slopes, is a phase of the Holloway series.

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

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. Mitten-Tevis complex, 30 to 60 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Aquolls and Aquepts, 0 to 2 percent slopes, is an undifferentiated group in this survey area.

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

The table "Acreage and Proportionate Extent of the Soils" in Parts I and II of the manuscript gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of 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.

## Alberton Series

The Alberton series consists of very deep, somewhat excessively drained soils that formed in alluvium. These soils are on stream terraces. Slope is 0 to 2 percent. Elevation is 2,800 to 3,500 feet. The average annual precipitation is 11 to 14 inches, the average annual air temperature is 43 to 45 degrees F, and the frost-free season is 105 to 120 days.

**Taxonomic Class:** Coarse-loamy, mixed, frigid Aridic Haploxerolls

### Typical Pedon

Alberton very fine sandy loam, 0 to 2 percent slopes, in an area of cropland, 500 feet west and 200 feet

south of the north quarter corner of sec. 34, T. 15 N., R. 21 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many very fine pores; neutral; abrupt smooth boundary.

A—9 to 16 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; many fine roots and pores; neutral; clear wavy boundary.

Bw—16 to 30 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine roots and pores; neutral; clear wavy boundary.

BC—30 to 60 inches; light brownish gray (10YR 6/2) loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; 10 percent pebbles; neutral.

### Range in Characteristics

*Soil temperature:* 45 to 47 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Mollic epipedon thickness:* 10 to 18 inches

*Depth to loamy fine sand and coarser material:* More than 25 inches

*Control section:* 5 to 18 percent clay and more than 35 percent sand coarser than very fine sand

*Mottles, relict:* Few brown and yellow mottles below a depth of 25 inches in some pedons

#### Ap horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 5 to 18 percent

Reaction: pH 6.6 to 7.3

#### A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: Fine sandy loam or sandy loam

Clay content: 5 to 18 percent

Reaction: pH 6.6 to 7.3

#### Bw horizon

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Fine sandy loam or sandy loam

Clay content: 5 to 18 percent

Reaction: pH 6.6 to 7.3

*BC horizon*

Value: 6 or 7 dry; 4 or 5 moist  
 Chroma: 2 or 3  
 Texture: Loamy sand or loamy fine sand  
 Clay content: 5 to 10 percent  
 Content of rock fragments: 0 to 15 percent pebbles  
 Reaction: pH 6.6 to 7.3

**1—Alberton very fine sandy loam, 0 to 2 percent slopes****Composition**

Alberton and similar soils: 85 percent  
 Inclusions: 15 percent

**Setting**

*Landform:* Stream terraces  
*Slope:* 0 to 2 percent  
*Elevation:* 2,800 to 3,500 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 105 to 120 days

**Component Description**

*Surface layer texture:* Very fine sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Alluvium  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 7.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Desmet and similar soils
- Grantsdale and similar soils
- Moiese and similar soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Ambrant Series**

The Ambrant series consists of very deep, somewhat excessively drained soils that formed in colluvium

derived from granite. These soils are on mountain slopes. Slope is 15 to 60 percent. Elevation is 4,500 to 5,500 feet. The average annual precipitation is 17 to 25 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Coarse-loamy, mixed, frigid Udic Ustochrepts

**Typical Pedon**

Ambrant gravelly sandy loam, in an area of Ambrant-Rochester, warm-Rock outcrop complex, 30 to 60 percent slopes; in a forested area, 1,015 feet east and 300 feet south of the northwest corner of sec. 9, T. 12 N., R. 16 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 4 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots and pores; 25 percent pebbles; neutral; clear wavy boundary.

E2—4 to 20 inches; light brownish gray (2.5Y 6/2) gravelly coarse sandy loam, grayish brown (2.5Y 5/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine pores; 25 percent pebbles; neutral; gradual wavy boundary.

E and Bt—20 to 39 inches; 75 percent light brownish gray (2.5Y 6/2) gravelly coarse sandy loam, dark grayish brown (2.5Y 4/2) moist (E part); 25 percent dark grayish brown (2.5Y 4/2) gravelly sandy loam lamellae, very dark grayish brown (2.5Y 3/2) moist (Bt part); when mixed, texture is gravelly coarse sandy loam; weak fine and medium blocky structure parting to moderate fine and medium granular; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine and fine pores; 35 percent pebbles; neutral; gradual wavy boundary.

2C—39 to 60 inches; light brownish gray (2.5Y 6/2) very gravelly coarse sand, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 55 percent pebbles; neutral.

**Range in Characteristics***E1 horizon*

Value: 5 to 7 dry; 3 or 4 moist  
 Chroma: 2 or 3  
 Clay content: 5 to 15 percent  
 Content of rock fragments: 0 to 35 percent—0 to 25 percent cobbles, stones, or boulders, 5 to 35 percent angular pebbles  
 Reaction: pH 5.6 to 7.3

*E2 horizon*

Hue: 10YR or 2.5Y  
 Value: 6 or 7 dry; 4 or 5 moist  
 Chroma: 1 to 3  
 Texture: Coarse sandy loam or loamy coarse sand  
 Clay content: 5 to 15 percent  
 Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles, stones, or boulders, 5 to 35 percent angular pebbles  
 Reaction: pH 5.6 to 7.3

*E and Bt horizon*

Hue: E part—10YR or 2.5Y; Bt part—10YR or 2.5Y  
 Value: E part—6 or 7 dry and 4 to 6 moist; B part—4 or 5 dry and 3 or 4 moist  
 Chroma: E part—2 or 3; B part—2 or 3  
 Clay content, mixed: 5 to 18 percent; less than 3 percent clay increase in lamellae  
 Texture: Sandy loam or coarse sandy loam  
 Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles, 10 to 35 percent angular pebbles  
 Reaction: pH 5.6 to 7.3

*2C horizon*

Hue: 10YR or 2.5Y  
 Value: 5 to 7 dry; 4 or 5 moist  
 Chroma: 1 to 4  
 Texture: Coarse sandy loam, coarse sand, loamy coarse sand, sand, or loamy sand  
 Clay content: 0 to 5 percent  
 Content of rock fragments: 15 to 60 percent—10 to 25 percent cobbles and stones, 10 to 45 percent angular pebbles  
 Reaction: pH 5.6 to 7.3

## **2—Ambrant gravelly sandy loam, 15 to 30 percent slopes**

### ***Composition***

Ambrant and similar soils: 85 percent  
 Inclusions: 15 percent

### ***Setting***

*Landform:* Mountains

*Slope:* 15 to 30 percent

*Elevation:* 4,500 to 5,500 feet

*Mean annual precipitation:* 17 to 25 inches

*Frost-free period:* 60 to 90 days

### ***Component Description***

*Surface layer texture:* Gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Igneous colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Rochester, warm, soils
- Areas of rock outcrop
- Sandy soils that are shallow over bedrock
- Soils that have a subsoil of sandy clay loam

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **3—Ambrant-Rochester, warm-Rock outcrop complex, 30 to 60 percent slopes**

### ***Composition***

Ambrant and similar soils: 40 percent  
 Rochester and similar soils: 30 percent  
 Rock outcrop: 15 percent  
 Inclusions: 15 percent

### ***Setting***

*Landform:*

- Ambrant—Mountains
- Rochester—Mountains
- Rock outcrop—Mountains

*Slope:*

- Ambrant—30 to 60 percent
- Rochester—30 to 60 percent
- Rock outcrop—30 to 60 percent

*Elevation:* 4,500 to 5,500 feet

*Mean annual precipitation:* 17 to 25 inches

*Frost-free period:* 60 to 90 days

### ***Component Description***

#### **Ambrant**

*Surface layer texture:* Gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.8 inches

#### **Rochester**

*Surface layer texture:* Gravelly sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.6 inches

#### **Rock outcrop**

*Definition:* Exposures of granite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Soils that are shallow over bedrock

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

#### **Aquepts**

Aquepts consist of very deep, poorly drained and very poorly drained soils that formed in alluvium. These soils are on flood plains. Slope is 0 to 2 percent. Elevation is 2,800 to 4,000 feet. The average annual precipitation is 11 to 30 inches, the average annual air temperature is 37 to 45 degrees F, and the frost-free season is 45 to 120 days.

#### **Typical Pedon**

Aquepts in a pastured area, 1,500 feet north of the southwest corner of sec. 33, T. 14 N., R. 20 W.

0 to 3 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; neutral; abrupt wavy boundary.

3 to 13 inches; light gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; common medium distinct brown and strong brown (7.5YR 4/4 and 5/8) mottles; moderate medium subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; neutral; clear wavy boundary.

13 to 29 inches; gray (N 6/0) sandy loam, very dark gray (N 3/0) moist; common medium distinct light brown and strong brown (7.5YR 6/4 and 5/8) mottles; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; neutral; clear smooth boundary.

29 to 60 inches; gray (N 6/0) very gravelly loamy sand, very dark gray (N 3/0) moist; common medium distinct yellowish red (5YR 5/8) mottles; massive; loose, nonsticky and nonplastic; neutral.

#### **Range in Characteristics**

*Texture:* Sand to clay

*Depth to a seasonal high water table:* 0 to 36 inches

#### **Aquic Haploxerolls**

Aquic Haploxerolls consist of very deep, somewhat poorly drained soils that formed in alluvium. These soils are on low stream terraces adjacent to streams and rivers in valley bottoms. Slope is 0 to 2 percent. Elevation is 3,000 to 3,200 feet. The average annual precipitation is 11 to 14 inches, the average annual air temperature is 43 to 45 degrees F, and the frost-free season is 105 to 120 days.

#### **Typical Pedon**

Aquic Haploxerolls in an area of hayland, 2,000 feet north and 2,700 feet east of the southwest corner of sec. 4, T. 13 N., R. 20 W.

0 to 11 inches; dark gray (10YR 4/1) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

11 to 17 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin and medium platy structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

17 to 30 inches; light brownish gray (10YR 6/2) loam, brown (10YR 5/3) moist; weak medium and thick platy structure; soft, very friable, nonsticky and nonplastic; few very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

30 to 37 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 5/3) moist; few medium distinct dark yellowish brown and yellowish brown (10YR 4/4 and 5/6) mottles; weak medium and thick platy structure; soft, very friable, slightly sticky and slightly plastic; slightly effervescent; moderately alkaline; clear smooth boundary.

37 to 53 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; many medium distinct yellow and brownish yellow (10YR 7/8 and 6/8) mottles; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; mildly alkaline; clear smooth boundary.

53 to 60 inches; light gray (10YR 7/1) clay, brown (10YR 5/3) moist; few fine faint yellow and brownish yellow (10YR 7/8 and 6/8) mottles; massive; very hard, very firm, very sticky and very plastic; mildly alkaline.

#### Range in Characteristics

*Texture:* Sand to clay

*Depth to a seasonal high water table:* 20 to 40 inches

### 4—Aquic Haploxerolls, 0 to 2 percent slopes

#### Composition

Aquic Haploxerolls and similar soils: 85 percent

Inclusions: 15 percent

#### Setting

*Landform:* Stream terraces

*Slope:* 0 to 2 percent

*Elevation:* 3,000 to 3,200 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 105 to 120 days

#### Component Description

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Kind of water table:* Apparent

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### Inclusions

- Well drained soils
- Poorly drained soils
- Areas of soils that are occasionally flooded

#### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

#### Aquic Udorthents

Aquic Udorthents consist of very deep, somewhat poorly drained soils that formed in glacial outwash. These soils are on outwash plains. Slope is 0 to 2 percent. Elevation is 3,900 to 4,200 feet. The average annual precipitation is 21 to 23 inches, the average annual air temperature is 41 to 43 degrees F, and the frost-free season is 70 to 80 days.

#### Typical Pedon

Aquic Udorthents in an area of woodland, 1,800 feet north and 600 feet east of the southwest corner of sec. 28, T. 16 N., R. 15 W.

2 inches to 0; highly decomposed forest litter.

0 to 17 inches; pinkish gray (10YR 7/2) sandy loam, brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; medium acid; clear wavy boundary.

17 to 25 inches; pinkish gray (10YR 7/2) loamy sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; medium acid; gradual smooth boundary.

25 to 60 inches; very pale brown (10YR 7/4) loamy sand, yellowish brown (10YR 5/4) moist; common medium faint grayish brown (10YR 5/2) mottles; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; neutral.

#### Range in Characteristics

*Texture:* Sandy loam to sand

*Depth to a seasonal high water table:* 20 to 40 inches

### 5—Aquic Udorthents, 0 to 2 percent slopes

#### Composition

Aquic Udorthents and similar soils: 85 percent

Inclusions: 15 percent

#### Setting

*Landform:* Outwash plains

*Slope:* 0 to 2 percent

*Elevation:* 3,900 to 4,200 feet

*Mean annual precipitation:* 21 to 23 inches

*Frost-free period:* 70 to 80 days

### **Component Description**

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained

*Dominant parent material:* Glacial outwash

*Flooding:* None

*Kind of water table:* Apparent

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Glaciercreek and similar soils
- Poorly drained soils
- Areas of soils that are occasionally flooded

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Aquolls**

Aquolls consist of very deep, poorly drained and very poorly drained soils that formed in alluvium. These soils are on flood plains. Slope is 0 to 2 percent. Elevation is 2,800 to 4,000 feet. The average annual precipitation is 11 to 30 inches, the average annual air temperature is 37 to 45 degrees F, and the frost-free season is 45 to 120 days.

### **Typical Pedon**

Aquolls in a pastured area, 1,000 feet north of the southeast corner of sec. 19, T. 20 N., R. 16 W.

0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; neutral; clear smooth boundary.

7 to 15 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; common medium distinct brown and strong brown (7.5YR 4/4 and 5/8) mottles; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; neutral; clear smooth boundary.

15 to 25 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; common medium distinct light brown and strong brown (7.5YR 6/4 and 5/8) mottles; massive; soft, friable, slightly sticky and slightly plastic; few very fine and fine roots; neutral; clear wavy boundary.

25 to 29 inches; light gray (5Y 7/1) silt loam, gray (5Y 5/1) moist; common medium distinct yellowish red (5YR 5/8) mottles; massive; soft, friable, nonsticky and nonplastic; neutral; clear wavy boundary.

29 to 60 inches; light gray (5Y 7/1) gravelly silt loam, gray (5Y 5/1) moist; common medium distinct light greenish gray (5GY 7/1) and reddish yellow (7.5YR 6/6) mottles; massive; soft, friable, nonsticky and nonplastic; neutral.

### **Range in Characteristics**

*Texture:* Sand to clay

*Depth to a seasonal high water table:* 0 to 36 inches

## **6—Aquolls and Aquepts, 0 to 2 percent slopes**

### **Composition**

Aquolls and similar soils: 45 percent

Aquepts and similar soils: 40 percent

Inclusions: 15 percent

### **Setting**

*Landform:*

- Aquolls—Flood plains
- Aquepts—Flood plains

*Slope:*

- Aquolls—0 to 2 percent
- Aquepts—0 to 2 percent

*Elevation:* 2,800 to 4,000 feet

*Mean annual precipitation:* 11 to 30 inches

*Frost-free period:* 45 to 120 days

### **Component Description**

#### **Aquolls**

*Dominant parent material:* Alluvium

*Flooding:* Occasional

*Kind of water table:* Apparent

*Note:* The properties of these soils are highly variable.

#### **Aquepts**

*Depth class:* Very deep (more than 60 inches)

*Dominant parent material:* Alluvium

*Flooding:* Occasional

*Kind of water table:* Apparent

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Soils that have an organic surface layer
- Areas of soils that are not subject to flooding
- Well drained soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Argixerolls**

Argixerolls consist of very deep, well drained soils that formed in Tertiary sediment. These soils are on alluvial fans, stream terraces, and hills. Slope is 0 to 60 percent. Elevation is 3,300 to 4,500 feet. The average annual precipitation is 13 to 16 inches, the average annual air temperature is 42 to 44 degrees F, and the frost-free season is 90 to 110 days.

### ***Typical Pedon***

Argixerolls in an area of rangeland, 1,150 feet north of the southeast corner of sec. 7, T. 12 N., R. 19 W.

- 0 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine and few fine roots; common very fine pores; 10 percent pebbles; neutral; abrupt smooth boundary.
- 13 to 23 inches; pale brown (10YR 6/3) clay, yellowish brown (10YR 5/6) moist; strong medium prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; few very fine roots and pores; moderately alkaline; gradual smooth boundary.
- 23 to 36 inches; very pale brown (10YR 7/3) silty clay loam, yellowish brown (10YR 5/4) moist; moderate fine angular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; few fine pores; slightly effervescent; moderately alkaline; gradual smooth boundary.
- 36 to 60 inches; light brownish gray (10YR 6/2) gravelly silty clay loam, brown (10YR 5/3) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few very fine roots and pores; 30 percent pebbles; strongly effervescent; moderately alkaline.

### **Range in Characteristics**

*Surface layer texture:* Loam, gravelly loam, very gravelly loam, gravelly silt loam, or very gravelly silt loam  
*Subsurface layer texture:* Extremely gravelly clay loam to clay

## **7—Argixerolls-Haploxerolls complex, 0 to 4 percent slopes**

### ***Composition***

Argixerolls and similar soils: 50 percent  
 Haploxerolls and similar soils: 40 percent  
 Inclusions: 10 percent

### ***Setting***

*Landform:*

- Argixerolls—Alluvial fans and stream terraces
- Haploxerolls—Alluvial fans and stream terraces

*Slope:*

- Argixerolls—0 to 4 percent
- Haploxerolls—0 to 4 percent

*Elevation:* 3,300 to 4,500 feet

*Mean annual precipitation:* 13 to 16 inches

*Frost-free period:* 90 to 110 days

### ***Component Description***

#### **Argixerolls**

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

#### **Haploxerolls**

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Soils that have a cobbly surface layer
- Poorly drained soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 8—Argixerolls-Haploxerolls complex, 4 to 15 percent slopes

### **Composition**

Argixerolls and similar soils: 50 percent  
Haploxerolls and similar soils: 40 percent  
Inclusions: 10 percent

### **Setting**

#### *Landform:*

- Argixerolls—Hills
- Haploxerolls—Hills

#### *Slope:*

- Argixerolls—4 to 15 percent
- Haploxerolls—4 to 15 percent

*Elevation:* 3,300 to 4,500 feet

*Mean annual precipitation:* 13 to 16 inches

*Frost-free period:* 90 to 110 days

### **Component Description**

#### **Argixerolls**

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

#### **Haploxerolls**

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Soils that have a cobbly surface layer
- Soils that have a stony surface layer

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section

- Wildlife habitat section
- Engineering and soil properties sections

## 9—Argixerolls-Haploxerolls complex, 15 to 30 percent slopes

### **Composition**

Argixerolls and similar soils: 50 percent  
Haploxerolls and similar soils: 40 percent  
Inclusions: 10 percent

### **Setting**

#### *Landform:*

- Argixerolls—Hills
- Haploxerolls—Hills

#### *Slope:*

- Argixerolls—15 to 30 percent
- Haploxerolls—15 to 30 percent

*Elevation:* 3,300 to 4,500 feet

*Mean annual precipitation:* 13 to 16 inches

*Frost-free period:* 90 to 110 days

### **Component Description**

#### **Argixerolls**

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

#### **Haploxerolls**

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Soils that have a cobbly surface layer
- Soils that have a stony surface layer
- Grassvalley and similar soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 10—Argixerolls-Haploxerolls complex, 30 to 60 percent slopes

### Composition

Argixerolls and similar soils: 50 percent  
 Haploxerolls and similar soils: 40 percent  
 Inclusions: 10 percent

### Setting

#### Landform:

- Argixerolls—Hills
- Haploxerolls—Hills

#### Slope:

- Argixerolls—30 to 60 percent
- Haploxerolls—30 to 60 percent

*Elevation:* 3,300 to 4,500 feet

*Mean annual precipitation:* 13 to 16 inches

*Frost-free period:* 90 to 110 days

### Component Description

#### Argixerolls

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

#### Haploxerolls

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Soils that have a cobbly surface layer
- Soils that have a stony surface layer

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Auggie Series

The Auggie series consists of very deep, well drained soils that formed in glaciolacustrine deposits. These

soils are on lake plains and moraines. Slope is 4 to 15 percent. Elevation is 3,800 to 4,400 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Fine-silty, mixed Typic Cryoboralfs

### Typical Pedon

Auggie silt loam, 4 to 15 percent slopes, in a forested area, 2,500 feet south and 1,300 feet west of the northeast corner of sec. 1, T. 20 N., R. 17 W.

O—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 6 inches; pinkish gray (7.5YR 7/2) silt loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; slightly acid; clear smooth boundary.

Bt/E—6 to 20 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist (Bt part); pinkish gray (7.5YR 7/2) silty clay loam, pinkish gray (7.5YR 6/2) moist (E part); moderate coarse subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common moderately thick clay films on faces of peds; slightly acid; clear smooth boundary.

Bt—20 to 45 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; moderate coarse subangular blocky structure; slightly hard, friable, very sticky and very plastic; few fine and medium roots; many moderately thick clay films on faces of peds and along root channels; mildly alkaline; gradual smooth boundary.

C—45 to 60 inches; pink (7.5YR 7/4) silt loam, brown (7.5YR 5/4) moist; weak medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; mildly alkaline.

### Range in Characteristics

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Content of clay in the control section:* 27 to 35 percent

#### E horizon

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Clay content: 10 to 20 percent

Content of rock fragments: 0 to 10 percent pebbles

Reaction: pH 5.6 to 7.3

#### Bt/E horizon

Hue: B part—10YR or 7.5YR; E part—10YR or 7.5YR

Value: B part—6 or 7 dry and 5 or 6 moist; E part—  
6 to 8 dry and 5 to 7 moist  
Chroma: B part—2 to 4; E part—2 or 3  
Clay content, mixed: 27 to 35 percent  
Content of rock fragments: 0 to 10 percent pebbles  
Reaction: pH 6.1 to 7.3

**Bt horizon**

Hue: 10YR or 7.5YR  
Value: 6 or 7 dry; 5 or 6 moist  
Chroma: 2 to 4  
Clay content: 27 to 35 percent  
Content of rock fragments: 0 to 10 percent pebbles  
Reaction: pH 6.1 to 7.8

**C horizon**

Hue: 10YR or 7.5YR  
Value: 6 or 7 dry; 5 or 6 moist  
Chroma: 2 to 4  
Clay content: 10 to 20 percent  
Content of rock fragments: 0 to 10 percent pebbles  
Reaction: pH 6.1 to 7.8

**11—Auggie silt loam, 4 to 15 percent slopes****Composition**

Auggie and similar soils: 85 percent  
Inclusions: 15 percent

**Setting**

*Landform:* Lake plains  
*Slope:* 4 to 15 percent  
*Elevation:* 3,800 to 4,400 feet  
*Mean annual precipitation:* 25 to 30 inches  
*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Glaciolacustrine deposits  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 10.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Upsata and similar soils
- Poorly drained soils
- Waldbillig and similar soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Bata Series**

The Bata series consists of very deep, well drained soils that formed in alpine till. The surface layer of these soils has a high content of volcanic ash. The soils are on moraines. Slope is 2 to 60 percent. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, mixed Andeptic Cryoboralfs

**Typical Pedon**

Bata gravelly silt loam, in an area of Bata-Waldbillig gravelly silt loams, 4 to 30 percent slopes; in a forested area, 1,450 feet east and 1,050 feet north of the southwest corner of sec. 25, T. 18 N., R. 16 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

Bs—0 to 9 inches; brown (7.5YR 5/4) gravelly silt loam, dark brown (7.5YR 4/4) moist; moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many fine pores; 15 percent pebbles; medium acid; clear wavy boundary.

2E/Bt—9 to 20 inches; about 70 percent pinkish gray (7.5YR 7/2) gravelly loam, pinkish gray (7.5YR 6/2) moist (E part); about 30 percent pink (7.5YR 7/4) gravelly loam, brown (7.5YR 5/4) moist (Bt part); weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots; many fine pores; 30 percent pebbles; medium acid; clear wavy boundary.

2Bt1—20 to 36 inches; pink (7.5YR 7/4) very gravelly clay loam, brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine roots; common fine pores; few moderately thick clay films on faces of peds and lining pores; 40 percent pebbles; medium acid; gradual wavy boundary.

2Bt2—36 to 60 inches; light brown (7.5YR 6/4) very gravelly clay loam, brown (7.5YR 4/4) moist;

moderate medium subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine roots; common fine pores; continuous moderately thick clay films on faces of peds and lining pores; 35 percent pebbles and 10 percent cobbles; slightly acid.

#### Range in Characteristics

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Content of clay in the control section:* 20 to 35 percent

*Other features:* A thin discontinuous E horizon above the Bs horizon in some pedons; 2E and 2Bt/E horizons in some pedons

#### Bs horizon

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 4 to 6

Clay content: 10 to 20 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles and stones, 15 to 30 percent pebbles

Reaction: pH 5.1 to 6.5

Moist bulk density: 1.0 g/cc or less

#### 2E/Bt horizon

Hue: E part—10YR, 7.5YR, or 5YR; B part—10YR, 7.5YR, or 5YR

Value: E part—6 to 8 dry and 5 or 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—3 or 4

Clay content, mixed: 12 to 25 percent

Content of rock fragments: 25 to 60 percent—0 to 10 percent cobbles and stones, 25 to 50 percent pebbles

Reaction: pH 5.6 to 6.5

#### 2Bt horizon

Hue: 10YR, 7.5YR, or 5YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 3 or 4

Texture: Sandy clay loam or clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles and stones, 35 to 50 percent pebbles

Reaction: pH 5.6 to 6.5

### 12—Bata gravelly silt loam, cool, 2 to 8 percent slopes

#### Composition

Bata and similar soils: 90 percent

Inclusions: 10 percent

#### Setting

*Landform:* Moraines

*Slope:* 2 to 8 percent

*Elevation:* 5,500 to 6,200 feet

*Mean annual precipitation:* 30 to 45 inches

*Frost-free period:* 40 to 60 days

#### Component Description

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### Inclusions

- Soils that have a lower content of clay
- Poorly drained soils

#### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### 13—Bata-Waldbillig gravelly silt loams, 4 to 30 percent slopes

#### Composition

Bata and similar soils: 45 percent

Waldbillig and similar soils: 35 percent

Inclusions: 20 percent

#### Setting

*Landform:*

- Bata—Moraines
- Waldbillig—Moraines

*Slope:*

- Bata—4 to 30 percent
- Waldbillig—4 to 30 percent

*Elevation:* 3,800 to 5,000 feet

*Mean annual precipitation:* 30 to 45 inches

*Frost-free period:* 40 to 60 days

### **Component Description**

#### **Bata**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

#### **Waldbillig**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Hollandlake and similar soils
- Poorly drained soils
- Upsata soils on terraces

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **Beeskove Series**

The Beeskove series consists of very deep, well drained soils that formed in colluvium derived from argillite and limestone. These soils are on mountain slopes. Slope is 30 to 80 percent. Elevation is 4,500 to 6,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 42 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Typic Eutrochrepts

### **Typical Pedon**

Beeskove gravelly loam, 30 to 60 percent slopes, in a forested area, 900 feet west and 900 feet south of the east quarter corner of sec. 10, T. 12 N., R. 21 W.

- Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.
- E—0 to 8 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and nonplastic; many very fine, fine, and medium and few coarse roots; many very fine and fine pores; 25 percent angular pebbles; neutral; clear wavy boundary.
- E/Bw—8 to 20 inches; 75 percent very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist (E part); 25 percent pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist (Bw part); when mixed, texture is very gravelly loam; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, and medium and few coarse roots; many very fine and fine pores; 40 percent angular pebbles; neutral; clear wavy boundary.
- Bw—20 to 27 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; common very fine and fine pores; 45 percent angular pebbles; neutral; clear wavy boundary.
- Bk1—27 to 47 inches; very pale brown (10YR 7/3) extremely gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots and pores; 60 percent angular pebbles and 5 percent angular cobbles; disseminated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.
- Bk2—47 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 65 percent angular pebbles and 5 percent angular cobbles; disseminated lime; violently effervescent; moderately alkaline.

### **Range in Characteristics**

*Soil temperature:* 42 to 46 degrees F  
*Moisture control section:* Between depths of 8 and 24 inches  
*Depth to Bk horizon:* 20 to 30 inches  
*Content of clay in the control section:* 5 to 15 percent  
*E horizon*  
 Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 or 3  
 Clay content: 5 to 15 percent  
 Content of rock fragments: 15 to 30 percent pebbles  
 Reaction: pH 6.6 to 7.3

**E/Bw horizon**

Value: 6 or 7 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: Loam or sandy loam  
 Clay content: 5 to 15 percent  
 Content of rock fragments: 35 to 55 percent—0 to  
 10 percent cobbles, 35 to 45 percent pebbles  
 Reaction: pH 6.6 to 7.3

**Bw horizon**

Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: Loam or sandy loam  
 Clay content: 5 to 15 percent  
 Content of rock fragments: 35 to 60 percent—0 to  
 10 percent cobbles, 35 to 60 percent pebbles  
 Reaction: pH 6.6 to 7.3

**Bk horizon**

Value: 6 or 7 dry; 5 or 6 moist  
 Chroma: 2 or 3  
 Texture: Loam or sandy loam  
 Clay content: 5 to 15 percent  
 Content of rock fragments: 60 to 75 percent—5 to  
 10 percent cobbles, 55 to 60 percent pebbles  
 Calcium carbonate equivalent: 10 to 15 percent  
 Reaction: pH 7.9 to 8.4

## 14—Beeskove gravelly loam, 30 to 60 percent slopes

### **Composition**

Beeskove and similar soils: 85 percent  
 Inclusions: 15 percent

### **Setting**

*Landform:* Mountains  
*Slope:* 30 to 60 percent, northeast aspect  
*Elevation:* 4,500 to 6,000 feet  
*Mean annual precipitation:* 25 to 35 inches  
*Frost-free period:* 60 to 90 days

### **Component Description**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Felan and similar soils
- Repp, cool, soils
- Tevis and similar soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 15—Beeskove-Rock outcrop complex, 50 to 80 percent slopes

### **Composition**

Beeskove and similar soils: 50 percent  
 Rock outcrop: 30 percent  
 Inclusions: 20 percent

### **Setting**

#### *Landform:*

- Beeskove—Mountains
  - Rock outcrop—Mountains
- Slope:* 50 to 80 percent, southwest aspect  
*Elevation:* 4,500 to 6,000 feet  
*Mean annual precipitation:* 25 to 35 inches  
*Frost-free period:* 60 to 90 days

### **Component Description**

#### **Beeskove**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.5 inches

#### **Rock outcrop**

*Definition:* Exposures of argillite or limestone bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as

horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Felan and similar soils
- Repp, cool, soils
- Tevis and similar soils
- Soils that are shallow over bedrock
- Areas of rubble land

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Bigarm Series**

The Bigarm series consists of very deep, somewhat excessively drained soils that formed in alluvium and colluvium. These soils are on stream terraces, alluvial fans, hills, and mountains. Slope is 0 to 60 percent. Elevation is 3,000 to 5,200 feet. The average annual precipitation is 14 to 17 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 90 to 110 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Typic Haploxerolls

### **Typical Pedon**

Bigarm gravelly loam, 4 to 15 percent slopes, in an area of rangeland, 1,200 feet north and 100 feet east of the southwest corner of sec. 4, T. 12 N., R. 19 W.

A1—0 to 11 inches; very dark grayish brown (10YR 3/2) gravelly loam, black (10YR 2/1) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine pores; 25 percent pebbles; neutral; clear wavy boundary.

A2—11 to 15 inches; dark grayish brown (10YR 4/2) very gravelly loam, black (10YR 2/1) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine pores; 40 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

Bw1—15 to 21 inches; brown (10YR 5/3) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many

very fine and fine roots; many very fine pores; 50 percent pebbles and 5 percent cobbles; neutral; clear wavy boundary.

Bw2—21 to 40 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; 50 percent pebbles and 10 percent cobbles; neutral; gradual smooth boundary.

C—40 to 60 inches; pale brown (10YR 6/3) extremely gravelly loamy sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; 50 percent pebbles and 25 percent cobbles; neutral.

### **Range in Characteristics**

*Soil temperature:* 43 to 47 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Mollic epipedon thickness:* 8 to 20 inches

*Content of rock fragments:* 35 to 70 percent in the control section

*Content of clay in the control section:* 5 to 18 percent

*Other features:* Mainly argillite and quartzite rock fragments; calcareous material below a depth of 40 inches in some pedons

#### *A horizon*

Hue: 7.5YR or 10YR

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 or 2

Clay content: 7 to 18 percent

Content of rock fragments: 20 to 60 percent—0 to 20 percent angular cobbles and stones, 10 to 50 percent angular pebbles

Reaction: pH 6.6 to 7.3

#### *Bw horizon*

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Loam, fine sandy loam, or sandy loam

Clay content: 5 to 18 percent

Content of rock fragments: 35 to 60 percent—0 to 30 percent angular cobbles and stones, 15 to 50 percent angular pebbles

Reaction: pH 6.6 to 7.3

#### *C horizon*

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or loamy sand

Clay content: 5 to 18 percent

Content of rock fragments: 40 to 85 percent—5 to 40 percent angular cobbles and stones, 20 to 60 percent angular pebbles

Reaction: pH 6.6 to 7.3

## 16—Bigarm gravelly loam, 0 to 4 percent slopes

### Composition

Bigarm and similar soils: 85 percent  
Inclusions: 15 percent

### Setting

*Landform:* Stream terraces  
*Slope:* 0 to 4 percent  
*Elevation:* 3,000 to 3,600 feet  
*Mean annual precipitation:* 14 to 17 inches  
*Frost-free period:* 90 to 110 days

### Component Description

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Alluvium  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Grantsdale and similar soils
- Poorly drained soils
- Moiese and similar soils
- Soils that have a cobbly surface layer
- Soils that have a stony surface layer

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 17—Bigarm gravelly loam, 4 to 15 percent slopes

### Composition

Bigarm and similar soils: 85 percent  
Inclusions: 15 percent

### Setting

*Landform:* Alluvial fans and stream terraces  
*Slope:* 4 to 15 percent

*Elevation:* 3,200 to 4,800 feet  
*Mean annual precipitation:* 14 to 17 inches  
*Frost-free period:* 90 to 110 days

### Component Description

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Biglake and similar soils
- Very deep, clayey soils
- Soils that have a stony surface layer

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 18—Bigarm gravelly loam, 15 to 30 percent slopes

### Composition

Bigarm and similar soils: 85 percent  
Inclusions: 15 percent

### Setting

*Landform:* Hills  
*Slope:* 15 to 30 percent  
*Elevation:* 3,200 to 4,800 feet  
*Mean annual precipitation:* 14 to 17 inches  
*Frost-free period:* 90 to 110 days

### Component Description

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Alluvium or colluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Biglake and similar soils
- Very deep, clayey soils
- Soils that have a stony surface layer

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **19—Bigarm gravelly loam, 30 to 60 percent slopes**

#### **Composition**

Bigarm and similar soils: 85 percent  
Inclusions: 15 percent

#### **Setting**

*Landform:* Mountains

*Slope:* 30 to 60 percent

*Elevation:* 3,200 to 5,200 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

#### **Component Description**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Alluvium or colluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Biglake and similar soils
- Winkler and similar soils
- Soils that have a stony surface layer

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **20—Bigarm-Rock outcrop complex, 30 to 60 percent slopes**

#### **Composition**

Bigarm and similar soils: 70 percent  
Rock outcrop: 15 percent  
Inclusions: 15 percent

#### **Setting**

*Landform:*

- Bigarm—Mountains
- Rock outcrop—Mountains

*Slope:* 30 to 60 percent

*Elevation:* 3,200 to 5,000 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

#### **Component Description**

##### **Bigarm**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

##### **Rock outcrop**

*Definition:* Exposures of quartzite or argillite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Biglake and similar soils
- Soils that are 10 to 40 inches deep over bedrock
- Areas of rubble land

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Biglake Series

The Biglake series consists of very deep, excessively drained soils that formed in alluvium. These soils are on alluvial fans and stream terraces. Slope is 8 to 30 percent. Elevation is 3,200 to 4,000 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 90 to 110 days.

**Taxonomic Class:** Sandy-skeletal, mixed, frigid Typic Haploxerolls

#### Typical Pedon

Biglake gravelly sandy loam, 8 to 15 percent slopes, in an area of rangeland, 300 feet east and 2,000 feet north of the southwest corner of sec. 12, T. 12 N., R. 20 W.

A—0 to 9 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many fine pores; 20 percent angular pebbles; neutral (pH 6.8); clear wavy boundary.

Bw—9 to 16 inches; brown (10YR 5/3) very gravelly sandy loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; common fine pores; 40 percent angular pebbles and 10 percent cobbles; neutral (pH 6.8); clear wavy boundary.

C—16 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots in the upper part; 55 percent angular pebbles and 10 percent cobbles; neutral (pH 7.0).

#### Range in Characteristics

*Soil temperature:* 43 to 47 degrees F

*Moisture control section:* Between depths of 12 and 35 inches

*Mollic epipedon thickness:* 8 to 16 inches

*Control section:* 2 to 10 percent clay; 35 to 80 percent rock fragments, mainly argillite and quartzite

#### A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: Loam or sandy loam

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 10 percent cobbles, 15 to 25 percent pebbles

Reaction: pH 6.6 to 7.3

#### Bw horizon

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Clay content: 5 to 10 percent

Content of rock fragments: 35 to 60 percent—0 to 15 percent cobbles, 35 to 45 percent pebbles

Reaction: pH 6.6 to 7.3

#### C horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loamy sand or sand

Clay content: 0 to 10 percent

Content of rock fragments: 60 to 80 percent—10 to 20 percent cobbles and stones, 50 to 60 percent pebbles

Reaction: pH 6.6 to 7.3

### 21—Biglake gravelly sandy loam, 8 to 15 percent slopes

#### Composition

Biglake and similar soils: 90 percent

Inclusions: 10 percent

#### Setting

*Landform:* Alluvial fans and stream terraces

*Slope:* 8 to 15 percent

*Elevation:* 3,200 to 4,000 feet

*Mean annual precipitation:* 14 to 16 inches

*Frost-free period:* 90 to 110 days

#### Component Description

*Surface layer texture:* Gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

### ***Inclusions***

- Bigarm and similar soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **22—Biglake gravelly sandy loam, 15 to 30 percent slopes**

### ***Composition***

Biglake and similar soils: 85 percent  
Inclusions: 15 percent

### ***Setting***

*Landform:* Stream terraces

*Position on the landform:* Risers

*Slope:* 15 to 30 percent

*Elevation:* 3,200 to 4,000 feet

*Mean annual precipitation:* 14 to 16 inches

*Frost-free period:* 90 to 110 days

### ***Component Description***

*Surface layer texture:* Gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

### ***Inclusions***

- Bigarm and similar soils
- Soils that have a thin surface layer

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Bignell Series**

The Bignell series consists of very deep, well drained soils that formed in alluvium. These soils are on hills and mountains. Slope is 8 to 60 percent. Elevation is 3,500 to 5,200 feet. The average annual precipitation is 17 to 24 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Clayey-skeletal, mixed Typic Eutroboralfs

### ***Typical Pedon***

Bignell gravelly loam, 8 to 30 percent slopes, in a forested area, 800 feet north and 300 feet east of the southwest corner of sec. 30, T. 14 N., R. 16 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 11 inches; pinkish gray (7.5YR 7/2) gravelly loam, pinkish gray (7.5YR 6/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots and pores; 20 percent pebbles; strongly acid; abrupt wavy boundary.

E/Bt—11 to 15 inches; pinkish gray (7.5YR 7/2) very gravelly loam, pinkish gray (7.5YR 6/2) moist (E part); pinkish gray (7.5YR 6/2) very gravelly clay loam, brown (7.5YR 5/2) moist (Bt part); when mixed, texture is very gravelly loam; moderate medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine pores; 45 percent pebbles; strongly acid; gradual wavy boundary.

Bt1—15 to 35 inches; light brown (7.5YR 6/4) very gravelly clay, brown (7.5YR 5/4) moist; strong fine and medium angular blocky structure; very hard, firm, sticky and very plastic; few very fine, fine, medium, and coarse roots; common very fine and fine pores; common moderately thick clay films on faces of peds and on pebbles; 45 percent pebbles; strongly acid; clear wavy boundary.

Bt2—35 to 60 inches; light brown (7.5YR 6/4) very gravelly clay, strong brown (7.5YR 5/6) moist;

strong fine and medium angular blocky structure; very hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; few very fine and fine pores; common moderately thick reddish yellow (7.5YR 7/8) and brown (7.5YR 5/4) clay films on faces of peds and on pebbles; 45 percent pebbles; medium acid.

#### **Range in Characteristics**

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Content of clay in the control section:* 35 to 60 percent

*E horizon:*

Hue: 7.5YR or 10YR

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Loam or clay loam

Clay content: 10 to 30 percent

Content of rock fragments: 15 to 60 percent—0 to 30 percent cobbles or stones, 10 to 30 percent pebbles

Surface stones: 0 to 3 percent of the surface covered by stones

Reaction: pH 5.1 to 6.5

*E/Bt horizon*

Hue: E part—7.5YR or 10YR; Bt part—7.5YR or 10YR

Value: E part—6 or 7 dry and 5 or 6 moist; Bt part—5 to 7 dry

Chroma: E part—2 or 3; Bt part—2 to 6

Texture: Loam, sandy clay loam, or clay loam

Clay content: 10 to 35 percent

Content of rock fragments: 25 to 60 percent—0 to 25 percent cobbles, 15 to 55 percent pebbles

Reaction: pH 5.1 to 6.5

*Bt horizon*

Hue: 5YR, 7.5YR, or 10YR

Value: 5 to 7 dry; 3 to 6 moist

Chroma: 2 to 6

Texture: Clay, sandy clay, or clay loam

Clay content: 35 to 60 percent

Content of rock fragments: 35 to 60 percent—0 to 30 percent cobbles, 15 to 45 percent pebbles

Reaction: pH 5.1 to 6.5; ranges to pH 7.8 below a depth of 40 inches

### **23—Bignell gravelly loam, 8 to 30 percent slopes**

#### **Composition**

Bignell and similar soils: 85 percent

Inclusions: 15 percent

#### **Setting**

*Landform:* Hills

*Slope:* 8 to 30 percent

*Elevation:* 3,500 to 5,200 feet

*Mean annual precipitation:* 17 to 24 inches

*Frost-free period:* 60 to 90 days

#### **Component Description**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Crow and similar soils
- Greenough and similar soils
- Shooflin and similar soils
- Winkler, cool, soils
- Soils that have a stony surface layer
- Soils that support western larch and grand fir

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **24—Bignell-Winkler, cool, complex, 30 to 60 percent slopes**

#### **Composition**

Bignell and similar soils: 55 percent

Winkler and similar soils: 30 percent

Inclusions: 15 percent

#### **Setting**

*Landform:*

- Bignell—Mountains
- Winkler—Mountains

*Slope:*

- Bignell—30 to 60 percent, northeast aspect
- Winkler—30 to 60 percent, northeast aspect

*Elevation:* 4,000 to 5,200 feet

*Mean annual precipitation:* 17 to 24 inches

*Frost-free period:* 60 to 90 days

### **Component Description**

#### **Bignell**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.6 inches

#### **Winkler**

*Surface layer texture:* Very gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Crow and similar soils
- Shooflin and similar soils
- Tevis and similar soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **25—Bignell, warm-Winkler complex, 30 to 60 percent slopes**

### **Composition**

Bignell and similar soils: 55 percent

Winkler and similar soils: 30 percent

Inclusions: 15 percent

### **Setting**

#### *Landform:*

- Bignell—Mountains
- Winkler—Mountains

#### *Slope:*

- Bignell—30 to 60 percent, southwest aspect
- Winkler—30 to 60 percent, southwest aspect

*Elevation:* 3,500 to 5,200 feet

*Mean annual precipitation:* 17 to 24 inches

*Frost-free period:* 60 to 90 days

### **Component Description**

#### **Bignell**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.4 inches

#### **Winkler**

*Surface layer texture:* Very gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Crow and similar soils
- Shooflin and similar soils
- Soils that support western larch
- Soils that have a stony surface layer

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Borohemists

Borohemists consist of very deep, poorly drained or very poorly drained soils that formed in organic deposits of mosses, rushes, grasses, sedges, cattails, trees, and other woody plants over mineral soil deposits. The plant material is in various stages of decomposition. Borohemists are in closed depressions in glaciated valleys and along streams. Slope is 0 to 2 percent. Elevation is 3,800 to 4,000 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is 39 to 41 degrees F, and the frost-free season is 40 to 60 days.

### Typical Pedon

Borohemists in an area of native grasses, sedges, rushes, and other water-tolerant plants, 500 feet east of the southwest corner of sec. 19, T. 20 N., R. 16 W.

Oe1—0 to 6 inches; hemic material, black (N 2/0) moist; about 60 percent fiber; weak thick platy structure; nonsticky; medium acid; clear smooth boundary.

Oe2—6 to 28 inches; hemic material, reddish brown (5YR 4/4) moist; about 50 percent fiber; weak thick platy structure; nonsticky; 80 percent herbaceous fiber and 20 percent mainly wood fiber; medium acid; abrupt wavy boundary.

Cg—28 to 60 inches; very fine sandy loam, light brownish gray (10YR 6/2) moist; common medium distinct light brown (7.5YR 6/4) and greenish gray (5G 6/1) mottles; massive; soft, friable, nonsticky and nonplastic; slightly acid.

### Range in Characteristics

*Thickness of organic material:* 16 to 40 inches

*Texture (mineral soil):* Sandy loam to silty clay loam

*Seasonal high water table:* At or near the surface

## 26—Borohemists, 0 to 2 percent slopes

### Composition

Borohemists and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Closed depressions

*Slope:* 0 to 2 percent

*Elevation:* 3,800 to 4,000 feet

*Mean annual precipitation:* 22 to 30 inches

*Frost-free period:* 40 to 60 days

### Component Description

*Depth class:* Very deep (more than 60 inches)

*Dominant parent material:* Peat

*Flooding:* None

*Kind of water table:* Apparent

*Duration of ponding:* Long

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Somewhat poorly drained soils
- Areas of soils that are occasionally flooded

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Chickaman Series

The Chickaman series consists of very deep, somewhat excessively drained soils that formed in material derived from micaceous schist. The surface layer of these soils has a high content of volcanic ash. The soils are on mountain slopes. Slope is 8 to 60 percent. Elevation is 4,500 to 6,000 feet. The average annual precipitation is 37 to 42 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Coarse-silty, micaceous Andic Cryochrepts

### Typical Pedon

Chickaman silt loam, 8 to 30 percent slopes, in a forested area, 1,200 feet north of the southwest corner of sec. 12, T. 11 N., R. 22 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

Bs—0 to 9 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium and few coarse roots; 5 percent hard micaceous pebbles and 5 percent soft micaceous pebbles; slightly acid; clear wavy boundary.

2E—9 to 18 inches; light gray (10YR 7/2) gravelly silt loam, grayish brown (10YR 5/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium and

few coarse roots; 20 percent hard pebbles; slightly acid; abrupt wavy boundary.

**2E and Bt**—18 to 30 inches; 75 percent light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist (E part); 25 percent brown (10YR 5/3) lamellae of silt loam about 1/8 to 1/2 inch thick, dark brown (10YR 4/3) moist (Bt part); weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; 5 percent hard micaceous pebbles and 15 percent soft micaceous pebbles; slightly acid; abrupt wavy boundary.

**2BC**—30 to 60 inches; light yellowish brown (10YR 6/4) very gravelly silt loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; 5 percent hard micaceous pebbles and 40 percent soft micaceous pebbles; slightly acid.

#### Range in Characteristics

*Soil temperature:* 39 to 43 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Control section:* 5 to 10 percent clay and more than 40 percent mica, by weight

#### *Bs horizon*

Value: 5 or 6 dry

Chroma: 3 or 4

Clay content: 5 to 8 percent

Content of rock fragments: 0 to 25 percent—0 to 10 percent hard pebbles, 0 to 15 percent soft micaceous pebbles

Moist bulk density: 0.95 g/cc or less

Reaction: pH 6.1 to 6.5

#### *2E horizon*

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 5 to 10 percent

Content of rock fragments: 15 to 35 percent— 0 to 10 percent hard pebbles

Reaction: pH 6.1 to 6.5

#### *2E and Bt horizon*

Value: E part—6 or 7 dry and 5 or 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—3 or 4

Clay content: 5 to 10 percent; less than 3 percent increase in clay in lamellae

Content of rock fragments: 15 to 35 percent—0 to 10 percent hard pebbles, 15 to 25 percent soft micaceous pebbles

Reaction: pH 6.1 to 6.5

#### *2BC horizon*

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Clay content: 5 to 10 percent

Content of rock fragments: 35 to 75 percent—0 to 10 percent hard cobbles and pebbles, 35 to 65 percent soft micaceous pebbles and cobbles

Reaction: pH 6.1 to 6.5

## 27—Chickaman silt loam, 8 to 30 percent slopes

### Composition

Chickaman and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 4,500 to 6,000 feet

*Mean annual precipitation:* 37 to 42 inches

*Frost-free period:* 40 to 60 days

### Component Description

*Surface layer texture:* Silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Holloway and similar soils
- Lantern and similar soils
- Petty and similar soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 28—Chickaman silt loam, 30 to 60 percent slopes

### Composition

Chickaman and similar soils: 85 percent  
Inclusions: 15 percent

### Setting

*Landform:* Mountains  
*Slope:* 30 to 60 percent  
*Elevation:* 4,500 to 6,000 feet  
*Mean annual precipitation:* 37 to 42 inches  
*Frost-free period:* 40 to 60 days

### Component Description

*Surface layer texture:* Silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Holloway and similar soils
- Lantern and similar soils
- Petty and similar soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Coerock Series

The Coerock series consists of shallow, well drained soils that formed in volcanic ash over argillite or quartzite bedrock. These soils are in cirque basins and on mountains. Slope is 4 to 80 percent. Elevation is 6,500 to 8,000 feet. The average annual precipitation is 50 to 80 inches, the average annual air temperature is

33 to 36 degrees F, and the frost-free season is 30 to 40 days.

**Taxonomic Class:** Medial-skeletal Lithic Cryandepts

### Typical Pedon

Coerock very gravelly silt loam, in an area of Coerock-Rock outcrop complex, 4 to 30 percent slopes; in a forested area, 2,000 feet west and 1,000 feet south of the northeast corner of sec. 2, T. 17 N., R. 17 W.

Oi—1 inch to 0; undecomposed and slightly decomposed forest litter.

Bs1—0 to 15 inches; reddish yellow (7.5YR 6/6) very gravelly silt loam, strong brown (7.5YR 4/6) moist; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium and few coarse roots; 40 percent pebbles; medium acid; gradual wavy boundary.

Bs2—15 to 18 inches; light brown (7.5YR 6/4) very gravelly loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; 35 percent pebbles and 10 percent cobbles; medium acid; abrupt wavy boundary.

R—18 inches; fractured quartzite bedrock.

### Range in Characteristics

*Soil temperature:* 35 to 38 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Depth to bedrock:* 14 to 20 inches

*Base saturation:* Less than 60 percent

#### Bs1 horizon

Hue: 7.5YR or 10YR

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 3 to 6

Clay content: 7 to 15 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles, 35 to 50 percent pebbles

Moist bulk density: Less than 0.85 g/cc

Reaction: pH 5.6 to 6.5

#### Bs2 horizon

Hue: 7.5YR or 10YR

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 3 to 6

Texture: Loam or silt loam

Clay content: 7 to 15 percent

Content of rock fragments: 35 to 50 percent—5 to 15 percent cobbles, 30 to 45 percent pebbles

Reaction: pH 5.6 to 6.5

Moist bulk density: Less than 0.85 g/cc

**29—Coerock-Rock outcrop complex, 4 to 30 percent slopes****Composition**

Coerock and similar soils: 45 percent  
 Rock outcrop: 35 percent  
 Inclusions: 20 percent

**Setting***Landform:*

- Coerock—Cirque basins
- Rock outcrop—Cirque basins

*Slope:*

- Coerock—4 to 30 percent
- Rock outcrop—4 to 30 percent

*Elevation:* 6,500 to 8,000 feet

*Mean annual precipitation:* 50 to 80 inches

*Frost-free period:* 30 to 40 days

**Component Description****Coerock**

*Surface layer texture:* Very gravelly silt loam

*Depth class:* Shallow (10 to 20 inches)

*Drainage class:* Well drained

*Dominant parent material:* Residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.0 inches

**Rock outcrop**

*Definition:* Exposures of argillite or quartzite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Very deep, loamy soils
- Poorly drained soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**30—Coerock-Rock outcrop complex, 50 to 80 percent slopes****Composition**

Coerock and similar soils: 45 percent  
 Rock outcrop: 35 percent  
 Inclusions: 20 percent

**Setting***Landform:*

- Coerock—Mountains
- Rock outcrop—Mountains

*Slope:* 50 to 80 percent

*Elevation:* 6,500 to 8,000 feet

*Mean annual precipitation:* 50 to 80 inches

*Frost-free period:* 30 to 40 days

**Component Description****Coerock**

*Surface layer texture:* Very gravelly silt loam

*Depth class:* Shallow (10 to 20 inches)

*Drainage class:* Well drained

*Dominant parent material:* Residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.0 inches

**Rock outcrop**

*Definition:* Exposures of argillite or quartzite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Very deep, loamy soils
- Areas of rubble land

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Courville Series**

The Courville series consists of very deep, well drained soils that formed in alpine till. The surface layer

of these soils has a high content of volcanic ash. These soils are on moraines and mountains. Slope is 8 to 60 percent. Elevation is 3,800 to 5,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Andic Dystric Eutrochrepts

#### Typical Pedon

Courville gravelly silt loam, 8 to 30 percent slopes, in a forested area, 2,400 feet west and 100 feet north of the southeast corner of sec. 11, T. 21 N., R. 17 W.

Oi—1 inch to 0; undecomposed and slightly decomposed forest litter.

Bs—0 to 10 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; very fine pores; 20 percent pebbles; slightly acid; clear smooth boundary.

2E—10 to 27 inches; light brownish gray (10YR 6/2) very gravelly fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine pores; 40 percent pebbles and 5 percent cobbles; slightly acid; clear wavy boundary.

2E/Bw—27 to 45 inches; 80 percent light brownish gray (10YR 6/2) very gravelly fine sandy loam, brown (10YR 4/3) moist (E part); 20 percent light yellowish brown (10YR 6/4) very gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist (Bw part); weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine pores; 40 percent pebbles and 10 percent cobbles; neutral; gradual wavy boundary.

2Bw/E—45 to 60 inches; 75 percent light yellowish brown (10YR 6/4) very gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist (Bw part); 25 percent light brownish gray (10YR 6/2) very gravelly fine sandy loam, brown (10YR 4/3) moist (E part); weak medium subangular blocky structure; hard, very friable, nonsticky and nonplastic; few very fine and fine roots; few very fine pores; 40 percent pebbles and 10 percent cobbles; neutral.

#### Range in Characteristics

*Soil temperature:* 40 to 45 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Bs horizon*

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 3 or 4

Clay content: 7 to 15 percent

Content of rock fragments: 0 to 35 percent—0 to 20 percent cobbles and stones, 0 to 30 percent pebbles

Bulk density: 1.0 g/cc or less

Reaction: pH 5.6 to 6.5

#### 2E horizon

Hue: 7.5YR or 10YR

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, fine sandy loam, or silt loam

Clay content: 5 to 18 percent

Content of rock fragments: 35 to 60 percent—0 to 20 percent cobbles and stones, 25 to 55 percent pebbles

Reaction: pH 5.6 to 7.3

#### 2E/Bw horizon

Hue: E part—7.5YR or 10YR; B part—7.5YR or 10YR

Value: E part—6 to 8 dry and 4 to 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—3 or 4

Texture: Loam, silt loam, fine sandy loam, or sandy loam

Clay content: 10 to 25 percent

Content of rock fragments: 35 to 60 percent—0 to 20 percent cobbles and stones, 25 to 50 percent pebbles

Reaction: pH 5.6 to 7.3

#### 2Bw/E horizon

Hue: B part—7.5YR or 10YR; E part—7.5YR or 10YR

Value: B part—5 or 6 dry and 4 or 5 moist; E part—6 to 8 dry and 4 to 6 moist

Chroma: B part—3 or 4; E part—2 or 3

Texture: Loam, silt loam, fine sandy loam, or sandy loam

Clay content: 10 to 25 percent

Content of rock fragments: 35 to 60 percent—0 to 20 percent cobbles and stones, 25 to 50 percent pebbles

Reaction: pH 5.6 to 7.3

### 31—Courville gravelly silt loam, 8 to 30 percent slopes

#### Composition

Courville and similar soils: 85 percent

Inclusions: 15 percent

**Setting**

*Landform:* Moraines  
*Slope:* 8 to 30 percent  
*Elevation:* 3,800 to 5,000 feet  
*Mean annual precipitation:* 25 to 35 inches  
*Frost-free period:* 60 to 90 days

**Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Rumblecreek and similar soils
- Poorly drained soils
- Winfall and similar soils
- Glaciercreek soils on terraces

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**32—Courville-Mitten gravelly silt loams, 30 to 60 percent slopes****Composition**

Courville and similar soils: 45 percent  
 Mitten and similar soils: 40 percent  
 Inclusions: 15 percent

**Setting**

*Landform:*  
 • Courville—Mountains  
 • Mitten—Mountains  
*Slope:*  
 • Courville—30 to 60 percent  
 • Mitten—30 to 60 percent

*Elevation:* 4,200 to 5,000 feet  
*Mean annual precipitation:* 25 to 35 inches  
*Frost-free period:* 60 to 90 days

**Component Description****Courville**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.1 inches

**Mitten**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Winfall and similar soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Crow Series**

The Crow series consists of very deep, well drained soils that formed in alluvium. These soils are on hills. Slope is 4 to 15 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 16 to 22 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Fine, mixed Typic Eutroboralfs

**Typical Pedon**

Crow silt loam, 4 to 15 percent slopes, in a forested

area, 200 feet north and 100 feet east of the southwest corner of sec. 22, T. 13 N., R. 15 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 1 inch; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; strong very thin platy structure; soft, very friable, nonsticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; 5 percent pebbles; medium acid; abrupt smooth boundary.

E2—1 to 4 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak thin platy structure; slightly hard, firm, slightly sticky and plastic; many very fine, fine, medium, and coarse roots; many very fine pores; 10 percent pebbles; medium acid; abrupt smooth boundary.

Bt/E—4 to 10 inches; yellowish brown (10YR 5/4) silty clay loam, brown (10YR 4/3) moist (Bt part); light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist (E part); strong medium subangular blocky structure; hard, firm, slightly sticky and plastic; many very fine, fine, medium, and coarse roots; many very fine pores; common moderately thick clay films lining pores; 10 percent pebbles; medium acid; clear smooth boundary.

Bt1—10 to 35 inches; yellowish brown (10YR 5/4) silty clay, brown (10YR 4/3) moist; strong medium prismatic structure parting to moderate coarse subangular blocky; very hard, very firm, sticky and plastic; common very fine, fine, medium, and coarse roots; many very fine pores; many moderately thick clay films on faces of peds; 10 percent pebbles; slightly acid; clear smooth boundary.

Bt2—35 to 48 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; strong medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky and plastic; few very fine and fine roots; common very fine pores; many thick clay films lining pores; 10 percent pebbles; slightly acid; gradual smooth boundary.

BC—48 to 60 inches; very pale brown (10YR 7/4) sandy clay loam, yellowish brown (10YR 5/4) moist; moderate very fine angular blocky structure; slightly hard, firm, sticky and plastic; few fine and very fine roots; many very fine pores; many moderately thick clay films; 10 percent pebbles; slightly acid.

#### Range in Characteristics

##### *E horizon*

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 10 to 20 percent

Content of rock fragments: 0 to 25 percent—0 to 5 percent cobbles, 0 to 25 percent pebbles

Reaction: pH 5.6 to 6.5

##### *Bt/E horizon*

Hue: 10YR or 2.5Y

Value: B part—5 or 6 dry and 4 or 5 moist; E part—6 to 8 dry and 5 or 6 moist

Chroma: B part—2 to 4; E part—2 or 3

Texture: Silty clay loam, clay loam, loam, or silt loam

Clay content, mixed: 20 to 40 percent

Content of rock fragments: 0 to 25 percent—0 to 5 percent cobbles, 0 to 25 percent pebbles

Reaction: pH 5.6 to 6.5

##### *Bt horizon*

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Silty clay, clay, sandy clay, or clay loam

Clay content: 35 to 60 percent

Content of rock fragments: 0 to 35 percent—0 to 10 percent cobbles, 0 to 25 percent pebbles

Reaction: pH 6.1 to 7.3

##### *BC horizon*

Hue: 2.5Y, 10YR, or 7.5YR

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Sandy clay loam, clay loam, loam, or sandy loam

Clay content: 15 to 35 percent

Content of rock fragments: 5 to 35 percent—0 to 10 percent cobbles, 5 to 25 percent pebbles

Reaction: pH 6.1 to 7.8

### 33—Crow silt loam, 4 to 15 percent slopes

#### *Composition*

Crow and similar soils: 85 percent

Inclusions: 15 percent

#### *Setting*

*Landform:* Hills

*Slope:* 4 to 15 percent

*Elevation:* 3,500 to 4,500 feet

*Mean annual precipitation:* 16 to 22 inches

*Frost-free period:* 60 to 90 days

#### *Component Description*

*Surface layer texture:* Silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 9.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Bignell and similar soils
- Greenough and similar soils
- Lubrecht and similar soils
- Shooflin and similar soils
- Winkler, cool, soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Desmet Series**

The Desmet series consists of very deep, well drained soils that formed in alluvium. These soils are on stream terraces. Slope is 0 to 2 percent. Elevation is 2,800 to 3,500 feet. The average annual precipitation is 11 to 14 inches, the average annual air temperature is 43 to 45 degrees F, and the frost-free season is 105 to 120 days.

**Taxonomic Class:** Coarse-silty, mixed, frigid Calciorthidic Haploxerolls

### ***Typical Pedon***

Desmet loam, 0 to 2 percent slopes, in an area of cropland, 600 feet south and 120 feet east of the northwest corner of sec. 34, T. 12 N., R. 20 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; common fine pores; neutral; abrupt smooth boundary.

A—7 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots and

pores; mildly alkaline; clear wavy boundary.

Bk—15 to 24 inches; light gray (2.5Y 7/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots and pores; common soft masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

BC—24 to 60 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots and pores; disseminated lime; strongly effervescent; moderately alkaline.

### ***Range in Characteristics***

*Soil temperature:* 45 to 47 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Mollic epipedon thickness:* 7 to 15 inches

*Content of clay in the control section:* 10 to 18 percent

*Depth to Bk horizon:* 11 to 20 inches

*Ap horizon*

Value: 2 or 3 moist

Clay content: 10 to 18 percent

Reaction: pH 6.6 to 7.8

*A horizon*

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loam or very fine sandy loam

Clay content: 10 to 18 percent

Reaction: pH 7.4 to 8.4

*Bk horizon*

Hue: 10YR or 2.5Y

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loam, silt loam, or very fine sandy loam

Clay content: 10 to 18 percent

Calcium carbonate equivalent: 8 to 15 percent

Reaction: pH 7.4 to 8.4

*BC horizon*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Content of rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 5 to 12 percent

Reaction: pH 7.4 to 8.4

## **34—Desmet loam, 0 to 2 percent slopes**

### ***Composition***

Desmet and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Stream terraces

*Slope:* 0 to 2 percent

*Elevation:* 2,800 to 3,500 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 105 to 120 days

*Note:* In areas outside the Missoula Valley, this soil has a shorter frost-free period.

### Component Description

*Surface layer texture:* Loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 9.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Alberton and similar soils
- Grantsdale and similar soils
- Moiese and similar soils
- Somewhat poorly drained soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Elkner Series

The Elkner series consists of very deep, somewhat excessively drained soils that formed in igneous colluvium. These soils are on mountain slopes. Slope is 8 to 60 percent. Elevation is 4,500 to 6,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Coarse-loamy, mixed Typic Cryochrepts

### Typical Pedon

Elkner sandy loam, in an area of Elkner-Ovando complex, 8 to 30 percent slopes; in a forested area, 1,000 feet east and 800 feet north of the south quarter corner of sec. 34, T. 13 N., R. 14 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 7 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak coarse granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium and few coarse roots; 5 percent pebbles; slightly acid; clear wavy boundary.

E2—7 to 20 inches; light yellowish brown (10YR 6/4) coarse sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; 5 percent pebbles; medium acid; clear wavy boundary.

E and Bt—20 to 36 inches; 80 percent light yellowish brown (10YR 6/4) coarse sandy loam, brown (10YR 4/3) moist (E part); 20 percent yellowish brown (10YR 5/4) coarse sandy loam lamellae that are about 1/8 to 1/2 inch thick and have a combined thickness of 2 to 4 inches, dark yellowish brown (10YR 4/4) moist (Bt part); weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; 10 percent pebbles; medium acid; gradual wavy boundary.

BC—36 to 60 inches; light yellowish brown (10YR 6/4) gravelly loamy coarse sand, brown (10YR 4/3) moist; massive; loose, nonsticky and nonplastic; 20 percent pebbles; medium acid.

### Range in Characteristics

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

#### E horizon

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 2 to 4

Clay content: 5 to 10 percent

Content of rock fragments: 0 to 35 percent—0 to 35 percent cobbles, stones, or boulders and 0 to 20 percent pebbles

Reaction: pH 5.6 to 6.5

#### E and Bt horizon

Hue: E part—10YR; B part—10YR or 2.5Y

Value: E part—6 or 7 dry and 4 or 5 moist; B part—4 or 5 dry or moist

Chroma: E part—2 to 4; B part—3 or 4

Texture: Coarse sandy loam or sandy loam

Clay content: 5 to 10 percent; less than 3 percent increase in clay in lamellae

Content of rock fragments: 0 to 20 percent—0 to 15 percent cobbles, stones, or boulders and 5 to 20 percent pebbles

Reaction: pH 5.6 to 6.5

**BC horizon**

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loamy coarse sand or coarse sandy loam

Clay content: 0 to 5 percent

Content of rock fragments: 0 to 35 percent—0 to 20 percent cobbles and stones, 5 to 20 percent pebbles

Reaction: pH 5.6 to 7.3

**35—Elkner-Ovando complex, 8 to 30 percent slopes****Composition**

Elkner and similar soils: 65 percent

Ovando and similar soils: 20 percent

Inclusions: 15 percent

**Setting****Landform:**

- Elkner—Mountains
- Ovando—Mountains

**Slope:**

- Elkner—8 to 30 percent
- Ovando—8 to 30 percent

**Elevation:** 4,500 to 6,200 feet**Mean annual precipitation:** 20 to 30 inches**Frost-free period:** 40 to 60 days**Component Description****Elkner****Surface layer texture:** Sandy loam**Depth class:** Very deep (more than 60 inches)**Drainage class:** Somewhat excessively drained**Dominant parent material:** Igneous colluvium**Native plant cover type:** Forest land**Flooding:** None**Available water capacity to 60 inches or root-limiting layer:** Mainly 4.7 inches**Ovando****Surface layer texture:** Gravelly sandy loam**Depth class:** Very deep (more than 60 inches)**Drainage class:** Excessively drained**Dominant parent material:** Igneous colluvium**Native plant cover type:** Forest land**Flooding:** None**Available water capacity to 60 inches or root-limiting layer:** Mainly 2.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil

Properties" section, Part II of this publication.

**Inclusions**

- Areas of rock outcrop
- Sandy soils that are shallow over bedrock
- Soils that have a subsoil of sandy clay loam
- Soils that have volcanic ash in the surface layer

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Evaro Series**

The Evaro series consists of very deep, somewhat excessively drained soils that formed in colluvium derived from argillite and quartzite. The surface layer of these soils has a high content of volcanic ash. The soils are on mountain slopes. Slope is 8 to 60 percent. Elevation is 4,500 to 6,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, mixed Typic Cryochrepts

**Typical Pedon**

Evaro gravelly loam, 30 to 60 percent slopes, in a forested area, 660 feet west and 1,050 feet north of the southeast corner of sec. 3, T. 12 N., R. 17 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

A—0 to 4 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 25 percent pebbles; slightly acid; clear wavy boundary.

2E—4 to 16 inches; pinkish gray (7.5YR 6/2) very gravelly sandy loam, brown (7.5YR 5/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 50 percent pebbles, 10 percent cobbles; slightly acid; gradual smooth boundary.

2E and Bt—16 to 60 inches; pinkish gray (7.5YR 6/2) extremely gravelly sandy loam, brown (7.5YR 5/2) moist (E part); brown (7.5YR 5/4) extremely gravelly

sandy loam lamellae, brown (7.5YR 4/4) moist (Bt part); massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; 60 percent pebbles, 10 percent cobbles; slightly acid.

#### **Range in Characteristics**

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

#### *A horizon*

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 to 5

Content of glass: 35 to 60 percent

Clay content: 7 to 15 percent

Content of rock fragments: 15 to 70 percent—0 to 20 percent stones, 0 to 25 percent cobbles, 15 to 25 percent pebbles

Reaction: pH 5.6 to 6.5

#### *2E horizon*

Hue: 10YR or 7.5YR

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 or 3

Texture: Loam or sandy loam

Clay content: 5 to 15 percent

Content of rock fragments: 40 to 80 percent—5 to 30 percent cobbles, 35 to 50 percent pebbles

Reaction: pH 5.6 to 7.3

#### *2E and Bt horizon*

Hue: E part—10YR or 7.5YR; B part—10YR or 7.5YR

Value: E part—6 or 7 dry and 4 to 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—3 or 4

Texture: Loam or sandy loam

Clay content: 5 to 18 percent; less than 3 percent clay increase in lamellae

Content of rock fragments: 60 to 80 percent—5 to 15 percent cobbles, 55 to 65 percent pebbles

Reaction: pH 5.6 to 7.3

### **36—Evaro gravelly loam, 8 to 30 percent slopes**

#### ***Composition***

Evaro and similar soils: 85 percent

Inclusions: 15 percent

#### ***Setting***

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 4,500 to 6,000 feet

*Mean annual precipitation:* 20 to 30 inches

*Frost-free period:* 40 to 60 days

#### ***Component Description***

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Holloway and similar soils
- Mitten and similar soils
- Tevis and similar soils

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **37—Evaro gravelly loam, 30 to 60 percent slopes**

#### ***Composition***

Evaro and similar soils: 85 percent

Inclusions: 15 percent

#### ***Setting***

*Landform:* Mountains

*Slope:* 30 to 60 percent, northeast aspect

*Elevation:* 4,500 to 6,000 feet

*Mean annual precipitation:* 20 to 30 inches

*Frost-free period:* 40 to 60 days

#### ***Component Description***

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Holloway and similar soils
- Mitten and similar soils
- Tevis and similar soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Felan Series**

The Felan series consists of very deep, well drained soils that formed in colluvium derived from limestone or argillite. The surface layer of these soils has a high content of volcanic ash. The soils are on mountain slopes. Slope is 8 to 60 percent. Elevation is 4,500 to 8,000 feet. The average annual precipitation is 30 to 60 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, mixed Andic Cryochrepts

### **Typical Pedon**

Felan gravelly silt loam, 30 to 60 percent slopes, in a forested area, 1,500 feet north and 1,500 feet west of the southeast corner of sec. 18, T. 15 N., R. 16 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 3 inches; light gray (10YR 7/2) gravelly silt loam, grayish brown (10YR 5/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; 15 percent angular pebbles; medium acid; clear wavy boundary.

Bs—3 to 8 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine,

fine, medium, and coarse roots; many very fine and fine pores; 25 percent angular pebbles; medium acid; clear wavy boundary.

2E—8 to 23 inches; light gray (2.5Y 7/2) very gravelly silt loam, light brownish gray (2.5Y 6/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine pores; 45 percent angular pebbles; medium acid; clear smooth boundary.

2Bt1—23 to 33 inches; pale yellow (2.5Y 7/4) very gravelly silt loam, light yellowish brown (2.5Y 6/4) moist; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine pores; common faint clay bridging and coatings on sand grains; 40 percent angular pebbles; neutral; clear smooth boundary.

2Bt2—33 to 49 inches; light yellowish brown (2.5Y 6/4) very gravelly loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine pores; common faint clay bridging and coatings on sand grains; 40 percent angular pebbles; mildly alkaline; gradual smooth boundary.

2Bt3—49 to 60 inches; pale yellow (2.5Y 7/4) very gravelly loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine pores; common faint clay bridging and coatings on sand grains; 40 percent angular pebbles, 5 percent cobbles; moderately alkaline.

### **Range in Characteristics**

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Control section:* 8 to 18 percent clay; 40 to 60 percent silt; less than 45 percent total sand; less than 35 percent sand coarser than very fine sand

*Depth to carbonates:* Commonly below a depth of 60 inches; as shallow as 40 inches in some pedons

#### *E horizon*

Hue: 2.5Y or 10YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent angular cobbles and stones, 15 to 30 percent angular pebbles

Moist bulk density: 1.0 g/cc or less

Reaction: pH 5.1 to 6.0

**Bs horizon**

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 4 or 6

Texture: Silt loam or loam

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent angular cobbles and stones, 15 to 30 percent angular pebbles

Moist bulk density: 1.0 g/cc or less

Reaction: pH 5.1 to 6.0

**2E horizon**

Hue: 2.5Y or 10YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Texture: Silt loam or loam

Clay content: 5 to 15 percent

Content of rock fragments: 35 to 70 percent—0 to 10 percent angular cobbles and stones, 35 to 60 percent angular pebbles

Reaction: pH 5.1 to 7.3

**2Bt horizon**

Hue: 2.5Y or 10YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 3 to 6

Texture: Loam or silt loam

Clay content: 8 to 20 percent

Content of rock fragments: 40 to 75 percent—0 to 10 percent angular cobbles and stones, 40 to 65 percent angular pebbles

Reaction: pH 6.6 to 8.4

**38—Felan gravelly silt loam, 8 to 30 percent slopes**

**Composition**

Felan and similar soils: 85 percent

Inclusions: 15 percent

**Setting**

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 4,500 to 6,500 feet

*Mean annual precipitation:* 30 to 50 inches

*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Felan, cool, soils
- Holloway and similar soils
- Jimlake and similar soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**39—Felan gravelly silt loam, 30 to 60 percent slopes**

**Composition**

Felan and similar soils: 85 percent

Inclusions: 15 percent

**Setting**

*Landform:* Mountains

*Slope:* 30 to 60 percent

*Elevation:* 4,500 to 6,500 feet

*Mean annual precipitation:* 30 to 50 inches

*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Felan, cool, soils
- Holloway and similar soils
- Jimlake and similar soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**40—Felan gravelly silt loam, cool, 8 to 30 percent slopes****Composition**

Felan and similar soils: 85 percent  
Inclusions: 15 percent

**Setting**

*Landform:* Mountains  
*Slope:* 8 to 30 percent  
*Elevation:* 6,000 to 8,000 feet  
*Mean annual precipitation:* 40 to 60 inches  
*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Holloway, cool, soils
- Soils that are shallow over bedrock
- Areas of rock outcrop

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**41—Felan gravelly silt loam, cool, 30 to 60 percent slopes****Composition**

Felan and similar soils: 85 percent  
Inclusions: 15 percent

**Setting**

*Landform:* Mountains  
*Slope:* 30 to 60 percent  
*Elevation:* 6,000 to 8,000 feet  
*Mean annual precipitation:* 40 to 60 inches  
*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Holloway, cool, soils
- Soils that are shallow over bedrock
- Areas of rock outcrop

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Glaciercreek Series

The Glaciercreek series consists of very deep, excessively drained soils that formed in glacial outwash. The upper layers of these soils have a high content of volcanic ash. The soils are on outwash plains, stream terraces, and hills. Slope is 0 to 20 percent. Elevation is 3,600 to 4,600 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Sandy-skeletal, mixed, frigid Andic Dystric Eutrochrepts

### Typical Pedon

Glaciercreek gravelly silt loam, 0 to 4 percent slopes, in a forested area, 2,640 feet north and 1,200 feet west of the southeast corner of sec. 12, T. 20 N., R. 17 W.

Oi—1 inch to 0; undecomposed and slightly decomposed forest litter.

A—0 to 2 inches; dark grayish brown (10YR 4/2) gravelly silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and few medium roots; 20 percent pebbles; medium acid; clear smooth boundary.

Bw—2 to 14 inches; very pale brown (10YR 7/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; 20 percent pebbles; medium acid; clear smooth boundary.

2C1—14 to 44 inches; light yellowish brown (10YR 6/4) extremely gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; few fine roots; 60 percent pebbles, 5 percent cobbles; medium acid; gradual smooth boundary.

2C2—44 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly coarse sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; few fine roots; 75 percent pebbles, 10 percent cobbles; slightly acid.

### Range in Characteristics

*Soil temperature:* 40 to 45 degrees F

*Moisture control section:* Between depths of 12 and 35 inches

*Depth to 2C horizon:* 10 to 18 inches

*Base saturation:* 60 to 85 percent

*Content of clay in the control section:* 2 to 12 percent

*A horizon*

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 1 to 3

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 10 percent cobbles and stones, 15 to 25 percent pebbles

Moist bulk density: Less than 0.95 g/cc

Reaction: pH 5.6 to 7.3

*Bw horizon*

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 3 or 4

Texture: Silt loam, sandy loam, or loam

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 10 percent cobbles and stones, 15 to 25 percent pebbles

Moist bulk density: Less than 0.95 g/cc

Reaction: pH 5.6 to 7.3

*2C horizon*

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: Loamy sand, loamy coarse sand, coarse sand, or sand

Clay content: 0 to 10 percent

Content of rock fragments: 60 to 90 percent—5 to 30 percent cobbles and stones, 55 to 75 percent pebbles

Reaction: pH 5.6 to 7.3

## 42—Glaciercreek gravelly silt loam, 0 to 4 percent slopes

### Composition

Glaciercreek and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Outwash plains

*Slope:* 0 to 4 percent

*Elevation:* 3,600 to 4,400 feet

*Mean annual precipitation:* 22 to 30 inches

*Frost-free period:* 60 to 90 days

### Component Description

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Glacial outwash

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Courville and similar soils
- Winfall and similar soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **Glaciercreek Variant**

The Glaciercreek variant consists of very deep, somewhat excessively drained soils that formed in alluvium over glacial outwash. These soils are on hills. Slope is 4 to 20 percent. Elevation is 3,800 to 4,600 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Coarse-loamy, mixed, frigid Dystric Eutrochrepts

### ***Typical Pedon***

Glaciercreek variant, in an area of Glaciercreek variant-Glaciercreek complex, 4 to 20 percent slopes; in a forested area, 2,000 feet north and 700 feet west of the southeast corner of sec. 30, T. 15 N., R. 14 W.

- Oi—1 inch to 0; undecomposed and slightly decomposed forest litter.
- E—0 to 9 inches; pinkish gray (7.5YR 6/2) fine sandy loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; neutral; clear wavy boundary.
- Bw1—9 to 20 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; neutral; clear irregular boundary.
- Bw2—20 to 32 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; soft, very friable,

nonsticky and nonplastic; common very fine and fine roots and pores; neutral; clear wavy boundary.

2C—32 to 60 inches; pinkish gray (7.5YR 7/2) extremely cobbly fine sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots and pores; 60 percent cobbles, 20 percent pebbles; neutral.

### ***Range in Characteristics***

*Soil temperature:* 40 to 45 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Base saturation:* 60 to 85 percent

#### *E horizon*

Clay content: 5 to 15 percent

Reaction: pH 5.6 to 7.3

#### *Bw horizon*

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 3 or 4

Texture: Silt loam, sandy loam, or loam

Clay content: 5 to 15 percent

Reaction: pH 5.6 to 7.3

#### *2C horizon*

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 2 to 4

Clay content: 5 to 15 percent

Content of rock fragments: 40 to 90 percent—20 to 60 percent cobbles, 20 to 30 percent pebbles

Reaction: pH 5.6 to 7.3

### **43—Glaciercreek variant-Glaciercreek complex, 4 to 20 percent slopes**

#### ***Composition***

Glaciercreek variant and similar soils: 60 percent

Glaciercreek and similar soils: 25 percent

Inclusions: 15 percent

#### ***Setting***

##### *Landform:*

- Glaciercreek variant—Hills
- Glaciercreek—Hills

##### *Position on the landform:*

- Glaciercreek variant—Foot slopes and toe slopes
- Glaciercreek—Back slopes and shoulders

##### *Slope:*

- Glaciercreek variant—4 to 20 percent
- Glaciercreek—4 to 20 percent

*Elevation:* 3,800 to 4,600 feet

*Mean annual precipitation:* 22 to 30 inches

*Frost-free period:* 60 to 90 days

### Component Description

#### Glaciercreek variant

*Surface layer texture:* Fine sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.1 inches

#### Glaciercreek

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Dominant parent material:* Glacial outwash  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Very deep, sandy soils
- Soils that have a stony surface layer

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Grantsdale Series

The Grantsdale series consists of very deep, well drained soils that formed in alluvium. These soils are on stream terraces. Slope is 0 to 2 percent. Elevation is 2,800 to 3,500 feet. The average annual precipitation is 11 to 14 inches, the average annual air temperature is 43 to 45 degrees F, and the frost-free season is 105 to 120 days.

**Taxonomic Class:** Coarse-silty over sandy or sandy-skeletal, mixed, frigid Calciorthidic Haploxerolls

### Typical Pedon

Grantsdale loam, 0 to 2 percent slopes, in an irrigated

pasture, 2,450 feet south of the northeast corner of sec. 35, T. 12 N., R. 20 W.

**Ap**—0 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; common fine and medium pores; neutral; clear smooth boundary.

**Bw**—9 to 17 inches; pale brown (10YR 6/3) loam, brown (10Y 5/3) moist; weak fine and moderate subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common fine pores; neutral; gradual smooth boundary.

**Bk**—17 to 32 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common fine pores; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

**2Ck**—32 to 36 inches; light gray (2.5Y 7/2) very gravelly loamy sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; 50 percent pebbles, 10 percent cobbles; thin lime coatings on undersides of pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

**2C**—36 to 60 inches; light brownish gray (10YR 6/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; 50 percent pebbles, 10 percent cobbles; slightly effervescent; mildly alkaline.

### Range in Characteristics

*Soil temperature:* 45 to 47 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Mollic epipedon thickness:* 7 to 16 inches

*Content of clay in the control section:* 6 to 12 percent

*Depth to Bk horizon:* 14 to 20 inches

*Base saturation:* 50 to 100 percent

#### Ap horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Reaction: pH 6.1 to 7.3

#### Bw horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: Loam, very fine sandy loam, or silt loam

Clay content: 10 to 18 percent

Reaction: pH 6.1 to 7.3

**Bk horizon**

Hue: 10YR or 2.5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 or 3  
 Texture: Loam, very fine sandy loam, or silt loam  
 Clay content: 10 to 18 percent  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.4 to 8.4

**2Ck and 2C horizons**

Hue: 10YR or 2.5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 or 3  
 Texture: Loamy sand or sand  
 Clay content: 5 to 10 percent  
 Content of rock fragments: 35 to 70 percent—5 to 20 percent cobbles, 30 to 50 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.4 to 8.4

**44—Grantsdale loam, 0 to 2 percent slopes****Composition**

Grantsdale and similar soils: 85 percent  
 Inclusions: 15 percent

**Setting**

**Landform:** Stream terraces  
**Slope:** 0 to 2 percent  
**Elevation:** 2,800 to 3,500 feet  
**Mean annual precipitation:** 11 to 14 inches  
**Frost-free period:** 105 to 120 days  
**Note:** In areas outside the Missoula Valley, this soil has a shorter frost-free period.

**Component Description**

**Surface layer texture:** Loam  
**Depth class:** Very deep (more than 60 inches)  
**Drainage class:** Well drained  
**Dominant parent material:** Alluvium  
**Flooding:** None  
**Available water capacity to 60 inches or root-limiting layer:** Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Alberton and similar soils
- Desmet and similar soils
- Moiese and similar soils
- Somewhat poorly drained soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Grassvalley Series**

The Grassvalley series consists of very deep, well drained soils that formed in glaciolacustrine deposits. These soils are on lake plains and hills. Slope is 0 to 30 percent. Elevation is 3,200 to 3,800 feet. The average annual precipitation is 11 to 14 inches, the average annual air temperature is 43 to 45 degrees F, and the frost-free season is 105 to 120 days.

**Taxonomic Class:** Fine, illitic, frigid Typic Haploxeralfs

**Typical Pedon**

Grassvalley silty clay loam, 0 to 4 percent slopes, in an area of hayland, 800 feet east and 100 feet south of the northwest corner of sec. 14, T. 13 N., R. 20 W.

- Ap—0 to 9 inches; pinkish gray (7.5YR 6/2) silty clay loam, brown (7.5YR 4/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots and pores; neutral; abrupt smooth boundary.
- Bt1—9 to 13 inches; light reddish brown (5YR 6/3) clay, reddish brown (5YR 4/3) moist; strong medium angular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; many very fine pores; common thin clay films on faces of peds and in pores; neutral; gradual wavy boundary.
- Bt2—13 to 21 inches; light reddish brown (5YR 6/4) clay, reddish brown (5YR 4/4) moist; strong moderate and coarse angular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots and pores; common thin clay films on faces of peds and in pores; mildly alkaline; gradual wavy boundary.
- Btk—21 to 28 inches; pink (5YR 7/3) clay, reddish brown (5YR 5/4) moist; strong fine angular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots and pores; few thin clay films on faces of peds and in pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.
- BC—28 to 37 inches; pink (5YR 7/3) clay, reddish brown (5YR 5/4) moist; weak coarse angular blocky structure parting to varves 1/8 to 1/2 inch thick; hard,

firm, sticky and plastic; few very fine roots and pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—37 to 60 inches; light reddish brown (5YR 6/4) clay, reddish brown (5YR 5/3) moist; massive; distinct varves ½ to 1 inch thick; hard, firm, sticky and plastic; strongly effervescent; moderately alkaline.

#### Range in Characteristics

*Soil temperature:* 45 to 47 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Content of clay in the control section:* 40 to 60 percent

*Depth to Btk horizon:* 15 to 26 inches

#### Ap horizon

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 30 to 40 percent

Reaction: pH 6.6 to 7.8

#### Bt horizon

Hue: 5YR or 7.5YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Clay or silty clay

Clay content: 40 to 60 percent

Reaction: pH 6.6 to 8.4

#### Btk horizon

Hue: 5YR or 7.5YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Clay or silty clay

Clay content: 40 to 60 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

#### BC horizon

Hue: 5YR or 7.5YR

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Clay, silty clay, or silty clay loam

Clay content: 35 to 60 percent

Reaction: pH 7.4 to 8.4

Note: The varves range from ½ inch to about 2 inches thick and limit the penetration of the soil by roots and water.

### 45—Grassvalley silty clay loam, 0 to 4 percent slopes

#### Composition

Grassvalley and similar soils: 85 percent

Inclusions: 15 percent

#### Setting

*Landform:* Lake plains

*Slope:* 0 to 4 percent

*Elevation:* 3,200 to 3,800 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 105 to 120 days

#### Component Description

*Surface layer texture:* Silty clay loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Glaciolacustrine deposits

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 9.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### Inclusions

- Soils that have a dark surface layer
- Moderately sodic soils
- Soils that are gravelly clay

#### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### 46—Grassvalley silty clay loam, 4 to 8 percent slopes

#### Composition

Grassvalley and similar soils: 85 percent

Inclusions: 15 percent

#### Setting

*Landform:* Lake plains

*Slope:* 4 to 8 percent

*Elevation:* 3,200 to 3,800 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 105 to 120 days

#### Component Description

*Surface layer texture:* Silty clay loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Glaciolacustrine deposits

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 9.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

#### ***Inclusions***

- Soils that have a dark surface layer
- Moderately sodic soils
- Soils that are gravelly clay

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **47—Grassvalley silty clay loam, 8 to 15 percent slopes**

#### ***Composition***

Grassvalley and similar soils: 85 percent

Inclusions: 15 percent

#### ***Setting***

*Landform:* Hills

*Slope:* 8 to 15 percent

*Elevation:* 3,200 to 3,800 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 105 to 120 days

#### ***Component Description***

*Surface layer texture:* Silty clay loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Glaciolacustrine deposits

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 9.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

#### ***Inclusions***

- Moderately sodic soils
- Soils that have a calcareous surface layer

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **48—Grassvalley silty clay loam, 15 to 30 percent slopes**

#### ***Composition***

Grassvalley and similar soils: 90 percent

Inclusions: 10 percent

#### ***Setting***

*Landform:* Hills

*Slope:* 15 to 30 percent

*Elevation:* 3,200 to 3,800 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 105 to 120 days

#### ***Component Description***

*Surface layer texture:* Silty clay loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Glaciolacustrine deposits

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 9.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

#### ***Inclusions***

- Soils that have a calcareous surface layer

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section

- Wildlife habitat section
- Engineering and soil properties sections

## Greenough Series

The Greenough series consists of very deep, well drained soils that formed in alluvium. These soils are on hills. Slope is 4 to 15 percent. Elevation is 3,200 to 4,500 feet. The average annual precipitation is 16 to 22 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Fine-silty, mixed Typic Eutroboralfs

### Typical Pedon

Greenough silt loam, 4 to 15 percent slopes, in a forested area, 3,000 feet north and 1,300 feet west of the southeast corner of sec. 35, T. 13 N., R. 15 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine, medium, and coarse roots; many very fine pores; 10 percent pebbles; medium acid; clear wavy boundary.

E/Bt—8 to 22 inches; 80 percent light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) moist (E part); 20 percent light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist (B part); when mixed, texture is silt loam; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many very fine pores; 10 percent pebbles; slightly acid; clear wavy boundary.

Bt1—22 to 49 inches; light gray (2.5Y 7/2) silt loam, light brownish gray (2.5Y 6/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; common very fine pores; common thin clay films on faces of peds and in pores; 10 percent pebbles; neutral; gradual wavy boundary.

Bt2—49 to 60 inches; light brownish gray (2.5Y 6/2) gravelly silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; few thin clay films on faces of peds and in pores; 30 percent pebbles; neutral.

### Range in Characteristics

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Other features:* A BC horizon in some pedons

### E horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 5 to 20 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 5.6 to 6.5

### E/Bt horizon

Hue: E part—10YR or 2.5Y; B part—10YR or 2.5Y

Value: E part—6 to 8 dry and 4 to 6 moist; B part—6 or 7 dry and 4 or 5 moist

Chroma: E part—2 to 4; B part—2 or 3

Clay content: 5 to 20 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.1 to 7.3

### Bt horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: Silty clay loam or silt loam

Clay content: 18 to 32 percent

Content of rock fragments: 0 to 15 percent—0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.1 to 7.3

Note: Below a depth of 49 inches, the content of rock fragments ranges from 0 to 35 percent.

## 49—Greenough silt loam, 4 to 15 percent slopes

### Composition

Greenough and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Hills

*Slope:* 4 to 15 percent

*Elevation:* 3,200 to 4,500 feet

*Mean annual precipitation:* 16 to 22 inches

*Frost-free period:* 60 to 90 days

### Component Description

*Surface layer texture:* Silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 11.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Crow and similar soils
- Lubrecht and similar soils
- Winkler, cool, soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Hagstadt Series**

The Hagstadt series consists of moderately deep, well drained soils that formed in material derived from consolidated siltstone. These soils are on hills. Slope is 4 to 25 percent. Elevation is 3,500 to 4,000 feet. The average annual precipitation is 16 to 22 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Fine-silty, mixed, frigid Udic Ustochrepts

### ***Typical Pedon***

Hagstadt silt loam, 4 to 25 percent slopes, in a forested area, 1,000 feet west and 2,200 feet south of the northeast corner of sec. 21, T. 13 N., R. 15 W.

Oi—1 inch to 0; undecomposed and slightly decomposed forest litter.

A—0 to 5 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very thin and thin platy structure; soft, friable, nonsticky and slightly plastic; common fine and medium roots; common fine pores; 1 percent pebbles; neutral; gradual smooth boundary.

Bw—5 to 21 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/6) moist; moderate and strong fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common medium and few fine roots; common very fine and fine pores; 5 percent pebbles; 70 percent soft siltstone fragments; neutral; abrupt wavy boundary.

Cr—21 to 40 inches; very pale brown (10YR 7/4) consolidated siltstone, yellowish brown (10YR 5/6) moist; neutral.

### ***Range in Characteristics***

*Soil temperature:* 44 to 47 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Depth to consolidated siltstone:* 20 to 40 inches

*Content of clay in the control section:* 28 to 35 percent

*Base saturation:* 60 to 100 percent

#### *A horizon*

Chroma: 2 or 3

Texture: Silt loam or silty clay loam

Clay content: 20 to 30 percent

Content of rock fragments: 0 to 5 percent pebbles

Reaction: pH 6.1 to 7.3

Note: When mixed to a depth of 7 inches, this horizon does not meet the requirements for a mollic epipedon.

#### *Bw horizon*

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 3 to 6

Texture: Silty clay loam

Clay content: 27 to 35 percent

Content of rock fragments: 0 to 5 percent hard pebbles and 60 to 75 percent soft siltstone fragments

Reaction: pH 6.1 to 7.3

## **50—Hagstadt silt loam, 4 to 25 percent slopes**

### ***Composition***

Hagstadt and similar soils: 85 percent  
Inclusions: 15 percent

### ***Setting***

*Landform:* Hills

*Slope:* 4 to 25 percent

*Elevation:* 3,500 to 4,000 feet

*Mean annual precipitation:* 16 to 22 inches

*Frost-free period:* 60 to 90 days

### ***Component Description***

*Surface layer texture:* Silt loam

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Siltstone residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Greenough and similar soils
- Lubrecht and similar soils
- Winkler, cool, soils
- Soils that are shallow over siltstone

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Half Moon Series**

The Half Moon series consists of very deep, well drained soils that formed in glaciolacustrine deposits. These soils are on lake plains. Slope is 4 to 8 percent. Elevation is 3,200 to 4,500 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Fine-silty, mixed Typic Eutroboralfs

### **Typical Pedon**

Half Moon silt loam, 4 to 8 percent slopes, in a forested area, 2,300 feet south and 1,300 feet west of the northeast corner of sec. 26, T. 14 N., R. 16 W.

Oi—1 inch to 0; undecomposed and slightly decomposed forest litter.

E—0 to 7 inches; pinkish gray (7.5YR 7/2) silt loam, brown (7.5YR 5/2) moist; moderate medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; common medium pores; medium acid; clear wavy boundary.

Bt—7 to 18 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; strong fine and medium subangular blocky structure; hard, friable, very sticky and very plastic; many very fine, medium, and coarse roots; common fine pores; neutral; gradual smooth boundary.

Bk1—18 to 23 inches; pinkish gray (7.5YR 7/2) silty clay loam, pinkish gray (7.5YR 6/2) moist; moderate

fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine, fine, medium, and coarse roots; common coarse pores; few fine soft masses of lime; strongly effervescent; mildly alkaline; gradual smooth boundary.

Bk2—23 to 41 inches; pinkish white (7.5YR 8/2) silt loam, pinkish gray (7.5YR 6/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; common fine pores; common fine soft masses of lime; violently effervescent; strongly alkaline; gradual smooth boundary.

C—41 to 60 inches; pinkish gray (7.5R 7/2) silt loam, pinkish gray (7.5YR 6/2) moist; varves 1/8 to 1/2 inch thick; hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine pores; strongly effervescent; moderately alkaline.

### **Range in Characteristics**

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Content of clay in the control section:* 25 to 35 percent

*Depth to Bk horizon:* 14 to 35 inches

*Other features:* A thin discontinuous A horizon in some pedons

#### *E horizon*

Hue: 2.5Y, 10YR, or 7.5YR

Value: 6 to 8 dry; 4 to 7 moist

Chroma: 1 to 3

Clay content: 15 to 25 percent

Content of rock fragments: 0 to 15 percent—0 to 10 percent cobbles, 0 to 5 percent pebbles

Reaction: pH 4.5 to 7.3

#### *Bt horizon*

Hue: 2.5Y, 10YR, or 7.5YR

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 3 or 4

Texture: Silt loam or silty clay loam

Clay content: 25 to 35 percent

Content of rock fragments: 0 to 10 percent pebbles

Reaction: pH 6.1 to 7.8

#### *Bk horizon*

Hue: 2.5Y, 10YR, or 7.5YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Silt loam or silty clay loam

Clay content: 25 to 30 percent

Calcium carbonate equivalent: 5 to 15 percent

Electrical conductivity: 0 to 4 mmhos/cc

Reaction: pH 7.4 to 8.4

#### *C horizon*

Hue: 2.5Y, 10YR, or 7.5YR

Value: 6 or 7 dry; 5 or 6 moist  
 Chroma: 2 to 4  
 Texture: Mainly very fine sandy loam, silt loam, or silty clay loam that has thin lenses of silty clay  
 Clay content: 20 to 30 percent  
 Electrical conductivity: 0 to 4 mmhos/cc  
 Reaction: pH 7.9 to 9.0

## 51—Half Moon silt loam, 4 to 8 percent slopes

### **Composition**

Half Moon and similar soils: 85 percent  
 Inclusions: 15 percent

### **Setting**

*Landform:* Lake plains  
*Slope:* 4 to 8 percent  
*Elevation:* 3,200 to 4,500 feet  
*Mean annual precipitation:* 18 to 22 inches  
*Frost-free period:* 60 to 90 days

### **Component Description**

*Surface layer texture:* Silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Glaciolacustrine deposits  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 10.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Totelake and similar soils
- Poorly drained soils
- Winkler, cool, soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Hanaker Series**

The Hanaker series consists of very deep, well drained soils that formed in glaciolacustrine deposits. These soils are on stream terraces. Slope is 0 to 6 percent. Elevation is 3,500 to 4,000 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Fine-silty, mixed Typic Argiborolls

### **Typical Pedon**

Hanaker silt loam, 0 to 6 percent slopes, in an area of cropland, 2,400 feet north and 1,000 feet west of the southeast corner of sec. 24, T. 14 N., R. 15 W.

- Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; common very fine and fine pores; neutral; clear smooth boundary.
- A—8 to 15 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots and pores; mildly alkaline; clear wavy boundary.
- Bt—15 to 25 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak fine blocky; slightly hard, friable, sticky and plastic; few very fine roots; common very fine pores; common moderately thick clay films on faces of peds; moderately alkaline; clear smooth boundary.
- Bk1—25 to 32 inches; white (10YR 8/2) silt loam, pale brown (10YR 6/3) moist; weak medium prismatic structure parting to weak fine blocky; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots and pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.
- Bk2—32 to 42 inches; white (10YR 8/2), stratified silt loam and very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.
- Bk3—42 to 60 inches; light gray (10YR 7/2), stratified gravelly sandy clay loam and gravelly sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; 25 percent pebbles; common fine soft masses of lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Mollic epipedon thickness:* 13 to 16 inches

*Depth to Bk horizon:* 18 to 30 inches

*Content of clay in the control section:* 28 to 35 percent

#### A horizon

Value: 2 or 3 moist

Chroma: 2 or 3

Clay content: 10 to 20 percent

Reaction: pH 6.6 to 7.8

#### Bt horizon

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 27 to 35 percent

Reaction: pH 7.9 to 8.4

#### Bk1 horizon

Value: 7 or 8 dry; 6 or 7 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

#### Bk2 horizon

Value: 7 or 8 dry; 6 or 7 moist

Chroma: 2 or 3

Texture: Mainly silt loam that has thin lenses of very fine sandy loam

Clay content: 10 to 20 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

#### Bk3 horizon

Value: 6 to 8 dry; 5 or 6 moist

Texture: Mainly sandy clay loam that has thin lenses of sandy loam

Clay content: 18 to 27 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles, 15 to 30 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

## 52—Hanaker silt loam, 0 to 6 percent slopes

### Composition

Hanaker and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Stream terraces

*Slope:* 0 to 6 percent

*Elevation:* 3,500 to 4,000 feet

*Mean annual precipitation:* 15 to 19 inches

*Frost-free period:* 60 to 90 days

### Component Description

*Surface layer texture:* Silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Glaciolacustrine deposits

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 10.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Perma and similar soils
- Tally variant soils
- Soils that have a light-colored surface layer

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Haploxerolls

Haploxerolls consist of very deep, well drained to excessively drained soils that formed in alluvium. These soils are on alluvial fans, stream terraces, and hills. Slope is 0 to 60 percent. Elevation is 3,300 to 4,500 feet. The average annual precipitation is 13 to 16 inches, the average annual air temperature is 42 to 44 degrees F, and the frost-free season is 90 to 110 days.

### Typical Pedon

Haploxerolls in an area of rangeland, 1,100 feet west and 2,500 feet south of the northeast corner of sec. 8, T. 14 N., R. 20 W.

0 to 13 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; 25 percent pebbles; neutral; gradual wavy boundary.

13 to 19 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and

nonplastic; many fine and very fine roots; 50 percent pebbles; neutral; clear wavy boundary.  
 19 to 34 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; 55 percent pebbles; slightly effervescent; moderately alkaline; gradual wavy boundary.  
 34 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; 65 percent pebbles; slightly effervescent; moderately alkaline.

#### Range in Characteristics

*Surface texture:* Gravelly loam, very gravelly loam, gravelly silt loam, or very gravelly silt loam

*Subsurface texture:* Extremely gravelly loamy sand to very gravelly loam

### Hollandlake Series

The Hollandlake series consists of very deep, well drained soils that formed in alpine till. These soils are on moraines. Slope is 4 to 60 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, mixed Typic Cryoboralfs

#### Typical Pedon

Hollandlake gravelly loam, 4 to 30 percent slopes, in a forested area, 860 feet north and 990 feet east of the west quarter corner of sec. 12, T. 19 N., R. 16 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 4 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; moderate fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine roots; 20 percent pebbles; medium acid; clear wavy boundary.

E/B—4 to 12 inches; 75 percent light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist (E part); 25 percent yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 4/4) moist (B part); weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; many fine and medium roots; 25 percent pebbles; medium acid; clear wavy boundary.

Bt/E—12 to 22 inches; 75 percent yellowish brown (10YR 5/4) very gravelly loam, dark yellowish brown (10YR 4/4) moist (Bt part); 25 percent light gray (10YR 7/2) very gravelly loam, grayish brown (10YR 5/2) moist (E part); weak medium subangular blocky structure; very hard, friable, nonsticky and slightly plastic; common fine roots; few thin clay films on faces of peds; 35 percent pebbles, 5 percent cobbles; medium acid; gradual wavy boundary.

Bt—22 to 60 inches; light brown (7.5YR 6/4) very gravelly clay loam, brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common moderately thick clay films on faces of peds; 35 percent pebbles, 10 percent cobbles; neutral.

#### Range in Characteristics

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Depth to argillic horizon:* 8 to 16 inches

#### E horizon

Hue: 7.5YR or 10YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Content of rock fragments: 15 to 35 percent pebbles

Reaction: pH 5.1 to 6.0

#### E/B horizon

Hue: E part—7.5YR or 10YR; B part—7.5YR or 10YR

Value: E part—6 or 7 dry and 5 or 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—3 or 4

Texture: Loam or silt loam

Clay content: 15 to 27 percent

Content of rock fragments: 15 to 35 percent pebbles

Reaction: pH 5.1 to 6.0

#### Bt/E horizon

Hue: B part—7.5YR or 10YR; E part—7.5YR or 10YR

Value: B part—5 or 6 dry and 4 or 5 moist; E part—6 or 7 dry and 5 or 6 moist

Chroma: B part—3 or 4; E part—2 or 3

Texture: Loam or clay loam

Clay content: 20 to 30 percent

Content of rock fragments: 35 to 55 percent—0 to 10 percent cobbles, 35 to 45 percent pebbles

Reaction: pH 5.1 to 6.0

#### Bt horizon

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 3 to 6  
 Texture: Clay loam or sandy clay loam  
 Clay content: 25 to 35 percent  
 Content of rock fragments: 35 to 55 percent—0 to 10 percent cobbles, 35 to 45 percent pebbles  
 Reaction: pH 6.6 to 7.3

### 53—Hollandlake gravelly loam, 4 to 30 percent slopes

#### **Composition**

Hollandlake and similar soils: 85 percent  
 Inclusions: 15 percent

#### **Setting**

*Landform:* Moraines  
*Slope:* 4 to 30 percent  
*Elevation:* 4,000 to 4,500 feet  
*Mean annual precipitation:* 30 to 40 inches  
*Frost-free period:* 40 to 60 days

#### **Component Description**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Bata and similar soils
- Poorly drained soils
- Rumblecreek and similar soils
- Upsata soils on terraces

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### 54—Hollandlake-Bata complex, 4 to 30 percent slopes

#### **Composition**

Hollandlake and similar soils: 45 percent  
 Bata and similar soils: 35 percent  
 Inclusions: 20 percent

#### **Setting**

*Landform:*  
 • Hollandlake—Moraines  
 • Bata—Moraines  
*Slope:*  
 • Hollandlake—4 to 30 percent  
 • Bata—4 to 30 percent  
*Elevation:* 4,000 to 5,000 feet  
*Mean annual precipitation:* 30 to 40 inches  
*Frost-free period:* 40 to 60 days

#### **Component Description**

##### **Hollandlake**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.3 inches

##### **Bata**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Rumblecreek and similar soils
- Poorly drained soils
- Waldbillig and similar soils
- Upsata soils on terraces

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section

- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 55—Hollandlake-Bata complex, 30 to 60 percent slopes

### Composition

Hollandlake and similar soils: 45 percent

Bata and similar soils: 35 percent

Inclusions: 20 percent

### Setting

#### Landform:

- Hollandlake—Moraines
- Bata—Moraines

#### Slope:

- Hollandlake—30 to 60 percent
- Bata—30 to 60 percent

Elevation: 4,000 to 5,000 feet

Mean annual precipitation: 30 to 40 inches

Frost-free period: 40 to 60 days

### Component Description

#### Hollandlake

Surface layer texture: Gravelly loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Alpine till

Native plant cover type: Forest land

Flooding: None

Available water capacity to 60 inches or root-limiting layer: Mainly 5.3 inches

#### Bata

Surface layer texture: Gravelly silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Alpine till

Native plant cover type: Forest land

Flooding: None

Available water capacity to 60 inches or root-limiting layer: Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Rumblecreek and similar soils
- Waldbillig and similar soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Holloway Series

The Holloway series consists of very deep, somewhat excessively drained soils that formed in colluvium derived from argillite and quartzite. The surface layer of these soils has a high content of volcanic ash. The soils are on mountains and moraines. Slope is 8 to 80 percent. Elevation is 4,200 to 7,000 feet. The average annual precipitation is 30 to 60 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, mixed Andic Cryochrepts

### Typical Pedon

Holloway gravelly silt loam, 30 to 60 percent slopes, in a forested area, 1,200 feet south and 800 feet east of the northwest corner of sec. 7, T. 11 N., R. 22 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

A—0 to 10 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; 25 percent pebbles, 5 percent cobbles; strongly acid; clear wavy boundary.

2E—10 to 17 inches; light gray (10YR 7/2) extremely gravelly fine sandy loam, light brownish gray (10YR 6/2) moist; weak fine granular structure; very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; common very fine and fine pores; 55 percent pebbles, 10 percent cobbles; medium acid; gradual smooth boundary.

2E and Bt—17 to 52 inches; about 75 percent light gray (10YR 7/2) extremely gravelly sandy loam, pale brown (10YR 6/3) moist (E part); about 25 percent pale brown (10YR 6/3) fine sandy loam lamellae 1/8 to 1/2 inch thick, brown (10YR 5/3) moist (Bt part); when mixed, texture is extremely gravelly sandy loam; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and few medium roots; common fine

and very fine pores; 55 percent pebbles, 10 percent cobbles; medium acid; gradual smooth boundary.  
 2C—52 to 60 inches; very pale brown (10YR 7/3) extremely gravelly sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots and pores; 55 percent pebbles, 15 percent cobbles; slightly acid.

### Range in Characteristics

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Control section:* 5 to 15 percent clay; less than 35 percent silt; 60 percent or more total sand; more than 35 percent fine sand and coarser textures

*Other features:* A thin discontinuous E horizon in some pedons

#### A horizon

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 4 to 6

Clay content: 5 to 15 percent

Content of rock fragments: 10 to 35 percent—0 to 10 percent angular cobbles or flagstones and stones, 10 to 30 percent angular pebbles or channers

Bulk density: 1.0 g/cc or less

Content of glass: 5 to 10 percent

Aluminum plus ½ iron percentages (by ammonium oxalate): 1 to 2 percent

Reaction: pH 5.1 to 6.5

#### 2E horizon

Hue: 10YR or 7.5YR

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 2 or 3

Texture: Loam, sandy loam, or fine sandy loam

Clay content: 5 to 15 percent

Content of rock fragments: 45 to 75 percent—0 to 15 percent angular cobbles or flagstones and stones, 45 to 60 percent angular pebbles or channers

Reaction: pH 5.1 to 6.5

#### 2E and Bt horizon

Hue: E part—10YR or 7.5YR; B part—10YR or 7.5YR

Value: E part—6 or 7 dry and 5 or 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—2 to 4

Texture: Sandy loam or fine sandy loam

Clay content: 5 to 15 percent; less than 3 percent clay increase in lamellae

Content of rock fragments: 60 to 80 percent—5 to 15 percent angular cobbles or flagstones and

stones, 55 to 70 percent angular pebbles or channers

Reaction: pH 5.1 to 6.5

#### 2C horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: Fine sandy loam, sandy loam, or loamy sand

Clay content: 5 to 15 percent

Content of rock fragments: 60 to 85 percent—5 to 20 percent angular cobbles or flagstones and stones, 55 to 70 percent angular pebbles or channers

Reaction: pH 5.1 to 6.5

## 56—Holloway gravelly silt loam, 8 to 30 percent slopes

### Composition

Holloway and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 4,500 to 5,500 feet

*Mean annual precipitation:* 30 to 40 inches

*Frost-free period:* 40 to 60 days

### Component Description

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Mitten and similar soils
- Tevis and similar soils
- Waldbillig and similar soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **57—Holloway gravelly silt loam, 30 to 60 percent slopes**

#### **Composition**

Holloway and similar soils: 85 percent  
Inclusions: 15 percent

#### **Setting**

*Landform:* Mountains  
*Slope:* 30 to 60 percent  
*Elevation:* 4,500 to 6,000 feet  
*Mean annual precipitation:* 30 to 40 inches  
*Frost-free period:* 40 to 60 days

#### **Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Mitten and similar soils
- Tevis and similar soils
- Waldbillig and similar soils
- Soils that are shallow over bedrock
- Areas of rock outcrop
- Areas of rubble land

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **58—Holloway gravelly silt loam, cool, 8 to 30 percent slopes**

#### **Composition**

Holloway and similar soils: 85 percent  
Inclusions: 15 percent

#### **Setting**

*Landform:* Mountains  
*Slope:* 8 to 30 percent  
*Elevation:* 6,000 to 7,000 feet  
*Mean annual precipitation:* 40 to 60 inches  
*Frost-free period:* 40 to 60 days

#### **Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Felan, cool, soils
- Soils that support Douglas-fir and larch
- Coerock and similar soils
- Areas of rock outcrop

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **59—Holloway gravelly silt loam, cool, 30 to 60 percent slopes**

#### **Composition**

Holloway and similar soils: 85 percent  
Inclusions: 15 percent

#### **Setting**

*Landform:* Mountains

*Slope:* 30 to 60 percent  
*Elevation:* 6,000 to 7,000 feet  
*Mean annual precipitation:* 40 to 60 inches  
*Frost-free period:* 40 to 60 days

### **Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Felan, cool, soils
- Soils that support Douglas-fir and larch
- Phillcher and similar soils
- Coerock and similar soils
- Areas of rock outcrop

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **60—Holloway-Rock outcrop complex, 50 to 80 percent slopes**

### **Composition**

Holloway and similar soils: 50 percent  
 Rock outcrop: 30 percent  
 Inclusions: 20 percent

### **Setting**

#### **Landform:**

- Holloway—Mountains
- Rock outcrop—Mountains

#### **Slope:**

- Holloway—50 to 80 percent
- Rock outcrop—50 to 80 percent

*Elevation:* 4,500 to 6,000 feet  
*Mean annual precipitation:* 30 to 40 inches  
*Frost-free period:* 40 to 60 days

### **Component Description**

#### **Holloway**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.4 inches

#### **Rock outcrop**

*Definition:* Exposures of argillite or quartzite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Holloway, cool, soils
- Mitten and similar soils
- Tevis and similar soils
- Soils that are shallow over bedrock
- Areas of rubble land
- Soils that have slopes of less than 50 percent

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Jimlake Series**

The Jimlake series consists of very deep, well drained soils that formed in alpine till derived mainly from limestone. The surface layer of these soils has a high content of volcanic ash. The soils are on moraines. Slope is 4 to 60 percent. Elevation is 3,800 to 6,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, mixed Andeptic Cryoboralfs

**Typical Pedon**

Jimlake gravelly silt loam, 4 to 30 percent slopes, in a forested area, 1,100 feet west and 900 feet north of the center of sec. 8, T. 20 N., R. 17 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 1 inch; light gray (10YR 7/2) gravelly silt loam, grayish brown (10YR 5/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many fine pores; 20 percent pebbles; medium acid; clear wavy boundary.

Bs—1 to 7 inches; brown (7.5YR 5/4) gravelly silt loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many fine pores; 20 percent pebbles; medium acid; clear wavy boundary.

2Bt/E—7 to 14 inches; 65 percent light yellowish brown gravelly silt loam, yellowish brown (10YR 5/6) moist (Bt part); 35 percent very pale brown (10YR 7/3) gravelly silt loam, pale brown (10YR 6/3) moist (E part); when mixed, texture is gravelly silt loam; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots; many fine pores; 25 percent pebbles; slightly acid; clear wavy boundary.

2Bt1—14 to 24 inches; light yellowish brown (10YR 6/4) very gravelly silt loam, yellowish brown (10YR 5/6) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; common moderately thick clay films on faces of peds; 35 percent pebbles; slightly acid; clear wavy boundary.

2Bt2—24 to 38 inches; light yellowish brown (10YR 6/4) very gravelly silt loam, yellowish brown (10YR 5/6) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; common thin clay films on faces of peds; 40 percent pebbles; neutral; gradual wavy boundary.

2BC—38 to 60 inches; light yellowish brown (2.5Y 6/4) very gravelly silt loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; 35 percent pebbles, 10 percent cobbles; neutral.

**Range in Characteristics**

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Content of clay in the control section:* 10 to 20 percent

*Content of rock fragments:* 35 to 60 percent in the control section

*Depth to carbonates:* Mainly below a depth of 60 inches but ranges to 40 inches

**E horizon**

Hue: 10YR to 7.5YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Clay content: 7 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles and stones, 15 to 30 percent pebbles

Reaction: pH 5.6 to 6.5

Moist bulk density: 0.95 g/cc or less

**Bs horizon**

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 4 or 6

Clay content: 7 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles and stones, 15 to 30 percent pebbles

Moist bulk density: 0.95 g/cc or less

Reaction: pH 5.6 to 6.5

Note: Some pedons have a thin E/B horizon.

**2Bt/E horizon**

Hue: B part—2.5Y or 10YR; E part—2.5Y or 10YR

Value: B part—5 or 6 dry and 4 or 5 moist; E part—6 or 7 dry and 5 or 6 moist

Chroma: B part—3 to 6; E part—2 to 4

Texture: Silt loam or loam

Clay content: 10 to 18 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles and stones, 15 to 30 percent pebbles

Reaction: pH 6.1 to 7.3

**2Bt horizon**

Hue: 2.5Y or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 4 or 6

Texture: Silt loam or loam

Clay content: 13 to 20 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles and stones, 35 to 50 percent pebbles

Reaction: pH 6.1 to 7.3

**2BC horizon**

Hue: 2.5Y or 10YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 3 or 4  
 Texture: Silt loam or loam  
 Clay content: 10 to 18 percent  
 Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles and stones, 35 to 50 percent pebbles  
 Reaction: pH 6.6 to 7.8  
 Note: Some pedons do not have a 2BC horizon.

### 61—Jimlake gravelly silt loam, 4 to 30 percent slopes

#### **Composition**

Jimlake and similar soils: 85 percent  
 Inclusions: 15 percent

#### **Setting**

*Landform:* Moraines  
*Slope:* 4 to 30 percent  
*Elevation:* 3,800 to 4,500 feet  
*Mean annual precipitation:* 30 to 40 inches  
*Frost-free period:* 40 to 60 days

#### **Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Waldbillig and similar soils
- Poorly drained, ponded soils
- Soils that have a lower content of clay
- Upsata soils on terraces
- Poorly drained soils

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section

- Wildlife habitat section
- Engineering and soil properties sections

### 62—Jimlake gravelly silt loam, 30 to 60 percent slopes

#### **Composition**

Jimlake and similar soils: 90 percent  
 Inclusions: 10 percent

#### **Setting**

*Landform:* Moraines  
*Slope:* 30 to 60 percent  
*Elevation:* 4,400 to 6,000 feet  
*Mean annual precipitation:* 30 to 40 inches  
*Frost-free period:* 40 to 60 days

#### **Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Felan and similar soils
- Soils that have a lower content of clay

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Lantern Series

The Lantern series consists of very deep, somewhat excessively drained soils that formed in material derived from micaceous schist. These soils are on mountain slopes. Slope is 8 to 80 percent. Elevation is 4,000 to 5,500 feet. The average annual precipitation is 25 to 40

inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Dystric Eutrochrepts

### Typical Pedon

Lantern gravelly sandy loam, 30 to 60 percent slopes, in a forested area, 1,750 feet east and 1,400 feet north of the southwest corner of sec. 2, T. 11 N., R. 22 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 14 inches; light gray (10YR 7/2) gravelly sandy loam, grayish brown (10YR 5/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; few very fine pores; 25 percent pebbles; slightly acid; gradual wavy boundary.

E2—14 to 26 inches; light gray (10YR 7/2) very gravelly sandy loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; few very fine pores; 30 percent pebbles, 10 percent cobbles; slightly acid; gradual wavy boundary.

E and Bt—26 to 39 inches; pale brown (10YR 6/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist (E part); lamellae of brown (10YR 5/3) very gravelly fine sandy loam, brown (10YR 4/3) moist (B part); weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; few very fine pores; 45 percent pebbles, 10 percent cobbles; neutral; gradual wavy boundary.

BC—39 to 60 inches; very pale brown (10YR 7/3) extremely gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; few very fine pores; 45 percent pebbles, 20 percent cobbles; neutral.

### Range in Characteristics

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Control section:* 5 to 17 percent clay and 15 to 40 percent mica, by weight

#### E1 horizon

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 35 percent pebbles

Reaction: pH 6.1 to 6.5

#### E2 horizon

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 60 percent—0 to 10 percent cobbles, 15 to 50 percent pebbles

Reaction: pH 6.1 to 6.5

#### E and Bt horizon

Hue: E part—10YR or 2.5Y; B part—10YR or 2.5Y

Value: E part—6 or 7 dry and 5 or 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—3 or 4; B part—3 or 4

Texture: Sandy loam or fine sandy loam

Clay content: 5 to 18 percent; less than 3 percent clay increase in lamellae

Content of rock fragments: 35 to 60 percent—0 to 15 percent cobbles, 35 to 45 percent pebbles

Reaction: pH 6.1 to 7.3

#### BC horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 3 or 4

Texture: Sandy loam or loamy sand

Clay content: 5 to 15 percent

Content of rock fragments: 45 to 80 percent—0 to 20 percent cobbles, 45 to 60 percent pebbles

Reaction: pH 6.1 to 7.3

## 63—Lantern gravelly sandy loam, 8 to 30 percent slopes

### Composition

Lantern and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 4,000 to 5,500 feet

*Mean annual precipitation:* 25 to 40 inches

*Frost-free period:* 60 to 90 days

### Component Description

*Surface layer texture:* Gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Chickaman and similar soils
- Lantern soils on drier aspects
- Soils that have a subsoil of sandy clay loam

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **64—Lantern gravelly sandy loam, 30 to 60 percent slopes**

### ***Composition***

Lantern and similar soils: 85 percent  
Inclusions: 15 percent

### ***Setting***

*Landform:* Mountains

*Slope:* 30 to 60 percent

*Elevation:* 4,000 to 5,500 feet

*Mean annual precipitation:* 25 to 40 inches

*Frost-free period:* 60 to 90 days

### ***Component Description***

*Surface layer texture:* Gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Chickaman and similar soils
- Lantern soils on drier aspects

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **65—Lantern-Rock outcrop complex, 50 to 80 percent slopes**

### ***Composition***

Lantern and similar soils: 55 percent

Rock outcrop: 25 percent

Inclusions: 20 percent

### ***Setting***

*Landform:*

- Lantern—Mountains
- Rock outcrop—Mountains

*Slope:*

- Lantern—50 to 80 percent, southwest aspect
- Rock outcrop—50 to 80 percent

*Elevation:* 4,200 to 5,500 feet

*Mean annual precipitation:* 25 to 40 inches

*Frost-free period:* 60 to 90 days

### ***Component Description***

#### **Lantern**

*Surface layer texture:* Gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.9 inches

#### **Rock outcrop**

*Definition:* Exposures of micaceous schist

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Soils that are shallow over bedrock
- Areas of rubble land

### ***Management***

For general and detailed information concerning

managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Lolopeak Series

The Lolopeak series consists of very deep, excessively drained soils that formed in colluvium derived from granite and gneiss. The surface layer of these soils has a high content of volcanic ash. The soils are on mountain slopes. Slope is 50 to 80 percent. Elevation is 6,500 to 8,500 feet. The average annual precipitation is 45 to 80 inches, the average annual air temperature is 33 to 36 degrees F, and the frost-free season is 30 to 40 days.

**Taxonomic Class:** Sandy-skeletal, mixed Andic Cryumbrepts

### Typical Pedon

Lolopeak bouldery loam, 50 to 80 percent slopes, in a forested area, 200 feet north and 800 feet west of the east quarter corner of sec. 34, T. 11 N., R. 22 W.

Oi—3 inches to 0; undecomposed and slightly decomposed forest litter.

A—0 to 9 inches; brown (10YR 4/3) bouldery loam, very dark brown (10YR 2/2) moist; weak medium and coarse granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 1 percent boulders and 10 percent pebbles; strongly acid; clear wavy boundary.

2Bw—9 to 27 inches; yellowish brown (10YR 5/4) extremely stony loamy coarse sand, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium and common coarse roots; 10 percent stones, 10 percent cobbles, 45 percent pebbles; medium acid; gradual wavy boundary.

2C—27 to 60 inches; pale brown (10YR 6/3) extremely stony loamy coarse sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; 15 percent stones, 10 percent cobbles, 50 percent pebbles; slightly acid.

### Range in Characteristics

*Soil temperature:* 35 to 38 degrees F

*Moisture control section:* Between depths of 12 and 35 inches

*Content of clay in the control section:* 0 to 5 percent

### A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 7 to 12 percent

Content of rock fragments: 15 to 35 percent—5 to 10 percent cobbles, stones, and boulders and 10 to 25 percent pebbles

Bulk density: 0.95 g/cc or less

Base saturation: 20 to 50 percent

Reaction: pH 5.1 to 6.0

### 2Bw horizon

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 or 4

Clay content: 0 to 5 percent

Content of rock fragments: 60 to 85 percent—15 to 35 percent cobbles and stones, 45 to 50 percent pebbles

Reaction: pH 5.1 to 6.0

### 2C horizon

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 3 or 4

Clay content: 0 to 5 percent

Content of rock fragments: 60 to 85 percent—15 to 35 percent cobbles and stones, 45 to 50 percent pebbles

Reaction: pH 5.1 to 6.0

## 66—Lolopeak bouldery loam, 50 to 80 percent slopes

### Composition

Lolopeak and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Mountains

*Slope:* 50 to 80 percent

*Elevation:* 6,500 to 8,500 feet

*Mean annual precipitation:* 45 to 80 inches

*Frost-free period:* 30 to 40 days

### Component Description

*Surface layer texture:* Bouldery loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as

horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Petty, cool, soils
- Soils that do not contain volcanic ash
- Soils derived from micaceous schist
- Areas of rock outcrop

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **67—Lolopeak-Rock outcrop complex, 50 to 80 percent slopes**

### ***Composition***

Lolopeak and similar soils: 50 percent  
Rock outcrop: 20 percent  
Inclusions: 30 percent

### ***Setting***

#### ***Landform:***

- Lolopeak—Mountains
- Rock outcrop—Mountains

#### ***Slope:***

- Lolopeak—50 to 80 percent
- Rock outcrop—50 to 80 percent

***Elevation:*** 6,500 to 8,500 feet

***Mean annual precipitation:*** 45 to 80 inches

***Frost-free period:*** 30 to 40 days

### ***Component Description***

#### **Lolopeak**

***Surface layer texture:*** Bouldery loam

***Depth class:*** Very deep (more than 60 inches)

***Drainage class:*** Excessively drained

***Dominant parent material:*** Colluvium

***Native plant cover type:*** Forest land

***Flooding:*** None

***Available water capacity to 60 inches or root-limiting layer:*** Mainly 2.0 inches

#### **Rock outcrop**

***Definition:*** Exposures of granite or gneiss bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as

horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Petty, cool, soils
- Soils derived from micaceous schist
- Soils that are 10 to 40 inches deep over bedrock
- Soils that do not contain volcanic ash

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Lubrecht Series**

The Lubrecht series consists of moderately deep, well drained soils that formed in material derived mainly from consolidated siltstone. These soils are on hills. Slope is 4 to 15 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 16 to 22 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Fine, mixed Typic Eutroboralfs

### ***Typical Pedon***

Lubrecht silt loam, 4 to 15 percent slopes, in a forested area, 2,300 feet west of the southeast corner of sec. 20, T. 13 N., R. 15 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 4 inches; light grayish brown (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak very thin platy structure parting to moderate very fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine pores; 5 percent pebbles; strongly acid; abrupt smooth boundary.

E/Bt—4 to 8 inches; 75 percent light grayish brown (10YR 6/2) silt loam, brown (10YR 4/3) moist (E part); 25 percent very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) moist (Bt part); moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine pores; common moderately thick clay films on faces of peds; 5 percent pebbles; slightly acid; clear smooth boundary.

Bt/E—8 to 11 inches; 80 percent very pale brown

(10YR 7/4) silty clay loam, dark yellowish brown (10YR 4/4) moist (Bt part); 20 percent brown (10YR 5/3) silty clay loam, dark yellowish brown (10YR 4/4) moist (E part); strong fine subangular blocky structure; very hard, firm, sticky and plastic; many very fine, fine, medium, and coarse roots; many fine pores; common moderately thick clay films on faces of peds; medium acid; abrupt wavy boundary.

**Bt1**—11 to 19 inches; very pale brown (10YR 7/3) silty clay, dark yellowish brown (10YR 4/4) moist; strong medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; common very fine, fine, medium, and coarse roots; common very fine pores; common moderately thick clay films on faces of peds; common very dark grayish brown (10YR 3/2) organic stains; medium acid; clear smooth boundary.

**Bt2**—19 to 30 inches; very pale brown (10YR 7/3) silty clay, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine and few medium and coarse roots; common very fine pores; many moderately thick clay films on faces of peds; medium acid; clear smooth boundary.

**Bt3**—30 to 36 inches; very pale brown (10YR 7/3) gravelly silty clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine and fine roots; common very fine pores; few thin clay films on faces of peds; 20 percent pebbles; medium acid; clear smooth boundary.

**Cr**—36 to 60 inches; consolidated siltstone.

#### **Range in Characteristics**

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Depth to consolidated siltstone:* 30 to 40 inches

#### **E horizon**

Value: 5 or 6 dry; 4 or 5 moist

Clay content: 10 to 27 percent

Texture: Loam or silt loam

Content of rock fragments: 0 to 15 percent pebbles

Reaction: pH 5.1 to 7.3

#### **E/Bt horizon**

Value: E part—6 or 7 dry and 4 to 6 moist; B part—5 or 6 dry and 3 or 4 moist

Chroma: E part—2 or 3; B part—2 to 4

Clay content, mixed: 10 to 27 percent

Texture: Loam or silt loam

Content of rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.1 to 7.3

#### **Bt/E horizon**

Value: B part—5 or 6 dry and 4 or 5 moist; E part—

6 or 7 dry and 4 to 6 moist

Chroma: B part—2 to 4; E part—2 to 4

Texture: Silty clay loam or clay loam

Clay content, mixed: 27 to 40 percent

Reaction: pH 5.6 to 7.3

#### **Bt1 and Bt2 horizons**

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Silty clay or clay

Clay content: 40 to 60 percent

Reaction: pH 5.1 to 7.3

#### **Bt3 horizon**

Value: 5 or 6 dry; 4 to 6 moist

Chroma: 2 to 4

Clay content: 27 to 40 percent

Texture: Silty clay or clay

Content of rock fragments: 15 to 35 percent—0 to 5 percent angular cobbles, 15 to 30 percent angular pebbles

Reaction: pH 5.1 to 7.3

## **68—Lubrecht silt loam, 4 to 15 percent slopes**

### **Composition**

Lubrecht and similar soils: 85 percent

Inclusions: 15 percent

### **Setting**

*Landform:* Hills

*Slope:* 4 to 15 percent

*Elevation:* 3,500 to 4,500 feet

*Mean annual precipitation:* 16 to 22 inches

*Frost-free period:* 60 to 90 days

### **Component Description**

*Surface layer texture:* Silt loam

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Siltstone residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Crow and similar soils

- Greenough and similar soils
- Hagstadt and similar soils
- Winkler, cool, soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Mitten Series

The Mitten series consists of very deep, somewhat excessively drained soils that formed in colluvium derived from argillite and quartzite bedrock. The surface layer of these soils has a high content of volcanic ash. The soils are on mountain slopes. Slope is 8 to 70 percent. Elevation is 4,200 to 6,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Andic Dystric Eutrochrepts

#### Typical Pedon

Mitten gravelly silt loam, 30 to 60 percent slopes, in a forested area, 1,500 feet east of the northwest corner of sec. 13, T. 12 N., R. 19 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

Bs—0 to 9 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 15 percent pebbles; slightly acid; abrupt wavy boundary.

2E—9 to 16 inches; pinkish gray (7.5YR 7/2) very gravelly sandy loam, brown (7.5YR 5/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 45 percent pebbles, 5 percent cobbles; slightly acid; clear wavy boundary.

2E and Bw—16 to 34 inches; 80 percent pinkish gray sandy (7.5YR 7/2) extremely gravelly sandy loam, brown (7.5YR 5/2) moist (E part); 20 percent brown (7.5YR 5/4) extremely gravelly sandy loam lamellae, brown (7.5YR 4/4) moist (B part); when mixed, texture is extremely gravelly sandy loam; massive; soft, very friable, nonsticky and nonplastic; common

very fine, fine, medium, and coarse roots; 50 percent angular pebbles, 15 percent angular cobbles; slightly acid; diffuse irregular boundary.  
2BC—34 to 60 inches; pinkish gray (7.5YR 5/2) extremely gravelly sandy loam, brown (7.5YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; 50 percent pebbles, 15 percent cobbles; neutral.

#### Range in Characteristics

*Soil temperature:* 41 to 46 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Content of clay in the control section:* 5 to 10 percent

#### Bs horizon

Value: 4 or 5 moist

Chroma: 3 or 4

Clay content: 5 to 10 percent

Content of rock fragments: 15 to 50 percent—0 to 30 percent angular cobbles, 10 to 45 percent angular pebbles

Reaction: pH 5.6 to 6.5

Moist bulk density: 1.0 g/cc or less

#### 2E horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Very fine sandy loam, fine sandy loam, sandy loam, or loam

Clay content: 5 to 10 percent

Content of rock fragments: 35 to 80 percent—5 to 10 percent angular cobbles, 30 to 70 percent angular pebbles

Reaction: pH 5.6 to 6.5

#### 2E and Bw horizon

Hue: E part—7.5YR or 10YR; B part—2.5Y, 7.5YR, or 10YR

Value: E part—6 or 7 dry and 5 or 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—3 or 4

Texture: Very fine sandy loam, fine sandy loam, sandy loam, or loam

Clay content, mixed: 5 to 10 percent

Content of rock fragments: 60 to 80 percent—10 to 20 percent angular cobbles, 50 to 60 percent angular pebbles

Reaction: pH 5.6 to 6.5

Note: Some pedons have a 2Bw/E horizon below the 2E/Bw horizon.

#### 2BC horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 5 or 6 moist  
 Chroma: 2 or 3  
 Texture: Fine sandy loam, sandy loam, coarse sandy loam, or loam  
 Clay content: 5 to 10 percent  
 Content of rock fragments: 60 to 85 percent—10 to 20 percent angular cobbles, 50 to 65 percent angular pebbles  
 Reaction: pH 5.6 to 7.3

### 69—Mitten gravelly silt loam, 30 to 60 percent slopes

#### **Composition**

Mitten and similar soils: 85 percent  
 Inclusions: 15 percent

#### **Setting**

*Landform:* Mountains  
*Slope:* 30 to 60 percent  
*Elevation:* 4,200 to 6,000 feet  
*Mean annual precipitation:* 25 to 40 inches  
*Frost-free period:* 60 to 90 days

#### **Component Description**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Holloway and similar soils
- Tevis and similar soils

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### 70—Mitten-Sharrott, cool, complex, 15 to 40 percent slopes

#### **Composition**

Mitten and similar soils: 50 percent  
 Sharrott and similar soils: 30 percent  
 Inclusions: 20 percent

#### **Setting**

*Landform:*  
 • Mitten—Mountains  
 • Sharrott—Mountains  
*Slope:*  
 • Mitten—15 to 40 percent  
 • Sharrott—15 to 40 percent  
*Elevation:* 4,200 to 5,200 feet  
*Mean annual precipitation:* 25 to 30 inches  
*Frost-free period:* 75 to 90 days

#### **Component Description**

##### **Mitten**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

##### **Sharrott**

*Surface layer texture:* Gravelly loam  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 1.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Holloway and similar soils
- Tevis and similar soils
- Areas of rock outcrop

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 71—Mitten-Tevis complex, 30 to 60 percent slopes

### **Composition**

Mitten and similar soils: 45 percent  
Tevis and similar soils: 35 percent  
Inclusions: 20 percent

### **Setting**

#### *Landform:*

- Mitten—Mountains
- Tevis—Mountains

#### *Slope:*

- Mitten—30 to 60 percent
- Tevis—30 to 60 percent

*Elevation:* 4,200 to 6,000 feet

*Mean annual precipitation:* 25 to 40 inches

*Frost-free period:* 60 to 90 days

### **Component Description**

#### **Mitten**

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

#### **Tevis**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Beeskove and similar soils
- Holloway and similar soils

- Winkler, cool, soils
- Soils that have slopes of more than 60 percent

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Moiese Series**

The Moiese series consists of very deep, excessively drained soils that formed in alluvium. These soils are on alluvial fans and stream terraces. Slope is 0 to 2 percent. Elevation is 2,800 to 3,500 feet. The average annual precipitation is 12 to 14 inches, the average annual air temperature is 43 to 45 degrees F, and the frost-free season is 105 to 120 days.

**Taxonomic Class:** Sandy-skeletal, mixed, frigid Calciorthidic Haploxerolls

### **Typical Pedon**

Moiese gravelly loam, 0 to 2 percent slopes, in an area of cropland, 2,640 feet west and 1,320 feet south of the northeast quarter corner of sec. 30, T. 13 N., R. 19 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many fine pores; 25 percent pebbles; neutral; clear wavy boundary.

Bw—9 to 21 inches; brown (10YR 5/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; many fine pores; 40 percent pebbles, 10 percent cobbles; neutral; clear wavy boundary.

2Bk1—21 to 31 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; few fine roots; 45 percent pebbles, 20 percent cobbles; slightly effervescent; moderately alkaline; gradual smooth boundary.

2Bk2—31 to 60 inches; pale brown (10YR 6/3) extremely gravelly sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; few fine roots; 55 percent pebbles, 20 percent cobbles; slightly effervescent; moderately alkaline.

**Range in Characteristics**

*Soil temperature:* 45 to 47 degrees F

*Moisture control section:* Between depths of 12 and 35 inches

*Mollic epipedon thickness:* 7 to 16 inches

*Content of clay in the control section:* 5 to 15 percent

**Ap horizon**

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 10 to 22 percent

Content of rock fragments: 0 to 35 percent—0 to 5 percent cobbles, 0 to 30 percent pebbles

Reaction: pH 6.1 to 7.3

**Bw horizon**

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 2 to 4

Clay content: 5 to 15 percent

Content of rock fragments: 35 to 60 percent—0 to 15 percent cobbles, 35 to 45 percent pebbles

Reaction: pH 6.6 to 7.8

**2Bk1 horizon**

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loamy sand, loamy coarse sand, sand, or fine sand

Clay content: 0 to 5 percent

Content of rock fragments: 45 to 75 percent—0 to 20 percent cobbles, 45 to 55 percent pebbles

Calcium carbonate equivalent: 8 to 15 percent

Reaction: pH 7.4 to 8.4

**2Bk2 horizon**

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Loamy coarse sand, coarse sand, or loamy sand

Clay content: 0 to 5 percent

Content of rock fragments: 50 to 85 percent—0 to 20 percent cobbles, 50 to 65 percent pebbles

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 8.4

**72—Moiese gravelly loam, 0 to 2 percent slopes****Composition**

Moiese and similar soils: 85 percent

Inclusions: 15 percent

**Setting**

*Landform:* Alluvial fans and stream terraces

*Slope:* 0 to 2 percent

*Elevation:* 2,800 to 3,500 feet

*Mean annual precipitation:* 12 to 14 inches

*Frost-free period:* 105 to 120 days

*Note:* In areas outside the Missoula Valley, this soil has a shorter frost-free period.

**Component Description**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Alberton and similar soils
- Bigarm and similar soils
- Grantsdale and similar soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Orthents**

Orthents consist of very deep, well drained to excessively drained soils that formed in a variety of disturbed and reworked soil material. These soils are on stream terraces. Slope is 0 to 4 percent. Elevation is 2,800 to 3,500 feet. The average annual precipitation is 11 to 14 inches, the average annual air temperature is 43 to 45 degrees F, and the frost-free season is 105 to 120 days.

**Typical Pedon**

Orthents on a golf course, 2,500 feet east and 1,000 feet north of the southwest corner of sec. 31, T. 13 N., R. 19 W.

0 to 4 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, nonsticky and nonplastic; 5 percent pebbles; neutral; clear smooth boundary.

4 to 20 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; massive; loose, nonsticky and nonplastic; 45 percent pebbles, 20 percent cobbles; neutral; gradual wavy boundary.

20 to 60 inches; pale brown (10YR 6/3) extremely gravelly sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; 55 percent pebbles, 20 percent cobbles; neutral.

#### Range in Characteristics

*Texture:* Silty clay loam to extremely gravelly sand

### 73—Orthents, 0 to 4 percent slopes

#### Composition

Orthents and similar soils: 85 percent

Inclusions: 15 percent

#### Setting

*Landform:* Stream terraces

*Slope:* 0 to 4 percent

*Elevation:* 2,800 to 3,500 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 105 to 120 days

#### Component Description

*Depth class:* Very deep (more than 60 inches)

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### Inclusions

- Areas of urban land
- Grantsdale and similar soils
- Moiese and similar soils
- Bigarm and similar soils
- Grassvalley and similar soils
- Argixerolls and similar soils

#### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Ovando Series

The Ovando series consists of very deep, excessively drained soils that formed in igneous colluvium. These soils are on mountain slopes. Slope is 8 to 60 percent. Elevation is 4,500 to 6,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Sandy-skeletal, mixed Typic Cryorthents

#### Typical Pedon

Ovando gravelly sandy loam, in an area of Ovando-Elkner-Rock outcrop complex, 30 to 60 percent slopes; in a forested area, 2,700 feet north and 1,000 feet east of the southwest corner of sec. 28, T. 13 N., R. 14 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 6 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; moderate very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; common very fine and fine pores; 20 percent pebbles; slightly acid; clear wavy boundary.

E2—6 to 25 inches; light gray (10YR 7/2) very gravelly loamy coarse sand, grayish brown (10YR 5/2) moist; weak fine granular structure; loose, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; common very fine and fine pores; 40 percent pebbles; medium acid; clear wavy boundary.

E and Bt—25 to 49 inches; 80 percent very pale brown (10YR 7/4) very gravelly loamy coarse sand, yellowish brown (10YR 5/4) moist (E part); 20 percent brown (10YR 5/3) lamellae of sandy loam  $\frac{1}{8}$  to  $\frac{1}{2}$  inch thick, dark yellowish brown (10YR 4/4) moist (Bt part); when mixed, texture is very gravelly loamy coarse sand; single grain; loose, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; 5 percent cobbles, 45 percent pebbles; medium acid; gradual smooth boundary.

C—49 to 60 inches; pale brown (10YR 6/3) extremely gravelly loamy coarse sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; 20 percent cobbles, 55 percent pebbles; medium acid.

#### Range in Characteristics

*Soil temperature:* 37 to 44 degrees F

*Moisture control section:* Between depths of 12 and 35 inches; not dry in any part for as long as 90 consecutive days

*E1 horizon*

Value: 6 or 7 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Clay content: 5 to 10 percent  
 Content of rock fragments: 15 to 80 percent—0 to 40 percent stones, boulders, or cobbles and 5 to 45 percent pebbles  
 Reaction: pH 5.6 to 6.5

*E2 horizon*

Hue: 10YR or 2.5Y  
 Value: 6 or 7 dry; 4 or 5 moist  
 Clay content: 0 to 10 percent  
 Texture: Sandy loam or loamy coarse sand  
 Content of rock fragments: 15 to 80 percent—0 to 40 percent stones, boulders, or cobbles and 5 to 45 percent pebbles  
 Reaction: pH 5.6 to 6.5

*E and Bt horizon*

Hue: E part—10YR or 2.5Y; B part—10YR or 2.5Y  
 Value: E part—6 or 7 dry and 4 or 5 moist; B part—4 or 5 dry and moist  
 Chroma: E part—2 to 4; B part—3 or 4  
 Clay content: 0 to 5 percent; less than 3 percent clay increase in lamellae  
 Content of rock fragments: 35 to 60 percent—0 to 40 percent cobbles and stones, 10 to 50 percent pebbles  
 Reaction: pH 5.6 to 7.3

*C horizon*

Hue: 10YR or 2.5Y  
 Value: 6 or 7 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Clay content: 0 to 5 percent  
 Content of rock fragments: 60 to 80 percent—5 to 40 percent cobbles and stones, 20 to 60 percent pebbles  
 Reaction: pH 5.6 to 7.3

## 74—Ovando-Elkner-Rock outcrop complex, 30 to 60 percent slopes

### **Composition**

Ovando and similar soils: 40 percent  
 Elkner and similar soils: 30 percent  
 Rock outcrop: 15 percent  
 Inclusions: 15 percent

### **Setting**

*Landform:*

- Ovando—Mountains
- Elkner—Mountains
- Rock outcrop—Mountains

*Slope:*

- Ovando—30 to 60 percent
- Elkner—30 to 60 percent
- Rock outcrop—30 to 60 percent

*Elevation:* 4,500 to 6,200 feet

*Mean annual precipitation:* 20 to 30 inches

*Frost-free period:* 40 to 60 days

### **Component Description**

**Ovando**

*Surface layer texture:* Gravelly sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.1 inches

**Elkner**

*Surface layer texture:* Sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.7 inches

**Rock outcrop**

*Definition:* Exposures of granite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Soils that are shallow over bedrock
- Soils that have volcanic ash in the surface layer

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **Perma Series**

The Perma series consists of very deep, somewhat excessively drained soils that formed in alluvium. These soils are on stream terraces and hills. Slope is 0 to 45

percent. Elevation is 3,500 to 4,700 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed Typic Haploborolls

### Typical Pedon

Perma gravelly loam, 0 to 4 percent slopes, in an area of rangeland, 1,500 feet east and 300 feet north of the southwest corner of sec. 19, T. 14 N., R. 15 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine and fine pores; 20 percent pebbles; neutral; clear wavy boundary.

A2—6 to 12 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine and fine pores; 30 percent pebbles; neutral; clear wavy boundary.

Bw1—12 to 22 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine pores; 35 percent pebbles, 15 percent cobbles; neutral; gradual wavy boundary.

Bw2—22 to 36 inches; pale brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine pores; 40 percent pebbles, 15 percent cobbles; mildly alkaline; gradual wavy boundary.

BC—36 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; 50 percent pebbles, 20 percent cobbles; mildly alkaline.

### Range in Characteristics

#### A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 7 to 20 percent

Content of rock fragments: 15 to 60 percent—0 to 30 percent cobbles, stones, and boulders and 10 to 50 percent pebbles

Reaction: pH 6.6 to 7.3

#### Bw horizon

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Loam or sandy loam

Clay content: 7 to 27 percent

Content of rock fragments: 35 to 85 percent—0 to 50 percent cobbles and stones, 25 to 65 percent pebbles

Reaction: pH 6.6 to 7.8

#### BC horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Loam, loamy sand, or sandy loam

Clay content: 0 to 15 percent

Content of rock fragments: 60 to 85 percent—10 to 50 percent cobbles and stones, 50 to 65 percent pebbles

Reaction: pH 6.6 to 7.8

## 75—Perma gravelly loam, 0 to 4 percent slopes

### Composition

Perma and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Stream terraces

*Slope:* 0 to 4 percent

*Elevation:* 3,500 to 4,500 feet

*Mean annual precipitation:* 15 to 19 inches

*Frost-free period:* 60 to 90 days

### Component Description

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Perma variant soils

- Perma stony loam
- Soils that have a substratum of sand and gravel

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **76—Perma gravelly loam, 20 to 45 percent slopes**

### **Composition**

Perma and similar soils: 85 percent  
Inclusions: 15 percent

### **Setting**

*Landform:* Hills

*Slope:* 20 to 45 percent

*Elevation:* 3,500 to 4,500 feet

*Mean annual precipitation:* 15 to 19 inches

*Frost-free period:* 60 to 90 days

### **Component Description**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

### **Inclusions**

- Perma variant soils
- Perma stony loam
- Soils that have a substratum of sand and gravel

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section

- Wildlife habitat section
- Engineering and soil properties sections

## **77—Perma stony loam, 2 to 12 percent slopes**

### **Composition**

Perma and similar soils: 85 percent

Inclusions: 15 percent

### **Setting**

*Landform:* Stream terraces

*Slope:* 2 to 12 percent

*Elevation:* 3,500 to 4,500 feet

*Mean annual precipitation:* 15 to 19 inches

*Frost-free period:* 60 to 90 days

### **Component Description**

*Surface layer texture:* Stony loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

### **Inclusions**

- Perma variant soils
- Perma gravelly loam
- Soils that have a substratum of sand and gravel

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Perma Variant**

The Perma variant consists of very deep, well drained soils that formed in alpine till. These soils are on moraines. Slope is 2 to 30 percent. Elevation is 3,800 to 4,700 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is

42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed Typic Argiborolls

### Typical Pedon

Perma variant stony silt loam, 2 to 8 percent slopes, in an area of rangeland, 1,900 feet north and 1,000 feet east of the southwest corner of sec. 27, T. 15 N., R. 14 W.

A—0 to 12 inches; dark grayish brown (10YR 4/2) stony silt loam, very dark grayish brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots; 10 percent pebbles, 3 percent stones; slightly acid; gradual smooth boundary.

Bt1—12 to 24 inches; pale brown (10YR 6/3) very gravelly clay loam, brown (10YR 4/3) moist; slightly hard, friable, sticky and plastic; many very fine and fine roots; common moderately thick clay films on faces of peds; 30 percent pebbles, 10 percent cobbles; neutral; clear smooth boundary.

Bt2—24 to 33 inches; very pale brown (10YR 7/3) very gravelly clay loam, brown (10YR 5/3) moist; hard, friable, sticky and plastic; common very fine and fine roots; many moderately thick clay films on faces of peds; 40 percent pebbles, 5 percent cobbles; neutral; clear smooth boundary.

Bk—33 to 60 inches; light gray (10YR 7/2) very gravelly clay loam, grayish brown (10YR 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; 40 percent pebbles, 10 percent cobbles; strongly effervescent; moderately alkaline.

### Range in Characteristics

#### A horizon

Value: 4 or 5 dry; 2 or 3 moist  
 Chroma: 2 or 3  
 Clay content: 15 to 25 percent  
 Content of rock fragments: 2 to 15 percent—2 to 5 percent stones, 0 to 10 percent pebbles  
 Reaction: pH 6.1 to 7.3

#### Bt horizon

Hue: 10YR or 7.5YR  
 Value: 6 or 7 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Clay content: 27 to 35 percent  
 Content of rock fragments: 35 to 60 percent—5 to 15 percent cobbles and stones, 30 to 45 percent pebbles  
 Reaction: pH 6.6 to 7.8

#### Bk horizon

Hue: 10YR or 7.5YR  
 Value: 6 or 7 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: Loam, clay loam, or sandy clay loam  
 Clay content: 15 to 30 percent  
 Content of rock fragments: 35 to 60 percent—5 to 15 percent cobbles and stones, 30 to 45 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.9 to 8.4

### 78—Perma variant stony silt loam, 2 to 8 percent slopes

#### Composition

Perma variant and similar soils: 90 percent  
 Inclusions: 10 percent

#### Setting

*Landform:* Moraines  
*Slope:* 2 to 8 percent  
*Elevation:* 3,800 to 4,200 feet  
*Mean annual precipitation:* 15 to 19 inches  
*Frost-free period:* 60 to 90 days

#### Component Description

*Surface layer texture:* Stony silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### Inclusions

- Perma and similar soils
- Poorly drained soils

#### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 79—Perma variant-Perma complex, 4 to 30 percent slopes

### Composition

Perma variant and similar soils: 50 percent

Perma and similar soils: 30 percent

Inclusions: 20 percent

### Setting

#### Landform:

- Perma variant—Moraines
- Perma—Stream terraces

#### Slope:

- Perma variant—4 to 30 percent
- Perma—4 to 30 percent

Elevation: 4,200 to 4,700 feet

Mean annual precipitation: 15 to 19 inches

Frost-free period: 60 to 90 days

### Component Description

#### Perma variant

Surface layer texture: Stony silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Alpine till

Native plant cover type: Rangeland

Flooding: None

Available water capacity to 60 inches or root-limiting layer: Mainly 6.5 inches

#### Perma

Surface layer texture: Stony loam

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat excessively drained

Dominant parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity to 60 inches or root-limiting layer: Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Very stony soils
- Soils that have a light-colored surface layer

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Agronomy section

- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Petty Series

The Petty series consists of very deep, somewhat excessively drained soils that formed in material derived mainly from igneous rock. The surface layer of these soils has a high content of volcanic ash. The soils are on mountain slopes. Slope is 8 to 80 percent. Elevation is 4,500 to 6,900 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, mixed Andic Cryochrepts

### Typical Pedon

Petty gravelly loam, 8 to 30 percent slopes, in a forested area, 400 feet west and 300 feet south of the northeast corner of sec. 4, T. 10 N., R. 23 W.

Oi—3 inches to 0; undecomposed and slightly decomposed forest litter.

Bs—0 to 12 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine and fine pores; 20 percent pebbles; medium acid; clear smooth boundary.

2E—12 to 24 inches; very pale brown (10YR 7/4) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and fine pores; 35 percent pebbles, 5 percent cobbles; medium acid; gradual wavy boundary.

2E and Bt—24 to 36 inches; 70 percent very pale brown (10YR 7/4) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist (E part); 30 percent strong brown (7.5YR 5/6) lamellae of fine sandy loam 1/8 to 1/2 inch thick, brown (7.5YR 4/4) moist (Bt part); weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine and fine pores; 45 percent pebbles, 10 percent cobbles; slightly acid; gradual wavy boundary.

2C—36 to 60 inches; very pale brown (10YR 7/4) extremely gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and

fine roots and pores; 50 percent pebbles, 15 percent cobbles; slightly acid.

### Range in Characteristics

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Control section:* 5 to 15 percent clay; more than 50 percent of the sand fraction is coarse sand or very coarse sand

*Other features:* A thin discontinuous horizon on the surface in some pedons

#### *Bs horizon*

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 4 to 6

Clay content: 7 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 10 percent cobbles and stones, 15 to 25 percent pebbles

Moist bulk density: More than 0.95 g/cc

Reaction: pH 5.6 to 6.5

#### *2E horizon*

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 3 to 6

Texture: Coarse sandy loam; coarse or very coarse sand in more than 50 percent of the sand fraction

Clay content: 5 to 15 percent

Content of rock fragments: 35 to 55 percent—5 to 10 percent cobbles and stones, 30 to 45 percent pebbles

Reaction: pH 5.6 to 6.5

#### *2E and Bt horizon*

Hue: E part—10YR or 7.5YR

Value: E part—6 or 7 dry and 4 or 5 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—3 to 6; B part—3 to 6

Clay content: 5 to 15 percent; less than 3 percent clay increase in lamellae

Content of rock fragments: 35 to 60 percent—5 to 15 percent cobbles and stones, 30 to 45 percent pebbles

Reaction: pH 5.6 to 6.5

#### *2C horizon*

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 3 to 6

Texture: Coarse sandy loam or loamy coarse sand

Clay content: 5 to 15 percent

Content of rock fragments: 45 to 70 percent—5 to

15 percent cobbles and stones, 40 to 55 percent pebbles  
Reaction: pH 5.6 to 6.5

## 80—Petty gravelly loam, 8 to 30 percent slopes

### Composition

Petty and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 4,500 to 6,000 feet

*Mean annual precipitation:* 35 to 45 inches

*Frost-free period:* 40 to 60 days

### Component Description

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Material weathered from igneous rock

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Somewhat poorly drained soils
- Poorly drained soils
- Chickaman and similar soils
- Selway and similar soils
- Soils that are very gravelly loamy sand
- Petty bouldery loam

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**81—Petty gravelly loam, 30 to 60 percent slopes****Composition**

Petty and similar soils: 85 percent  
Inclusions: 15 percent

**Setting**

*Landform:* Mountains  
*Slope:* 30 to 60 percent  
*Elevation:* 4,500 to 6,000 feet  
*Mean annual precipitation:* 35 to 45 inches  
*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Material weathered from igneous rock  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Chickaman and similar soils
- Selway and similar soils
- Petty bouldery loam
- Soils that are very gravelly loamy sand
- Areas of rock outcrop

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**82—Petty bouldery loam, 30 to 60 percent slopes****Composition**

Petty and similar soils: 85 percent  
Inclusions: 15 percent

**Setting**

*Landform:* Mountains  
*Slope:* 30 to 60 percent  
*Elevation:* 4,500 to 6,000 feet  
*Mean annual precipitation:* 35 to 45 inches  
*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Bouldery loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Material weathered from igneous rock  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Petty gravelly loam
- Very bouldery soils
- Soils that are very gravelly loamy sand
- Areas of rock outcrop

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**83—Petty gravelly loam, cool, 8 to 30 percent slopes****Composition**

Petty and similar soils: 85 percent  
Inclusions: 15 percent

**Setting**

*Landform:* Mountains  
*Slope:* 8 to 30 percent  
*Elevation:* 6,000 to 6,900 feet  
*Mean annual precipitation:* 40 to 50 inches  
*Frost-free period:* 40 to 60 days

### **Component Description**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Material weathered from igneous rock  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Lolopeak and similar soils
- Poorly drained soils
- Somewhat poorly drained soils
- Soils that support Douglas-fir and larch
- Areas of rock outcrop

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **84—Petty bouldery loam, cool, 50 to 80 percent slopes**

### **Composition**

Petty and similar soils: 85 percent  
 Inclusions: 15 percent

### **Setting**

*Landform:* Mountains  
*Slope:* 50 to 80 percent  
*Elevation:* 6,000 to 6,900 feet  
*Mean annual precipitation:* 40 to 50 inches  
*Frost-free period:* 40 to 60 days

### **Component Description**

*Surface layer texture:* Bouldery loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Material weathered from igneous rock

*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Lolopeak and similar soils
- Soils that support Douglas-fir and larch
- Areas of rock outcrop
- Areas of rubble land

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **85—Petty, cool-Rock outcrop complex, 50 to 80 percent slopes**

### **Composition**

Petty and similar soils: 60 percent  
 Rock outcrop: 25 percent  
 Inclusions: 15 percent

### **Setting**

*Landform:*  
 • Petty—Mountains  
 • Rock outcrop—Mountains  
*Slope:*  
 • Petty—50 to 80 percent  
 • Rock outcrop—50 to 80 percent  
*Elevation:* 6,000 to 6,900 feet  
*Mean annual precipitation:* 40 to 50 inches  
*Frost-free period:* 40 to 60 days

### **Component Description**

#### **Petty**

*Surface layer texture:* Bouldery loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Material weathered from igneous rock  
*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

### Rock outcrop

*Definition:* Exposures of granite or gneiss bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Lolopeak and similar soils
- Soils that support Douglas-fir and larch
- Areas of rubble land

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Phillcher Series

The Phillcher series consists of very deep, somewhat excessively drained soils that formed in colluvium and alpine till derived from argillite and quartzite. The surface layer of these soils has a high content of volcanic ash. The soils are on moraines and mountains. Slope is 4 to 80 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 50 to 80 inches, the average annual air temperature is 33 to 36 degrees F, and the frost-free season is 30 to 40 days.

**Taxonomic Class:** Loamy-skeletal, mixed Andic Cryochrepts

### Typical Pedon

Phillcher silt loam, 4 to 30 percent slopes, in a forested area, 1,000 feet west of the east quarter corner of sec. 12, T. 17 N., R. 17 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

Bs—0 to 10 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 10 percent pebbles; medium acid; clear wavy boundary.

2Bw—10 to 24 inches; light gray (2.5Y 7/2) very

gravelly sandy loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; 5 percent cobbles, 45 percent pebbles; medium acid; gradual wavy boundary.

2C—24 to 60 inches; light gray (2.5Y 7/2) extremely gravelly sandy loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; 10 percent cobbles, 55 percent pebbles; medium acid.

### Range in Characteristics

*Soil temperature:* 35 to 38 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Content of clay in the control section:* 0 to 10 percent

*Bs horizon*

Hue: 10YR or 7.5YR

Value: 4 to 6 dry; 2 to 4 moist

Chroma: 2 to 4

Clay content: 5 to 10 percent

Content of rock fragments: 0 to 35 percent pebbles

Reaction: pH 5.6 to 6.0

Moist bulk density: 0.95 g/cc or less

*2Bw horizon*

Hue: 10YR, 7.5YR, or 2.5Y

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles, 35 to 50 percent pebbles

Reaction: pH 5.6 to 6.0

*2C horizon*

Hue: 10YR, 7.5YR, or 2.5Y

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Sandy loam or loamy sand

Clay content: 0 to 10 percent

Content of rock fragments: 60 to 80 percent—5 to 20 percent cobbles, 55 to 60 percent pebbles

Reaction: pH 5.6 to 6.0

## 86—Phillcher silt loam, 4 to 30 percent slopes

### Composition

Phillcher and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Moraines

*Slope:* 4 to 30 percent

*Elevation:* 6,000 to 8,000 feet  
*Mean annual precipitation:* 50 to 80 inches  
*Frost-free period:* 30 to 40 days

### **Component Description**

*Surface layer texture:* Silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Coerock and similar soils
- Poorly drained soils
- Holloway, cool, soils
- Areas of rock outcrop

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **87—Phillcher-Rock outcrop complex, 50 to 80 percent slopes**

### **Composition**

Phillcher and similar soils: 60 percent  
 Rock outcrop: 20 percent  
 Inclusions: 20 percent

### **Setting**

*Landform:*

- Phillcher—Mountains
- Rock outcrop—Mountains

*Slope:*

- Phillcher—50 to 80 percent
- Rock outcrop—50 to 80 percent

*Elevation:* 6,000 to 8,000 feet

*Mean annual precipitation:* 50 to 80 inches

*Frost-free period:* 30 to 40 days

### **Component Description**

#### **Phillcher**

*Surface layer texture:* Silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.2 inches

#### **Rock outcrop**

*Definition:* Exposures of argillite or quartzite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Coerock and similar soils
- Holloway, cool, soils
- Areas of rubble land

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **88—Pits, gravel**

### **Composition**

Pits: 100 percent

### **Setting**

*Landform:* Stream terraces

### **Component Description**

*Definition:* Open excavations from which soil material and gravel have been removed

*Dominant parent material:* Alluvium

### **Repp Series**

The Repp series consists of very deep, well drained soils that formed in colluvium derived from argillite and limestone. These soils are on mountain slopes. Slope is 8 to 80 percent. Elevation is 3,500 to 5,600 feet. The

average annual precipitation is 17 to 25 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 70 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Typic Ustochrepts

#### Typical Pedon

Repp very gravelly loam, 30 to 60 percent slopes, in a forested area, 300 feet north and 400 feet east of the south quarter corner of sec. 8, T. 14 N., R. 21 W.

Oi—1 inch to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 5 inches; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 40 percent pebbles; slightly effervescent; mildly alkaline; clear smooth boundary.

E2—5 to 12 inches; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; 45 percent pebbles; slightly effervescent; mildly alkaline; clear smooth boundary.

Bw—12 to 24 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; 50 percent pebbles; few lime coatings on pebbles; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—24 to 40 inches; very pale brown (10YR 7/3) extremely gravelly loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; 70 percent pebbles; thin lime coatings on undersides of pebbles; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—40 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; 65 percent pebbles; thin lime coatings on undersides of pebbles; disseminated lime; violently effervescent; moderately alkaline.

#### Range in Characteristics

*Soil temperature:* 44 to 47 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Content of clay in the control section:* 10 to 20 percent

*Depth to Bk horizon:* 13 to 36 inches

#### E horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 10 to 20 percent

Content of rock fragments: 20 to 50 percent—0 to 10 percent cobbles and stones, 20 to 50 percent pebbles

Reaction: pH 6.1 to 7.8

#### Bw horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 10 to 20 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles, 35 to 50 percent pebbles

Reaction: pH 7.4 to 8.4

#### Bk horizon

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Clay content: 10 to 18 percent

Content of rock fragments: 60 to 85 percent—0 to 10 percent cobbles, 60 to 75 percent pebbles

Calcium carbonate equivalent: 10 to 15 percent  
Reaction: pH 7.4 to 9.0

### 89—Repp very gravelly loam, 30 to 60 percent slopes

#### Composition

Repp and similar soils: 85 percent

Inclusions: 15 percent

#### Setting

*Landform:* Mountains

*Slope:* 30 to 60 percent, southwest aspect

*Elevation:* 3,500 to 5,600 feet

*Mean annual precipitation:* 17 to 25 inches

*Frost-free period:* 70 to 90 days

#### Component Description

*Surface layer texture:* Very gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as

horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Winkler and similar soils
- Soils that are shallow over bedrock
- Repp soils on cooler aspects
- Soils on warmer, drier aspects
- Soils that have a clayey subsoil
- Areas of rock outcrop and rubble land

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **90—Repp very gravelly loam, cool, 8 to 30 percent slopes**

### ***Composition***

Repp and similar soils: 85 percent  
Inclusions: 15 percent

### ***Setting***

*Landform:* Mountains  
*Slope:* 8 to 30 percent  
*Elevation:* 4,000 to 5,500 feet  
*Mean annual precipitation:* 17 to 25 inches  
*Frost-free period:* 70 to 90 days

### ***Component Description***

*Surface layer texture:* Very gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Winkler, cool, soils
- Trapps and similar soils
- Repp soils on warmer aspects

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **91—Repp very gravelly loam, cool, 30 to 60 percent slopes**

### ***Composition***

Repp and similar soils: 85 percent  
Inclusions: 15 percent

### ***Setting***

*Landform:* Mountains  
*Slope:* 30 to 60 percent, northeast aspect  
*Elevation:* 4,000 to 5,500 feet  
*Mean annual precipitation:* 17 to 25 inches  
*Frost-free period:* 70 to 90 days

### ***Component Description***

*Surface layer texture:* Very gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Winkler, cool, soils
- Trapps and similar soils
- Repp soils on warmer aspects
- Soils that do not contain rock fragments

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section

- Wildlife habitat section
- Engineering and soil properties sections

## 92—Repp-Rock outcrop complex, 50 to 80 percent slopes

### **Composition**

Repp and similar soils: 40 percent  
 Rock outcrop: 35 percent  
 Inclusions: 25 percent

### **Setting**

#### *Landform:*

- Repp—Mountains
- Rock outcrop—Mountains

#### *Slope:*

- Repp—50 to 80 percent, southwest aspect
- Rock outcrop—50 to 80 percent

*Elevation:* 3,500 to 5,600 feet

*Mean annual precipitation:* 17 to 25 inches

*Frost-free period:* 70 to 90 days

### **Component Description**

#### **Repp**

*Surface layer texture:* Very gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.9 inches

#### **Rock outcrop**

*Definition:* Exposures of limestone or argillite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Winkler and similar soils
- Soils that are shallow over bedrock
- Repp soils on cooler aspects
- Areas of rubble land

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section

- Wildlife habitat section
- Engineering and soil properties sections

## 93—Riverwash

### **Composition**

Riverwash: 90 percent  
 Inclusions: 10 percent

### **Setting**

*Landform:* Flood plains

*Slope:* 0 to 2 percent

### **Component Description**

*Definition:* Areas of sandy, silty, clayey, or gravelly sediments that are frequently reworked by water and that support little or no permanent vegetation

*Dominant parent material:* Alluvium

*Flooding:* Frequent

### **Inclusions**

- Poorly drained soils
- Areas of soils that are frequently flooded

## **Rochester Series**

The Rochester series consists of very deep, excessively drained soils that formed in colluvium derived from igneous rock. These soils are on mountain slopes. Slope is 30 to 60 percent. Elevation is 4,500 to 5,500 feet. The average annual precipitation is 17 to 25 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Sandy-skeletal, mixed, frigid Typic Ustorthents

### **Typical Pedon**

Rochester gravelly sandy loam, warm, in an area of Ambrant-Rochester, warm-Rock outcrop complex, 30 to 60 percent slopes; in a forested area, 1,000 feet south and 800 feet east of the west quarter corner of sec. 15, T. 13 N., R. 14 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

A—0 to 7 inches; light brownish gray (2.5Y 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 15 percent pebbles; neutral; clear wavy boundary.

C1—7 to 12 inches; light brownish gray (2.5Y 6/2) gravelly loamy coarse sand, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; soft, very friable,

nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; 20 percent pebbles; neutral; gradual wavy boundary.

C2—12 to 60 inches; light brownish gray (2.5Y 6/2) very gravelly loamy coarse sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; 45 percent pebbles; neutral.

#### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* Between depths of 12 and 35 inches

#### A horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 1 to 3

Clay content: 0 to 10 percent

Content of rock fragments: 15 to 60 percent—0 to 25 percent cobbles, stones, and boulders and 15 to 35 percent pebbles

Reaction: pH 6.6 to 7.3

#### C1 horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 1 to 3

Texture: Loamy sand, loamy coarse sand, sandy loam, coarse sandy loam, or coarse sand; medium sand or coarser textures in 50 percent or more of the sand fraction

Clay content: 0 to 10 percent

Content of rock fragments: 15 to 80 percent—0 to 40 percent cobbles, stones, and boulders and 15 to 30 percent pebbles

Reaction: pH 5.6 to 7.3

#### C2 horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 1 to 3

Texture: Loamy sand, loamy coarse sand, sand, or coarse sand; medium sand or coarser textures in 50 percent or more of the sand fraction

Clay content: 0 to 10 percent

Content of rock fragments: 35 to 80 percent—0 to 40 percent cobbles, stones, and boulders and 20 to 60 percent pebbles

Reaction: pH 5.6 to 7.8

## 94—Rock outcrop-Rubble land complex

### Composition

Rock outcrop: 45 percent

Rubble land: 45 percent

Inclusions: 10 percent

### Setting

#### Landform:

- Rock outcrop—Mountains
- Rubble land—Mountains

#### Position on the landform:

- Rock outcrop—Shoulders and summits
- Rubble land—Shoulders and summits

#### Slope:

- Rock outcrop—30 to 90 percent
- Rubble land—30 to 90 percent

### Component Description

#### Rock outcrop

*Definition:* Exposures of bare bedrock

#### Rubble land

*Definition:* Areas in which stones or boulders cover more than 90 percent of the soil surface

### Inclusions

- Soils that are shallow over bedrock
- Very deep soils

## Rumblecreek Series

The Rumblecreek series consists of very deep, well drained soils that formed in alpine till. These soils are on moraines. Slope is 4 to 30 percent. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed Typic Eutroboralfs

### Typical Pedon

Rumblecreek gravelly loam, 4 to 30 percent slopes, in a forested area, 2,150 feet south and 1,700 feet west of the northeast corner of sec. 12, T. 21 N., R. 17 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 8 inches; pale brown (10YR 6/3) gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many fine pores; 25 percent pebbles; medium acid; gradual wavy boundary.

E2—8 to 20 inches; light gray (10YR 7/2) gravelly loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine and medium roots; many fine pores; 30 percent pebbles; medium acid; gradual wavy boundary.

Bt/E—20 to 32 inches; 60 percent yellowish brown

(10YR 5/6) very gravelly clay loam, dark yellowish brown (10YR 4/4) moist (Bt part); 40 percent light gray (10YR 7/2) very gravelly loam, brown (10YR 5/3) moist (E part); when mixed, texture is very gravelly clay loam; moderate coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common fine roots and pores; 35 percent pebbles, 5 percent cobbles; common thin clay films on faces of peds; slightly acid; gradual wavy boundary.

Bt—32 to 60 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; few fine roots; common fine pores; 40 percent pebbles, 5 percent cobbles; common moderately thick clay films on faces of peds and on pebbles; slightly acid.

#### Range in Characteristics

*Soil temperature:* 40 to 46 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Depth to argillic horizon:* 10 to 22 inches

*Other features:* An E/Bt horizon in some pedons

#### E horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 or 3

Clay content: 10 to 27 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles, 15 to 30 percent pebbles

Reaction: pH 5.1 to 7.3

#### Bt/E horizon

Hue: B part—10YR or 7.5YR; E part—10YR or 7.5YR

Value: B part—5 or 6 dry and moist; E part—6 or 7 dry and 5 or 6 moist

Chroma: B part—3 to 6; E part—2 or 3

Texture: Loam, clay loam, or sandy clay loam

Clay content, mixed: 20 to 35 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles, 35 to 50 percent pebbles

Reaction: pH 5.6 to 7.8

#### Bt horizon

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 to 6

Texture: Clay loam or sandy clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles, 35 to 50 percent pebbles

Reaction: pH 5.6 to 7.8

## 95—Rumblecreek gravelly loam, 4 to 30 percent slopes

### Composition

Rumblecreek and similar soils: 85 percent  
Inclusions: 15 percent

### Setting

*Landform:* Moraines

*Slope:* 4 to 30 percent

*Elevation:* 3,800 to 4,500 feet

*Mean annual precipitation:* 25 to 40 inches

*Frost-free period:* 60 to 90 days

### Component Description

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Hollandlake and similar soils
- Poorly drained soils
- Winfall and similar soils
- Glaciercreek soils on terraces

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Selway Series

The Selway series consists of very deep, somewhat excessively drained soils that formed in material derived from igneous rock and colluvium. These soils are on mountain slopes. Slope is 8 to 60 percent. Elevation is 4,200 to 5,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is

40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Dystric Eutrochrepts

### Typical Pedon

Selway gravelly sandy loam, 8 to 30 percent slopes, in a forested area, 2,000 feet west and 1,500 feet south of the northeast corner of sec. 17, T. 11 N., R. 23 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 8 inches; pale brown (10YR 6/3) gravelly sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; 20 percent pebbles; slightly acid; clear wavy boundary.

E2—8 to 18 inches; light gray (10YR 7/2) gravelly sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine and fine pores; 30 percent pebbles; slightly acid; clear wavy boundary.

E and Bt1—18 to 35 inches; 75 percent very pale brown (10YR 7/3) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist (E part); 25 percent few thin lamellae of yellowish brown (10YR 5/4) very gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist (Bt part); when mixed, texture is very gravelly coarse sandy loam; weak fine and moderate subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and fine pores; 55 percent pebbles; medium acid; abrupt wavy boundary.

E and Bt2—35 to 51 inches; 75 percent brownish yellow (10YR 6/6) very gravelly coarse sandy loam, yellowish brown (10YR 5/6) moist (E part); 25 percent few thin lamellae of yellowish brown (10YR 5/4) very gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist (Bt part); when mixed, texture is very gravelly coarse sandy loam; weak fine and medium subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and fine pores; 60 percent pebbles; medium acid; diffuse irregular boundary.

BC—51 to 60 inches; brownish yellow (10YR 6/6) very gravelly loamy coarse sand, yellowish brown (10YR 5/6) moist; single grain; loose, nonsticky and nonplastic; common very fine, fine, and medium

roots; common very fine pores; 45 percent pebbles; slightly acid.

### Range in Characteristics

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Control section:* 5 to 15 percent clay; more than 50 percent coarse or very coarse sand

#### E horizon

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles, stones, and boulders and 15 to 30 percent angular pebbles

Reaction: pH 6.1 to 7.3

Note: In some pedons the upper 3 to 5 inches of the E horizon is dark colored; however, it does not meet the requirements for a mollic epipedon where mixed to a depth of 7 inches.

#### E and Bt horizon

Value: E part—6 or 7 dry and 5 or 6 moist; B part—4 to 6 dry and 3 or 4 moist

Chroma: E part—3 or 4; B part—4 to 6

Clay content, mixed: 5 to 15 percent

Content of rock fragments: 35 to 75 percent pebbles

Reaction: pH 5.6 to 6.5

#### BC horizon

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 3 to 6

Clay content: 5 to 10 percent

Content of rock fragments: 35 to 80 percent—0 to 10 percent stones, 35 to 70 percent pebbles

Reaction: pH 5.6 to 6.5

## 96—Selway gravelly sandy loam, 8 to 30 percent slopes

### Composition

Selway and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 4,200 to 5,500 feet

*Mean annual precipitation:* 25 to 35 inches

*Frost-free period:* 60 to 90 days

### Component Description

*Surface layer texture:* Gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Material weathered from igneous rock  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Petty and similar soils
- Soils that are very gravelly loamy sand
- Soils that have a stony surface layer
- Soils that have a bouldery surface layer

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **97—Selway gravelly sandy loam, 30 to 60 percent slopes**

#### ***Composition***

Selway and similar soils: 85 percent  
 Inclusions: 15 percent

#### ***Setting***

*Landform:* Mountains  
*Slope:* 30 to 60 percent, southwest aspect  
*Elevation:* 4,200 to 5,500 feet  
*Mean annual precipitation:* 25 to 35 inches  
*Frost-free period:* 60 to 90 days

#### ***Component Description***

*Surface layer texture:* Gravelly sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Petty and similar soils
- Soils that are very gravelly loamy sand
- Soils that have a stony surface layer
- Soils that have a bouldery surface layer

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **98—Selway bouldery sandy loam, 30 to 60 percent slopes**

#### ***Composition***

Selway and similar soils: 85 percent  
 Inclusions: 15 percent

#### ***Setting***

*Landform:* Mountains  
*Slope:* 30 to 60 percent, southwest aspect  
*Elevation:* 4,200 to 5,500 feet  
*Mean annual precipitation:* 25 to 35 inches  
*Frost-free period:* 60 to 90 days

#### ***Component Description***

*Surface layer texture:* Bouldery sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Petty and similar soils
- Soils that are very gravelly loamy sand

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Sharrott Series

The Sharrott series consists of shallow, well drained soils that formed in material derived from argillite or quartzite bedrock. These soils are on mountain slopes. Slope is 4 to 40 percent. Elevation is 3,500 to 5,500 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 75 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Lithic Ustochrepts

#### Typical Pedon

Sharrott gravelly loam, in an area of Sharrott-Rock outcrop complex, 4 to 30 percent slopes; in a forested area, 1,000 feet south and 150 feet east of the northwest corner of sec. 23, T. 14 N., R. 15 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

A—0 to 4 inches; brown (10YR 5/3) gravelly loam, brown (10YR 4/3) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 20 percent pebbles; slightly acid; clear smooth boundary.

Bw—4 to 13 inches; light yellowish brown (10YR 6/4) very gravelly loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 40 percent pebbles; medium acid; abrupt wavy boundary.

BC—13 to 15 inches; pale brown (10YR 6/3) extremely gravelly loam, brown (10YR 4/3) moist; massive; soft, friable, nonsticky and nonplastic; few medium and coarse roots; 70 percent pebbles; medium acid; abrupt irregular boundary.

R—15 inches; fractured argillite bedrock.

#### Range in Characteristics

*Soil temperature:* 44 to 47 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Content of clay in the control section:* 10 to 15 percent

*Depth to bedrock:* 10 to 20 inches

*Content of rock fragments:* 35 to 80 percent in the control section

#### A horizon

Hue: 10YR or 7.5YR

Value: 4 or 5 dry; 2 to 4 moist

Chroma: 2 or 3

Clay content: 10 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 25 percent angular cobbles and stones, 15 to 25 percent angular pebbles

Reaction: pH 5.6 to 7.3

Note: Some pedons have a thin E horizon.

#### Bw horizon

Hue: 7.5YR or 10YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 10 to 15 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent angular cobbles, 35 to 50 percent angular pebbles

Reaction: pH 5.6 to 7.3

#### BC horizon

Hue: 7.5YR or 10YR

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 or 3

Clay content: 10 to 15 percent

Content of rock fragments: 65 to 80 percent—0 to 10 percent angular cobbles, 65 to 70 percent angular pebbles

Reaction: pH 5.6 to 6.5

### 99—Sharrott-Rock outcrop complex, 4 to 30 percent slopes

#### Composition

Sharrott and similar soils: 60 percent

Rock outcrop: 20 percent

Inclusions: 20 percent

#### Setting

##### Landform:

• Sharrott—Mountains

• Rock outcrop—Mountains

*Slope:* 4 to 30 percent

*Elevation:* 3,500 to 5,500 feet

*Mean annual precipitation:* 17 to 25 inches

*Frost-free period:* 75 to 90 days

#### Component Description

##### Sharrott

*Surface layer texture:* Gravelly loam

*Depth class:* Shallow (10 to 20 inches)

*Drainage class:* Well drained

*Dominant parent material:* Residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 1.5 inches

### Rock outcrop

*Definition:* Exposures of argillite or quartzite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Winkler soils on warm aspects
- Winkler, cool, soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Shooflin Series

The Shooflin series consists of deep, well drained soils that formed in mudstone residuum. These soils are on hills. Slope is 4 to 15 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is 16 to 22 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Very fine, montmorillonitic Typic Eutroboralfs

### Typical Pedon

Shooflin silt loam; 4 to 15 percent slopes, in a forested area, 1,300 feet north and 500 feet west of the southeast corner of sec. 26, T. 14 N., R. 17 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 4 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate thin platy structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many very fine pores; medium acid; clear wavy boundary.

E2—4 to 12 inches; light gray (10YR 7/2) silt loam,

grayish brown (10YR 5/2) moist; moderate medium platy structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine pores; medium acid; abrupt smooth boundary.

Bt1—12 to 19 inches; light brownish gray (2.5Y 6/2) clay, olive brown (2.5Y 4/4) moist; strong medium prismatic structure; extremely hard, extremely firm, very sticky and very plastic; common fine and medium roots; few medium pores; thin continuous clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—19 to 25 inches; light brownish gray (2.5Y 6/2) clay, light olive brown (2.5Y 5/4) moist; strong medium prismatic structure; extremely hard, extremely firm, very sticky and very plastic; common fine and medium roots; few medium pores; thin continuous clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—25 to 40 inches; pale yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; moderate medium angular blocky structure; hard, very firm, very sticky and very plastic; common fine and medium roots; common very fine pores; thin continuous clay films on faces of peds; strongly acid; clear smooth boundary.

Bt4—40 to 51 inches; yellow (2.5Y 7/6) clay, light yellowish brown (2.5Y 6/4) moist; moderate fine angular blocky structure; hard, very firm, sticky and very plastic; few fine roots; common very fine pores; thin continuous clay films on faces of peds; strongly acid; clear smooth boundary.

Cr—51 to 60 inches; pale yellow (2.5Y 7/4), fractured, semiconsolidated sedimentary mudstone beds that texture to silt loam, light gray (2.5Y 7/2) moist.

### Range in Characteristics

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Content of clay in the control section:* 60 to 80 percent

*Depth to paralithic contact:* 40 to 60 inches

#### E horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 3 to 6 moist

Chroma: 1 to 3

Clay content: 10 to 20 percent

Content of rock fragments: 0 to 15 percent—0 to 10 percent cobbles, 0 to 5 percent pebbles

Reaction: pH 5.1 to 6.0

#### Bt horizon

Hue: 2.5Y, 10YR, or 7.5YR

Value: 4 to 7 dry; 4 to 6 moist

Chroma: 2 to 6

Clay content: 60 to 80 percent  
 Content of rock fragments: 0 to 10 percent—0 to 5 percent cobbles, 0 to 5 percent pebbles  
 Reaction: pH 4.5 to 6.0

*Cr horizon*

Hue: 2.5Y or 10YR  
 Value: 6 or 7 dry; 5 to 7 moist  
 Chroma: 2 to 5  
 Sedimentary beds: Semiconsolidated or weakly consolidated mudstone or siltstone  
 Reaction: pH 4.5 to 6.0

## 100—Shooflin silt loam, 4 to 15 percent slopes

### **Composition**

Shooflin and similar soils: 85 percent  
 Inclusions: 15 percent

### **Setting**

*Landform:* Hills  
*Slope:* 4 to 15 percent  
*Elevation:* 3,500 to 4,500 feet  
*Mean annual precipitation:* 16 to 22 inches  
*Frost-free period:* 60 to 90 days

### **Component Description**

*Surface layer texture:* Silt loam  
*Depth class:* Deep (40 to 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Mudstone residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 8.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Bignell and similar soils
- Poorly drained soils
- Crow and similar soils
- Lubrecht and similar soils
- Winkler, cool, soils
- Somewhat poorly drained soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **Tally Variant**

The Tally variant consists of very deep, somewhat excessively drained soils that formed in alluvium. These soils are on stream terraces. Slope is 0 to 4 percent. Elevation is 3,300 to 4,200 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Sandy, mixed Typic Haploborolls

### **Typical Pedon**

Tally variant sandy loam, 0 to 4 percent slopes, in an area of hayland, 2,300 feet west and 100 feet north of the southeast corner of sec. 23, T. 14 N., R. 15 W.

- A—0 to 10 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine pores; slightly acid; clear wavy boundary.
- Bw—10 to 20 inches; yellowish brown (10YR 5/4) sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine pores; slightly acid; clear wavy boundary.
- C1—20 to 30 inches; brown (10YR 5/3) loamy sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; common very fine and fine roots; common very fine pores; neutral; gradual wavy boundary.
- C2—30 to 48 inches; multicolored sand; single grain; loose, nonsticky and nonplastic; few very fine roots and pores; neutral; gradual wavy boundary.
- C3—48 to 60 inches; multicolored gravelly sand; single grain; loose, nonsticky and nonplastic; 30 percent pebbles; neutral.

### **Range in Characteristics**

*A horizon*

Hue: 2.5Y, 10YR, or 7.5YR  
 Value: 3 to 5 dry; 2 to 4 moist  
 Chroma: 2 or 3  
 Clay content: 5 to 15 percent  
 Content of rock fragments: 0 to 15 percent pebbles  
 Reaction: pH 6.1 to 7.3

**Bw horizon**

Hue: 7.5YR, 10YR, or 2.5Y  
 Value: 4 or 5 dry; 2 to 4 moist  
 Chroma: 2 to 4  
 Clay content: 5 to 15 percent  
 Content of rock fragments: 0 to 15 percent pebbles  
 Reaction: pH 6.1 to 7.3

**C horizon**

Hue: 7.5YR, 10YR, or 2.5Y  
 Value: 4 or 5 dry; 3 or 4 moist  
 Chroma: 2 or 3  
 Texture: Loamy sand or sand  
 Clay content: 0 to 10 percent  
 Content of rock fragments: 0 to 35 percent pebbles  
 Reaction: pH 6.6 to 7.3

**101—Tally variant sandy loam, 0 to 4 percent slopes****Composition**

Tally variant and similar soils: 85 percent  
 Inclusions: 15 percent

**Setting**

*Landform:* Stream terraces  
*Slope:* 0 to 4 percent  
*Elevation:* 3,300 to 4,200 feet  
*Mean annual precipitation:* 15 to 19 inches  
*Frost-free period:* 60 to 90 days

**Component Description**

*Surface layer texture:* Sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Alluvium  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Perma and similar soils
- Totelake and similar soils
- Areas of soils that are occasionally flooded

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Tevis Series**

The Tevis series consists of very deep, somewhat excessively drained soils that formed in colluvium derived from argillite and quartzite. These soils are on mountain slopes. Slope is 8 to 70 percent. Elevation is 4,200 to 6,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Dystric Eutrochrepts

**Typical Pedon**

Tevis gravelly loam, in an area of Mitten-Tevis complex, 30 to 60 percent slopes; in a forested area, 500 feet north and 1,000 feet east of the southwest corner of sec. 19, T. 12 N., R. 23 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

A—0 to 3 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; 30 percent pebbles; medium acid; abrupt wavy boundary.

E1—3 to 14 inches; very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; 50 percent pebbles; slightly acid; clear wavy boundary.

E2—14 to 22 inches; light gray (10YR 7/2) extremely gravelly sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine pores; 60 percent pebbles, 5 percent cobbles; slightly acid; clear wavy boundary.

E/Bw—22 to 60 inches; 80 percent very pale brown (10YR 7/3) extremely gravelly sandy loam, brown (10YR 5/3) moist (E part); 20 percent pale brown (10YR 6/3) extremely gravelly sandy loam, brown (10YR 4/3) moist (Bw part); weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine and fine

pores; 60 percent pebbles, 10 percent cobbles; slightly acid.

#### **Range in Characteristics**

*Soil temperature:* 40 to 46 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Control section:* 5 to 10 percent clay and 60 to 85 percent rock fragments

#### *A horizon*

Hue: 10YR or 7.5YR

Value: 4 to 6 dry

Chroma: 2 or 3

Clay content: 10 to 15 percent

Content of rock fragments: 15 to 60 percent—0 to 5 percent cobbles, 15 to 30 percent pebbles

Reaction: pH 5.6 to 7.3

#### *E1 horizon*

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Fine sandy loam, sandy loam, or loam

Clay content: 5 to 10 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles, 35 to 50 percent pebbles

Reaction: pH 5.6 to 7.3

#### *E2 horizon*

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Fine sandy loam, sandy loam, or loam

Clay content: 5 to 10 percent

Content of rock fragments: 60 to 80 percent—0 to 10 percent cobbles, 60 to 70 percent pebbles

Reaction: pH 5.6 to 7.3

#### *E/Bw horizon*

Hue: E part—10YR or 7.5YR

Value: E part—6 or 7 dry and 5 or 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—2 to 4

Texture: Sandy loam, fine sandy loam, or loam

Clay content: 5 to 10 percent

Content of rock fragments: 60 to 85 percent—0 to 10 percent cobbles, 60 to 75 percent pebbles

Reaction: pH 6.1 to 7.3

### **102—Tevis gravelly loam, 30 to 60 percent slopes**

#### ***Composition***

Tevis and similar soils: 85 percent

Inclusions: 15 percent

#### ***Setting***

*Landform:* Mountains

*Slope:* 30 to 60 percent

*Elevation:* 4,200 to 6,000 feet

*Mean annual precipitation:* 25 to 40 inches

*Frost-free period:* 60 to 90 days

#### ***Component Description***

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Beeskove and similar soils
- Mitten and similar soils
- Winkler, cool, soils
- Soils that have volcanic ash in the surface layer

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **103—Tevis-Mitten complex, 8 to 30 percent slopes**

#### ***Composition***

Tevis and similar soils: 45 percent

Mitten and similar soils: 35 percent

Inclusions: 20 percent

#### ***Setting***

*Landform:*

- Tevis—Mountains
- Mitten—Mountains

*Slope:*

- Tevis—8 to 30 percent
- Mitten—8 to 30 percent

*Elevation:* 4,200 to 6,000 feet  
*Mean annual precipitation:* 25 to 40 inches  
*Frost-free period:* 60 to 90 days

### **Component Description**

#### **Tevis**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.8 inches

#### **Mitten**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Holloway and similar soils
- Winkler, cool, soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **104—Tevis-Mitten-Rock outcrop complex, 45 to 70 percent slopes**

### **Composition**

Tevis and similar soils: 40 percent  
 Mitten and similar soils: 25 percent  
 Rock outcrop: 15 percent  
 Inclusions: 20 percent

### **Setting**

#### **Landform:**

- Tevis—Mountains
- Mitten—Mountains
- Rock outcrop—Mountains

#### **Slope:**

- Tevis—45 to 70 percent
- Mitten—45 to 70 percent
- Rock outcrop—45 to 70 percent

*Elevation:* 4,200 to 6,000 feet  
*Mean annual precipitation:* 25 to 40 inches  
*Frost-free period:* 60 to 90 days

### **Component Description**

#### **Tevis**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.8 inches

#### **Mitten**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

#### **Rock outcrop**

*Definition:* Exposures of argillite or quartzite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Evaro and similar soils
- Sharrott, cool, soils
- Winkler, cool, soils
- Areas of rubble land

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section

- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Totelake Series

The Totelake series consists of very deep, excessively drained soils that formed in alluvium. These soils are on stream terraces and hills. Slope is 2 to 30 percent. Elevation is 3,200 to 4,200 feet. The average annual precipitation is 15 to 20 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 70 to 90 days.

**Taxonomic Class:** Sandy-skeletal, mixed, frigid Udic Ustochrepts

### Typical Pedon

Totelake gravelly loam, 2 to 8 percent slopes, in a forested area, 2,100 feet south and 1,100 feet east of the northwest corner of sec. 20, T. 15 N., R. 14 W.

Oi—1 inch to 0; undecomposed and slightly decomposed forest litter.

A—0 to 7 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many fine and medium pores; 10 percent cobbles, 20 percent pebbles; neutral; clear wavy boundary.

Bw—7 to 22 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; 1 percent stones, 15 percent cobbles, 35 percent pebbles; neutral; gradual wavy boundary.

2C—22 to 60 inches; pale brown (10YR 6/3) extremely gravelly loamy sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine, fine, and medium roots; 2 percent stones, 20 percent cobbles, 50 percent pebbles; neutral.

### Range in Characteristics

*Soil temperature:* 41 to 47 degrees F

*Moisture control section:* Between depths of 12 and 35 inches

*Other features:* A layer of volcanic ash in the top 2 to 4 inches of the surface layer in some pedons; this layer does not meet the thickness or bulk density requirements for the andic intergrades. Faint lime cast on the undersides of rock fragments and some disseminated lime occurs in lower horizons in areas of calcareous till or limestone rock.

### A horizon

Value: 4 to 6 dry; 2 to 4 moist

Chroma: 1 to 3

Clay content: 8 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 15 percent cobbles and stones, 15 to 20 percent pebbles

Reaction: pH 6.6 to 7.3

### Bw horizon

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 5 to 10 percent

Content of rock fragments: 35 to 60 percent—0 to 15 percent cobbles and stones, 35 to 45 percent pebbles

Reaction: pH 6.6 to 7.8

### 2C horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: Loamy sand or sand

Clay content: 0 to 10 percent

Content of rock fragments: 60 to 80 percent—15 to 25 percent cobbles and stones, 45 to 55 percent pebbles

Reaction: pH 6.6 to 7.8

## 105—Totelake gravelly loam, 2 to 8 percent slopes

### Composition

Totelake and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Stream terraces

*Slope:* 2 to 8 percent

*Elevation:* 3,200 to 4,200 feet

*Mean annual precipitation:* 15 to 20 inches

*Frost-free period:* 70 to 90 days

### Component Description

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

### ***Inclusions***

- Glaciercreek and similar soils
- Poorly drained soils
- Perma and similar soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **106—Totelake gravelly loam, 8 to 30 percent slopes**

### ***Composition***

Totelake and similar soils: 85 percent  
Inclusions: 15 percent

### ***Setting***

*Landform:* Hills  
*Slope:* 8 to 30 percent  
*Elevation:* 3,200 to 4,200 feet  
*Mean annual precipitation:* 15 to 20 inches  
*Frost-free period:* 70 to 90 days

### ***Component Description***

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

### ***Inclusions***

- Glaciercreek and similar soils
- Perma and similar soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **107—Totelake extremely stony loam, 2 to 8 percent slopes**

### ***Composition***

Totelake and similar soils: 85 percent  
Inclusions: 15 percent

### ***Setting***

*Landform:* Stream terraces  
*Slope:* 2 to 8 percent  
*Elevation:* 3,200 to 3,800 feet  
*Mean annual precipitation:* 15 to 20 inches  
*Frost-free period:* 70 to 90 days

### ***Component Description***

*Surface layer texture:* Extremely stony loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section, Part II of this publication.

### ***Inclusions***

- Glaciercreek and similar soils
- Poorly drained soils
- Perma and similar soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section

- Wildlife habitat section
- Engineering and soil properties sections

## Trapps Series

The Trapps series consists of very deep, well drained soils that formed in colluvium derived from limestone or argillite. These soils are on mountain slopes. Slope is 8 to 60 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 18 to 25 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed Typic Eutroboralfs

### Typical Pedon

Trapps gravelly loam, 30 to 60 percent slopes, in a forested area, 300 feet north and 800 feet east of the west quarter corner of sec. 21, T. 11 N., R. 20 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 10 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; moderate fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine pores; 25 percent pebbles; neutral; clear wavy boundary.

Bt—10 to 24 inches; yellowish brown (10YR 5/4) very gravelly clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; many very fine, fine, medium, and coarse roots; many very fine pores; common moderately thick clay films on faces of peds; 40 percent pebbles; mildly alkaline; clear wavy boundary.

Bk1—24 to 35 inches; very pale brown (10YR 7/3) very gravelly loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine pores; lime coatings on undersides of pebbles; 50 percent pebbles; disseminated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—35 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, medium, and coarse roots; common very fine pores; lime coatings on undersides of rock fragments; 20 percent cobbles, 50 percent pebbles; disseminated lime; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Depth to Bk horizon:* 15 to 35 inches

*Note:* Some pedons have a dark A horizon less than 4 inches thick.

#### E horizon

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Clay content: 10 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 20 percent cobbles, flagstones, and stones and 15 to 25 percent pebbles or channers

Reaction: pH 5.6 to 7.3

#### Bt horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 2 to 6

Clay content: 27 to 35 percent

Content of rock fragments: 35 to 60 percent—0 to 10 percent cobbles or flagstones, 35 to 50 percent pebbles or channers

Reaction: pH 6.6 to 8.4

#### Bk1 horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 2 to 8

Texture: Loam or sandy loam

Clay content: 10 to 15 percent

Content of rock fragments: 35 to 60 percent—0 to 20 percent cobbles, flagstones, or stones and 35 to 40 percent pebbles or channers

Calcium carbonate equivalent: 15 to 40 percent

Reaction: pH 7.9 to 8.4

#### Bk2 horizon

Hue: 7.5YR, 10YR, or 2.5Y

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 2 to 8

Texture: Loam or sandy loam

Clay content: 10 to 15 percent

Content of rock fragments: 45 to 85 percent—10 to 30 percent cobbles, flagstones, or stones and 50 to 55 percent pebbles or channers

Calcium carbonate equivalent: 10 to 35 percent

Reaction: pH 7.9 to 8.4

## 108—Trapps gravelly loam, 8 to 30 percent slopes

### Composition

Trapps and similar soils: 85 percent

Inclusions: 15 percent

**Setting**

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 4,000 to 6,000 feet

*Mean annual precipitation:* 18 to 25 inches

*Frost-free period:* 60 to 90 days

**Component Description**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Beeskove and similar soils
- Repp, cool, soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**109—Trapps gravelly loam, 30 to 60 percent slopes****Composition**

Trapps and similar soils: 85 percent

Inclusions: 15 percent

**Setting**

*Landform:* Mountains

*Slope:* 30 to 60 percent

*Elevation:* 4,000 to 6,000 feet

*Mean annual precipitation:* 18 to 25 inches

*Frost-free period:* 60 to 90 days

**Component Description**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Beeskove and similar soils
- Repp, cool, soils

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**Turrah Series**

The Turrah series consists of very deep, poorly drained soils that formed in alluvium. These soils are on stream terraces. Slope is 0 to 2 percent. Elevation is 3,500 to 4,000 feet. The average annual precipitation is 15 to 22 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Fine, mixed, frigid Cumulic Haplaquolls

**Typical Pedon**

Turrah silty clay loam, 0 to 2 percent slopes, in an area of hayland, 1,300 feet east and 700 feet north of the southwest corner of sec. 21, T. 13 N., R. 15 W.

A1—0 to 4 inches; black (10YR 2/1) silty clay loam, black (10YR 2/1) dry; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; many very fine roots and pores; slightly acid; abrupt smooth boundary.

A2—4 to 12 inches; black (10YR 2/1) clay, black (10YR 2/1) dry; common fine distinct brownish yellow (10YR 6/6) mottles; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; many very fine roots and pores; neutral; clear smooth boundary.

Bg1—12 to 22 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; common medium distinct brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; many very fine pores; common black (10YR 2/1) organic stains; neutral; clear smooth boundary.

Bg2—22 to 38 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; many fine and medium prominent brownish yellow (10YR 6/6) and dark brownish yellow (10YR 4/4) mottles; strong medium subangular blocky structure; very hard, firm, sticky and very plastic; common very fine and fine roots; common very fine pores; mildly alkaline; abrupt smooth boundary.

2Cg—38 to 60 inches; gray (5Y 5/1) very gravelly sandy clay loam, grayish brown (2.5Y 5/2) dry; common fine distinct brownish yellow (10YR 6/6) and dark brownish yellow (10YR 4/4) mottles; massive; very hard, friable, sticky and plastic; 60 percent pebbles; mildly alkaline.

#### Range in Characteristics

*Soil temperature:* 41 to 47 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Mollic epipedon thickness:* 24 to 48 inches

*Depth to a seasonal high water table:* 12 to 24 inches

*Note:* Some pedons have an organic layer less than 3 inches thick.

#### A1 horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 2 to 4 dry; 2, 2.5, or 3 moist

Chroma: 1 or 2

Clay content: 27 to 40 percent

Reaction: pH 5.6 to 7.3

#### A2 horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 2 to 4 dry; 2, 2.5, or 3 moist

Chroma: 1 or 2

Redox concentrations: 10YR 4/3, 10YR 4/4, 10YR 4/6, 10YR 5/6, 10YR 6/4, or 10YR 6/6

Texture: Clay, silty clay loam, or silty clay

Clay content: 35 to 60 percent

Reaction: pH 5.6 to 7.3

#### Bg horizon

Hue: 10YR, 2.5Y, or 5Y or neutral

Value: 4 to 6 dry; 2, 2.5, 3, 4, or 5 moist

Chroma: 0 to 3

Redox concentrations: 10YR 4/4, 10YR 4/6, 10YR 5/6, 10YR 6/4, 10YR 6/6, or 7.5YR 5/6

Texture: Clay, silty clay, silty clay loam, or clay loam

Clay content: 35 to 60 percent

Reaction: pH 6.6 to 7.8

#### 2Cg horizon

Hue: 2.5Y or 5Y

Value: 4 to 6 dry; 4 or 5 moist

Chroma: 1 or 2

Redox concentrations: 10YR 6/6, 10YR 4/6, or 10YR 4/4

Texture: Sandy clay loam, sandy loam, or clay loam

Clay content: 20 to 40 percent

Content of rock fragments: 35 to 85 percent—0 to 35 percent cobbles, 20 to 60 percent pebbles

Reaction: pH 6.6 to 7.8

### 110—Turrah silty clay loam, 0 to 2 percent slopes

#### Composition

Turrah and similar soils: 85 percent

Inclusions: 15 percent

#### Setting

*Landform:* Stream terraces

*Slope:* 0 to 2 percent

*Elevation:* 3,500 to 4,000 feet

*Mean annual precipitation:* 15 to 22 inches

*Frost-free period:* 60 to 90 days

#### Component Description

*Surface layer texture:* Silty clay loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Poorly drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Kind of water table:* Apparent

*Available water capacity to 60 inches or root-limiting layer:* Mainly 7.6 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### Inclusions

- Soils that have a lower content of clay
- Soils that have a substratum of sand and gravel
- Somewhat poorly drained soils
- Areas of soils that are occasionally flooded

#### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Udifuluents

Udifuluents consist of very deep, somewhat poorly drained to well drained soils that formed in alluvium. These soils are on flood plains. Slope is 0 to 2 percent. Elevation is 3,800 to 4,000 feet. The average annual precipitation is 24 to 26 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 35 to 60 days.

### Typical Pedon

Udifuluents in an area of woodland, 1,000 feet south and 2,000 feet east of the northwest corner of sec. 1, T. 21 N., R. 17 W.

- 1 inch to 0; highly decomposed forest litter.
- 0 to 15 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 10 percent pebbles; neutral; clear wavy boundary.
- 15 to 24 inches; pinkish gray (7.5YR 6/2) very gravelly loamy sand, brown (7.5YR 4/2) moist; massive; loose, nonsticky and nonplastic; few very fine roots; 35 percent pebbles, 20 percent cobbles; neutral; gradual wavy boundary.
- 24 to 60 inches; pinkish gray (7.5YR 6/2) extremely gravelly sand, brown (7.5YR 4/2) moist; common distinct light reddish brown (5YR 6/4) and yellowish brown (10YR 5/6) mottles; single grain; loose, nonsticky and nonplastic; 50 percent pebbles, 30 percent cobbles; neutral.

### Range in Characteristics

*Surface texture:* Loam to fine sandy loam  
*Subsurface texture:* Loam to extremely gravelly sand  
*Depth to a seasonal high water table:* 36 to more than 60 inches

## 111—Udifuluents, 0 to 2 percent slopes

### Composition

Udifuluents and similar soils: 85 percent  
 Inclusions: 15 percent

### Setting

*Landform:* Flood plains  
*Slope:* 0 to 2 percent  
*Elevation:* 3,800 to 4,000 feet

*Mean annual precipitation:* 24 to 26 inches  
*Frost-free period:* 35 to 60 days

### Component Description

*Depth class:* Very deep (more than 60 inches)  
*Dominant parent material:* Alluvium  
*Flooding:* Frequent  
*Kind of water table:* Apparent  
*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Glaciercreek and similar soils
- Poorly drained soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Udorthents

Udorthents consist of very deep, excessively drained soils that formed in sandy alluvial deposits. These soils are on stream terraces. Slope is 0 to 8 percent. Elevation is 3,900 to 4,200 feet. The average annual precipitation is 22 to 23 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

### Typical Pedon

Udorthents in an area of woodland, 800 feet west and 1,000 feet north of the southeast corner of sec. 29, T. 17 N., R. 15 W.

- 2 inches to 0; undecomposed and slightly decomposed forest litter.
- 0 to 10 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and few medium roots; medium acid; clear wavy boundary.
- 10 to 52 inches; pink (5YR 7/3) loamy sand, reddish brown (5YR 5/3) moist; massive; loose, nonsticky and nonplastic; many fine and medium roots to a depth of 24 inches and few fine roots to a depth of 52 inches; discontinuous fine sandy loam bands ¼

to ½ inch thick that are 6 to 15 inches apart; medium acid; clear wavy boundary. 52 to 60 inches; light reddish brown (5YR 6/3) gravelly loamy sand, reddish brown (5YR 4/3) moist; massive; loose, nonsticky and nonplastic; few fine roots; 25 percent pebbles; slightly acid.

#### Range in Characteristics

*Surface texture:* Loam, fine sandy loam, or sandy loam  
*Subsurface texture:* Loamy sand to loamy fine sand that has bands of fine sandy loam or sandy loam ¼ to ½ inch thick and 4 to 20 inches apart; below a depth of 40 inches, loamy sand, loamy fine sand, or sand textures and 0 to 35 percent pebbles and cobbles

### 112—Udorthents-Glaciercreek complex, 0 to 8 percent slopes

#### Composition

Udorthents and similar soils: 45 percent  
Glaciercreek and similar soils: 40 percent  
Inclusions: 15 percent

#### Setting

##### Landform:

- Udorthents—Stream terraces
- Glaciercreek—Stream terraces

##### Slope:

- Udorthents—0 to 8 percent
- Glaciercreek—0 to 8 percent

*Elevation:* 3,900 to 4,200 feet

*Mean annual precipitation:* 22 to 23 inches

*Frost-free period:* 60 to 90 days

#### Component Description

##### Udorthents

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Alluvium

*Flooding:* None

*Note:* The properties of these soils are highly variable.

##### Glaciercreek

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Glacial outwash

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### Inclusions

- Upsata and similar soils
- Poorly drained soils

#### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Upsata Series

The Upsata series consists of very deep, excessively drained soils that formed in glacial outwash. The surface layer of these soils has a high content of volcanic ash. The soils are on stream terraces in cool, narrow valleys that are affected by cold air drainage. Slope is 2 to 8 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Sandy-skeletal, mixed Andic Cryochrepts

#### Typical Pedon

Upsata gravelly fine sandy loam, 2 to 8 percent slopes, in a forested area, 3,000 feet east and 1,200 feet south of the northwest corner of sec. 10, T. 16 N., R. 16 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 2 inches; pinkish gray (7.5YR 7/2) loam, brown (7.5YR 4/2) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine pores; 10 percent pebbles; medium acid; clear wavy boundary.

Bs—2 to 14 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, brown (7.5YR 4/4) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine pores; 20 percent pebbles; medium acid; clear wavy boundary.

2C1—14 to 40 inches; pinkish gray (7.5YR 6/2) extremely gravelly loamy coarse sand, brown (7.5YR 5/2) moist; single grain; loose, nonsticky and

nonplastic; many very fine, fine, and medium roots; 50 percent pebbles, 20 percent cobbles; medium acid; gradual smooth boundary.

2C2—40 to 60 inches; pink (5YR 7/3) extremely gravelly loamy coarse sand, reddish gray (5YR 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine, fine, and medium roots; 50 percent pebbles, 20 percent cobbles; medium acid.

#### Range in Characteristics

*Soil temperature:* 38 to 42 degrees F

*Moisture control section:* Between depths of 12 and 35 inches

*Content of clay in the control section:* 1 to 6 percent

*Note:* Base saturation is more than 60 percent below a depth of 14 inches.

#### E horizon

Hue: 7.5YR

Value: 6 or 7 dry; 3 to 5 moist

Clay content: 7 to 15 percent

Content of rock fragments: 0 to 15 percent pebbles

Reaction: pH 5.1 to 6.5

Moist bulk density: 0.95 g/cc or less

#### Bs horizon

Hue: 10YR or 7.5YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 4 to 6

Clay content: 3 to 7 percent

Content of rock fragments: 15 to 35 percent—0 to 5 percent cobbles, 15 to 30 percent pebbles

Reaction: pH 5.6 to 6.5

Moist bulk density: 0.95 g/cc or less

#### 2C horizon

Hue: 5YR, 2.5YR, or 7.5YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Loamy coarse sand, loamy sand, or sand

Clay content: 0 to 5 percent

Content of rock fragments: 80 to 85 percent—15 to 25 percent cobbles, 45 to 60 percent pebbles

Reaction: pH 5.1 to 6.5

### 113—Upsata gravelly fine sandy loam, 2 to 8 percent slopes

#### Composition

Upsata and similar soils: 85 percent

Inclusions: 15 percent

#### Setting

*Landform:* Stream terraces

*Slope:* 2 to 8 percent

*Elevation:* 4,000 to 5,000 feet

*Mean annual precipitation:* 22 to 30 inches

*Frost-free period:* 40 to 60 days

#### Component Description

*Surface layer texture:* Gravelly fine sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Dominant parent material:* Glacial outwash

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### Inclusions

- Waldbillig and similar soils
- Poorly drained soils
- Soils that do not contain volcanic ash

#### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### 114—Urban land

#### Composition

Urban land: 85 percent

Inclusions: 15 percent

#### Component Description

*Definition:* Areas in which most of the soil is covered by asphalt, concrete, or buildings and in which the exposed soil is highly disturbed

#### Inclusions

- Orthents
- Argixerolls
- Bigarm and similar soils
- Grassvalley and similar soils
- Desmet and similar soils
- Grantsdale and similar soils

## Waldbillig Series

The Waldbillig series consists of very deep, well drained soils that formed in alpine till. The surface layer of these soils has a high content of volcanic ash. The soils are on moraines. Slope is 4 to 60 percent. Elevation is 3,800 to 7,000 feet. The average annual precipitation is 28 to 50 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, mixed Andic Cryochrepts

### Typical Pedon

Waldbillig gravelly silt loam, 4 to 30 percent slopes, in a forested area, 1,780 feet west and 1,320 feet north of the southeast corner of sec. 18, T. 17 N., R. 15 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

Bs—0 to 10 inches; light brown (7.5YR 6/4) gravelly silt loam, brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many fine pores; 25 percent pebbles; medium acid; clear wavy boundary.

2E—10 to 26 inches; pink (5YR 7/3) very gravelly fine sandy loam, reddish brown (5YR 5/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; many fine pores; 30 percent pebbles, 10 percent cobbles; slightly acid; gradual wavy boundary.

2E and Bt—26 to 60 inches; about 75 percent light reddish brown (5YR 6/3) very gravelly fine sandy loam, reddish brown (5YR 5/4) moist (E part); about 25 percent reddish brown (5YR 5/4) lamellae of very fine sandy loam  $\frac{1}{4}$  to  $\frac{1}{2}$  inch thick with a combined thickness of 3 to 5 inches, dark reddish brown (5YR 3/4) moist (Bt part); when mixed, texture is very gravelly fine sandy loam; weak medium subangular blocky structure; very hard, very friable, nonsticky and nonplastic; few fine roots; many fine pores; 35 percent pebbles, 15 percent cobbles; neutral.

### Range in Characteristics

*Soil temperature:* 39 to 44 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Control section:* 7 to 18 percent clay and more than 15 percent fine sand or coarser

### Bs horizon

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 or 4

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 35 percent—0 to 10 percent cobbles, stones, and boulders and 15 to 25 percent pebbles

Moist bulk density: 0.95 g/cc or less

Reaction: pH 5.6 to 6.5

### 2E horizon

Hue: 5YR or 7.5YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Texture: Fine sandy loam or sandy loam

Clay content: 7 to 18 percent

Content of rock fragments: 35 to 60 percent—5 to 10 percent cobbles, stones, and boulders and 30 to 50 percent pebbles

Reaction: pH 5.6 to 6.5

### 2E and Bt horizon

Hue: E part—5YR or 7.5YR; B part—5YR or 7.5YR

Value: E part—5 to 7 dry and 4 to 6 moist; B part—5 or 6 dry and 3 or 4 moist

Chroma: E part—3 or 4; B part—2 to 4

Texture: Fine sandy loam, sandy loam, or loam

Clay content: 7 to 18 percent; less than 3 percent clay increase in lamellae

Content of rock fragments: 35 to 60 percent—5 to 20 percent cobbles, stones, and boulders and 30 to 40 percent pebbles

Reaction: pH 6.1 to 7.3

## 115—Waldbillig gravelly silt loam, 4 to 30 percent slopes

### Composition

Waldbillig and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Moraines

*Slope:* 4 to 30 percent

*Elevation:* 3,800 to 5,000 feet

*Mean annual precipitation:* 30 to 40 inches

*Frost-free period:* 40 to 60 days

### Component Description

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Auggie and similar soils
- Poorly drained soils
- Bata and similar soils
- Jimlake and similar soils
- Upsata soils on terraces

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **116—Waldbillig gravelly silt loam, 30 to 60 percent slopes**

### ***Composition***

Waldbillig and similar soils: 85 percent  
Inclusions: 15 percent

### ***Setting***

*Landform:* Moraines

*Slope:* 30 to 60 percent

*Elevation:* 3,800 to 5,000 feet

*Mean annual precipitation:* 30 to 40 inches

*Frost-free period:* 40 to 60 days

### ***Component Description***

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### ***Inclusions***

- Bata and similar soils
- Holloway and similar soils
- Jimlake and similar soils

### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **117—Waldbillig-Auggie complex, 4 to 15 percent slopes**

### ***Composition***

Waldbillig and similar soils: 45 percent  
Auggie and similar soils: 35 percent  
Inclusions: 20 percent

### ***Setting***

*Landform:*

- Waldbillig—Moraines
- Auggie—Moraines

*Position on the landform:*

- Waldbillig—Back slopes and shoulders
- Auggie—Foot slopes and toe slopes

*Slope:*

- Waldbillig—4 to 15 percent
- Auggie—4 to 15 percent

*Elevation:* 3,800 to 4,400 feet

*Mean annual precipitation:* 28 to 32 inches

*Frost-free period:* 40 to 60 days

### ***Component Description***

#### **Waldbillig**

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

#### **Auggie**

*Surface layer texture:* Silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Glaciolacustrine deposits

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 10.9 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Soils that do not contain volcanic ash
- Poorly drained soils

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **118—Waldbillig-Holloway gravelly silt loams, 8 to 30 percent slopes**

#### ***Composition***

Waldbillig and similar soils: 55 percent

Holloway and similar soils: 30 percent

Inclusions: 15 percent

#### ***Setting***

*Landform:*

- Waldbillig—Moraines
- Holloway—Moraines

*Slope:*

- Waldbillig—8 to 30 percent
- Holloway—8 to 30 percent

*Elevation:* 4,200 to 5,000 feet

*Mean annual precipitation:* 30 to 40 inches

*Frost-free period:* 40 to 60 days

#### ***Component Description***

##### **Waldbillig**

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

##### **Holloway**

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Bata and similar soils
- Poorly drained soils
- Courville and similar soils
- Hollandlake and similar soils
- Upsata soils on terraces
- Areas of rock outcrop

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **119—Waldbillig-Holloway gravelly silt loams, 30 to 60 percent slopes**

#### ***Composition***

Waldbillig and similar soils: 55 percent

Holloway and similar soils: 30 percent

Inclusions: 15 percent

#### ***Setting***

*Landform:*

- Waldbillig—Moraines
- Holloway—Mountains

*Slope:*

- Waldbillig—30 to 60 percent
- Holloway—30 to 60 percent

*Elevation:* 4,200 to 5,000 feet

*Mean annual precipitation:* 30 to 40 inches

*Frost-free period:* 40 to 60 days

### **Component Description**

#### **Waldbillig**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

#### **Holloway**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Bata and similar soils
- Courville and similar soils
- Areas of rock outcrop

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **120—Waldbillig-Holloway gravelly silt loams, cool, 8 to 30 percent slopes**

#### **Composition**

Waldbillig and similar soils: 55 percent  
 Holloway and similar soils: 30 percent  
 Inclusions: 15 percent

#### **Setting**

##### *Landform:*

- Waldbillig—Moraines
- Holloway—Moraines

##### *Slope:*

- Waldbillig—8 to 30 percent
  - Holloway—8 to 30 percent
- Elevation:* 6,000 to 7,000 feet  
*Mean annual precipitation:* 40 to 50 inches  
*Frost-free period:* 40 to 60 days

### **Component Description**

#### **Waldbillig**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

#### **Holloway**

*Surface layer texture:* Gravelly silt loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Coerock and similar soils
- Poorly drained soils
- Phillcher and similar soils
- Areas of rock outcrop

#### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **121—Waldbillig-Holloway gravelly silt loams, cool, 30 to 60 percent slopes**

#### **Composition**

Waldbillig and similar soils: 55 percent

Holloway and similar soils: 30 percent  
Inclusions: 15 percent

### Setting

#### Landform:

- Waldbillig—Mountains
- Holloway—Mountains

#### Slope:

- Waldbillig—30 to 60 percent
- Holloway—30 to 60 percent

*Elevation:* 6,000 to 7,000 feet

*Mean annual precipitation:* 40 to 50 inches

*Frost-free period:* 40 to 60 days

### Component Description

#### Waldbillig

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

#### Holloway

*Surface layer texture:* Gravelly silt loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Coerock and similar soils
- Phillcher and similar soils
- Areas of rock outcrop

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## W—Water

### Description

Open areas of fresh water

### Whitore Series

The Whitore series consists of very deep, well drained soils that formed in colluvium derived from limestone and calcareous argillite. These soils are on mountain slopes. Slope is 8 to 60 percent. Elevation is 5,000 to 6,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 37 to 42 degrees F, and the frost-free season is 40 to 60 days.

**Taxonomic Class:** Loamy-skeletal, carbonatic Typic Cryochrepts

### Typical Pedon

Whitore gravelly clay loam, 30 to 60 percent slopes, in a forested area, 1,200 feet north and 1,200 feet east of the southwest corner of sec. 18, T. 12 N., R. 15 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

Bw—0 to 8 inches; yellowish brown (10YR 5/4) gravelly clay loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; soft, friable, sticky and plastic; many very fine, fine, and medium roots; many very fine and fine pores; 20 percent pebbles; neutral; clear smooth boundary.

Bk1—8 to 17 inches; very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine pores; 40 percent pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

Bk2—17 to 60 inches; very pale brown (10YR 7/3) very gravelly loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine and fine pores; 50 percent pebbles; violently effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 38 to 42 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

*Depth to Bk horizon:* 5 to 15 inches

*Bw horizon*

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Clay loam or loam  
 Clay content: 20 to 35 percent  
 Content of rock fragments: 15 to 60 percent—10 to 25 percent cobbles and stones, 5 to 35 percent pebbles or channers  
 Effervescence: Slight to violent in the lower half  
 Reaction: pH 6.6 to 9.0

**Bk1 and Bk2 horizons**

Hue: 10YR or 2.5Y  
 Value: 6 to 8 dry; 4 to 7 moist  
 Chroma: 2 to 4  
 Texture: Clay loam or loam  
 Clay content: 20 to 35 percent  
 Content of rock fragments: 35 to 80 percent—0 to 40 percent cobbles and stones, 25 to 45 percent pebbles or channers  
 Calcium carbonate equivalent: 40 to 50 percent  
 Reaction: pH 7.4 to 9.0

**122—Whitore gravelly clay loam, 8 to 30 percent slopes****Composition**

Whitore and similar soils: 85 percent  
 Inclusions: 15 percent

**Setting**

*Landform:* Mountains  
*Slope:* 8 to 30 percent  
*Elevation:* 5,000 to 6,000 feet  
*Mean annual precipitation:* 20 to 30 inches  
*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Repp, cool, soils
- Soils that have volcanic ash in the surface layer

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**123—Whitore gravelly clay loam, 30 to 60 percent slopes****Composition**

Whitore and similar soils: 85 percent  
 Inclusions: 15 percent

**Setting**

*Landform:* Mountains  
*Slope:* 30 to 60 percent, northeast aspect  
*Elevation:* 5,000 to 6,000 feet  
*Mean annual precipitation:* 20 to 30 inches  
*Frost-free period:* 40 to 60 days

**Component Description**

*Surface layer texture:* Gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 4.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Repp, cool, soils
- Soils that have volcanic ash in the surface layer

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Wildgen Series

The Wildgen series consists of very deep, well drained soils that formed in alpine till. These soils are on moraines and mountains. Slope is 4 to 60 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 70 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Udic Ustochrepts

### Typical Pedon

Wildgen gravelly loam, 4 to 30 percent slopes, in a forested area, 3,000 feet south and 100 feet west of the northeast corner of sec. 35, T. 16 N., R. 14 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 6 inches; pinkish gray (7.5YR 6/2) gravelly loam, brown (7.5YR 4/2) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 20 percent pebbles; neutral; clear wavy boundary.

E2—6 to 19 inches; pinkish gray (7.5YR 7/2) gravelly loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 20 percent pebbles; slightly acid; gradual wavy boundary.

E and Bt1—19 to 32 inches; 75 percent pinkish gray (7.5YR 7/2) very gravelly loam, brown (7.5YR 5/4) moist (E part); 25 percent brown (7.5YR 5/4) lamella of very gravelly loam, brown (7.5YR 4/4) moist (Bt part); moderate medium subangular blocky structure; hard, friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; 40 percent pebbles, 5 percent cobbles; slightly acid; gradual wavy boundary.

E and Bt2—32 to 50 inches; 75 percent pinkish gray (7.5YR 7/2) very gravelly loam, brown (7.5YR 5/4) moist (E part); 25 percent brown (7.5YR 5/4) lamellae of very gravelly loam, brown (7.5YR 4/4) moist (Bt part); medium fine and moderate subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine and fine roots; 40 percent pebbles, 10 percent cobbles; slightly acid; gradual wavy boundary.

C—50 to 60 inches; pinkish gray (7.5YR 7/2) very gravelly loam, brown (7.5YR 5/2) moist; massive; hard, friable, nonsticky and nonplastic; 35 percent pebbles, 10 percent cobbles; slightly acid.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* Between depths of 4 and 12 inches

#### E1 horizon

Hue: 10YR or 7.5YR

Value: 6 or 7 dry; 3 or 4 moist

Chroma: 2 to 4

Clay content: 15 to 25 percent

Content of rock fragments: 20 to 50 percent—0 to 15 percent cobbles and stones, 20 to 35 percent pebbles

Reaction: pH 5.6 to 7.3

#### E2 horizon

Hue: 10YR or 7.5YR

Value: 6 to 8 dry; 4 to 7 moist

Chroma: 1 to 4

Texture: Loam or sandy loam

Clay content: 10 to 25 percent

Content of rock fragments: 35 to 60 percent—0 to 20 percent cobbles and stones, 20 to 40 percent pebbles

Reaction: pH 5.6 to 7.3

#### E and Bt horizon

Hue: E part—10YR or 7.5YR; Bt part—10YR or 7.5YR

Value: E part—6 to 8 dry and 5 to 7 moist; Bt part—4 to 7 dry and 3 to 5 moist

Chroma: E part—1 to 4; Bt part—3 to 6

Texture: Loam or sandy loam

Clay content: 10 to 25 percent; less than 3 percent increase in clay in lamellae

Content of rock fragments: 40 to 60 percent—0 to 20 percent cobbles and stones, 35 to 40 percent pebbles

Reaction: pH 5.6 to 7.3

#### C horizon

Hue: 10YR or 7.5YR

Value: 6 to 8 dry; 4 to 7 moist

Chroma: 1 to 4

Clay content: 10 to 25 percent

Content of rock fragments: 35 to 60 percent—0 to 20 percent cobbles and stones, 20 to 40 percent pebbles

Reaction: pH 5.6 to 7.3

## 124—Wildgen gravelly loam, 4 to 30 percent slopes

### Composition

Wildgen and similar soils: 85 percent

Inclusions: 15 percent

**Setting**

*Landform:* Moraines  
*Slope:* 4 to 30 percent  
*Elevation:* 4,000 to 5,000 feet  
*Mean annual precipitation:* 18 to 22 inches  
*Frost-free period:* 70 to 90 days

**Component Description**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Winfall soils on north aspects
- Poorly drained soils
- Soils that have a clayey subsoil
- Soils that have a stony surface layer

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**125—Wildgen-Winkler, cool, gravelly loams, 15 to 30 percent slopes****Composition**

Wildgen and similar soils: 60 percent  
 Winkler and similar soils: 30 percent  
 Inclusions: 10 percent

**Setting**

*Landform:*

- Wildgen—Moraines
- Winkler—Moraines

*Slope:*

- Wildgen—15 to 30 percent
- Winkler—15 to 30 percent

*Elevation:* 4,000 to 5,000 feet  
*Mean annual precipitation:* 18 to 22 inches  
*Frost-free period:* 70 to 90 days

**Component Description****Wildgen**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alpine till  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

**Winkler**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Winfall soils on north aspects

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**126—Wildgen-Winkler, cool, gravelly loams, 30 to 60 percent slopes****Composition**

Wildgen and similar soils: 60 percent  
 Winkler and similar soils: 30 percent  
 Inclusions: 10 percent

**Setting**

*Landform:*

- Wildgen—Mountains

- Winkler—Mountains

*Slope:*

- Wildgen—30 to 60 percent
- Winkler—30 to 60 percent

*Elevation:* 4,000 to 5,000 feet

*Mean annual precipitation:* 18 to 22 inches

*Frost-free period:* 70 to 90 days

### **Component Description**

#### **Wildgen**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.2 inches

#### **Winkler**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Winfall soils on north aspects
- Sharrott and similar soils
- Areas of rock outcrop

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## **127—Wildgen, dry-Winkler complex, 15 to 30 percent slopes**

### **Composition**

Wildgen and similar soils: 60 percent

Winkler and similar soils: 30 percent

Inclusions: 10 percent

### **Setting**

*Landform:*

- Wildgen—Moraines
- Winkler—Moraines

*Slope:*

- Wildgen—15 to 30 percent
- Winkler—15 to 30 percent

*Elevation:* 4,000 to 5,000 feet

*Mean annual precipitation:* 18 to 20 inches

*Frost-free period:* 70 to 90 days

### **Component Description**

#### **Wildgen**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.1 inches

#### **Winkler**

*Surface layer texture:* Very gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### **Inclusions**

- Wildgen soils on north aspects
- Winkler, cool, soils
- Sharrott and similar soils
- Areas of rock outcrop

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## 128—Wildgen, dry-Winkler complex, 30 to 60 percent slopes

### Composition

Wildgen and similar soils: 60 percent

Winkler and similar soils: 30 percent

Inclusions: 10 percent

### Setting

*Landform:*

- Wildgen—Mountains
- Winkler—Mountains

*Slope:*

- Wildgen—30 to 60 percent
- Winkler—30 to 60 percent

*Elevation:* 4,000 to 5,000 feet

*Mean annual precipitation:* 18 to 20 inches

*Frost-free period:* 70 to 90 days

### Component Description

#### Wildgen

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.1 inches

#### Winkler

*Surface layer texture:* Very gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 2.8 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Wildgen soils on north aspects
- Winkler, cool, soils
- Sharrott and similar soils
- Areas of rock outcrop

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

## Winfall Series

The Winfall series consists of very deep, well drained soils that formed in alpine till. These soils are on moraines. Slope is 4 to 30 percent. Elevation is 3,800 to 4,500 feet. The average annual precipitation is 22 to 35 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Dystric Eutrochrepts

### Typical Pedon

Winfall gravelly loam, 4 to 30 percent slopes, in a forested area, 1,000 feet north and 1,000 feet west of the southeast corner of sec. 21, T. 19 N., R. 16 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E—0 to 18 inches; pinkish gray (7.5YR 7/2) gravelly loam, brown (7.5YR 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium and few coarse roots; many very fine and fine pores; 25 percent pebbles; strongly acid; gradual smooth boundary.

E and Bt—18 to 60 inches; 80 percent pinkish gray (7.5YR 7/2) very gravelly loam, brown (7.5YR 5/2) moist (E part); 20 percent brown (7.5YR 5/2) lamellae of very fine sandy loam  $\frac{1}{8}$  to  $\frac{1}{4}$  inch thick, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine and medium roots; few fine pores; 35 percent pebbles, 10 percent cobbles; medium acid.

### Range in Characteristics

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

*Note:* Some pedons have a thin A horizon.

*E horizon*

Hue: 5YR, 7.5YR, or 10YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 10 to 20 percent

Content of rock fragments: 15 to 60 percent—0 to

10 percent cobbles and stones, 15 to 50 percent pebbles

Reaction: pH 5.1 to 6.5

#### *E and Bt horizon*

Hue: E part—5YR, 7.5YR, or 10YR; B part—5YR, 7.5YR, or 10YR

Value: E part—6 or 7 dry and 5 or 6 moist; B part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; B part—3 or 4

Texture: Loam, fine sandy loam, or sandy loam

Clay content: 10 to 20 percent; less than 3 percent increase in clay in lamellae

Content of rock fragments: 35 to 60 percent—0 to 15 percent cobbles, 35 to 45 percent pebbles

Reaction: pH 5.1 to 6.5

Note: This horizon is hard or very hard when it is dry.

### **129—Winfall gravelly loam, 4 to 30 percent slopes**

#### ***Composition***

Winfall and similar soils: 85 percent

Inclusions: 15 percent

#### ***Setting***

*Landform:* Moraines

*Slope:* 4 to 30 percent

*Elevation:* 3,800 to 4,500 feet

*Mean annual precipitation:* 22 to 35 inches

*Frost-free period:* 60 to 90 days

#### ***Component Description***

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Courville and similar soils
- Poorly drained soils
- Rumblecreek and similar soils

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

#### ***Winkler Series***

The Winkler series consists of very deep, somewhat excessively drained soils that formed in colluvium derived from argillite and quartzite. These soils are on moraines and mountains. Slope is 8 to 80 percent. Elevation is 3,500 to 5,600 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Udic Ustochrepts

#### ***Typical Pedon***

Winkler very gravelly sandy loam, 30 to 60 percent slopes, in a forested area, 1,320 feet east and 660 feet south of the northwest corner of sec. 3, T. 13 N., R. 17 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

A—0 to 3 inches; grayish brown (10YR 5/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many fine pores; 40 percent angular pebbles; slightly acid; clear smooth boundary.

E1—3 to 8 inches; pinkish gray (7.5YR 6/2) very gravelly sandy loam, brown (7.5YR 5/2) moist; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many fine pores; 40 percent angular pebbles; slightly acid; gradual wavy boundary.

E2—8 to 25 inches; pinkish gray (7.5YR 6/2) very gravelly sandy loam, brown (7.5YR 5/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many fine pores; 45 percent angular pebbles; slightly acid; gradual wavy boundary.

E and Bt—25 to 42 inches; 75 percent pinkish gray (7.5YR 6/2) extremely gravelly sandy loam, brown

(7.5YR 5/2) moist (E part); 25 percent reddish brown (5YR 5/3) lamellae of fine sandy loam  $\frac{1}{8}$  to  $\frac{1}{2}$  inch thick, reddish brown (5YR 4/4) moist (Bt part); weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common very fine and fine pores; 20 percent angular cobbles, 50 percent angular pebbles; medium acid; gradual wavy boundary.

C—42 to 60 inches; pinkish gray (7.5YR 6/2) extremely gravelly sandy loam, brown (7.5YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots and pores; 20 percent angular cobbles, 55 percent angular pebbles; medium acid.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* Between depths of 8 and 24 inches

#### A horizon

Hue: 7.5YR or 10YR

Value: 3 or 4 moist

Chroma: 2 or 3

Texture: Sandy loam or loam

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 60 percent—0 to 5 percent angular cobbles, 15 to 55 percent angular pebbles

Reaction: pH 6.1 to 7.3

#### E1 horizon

Hue: 7.5YR or 10YR

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4

Texture: Sandy loam or loam

Clay content: 5 to 15 percent

Content of rock fragments: 15 to 60 percent—0 to 5 percent angular cobbles, 15 to 55 percent angular pebbles

Reaction: pH 5.6 to 7.3

#### E2 horizon

Hue: 2.5Y, 7.5YR, or 10YR

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4

Texture: Sandy loam or loam

Clay content: 5 to 15 percent

Content of rock fragments: 35 to 70 percent—0 to 10 percent angular cobbles, 35 to 60 percent angular pebbles

Reaction: pH 5.6 to 7.3

#### E and Bt horizon

Hue: E part—2.5Y, 7.5YR, or 10YR; B part—2.5Y, 5YR, 7.5YR, or 10YR

Value: E part—6 to 8 dry and 5 to 7 moist; B

part—4 to 6 dry and 4 or 5 moist

Chroma: E part—2 to 4; B part—3 or 4

Texture: Fine sandy loam, sandy loam, or loam

Clay content: 5 to 15 percent; less than 5 percent increase in clay in lamellae

Content of rock fragments: 60 to 85 percent—10 to 25 percent angular cobbles, 50 to 60 percent angular pebbles

Reaction: pH 5.6 to 6.5

#### C horizon

Hue: 7.5YR or 10YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: Sandy loam or fine sandy loam

Clay content: 5 to 15 percent

Content of rock fragments: 60 to 85 percent—10 to 25 percent angular cobbles, 50 to 60 percent angular pebbles

Reaction: pH 5.6 to 7.3

## 130—Winkler very gravelly sandy loam, 8 to 30 percent slopes

### Composition

Winkler and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 3,500 to 5,600 feet

*Mean annual precipitation:* 17 to 24 inches

*Frost-free period:* 70 to 90 days

### Component Description

*Surface layer texture:* Very gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Bigarm and similar soils

- Bignell and similar soils
- Winkler, cool, soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **131—Winkler very gravelly sandy loam, 30 to 60 percent slopes**

#### **Composition**

Winkler and similar soils: 85 percent  
Inclusions: 15 percent

#### **Setting**

*Landform:* Mountains

*Slope:* 30 to 60 percent, southwest aspect

*Elevation:* 3,500 to 5,600 feet

*Mean annual precipitation:* 17 to 24 inches

*Frost-free period:* 70 to 90 days

#### **Component Description**

*Surface layer texture:* Very gravelly sandy loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Bigarm and similar soils
- Repp and similar soils
- Sharrott and similar soils
- Areas of rock outcrop and rubble land
- Winkler, cool, soils
- Cooler, moist soils

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### **132—Winkler gravelly loam, cool, 8 to 30 percent slopes**

#### **Composition**

Winkler and similar soils: 85 percent  
Inclusions: 15 percent

#### **Setting**

*Landform:* Mountains

*Slope:* 8 to 30 percent

*Elevation:* 3,500 to 5,600 feet

*Mean annual precipitation:* 17 to 30 inches

*Frost-free period:* 70 to 90 days

#### **Component Description**

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### **Inclusions**

- Tevis and similar soils
- Winkler soils on warm aspects
- Soils that have a clayey subsoil

### **Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**133—Winkler gravelly loam, cool, 30 to 60 percent slopes****Composition**

Winkler and similar soils: 85 percent  
Inclusions: 15 percent

**Setting**

*Landform:* Mountains  
*Slope:* 30 to 60 percent, northeast aspect  
*Elevation:* 3,500 to 5,600 feet  
*Mean annual precipitation:* 17 to 30 inches  
*Frost-free period:* 70 to 90 days

**Component Description**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Repp, cool, soils
- Tevis and similar soils
- Winkler soils on warm aspects
- Soils that have volcanic ash in the surface layer
- Areas of rock outcrop

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**134—Winkler-Rubble land complex, 50 to 80 percent slopes****Composition**

Winkler and similar soils: 45 percent  
Rubble land: 40 percent  
Inclusions: 15 percent

**Setting**

*Landform:*  
• Winkler—Mountains  
• Rubble land—Mountains  
*Slope:*  
• Winkler—50 to 80 percent, southwest aspect  
• Rubble land—50 to 80 percent  
*Elevation:* 3,500 to 5,600 feet  
*Mean annual precipitation:* 17 to 24 inches  
*Frost-free period:* 70 to 90 days

**Component Description****Winkler**

*Surface layer texture:* Very gravelly sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.1 inches

**Rubble land**

*Definition:* Areas in which stones or boulders cover more than 90 percent of the surface

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

**Inclusions**

- Repp and similar soils
- Winkler, cool, soils
- Sharrott and similar soils
- Areas of rock outcrop

**Management**

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

**135—Winkler, cool-Rock outcrop complex, 50 to 80 percent slopes****Composition**

Winkler and similar soils: 55 percent  
Rock outcrop: 25 percent  
Inclusions: 20 percent

### Setting

#### Landform:

- Winkler—Mountains
- Rock outcrop—Mountains

#### Slope:

- Winkler—50 to 80 percent, northeast aspect
- Rock outcrop—50 to 80 percent

*Elevation:* 3,500 to 5,600 feet

*Mean annual precipitation:* 17 to 30 inches

*Frost-free period:* 70 to 90 days

### Component Description

#### Winkler

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Dominant parent material:* Colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 3.0 inches

#### Rock outcrop

*Definition:* Exposures of argillite or quartzite bedrock

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Mitten and similar soils
- Repp, cool, soils
- Tevis and similar soils
- Winkler soils on warm aspects
- Soils that are shallow over bedrock
- Areas of rubble land

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Xerofluvents

Xerofluvents consist of very deep, somewhat poorly drained to well drained soils that formed in alluvium. These soils are on flood plains. Slope is 0 to 2 percent. Elevation is 2,900 to 3,200 feet. The average annual

precipitation is 11 to 14 inches, the average annual air temperature is 44 to 46 degrees F, and the frost-free season is 90 to 110 days.

### Typical Pedon

Xerofluvents in an area of pasture, 1,200 feet south and 900 feet west of the northeast corner of sec. 4, T. 14 N., R. 21 W.

0 to 3 inches; light brownish gray (10YR 6/2) sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear wavy boundary.

3 to 13 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; neutral; gradual wavy boundary.

13 to 60 inches; light gray (10YR 7/2) very gravelly loamy sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; neutral.

### Range in Characteristics

*Surface texture:* Loamy very fine sand to loam

*Subsurface texture:* Loam to extremely gravelly sand

## 136—Xerofluvents, 0 to 2 percent slopes

### Composition

Xerofluvents and similar soils: 85 percent

Inclusions: 15 percent

### Setting

*Landform:* Flood plains

*Slope:* 0 to 2 percent

*Elevation:* 2,900 to 3,200 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 90 to 110 days

### Component Description

*Depth class:* Very deep (more than 60 inches)

*Dominant parent material:* Alluvium

*Flooding:* Frequent

*Note:* The properties of these soils are highly variable.

A typical soil description with range in characteristics is included, in alphabetical order, in this section.

Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

### Inclusions

- Moiese and similar soils

- Areas of riverwash
- Poorly drained soils

### Management

For general and detailed information concerning managing the unit, see Part II of this publication:

- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

### Yourame Series

The Yourame series consists of very deep, well drained soils that formed in alpine till. These soils are on moraines. Slope is 4 to 30 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 17 to 23 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free season is 60 to 90 days.

**Taxonomic Class:** Loamy-skeletal, mixed Typic Eutroboralfs

### Typical Pedon

Yourame gravelly loam, 4 to 30 percent slopes, in a forested area, 360 feet south of the east quarter corner of sec. 1, T. 15 N., R. 14 W.

Oi—2 inches to 0; undecomposed and slightly decomposed forest litter.

E1—0 to 4 inches; light brownish gray (10YR 6/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 15 percent pebbles; slightly acid; abrupt wavy boundary.

E2—4 to 11 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; strong medium and coarse granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 15 percent pebbles; neutral; clear smooth boundary.

E/Bt—11 to 21 inches; 80 percent pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist (E part); 20 percent light yellowish brown (10YR 6/4) gravelly loam, yellowish brown (10YR 5/4) moist (Bt part); moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; few thin clay films on faces of peds; 20 percent pebbles; neutral; clear smooth boundary.

Bt—21 to 48 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky

structure; very hard, friable, sticky and plastic; common very fine, fine, and medium roots; common moderately thick clay films on faces of peds; 10 percent cobbles, 40 percent pebbles; neutral; abrupt smooth boundary.

Bk—48 to 60 inches; very pale brown (10YR 7/3) very gravelly clay loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; 15 percent cobbles, 40 percent pebbles; disseminated lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 46 degrees F

*Depth to Bk horizon:* 35 to 60 inches

#### E1 horizon

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 7 to 20 percent

Content of rock fragments: 15 to 35 percent—5 to 15 percent cobbles and stones, 15 to 35 percent pebbles

Reaction: pH 5.6 to 7.3

#### E2 horizon

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 or 3

Texture: Loam or sandy loam

Clay content: 7 to 20 percent

Content of rock fragments: 15 to 35 percent—0 to 10 percent cobbles and stones, 15 to 25 percent pebbles

Reaction: pH 5.6 to 7.3

#### E/Bt horizon

Hue: E part—10YR or 7.5YR; Bt part—10YR or 7.5YR

Value: E part—6 or 7 dry and 5 or 6 moist; Bt part—5 or 6 dry and 4 or 5 moist

Chroma: E part—2 or 3; Bt part—2 to 4

Texture: Loam or sandy loam

Clay content, mixed: 7 to 25 percent

Content of rock fragments: 15 to 35 percent—0 to 10 percent cobbles and stones, 15 to 25 percent pebbles

Reaction: pH 5.6 to 7.3

#### Bt horizon

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: Clay loam or sandy clay loam

Clay content: 20 to 35 percent

Content of rock fragments: 35 to 60 percent—5 to 20 percent cobbles and stones, 30 to 40 percent pebbles

Reaction: pH 5.6 to 7.3

*Bk horizon*

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 or 3

Texture: Clay loam or loam

Clay content: 18 to 30 percent

Content of rock fragments: 35 to 60 percent—5 to 20 percent cobbles and stones, 30 to 40 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

### **137—Yourame gravelly loam, 4 to 30 percent slopes**

#### ***Composition***

Yourame and similar soils: 85 percent

Inclusions: 15 percent

#### ***Setting***

*Landform:* Moraines

*Slope:* 4 to 30 percent

*Elevation:* 4,000 to 5,000 feet

*Mean annual precipitation:* 17 to 23 inches

*Frost-free period:* 60 to 90 days

#### ***Component Description***

*Surface layer texture:* Gravelly loam

*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Dominant parent material:* Alpine till

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity to 60 inches or root-limiting layer:* Mainly 5.7 inches

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section, Part II of this publication.

#### ***Inclusions***

- Rumblecreek and similar soils
- Poorly drained soils
- Wildgen and similar soils
- Soils that are shallow over bedrock
- Areas of rock outcrop

#### ***Management***

For general and detailed information concerning managing the unit, see Part II of this publication:

- Range section
- Forest land section
- Agronomy section
- Recreation section
- Wildlife habitat section
- Engineering and soil properties sections

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# Glossary

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**Ablation till.** Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

**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.

**Alluvial fan.** A body of alluvium, with overflow of water and debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. Source uplands range in relief and areal extent from mountains to gullied terrains on hill slopes.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**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.

**Argillite.** Weakly metamorphosed mudstone or shale.

**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 3.75
Low .....	3.75 to 5.0
Moderate .....	5.0 to 7.5
High .....	more than 7.5

**Avalanche chute.** The track or path formed by an avalanche.

**Back slope.** The geomorphic component that forms the steepest inclined surface and principal element of many hill slopes. Back slopes in profile are commonly steep and linear and descend to a foot slope. In terms of gradational process, back slopes are erosional forms produced mainly by mass wasting and running water.

**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.

**Base saturation.** The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

**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-floored plain.** An extensive nearly level to gently rolling or moderately sloping area that is underlain by hard bedrock and has a slope of 0 to 8 percent.

**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.

- 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.
- Board foot.** A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board one foot wide, one foot long, and one inch thick before finishing.
- 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 or 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.
- Brush management.** Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.
- 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, a felled tree generally is 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.
- 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 just beneath the solum, or it is exposed at the surface by erosion.
- California bearing ratio (CBR).** The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.
- Canopy.** The leafy crown of trees or shrubs. (See Crown.)
- Capillary water.** Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.
- Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.
- Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.
- Catsteps.** Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.
- Channeled.** Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.
- Channery soil.** A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.
- Chemical treatment.** Control of unwanted vegetation by use of chemicals.
- Chiseling.** Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.
- Cirque.** A semicircular, concave, bowl-like area that has steep faces primarily resulting from erosive activity of a mountain glacier.
- 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.
- Clayey soil.** Silty clay, sandy clay, or clay.
- 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.
- Clearcut.** A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from adjacent stands.
- Climax plant community.** The plant community on a

given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

**Closed depression.** A low area completely surrounded by higher ground and having no natural outlet.

**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 is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

**Codominant trees.** Trees whose crowns form the general level of the forest canopy and that receive full light from above but comparatively little from the sides.

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

**Commercial forest.** Forest land capable of producing 20 cubic feet or more per acre per year at the culmination of mean annual increment.

**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.

**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 to subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer 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 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.** Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the soil surface after planting in order to reduce the hazard of water erosion; in areas where soil blowing is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or the equivalent during the critical erosion period.

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

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

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

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

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

*Sticky.*—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

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

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

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

**Consolidated sandstone.** Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.

**Consolidated shale.** Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.

**Contour stripcropping (or contour farming).** 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.

**Coprogenous earth (sedimentary peat).** Fecal material deposited in water by aquatic organisms.

**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 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 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.

**Deep soil.** A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

**Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.

**Depth to rock** (in tables). Bedrock is too near the surface for the specified use.

**Dip slope.** A slope of the land surface, roughly determined by and approximately conforming with the dip of underlying bedded rock.

**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 the use of a full stripcropping pattern.

**Dominant trees.** Trees whose crowns form the general level of the forest canopy and that receive full light from above and from the sides.

**Drainage class (natural).** Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

*Excessively drained.*—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

*Somewhat excessively drained.*—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

*Well drained.*—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

*Moderately well drained.*—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

*Somewhat poorly drained.*—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

*Poorly drained.*—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low

hydraulic conductivity, seepage, or a combination of these.

*Very poorly drained.*—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

**Drainage, surface.** Runoff, or surface flow of water, from an area.

**Drainageway.** An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

**Drumlin.** A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

**Duff.** A term used to identify 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.

**Dune.** A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.

**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,

for example, 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. The term is more often applied to cliffs resulting from differential erosion.

**Esker.** A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier and that were left behind when the ice melted. Eskers range from less than a mile to more than 100 miles in length and from 10 to 100 feet in height.

**Even aged.** Refers to a stand of trees in which only small differences in age occur between the individuals. A range of 20 years is allowed.

**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.

**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.

**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 oven-dry 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*.

**Fine textured soil.** Sandy clay, silty clay, or clay.

**Firebreak.** An area cleared of flammable material to stop or help control creeping or running fires. A firebreak also serves as a line from which to work and to facilitate the movement of fire fighters and

equipment. Designated roads also serve as firebreaks.

**First bottom.** The normal flood plain of a stream, subject to frequent or occasional flooding.

**Flaggy soil material.** Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

**Flagstone.** A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

**Flood plain.** A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.

**Fluvial.** Of or pertaining to rivers; produced by river action, as a fluvial plain.

**Foothills.** A region of relatively low, rounded hills at the base of a mountain range.

**Foot slope.** The geomorphic component that forms the inner, gently inclined surface at the base of a hill slope. The surface profile is dominantly concave. In terms of gradational processes, a foot slope is a transition zone between an upslope site of erosion (back slope) and a downslope site of deposition (toe slope).

**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.

**Fragipan.** A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

**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.

**Giant ripple mark.** The undulating surface sculpture produced in noncoherent granular materials by currents of water and by the agitation of water in

wave action during the draining of large glacial lakes, such as Glacial Lake Missoula.

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

**Glacial outwash (geology).** Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

**Glacial till (geology).** Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

**Glaciated uplands.** Land areas that were previously covered by continental or alpine glaciers and that are at a higher elevation than the flood plain.

**Glaciofluvial deposits (geology).** Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

**Glaciolacustrine deposits.** Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

**Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

**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 50 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 (geology).** 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. A gullied map unit is one that has numerous gullies.

**Gypsum.** A mineral consisting of hydrous calcium sulfate.

**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.

**Heavy metal.** Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

**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 8 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

**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. 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.

*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.

*E horizon.*—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

*C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material.

The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

*Cr horizon.*—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

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

**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. Increases commonly are the shorter plants and are 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.

**Kame.** A moundlike hill of glacial drift, composed chiefly of stratified sand and gravel.

**Kame terrace.** A terracelike ridge consisting of stratified sand and gravel that were deposited by a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine and that remained after the disappearance of the ice. It is commonly pitted with kettles and has an irregular ice-contact slope.

**Lacustrine deposit (geology).** Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

**Lake plain.** A surface marking the floor of an extinct lake, filled in by well sorted, stratified sediments.

**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 (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

**Lateral moraine.** A ridgelike moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from the valley walls by glacial abrasion and plucking or by mass wasting.

**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.

**Loamy soil.** Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

**Loess.** Fine grained material, dominantly of silt-sized particles, deposited by the wind.

- Low-residue crops.** Crops such as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.
- Low strength.** The soil is not strong enough to support loads.
- Marl.** An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.
- Mean annual increment (MAI).** The average annual increase in volume of a tree during the entire life of the tree.
- 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.
- Merchantable trees.** Trees that are of sufficient size to be economically processed into wood products.
- 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.
- Microhigh.** An area that is 2 to 12 inches higher than the adjacent microlow.
- Microlow.** An area that is 2 to 12 inches lower than the adjacent microhigh.
- 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 deep soil.** A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.
- Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.
- Moraine.** An accumulation of glacial drift in a topographic landform of its own, resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.
- Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.
- Mottling, soil.** Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the 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 limited summit area and generally having steep sides (slopes greater than 25 percent) and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by deep-seated earth movements or volcanic action and secondarily by differential erosion.
- Muck.** Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)
- Mudstone.** Sedimentary rock formed by induration of silt and clay in approximately equal amounts.
- 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.
- Neutral soil.** A soil having a pH value between 6.6 and 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.
- Observed rooting depth.** Depth to which roots have been observed to penetrate.
- Organic matter.** Plant and animal residue in the soil in various stages of decomposition.
- Outwash plain.** An extensive area of glaciofluvial material that was deposited by meltwater streams.
- Overstory.** The trees in a forest that form the upper crown cover.
- Oxbow.** The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.
- Pan.** A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.
- Parent material.** The unconsolidated organic and mineral material in which soil forms.
- Peat.** Unconsolidated material, largely undecomposed

organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

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

**Permeability.** The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

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 thickness.

**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.

**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.

**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 flooding occurs primarily in response to precipitation and runoff.

**Plowpan.** A compacted layer formed in the soil directly below the plowed layer.

**Ponding.** Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

**Poor filter** (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

**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.** The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

**Productivity, soil.** The capability of a soil for producing a specified plant or sequence of plants under specific management.

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

**Proper grazing use.** Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This 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.

**Quartzite, metamorphic.** Rock consisting mainly of quartz that formed through recrystallization of quartz-rich sandstone or chert.

**Quartzite, sedimentary.** Very hard but unmetamorphosed sandstone consisting chiefly of quartz grains.

**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
Medium acid . . . . .	5.6 to 6.0
Slightly acid . . . . .	6.1 to 6.5
Neutral . . . . .	6.6 to 7.3
Mildly alkaline . . . . .	7.4 to 7.8
Moderately alkaline . . . . .	7.9 to 8.4
Strongly alkaline . . . . .	8.5 to 9.0
Very strongly alkaline . . . . .	9.1 and higher

**Recessional moraine.** A moraine formed during a temporary but significant halt in the retreat of a glacier.

**Red beds.** Sedimentary strata mainly red in color and composed largely of sandstone and shale.

**Regeneration.** The new growth of a natural plant community, developing from seed.

**Regolith.** The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

**Relict stream terrace.** One of a series of platforms in or adjacent to a stream valley that formed prior to the current stream system.

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

**Residuum (residual soil material).** Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

**Rill.** A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

**Riser.** The relatively short, steeply sloping area below a terrace tread that grades to a lower terrace tread or base level.

**Riverwash.** Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.

**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.

**Rock outcrop.** Exposures of bare bedrock other than lava flows and rock-lined pits.

**Rooting depth** (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

**Root zone.** The part of the soil that can be penetrated by plant roots.

**Rubble land.** Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.

**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.

**Saline soil.** A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

**Salinity.** The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:

Nonsaline . . . . .	0 to 4
Slightly saline . . . . .	4 to 8
Moderately saline . . . . .	8 to 16
Strongly saline . . . . .	more than 16

**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.

**Sandy soil.** Sand or loamy sand.

**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.

**Sawlogs.** Logs of suitable size and quality for the production of lumber.

**Scarification.** The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

**Scribner's log rule.** A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

**Sedimentary plain.** An extensive nearly level to gently

rolling or moderately sloping area that is underlain by sedimentary bedrock and that has a slope of 0 to 8 percent.

**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.

**Sedimentary uplands.** Land areas of bedrock formed from water- or wind-deposited sediments. They are higher on the landscape than the flood plain.

**Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

**Semiconsolidated sedimentary beds.** Soft geologic sediments that disperse when fragments are placed in water. The fragments are hard or very hard when dry. Determining the texture by the usual field method is difficult.

**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 or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

**Shale.** Sedimentary rock formed by the hardening of a clay deposit.

**Shallow soil.** A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

**Sheet erosion.** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**Shelterwood system.** A forest management system requiring the removal of a stand in a series of cuts so that regeneration occurs under a partial canopy. After regeneration, a final cut removes the shelterwood and allows the stand to develop in the open as an even-aged stand. The system is well suited to sites where shelter is needed for regeneration, and it can aid regeneration of the more intolerant tree species in a stand.

**Shoulder.** The uppermost inclined surface at the top of a hillside. It is the transition zone from the back slope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

**Silica.** A combination of silicon and oxygen. The mineral form is called quartz.

**Silt.** As a soil separate, individual mineral particles that

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

**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.

**Sinkhole.** A depression in the landscape where limestone has been dissolved.

**Site class.** A grouping of site indexes into five to seven 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 or dominant and codominant 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 or dominant and codominant 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 shows the average height of dominant or 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 or 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 or 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.** Pathways along which logs are dragged to a common site for loading onto a logging truck.

**Slash.** The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

**Slickens.** Accumulations of fine-textured material, such as material separated in placer-mine and ore-mill operations. Slickens from ore mills commonly consist of freshly ground rock that has undergone chemical treatment during the milling process.

**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 loamy or clayey, is slippery when wet, and is low in productivity.

**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. In this survey the following slope classes are recognized:

Nearly level .....	0 to 2 percent
Gently sloping .....	2 to 4 percent
Moderately sloping .....	4 to 8 percent
Strongly sloping .....	8 to 15 percent
Moderately steep .....	15 to 25 percent
Steep .....	25 to 45 percent
Very steep .....	more than 45 percent

**Slope (in tables).** Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

**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 underlying material. The living roots and plant and animal activities are largely confined to the solum.

**Species.** A single, distinct kind of plant or animal having certain distinguishing characteristics.

**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 15 to 24 inches (38 to 60 centimeters) in length if flat.

**Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.

**Strath terrace.** A surface cut formed by the erosion of hard or semiconsolidated bedrock and thinly mantled with stream deposits.

**Stream channel.** The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

**Stream terrace.** One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing 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 grain* (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 soil blowing 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 or loosen a layer that is restrictive to roots.
- 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.
- Summit.** A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.
- 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."
- Tailwater.** The water directly downstream of a structure.
- Talus.** Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.
- Terminal moraine.** A belt of thick glacial drift that generally marks the termination of important glacial advances. It commonly is a massive arcuate ridge or complex of ridges underlain by till and other types of drift.
- 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 is generally 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). A layer of otherwise suitable soil material that is too thin for the specified use.
- Till plain.** An extensive nearly level to gently rolling or moderately sloping area that is underlain by or consists of till and that has a slope of 0 to 8 percent.
- 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. Toe slopes are commonly gentle and linear in profile.
- 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.
- Trace elements.** Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.
- Trafficability.** The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.
- Tread.** The relatively flat terrace surface that was cut or built by stream or wave action.
- Tuff.** A compacted deposit that is 50 percent or more volcanic ash and dust.
- Understory.** Any plants in a forest community that grow to a height of less than 5 feet.
- Upland** (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.
- Valley.** An elongated depressional area primarily developed by stream action.
- Valley fill.** In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.
- Variation.** Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

**Varve.** A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

**Very deep soil.** A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

**Very shallow soil.** A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

**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.

**Waterspreading.** Diverting runoff from natural channels by means of a system of dams, dikes, or ditches

and spreading it over relatively flat surfaces.

**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 oven-dry 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 action of uprooting and tipping over trees by the wind.



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