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Department of  
Agriculture



Natural  
Resources  
Conservation  
Service

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

# Soil Survey of Phillips County Area, Montana Part I





# How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the 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.

## Detailed Soil Maps

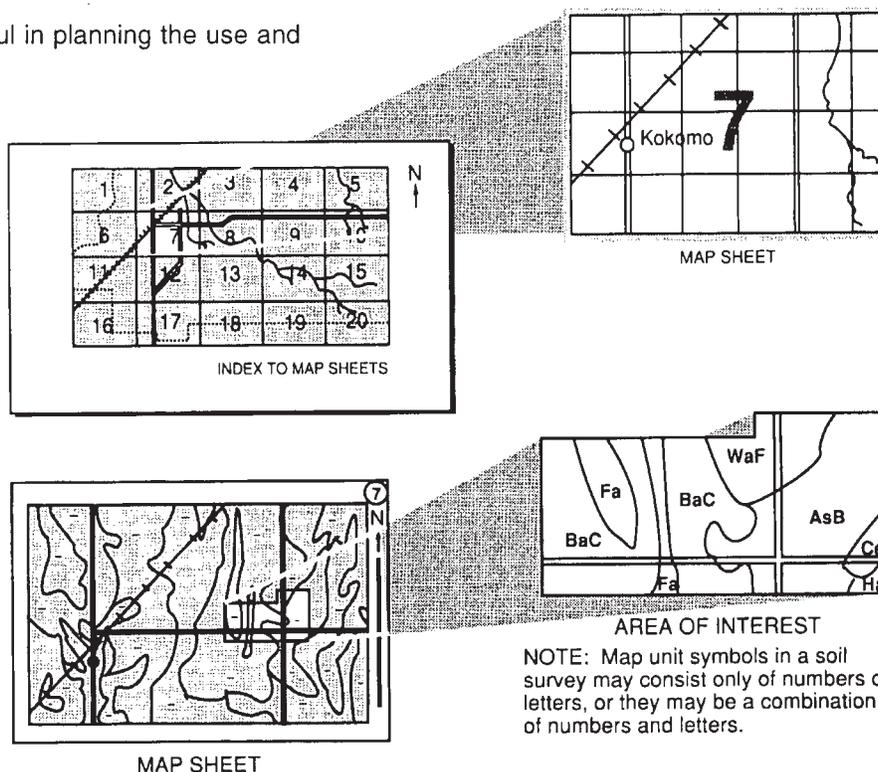
The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area in 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 1:250,000 along with groups of associated soils. It replaces the general soils map published in older surveys. This map and its data base can be useful for planning multi-county areas and map output can be tailored for specific uses. For more information about the State Soil Geographic Data Base for this survey area, or for any portion of Montana, contact your local Natural Resources Conservation Service office.



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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 (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1993. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1993. This survey was made cooperatively by the Natural Resources Conservation Service, United States Department of Interior - Bureau of Land Management, U.S. Fish and Wildlife Service, and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Phillips County Conservation District.

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.

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**Cover: Fourchette Bay area on Fort Peck Reservoir in southern Phillips County.**

*Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is <http://www.nrcs.usda.gov>.*

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# Foreword

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This soil survey contains information that can be used in land-planning programs in the Phillips County area. 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.

Dave White  
State Conservationist  
Natural Resources Conservation Service



# Soil Survey of Phillips County Area, Montana

Fieldwork by Richard G. Bandy, Ron Raney, Kevin Sullivan, and Neal Svendsen,  
Natural Resources Conservation Service

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

PHILLIPS COUNTY AREA is located in northern Montana (fig. 1), bordered by Canada to the north, Blaine County to the west, and Valley County to the east. The survey area has a total area of about 3,212,200 acres, or 5,019 square miles. Phillips County Area has a variety of topography but is dominated by level to rolling till plains. The Missouri River and Fort Peck Reservoir border the southern edge of the area. Malta, the county seat, is along the Milk River in the central part of the survey area.

About 77 percent of the survey area is used as rangeland; 17 percent is used for dryland crops; 2 percent is used for irrigated crops; 3 percent is woodland; and about 1 percent is water. The principal dryland crop is wheat. The principal irrigated crops are small grains and alfalfa, which is used for hay.

Elevation ranges from 2,171 feet on the Milk River flood plain to 5,720 feet in the Little Rocky Mountains. The average annual precipitation ranges from 11 to 14 inches for most of the survey area. The mountains receive up to 25 inches annually. The average annual temperature ranges from 38 to 45 degrees F, and the frost-free period is 90 to 120 days.

An older survey, "Soil Survey (Reconnaissance) of the Northern Plains of Montana," was published in 1929. The present survey, however, updates the earlier survey and provides additional information and larger maps that show the soils in greater detail.

## General Nature of the Survey Area

The following sections describe some of the environmental and cultural features that affect the use and management of soils in the survey area. These

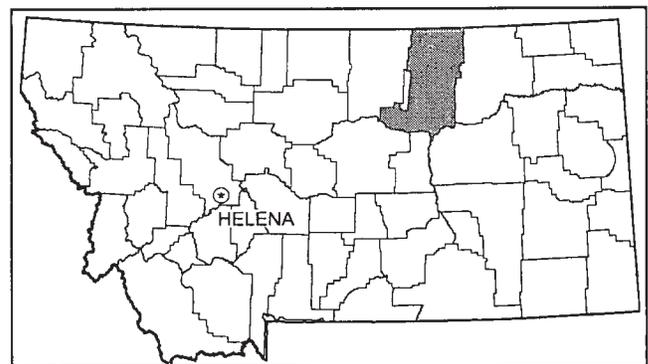


Figure 1. Location of Phillips County Area, Montana.

features are history and development; industry, transportation, and recreation; physiography and drainage; geology; mineral and natural gas resources; ground water and geothermal resources; and climate.

## History and Development

The Lewis and Clark Expedition, from 1804 to 1806, explored the southern part of what is now Phillips County. The expedition's route followed the southern boundary along the Missouri River. The region was inhabited by the Gros Ventre and Assiniboine Indian tribes at that time.

In the 1800s, the Missouri River was the principal freight route for the western gold fields in the Montana Territory. During the summer months, the river was often too low for navigation to Fort Benton. The trading posts of Carroll and Rocky Point, situated in what is now the southern part of Phillips County,

became important freight depots for the region. From these frontier trading posts, overland routes, known as the Cow Island and Broadwater Trails, led to Fort Benton and on to Helena, Virginia City, and other mining camps throughout the Montana Territory.

From 1853 to 1855, the Stevens Expedition explored the region in search of a northwestern, transcontinental railroad route. In 1887, the Great Northern Railroad was constructed through the Montana Territory.

By 1880, livestock production was making its appearance on the plains of northeastern Montana. For many years, this was the chief industry of the Phillips County Area. From the Missouri River Breaks to the Canadian border, thousands of head of sheep and cattle ranged the plains and the slopes of the Little Rocky Mountains. Malta, located on the Burlington Northern Sante Fe Railroad (formerly the Great Northern Railroad), became a principal shipping point for the area and, by the turn of the century, was well established.

In the 1880s, discovery of gold in the Little Rocky Mountains brought a stampede of miners, gamblers, and desperados to the area. The small towns of Zortman and Landusky were once thriving gold mining camps. Landusky was one of the largest towns in the area.

In 1906, the dryland movement began. Land from the Canadian border to the Missouri River was homesteaded, although much of the territory was not surveyed or sectionized until 1910. The momentum of the homestead movement continued until 1918. The Milk River Irrigation Project was opened for settlement in 1913, providing income stability for area settlers.

In 1915, Phillips County was established. It included the area around the town of Malta, the eastern portion of Blaine County, and the western portion of Valley County. The new county was named after Ben D. Phillips, president and general manager of the Ruby Mining Company in the Little Rocky Mountains. Phillips was also a rancher and a state representative. When gold mining was at its height, the production and employment from mining around Zortman and Landusky was vital to the prosperity of the new county.

The gold mines closed in 1917. In the 1920s and 1930s, some mines were reopened and operated until closed by government action in 1942. By the late 1950s, both Zortman and Landusky became virtual ghost towns. Recent mining, begun by Pegasus Gold in 1979, was on a much different and larger scale than earlier in the century. Gold produced in 1991

totaled 115,000 ounces. The facilities of the recent mining activity are now being reclaimed.

## Industry, Transportation, and Recreation

Today the main industries of the survey area are livestock production and farming. Cattle ranching is dominant; the area is one of the top cattle-producing parts of the state. Sheep and hog production are also important. Dryland farming is important in the northern part of the survey area, as the soils are more suitable than in the southern part. The principal crops are spring wheat, barley, and oats. Irrigated alfalfa and small grains are grown in the Milk River valley and along Frenchman and Beaver Creeks.

Most cattle and other livestock are marketed through local stockyards and shipped by truck to markets throughout the Midwest. Alfalfa hay is used and sold locally. Small grains that are produced are used locally for feed and marketed through local elevators. The grain is shipped by train or truck to elevators in northern Montana or points west.

U.S. Highway 2 runs east and west through the area and is the main transportation route across northern Montana. U.S. Highway 191 travels southwest from Malta, past the Little Rocky Mountains, connecting the area to southern markets. State Highway 242 runs north from Malta to the Port of Morgan at the Canadian border. Numerous county roads and trails provide good access to most of the survey area, however, the lack of gravel surfaces in some areas makes travel difficult in wet weather. The southernmost part of the survey area is accessible by a few improved roads, but travel is mainly on unimproved trails and is not recommended during wet periods. Amtrack and the Burlington Northern Sante Fe Railroad parallel U.S. Highway 2 through the area, providing freight and passenger service.

Nearly one-half of the survey area is on public lands administered by the Bureau of Land Management and the U.S. Fish and Wildlife Service. Both the public and private lands provide numerous recreational opportunities for the area.

East of Malta, the Bowdoin Wildlife Refuge and Bowdoin Lake provide habitat for waterfowl, upland game birds, deer, antelope, and many other species. Hunting of waterfowl and game birds is permitted in certain sections. A 15-mile automobile tour offers a comprehensive view of wildlife on the refuge.

The Charles M. Russell National Wildlife Refuge and Fort Peck Lake, along the southern edge of the survey area, provide recreational activities such as hunting, fishing, wildlife observation, photography,

and hiking. The refuge is home to many species of birds and animals, including deer, elk, and bighorn sheep. A self-guided automobile tour runs through the refuge and covers a length of about 20 miles.

The Milk and Missouri Rivers, along with numerous well-stocked ponds and reservoirs, contain a variety of fish species. Walleye, bass, northern pike, perch, rainbow trout, and paddlefish are some of the game fish in the area. Fort Peck Reservoir, Nelson Reservoir, and Cole Ponds are popular fishing spots.

The Little Rocky Mountains have several roads and hiking trails, and updated campgrounds are available. The Sleeping Buffalo Resort is a year-round recreation site with hot mineral-water springs located east of Malta.

## Physiography and Drainage

Phillips County Area is within the Great Plains Physiographic Province, and, with the exception of the Little Rocky Mountains, the area is within the Glaciated Missouri Plateau. Elevations range from 2,171 feet above sea level, where the Milk River exits the area, to 5,720 feet at Antoine Butte in the Little Rocky Mountains. Elevation for most of the area is less than 3,500 feet above sea level.

The Little Rocky Mountains were formed by magmatic intrusions occurring approximately 60-million years ago. The magma cooled, at depth, to form several domes of igneous rock. Today, the igneous core is exposed at the surface because of erosion of the overlying sedimentary rocks. The younger sedimentary strata, which are nearly horizontal in the surrounding plains, bend upward toward the mountains and around the igneous core. Steep walls that surround the core were formed by limestone, which, in dry climates, is resistant to erosion.

During the Bull Lake Ice Age, between 130,000 and 70,000 years ago, a continental glacier covered all of the area except the Little Rocky Mountains. Prior to this period of glaciation, the Missouri River drained north into Hudson Bay. The glacier dammed the river, rerouting water along the southern edge of the glacier. The river was then forced to flow eastward, as it does on its present course, to the Gulf of Mexico. The damming of the Missouri River also formed Glacial Lake Musselshell along what is now the southern border of the area. Most recently, glaciation occurred, approximately 15,000 years ago, when the northern two-thirds of the area were covered by the Pinedale Glacier. This glacier impounded a small glacial lake just north of the Little Rocky Mountains.

Phillips County Area was located at the southern extent of these glaciers. Since the glaciers were far from their source, they did not have enough energy to extensively erode the landscape. Deposits of glacial materials are evidence of glaciation occurring in this area. Glacial till overlays most of the area. The till is up to 50-feet thick in the northern part of the survey area, thinning towards the south. Glacial erratics, which are common throughout the survey area, are large rocks transported from their source by ice and deposited on a different type of bedrock. The glacial erratics include coarse-grained crystalline rocks, which were probably transported from northern Manitoba. Other glacial deposits observed in the area include moraines, kames, and eskers. Moraines are unsorted, unstratified piles of rock and sediment deposited at the edge of a melting glacier. Kames and eskers are stratified sediments, composed largely of sand and gravel deposited by streams flowing on or under slowly melting or stagnant ice.

The Larb Hills are located along the eastern border of the Phillips County Area, between Saco and the Fort Peck Reservoir. The hills are composed of sandstone and shale formations that have eroded to form badlands. Glacial erratics are present as evidence of the glaciation throughout these hills; however, subsequent erosion has removed all of the glacial till in the southern portion of the hills.

A dendritic drainage pattern exists throughout most of the area. Dendritic drainage is typical in areas where rocks have not been deformed and have uniform resistance to erosion. The major drainages in the survey area are the Milk and Missouri Rivers. Both flow eastward through the area. The Milk River drains the majority of the survey area; however, the southern one-fifth is drained by the Missouri River. The Milk River flows into the Missouri River downstream from Fort Peck Dam, in neighboring Valley County.

Throughout the area, the Milk River meanders through a broad valley that was eroded by the Missouri River on its preglacial course. The Milk River could not have eroded a valley this large. From the north, tributaries joining the Milk River are the Dodson, Assiniboine, Cottonwood, Little Cottonwood, Whitewater, White, and Frenchman Creeks. Tributaries entering from the south include the Peoples, Alkali, Beaver, and Larb Creeks. The northern portion of the Little Rocky Mountains is drained by the Peoples Creek and Beaver Creek systems, while the southern portions are drained by tributaries of the Missouri River.

The Missouri River is joined from the north by several small creeks. Fort Peck Dam is located

downstream from Phillips County in eastern Valley County. The dam, which stands 250 feet above river level and has a capacity of 20-million acre-feet, was completed in 1937. The Fort Peck Reservoir extends 134 miles upstream of the dam, comprising most of the southern border of the survey area. Upstream from the reservoir, the last free-flowing stretch of the Missouri River comprises the remainder of the southern county line. The Missouri River valley is relatively narrow, reflecting the recent rerouting of the river during glaciation.

Numerous small lakes and wetlands are present and are especially prevalent in the northwestern corner of the survey area. The depressions where lakes and wetlands form are kettles left from the retreat of glaciers. The terrain appears as small basins and mounds known as kettle-and-kame topography. Lake Bowdoin, located in an oxbow of the preglacial Missouri River, is the largest natural lake in Phillips County.

## Geology

The surficial geologic formations throughout most of the area are shales and sandstones deposited during the Cretaceous Period. Glacial deposits cover the bedrock in most places. Rocks exposed in the Little Rocky Mountains range in age from Precambrian to recent.

The Bowdoin Dome is an important structural feature in the area. The dome is comprised of Cretaceous formations and is located in the northern half of the area. Erosion has exposed older formations in the center of the dome.

The geologic units exposed in the area are described below beginning with the oldest rocks. Rock units are classified into groups, formations, and members on the basis of lithology. A group is the largest class and is subdivided into formations. Formations are subdivided into members.

### **Precambrian [4,500 to 570 million-years ago (m.y.a.)].**

Pre-Belt (older than 800 m.y.a.) metamorphic rocks outcrop in and around the igneous core of the Little Rocky Mountains. These rocks include metasedimentary rocks, such as biotite schist and gneiss, as well as metavolcanic rocks, such as hornblende gneiss and amphibolite.

### **Paleozoic Era (570 to 225 m.y.a.).**

Formations from this era underlie most of the area at great depth and outcrop only in the Little Rocky Mountains.

The Flathead and Emerson Formations were deposited in the Cambrian and Ordovician Periods (570 to 500 m.y.a.). The Flathead Formation contains light-colored sandstone interbedded with some relatively fine-grained conglomerate. The Emerson Formation contains greenish gray shale with thin beds of limestone and dolomite. These formations are mapped together in the area. Typical soils formed from these formations include the Macmeal, Silverchief, and Whitecow series.

The Bighorn Formation was deposited during the Ordovician Period (500 to 430 m.y.a.). The upper portion of the formation is thinly bedded, hard, gray dolomite. The lower portion of the formation consists of massive, dapple-gray dolomitic limestone and commonly exhibits pitted surfaces on outcrops. Typical soils derived from this formation include the Warneke and Whitecow series.

There are no rocks from the Silurian Period (430 to 395 m.y.a.) mapped in the survey area.

Rocks deposited during the Devonian Period (395 to 345 m.y.a.) include carbonaceous shale, sandstone, and limestone. Typical soils formed from these units include Silverchief and Whitecow.

During the Mississippian Period (345 to 325 m.y.a.), a sequence of limestone formations known collectively as the Madison Group was deposited. Limestone of the Lodgepole Formation is fossiliferous and thinly bedded, with some massively bedded ledges. The formation also contains many small chert lenses and thin partings of shale. The overlying Mission Canyon Formation is composed mainly of coarse-grained, massively bedded limestone but is crossbedded in some locations. The formation also contains lenses of cherty material, and solution cavities are common in the upper portion. Erosion-resistant limestones form the steep walls that surround the core of the Little Rocky Mountains and rise above the younger formations. Typical soils formed from this group include the Warneke and Whitecow series.

Rocks from the Pennsylvanian and Permian Periods (325 to 225 m.y.a.) are absent from the geologic record in the survey area.

Mesozoic Era (225 to 65 m.y.a.).

During the Triassic Period (225 to 190 m.y.a.), most of Montana was an elevated land area undergoing erosion. No rocks were deposited in the area during this time.

During the Jurassic Period (190 to 136 m.y.a.), calcareous shale, mudstone, and sandstone were deposited in an inland sea. Jurassic deposits in this area include the Morrison, Rierdon, and Swift Formations; however, their outcrop areas are small,

and individual formations were not differentiated in geologic mapping. The Jurassic deposits outcrop only in the Little Rocky Mountains.

During the Cretaceous Period (136 to 65 m.y.a.), a sequence of sandstone and shale formations was deposited by a seaway.

The Kootenai Formation outcrops in narrow bands around the core of the Little Rocky Mountains. The formation is composed of maroon and gray clay and light gray sandstone and limestone. The Kootenai Formation is 100- to 300-feet thick, thickening toward the south.

The Colorado Group, primarily dark gray shale, outcrops only in narrow bands around the core of the Little Rocky Mountains. Underlying most of the area, the formation is 1,600- to 1,850-feet thick. Typical soils derived from this group are the Barkof series.

The Eagle Formation, composed mainly of shale and sandstone, also outcrops only in narrow bands around the core of the Little Rocky Mountains. The Eagle Formation is about 250-feet thick in the western part of the survey area and thickens in the eastern part. Typical soils derived from this formation are the Cabba series.

The Claggett Formation is composed of dark gray shale and siltstone that weathers to a brownish gray. The formation also contains a few beds of bentonite and some large septarian concretions. Septarian concretions are characterized by intersecting radial and concentric cracks that are filled with calcite crystals. The Claggett Formation and older formations underlie all of the area, exclusive of the Little Rocky Mountains. The Claggett Formation outcrops in the Bowdoin Dome and the Little Rocky Mountains. The formation is approximately 500-feet thick throughout most of the area. Typical soils derived from this formation include the Bascovy and Neldore series.

The Judith River Formation contains interbedded, light gray to buff sandstone, shale, and gray impure clay with a few thin coal beds in the upper portion. The formation underlies most of the area, with the exception of the Little Rocky Mountains and the center of the Bowdoin Dome. The formation outcrops in the Bowdoin Dome area and the Little Rocky Mountains. The Judith River Formation reaches a thickness of 550 feet in this survey area. Typical soils derived from this formation include the Cabbart, Evanston, Marmarth, and Twilight series.

The Bearpaw Formation is composed primarily of dark gray marine shale with some bentonite, sandstone, cherty material, and calcareous concretions. The formation outcrops in the northwestern and northeastern corners of the survey area, as well as throughout most of the southern

half of the area. The Bearpaw Formation is up to 1,100-feet thick. Typical soils derived from this formation include the Bascovy, Gerdrum, Marvan, Neldore, and Weingart series.

The Fox Hills Formation is primarily a massive brown sandstone. The overlying Hell Creek Formation is primarily composed of interbedded sandstone and shale. In the survey area, these formations are present only in the southeastern corner in the southern Larb Hills. Typical soils derived from the Fox Hills Formation include the Chinook and Twilight series. Typical soils derived from the Hell Creek Formation include the Cabbart, Delpoint, and Yawdim series.

### **Cenozoic Era (65 to 0 m.y.a.).**

Igneous rocks comprising the core of the Little Rocky Mountains were formed early in the Cenozoic Era, approximately 60-million years ago. The rocks, formed from alkalic magma, include large bodies of syenite porphyry and dikes of trachyte. Syenite is composed of microcline and orthoclase feldspars with small amounts of plagioclase, hornblende, and biotite with little or no quartz. The syenite porphyry has a fine-grained matrix with large phenocrysts. Trachyte has a similar mineral composition but is fine grained, with a parallel alignment of orthoclase feldspar crystals. Typical soils formed from these rocks include the Mocmont and Tolex series.

Remnants of alluvial terrace deposits from late Tertiary and early Quaternary Periods (10 to 0.01 m.y.a.), are present in the Little Rocky Mountains and in the northwestern section of the survey area. The deposits are known as the Flaxville Formation in the latter area and were deposited between 10- and 1.7- million years ago. The formation contains large amounts of quartzite gravel and is more resistant to erosion than shale of the surrounding Bearpaw Formation. The Flaxville Formation caps the uplands near Woody Island Coulee. The formation is only 10- to 20-feet thick in this survey area. The Flaxville Formation is covered by glacial till throughout the area so is not a parent material for any soils mapped in this area.

Glacial till was deposited near the end of the Tertiary Period between 130,000 and 15,000 years ago. Typical soils derived from these deposits include the Absher, Elloam, Hillon, Kevin, Phillips, Scobey, and Thoency series.

Significant deposits of Recent (younger than 0.01 m.y.a.) alluvium are present in the Milk River valley and the lower valleys of Whitewater, Frenchman, Beaver, and Larb Creeks. Significant

deposits are also present as alluvial fans in the Little Rocky Mountains. Small deposits of alluvium are present along the Missouri River upstream of Fort Peck Reservoir. Typical soils derived from these deposits include the Bowdoin, Glendive, Harlem, and Havre series.

## Mineral and Natural Gas Resources

Gold and silver were mined in the Little Rocky Mountains. Gold placer deposits were discovered in 1884. Placer mining was not very profitable here, partly because of the limited amount of water available for dredging. In 1893, lode deposits were discovered where minerals had been deposited by hydrothermal solutions in fault zones within the igneous intrusions. In 1894, the town of Landusky was founded and four underground lode mines began operations. The first cyanide mill in the area was constructed at Zortman in 1903.

Between 1918 and 1931, total gold production from the Little Rocky Mountains was approximately 30,500 ounces. Most of the gold was produced from relatively low-grade ore. In 1942, mining operations ceased, not to be resumed until 1979, when Pegasus Gold Corporation obtained permits for open-pit mining and heap-leaching operations. The Zortman-Landusky Mine was one of the largest gold mining operations in the state. In 1991, annual gold production was 115,000 ounces and silver production was 900,000 ounces.

Bentonite was mined at the American Colloid Pit south of Malta from 1970 to the mid-1980s. Bentonite is formed through alteration of volcanic ash and contains the clay mineral, montmorillonite. It is used commercially as a decolorizing agent, filler in paper and rubber, a base for cosmetics and medicines, drilling mud, and a sealant for wells.

The Phillips County Area is one of the largest producers of natural gas in Montana. The gas fields are located within the Bowdoin Dome in the northern portion of the area. The crest of the dome trapped natural gas in sandstone layers from the Colorado Group. Slight fluctuations of sea level during the Cretaceous Period resulted in the deposition of the Bowdoin and Phillips Sandstones, primarily in shale from the Colorado Group. Both units are composed of very fine-grained, gray, shaly or silty sandstone.

In 1913, natural gas was discovered in a water well. Drilling for gas production began in 1916 and expanded with pipeline construction, starting in 1929. The Bowdoin Gas Field is the largest producer in

the area with 358 wells producing 3,986,470-million cubic feet (MCF) in 1991. Seven other gas fields in this area produced a total of 4,841,507 MCF from 604 wells in 1991. Gas development continues in these fields with 74 new wells drilled in 1991.

## Ground Water and Geothermal Resources

Most water wells in the survey area obtain water from the Judith River Formation, alluvial deposits, or glacial deposits.

Several geothermal springs are present in the Little Rocky Mountain area. Average water temperature is 75 degrees F. Considerable volumes of warm water are also available in the Madison Group, at depths of less than 1,150 feet. In 1981, total usable discharge from these resources was 13,500 gallons per minute (gpm).

The Sleeping Buffalo Hot Springs obtains water from a flowing well that was drilled into the Madison Formation. The well produces approximately 90 gpm from a depth of 3,200 feet. Water temperature is 108 degrees F. The well is used to supply a resort east of Malta.

## Climate

In the summer, the Phillips County Area is normally very warm to hot with frequent days of temperatures exceeding 100 degrees F. There are occasional cool days during the summer where the temperatures do not exceed 60 degrees F.

Winters tend to be very cold because of the arctic air masses that frequently move into northeastern Montana. These arctic air masses, often accompanied by strong winds, can rapidly drop the air temperature by as much as 30 degrees F in less than 24 hours. January is the coldest month.

In midafternoon, the average relative humidity is about 45 percent; at dawn, the average is about 70 percent. Humidity is higher at night. The sun shines 80 percent of the daylight hours in summer and 50 percent in winter. The prevailing wind is from the west and is highest during the spring.

Precipitation does not vary to a great extent in the survey area, except in the Little Rocky Mountains. Most of the area is in the 11- to 14-inch precipitation zone, with the Larb Hills receiving about 1 inch more. The Little Rocky Mountains receive between 17 and 25 inches of total precipitation during an average year. Most of the precipitation falls as rain during the spring and early summer. The timing of this

precipitation is what makes dryland farming in the area possible. During the summer, precipitation generally comes in the form of violent thunderstorms that may have associated hail. Snowfall in the area is normally light. Snow is generally accompanied by strong winds that blow it into drifts, leaving much of the ground free of snow.

The "Temperature and Precipitation" table gives data on temperature and precipitation for the survey area as recorded at Malta, Saco, Content, Forks, 35 miles south of Malta, and Zortman, for the period 1963 to 1994. The "Freeze Dates in Spring and Fall" table shows probable dates of the first freeze in the fall and the last freeze in the spring. The "Growing Season" table provides data on length of the growing season.

## How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. This 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 survey area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, soil scientists develop a concept, or model, of how the soils were formed. During mapping, this model enables 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, 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 data from these analyses and tests as well as field-observed characteristics and 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 for crop yields under high levels of management are modeled and validated with farm records and field or plot information 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, 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.

Descriptions, names, and delineations of the soils in this survey area may not fully agree with those of the soils in adjacent survey areas. Differences result from 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.

Temperature and Precipitation

(Recorded in the period 1963-94 at Content, Forks, Malta, and Zortman)

Month	Temperature (degrees F.)						Precipitation					
	Aver- age daily	Aver- age daily	2 yrs in 10 will have--		Average number of growing degree days	Average number of days with .10 inch or more	2 yrs in 10 will have--		Average number of days with .10 inch or more	Aver- age snow fall		
	maxi- mum	mini- mum	Aver- age	max. temp. more than	min. temp. less than	(in.)	Less than (in.)	More than (in.)	(in.)	(in.)		
FORKS:												
January	20.3	-0.5	9.9	50	-36	1	0.40	0.12	0.65	1	6.4	
February	27.5	5.7	16.6	55	-31	3	0.30	0.11	0.46	1	4.3	
March	40.3	17.4	28.8	69	-17	25	0.53	0.19	0.87	1	5.2	
April	55.9	29.4	42.7	82	3	159	0.93	0.27	1.46	2	3.2	
May	67.8	40.0	53.9	91	22	434	2.08	1.00	3.01	5	0.8	
June	76.5	48.0	62.2	97	32	666	2.62	1.11	3.91	5	0.0	
July	83.8	52.8	68.3	100	40	865	2.06	0.75	3.15	4	0.0	
August	83.0	51.6	67.3	101	35	842	1.22	0.35	1.92	2	0.0	
September	70.9	41.4	56.2	96	22	485	1.11	0.41	1.69	3	0.1	
October	58.2	30.9	44.5	84	5	207	0.59	0.15	1.00	1	1.6	
November	38.2	16.5	27.3	65	-19	19	0.42	0.17	0.68	1	3.9	
December	25.1	4.5	14.8	53	-34	1	0.38	0.13	0.61	1	5.3	
Yearly:												
Average	54.0	28.1	41.1	---	---	---	----	----	----	---	---	
Extreme	107	-42	---	102	-38	---	----	----	----	---	---	
Total	---	---	---	---	---	3707	12.63	9.98	15.07	27	30.8	
MALTA:												
January	27.0	3.6	15.3	57	-35	5	0.41	0.12	0.67	1	8.6	
February	34.1	9.4	21.8	63	-29	11	0.28	0.12	0.44	1	5.4	
March	45.4	20.4	32.9	73	-16	45	0.58	0.20	0.89	1	6.1	
April	57.8	29.8	43.8	83	5	174	1.15	0.43	1.75	3	6.2	
May	69.2	40.4	54.8	91	22	453	2.29	1.07	3.34	4	1.0	
June	77.6	48.9	63.2	99	34	687	2.47	1.29	3.51	5	0.0	
July	86.1	53.7	69.9	102	40	913	1.69	0.57	2.71	4	0.0	
August	85.4	52.4	68.9	102	36	870	1.49	0.51	2.30	3	0.0	
September	72.8	41.0	56.9	97	21	494	1.16	0.21	1.96	2	0.1	
October	60.7	31.0	45.9	86	5	226	0.52	0.17	0.95	1	1.2	
November	41.5	17.7	29.6	70	-19	31	0.35	0.10	0.60	1	5.5	
December	30.9	7.1	19.0	60	-37	8	0.37	0.15	0.60	1	6.8	
Yearly:												
Average	57.4	29.6	43.5	---	---	---	----	----	----	---	---	
Extreme	109	-51	---	106	-41	---	----	----	----	---	---	
Total	---	---	---	---	---	3917	12.76	7.02	15.72	27	41.0	

\* See footnote at end of table.

## Temperature and Precipitation--Continued

Month	Temperature (degrees F.)						Precipitation					
	Aver- age daily	Aver- age daily		2 yrs in 10 will have-		Average number of growing degree days	2 yrs in 10 will have--			Average number of days with .10 inch or more	Aver- age snow fall	
	maxi- mum	mini- mum	Aver- age	max. temp. more than	min. temp. less than		Aver- age	Less than (in.)	More than (in.)	(in.)	(in.)	
CONTENT:												
January	26.8	4.2	15.5	56	-36	4	0.42	0.15	0.70	1	5.6	
February	33.2	9.8	21.5	62	-30	10	0.19	0.06	0.35	0	2.3	
March	45.4	20.5	33.0	72	-14	43	0.45	0.19	0.71	1	1.9	
April	58.7	30.3	44.5	84	5	191	0.99	0.31	1.54	3	1.1	
May	69.5	40.9	55.2	93	22	468	2.04	0.72	3.14	5	0.1	
June	78.0	49.3	63.6	99	32	701	2.33	1.10	3.38	5	0.0	
July	85.2	53.8	69.5	102	33	905	1.64	0.57	2.63	4	0.0	
August	84.4	52.0	68.2	102	35	859	1.25	0.24	2.02	2	0.0	
September	72.6	41.3	57.0	97	21	506	1.14	0.26	1.91	2	0.0	
October	60.0	31.1	45.5	86	5	225	0.63	0.21	1.02	2	0.7	
November	42.2	18.2	30.2	68	-19	31	0.32	0.13	0.57	1	1.5	
December	30.8	7.3	19.0	59	-35	5	11.86	0.01	16.34	1	3.8	
Yearly :												
Average	57.2	29.9	43.6	---	---	---	---	---	---	---	---	
Extreme	107	-49	---	104	-40	---	---	---	---	---	---	
Total	---	---	---	---	---	3948	23.26	4.30	35.16	27	17.0	
ZORTMAN:												
January	30.7	7.9	19.3	59	-30	16	0.94	0.33	1.61	3	5.4	
February	35.0	11.8	23.4	61	-23	12	0.59	0.19	0.91	2	5.0	
March	43.2	20.2	31.7	67	-13	35	0.83	0.36	1.23	2	6.4	
April	52.3	29.0	40.7	78	5	118	1.68	0.63	2.57	4	1.4	
May	63.6	38.4	51.0	85	21	345	2.78	1.36	4.01	6	0.2	
June	71.5	46.2	58.9	92	26	548	3.76	1.79	5.47	7	0.0	
July	79.2	50.5	64.9	95	36	741	2.08	0.59	3.29	5	0.0	
August	78.7	50.0	64.4	96	34	714	1.82	0.88	3.29	3	0.0	
September	67.5	40.3	53.9	89	22	410	1.78	0.60	2.89	3	0.0	
October	56.0	30.7	43.4	80	4	187	0.67	0.30	1.11	1	0.4	
November	40.6	18.7	29.7	66	-13	27	0.43	0.16	0.84	1	4.4	
December	33.6	11.6	22.6	56	-29	8	0.82	0.30	1.25	3	8.7	
Yearly:												
Average	54.3	29.6	42.0	---	---	---	---	---	---	---	---	
Extreme	101	-51	---	98	-34	---	---	---	---	---	---	
Total	---	---	---	---	---	3160	18.19	6.13	21.02	40	31.8	

\*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 (40.0 deg. F)

Freeze Dates in Spring and Fall

(Recorded in the period 1963 to 1994 at Content, Forks, Malta, and Zortman)

Probability	Temperature		
	24 degrees F or lower	28 degrees F or lower	32 degrees F or lower
<b>FORKS:</b>			
Last freezing temperature in spring: January-July			
1 year in 10 later than---	May 11	May 22	June 5
2 years in 10 later than---	May 6	May 17	May 30
5 years in 10 later than---	April 26	May 7	May 20
First freezing temperature in fall: August -Dec.			
1 yr in 10 earlier than---	September 17	September 10	September 6
2 years in 10 earlier than-	September 23	September 15	September 10
5 years in 10 earlier than-	October 4	September 25	September 16
<b>MALTA:</b>			
Last freezing temperature in spring: January-July			
1 year in 10 later than---	May 10	May 20	June 2
2 years in 10 later than---	May 5	May 15	May 28
5 years in 10 later than---	April 25	May 4	May 19
First freezing temperature in fall: August -Dec.			
1 year in 10 earlier than--	September 19	September 10	September 4
2 years in 10 earlier than-	September 23	September 15	September 8
5 years in 10 earlier than-	October 3	September 23	September 14

## Freeze Dates in Spring and Fall--Continued

Probability	Temperature		
	24 degrees F or lower	28 degrees F or lower	32 degrees F or lower
<b>CONTENT:</b>			
Last freezing temperature in spring: January-July			
1 year in 10 later than--	May 10	May 27	June 6
2 year in 10 later than--	May 5	May 20	May 31
5 year in 10 later than--	April 26	May 7	May 20
First freezing temperature in fall:			
1 yr in 10 earlier than--	September 15	September 7	September 3
2 yr in 10 earlier than--	September 21	September 13	September 7
5 yr in 10 earlier than--	October 3	September 24	September 14
<b>ZORTMAN:</b>			
Last freezing temperature in spring: January-July			
1 year in 10 later than----	May 15	June 3	June 19
2 years in 10 later than---	May 9	May 26	June 11
5 years in 10 later than---	April 29	May 11	May 26
First freezing temperature in fall: August -Dec.			
1 year in 10 earlier than--	September 15	September 11	August 30
2 years in 10 earlier than-	September 21	September 16	September 5
5 years in 10 earlier than-	October 3	September 25	September 17

Growing Season

(Recorded in the period 1963 to 1994 at Content, Forks, Malta, and Zortman)

Probability	Daily Minimum Temperature		
	Higher than 24 degrees F	Higher than 28 degrees F	Higher than 32 degrees F
	Days	Days	Days
<b>FORKS:</b>			
9 years in 10-----	135	120	99
8 years in 10-----	144	127	106
5 years in 10-----	161	141	118
2 years in 10-----	178	155	131
1 year in 10-----	187	162	137
<b>MALTA:</b>			
9 years in 10-----	136	118	99
8 years in 10-----	144	125	105
5 years in 10-----	159	140	117
2 years in 10-----	175	154	129
1 year in 10-----	183	162	136
<b>CONTENT:</b>			
9 years in 10-----	133	113	95
8 years in 10-----	141	122	103
5 years in 10-----	156	139	117
2 years in 10-----	171	157	132
1 year in 10-----	179	166	140
<b>ZORTMAN:</b>			
9 years in 10-----	132	119	89
8 years in 10-----	140	125	98
5 years in 10-----	155	138	117
2 years in 10-----	170	151	136
1 year in 10	178	157	145



# Formation and Classification of the Soils

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This section relates the soils in the survey area to the major factors of soil formation 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

### Climate

Climate, an active force in the formation of soils, is determined mainly through the effects of temperature and precipitation, though wind has some influence. Erosion and alternate freezing and thawing breaks rocks to a material in which soils form. This weathered material is further broken down by chemical reactions such as solution and hydration.

Precipitation and temperature affect the kind and amount of vegetation that grows on a soil. Subsequently, vegetation decays to produce organic matter in the soil. Soils that have cool temperatures and high precipitation generally contain more organic matter and are dark colored. Soils with warm temperature and low precipitation generally contain less organic matter and are light colored.

Annual precipitation in the Phillips County area ranges from 11 to 17 inches on till plains and sedimentary plains, and from 17 to 25 inches in the foothills and mountains.

### Living Organisms

Living organisms are active in the formation of soils. Organic matter is the main source for the dark colored surface layer of a soil. Fungi and algae are among the earliest inhabitants of rock material that contribute to rock decomposition. As rocks

decompose, grasses, shrubs, and trees are able to grow and support animal life.

The kinds of plants and animals in existence largely determine the kinds and amounts of organic matter added to the soil, and how this matter is incorporated with the mineral parts of the soil. Roots, rodents, and insects penetrate the soil and influence its structure. Leaves, roots, and whole plants remain on the surface layer, where they are changed to humus by micro-organisms, chemicals in the soil, and insects.

Vegetation in the area ranges from short to mid grasses and shrubs in most areas, to deciduous and coniferous trees in Little Rocky Mountains and the Missouri River Breaks. Common rodents are gophers, prairie dogs, badgers, rabbits, and mice.

### Topography

Topography is mainly determined by the age of geologic formations, and its resistance to erosion by water and wind. On the eroded uplands of the area, runoff water has carved deep valleys into the bedrock formations. This rugged relief contrasts sharply with the smooth relief of glacial till plains and the flood plains of river valleys.

On uplands, the number and distinctness of soil horizons generally decrease as slope increases. Exceptions to this are the Mocmont and Macmeal soils, that formed on steep mountain slopes. Soils on steep slopes with rapid runoff have many characteristics similar to those of soils formed in arid climates. Nearly level soils, receiving runoff water from upland areas, have many of the characteristics of soils forming in more humid climates. Examples of this pattern are the Hillon and Scobey soils. Hillon is generally on upper side slopes and tops of hills. It has a light colored surface layer with lime accumulations starting at 3 inches. The Scobey soil is generally at the lower end of slopes, has a dark surface color, and

lime accumulations are at least 11 inches below the soil surface.

## Parent material

The majority of soils in the survey area formed in glacial till or in glacial outwash material. Some soils formed in alluvium that was derived from mixed sources. Other soils formed in material weathered from sandstone, shale, limestone, or igneous rocks. Soils forming in glacial till, such as Scobey, Phillips, and Telstad, are loamy or clayey, depending on the texture of the glacial till. Soils forming in shale, such as Neldore and Bascovy, are generally clayey. Soils forming in weathered sandstone are sandy, such as the Twilight series. Soils forming in recent alluvium range from the sandy Hanly soil to the clayey Bowdoin soils. Soils such as Whitecow and Mocmont that formed from limestone or igneous rocks, in the Little Rocky Mountains, are generally loamy.

Many soils in the area have accumulated salt and sodium from the parent materials. These salts and sodium make the soils saline and/or sodic, and limit the kinds and amount of plants able to grow on them. Soils that formed in outwash material generally have a high percentage of sand and gravel.

## Time

Changes taking place in soils over a long period of time are called soil genesis. These changes give the soil distinct horizons, or layers, by which it can be recognized. The kind and arrangement of these horizons is called soil morphology. It is described in terms of color, texture, structure, consistence, thickness, permeability, and chemistry.

Soils are classified as young to mature. The age of a soil is determined from thickness of the A horizon, content of organic matter and clay, depth to which soluble material is leached, and the form and distribution of calcium carbonate and gypsum in the soil.

Young soils show very little profile development. The Havre series, a soil of the Entisol order, is an example of a young soil. It is on a flood plain adjacent to a flowing stream. The soil contains little organic matter to form an A horizon, it has little clay accumulation, and little translocation of carbonates within the profile has occurred.

Evanston series, of the Mollisol order, formed in parent materials similar to the Havre series, but much

older. Evanston soils formed in alluvium on uplands. They contain enough organic matter to have a dark colored A horizon, they have a distinct clay accumulation in the subsoil or Bt horizon, and nearly all of the carbonates have been leached to a depth of about 12 inches.

Many of the sloping, steep, shallow soils appear to have been in the process of formation about as long as some of the more developed soils that are less sloping. However, erosion removes the soil as fast as it forms. In this situation, the effect of time has been offset by the effect of relief.

## Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA-SCS, 1975) (USDA-SCS, 1992). 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 Mollisol.

**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 Boroll (*Bor*, meaning cool, plus *oll*, from Mollisol).

**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 Argiborolls (*Argi*, meaning having and argillic or clay accumulation, plus *boroll*, the suborder of the Mollisols that has a cool climate).

**SUBGROUP.** Each great group has a typical subgroup. Other subgroups are intergrades or extragrades. The typical 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 that typifies the great group. An example is Typic Argiborolls.

**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 fine-loamy, mixed Typic Argiborolls.

**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. An example is the Evanston series. The Evanston series are fine-loamy, mixed Typic Argiborolls.

## Classification of the Soils

Soil name	Family or higher taxonomic class
Absher-----	Fine, montmorillonitic Typic Natriboralfs
Arsite-----	Clayey, montmorillonitic, nonacid, frigid, shallow Aridic Ustorthents
Assinniboine-----	Fine-loamy, mixed Aridic Argiborolls
Attewan-----	Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls
Barkof-----	Fine, montmorillonitic, frigid Leptic Udic Haplusterts
Bascovy-----	Fine, montmorillonitic, frigid Leptic Udic Haplusterts
Beaverell-----	Loamy-skeletal over sandy or sandy-skeletal, mixed Aridic Argiborolls
Beaverton-----	Loamy-skeletal over sandy or sandy-skeletal, mixed Typic Argiborolls
Benz-----	Fine-loamy, mixed (calcareous), frigid Aridic Ustorthents
Bigsag-----	Fine, montmorillonitic (calcareous), frigid Typic Halaquepts
Binna-----	Fine-loamy over sandy or sandy-skeletal, mixed Aridic Calciborolls
Bowdoin-----	Very-fine, montmorillonitic, frigid Sodic Haplusterts
Bullhook-----	Fine-loamy, mixed (calcareous), frigid Aridic Ustifluvents
Busby-----	Coarse-loamy, mixed, frigid Aridic Ustochrepts
Cabba-----	Loamy, mixed (calcareous), frigid, shallow Typic Ustorthents
Cabbart-----	Loamy, mixed (calcareous), frigid, shallow Aridic Ustorthents
Chinook-----	Coarse-loamy, mixed Aridic Haploborolls
Creed-----	Fine, montmorillonitic Typic Natriboralfs
Danvers-----	Fine, montmorillonitic Typic Argiborolls
Degrad-----	Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls
Delpoint-----	Fine-loamy, mixed, frigid Aridic Ustochrepts
Dimmick-----	Fine, montmorillonitic, frigid Vertic Epiaquolls
Elloam-----	Fine, montmorillonitic Typic Natriboralfs
Ethridge-----	Fine, montmorillonitic Aridic Argiborolls
Evanston-----	Fine-loamy, mixed Aridic Argiborolls
Farnuf-----	Fine-loamy, mixed Typic Argiborolls
Ferd-----	Fine, montmorillonitic Glossic Eutroboralfs
Fortbenton-----	Fine-loamy, mixed Aridic Haploborolls
Gerdrum-----	Fine, montmorillonitic Typic Natriboralfs
Glendive-----	Coarse-loamy, mixed (calcareous), frigid Aridic Ustifluvents
Hanly-----	Sandy, mixed, frigid Aridic Ustifluvents
Harlake-----	Fine, montmorillonitic (calcareous), frigid Aridic Ustifluvents
Havre-----	Fine-loamy, mixed (calcareous), frigid Aridic Ustifluvents
Hillon-----	Fine-loamy, mixed (calcareous), frigid Aridic Ustorthents
Joplin-----	Fine-loamy, mixed Aridic Argiborolls
Judith-----	Fine-loamy, carbonatic Typic Calciborolls
Kevin-----	Fine-loamy, mixed Aridic Argiborolls
Kobase-----	Fine, montmorillonitic, frigid Aridic Ustochrepts
Lallie-----	Fine, montmorillonitic (calcareous), frigid Vertic Fluvaquents
Landusky-----	Fragmental, mixed, frigid Typic Ustorthents
Lardell-----	Fine-loamy, mixed, frigid Aquollic Salorthids
Lostriver-----	Fine, montmorillonitic (calcareous), frigid Aridic Ustifluvents
Macmeal-----	Loamy-skeletal, mixed Typic Eutroboralfs
Marmarth-----	Fine-loamy, mixed Aridic Argiborolls
Martinsdale-----	Fine-loamy, mixed Typic Argiborolls
Marvan-----	Fine, montmorillonitic, frigid Sodic Haplusterts
McKenzie-----	Fine, montmorillonitic, frigid Chromic Endoaquerts
Megonot-----	Fine, montmorillonitic, frigid Aridic Ustochrepts
Mocmont-----	Loamy-skeletal, mixed Glossic Eutroboralfs
Neldore-----	Clayey, montmorillonitic, nonacid, frigid, shallow Aridic Ustorthents
Nesda-----	Sandy-skeletal, mixed Fluventic Haploborolls
Nishon-----	Fine, montmorillonitic, frigid Typic Albaqualfs
Nobe-----	Fine, montmorillonitic (calcareous), frigid Oxyaquic Ustorthents
Pendroy-----	Very-fine, montmorillonitic, frigid Chromic Udic Haplusterts
Phillips-----	Fine, montmorillonitic Typic Eutroboralfs
Pinebreaks-----	Clayey, montmorillonitic, acid, frigid, shallow Typic Ustorthents
Savage-----	Fine, montmorillonitic Typic Argiborolls
Saypo-----	Fine-loamy, mixed Aquic Calciborolls
Scobey-----	Fine, montmorillonitic Aridic Argiborolls
Silverchief-----	Fine, mixed Typic Eutroboralfs

## Classification of the Soils--Continued

Soil name	Family or higher taxonomic class
Sunburst-----	Fine, montmorillonitic (calcareous), frigid Aridic Ustorthents
Tamaneen-----	Fine, montmorillonitic Typic Argiborolls
Telstad-----	Fine-loamy, mixed Aridic Argiborolls
Thoeny-----	Fine, montmorillonitic Typic Natriboralfs
Tinsley-----	Sandy-skeletal, mixed, frigid Typic Ustorthents
Tolex-----	Loamy-skeletal, mixed Lithic Eutroboralfs
Toston-----	Fine-loamy, mixed Typic Natriboralfs
Twilight-----	Coarse-loamy, mixed, frigid Aridic Ustochrepts
Vaeda-----	Fine, montmorillonitic, nonacid, frigid Aridic Ustorthents
Vanda-----	Fine, montmorillonitic (calcareous), frigid Aridic Ustorthents
Volborg-----	Clayey, montmorillonitic, acid, frigid, shallow Aridic Ustorthents
Warneke-----	Loamy-skeletal, carbonatic, frigid Lithic Ustochrepts
Weingart-----	Fine, montmorillonitic Typic Natriboralfs
Wheatbelt-----	Very-fine, montmorillonitic, frigid Sodic Epiaquerts
Whitecow-----	Loamy-skeletal, carbonatic, frigid Calcic Ustochrepts
Windham-----	Loamy-skeletal, carbonatic Typic Calciborolls
Yamacall-----	Fine-loamy, mixed, frigid Aridic Ustochrepts
Yawdim-----	Clayey, montmorillonitic (calcareous), frigid, shallow Aridic Ustorthents
Yetull-----	Mixed, frigid Typic Ustipsamments

## Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
10C	Barkof clay, 2 to 8 percent slopes-----	261	*
11B	Degrad loam, 0 to 4 percent slopes-----	3,982	0.1
13B	Beaverton gravelly loam, 0 to 4 percent slopes-----	462	*
25C	Bascovy clay, 2 to 8 percent slopes-----	4,858	0.2
28A	Nishon clay loam, 0 to 2 percent slopes-----	14,432	0.4
29A	McKenzie clay, 0 to 2 percent slopes-----	2,710	*
30A	Marvan clay, 0 to 2 percent slopes-----	7,859	0.2
31B	Ferd loam, 0 to 4 percent slopes-----	2,097	*
32B	Kobase silty clay loam, 0 to 4 percent slopes-----	14,528	0.5
33B	Phillips loam, 0 to 4 percent slopes-----	2,037	*
35C	Assinniboine fine sandy loam, 2 to 8 percent slopes-----	4,213	0.1
36C	Chinook fine sandy loam, 2 to 8 percent slopes-----	2,790	*
37B	Evanston loam, 0 to 4 percent slopes-----	27,899	0.9
37C	Evanston loam, 4 to 8 percent slopes-----	5,562	0.2
38B	Ethridge clay loam, 0 to 4 percent slopes-----	21,444	0.7
38C	Ethridge clay loam, 4 to 8 percent slopes-----	1,915	*
41A	Vaeda clay, 0 to 2 percent slopes-----	40,650	1.3
43A	Pendroy clay, 0 to 2 percent slopes-----	15,524	0.5
48A	Vanda clay, 0 to 2 percent slopes-----	6,153	0.2
49A	Lardell clay loam, 0 to 2 percent slopes-----	6,926	0.2
50B	Telstad loam, 0 to 4 percent slopes-----	16,759	0.5
52B	Elloam clay loam, 0 to 4 percent slopes-----	678	*
56B	Scobey clay loam, 0 to 4 percent slopes-----	34,773	1.1
59B	Weingart clay loam, 0 to 4 percent slopes-----	490	*
60A	Havre loam, 0 to 2 percent slopes-----	34,479	1.1
75C	Farnuf loam, 2 to 8 percent slopes-----	1,515	*
79C	Yamacall loam, 2 to 8 percent slopes-----	5,033	0.2
81A	Glendive loam, 0 to 2 percent slopes-----	1,440	*
82B	Savage silty clay loam, 0 to 4 percent slopes-----	1,450	*
82C	Savage silty clay loam, 4 to 8 percent slopes-----	307	*
84F	Macmeal complex, 25 to 60 percent slopes-----	1,258	*
90A	Harlake clay, 0 to 2 percent slopes-----	34,359	1.1
93A	Bowdoin clay, 0 to 2 percent slopes-----	31,458	1.0
94C	Busby fine sandy loam, 2 to 8 percent slopes-----	1,448	*
94D	Busby fine sandy loam, 8 to 15 percent slopes-----	506	*
96D	Megonot-Kobase silty clay loams, 8 to 15 percent slopes-----	741	*
97D	Neldore-Bascovy clays, 4 to 15 percent slopes-----	6,145	0.2
100A	Hanly fine sandy loam, 0 to 2 percent slopes-----	344	*
101E	Barkof-Windham complex, 8 to 25 percent slopes-----	9,884	0.3
110C	Attewan-Beaverell complex, 0 to 8 percent slopes-----	10,629	0.3
115F	Silverchief-Whitecow-Macmeal complex, 15 to 60 percent slopes-----	2,513	*
120F	Mocmont complex, 25 to 60 percent slopes-----	2,625	*
121F	Mocmont-Tolex complex, 25 to 60 percent slopes-----	9,475	0.3
122F	Mocmont-Landusky complex, 25 to 60 percent slopes-----	2,277	*
130F	Rubble land-Mocmont-Rock outcrop complex, 25 to 60 percent slopes-----	1,550	*
139F	Whitecow-Warneke gravelly loams, 25 to 60 percent slopes-----	2,952	*
140F	Whitecow complex, 25 to 60 percent slopes-----	2,849	*
151F	Warneke-Whitecow-Rock outcrop complex, 25 to 70 percent slopes-----	3,840	0.1
160D	Whitecow gravelly loam, 8 to 15 percent slopes-----	550	*
160E	Whitecow gravelly loam, 15 to 35 percent slopes-----	482	*
170A	Dimmick clay, 0 to 1 percent slopes-----	7,088	0.2
180B	Binna-Saypo complex, 0 to 4 percent slopes-----	387	*
190B	Nesda complex, 0 to 4 percent slopes-----	674	*
200F	Mined land-----	1,318	*
201D	Cabba-Windham complex, 8 to 25 percent slopes-----	1,837	*
211B	Thoeny-Absher complex, 0 to 4 percent slopes-----	48,005	1.5
212B	Thoeny-Elloam complex, 0 to 4 percent slopes-----	30,148	0.9
220E	Hillon-Joplin cobbly loams, 8 to 35 percent slopes-----	35,137	1.1
221D	Hillon-Kevin complex, 8 to 15 percent slopes-----	33,698	1.0
221E	Hillon-Kevin complex, 15 to 25 percent slopes-----	19,050	0.6
224D	Hillon-Joplin gravelly loams, 8 to 15 percent slopes-----	9,395	0.3
241B	Benz-Vanda complex, 0 to 4 percent slopes-----	2,696	*

\* See footnote at end of table.

## Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
250E	Bascovy-Neldore-Weingart clays, 8 to 25 percent slopes-----	33,528	1.0
251C	Bascovy-Neldore clays, 2 to 8 percent slopes-----	10,340	0.3
270E	Beaverell-Tinsley complex, 15 to 45 percent slopes-----	2,648	*
271D	Beaverell-Evanston complex, 8 to 15 percent slopes-----	741	*
301C	Marvan complex, 2 to 8 percent slopes-----	9,106	0.3
302B	Marvan-Vanda clays, 0 to 8 percent slopes-----	65,913	2.1
311B	Ferd-Gerdrum complex, 0 to 4 percent slopes-----	14,510	0.5
312B	Ferd-Absher complex, 0 to 4 percent slopes-----	5,366	0.2
320A	Kobase silty clay, 0 to 2 percent slopes-----	1,450	*
322C	Kobase-Megonot silty clay loams, 2 to 8 percent slopes-----	1,882	*
323B	Kobase-Marvan-Weingart complex, 0 to 4 percent slopes-----	904	*
331B	Phillips-Absher complex, 0 to 4 percent slopes-----	89,437	2.8
331C	Phillips-Absher complex, 4 to 8 percent slopes-----	13,735	0.4
332B	Phillips-Elloam complex, 0 to 4 percent slopes-----	87,157	2.7
333C	Phillips-Kevin, gravelly complex, 2 to 8 percent slopes-----	11,270	0.4
334C	Phillips-Kevin complex, 2 to 8 percent slopes-----	21,000	0.7
351C	Fortbenton fine sandy loam, 2 to 8 percent slopes-----	1,189	*
373C	Evanston-Chinook complex, 2 to 8 percent slopes-----	2,419	*
381B	Ethridge-Gerdrum clay loams, 0 to 4 percent slopes-----	14,729	0.5
383C	Ethridge-Beaverell complex, 2 to 8 percent slopes-----	3,423	0.1
391B	Creed-Absher complex, 0 to 4 percent slopes-----	9,460	0.3
392B	Creed-Gerdrum complex, 0 to 4 percent slopes-----	7,174	0.2
402B	Gerdrum-Absher complex, 0 to 4 percent slopes-----	20,744	0.6
421C	Joplin-Hillon loams, 2 to 8 percent slopes-----	24,200	0.8
424D	Joplin-Telstad loams, 8 to 15 percent slopes-----	2,538	*
426C	Joplin-Hillon gravelly loams, 2 to 8 percent slopes-----	7,783	0.2
442C	Kevin-Hillon complex, 2 to 8 percent slopes-----	6,633	0.2
444C	Kevin-Sunburst clay loams, 2 to 8 percent slopes-----	26,554	0.8
446D	Kevin-Sunburst very gravelly clay loams, 8 to 15 percent slopes-----	5,548	0.2
481A	Bigzag clay, 0 to 2 percent slopes-----	3,136	*
502C	Telstad-Elloam complex, 2 to 8 percent slopes-----	99,018	3.1
503C	Telstad-Joplin loams, 2 to 8 percent slopes-----	61,096	1.9
504C	Telstad-Absher complex, 2 to 8 percent slopes-----	6,389	0.2
505C	Telstad-Hillon loams, 2 to 8 percent slopes-----	898	*
511B	Martinsdale-Judith loams, 0 to 4 percent slopes-----	5,137	0.2
521B	Elloam-Absher complex, 0 to 4 percent slopes-----	82,915	2.6
561B	Scobey-Phillips complex, 0 to 4 percent slopes-----	86,567	2.7
562C	Scobey-Elloam clay loams, 2 to 8 percent slopes-----	48,677	1.5
563C	Scobey-Kevin clay loams, 2 to 8 percent slopes-----	146,706	4.6
564C	Scobey-Kevin-Elloam clay loams, 2 to 8 percent slopes-----	69,777	2.2
566C	Scobey-Kevin complex, 2 to 8 percent slopes-----	37,169	1.2
567C	Scobey-Elloam-Absher gravelly clay loams, 2 to 8 percent slopes-----	12,232	0.4
600	Pits, gravel-----	534	*
601A	Havre-Harlake-Glendive complex, 0 to 2 percent slopes-----	17,111	0.5
603A	Havre clay, 0 to 2 percent slopes-----	9,898	0.3
604A	Bullhook loam, 0 to 2 percent slopes-----	2,883	*
610	Pits, bentonite-----	112	*
650C	Yetull loamy fine sand, 2 to 8 percent slopes-----	290	*
650D	Yetull loamy fine sand, 8 to 15 percent slopes-----	66	*
731C	Judith-Windham complex, 2 to 8 percent slopes-----	3,992	0.1
791E	Yamacall complex, 8 to 35 percent slopes-----	2,434	*
792C	Yamacall complex, 2 to 8 percent slopes-----	5,360	0.2
811A	Glendive-Havre loams, 0 to 2 percent slopes-----	9,422	0.3
821D	Savage-Farnuf complex, 8 to 15 percent slopes-----	261	*
860C	Weingart complex, 2 to 8 percent slopes-----	6,619	0.2
871B	Tamaneen-Danvers clay loams, 0 to 4 percent slopes-----	6,019	0.2
901A	Lallie clay loam, 0 to 1 percent slopes-----	3,846	0.1
902A	Lostriver-Bullhook complex, 0 to 2 percent slopes-----	12,323	0.4
903A	Harlake-Lostriver clays, 0 to 2 percent slopes-----	32,528	1.0
905A	Harlake-Havre clay loams, 0 to 2 percent slopes-----	6,020	0.2
921D	Sunburst-Kevin gravelly clay loams, 8 to 15 percent slopes-----	29,198	0.9
923C	Sunburst-Kevin gravelly clay loams, 2 to 8 percent slopes-----	4,820	0.2

\* See footnote at end of table.

## Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
923F	Sunburst-Kevin complex, 15 to 45 percent slopes-----	29,567	0.9
924E	Sunburst-Bascovy-Neldore complex, 8 to 35 percent slopes-----	42,954	1.3
925C	Sunburst-Bascovy-Weingart complex, 2 to 8 percent slopes-----	15,532	0.5
926F	Sunburst-Neldore-Rock outcrop complex, 15 to 45 percent slopes-----	8,746	0.3
930A	Wheatbelt clay, 0 to 1 percent slopes-----	2,909	*
971F	Neldore-Cabbart-Tinsley complex, 25 to 65 percent slopes-----	17,856	0.6
973E	Neldore, cool-Bascovy clays, 8 to 35 percent slopes-----	12,224	0.4
974F	Pinebreaks-Neldore clays, 15 to 60 percent slopes-----	2,876	*
1021E	Cabbart-Twilight-Yawdim association, 8 to 35 percent slopes-----	22,834	0.7
1022F	Hillon-Cabbart-Rock outcrop association, 15 to 65 percent slopes-----	54,952	1.7
1030D	Marvan-Gerdrum association, 2 to 15 percent slopes-----	17,847	0.6
1037D	Evanston-Yamacall association, 0 to 15 percent slopes-----	6,607	0.2
1052B	Elloam-Thoeny association, 0 to 6 percent slopes-----	20,980	0.7
1059E	Weingart-Vaeda-Bascovy association, 4 to 25 percent slopes-----	9,055	0.3
1066D	Twilight-Cabbart-Marmarth association, 4 to 15 percent slopes-----	6,563	0.2
1090B	Harlake-Marvan association, 0 to 4 percent slopes-----	27,317	0.9
1221F	Hillon-Kevin association, 15 to 45 percent slopes-----	86,012	2.7
1251E	Neldore-Bascovy association, 8 to 35 percent slopes-----	117,060	3.6
1261B	Absher-Nobe clays, 0 to 4 percent slopes-----	1,269	*
1262A	Toston-Nobe complex, 0 to 2 percent slopes-----	2,664	*
1332C	Phillips-Elloam-Thoeny association, 0 to 8 percent slopes-----	55,281	1.7
1333C	Kevin-Phillips-Elloam association, 2 to 15 percent slopes-----	12,719	0.4
1373C	Evanston-Chinook-Marmarth association, 0 to 8 percent slopes-----	2,146	*
1392B	Creed-Gerdrum-Absher association, 0 to 4 percent slopes-----	6,297	0.2
1400F	Rock outcrop-Arsite association, 8 to 60 percent slopes-----	16,835	0.5
1441D	Kevin-Scobey-Phillips association, 2 to 15 percent slopes-----	132,313	4.1
1443E	Kevin-Scobey-Nishon association, 0 to 25 percent slopes-----	32,569	1.0
1503D	Telstad-Joplin association, 0 to 15 percent slopes-----	9,391	0.3
1523C	Elloam-Phillips-Absher association, 0 to 8 percent slopes-----	74,371	2.3
1850F	Cabbart-Twilight-Delpoint association, 25 to 70 percent slopes-----	5,365	0.2
1920F	Sunburst-Neldore association, 15 to 45 percent slopes-----	66,650	2.1
1970F	Neldore-Bascovy-Rock outcrop association, 8 to 60 percent slopes-----	128,865	4.0
1971F	Yawdim-Cabbart-Rock outcrop association, 25 to 70 percent slopes-----	55,771	1.7
1972F	Volborg-Rock outcrop association, 8 to 45 percent slopes-----	28,956	0.9
1973F	Neldore, cool-Neldore-Rock outcrop association, 15 to 60 percent slopes--	41,377	1.3
1976F	Neldore-Pinebreaks-Bascovy association, 15 to 60 percent slopes-----	9,602	0.3
1977F	Volborg-Pinebreaks-Rock outcrop association, 15 to 60 percent slopes----	35,509	1.1
2972F	Volborg-Neldore-Rock outcrop association, 15 to 60 percent slopes-----	31,281	1.0
W	Water-----	47,700	1.5
	Total-----	3,212,200	100.0

\* Less than 0.1 percent.

## 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 (USDA-SCS, 1993). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (USDA-SCS, 1975). 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, are mapped without areas of minor components of other taxonomic classes. Consequently, map units are made up of the soils or miscellaneous areas for which they are named and

some areas of minor components that belong to other taxonomic classes.

Minor components have properties and behavioral characteristics divergent enough to affect use or to require different management. 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. A few areas of minor components 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 minor components 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, Hillon cobbly loam is a phase of the Hillon series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, 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. Hillon-Kevin complex, 8 to 15 percent slopes is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Marvan-Gerdrum association, 2 to 15 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.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop 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.

## Absher Series

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

*Drainage class:* Moderately well drained

*Permeability:* Very slow: .06 inch/hour)

*Landform:* Alluvial fans, stream terraces, drainageways, till plains

*Parent material:* Alluvium, till

*Slope range:* 0 to 8 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Typic Natriboralfs

## Typical Pedon

Absher clay, in an area of Elloam-Absher complex, 0 to 4 percent slopes, in rangeland, 2,500 feet north and 600 feet east of the southwest corner of sec. 20, T. 24 N., R. 30 E.

- E—0 to 1 inch; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; vesicular crust; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine and few medium vesicular pores; slightly alkaline; abrupt smooth boundary.
- Btn—1 to 9 inches; brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) moist; moderate medium columnar structure parting to moderate fine and medium subangular blocky; very hard, firm, very sticky and plastic; few fine and very fine roots; few very fine tubular pores; many skeletons on tops of columns and on faces of peds in upper part; common distinct clay films on faces of peds; 5 percent pebbles; moderately alkaline; clear smooth boundary.
- Btkn—9 to 14 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, sticky and plastic; few fine and very fine roots; common very fine tubular pores; few faint clay films on faces of peds; few fine irregular masses of lime; 5 percent pebbles; violently effervescent; moderately alkaline; clear wavy boundary.
- Bknyz—14 to 42 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few fine and very fine roots; common very fine tubular pores; common fine masses of lime, gypsum, and other salts; 10 percent pebbles; strongly effervescent; moderately alkaline; clear irregular boundary.

Bnyz—42 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong coarse prismatic structure parting to strong fine and medium angular blocky; very hard, friable, sticky and plastic; few very fine tubular pores;

common fine masses of gypsum crystals and other salts; 5 percent pebbles; slightly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to Btkn horizon:* 6 to 20 inches

#### *E horizon*

Hue: 2.5Y to 7.5YR  
 Value: 6 or 7 dry; 3 to 5 moist  
 Chroma: 1 to 3  
 Texture: loam (where mixed with the Bt horizon, textures are mainly clay loam or clay)  
 Clay content: 20 to 55 percent  
 Rock fragments: 0 to 30 percent pebbles, 0 to 5 percent cobbles  
 Electrical conductivity: 4 to 8 mmhos/cm  
 Reaction: pH 6.6 to 8.4

#### *Btn horizon*

Hue: 2.5Y to 7.5YR  
 Value: 4 to 6 dry; 4 or 5 moist  
 Chroma: 1 to 3  
 Texture: silty clay, clay, or clay loam  
 Clay content: 35 to 60 percent  
 Rock fragments: 0 to 15 percent pebbles  
 Electrical conductivity: 8 to 16 mmhos/cm  
 Sodium adsorption ratio: 18 to 70  
 Reaction: pH 6.6 to 9.0

#### *Btkn horizon*

Hue: 2.5Y to 7.5YR  
 Value: 4 to 6 dry; 4 or 5 moist  
 Chroma: 2 or 3  
 Texture: clay loam, clay, or silty clay  
 Clay content: 35 to 50 percent  
 Rock fragments: 0 to 20 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Electrical conductivity: 16 to 30 mmhos/cm  
 Sodium adsorption ratio: 18 to 70  
 Gypsum: 1 to 5 percent  
 Reaction: pH 7.9 to 9.6  
 Note: Some pedons have Btknyz horizons.

#### *Bknyz and Bnyz horizons*

Hue: 2.5Y to 7.5YR  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 to 4  
 Texture: clay loam, silty clay, clay, or silty clay loam  
 Clay content: 35 to 50 percent  
 Rock fragments: 0 to 20 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Electrical conductivity: 16 to 30 mmhos/cm

Sodium adsorption ratio: 18 to 70  
 Gypsum: 1 to 5 percent  
 Reaction: pH 7.9 to 9.6

## 1261B—Absher-Nobe clays, 0 to 4 percent slopes

### Setting

#### *Landform:*

Absher—Alluvial fans and stream terraces  
 Nobe—Alluvial fans and stream terraces

#### *Position on landform:*

Absher—Microlows  
 Nobe—Microhighs

#### *Slope:*

Absher—0 to 4 percent  
 Nobe—0 to 4 percent

#### *Elevation:* 2,170 to 3,400 feet

#### *Mean annual precipitation:* 11 to 14 inches

#### *Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Absher and similar soils: 50 percent  
 Nobe and similar soils: 40 percent

#### Minor Components

Creed and similar soils: 0 to 3 percent  
 Saline and sodic loamy soils: 0 to 3 percent  
 Somewhat poorly drained soils: 0 to 2 percent  
 Poorly drained soils: 0 to 2 percent

### Major Component Description

#### Absher

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.0 inches

#### Nobe

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Arsite Series

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

*Drainage class:* Well drained

*Permeability:* Very slow: .06 inch/hour

*Landform:* Hills

*Parent material:* Shale residuum

*Slope range:* 8 to 60 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Clayey, montmorillonitic, nonacid, frigid, shallow Aridic Ustorthents

### Typical Pedon

Arsite clay, in an area of Rock outcrop-Arsite association, 8 to 60 percent slopes, in rangeland, 1,500 feet north and 1,200 feet east of the southwest corner of sec. 7, T. 22 N., R. 32 E.

A—0 to 3 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive when dry and strong fine granular structure when moist; very hard, firm, very sticky and very plastic; few fine and very fine roots; few very fine masses of salt crystals; slightly acid; clear wavy boundary.

Cyz1—3 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive when dry and strong fine and medium granular structure when moist; very hard, firm, very sticky and very plastic; few fine and very fine roots; many very fine tubular pores; few fine masses of gypsum crystals and other salts; 10 percent soft shale chips; moderately acid; gradual wavy boundary.

Cyz2—13 to 19 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive

when dry and strong fine and medium granular structure when moist; hard, firm, very sticky and very plastic; few fine and very fine roots; common very fine tubular pores; few medium gypsum crystals, few fine masses of other salts; 50 percent soft shale chips; moderately acid; gradual wavy boundary.

Cr—19 to 60 inches; grayish brown (2/5Y 5/2) shale, dark grayish brown (2/5Y 4/2) moist; moderately acid.

### Range in Characteristics

*Soil temperature:* 43 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Cr horizon:* 10 to 20 inches

*Note:* The dark colors in the C horizon are lithochromic.

#### A horizon

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 40 to 60 percent

Electrical conductivity: 8 to 16 mmhos/cm

Reaction: pH 6.1 to 7.8

#### Cyz1 horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: clay or silty clay

Clay content: 40 to 60 percent

Electrical conductivity: 12 to 18 mmhos/cm

Reaction: pH 5.6 to 7.3

#### Cyz2 horizon

Hue: 10YR, 2.5Y, or 5Y

Value: 5 or 6 dry; 3, 4, or 5 moist

Chroma: 2 or 3

Texture: silty clay or clay

Clay content: 40 to 60 percent

Coarse fragments: 30 to 50 percent soft shale fragments

Electrical conductivity: 12 to 18 mmhos/cm

Reaction: pH 5.6 to 7.8

### Assinniboine Series

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour)

*Landform:* Alluvial fans, stream terraces

*Parent material:* Alluvium

*Slope range:* 2 to 8 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Aridic  
Argiborolls

### Typical Pedon

Assinniboine fine sandy loam, 2 to 8 percent slopes, in rangeland, 300 feet south and 900 feet east of the northwest corner of sec. 20, T. 29 N., R. 32 E.

A—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine roots; many very fine tubular pores; neutral; clear smooth boundary.

Bt1—6 to 12 inches; yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; common distinct clay films on faces of peds; neutral; clear wavy boundary.

Bt2—12 to 16 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very friable, slightly sticky and nonplastic; common fine and very fine roots; many very fine tubular pores; few faint clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk1—16 to 34 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine tubular pores; 2 percent pebbles; few fine masses of lime, common distinct lime coatings on lower surfaces of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—34 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine irregular pores; 2 percent pebbles; few fine masses of lime, common distinct lime coatings on lower surfaces of rock fragments; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 43 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 16 inches

*Depth to the Bk horizon:* 10 to 25 inches

*A horizon*

Hue: 10YR or 2.5Y

Chroma: 2 or 3

Rock fragments: 0 to 15 percent pebbles

Clay content: 5 to 15 percent

Reaction: pH 6.1 to 7.8

*Bt horizons*

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: sandy clay loam or fine sandy loam

Clay content: 18 to 30 percent

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.6 to 7.8

*Bk1 horizon*

Hue: 2.5Y or 10YR

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: sandy loam, fine sandy loam, or sandy clay loam

Clay content: 10 to 27 percent

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

Note: Some pedons have a Btk horizon.

*Bk2 horizon*

Hue: 2.5Y or 10YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2, 3, or 4

Texture: fine sandy loam, sandy loam, loamy fine sand, or fine sand, or stratifications of these textures

Clay content: 0 to 15 percent

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 8.4

### 35C—Assinniboine fine sandy loam, 2 to 8 percent slopes

#### Setting

*Landform:* Alluvial fans and stream terraces

*Slope:* 2 to 8 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Assinniboine and similar soils: 90 percent

#### Minor Components

Fortbenton and similar soils: 0 to 5 percent  
 Loam surface layers: 0 to 3 percent  
 Saline and sodic soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Fine sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 6.9 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Attewan Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour) above 29 inches; rapid (6.0 to 20.0 inches/hour) below  
*Landform:* Stream terraces, outwash plains  
*Parent material:* Alluvium, glacial outwash  
*Slope range:* 0 to 8 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls

### Typical Pedon

Attewan loam, in an area of Attewan-Beaverell complex, 0 to 8 percent slopes, in cropland, 1,400

feet west and 2,200 feet north of the southeast corner of sec. 5, T. 28 N., R. 31 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; 10 percent pebbles; neutral; abrupt smooth boundary.

Bt—6 to 17 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; common faint clay films on faces of peds; 5 percent pebbles; slightly alkaline; clear wavy boundary.

Bk—17 to 29 inches; light brownish gray (2.5Y 6/2) clay loam; dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; common fine masses of lime, disseminated lime; 10 percent pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk—29 to 60 inches; light brownish gray (2.5Y 6/2) very gravelly loamy sand; dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; 40 percent pebbles; common distinct lime coatings on lower surfaces of rock fragments; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Mollic epipedon thickness:* 7 to 12 inches  
*Depth to Bk horizon:* 10 to 21 inches  
*Depth to 2Bk horizon:* 20 to 40 inches

#### Ap horizon

Hue: 10YR or 2.5Y  
 Value: 4 or 5 dry; 2 or 3 moist  
 Chroma: 2 or 3  
 Clay content: 10 to 20 percent  
 Rock fragments: 0 to 15 percent-0 to 5 percent cobbles; 0 to 15 percent pebbles  
 Reaction: pH 6.1 to 7.3

#### Bt horizon

Hue: 10YR or 2.5Y  
 Value: 4 to 6 dry; 3 or 4 moist  
 Chroma: 2 or 3

Texture: clay loam, sandy clay loam, or loam  
 Clay content: 20 to 35 percent  
 Rock fragments: 0 to 25 percent-0 to 5 percent  
 cobbles; 0 to 20 percent pebbles  
 Reaction: pH 6.6 to 7.8

*Bk horizon*

Hue: 10YR or 2.5Y  
 Value: 5 to 8 dry; 4 to 6 moist  
 Chroma: 2 to 6  
 Texture: loam, clay loam, sandy clay loam, or sandy  
 loam  
 Clay content: 15 to 30 percent  
 Rock fragments: 0 to 30 percent-0 to 5 cobbles; 0 to  
 25 percent pebbles  
 Calcium carbonate equivalent: 10 to 15 percent  
 Reaction: pH 7.4 to 8.4

*2Bk horizon*

Hue: 2.5Y or 10YR  
 Value: 4 to 6 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: loamy sand, sand, loamy coarse sand, or  
 coarse sand  
 Clay content: 0 to 10 percent  
 Rock fragments: 35 to 75 percent-0 to 15 percent  
 cobbles; 35 to 60 percent pebbles  
 Calcium carbonate equivalent: 5 to 10 percent  
 Reaction: pH 7.4 to 8.4

### 110C—Attewan-Beaverell complex, 0 to 8 percent slopes

#### Setting

*Landform:*

Attewan—Stream terraces and outwash plains  
 Beaverell—Stream terraces and outwash plains

*Position on landform:*

Attewan—Foothills and toeslopes  
 Beaverell—Backslopes and shoulders

*Slope:*

Attewan—0 to 8 percent  
 Beaverell—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Attewan and similar soils: 50 percent  
 Beaverell and similar soils: 35 percent

##### Minor Components

Evanston and similar soils: 0 to 8 percent  
 Very gravelly surface layers: 0 to 5 percent  
 Creed and similar soils: 0 to 1 percent  
 Gerdrum and similar soils: 0 to 1 percent

#### Major Component Description

##### Attewan

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 5.2 inches

##### Beaverell

*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:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

##### Barkof Series

*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Permeability:* Very slow: .06 inch/hour)  
*Landform:* Sedimentary plains, hills  
*Parent material:* Shale residuum  
*Slope range:* 2 to 25 percent  
*Annual precipitation:* 14 to 17 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Fine, montmorillonitic, frigid  
 Leptic Udic Haplusterts

### Typical Pedon

Barkof clay, in an area of Barkof-Windham complex, 8 to 25 percent slopes, in rangeland, 2,100 feet north and 200 feet west of the southeast corner of sec. 25, T. 25 N., R. 25 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; hard, friable, very sticky and very plastic; many fine and very fine and few medium roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bss—4 to 17 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, very sticky and very plastic; many fine and very fine and few medium roots; common very fine tubular pores; few intersecting slickensides; strongly effervescent; moderately alkaline; clear wavy boundary.

Bkss—17 to 29 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine and very fine and few medium roots; few very fine tubular pores; few intersecting slickensides; few fine and medium masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cr—29 to 60 inches; light brownish gray (2.5Y 6/2) semiconsolidated shale, dark grayish brown (2.5Y 4/2) moist; few very fine roots in upper part; few fine and medium masses of gypsum crystals; slightly alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Cr horizon:* 20 to 40 inches

*Note:* In most years, this soil has 1/4- to 2-inch cracks that extend from the surface to 20 or 30 inches from late June through September.

Intersecting slickensides and pressure faces are faint to prominent.

#### *A horizon*

Hue: 5Y to 10YR

Value: 4 or 5 dry, 4 or 5 moist

Chroma: 2 to 4

Clay content: 45 to 55 percent

Rock fragments: 0 to 15 percent-0 to 5 cobbles, 0 to 15 percent pebbles

Reaction: pH 6.6 to 8.4

#### *Bss, Bkss horizons*

Hue: 5Y to 10YR

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Texture: clay or silty clay

Clay content: 45 to 60 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 6.6 to 9.0

Note: Some pedons have a By horizon with 1 to 3 percent gypsum and 0 to 20 percent soft shale fragments.

### 10C—Barkof clay, 2 to 8 percent slopes

#### Setting

*Landform:* Sedimentary plains

*Slope:* 2 to 8 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

#### Composition

#### Major Components

Barkof and similar soils: 85 percent

#### Minor Components

Shallow clayey soils: 0 to 10 percent

Deep or very deep clayey soils: 0 to 5 percent

#### Major Component Description

*Surface layer texture:* Clay

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 101E—Barkof-Windham complex, 8 to 25 percent slopes

#### Setting

##### *Landform:*

Barkof—Hills  
Windham—Hills

##### *Position on landform:*

Barkof—Backslopes and footslopes  
Windham—Shoulders and summits

##### *Slope:*

Barkof—8 to 25 percent  
Windham—8 to 25 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

#### Composition

##### Major Components

Barkof and similar soils: 55 percent  
Windham and similar soils: 30 percent

##### Minor Components

Shallow clayey soils: 0 to 5 percent  
Slopes greater than 25 percent: 0 to 5 percent  
Soils with ponderosa pine: 0 to 3 percent  
Judith and similar soils: 0 to 2 percent

#### Major Component Description

##### Barkof

*Surface layer texture:* Clay

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 4.4 inches

##### Windham

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Limestone alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Bascovy Series

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Permeability:* Very slow: .06 inch/hour)

*Landform:* Hills, sedimentary plains

*Parent material:* Shale residuum

*Slope range:* 2 to 45 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic, frigid  
Leptic Udic Haplusterts

#### Typical Pedon

Bascovy clay, in an area of Bascovy-Neldore-Weingart clays, 8 to 25 percent slopes, in rangeland, 2,000 feet west and 100 feet south of the northeast corner of sec. 11, T. 31 N., R. 26 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; hard, friable, very sticky and very plastic; many fine and very fine roots; slightly alkaline; clear smooth boundary.

Bss—4 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; extremely hard, firm, very sticky and very plastic; common fine and very fine roots; few very fine tubular pores; few intersecting slickensides; slightly effervescent in spots; slightly alkaline; gradual wavy boundary.

**Bssy**—15 to 28 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few intersecting slickensides; 40 percent soft shale chips; few fine masses of gypsum crystals; common fine yellowish brown (10YR 5/4) iron stains; neutral; gradual wavy boundary.

**Cr**—28 to 60 inches; grayish brown (2.5Y 5/2) semiconsolidated shale, dark grayish brown (2.5Y 4/2) moist; few fine masses of gypsum crystals; common fine dark yellowish brown (10YR 4/6) iron stains; neutral.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to Cr horizon:* 20 to 40 inches  
*Note:* Some pedons have a B<sub>y</sub> or C horizon.

#### A horizon

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 3 to 5 moist  
 Chroma: 2 or 3  
 Clay content: 40 to 60 percent  
 Reaction: pH 6.6 to 8.4

#### B<sub>ss</sub> horizon

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 or 5 moist  
 Chroma: 2 or 3  
 Texture: clay or silty clay  
 Clay content: 40 to 60 percent  
 Reaction: pH 6.1 to 8.4

#### B<sub>ssy</sub> horizon

Hue: 10YR to 5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 or 3  
 Texture: clay or silty clay  
 Clay content: 40 to 60 percent  
 Electrical conductivity: 0 to 4 mmhos/cm  
 Sodium adsorption ratio: 10 to 13  
 Gypsum: 1 to 5 percent  
 Reaction: 5.1 to 8.4

## 25C—Bascovy clay, 2 to 8 percent slopes

### Setting

*Landform:* Sedimentary plains  
*Slope:* 2 to 8 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Bascovy and similar soils: 90 percent

#### Minor Components

Neldore and similar soils: 0 to 5 percent  
 Marvan and similar soils: 0 to 3 percent  
 Mego not and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 251C—Bascovy-Neldore clays, 2 to 8 percent slopes

### Setting

#### Landform:

Bascovy—Sedimentary plains  
 Neldore—Sedimentary plains

#### Position on landform:

Bascovy—Backslopes and footslopes  
 Neldore—Backslopes and shoulders

#### Slope:

Bascovy—2 to 8 percent  
 Neldore—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Bascovy and similar soils: 55 percent

Neldore and similar soils: 30 percent

### Minor Components

Marvan and similar soils: 0 to 10 percent

Weingart and similar soils: 0 to 3 percent

Very shallow soils: 0 to 2 percent

### Major Component Description

#### Bascovy

*Surface layer texture:* Clay

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 4.3 inches

#### Neldore

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 2.2 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 250E—Bascovy-Neldore-Weingart clays, 8 to 25 percent slopes

### Setting

*Landform:*

Bascovy—Hills

Neldore—Hills

Weingart, thin—Hills

*Position on landform:*

Bascovy—Backslopes and footslopes

Neldore—Backslopes and shoulders

Weingart, thin—Microlows

*Slope:*

Bascovy—8 to 25 percent

Neldore—8 to 25 percent

Weingart, thin—8 to 15 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Bascovy and similar soils: 40 percent

Neldore and similar soils: 30 percent

Weingart, Thin and similar soils: 20 percent

### Minor Components

Marvan and similar soils: 0 to 5 percent

Strongly saline soils: 0 to 2 percent

Strongly sodic soils: 0 to 1 percent

Slopes less than 8 percent: 0 to 2 percent

### Major Component Description

#### Bascovy

*Surface layer texture:* Clay

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 4.3 inches

#### Neldore

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 2.2 inches

#### Weingart, thin

*Surface layer texture:* Clay

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Beaverell Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour) above 13 inches; rapid (6.0 to 20.0 inches/hour) below  
*Landform:* Stream terraces, outwash plains, kames and eskers  
*Parent material:* Alluvium, glacial outwash  
*Slope range:* 0 to 25 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Loamy-skeletal over sandy or sandy-skeletal, mixed Aridic Argiborolls

### Typical Pedon

Beaverell gravelly loam, in an area of Attewan-Beaverell complex, 0 to 8 percent slopes, in rangeland, 800 feet east and 600 feet south of the northwest corner of sec. 4, T. 25 N., R. 27 E.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 10 percent cobbles and 20 percent pebbles; slightly alkaline; clear wavy boundary.

Bt1—4 to 9 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; common very fine tubular pores; common faint clay films on faces of peds; 40 percent pebbles; neutral; clear wavy boundary.

Bt2—9 to 13 inches; brown (10YR 5/3) very gravelly sandy clay loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, very friable, sticky and plastic; common fine and very fine roots; many very fine and few fine tubular pores; common faint clay films on faces of peds and bridging sand grains; 40 percent pebbles; neutral; clear wavy boundary.

2Bk1—13 to 35 inches; pale brown (10YR 6/3) extremely gravelly sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many fine and very fine irregular pores; continuous prominent lime coatings on lower surfaces of rock fragments; violently effervescent; 20 percent cobbles and 45 percent pebbles; moderately alkaline; gradual wavy boundary.

2Bk2—35 to 60 inches; pale brown (10YR 6/3) extremely gravelly coarse sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; many fine and very fine irregular pores; common distinct lime coatings on lower surfaces of rock fragments; strongly effervescent; 20 percent cobbles and 45 percent pebbles; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Mollic epipedon thickness:* 7 to 14 inches and may include all or part of the argillic horizon.  
*Depth to 2Bk horizon:* 10 to 20 inches  
*Note:* Some pedons have a 2C horizon.

#### A horizon

Value: 2 or 3 moist  
 Chroma: 2 or 3  
 Clay content: 10 to 27 percent  
 Rock fragments: 15 to 35 percent-0 to 10 percent cobbles, 15 to 35 percent pebbles  
 Reaction: pH 6.6 to 7.8

#### Bt1 horizon

Hue: 10YR or 7.5YR  
 Value: 3 to 5 dry; 2 to 4 moist  
 Chroma: 2 to 4  
 Texture: clay loam, sandy clay loam, or loam  
 Clay content: 20 to 35 percent  
 Rock fragments: 35 to 60 percent-0 to 15 percent cobbles, 35 to 45 percent pebbles  
 Reaction: pH 6.6 to 7.8

#### Bt2 horizon

Hue: 10YR or 2.5Y

Value: 3 to 5 dry; 2 to 4 moist  
 Chroma: 2 to 6  
 Texture: clay loam, sandy clay loam, or loam  
 Clay content: 20 to 35 percent  
 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 2.5Y  
 Value: 5 to 8 dry; 4 to 6 moist  
 Chroma: 2 to 4  
 Texture: loamy sand or sand  
 Clay content: 0 to 5 percent  
 Rock fragments: 35 to 75 percent-5 to 30 percent  
 cobbles, 30 to 45 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.4 to 8.4

*2Bk2 horizon*

Hue: 10YR or 2.5Y  
 Value: 4 to 6 dry; 4 to 6 moist  
 Chroma: 2 to 6  
 Texture: loamy sand, sand, loamy coarse sand, or  
 coarse sand  
 Clay content: 0 to 5 percent  
 Rock fragments: 35 to 80 percent-5 to 30 percent  
 cobbles and stones, 30 to 60 percent pebbles  
 Calcium carbonate equivalent: 2 to 10 percent  
 Reaction: pH 7.4 to 8.4

## 271D—Beaverell-Evanston complex, 8 to 15 percent slopes

### Setting

*Landform:*

Beaverell—Kames and eskers  
 Evanston—Alluvial fans and stream terraces

*Position on landform:*

Beaverell—Backslopes and shoulders  
 Evanston—Footslopes and toeslopes

*Slope:*

Beaverell—8 to 15 percent  
 Evanston—8 to 15 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Beaverell and similar soils: 55 percent  
 Evanston and similar soils: 35 percent

#### Minor Components

Tinsley and similar soils: 0 to 5 percent  
 Very cobbly surface layers: 0 to 3 percent  
 Ethridge and similar soils: 0 to 2 percent

### Major Component Description

#### Beaverell

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Glacial outwash  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.7 inches

#### Evanston

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 10.1 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 270E—Beaverell-Tinsley complex, 15 to 45 percent slopes

### Setting

*Landform:*

Beaverell—Kames and eskers  
 Tinsley—Kames and eskers

*Position on landform:*

Beaverell—Backslopes and footslopes  
 Tinsley—Backslopes and shoulders

*Slope:*

Beaverell—15 to 25 percent  
 Tinsley—15 to 45 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Beaverell and similar soils: 60 percent  
 Tinsley and similar soils: 30 percent

#### Minor Components

Very cobbly surface layers: 0 to 5 percent  
 Slopes less than 15 percent: 0 to 3 percent  
 Hillon and similar soils: 0 to 2 percent

### Major Component Description

#### Beaverell

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Glacial outwash  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.7 inches

#### Tinsley

*Surface layer texture:* Gravelly sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Dominant parent material:* Glacial outwash  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 1.2 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Beaverton Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour) above 18 inches; rapid (6.0 to 20.0 inches/hour) below  
*Landform:* Stream terraces  
*Parent material:* Alluvium

*Slope range:* 0 to 4 percent  
*Annual precipitation:* 14 to 17 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Loamy-skeletal over sandy or sandy-skeletal, mixed Typic Argiborolls

### Typical Pedon

Beaverton gravelly loam, 0 to 4 percent slopes, in rangeland, 650 feet south and 750 feet west of the northeast corner of sec. 3, T. 24 N., R. 24 E.

- A—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine and few medium roots; 15 percent pebbles and 5 percent cobbles; neutral; clear wavy boundary.
- Bt—5 to 13 inches; brown (10YR 4/3) very gravelly clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; common very fine tubular pores; common distinct clay films on faces of peds; 35 percent pebbles and 5 percent cobbles; slightly alkaline; clear wavy boundary.
- Bk—13 to 18 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine roots; many very fine tubular pores; 45 percent pebbles and 10 percent cobbles; disseminated lime, continuous prominent lime coatings on rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.
- 2Bk—18 to 34 inches; light gray (10YR 7/2) extremely gravelly loamy sand, pale brown (10YR 6/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many fine and very fine irregular pores; 60 percent pebbles and 10 percent cobbles; disseminated lime, continuous distinct lime coatings on rock fragments and continuous prominent lime crusts on lower surfaces of rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.
- 2C—34 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonsticky; many fine and very fine irregular pores; 60 percent pebbles and 10 percent

cobbles; disseminated lime, common distinct lime coatings on lower surfaces of rock fragments; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Mollic epipedon thickness:* 7 to 14 inches (may include all or part of the Bt horizons)

*Depth to Bk horizon:* 10 to 20 inches

*Note:* The Beaverton soils in Phillips County have a Bk horizon with more than 15 percent calcium carbonate equivalent which is outside the range defined for the series. This does not significantly affect the use or management of the soil.

#### *A horizon*

Hue: 2.5Y to 7.5YR

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 15 to 27 percent

Rock fragments: 15 to 35 percent-0 to 5 percent cobbles, 15 to 30 percent pebbles

Reaction: pH 6.6 to 7.8

#### *Bt horizon*

Hue: 2.5Y to 7.5YR

Value: 4 or 5 dry; 2 to 4 moist

Chroma: 2 or 3

Texture: clay loam or sandy clay loam

Clay content: 25 to 35 percent

Rock fragments: 35 to 60 percent-0 to 30 percent cobbles, 15 to 45 percent pebbles

Reaction: pH 6.6 to 7.8

#### *Bk horizon*

Hue: 2.5Y to 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: sandy loam or sandy clay loam

Clay content: 18 to 25 percent

Rock fragments: 35 to 60 percent-0 to 30 percent cobbles, 15 to 45 percent pebbles

Calcium carbonate equivalent: 15 to 25 percent

Reaction: pH 7.4 to 8.4

#### *2Bk horizon*

Hue: 2.5Y to 7.5YR

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loamy sand or sand

Clay content: 0 to 10 percent

Rock fragments: 35 to 80 percent-0 to 35 percent cobbles, 15 to 60 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

#### *2C horizon*

Hue: 2.5Y to 7.5YR

Value: 5 or 6 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loamy sand or sand

Clay content: 0 to 10 percent

Rock fragments: 35 to 80 percent-0 to 5 percent stones, 0 to 35 percent cobbles, 15 to 65 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

## 13B—Beaverton gravelly loam, 0 to 4 percent slopes

### Setting

*Landform:* Stream terraces

*Slope:* 0 to 4 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 100 days

### Composition

#### Major Components

Beaverton and similar soils: 85 percent

#### Minor Components

Beaverton very cobbly loam: 0 to 10 percent

Binna and similar soils: 0 to 5 percent

### Major 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:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Benz Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Alluvial fans, stream terraces

*Parent material:* Alluvium

*Slope range:* 0 to 4 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed (calcareous), frigid Aridic Ustorthents

### Typical Pedon

Benz clay loam, in an area of Benz-Vanda complex, 0 to 4 percent slopes, in rangeland, 1,600 feet east and 2,300 feet north of the southwest corner of sec. 19, T. 25 N., R. 28 E.

- A—0 to 3 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium granular structure; hard, very friable, sticky and plastic; few fine and very fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.
- C1—3 to 15 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; hard, friable, sticky and slightly plastic; few fine and very fine roots; many very fine tubular pores; disseminated lime, few fine masses of lime; common fine masses of gypsum crystals; violently effervescent; strongly alkaline; clear wavy boundary.
- C2—15 to 29 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; disseminated lime, few fine masses of lime; common fine masses of gypsum crystals; violently effervescent; strongly alkaline; gradual wavy boundary.
- C3—29 to 60 inches; light brownish gray (2.5Y 6/2) clay loam with thin lenses of fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; disseminated lime; many fine seams and masses of gypsum and other salt crystals; violently effervescent; strongly alkaline.

## Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Note:* The surface is crusted and is hard or very hard when dry.

### A horizon

Hue: 2.5Y or 10YR

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 27 to 35 percent

Electrical conductivity: 4 to 8 mmhos/cm

Sodium adsorption ratio: 4 to 13

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 9.0

### C horizons

Hue: 5Y to 10YR

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: loam, clay loam, silt loam, or fine sandy loam or stratifications of these textures

Clay content: 18 to 35 percent

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Calcium carbonate equivalent: 5 to 15 percent

Gypsum content: 2 to 5 percent

Reaction: pH 8.5 to 9.6

## 241B—Benz-Vanda complex, 0 to 4 percent slopes

### Setting

#### Landform:

Benz—Alluvial fans and stream terraces

Vanda—Alluvial fans and stream terraces

#### Slope:

Benz—0 to 4 percent

Vanda—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Benz and similar soils: 60 percent

Vanda and similar soils: 30 percent

### Minor Components

Strongly sodic surface layers: 0 to 5 percent  
 Gerdrum and similar soils: 0 to 3 percent  
 Slightly saline soils: 0 to 1 percent  
 Slightly sodic soils: 0 to 1 percent

### Major Component Description

#### Benz

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.4 inches

#### Vanda

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Bigzag Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Poorly drained  
*Permeability:* Very slow: .06 inch/hour)  
*Landform:* Flood plains  
*Parent material:* Glaciolacustrine deposits  
*Slope range:* 0 to 2 percent  
*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic (calcareous), frigid Typic Halaquepts

### Typical Pedon

Bigzag clay, 0 to 2 percent slopes, in rangeland, 2,100 feet west and 1,700 feet south of the northeast corner of sec. 5, T. 30 N., R. 31 E.

Anyz—0 to 3 inches; dark grayish brown (2.5Y 4/2) clay, grayish brown (2.5Y 5/2) dry; strong fine granular structure; very hard, friable, sticky and plastic; common fine and very fine and few medium roots; few fine masses of gypsum and other salt crystals when dry; slightly effervescent; moderately alkaline; clear smooth boundary.

Bknyzg1—3 to 9 inches; dark grayish brown (2.5Y 4/2) clay, light brownish gray (2.5Y 6/2) dry; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine and few medium roots; few very fine tubular pores; few fine distinct light yellowish brown (2.5Y 5/4) dry redox concentrations; few fine seams of lime; many fine masses of gypsum and other salt crystals when dry; strongly effervescent; strongly alkaline; clear wavy boundary.

Bknyzg2—9 to 20 inches; dark grayish brown (2.5Y 4/2) clay loam, light brownish gray (2.5Y 6/2) dry; massive; very hard, friable, sticky and plastic; few very fine roots; few very fine tubular pores; few fine faint light yellowish brown (2.5Y 6/4) dry redox concentrations; few fine seams of lime; many fine masses of gypsum and other salt crystals when dry; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bnyzg—20 to 60 inches; dark grayish brown (2.5Y 4/2) clay loam, light brownish gray (2.5Y 6/2) dry; massive; extremely hard, friable, sticky and plastic; few very fine tubular pores; few medium faint light yellowish brown (2.5Y 6/4) dry redox concentrations; few fine seams of gypsum crystals; many fine masses of other salt crystals when dry; strongly effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 44 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches

*Depth to seasonal high water table:* 12 to 24 inches  
*Depth to redox concentrations:* 3 to 20 inches

*Anyz horizon*

Hue: 10YR, 2.5Y, or 5Y  
 Value: 5 or 6 dry, 3 or 4 moist  
 Chroma: 1 or 2  
 Clay content: 40 to 60 percent  
 Electrical conductivity: greater than 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 20  
 Calcium carbonate equivalent: 1 to 5 percent  
 Reaction: pH 7.9 to 9.0

*Bknyzg1 horizon*

Hue: 2.5Y or 5Y  
 Value: 5 or 6 dry, 4 or 5 moist  
 Chroma: 1 or 2  
 Redox concentrations: none to common—Chroma: 3 or 4  
 Texture: silty clay loam, clay loam, silty clay, or clay  
 Clay content: 35 to 60 percent  
 Electrical conductivity: greater than 16 mmhos/cm  
 Sodium adsorption ratio: 20 to 40  
 Gypsum: 3 to 5 percent  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 8.5 to 9.0

*Bknyzg2 and Bnyzg horizons*

Hue: 2.5Y or 5Y  
 Value: 5 or 6 dry, 4 or 5 moist  
 Chroma: 1 or 2  
 Redox concentrations: few to many—Hue: 2.5Y or 5Y—Value: 5 or 6 dry, Chroma: 3 or 4  
 Texture: silty clay loam, clay loam, silty clay, or clay  
 Clay content: 35 to 60 percent  
 Electrical conductivity: greater than 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 30, decreasing with depth  
 Gypsum: 3 to 5 percent  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 8.5 to 9.0

**481A—Bigzag clay, 0 to 2 percent slopes**

**Setting**

*Landform:* Flood plains  
*Slope:* 0 to 2 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

**Composition**

**Major Components**

Bigzag and similar soils: 90 percent

**Minor Components**

Poorly drained loamy soils: 0 to 3 percent  
 Moderately well drained soils: 0 to 3 percent  
 Slightly saline soils: 0 to 2 percent  
 Slightly sodic soils: 0 to 2 percent

**Major Component Description**

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Poorly drained  
*Dominant parent material:* Glaciolacustrine deposits  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Water table:* Apparent  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 5.1 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**Binna Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour) in the upper 20 inches; rapid (2.0 to 6.0 inches/hour) below  
*Landform:* Alluvial fans  
*Parent material:* Alluvium  
*Slope range:* 0 to 4 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy over sandy or sandy-skeletal, mixed Aridic Calciborolls

### Typical Pedon

Binna loam, in an area of Binna-Saypo complex, 0 to 4 percent slopes, in rangeland, 1,200 feet west and 700 feet north of the southeast corner of sec. 4, T. 36 N., R. 28 E.

A—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; 5 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk—8 to 20 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine tubular pores; 5 percent pebbles; many medium masses of lime; violently effervescent; strongly alkaline; abrupt wavy boundary.

2C—20 to 60 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; 40 percent pebbles; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 10 inches

*Depth to 2C horizon:* 20 to 40 inches

#### *A horizon*

Hue: 10YR or 2.5Y

Value: 4 or 5 dry (value dry is 5 when mixed to 7 inches)

Chroma: 2 or 3

Clay content: 15 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 8.4

#### *Bk horizon*

Hue: 10YR or 2.5Y

Value: 7 or 8 dry, 5 or 6 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Rock fragments: 0 to 30 percent-0 to 10 percent cobbles, 0 to 20 percent pebbles

Calcium carbonate equivalent: 15 to 30 percent

Reaction: pH 7.9 to 9.0

#### *2C horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry, 5 or 6 moist

Chroma: 2 to 4

Texture: sand or loamy sand

Clay content: 0 to 10 percent

Rock fragments: 35 to 80 percent-5 to 15 percent cobbles, 30 to 65 percent pebbles

Calcium carbonate equivalent: 5 to 20 percent

Reaction: pH 7.9 to 9.0

### 180B—Binna-Saypo complex, 0 to 4 percent slopes

#### Setting

##### *Landform:*

Binna—Alluvial fans

Saypo—Stream terraces

##### *Slope:*

Binna—0 to 4 percent

Saypo—0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Binna and similar soils: 55 percent

Saypo and similar soils: 30 percent

##### Minor Components

Sandy loam surface layers: 0 to 5 percent

Moderately saline soils: 0 to 5 percent

Moderately sodic soils: 0 to 3 percent

Poorly drained soils: 0 to 2 percent

#### Major Component Description

##### Binna

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 4.4 inches

##### Saypo

*Surface layer texture:* Clay loam

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

*Drainage class:* Somewhat poorly drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Water table:* Apparent  
*Available water capacity:* Mainly 7.5 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Bowdoin Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Very slow: .06 inch/hour  
*Landform:* Flood plains  
*Parent material:* Glaciolacustrine deposits  
*Slope range:* 0 to 2 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Very-fine, montmorillonitic, frigid  
 Sodic Haplusterts

### Typical Pedon

Bowdoin clay, 0 to 2 percent slopes, in rangeland, 700 feet north and 300 feet east of the southwest corner of sec. 18, T. 30 N., R. 28 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

Bnss1—3 to 14 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, very sticky and very plastic; common very fine roots; few very fine tubular pores; many intersecting slickensides; few fine masses of gypsum crystals; slightly effervescent; strongly alkaline; gradual wavy boundary.

Bnss2—14 to 31 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few intersecting slickensides; few fine masses of gypsum crystals; slightly effervescent; strongly alkaline; gradual wavy boundary.

Bnssy—31 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; extremely hard, extremely firm, very sticky and very plastic; few very fine tubular pores; few intersecting slickensides; common fine masses of gypsum crystals; slightly effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Notes:* Dry bulk density is 1.8. Some pedons have a thin salt crust on the surface. Some pedons are stratified with silt loam and silty clay loam below a depth of about 40 inches.

#### A horizon

Hue: 2.5Y or 5Y

Value: 5 or 6 dry, 4 or 5 moist

Clay content: 50 to 70 percent

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 5 to 13

Calcium carbontae equivalent: 1 to 5 percent

Reaction: pH 7.4 to 9.0

#### Bnss horizons

Hue: 2.5Y or 5Y

Value: 5 or 6 dry, 4 or 5 moist

Clay content: 60 to 80 percent

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Calcium carbontae equivalent: 1 to 5 percent

Reaction: pH 7.4 to 9.0

#### Bnssy horizon

Hue: 2.5Y or 5Y

Value: 5 or 6 dry, 4 or 5 moist

Chroma: 1 or 2

Clay content: 50 to 70 percent

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Gypsum: 1 to 5 percent

Calcium carbontae equivalent: 2 to 10 percent

Reaction: pH 7.9 to 9.0

**93A—Bowdoin clay, 0 to 2 percent slopes****Setting**

*Landform:* Flood plains

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

**Composition****Major Components**

Bowdoin and similar soils: 85 percent

**Minor Components**

Harlake and similar soils: 0 to 5 percent

Strongly saline soils: 0 to 5 percent

Strongly sodic soils: 0 to 4 percent

Poorly drained soils: 0 to 1 percent

**Major Component Description**

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Glaciolacustrine deposits

*Native plant cover type:* Rangeland

*Flooding:* Rare

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 6.9 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**Bullhook Series**

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour)

*Landform:* Flood plains

*Parent material:* Alluvium

*Slope range:* 0 to 2 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed (calcareous), frigid Aridic Ustifluvents

**Typical Pedon**

Bullhook loam, 0 to 2 percent slopes, in rangeland, 1,800 feet south and 1,300 feet west of the northeast corner of sec. 27, T. 30 N., R. 28 E.

A—0 to 4 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, very friable, sticky and slightly plastic; many fine and very fine and few medium roots; slightly effervescent; moderately alkaline; clear smooth boundary.

C—4 to 14 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and slightly plastic; many fine and very fine and few medium roots; common very fine tubular pores; few fine masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cyz1—14 to 30 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; few fine masses of gypsum and other salt crystals; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cyz2—30 to 60 inches; light brownish gray (2.5Y 6/2) clay loam with thin lenses of loam and fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; few fine and medium masses of gypsum and other salt crystals; strongly effervescent; strongly alkaline.

**Range in Characteristics**

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Note:* Gypsum and other salts are inherent in the parent material.

*A horizon*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 15 to 27 percent  
 Electrical conductivity: 2 to 8 mmhos/cm  
 Sodium adsorption ratio: 8 to 13  
 Calcium carbonate equivalent: 0 to 5 percent  
 Reaction: pH 7.4 to 9.4

*C horizon*

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: clay loam, loam, or silty clay loam with or without thin layers of loam, clay, silty clay loam, fine sandy loam, or silt loam

Clay content: 18 to 35 percent  
 Electrical conductivity: 4 to 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 20  
 Calcium carbonate equivalent: 5 to 10 percent  
 Reaction: pH 7.4 to 9.6

*Cyz horizons*

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: clay loam, loam, or silty clay loam with or without thin layers of fine sandy loam, loam, clay loam, silty clay loam, or silt loam

Clay content: 18 to 35 percent  
 Electrical conductivity: 8 to 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 30  
 Gypsum: 2 to 5 percent  
 Calcium carbonate equivalent: 5 to 10 percent  
 Reaction: pH 7.4 to 9.6

**604A—Bullhook loam, 0 to 2 percent slopes**

**Setting**

*Landform:* Flood plains  
*Slope:* 0 to 2 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

**Composition**

**Major Components**

Bullhook and similar soils: 90 percent

**Minor Components**

Havre and similar soils: 0 to 2 percent  
 Harlake and similar soils: 0 to 2 percent  
 Glendive and similar soils: 0 to 2 percent

Strongly saline soils: 0 to 2 percent  
 Strongly sodic soils: 0 to 2 percent

**Major Component Description**

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 8.7 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**Busby Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderately rapid (2.0 to 6.0 inches/hour)  
*Landform:* Alluvial fans, hills  
*Parent material:* Alluvium, eolian material  
*Slope range:* 2 to 15 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

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

**Typical Pedon**

Busby fine sandy loam, 2 to 8 percent slopes, in cropland, 1,500 feet west and 2,100 feet north of the southeast corner of sec. 7, T. 30 N., R. 29 E.

Ap—0 to 3 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, nonsticky and slightly plastic; many fine and very fine roots; slightly alkaline; abrupt smooth boundary.

Bw—3 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2)

moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; slightly alkaline; clear wavy boundary.

**Bk1**—11 to 21 inches; light olive brown (2.5Y 5/4) fine sandy loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and slightly plastic; common very fine roots; many very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

**Bk2**—21 to 31 inches; light yellowish brown (2.5Y 6/4) fine sandy loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; common fine seams and masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

**Bk3**—31 to 60 inches; pale yellow (2.5Y 7/4) fine sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine tubular pores; few fine masses of lime; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 8 and 24 inches

*Depth to Bk horizon:* 10 to 20 inches

#### *Ap horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry, 3 or 4 moist

Chroma: 2 to 4

Clay content: 10 to 18 percent

Reaction: pH 7.4 to 8.4

#### *Bw horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry, 4 or 5 moist

Chroma: 2 to 4

Texture: fine sandy loam, sandy loam, loam

Clay content: 10 to 18 percent

Reaction: pH 7.4 to 8.4

#### *Bk1 and Bk2 horizons*

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: fine sandy loam, sandy loam

Clay content: 10 to 18 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

#### *Bk3 horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: fine sandy loam, sandy loam, loamy fine sand, loamy sand, or fine sand (The loamy fine sand, loamy sand, or fine sand textures are below depths of 40 inches.)

Clay content: 3 to 18 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

## **94C—Busby fine sandy loam, 2 to 8 percent slopes**

### Setting

*Landform:* Alluvial fans

*Slope:* 2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Busby and similar soils: 90 percent

#### Minor Components

Chinook and similar soils: 0 to 3 percent

Busby loam: 0 to 3 percent

Yamacall and similar soils: 0 to 2 percent

Yetull and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Fine sandy loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 6.9 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 94D—Busby fine sandy loam, 8 to 15 percent slopes

#### Setting

*Landform:* Hills  
*Slope:* 8 to 15 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Busby and similar soils: 85 percent

##### Minor Components

Yetull and similar soils: 0 to 7 percent  
 Slopes less than 8 percent: 0 to 5 percent  
 Twilight and similar soils: 0 to 3 percent

#### Major Component Description

*Surface layer texture:* Fine sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium or eolian material  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 6.9 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Cabba Series

*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour)  
*Landform:* Hills

*Parent material:* Interbedded sandstone and shale residuum

*Slope range:* 8 to 25 percent

*Annual precipitation:* 14 to 17 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Loamy, mixed (calcareous), frigid, shallow Typic Ustorthents

#### Typical Pedon

Cabba loam, in an area of Cabba-Windham complex, 8 to 25 percent slopes, in rangeland, 500 feet south and 300 feet east of the northwest corner of sec. 23, T. 25 N., R. 23 E.

A—0 to 4 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk—4 to 14 inches; light yellowish brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; many fine masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Cr—14 to 60 inches; light gray (2.5Y 7/2) interbedded sandstone and shale, light olive brown (2.5Y 5/4) moist; violently effervescent; moderately alkaline.

#### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* 4 to 12 inches

*Depth to Cr horizon:* 10 to 20 inches

##### A horizon

Hue: 10YR or 2.5Y

Value: 3 to 6 dry; 3 or 4 moist

Chroma: 1 to 4

Clay content: 10 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 cobbles; 0 to 10 percent pebbles or channers

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 9.0

Note: The chromas of 1 are lithochromic.

##### Bk horizon

Hue: 10YR to 5Y

Value: 5 to 8 dry; 4 to 7 moist

Chroma: 1 to 6

Texture: loam, silt loam, clay loam, or silty clay loam  
 Clay content: 20 to 35 percent  
 Rock fragments: 0 to 35 percent-0 to 5 percent  
 cobbles, 0 to 30 percent pebbles or channers  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.4 to 9.0

#### *Cr horizon*

Note: This horizon consists of interbedded layers of sandstone and shale. They crush to loam, silt loam, very fine sandy loam, clay loam, or silty clay loam. Some layers are harder than others, but all are considered rippable or soft and are readily dug with power tools.

Reaction: pH 7.4 to 8.4

### **201D—Cabba-Windham complex, 8 to 25 percent slopes**

#### **Setting**

##### *Landform:*

Cabba—Hills  
 Windham—Hills

##### *Position on landform:*

Cabba—Backslopes  
 Windham—Shoulders and summits

##### *Slope:*

Cabba—8 to 25 percent  
 Windham—8 to 25 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

#### **Composition**

##### **Major Components**

Cabba and similar soils: 55 percent  
 Windham and similar soils: 30 percent

##### **Minor Components**

Barkof and similar soils: 0 to 3 percent  
 Shallow clayey soils: 0 to 3 percent  
 Very cobbly surface layers: 0 to 3 percent  
 Slopes less than 8 percent: 0 to 3 percent  
 Slopes greater than 25 percent: 0 to 3 percent

#### **Major Component Description**

##### **Cabba**

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Interbedded sandstone and shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 2.3 inches

##### **Windham**

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Limestone alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

#### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

#### **Cabbart Series**

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour)

*Landform:* Hills, escarpments

*Parent material:* Interbedded sandstone and shale residuum

*Slope range:* 4 to 70 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Loamy, mixed (calcareous), frigid, shallow Aridic Ustorthents

#### **Typical Pedon**

Cabbart loam, in an area of Hillon-Cabbart-Rock outcrop association, 15 to 65 percent slopes, in rangeland, 100 feet west and 1,200 feet south of the northeast corner of sec. 2, T. 30 N., R. 28 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky

and slightly plastic; many fine and very fine roots; strongly effervescent; slightly alkaline; clear wavy boundary.

Bk1—3 to 9 inches; light yellowish brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; weak fine subangular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; many fine and medium masses of lime, disseminated lime; violently effervescent; strongly alkaline; gradual wavy boundary.

Bk2—9 to 16 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; weak thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; common very fine tubular pores; many fine and medium masses of lime; disseminated lime; violently effervescent; strongly alkaline; clear smooth boundary.

Cr—16 to 60 inches; light brownish gray (2.5Y 6/2) interbedded sandstone and shale; dark grayish brown (2.5Y 4/2) moist; slightly effervescent; moderately alkaline,

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Cr horizon:* 10 to 20 inches

#### *A horizon*

Hue: 10YR to 5Y

Value: 5 to 7 dry; 3 to 5 moist

Chroma: 2 to 4

Clay content: 18 to 27 percent

Rock fragments: 0 to 15 percent hard fragments-  
0 to 5 percent cobbles, 0 to 15 percent pebbles

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 9.0

#### *Bk horizons*

Hue: 10YR to 5Y

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loam, clay loam, silt loam, silty clay loam

Clay content: 18 to 35 percent

Rock fragments: 0 to 45 percent-0 to 15 percent hard  
pebbles, 0 to 45 percent soft pebbles

Calcium carbonate equivalent: 15 to 25 percent

Reaction: pH 7.4 to 9.0

## 1850F—Cabbart-Twilight-Delpoint association, 25 to 70 percent slopes

### Setting

#### *Landform:*

Cabbart—Escarpments

Twilight—Hills

Delpoint—Hills

#### *Position on landform:*

Cabbart—Backslopes and shoulders

Twilight—Backslopes

Delpoint—Backslopes and footslopes

#### *Slope:*

Cabbart—25 to 70 percent, southwest aspect

Twilight—25 to 45 percent

Delpoint—25 to 45 percent, northeast aspect

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Cabbart and similar soils: 30 percent

Twilight and similar soils: 30 percent

Delpoint and similar soils: 25 percent

#### Minor Components

Rangeland soils: 0 to 5 percent

Douglas-fir on cooler aspects: 0 to 5 percent

Rock outcrop: 0 to 2 percent

Very deep loamy soils: 0 to 1 percent

Very deep sandy soils: 0 to 1 percent

Shallow sandy soils: 0 to 1 percent

### Major Component Description

#### Cabbart

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Interbedded sandstone  
and shale residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 3.1 inches

**Twilight**

*Surface layer texture:* Fine sandy loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Sandstone residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 3.9 inches

**Delpoint**

*Surface layer texture:* Loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Interbedded sandstone and shale residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 4.7 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**1021E—Cabbart-Twilight-Yawdim association, 8 to 35 percent slopes**

**Setting**

*Landform:*

- Cabbart—Hills
- Twilight—Hills
- Yawdim—Hills

*Position on landform:*

- Cabbart—Shoulders and summits
- Twilight—Backslopes and footslopes
- Yawdim—Backslopes and shoulders

*Slope:*

- Cabbart—8 to 35 percent
- Twilight—8 to 35 percent
- Yawdim—8 to 35 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

**Composition**

**Major Components**

Cabbart and similar soils: 40 percent  
 Twilight and similar soils: 30 percent  
 Yawdim and similar soils: 15 percent

**Minor Components**

Yamacall and similar soils: 0 to 3 percent  
 Very shallow soils: 0 to 3 percent  
 Slopes less than 8 percent: 0 to 3 percent  
 Marvan and similar soils: 0 to 2 percent  
 Soils with ponderosa pine: 0 to 2 percent  
 Rock outcrop: 0 to 2 percent

**Major Component Description**

**Cabbart**

*Surface layer texture:* Loam  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Interbedded sandstone and shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.8 inches

**Twilight**

*Surface layer texture:* Fine sandy loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Sandstone residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 3.1 inches

**Yawdim**

*Surface layer texture:* Clay loam  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.9 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Chinook Series

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

*Drainage class:* Well drained

*Permeability:* Moderately rapid (2.0 to 6.0 inches/hour)

*Landform:* Alluvial fans

*Parent material:* Alluvium

*Slope range:* 0 to 8 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Coarse-loamy, mixed Aridic Haploborolls

### Typical Pedon

Chinook fine sandy loam, 2 to 8 percent slopes, in cropland, 2,400 feet east and 1,300 feet north of the southwest corner of sec. 8, T. 28 N., R. 33 E.

Ap—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; neutral; abrupt smooth boundary.

Bw—6 to 16 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, very friable, slightly sticky and nonplastic; common fine and very fine roots; many very fine tubular pores; neutral; clear wavy boundary.

Bk1—16 to 24 inches; grayish brown (10YR 5/2) fine sandy loam; dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine tubular pores; few fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—24 to 44 inches; light brownish gray (2.5Y 6/2) fine sandy loam; dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; common fine masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—44 to 60 inches; light brownish gray (2.5Y 6/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine tubular pores; few fine masses of lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 8 and 24 inches

*Mollic epipedon thickness:* 7 to 15 inches

*Depth to Bk horizon:* 10 to 35 inches

#### Ap horizon

Hue: 10YR or 2.5Y

Value: 2 or 3 moist

Chroma: 2 or 3

Clay content: 5 to 18 percent

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.6 to 8.4

#### Bw horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 to 4

Textures: fine sandy loam or sandy loam

Clay content: 5 to 18 percent and more than 50 percent medium, fine, and coarser sand.

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.6 to 8.4

#### Bk1 and Bk2 horizons

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: fine sandy loam or sandy loam

Clay content: 5 to 18 percent and more than 50 percent medium, fine, and coarser sand

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 3 to 15 percent

Reaction: pH 6.6 to 9.0

#### Bk3 horizon

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: fine sandy loam, sandy loam, loamy fine sand, or loamy sand  
 Clay content: 5 to 15 percent  
 Rock fragments: 0 to 15 percent pebbles  
 Calcium carbonate equivalent: 1 to 5 percent  
 Reaction: pH 7.4 to 9.0

### 36C—Chinook fine sandy loam, 2 to 8 percent slopes

#### Setting

*Landform:* Alluvial fans  
*Slope:* 2 to 8 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Chinook and similar soils: 90 percent

##### Minor Components

Chinook loam: 0 to 4 percent  
 Evanston and similar soils: 0 to 4 percent  
 Slightly saline soils: 0 to 1 percent  
 Slightly sodic soils: 0 to 1 percent

#### Major Component Description

*Surface layer texture:* Fine sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 7.8 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

#### Creed Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)  
*Landform:* Alluvial fans, stream terraces  
*Parent material:* Alluvium  
*Slope range:* 0 to 4 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Typic Natriboralfs

#### Typical Pedon

Creed loam, in an area of Creed-Absher complex, 0 to 4 percent slopes, in cropland, 800 feet east and 2,600 feet north of the southwest corner of sec. 10, T. 28 N., R. 30 E.

Ap—0 to 5 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; neutral; clear smooth boundary.

E—5 to 8 inches; pale brown (10YR 6/3) loam, grayish brown (10YR 5/2) moist; weak thin platy structure; slightly hard, very friable, slightly sticky and nonplastic; common fine and very fine roots; many very fine tubular pores; many unstained silt and sand grains; neutral; abrupt smooth boundary.

Btn—8 to 14 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong fine and medium columnar structure parting to strong fine and medium angular blocky; extremely hard, very firm, very sticky and very plastic; few fine roots along faces of peds; few very fine tubular pores; many prominent clay films on faces of peds; many light gray (10YR 7/2) skeletans on top of columns, and common skeletans on vertical faces of columns; moderately alkaline; clear wavy boundary.

Bkn—14 to 26 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; common fine and medium masses of lime; violently effervescent; strongly alkaline; gradual wavy boundary.

Bknyz—26 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm,

sticky and plastic; few very fine roots; common very fine tubular pores; many fine seams and masses of lime; few fine masses of gypsum and other salt crystals; violently effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* 4 to 12 inches

*Depth to Bkn horizon:* 10 to 20 inches

*Depth to Bknyz horizon:* 22 to 30 inches

#### *A horizon*

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 20 to 27 percent

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.1 to 8.4

#### *E horizon*

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 7 moist

Chroma: 2 or 3

Texture: loam or sandy loam

Clay content: 20 to 27 percent

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.1 to 8.4

#### *Btn horizon*

Hue: 10YR to 5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Texture: clay loam, silty clay loam, clay, silty clay

Clay contents: 35 to 55 percent

Rock fragments: 0 to 15 percent pebbles

Electrical conductivity: 2 to 4 mmhos/cm

Sodium adsorption ratio: 8 to 13

Reaction: pH 6.6 to 9.0

#### *Bkn horizon*

Hue: 10YR to 5Y

Value: 4 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: silty clay loam, clay loam, sandy clay loam, loam, or clay

Rock fragments: 0 to 15 percent pebbles

Clay content: 27 to 45 percent

Calcium carbonate equivalent: 5 to 15 percent

Electrical conductivity: 4 to 8 mmhos/cm

Sodium adsorption ratio: 13 to 20

Gypsum: 0 to 2 percent

Reaction: pH 7.9 to 9.0

#### *Bknyz horizon*

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: loam, clay loam, sandy clay loam, which are thinly stratified or stratified with thin layers of coarser material; or silty clay loam

Clay content: 25 to 35 percent

Calcium carbonate equivalent: 5 to 15 percent

Rock fragments: 0 to 15 percent pebbles

Electrical conductivity: 4 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 25

Gypsum: 1 to 5 percent

Reaction: pH 7.9 to 9.0

## 391B—Creed-Absher complex, 0 to 4 percent slopes

### Setting

#### *Landform:*

Creed—Alluvial fans and stream terraces

Absher—Alluvial fans and stream terraces

#### *Position on landform:*

Creed—Microhighs

Absher—Microlows

#### *Slope:*

Creed—0 to 4 percent

Absher—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Creed and similar soils: 55 percent

Absher and similar soils: 35 percent

#### Minor Components

Gerdrum and similar soils: 0 to 3 percent

Ethridge and similar soils: 0 to 3 percent

Ferd and similar soils: 0 to 2 percent

Saline and sodic loamy soils: 0 to 2 percent

### Major Component Description

#### Creed

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 inches

### **Absher**

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.0 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **392B—Creed-Gerdrum complex, 0 to 4 percent slopes**

### **Setting**

*Landform:*  
 Creed—Alluvial fans and stream terraces  
 Gerdrum—Alluvial fans and stream terraces  
*Position on landform:*  
 Creed—Microhighs  
 Gerdrum—Microlows  
*Slope:*  
 Creed—0 to 4 percent  
 Gerdrum—0 to 4 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### **Composition**

#### **Major Components**

Creed and similar soils: 50 percent  
 Gerdrum and similar soils: 40 percent

### **Minor Components**

Ferd and similar soils: 0 to 5 percent  
 Absher and similar soils: 0 to 5 percent

### **Major Component Description**

#### **Creed**

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 inches

#### **Gerdrum**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **1392B—Creed-Gerdrum-Absher association, 0 to 4 percent slopes**

### **Setting**

*Landform:*  
 Creed—Alluvial fans and stream terraces  
 Gerdrum—Alluvial fans and stream terraces  
 Absher—Alluvial fans and stream terraces  
*Position on landform:*  
 Creed—Microhighs  
 Gerdrum—Microlows  
 Absher—Microlows

*Slope:*

Creed—0 to 4 percent

Gerdrum—0 to 4 percent

Absher—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Creed and similar soils: 35 percent

Gerdrum and similar soils: 30 percent

Absher and similar soils: 25 percent

**Minor Components**

Ferd and similar soils: 0 to 5 percent

Saline and sodic loamy soils: 0 to 5 percent

**Major Component Description****Creed***Surface layer texture:* Loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* None*Salt affected:* Saline within 30 inches*Sodium affected:* Sodic within 30 inches*Available water capacity:* Mainly 6.6 inches**Gerdrum***Surface layer texture:* Clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* None*Salt affected:* Saline within 30 inches*Sodium affected:* Sodic within 30 inches*Available water capacity:* Mainly 6.1 inches**Absher***Surface layer texture:* Clay*Depth class:* Very deep (more than 60 inches)*Drainage class:* Moderately well drained*Dominant parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* None*Salt affected:* Saline within 30 inches*Sodium affected:* Sodic within 30 inches*Available water capacity:* Mainly 4.0 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**Danvers Series***Depth class:* Very deep (greater than 60 inches)*Drainage class:* Well drained*Permeability:* Slow (0.06 to 0.2 inch/hour)*Landform:* Relict stream terraces*Parent material:* Alluvium*Slope range:* 0 to 4 percent*Annual precipitation:* 14 to 17 inches*Annual air temperature:* 40 to 45 degrees F*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Fine, montmorillonitic Typic Argiborolls

**Typical Pedon**

Danvers clay loam, in an area of Tamaneen-Danvers clay loams, 0 to 4 percent slopes, in cropland, 1,800 feet west and 1,700 feet north of the southeast corner of sec. 24, T. 25 N., R. 22 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to moderate medium granular; soft, very friable, sticky and plastic; many very fine and common fine roots; neutral; clear smooth boundary.

Bt1—6 to 10 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and plastic; many very fine and few fine roots; common very fine tubular pores; many distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bt2—10 to 16 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and plastic; many very fine roots; common very fine tubular pores; many distinct clay films on

faces of peds; slightly alkaline; clear wavy boundary.

**Btk**—16 to 21 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to strong fine and medium subangular blocky; very hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; common faint clay films on faces of peds; few fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

**Bk**—21 to 48 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; 5 percent pebbles; many medium and coarse masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

**2Bk**—48 to 60 inches; very pale brown (10YR 7/3) gravelly clay loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; many very fine tubular pores; 20 percent pebbles; common medium and coarse masses of lime; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 41 to 47 degrees F

*Moisture control section:* 4 to 12 inches

*Mollic epipedon thickness:* 7 to 12 inches

*Depth to calcic horizon:* 14 to 25 inches

#### *Ap horizon*

Hue: 7.5YR to 2.5Y

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 27 to 35

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.1 to 7.8

#### *Bt horizons*

Hue: 7.5YR to 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: silty clay loam, clay loam, silty clay, or clay

Clay content: 35 to 50 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles and stones, 0 to 10 percent pebbles

Reaction: pH 6.6 to 8.4

#### *Btk horizon*

Hue: 7.5YR to 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: clay, clay loam, or silty clay loam

Clay content: 35 to 45 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles and stones, 0 to 10 percent pebbles

Calcium carbonate equivalent: 10 to 20 percent

Reaction: pH 7.4 to 8.4

#### *Bk horizon*

Hue: 7.5YR to 2.5Y

Value: 6 to 8 dry; 5 or 6 moist

Chroma: 1 to 3

Texture: silty clay, clay loam, silty clay loam, or clay

Clay content: 35 to 45 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles and stones, 0 to 10 percent pebbles

Calcium carbonate equivalent: 20 to 40 percent

Reaction: pH 7.4 to 8.4

#### *2Bk horizon*

Hue: 7.5YR to 2.5Y

Value: 6 or 7 dry, 5 or 6 moist

Chroma: 2 or 3

Texture: loam, sandy loam, or clay loam

Clay content: 10 to 35 percent

Rock fragments: 15 to 65 percent-0 to 10 percent cobbles and stones, 10 to 55 percent pebbles

Calcium carbonate equivalent: 15 to 35 percent

Reaction: pH 7.4 to 8.4

## Degrand Series

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour) in the upper 23 inches; rapid (6.0 to 20.0 inches/hour) below

*Landform:* Stream terraces, outwash plains

*Parent material:* Alluvium

*Slope range:* 0 to 4 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls

### Typical Pedon

Degrand loam, 0 to 4 percent slopes, in cropland, 2,500 feet east and 2,000 feet south of the northwest corner of sec. 1, T. 28 N., R. 31 E.

**Ap**—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable,

slightly sticky and slightly plastic; many very fine roots; 10 percent pebbles; neutral; abrupt smooth boundary.

**Bt1**—6 to 11 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; common faint clay films on faces of peds; 5 percent pebbles; slightly alkaline; clear wavy boundary.

**Bt2**—11 to 15 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very friable, sticky and plastic; few very fine roots; many very fine tubular pores; common faint clay films on faces of peds and bridging sand grains; 5 percent pebbles; slightly alkaline; clear wavy boundary.

**Bk**—15 to 23 inches; light gray (2.5Y 7/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, very friable, sticky and plastic; few very fine roots; many very fine tubular pores; 10 percent pebbles; common distinct lime coatings on pebbles; many fine and medium masses of lime; violently effervescent; strongly alkaline; clear wavy boundary.

**2Bk**—23 to 60 inches; light brownish gray (2.5Y 6/2) sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; few fine masses of lime; 10 percent pebbles; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* 4 to 12 inches

*Mollic epipedon thickness:* 7 to 16 inches (includes part of the Bt horizon)

*Depth to Bk horizon:* 10 to 23 inches

*Depth to 2Bk horizon:* 20 to 40 inches

*Ap horizon*

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 10 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.6 to 7.8

*Bt horizons*

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: clay loam or sandy clay loam

Clay content: 20 to 35 percent (sand content 35 to 55 percent)

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.6 to 8.4

*Bk horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: sandy clay loam, loam, or clay loam

Clay content: 15 to 30 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Calcium carbonate equivalent: 15 to 40 percent

Reaction: pH 7.4 to 9.0

*2Bk horizon*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: sand, coarse sand, fine sand, or loamy sand

Clay content: 0 to 5 percent

Rock fragments: 0 to 35 percent-0 to 5 percent cobbles, 0 to 30 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

### 11B—Degrand loam, 0 to 4 percent slopes

#### Setting

*Landform:* Stream terraces and outwash plains

*Slope:* 0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Degrad and similar soils: 90 percent

##### Minor Components

Beaverell and similar soils: 0 to 4 percent

Evanston and similar soils: 0 to 3 percent

Degrad sandy loam: 0 to 3 percent

### Major Component Description

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Delpoint Series

*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour)  
*Landform:* Hills  
*Parent material:* Interbedded sandstone and shale residuum  
*Slope range:* 25 to 45 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed, frigid Aridic Ustochrepts

### Typical Pedon

Delpoint loam, in an area of Cabbart-Twilight-Delpoint association, 25 to 70 percent slopes, in woodland, 1,300 feet south and 150 feet east of the northwest corner of sec. 23, T. 23 N., R. 33 E.

Oi—1 to 0 inch; partly decomposed needles and twigs.  
 A—0 to 4 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine and few medium and coarse roots; slightly effervescent; slightly alkaline; clear wavy boundary.  
 Bw1—4 to 11 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure;

slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine and few medium and coarse roots; many very fine tubular pores; strongly effervescent; moderately alkaline; clear wavy boundary.

Bw2—11 to 16 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common fine and very fine and few medium roots; many very fine tubular pores; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk1—16 to 21 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; common fine and very fine and few medium roots; common very fine tubular pores; common fine masses of lime; violently effervescent; strongly alkaline; gradual wavy boundary.

Bk2—21 to 29 inches; light brownish gray (2.5Y 6/2) and light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few fine and very fine roots; common very fine tubular pores; few fine masses of lime; violently effervescent; strongly alkaline; clear wavy boundary.

Cr—29 to 60 inches; light brownish gray (2.5Y 6/2) interbedded shale and sandstone, dark grayish brown (2.5Y 4/2) moist; strongly effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to Bk horizon:* 10 to 20 inches  
*Depth to Cr horizon:* 20 to 40 inches

#### A horizon

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry; 3 to 5 moist  
 Chroma: 2 to 4  
 Clay content: 20 to 27 percent  
 Rock fragments: 0 to 5 percent pebbles  
 Calcium carbonate equivalent: 0 to 5 percent  
 Reaction: pH 6.6 to 8.4

#### Bw horizons

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: loam, clay loam, or silty clay loam

Clay content: 18 to 35 percent clay  
 Rock fragments: 0 to 15 percent pebbles  
 Calcium carbonate equivalent: 2 to 10 percent  
 Reaction: pH 6.6 to 8.4

#### *Bk horizons*

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 to 4  
 Texture: loam, sandy loam, clay loam, or silty clay loam  
 Clay content: 18 to 35 percent clay  
 Rock fragments: 0 to 15 percent pebbles  
 Calcium carbonate equivalent: 5 to 30 percent.  
 Reaction: pH 7.9 to 9.0

### **Dimmick Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Very poorly drained  
*Permeability:* Very slow: .06 inch/hour)  
*Landform:* Closed depressions  
*Parent material:* Alluvium  
*Slope range:* 0 to 1 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic, frigid Vertic Epiaquolls

#### **Typical Pedon**

Dimmick clay, 0 to 1 percent slopes, in rangeland, 2,200 feet west, 500 feet south of the northeast corner of sec. 35, T. 35 N., R. 29 E.

Ag1—0 to 2 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very hard, friable, sticky and plastic; common very fine, fine, and medium roots; common very fine tubular pores; common medium prominent yellowish brown (10YR 5/6) dry redox concentrations; neutral; abrupt smooth boundary.

Ag2—2 to 18 inches; very dark gray (5Y 3/1) clay, gray (5Y 5/1) dry; weak fine angular blocky structure; extremely hard, firm, very sticky and very plastic; few fine and very fine roots; few very fine tubular pores; neutral; clear wavy boundary.

Cg1—18 to 28 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; weak fine angular blocky structure; extremely hard, firm, very sticky and very plastic;

few very fine roots; few very fine tubular pores; slightly alkaline; clear wavy boundary.  
 Cg2—28 to 60 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; massive; extremely hard, firm, very sticky and very plastic; slightly alkaline.

#### **Range in Characteristics**

*Soil temperature:* 41 to 47 degrees F  
*Mollic epipedon thickness:* 14 to 24 inches  
*Depth to carbonates:* 20 to more than 40 inches  
*Linear extensibility:* 6.0 cm or more  
*Note:* Some pedons have Bk horizons.

#### *Ag horizons*

Hue: 10YR to 5Y  
 Value: 2 or 3 moist, 3 to 5 dry  
 Chroma: 1 or 2  
 Clay content: 40 to 50 percent  
 Reaction: pH 6.1 to 7.8

#### *Cg horizons*

Hue: 2.5Y, 5Y, or neutral  
 Value: 4 or 5 moist, 5 or 6 dry  
 Chroma: 0 to 3  
 Texture: clay or silty clay; some pedons have strata of silty clay loam, clay loam, or sandy clay loam  
 Clay content: 40 to 60 percent  
 Reaction: pH 6.6 to 8.4

### **170A—Dimmick clay, 0 to 1 percent slopes**

#### **Setting**

*Landform:* Closed depressions  
*Slope:* 0 to 1 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

#### **Composition**

##### **Major Components**

Dimmick and similar soils: 90 percent

##### **Minor Components**

Nishon and similar soils: 0 to 5 percent  
 Saline and sodic soils: 0 to 5 percent

#### **Major Component Description**

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Very poorly drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Water table:* Apparent  
*Ponding:* long  
*Available water capacity:* Mainly 10.3 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Elloam Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Very slow: .06 inch/hour  
*Landform:* Till plains  
*Parent material:* Till  
*Slope range:* 0 to 8 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Typic Natriboralfs

### Typical Pedon

Elloam loam, in an area of Phillips-Elloam-Thoeny association, 0 to 8 percent slopes, in rangeland, 1,400 feet south and 1,500 feet east of northwest corner sec. 5, T. 24 N., R. 30 E.

E—0 to 3 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; common very fine tubular pores; 2 percent pebbles; neutral; abrupt smooth boundary.  
 Btn—3 to 12 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong medium columnar structure parting to moderate medium angular blocky; very hard, friable, sticky and plastic; common fine and very fine and few

medium roots between peds; common very fine tubular pores; common distinct clay films on faces of peds; many light gray (10YR 7/2) skeletons on tops of columns and common skeletons on vertical faces of columns; 2 percent pebbles; slightly alkaline; clear wavy boundary.

Bkn—12 to 20 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; few fine and very fine roots between peds; common very fine tubular pores; common fine and medium masses of lime; 2 percent pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.  
 Bknyz—20 to 45 inches; grayish brown (2.5Y 5/2) clay loam; dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few fine and very fine roots; few very fine tubular pores; common fine masses of lime; few fine masses of gypsum and other salt crystals; 2 percent pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.  
 Bnyz—45 to 60 inches; grayish brown (2.5Y 5/2) clay loam; dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few very fine tubular pores; 2 inch thick stone line of pebbles at 52 inches; common fine and medium masses of gypsum and other salt crystals; 5 percent pebbles; few fine distinct very dark gray (5Y 3/1) relict redox depletions; few fine prominent brownish yellow (10YR 6/8) relict redox concentrations; strongly effervescent; slightly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* 4 to 12 inches  
*Depth to Bkn horizon:* 8 to 18 inches  
*Depth to gypsum and other salts:* 12 to 25 inches

#### E horizon

Hue: 10YR or 2.5Y  
 Value: 5 to 7 dry; 4 or 5 moist  
 Chroma: 2 or 3  
 Texture: loam (clay loam when mixed to 7 inches)  
 Clay content: 20 to 27 percent  
 Clay content: 27 to 35 percent when mixed to 7 inches

Rock fragments: 0 to 30 percent-0 to trace stones, 0 to 5 percent cobbles, 0 to 25 percent pebbles.  
 Electrical conductivity: 0 to 2 mmhos/cm  
 Reaction: pH 6.1 to 7.8  
 Note: The surface layer is crusted in the natural state and is also crusted where cultivated.

*Btn horizon*

Hue: 10YR or 2.5Y  
 Value: 4 to 6 dry; 3 to 5 moist  
 Chroma: 2 or 3  
 Texture: clay loam or clay  
 Clay content: 35 to 55 percent  
 Rock fragments: 0 to 15 percent-0 to trace cobbles; 0 to 15 percent pebbles  
 Electrical conductivity: 2 to 8 mmhos/cm  
 Sodium adsorption ratio: 8 to 25  
 Reaction: pH 6.6 to 9.0

*Bkn horizon*

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 or 3  
 Texture: clay loam or clay  
 Clay content: 30 to 45 percent  
 Rock fragments: 0 to 15 percent-0 to trace cobbles; 0 to 15 percent pebbles  
 Electrical conductivity: 4 to 8 mmhos/cm  
 Sodium adsorption ratio: 13 to 25  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.9 to 9.0

*Bknyz horizon*

Hue: 10YR to 5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 1 to 3  
 Texture: loam or clay loam  
 Clay content: 25 to 40 percent  
 Rock fragments: 0 to 15 percent-0 to trace cobbles; 0 to 15 percent pebbles  
 Electrical conductivity: 8 to 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 25  
 Gypsum: 1 to 3 percent  
 Calcium carbonate equivalent: 5 to 10 percent  
 Reaction: pH 7.9 to 9.0

*Bnyz horizon*

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 or 5 moist  
 Chroma: 1 to 3  
 Texture: loam or clay loam  
 Clay content: 25 to 40 percent

Rock fragments: 0 to 15 percent-0 to trace cobbles; 0 to 15 percent pebbles  
 Electrical conductivity: 8 to 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 25  
 Gypsum: 1 to 3 percent  
 Reaction: pH 7.4 to 7.8  
 Bulk density: 1.55 grams/cc and greater

## 52B—Elloam clay loam, 0 to 4 percent slopes

### Setting

*Landform:* Till plains  
*Slope:* 0 to 4 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Elloam and similar soils: 85 percent

#### Minor Components

Thoeny and similar soils: 0 to 6 percent  
 Absher and similar soils: 0 to 5 percent  
 Phillips and similar soils: 0 to 3 percent  
 Nishon and similar soils: 0 to 1 percent

### Major Component Description

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 521B—Elloam-Absher complex, 0 to 4 percent slopes

### Setting

#### Landform:

Elloam—Till plains

Absher—Till plains

#### Position on landform:

Elloam—Microhighs

Absher—Microlows

#### Slope:

Elloam—0 to 4 percent

Absher—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Elloam and similar soils: 50 percent

Absher and similar soils: 40 percent

#### Minor Components

Thoeny and similar soils: 0 to 6 percent

Phillips and similar soils: 0 to 3 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Elloam

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 6.6 inches

#### Absher

*Surface layer texture:* Clay

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

*Drainage class:* Moderately well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 4.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1523C—Elloam-Phillips-Absher association, 0 to 8 percent slopes

### Setting

#### Landform:

Elloam—Till plains

Phillips—Till plains

Absher—Till plains

#### Position on landform:

Elloam—Microlows

Phillips—Microhighs

Absher—Microlows

#### Slope:

Elloam—0 to 8 percent

Phillips—0 to 8 percent

Absher—0 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Elloam and similar soils: 40 percent

Phillips and similar soils: 25 percent

Absher and similar soils: 15 percent

#### Minor Components

Kevin and similar soils: 0 to 6 percent

Thoeny and similar soils: 0 to 5 percent

Telstad and similar soils: 0 to 3 percent

Hillon and similar soils: 0 to 3 percent

Slopes greater than 8 percent: 0 to 2 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Elloam

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 inches

### Phillips

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.4 inches

### Absher

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1052B—Elloam-Thoeny association, 0 to 6 percent slopes

### Setting

#### *Landform:*

Elloam—Till plains  
 Thoeny—Till plains

#### *Position on landform:*

Elloam—Microlows  
 Thoeny—Microhighs

#### *Slope:*

Elloam—0 to 6 percent

Thoeny—0 to 6 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Elloam and similar soils: 50 percent

Thoeny and similar soils: 30 percent

#### Minor Components

Phillips and similar soils: 0 to 5 percent

Absher and similar soils: 0 to 5 percent

Kevin and similar soils: 0 to 5 percent

Slopes greater than 6 percent: 0 to 4 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Elloam

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 inches

#### Thoeny

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 7.4 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Ethridge Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Alluvial fans, stream terraces, drainageways

*Parent material:* Alluvium, glaciofluvial deposits

*Slope range:* 0 to 8 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Aridic Argiborolls

## Typical Pedon

Ethridge clay loam, 0 to 4 percent slopes, in cropland, 1,900 feet east and 600 feet south of the northwest corner of sec. 23, T. 34 N., R. 29 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; neutral; abrupt smooth boundary.

Bt—6 to 16 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong fine angular blocky; very hard, firm, sticky and very plastic; common fine and very fine roots; common very fine tubular pores; many faint clay films on faces on peds; neutral; clear wavy boundary.

Bk1—16 to 30 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, sticky and plastic; few fine and very fine roots; common very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—30 to 44 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky

structure; very hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk3—44 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; very hard, friable, sticky and plastic; common very fine tubular pores; common fine masses of lime; slightly effervescent; moderately alkaline.

## Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* 4 to 12 inches

*Mollic epipedon thickness:* 7 to 14 inches and may include all or part of the Bt horizon

*Depth to Bk horizon:* 10 to 20 inches

*Note:* Some pedons have a Bky or By horizon.

*Ap horizon*

Hue: 10YR or 2.5Y

Value: 2 or 3 moist

Chroma: 2 or 3

Clay content: 27 to 35 percent

Rock fragments: 0 to 5 percent pebbles

Reaction: pH 6.1 to 7.8

*Bt horizon*

Hue: 10YR or 2.5Y

Value: 3 or 4 moist

Chroma: 2 to 4

Texture: clay, silty clay, clay loam, or silty clay loam

Clay content: 35 to 45 percent

Rock fragments: 0 to 5 percent pebbles

Reaction: pH 6.6 to 8.4

*Bk1, Bk2 horizons*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: clay, silty clay loam, clay loam or silty clay

Clay content: 30 to 45 percent

Rock fragments: 0 to 5 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 9.0

*Bk3 horizon*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: clay loam, silt loam, or silty clay loam (these textures may consist of strata of finer and coarser materials.)

Clay content: 25 to 40 percent

Rock fragments: 0 to 5 percent

Electrical conductivity: 0 to 4 mmhos/cm

Gypsum: 0 to 3 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 9.0

Note: In some pedons this horizon may not be stratified.

### 38B—Ethridge clay loam, 0 to 4 percent slopes

#### Setting

*Landform:* Alluvial fans, stream terraces, and drainageways

*Slope:* 0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Ethridge and similar soils: 90 percent

##### Minor Components

Evanston and similar soils: 0 to 5 percent

Creed and similar soils: 0 to 2 percent

Gerdrum and similar soils: 0 to 2 percent

Absher and similar soils: 0 to 1 percent

#### Major Component Description

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.8 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 38C—Ethridge clay loam, 4 to 8 percent slopes

#### Setting

*Landform:* Alluvial fans

*Slope:* 4 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Ethridge and similar soils: 90 percent

##### Minor Components

Evanston and similar soils: 0 to 4 percent

Slopes less than 4 percent: 0 to 3 percent

Creed and similar soils: 0 to 1 percent

Gerdrum and similar soils: 0 to 1 percent

Absher and similar soils: 0 to 1 percent

#### Major Component Description

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.8 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 383C—Ethridge-Beaverell complex, 2 to 8 percent slopes

#### Setting

*Landform:*

Ethridge—Alluvial fans, stream terraces, and drainageways

Beaverell—Kames and eskers

*Position on landform:*

Ethridge—Foothills and toeslopes  
 Beaverell—Backslopes and shoulders

*Slope:*

Ethridge—2 to 8 percent  
 Beaverell—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Ethridge and similar soils: 55 percent  
 Beaverell and similar soils: 35 percent

**Minor Components**

Evanston and similar soils: 0 to 5 percent  
 Sandy loam surface layers: 0 to 3 percent  
 Tinsley and similar soils: 0 to 2 percent

**Major Component Description****Ethridge**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Glaciofluvial deposits  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.8 inches

**Beaverell**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Glacial outwash  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**381B—Ethridge-Gerdrum clay loams, 0 to 4 percent slopes****Setting***Landform:*

Ethridge—Alluvial fans, stream terraces, and drainageways  
 Gerdrum—Alluvial fans, stream terraces, and drainageways

*Position on landform:*

Ethridge—Microhighs  
 Gerdrum—Microlows

*Slope:*

Ethridge—0 to 4 percent  
 Gerdrum—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Ethridge and similar soils: 55 percent  
 Gerdrum and similar soils: 35 percent

**Minor Components**

Evanston and similar soils: 0 to 5 percent  
 Ferd and similar soils: 0 to 3 percent  
 Absher and similar soils: 0 to 2 percent

**Major Component Description****Ethridge**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.8 inches

**Gerdrum**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Evanston Series

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour)

*Landform:* Alluvial fans, stream terraces, drainageways

*Parent material:* Alluvium

*Slope range:* 0 to 15 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Aridic Argiborolls

### Typical Pedon

Evanston loam, 0 to 4 percent slopes, in rangeland, 900 feet east and 700 feet north of the southwest corner of sec. 33, T. 30 N., R. 31 E.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 5 percent pebbles; neutral; clear smooth boundary.

Bt—5 to 12 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many very fine and few fine tubular pores; common faint clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk1—12 to 24 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very friable, sticky and plastic; common very fine roots; many very fine and few fine tubular pores; common fine and few medium masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—24 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; hard, very friable, sticky and plastic; few very fine roots; many very fine and few fine tubular pores; common fine seams and masses of lime; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 15 inches

*Depth to Bk horizon:* 8 to 20 inches

#### A horizon

Hue: 10YR or 2.5Y

Value: 2 or 3 moist

Chroma: 2 or 3

Clay content: 20 to 27 percent

Reaction: pH 6.6 to 7.8

#### Bt horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: clay loam or loam

Clay content: 25 to 35 percent

Reaction: pH 6.6 to 7.8

#### Bk1 horizon

Hue: 2.5Y or 10YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: loam, clay loam, or silty clay loam

Clay content: 20 to 35 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

#### Bk2 horizon

Hue: 2.5Y or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2, 3 or 4

Texture: loam, clay loam, or fine sandy loam

Clay content: 15 to 30 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 9.0

### 37B—Evanston loam, 0 to 4 percent slopes

#### Setting

*Landform:* Alluvial fans, stream terraces, and drainageways

*Slope:* 0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Evanston and similar soils: 90 percent

#### Minor Components

Ethridge and similar soils: 0 to 5 percent  
 Chinook and similar soils: 0 to 3 percent  
 Creed and similar soils: 0 to 1 percent  
 Gerdrum and similar soils: 0 to 1 percent

### Major Component Description

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 10.1 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 37C—Evanston loam, 4 to 8 percent slopes

### Setting

*Landform:* Alluvial fans  
*Slope:* 4 to 8 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Evanston and similar soils: 90 percent

#### Minor Components

Ethridge and similar soils: 0 to 3 percent  
 Chinook and similar soils: 0 to 3 percent

Slopes less than 4 percent: 0 to 2 percent  
 Creed and similar soils: 0 to 1 percent  
 Gerdrum and similar soils: 0 to 1 percent

### Major Component Description

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 10.1 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 373C—Evanston-Chinook complex, 2 to 8 percent slopes

### Setting

*Landform:*  
 Evanston—Alluvial fans  
 Chinook—Alluvial fans  
*Position on landform:*  
 Evanston—Foothslopes and toeslopes  
 Chinook—Backslopes  
*Slope:*  
 Evanston—2 to 8 percent  
 Chinook—2 to 8 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Evanston and similar soils: 50 percent  
 Chinook and similar soils: 35 percent

#### Minor Components

Fortbenton and similar soils: 0 to 10 percent  
 Yetull and similar soils: 0 to 2 percent  
 Creed and similar soils: 0 to 2 percent  
 Gerdrum and similar soils: 0 to 1 percent

## Major Component Description

### Evanston

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 10.1 inches

### Chinook

*Surface layer texture:* Fine sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 7.8 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1373C—Evanston-Chinook-Marmarth association, 0 to 8 percent slopes

## Setting

### *Landform:*

Evanston—Alluvial fans  
 Chinook—Alluvial fans  
 Marmarth—Sedimentary plains

### *Position on landform:*

Evanston—Foothills and toeslopes  
 Chinook—Backslopes and foothills  
 Marmarth—Backslopes and shoulders

### *Slope:*

Evanston—0 to 8 percent  
 Chinook—0 to 8 percent  
 Marmarth—0 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Evanston and similar soils: 40 percent  
 Chinook and similar soils: 25 percent  
 Marmarth and similar soils: 20 percent

### Minor Components

Twilight and similar soils: 0 to 5 percent  
 Cabbart and similar soils: 0 to 3 percent  
 Moderately deep clayey soils: 0 to 3 percent  
 Ethridge and similar soils: 0 to 2 percent  
 Slopes greater than 8 percent: 0 to 2 percent

## Major Component Description

### Evanston

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 10.1 inches

### Chinook

*Surface layer texture:* Fine sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 7.8 inches

### Marmarth

*Surface layer texture:* Loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Interbedded sandstone and shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 1037D—Evanston-Yamacall association, 0 to 15 percent slopes

#### Setting

##### Landform:

Evanston—Alluvial fans and stream terraces

Yamacall—Alluvial fans and stream terraces

##### Position on landform:

Evanston—Foothills and toeslopes

Yamacall—Backslopes

##### Slope:

Evanston—0 to 15 percent

Yamacall—0 to 15 percent

Elevation: 2,170 to 3,400 feet

Mean annual precipitation: 11 to 14 inches

Frost-free period: 100 to 120 days

#### Composition

##### Major Components

Evanston and similar soils: 50 percent

Yamacall and similar soils: 25 percent

##### Minor Components

Kobase and similar soils: 0 to 5 percent

Marvan and similar soils: 0 to 5 percent

Benz and similar soils: 0 to 5 percent

Gerdrum and similar soils: 0 to 5 percent

Creed and similar soils: 0 to 5 percent

#### Major Component Description

##### Evanston

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 10.1 inches

##### Yamacall

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Alluvium

Native plant cover type: Rangeland

Flooding: None

Available water capacity: Mainly 9.7 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

#### Farnuf Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Moderate (0.6 to 2.0 inches/hour)

Landform: Alluvial fans

Parent material: Alluvium

Slope range: 2 to 15 percent

Annual precipitation: 14 to 17 inches

Annual air temperature: 40 to 45 degrees F

Frost-free period: 90 to 110 days

**Taxonomic Class:** Fine loamy, mixed Typic  
Argiborolls

#### Typical Pedon

Farnuf loam, 2 to 8 percent slopes, in cropland, 300 feet west and 1,700 feet north of the southeast corner of sec. 20, T. 25 N., R. 23 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; abrupt smooth boundary.

Bt1—6 to 13 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots; many very fine and few fine tubular pores; common faint clay films on faces of peds; neutral; clear wavy boundary.

Bt2—13 to 19 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium

prismatic structure parting to moderate fine subangular blocky; hard, very friable, sticky and plastic; common fine and very fine roots; many very fine and few fine tubular pores; common faint clay films on faces of ped; slightly alkaline; clear wavy boundary.

**Bk1**—19 to 32 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; few very fine roots; many very fine and few fine tubular pores; many fine masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

**Bk2**—32 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine and few fine tubular pores; few fine distinct yellowish brown (10YR 5/6) relict redox concentrations; many fine and medium masses of lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 41 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 15 inches and includes all or part of the argillic horizon

*Depth to Bk horizon:* 10 to 25 inches

#### *A horizon*

Hue: 2.5Y or 10YR

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 15 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles and stones, 0 to 10 percent pebbles

Reaction: pH 6.1 to 7.8

#### *Bt horizons*

Hue: 2.5Y to 7.5YR

Value: 3 to 6 dry; 2 to 4 moist

Chroma: 2 to 4

Texture: loam, clay loam, or silty clay loam

Clay content: 25 to 35 percent

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.1 to 7.8

#### *Bk1 horizon*

Hue: 2.5Y to 7.5YR

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: fine sandy loam, loam, silt loam, silty clay loam, or clay loam

Clay content: 20 to 30 percent

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

#### *Bk2 horizon*

Hue: 2.5Y to 7.5YR

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loam or clay loam—or strata consisting of thin layers of fine sandy loam, clay loam, silty clay loam, silty clay, and silt loam

Clay content: 15 to 30 percent

Rock fragments: 0 to 30 percent-0 to 10 percent cobbles, 0 to 20 percent pebbles

Calcium carbonate equivalent: 3 to 12 percent

Electrical conductivity: 2 to 8 mmhos/cm

Reaction: pH 7.4 to 9.0

## 75C—Farnuf loam, 2 to 8 percent slopes

### Setting

*Landform:* Alluvial fans

*Slope:* 2 to 8 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

### Composition

#### Major Components

Farnuf and similar soils: 90 percent

#### Minor Components

Savage and similar soils: 0 to 8 percent

Saline and sodic soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Ferd Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Alluvial fans, stream terraces, drainageways

*Parent material:* Alluvium

*Slope range:* 0 to 4 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Glossic Eutroboralfs

## Typical Pedon

Ferd loam, 0 to 4 percent slopes, in cropland, 1,500 feet west and 800 feet south of the northeast corner of sec. 3, T. 37 N., R. 32 E.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to moderate fine granular; soft, very friable, nonsticky and nonplastic; many very fine roots; common very fine tubular pores; neutral; clear smooth boundary.

Bt—6 to 13 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium prismatic structure parting to strong angular blocky; very hard, firm, sticky and plastic; many very fine roots; common very fine tubular pores; many faint clay films on faces of peds; neutral; clear wavy boundary.

Bk1—13 to 22 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—22 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine

roots; common very fine tubular pores; few fine masses of lime; strongly effervescent; moderately alkaline.

## Range in Characteristics

*Soil temperature:* 43 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bk horizon:* 12 to 16 inches

*Note:* Some pedons have a By or Bky horizon and thin lenses of fine sandy loam or fine sand below 20 inches.

*Taxonomic Note:* Ferd soils in Phillips County are a taxadjunct to the series. They do not have a glossic horizon and classify as fine, montmorillonitic Typic Eutroboralfs. This difference does not significantly affect the use or management of the soil.

*Ap horizon*

Hue: 10YR or 2.5Y

Value: 3 or 4 moist

Clay content: 20 to 27 percent

Reaction: pH 6.6 to 7.3

*Bt horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry

Chroma: 2 or 3

Texture: clay loam, silty clay loam, or clay

Clay content: 35 to 50 percent

Reaction: pH 6.6 to 8.4

*Note:* Some pedons have a Btk horizon

*Bk1 horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry, 4 or 5 moist

Chroma: 2 or 3

Texture: clay loam or silty clay loam

Clay content: 27 to 40 percent

Calcium carbonate equivalent: 5 to 15 percent

Electrical conductivity: 2 to 8 mmhos/cm

Sodium adsorption ratio: 0 to 13

Reaction: pH 7.9 to 9.0

*Bk2 horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry, 4 or 5 moist

Chroma: 2, 3, or 4

Texture: clay loam or silty clay loam

Clay content: 27 to 40 percent

Calcium carbonate equivalent: 5 to 15 percent

Electrical conductivity: 4 to 8 mmhos/cm

Sodium adsorption ratio: 8 to 13

Reaction: pH 7.9 to 9.6

**31B—Ferd loam, 0 to 4 percent slopes****Setting**

*Landform:* Alluvial fans, stream terraces and drainageways

*Slope:* 0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

**Composition****Major Components**

Ferd and similar soils: 90 percent

**Minor Components**

Evanston and similar soils: 0 to 5 percent

Fine sandy loam surface layers: 0 to 2 percent

Creed and similar soils: 0 to 1 percent

Gerdrum and similar soils: 0 to 1 percent

Absher and similar soils: 0 to 1 percent

**Major Component Description**

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.4 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**312B—Ferd-Absher complex, 0 to 4 percent slopes****Setting**

*Landform:*

Ferd—Alluvial fans, stream terraces, and drainageways

Absher—Alluvial fans, stream terraces, and drainageways

*Position on landform:*

Ferd—Microhighs

Absher—Microlows

*Slope:*

Ferd—0 to 4 percent

Absher—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

**Composition****Major Components**

Ferd and similar soils: 55 percent

Absher and similar soils: 35 percent

**Minor Components**

Evanston and similar soils: 0 to 5 percent

Gerdrum and similar soils: 0 to 3 percent

Creed and similar soils: 0 to 2 percent

**Major Component Description****Ferd**

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.4 inches

**Absher**

*Surface layer texture:* Clay

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

*Drainage class:* Moderately well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 4.0 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## 311B—Ferd-Gerdrum complex, 0 to 4 percent slopes

### Setting

#### Landform:

Ferd—Alluvial fans, stream terraces, and drainageways

Gerdrum—Alluvial fans, stream terraces, and drainageways

#### Position on landform:

Ferd—Microhighs

Gerdrum—Microlows

#### Slope:

Ferd—0 to 4 percent

Gerdrum—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Ferd and similar soils: 55 percent

Gerdrum and similar soils: 35 percent

#### Minor Components

Creed and similar soils: 0 to 3 percent

Evanston and similar soils: 0 to 3 percent

Absher and similar soils: 0 to 2 percent

Fine sandy loam surface layers: 0 to 2 percent

### Major Component Description

#### Ferd

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.4 inches

#### Gerdrum

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Fortbenton Series

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

*Drainage class:* Well drained

*Permeability:* Moderately rapid (2.0 to 6.0 inches/hour) in the upper 29 inches; slow (0.06 to 0.2 inch/hour) below

*Landform:* Till plains

*Parent material:* Alluvium or eolian material over till

*Slope range:* 2 to 8 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Aridic Haploborolls

### Typical Pedon

Fortbenton fine sandy loam, 2 to 8 percent slopes, in cropland, 300 feet north and 150 feet east of the southwest corner of sec. 21, T. 30 N., R. 27 E.

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

Bw1—7 to 14 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine tubular pores; few faint clay films on faces of peds; neutral; clear wavy boundary.

Bw2—14 to 23 inches; brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable, slightly sticky and nonplastic; few fine

and very fine roots; many very fine tubular pores; neutral; clear wavy boundary.

Bk—23 to 29 inches; pale brown (10YR 6/3) fine sandy loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine tubular pores; few fine masses of lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

2Bk1—29 to 46 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine tubular pores; many fine seams and masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

2Bk2—46 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine tubular pores; common fine seams and masses of lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* 4 to 12 inches

*Mollic epipedon thickness:* 7 to 15 inches

*Depth to Bk horizon:* 11 to 30 inches

*Depth to 2Bk horizon:* 15 to 30 inches

#### *Ap horizon*

Hue: 10YR or 2.5Y

Chroma: 2 or 3

Clay content: 5 to 18 percent

Reaction: pH 6.6 to 7.8

#### *Bw1 horizon*

Hue: 10YR or 2.5Y

Value: 4 or 5 dry, 3 or 4 moist

Chroma: 2 or 3

Texture: fine sandy loam or sandy loam

Clay content: 5 to 18 percent

Reaction: pH 6.6 to 7.8

#### *Bw2 horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry

Chroma: 2 to 4

Texture: fine sandy loam or sandy loam

Clay content: 5 to 18 percent

Reaction: pH 6.6 to 7.8

#### *Bk horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry, 4 or 5 moist

Chroma: 2 to 4

Texture: loam, sandy loam or fine sandy loam

Clay content: 5 to 18 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 9.0

#### *2Bk horizons*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry, 4 or 5 moist

Chroma: 2 to 4

Texture: clay loam or silty clay loam

Clay content: 27 to 35 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 9.0

## 351C—Fortbenton fine sandy loam, 2 to 8 percent slopes

### Setting

*Landform:* Till plains

*Slope:* 2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Fortbenton and similar soils: 90 percent

#### Minor Components

Chinook and similar soils: 0 to 3 percent

Assinniboine and similar soils: 0 to 2 percent

Evanston and similar soils: 0 to 2 percent

Thoeny and similar soils: 0 to 1 percent

Joplin and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Fine sandy loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium or eolian material

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.6 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Gerdrum Series

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

*Drainage class:* Well drained

*Permeability:* Very slow: .06 inch/hour)

*Landform:* Alluvial fans, stream terraces, drainageways

*Parent material:* Alluvium

*Slope range:* 0 to 8 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Typic Natriboralfs

## Typical Pedon

Gerdrum clay loam, in an area of Ethridge-Gerdrum clay loams, 0 to 4 percent slopes, in rangeland, 1,100 feet east and 20 feet north of the southwest corner of sec. 22, T. 24 N., R. 28 E.

E—0 to 3 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine and common fine vesicular pores; neutral; abrupt smooth boundary.

Btn1—3 to 7 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong fine columnar structure parting to moderate fine subangular blocky; extremely hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; many faint clay films on faces of peds; many light gray (10YR 7/2) skeletalans on tops of columns and common skeletalans on vertical faces of columns; slightly alkaline; clear wavy boundary.

Btn2—7 to 12 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong fine prismatic structure parting to strong fine and medium subangular blocky; extremely hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; common faint clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bkn—12 to 23 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate fine

subangular blocky; very hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; few fine masses of lime, disseminated lime; strongly effervescent; strongly alkaline; clear wavy boundary.

Bknyz1—23 to 32 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; few fine masses of lime; few fine and medium masses of gypsum crystals; few fine masses of other salt crystals; violently effervescent; moderately alkaline; gradual wavy boundary.

Bknyz2—32 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam with thin strata of silty clay loam, olive brown (2.5Y 4/4) moist; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine tubular pores; few fine masses of lime, gypsum, and other salt crystals; violently effervescent; moderately alkaline; clear wavy boundary.

## Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* 4 to 12 inches

*Depth to Bkn horizon:* 10 to 24 inches

*Depth to Bknyz horizon:* 10 to 28 inches

*Notes:* Some pedons have a thin A horizon. Some pedons have a Btkn horizon

### *E horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: loam or clay loam (clay loam when mixed to 7 inches)

Clay content: 20 to 35 percent; 27 to 40 percent where mixed to 7 inches

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.6 to 7.8

### *Btn horizons*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Textures: clay, silty clay, silty clay loam

Clay content: 35 to 55 percent

Rock fragments: 0 to 10 percent pebbles

Electrical conductivity: 1 to 8 mmhos/cm

Sodium adsorption ratio: 10 to 20

Reaction: pH 7.4 to 9.0

*Bkn horizon*

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 or 3  
 Texture: clay, silty clay, silty clay loam, or clay loam  
 Clay content: 35 to 55 percent  
 Rock fragments: 0 to 10 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Electrical conductivity: 2 to 8 mmhos/cm  
 Sodium adsorption ratio: 13 to 20  
 Reaction: pH 7.4 to 9.0

*Bknyz horizons*

Hue: 10YR to 5Y  
 Value: 4 to 7 dry; 4 to 6 moist  
 Chroma: 2 to 4  
 Textures: clay loam, sandy clay loam, clay, or silty clay  
 Clay content: 30 to 50 percent  
 Rock fragments: 0 to 10 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Electrical conductivity: 8 to 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 30  
 Gypsum: 1 to 5 percent  
 Reaction: pH 7.9 to 9.0

### 402B—Gerdrum-Absher complex, 0 to 4 percent slopes

#### Setting

*Landform:*

Gerdrum—Alluvial fans, stream terraces, and drainageways  
 Absher—Alluvial fans, stream terraces, and drainageways

*Position on landform:*

Gerdrum—Microhighs  
 Absher—Microlows

*Slope:*

Gerdrum—0 to 4 percent  
 Absher—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Gerdrum and similar soils: 50 percent  
 Absher and similar soils: 40 percent

##### Minor Components

Ferd and similar soils: 0 to 5 percent  
 Creed and similar soils: 0 to 5 percent

#### Major Component Description

##### Gerdrum

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.1 inches

##### Absher

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.0 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

##### Glendive Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderately rapid (2.0 to 6.0 inches/hour)  
*Landform:* Flood plains  
*Parent material:* Alluvium  
*Slope range:* 0 to 2 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Coarse loamy, mixed  
(calcareous), frigid Aridic Ustifluvents

### Typical Pedon

Glendive loam in an area of Glendive-Havre loams, 0 to 2 percent slopes, in woodland, 900 feet west and 1,900 feet north of the southeast corner of sec. 15, T. 30 N., R. 28 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly effervescent; slightly alkaline; clear wavy boundary.

C1—4 to 26 inches; light brownish gray (2.5Y 6/2) fine sandy loam with thin strata of loam and loamy fine sand, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine and few fine tubular pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—26 to 60 inches; light brownish gray (2.5Y 6/2) fine sandy loam with thin strata of loamy fine sand, loam and silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 8 and 24 inches

#### A horizon

Hue: 10YR to 5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 10 to 27 percent

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 6.6 to 9.0

#### C1 horizon

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loam, silt loam, sandy loam, fine sandy loam

Clay content: 5 to 18 percent

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 2 to 10 percent

Reaction: pH 7.4 to 9.0

#### C2 horizon

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: sandy loam or fine sandy loam consisting of thin layers of loam, sandy loam, silt loam, loamy sand, loamy fine sand, and occasionally clay loam

Clay content: 5 to 18 percent

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 2 to 10 percent

Reaction: pH 7.4 to 9.0

## 81A—Glendive loam, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Glendive and similar soils: 90 percent

#### Minor Components

Glendive fine sandy loam: 0 to 4 percent

Havre and similar soils: 0 to 2 percent

Hanly and similar soils: 0 to 2 percent

Lallie and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* Rare

*Available water capacity:* Mainly 8.8 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 811A—Glendive-Havre loams, 0 to 2 percent slopes

#### Setting

##### Landform:

Glendive—Flood plains

Havre—Flood plains

##### Slope:

Glendive—0 to 2 percent

Havre—0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Glendive and similar soils: 60 percent

Havre and similar soils: 30 percent

##### Minor Components

Hanly and similar soils: 0 to 3 percent

Bullhook and similar soils: 0 to 3 percent

Harlake and similar soils: 0 to 2 percent

Lallie and similar soils: 0 to 2 percent

#### Major Component Description

##### Glendive

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Forest land

*Flooding:* Rare

*Available water capacity:* Mainly 8.8 inches

##### Havre

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Forest land

*Flooding:* Rare

*Available water capacity:* Mainly 9.7 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Hanly Series

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

*Drainage class:* Somewhat excessively drained

*Permeability:* Rapid (6.0 to 20.0 inches/hour)

*Landform:* Flood plains

*Parent material:* Alluvium

*Slope range:* 0 to 2 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Sandy, mixed, frigid Aridic  
Ustifluvents

## Typical Pedon

Hanly fine sandy loam, 0 to 2 percent slopes, in cropland, 400 feet east and 800 feet south of the northwest corner of sec. 18, T. 30 N., R. 29 E.

Ap—0 to 3 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; common fine and very fine roots; slightly effervescent; neutral; abrupt smooth boundary.

C1—3 to 7 inches; light brownish gray (2.5Y 6/2) loamy fine sand with strata of fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine and few fine and medium tubular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

C2—7 to 60 inches; light brownish gray (2.5Y 6/2) loamy fine sand with thin strata of fine sandy loam and silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine and few fine tubular pores; few

fine iron stains; slightly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 12 and 35 inches

#### *Ap horizon*

Hue: 2.5Y or 10YR  
Value: 5 to 7 dry; 4 to 6 moist  
Chroma: 2 or 3  
Clay content: 10 to 20 percent  
Calcium carbonate equivalent: 1 to 5 percent  
Reaction: pH 6.6 to 8.4

#### *C horizons*

Hue: 10YR to 5Y  
Value: 5 to 7 dry; 4 to 6 moist  
Chroma: 2 to 4  
Texture: loamy fine sand, loamy sand, fine sand, or sand; typically with thin strata of fine sandy loam, loam, or silt loam. Some pedons contain thin coarse sand layers below a depth of 30 inches. A few pedons contain thin Ab horizons below a depth of 40 inches.  
Clay content: 0 to 12 percent  
Calcium carbonate equivalent: 2 to 10 percent  
Reaction: pH 6.6 to 8.4

## 100A—Hanly fine sandy loam, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains  
*Slope:* 0 to 2 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Hanly and similar soils: 90 percent

#### Minor Components

Glendive and similar soils: 0 to 8 percent  
Havre and similar soils: 0 to 2 percent

### Major Component Description

*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:* Rangeland  
*Flooding:* Rare  
*Available water capacity:* Mainly 5.8 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Harlake Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Slow (0.06 to 0.2 inch/hour)  
*Landform:* Flood plains  
*Parent material:* Alluvium  
*Slope range:* 0 to 2 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic (calcareous), frigid Aridic Ustifluvents

### Typical Pedon

Harlake clay, 0 to 2 percent slopes, in irrigated cropland, 400 feet north and 2,000 feet west of the southeast corner of sec. 14, T. 30 N., R. 28 E.

Ap—0 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; very hard, firm, very sticky and very plastic; many very fine and few fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—8 to 23 inches; light brownish gray (2.5Y 6/2) clay with thin strata of clay loam and loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; strongly effervescent; strongly alkaline; clear wavy boundary.

C2—23 to 50 inches; grayish brown (2.5Y 5/2) clay with thin strata of clay loam and silty clay loam,

dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; strongly effervescent; strongly alkaline.

C3—50 to 60 inches; grayish brown (2.5Y 5/2) stratified clay loam and silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; few very fine tubular pores; strongly effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

#### *Ap horizon*

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay loam or clay

Clay content: 27 to 55 percent

Electrical conductivity: 0 to 4 mmhos/cm

Sodium adsorption ratio: 0 to 13

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 6.6 to 8.4

#### *C1 horizon*

Hue: 10YR to 5Y

Value: 4 to 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay, silty clay, or silty clay loam consisting of stratified layers of clay, silt loam, silty clay loam, clay loam, loam and silty clay

Clay content: 35 to 60 percent

Electrical conductivity: 0 to 4 mmhos/cm

Sodium adsorption ratio: 0 to 13

Calcium carbonate equivalent: 2 to 10 percent

Reaction: pH 7.4 to 9.0

#### *C2 horizon*

Hue: 10YR to 5Y

Value: 4 to 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay, silty clay, or silty clay loam consisting of stratified layers of clay, silt loam, silty clay loam, clay loam and silty clay

Clay content: 35 to 60 percent

Electrical conductivity: 0 to 4 mmhos/cm; the saline phase is 4 to 16 mmhos/cm

Sodium adsorption ratio: 0 to 13

Calcium carbonate equivalent: 2 to 10 percent

Reaction: pH 7.4 to 9.0

#### *C3 horizon*

Hue: 10YR to 5Y

Value: 4 to 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: silt loam, loam, clay loam, or fine sandy loam consisting of stratified layers of silty clay loam, silt loam, and fine sandy loam

Clay content: 15 to 35 percent

Electrical conductivity: 4 to 8 mmhos/cm

Sodium adsorption ratio: 0 to 13

Calcium carbonate equivalent: 2 to 10 percent

Reaction : pH 7.9 to 9.0

## 90A—Harlake clay, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Harlake and similar soils: 85 percent

#### Minor Components

Lostriver and similar soils: 0 to 3 percent

Havre and similar soils: 0 to 3 percent

Bullhook and similar soils: 0 to 3 percent

Bowdoin and similar soils: 0 to 2 percent

Somewhat poorly drained soils: 0 to 2 percent

Lallie and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* Rare

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

**905A—Harlake-Havre clay loams, 0 to 2 percent slopes****Setting***Landform:*

Harlake—Flood plains

Havre—Flood plains

*Slope:*

Harlake—0 to 2 percent

Havre—0 to 2 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Harlake and similar soils: 50 percent

Havre and similar soils: 35 percent

**Minor Components**

Clay surface layers: 0 to 5 percent

Moderately saline soils: 0 to 3 percent

Occasionally flooded soils: 0 to 3 percent

Moderately sodic soils: 0 to 2 percent

Poorly drained soils: 0 to 2 percent

**Major Component Description****Harlake***Surface layer texture:* Clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Moderately well drained*Dominant parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* Rare*Water table:* Apparent*Available water capacity:* Mainly 9.6 inches**Havre***Surface layer texture:* Clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Moderately well drained*Dominant parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* Rare*Water table:* Apparent*Available water capacity:* Mainly 10.1 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**903A—Harlake-Lostriver clays, 0 to 2 percent slopes****Setting***Landform:*

Harlake—Flood plains

Lostriver—Flood plains

*Slope:*

Harlake—0 to 2 percent

Lostriver—0 to 2 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Harlake and similar soils: 50 percent

Lostriver and similar soils: 40 percent

**Minor Components**

Bowdoin and similar soils: 0 to 4 percent

Havre and similar soils: 0 to 2 percent

Strongly saline soils: 0 to 2 percent

Strongly sodic soils: 0 to 2 percent

**Major Component Description****Harlake***Surface layer texture:* Clay*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Alluvium*Native plant cover type:* Rangeland*Flooding:* Rare*Available water capacity:* Mainly 9.3 inches**Lostriver***Surface layer texture:* Clay*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 8.6 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1090B—Harlake-Marvan association, 0 to 4 percent slopes

### Setting

*Landform:*

Harlake—Flood plains  
 Marvan—Alluvial fans and stream terraces

*Slope:*

Harlake—0 to 2 percent  
 Marvan—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Harlake and similar soils: 45 percent  
 Marvan and similar soils: 30 percent

#### Minor Components

Occasionally flooded soils: 0 to 10 percent  
 Havre and similar soils: 0 to 5 percent  
 Bowdoin and similar soils: 0 to 5 percent  
 Strongly saline soils: 0 to 3 percent  
 Strongly sodic soils: 0 to 2 percent

### Major Component Description

#### Harlake

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Available water capacity:* Mainly 9.1 inches

#### Marvan

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 7.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Havre Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour)  
*Landform:* Flood plains  
*Parent material:* Alluvium  
*Slope range:* 0 to 2 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed (calcareous), frigid Aridic Ustifluvents

### Typical Pedon

Havre loam, 0 to 2 percent slopes, in rangeland, 600 feet east and 2,500 feet south of the northwest corner of sec. 30, T. 34 N., R. 32 E.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly effervescent; slightly alkaline; clear wavy boundary.

C1—5 to 28 inches; light brownish gray (2.5Y 6/2) loam with thin strata of clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—28 to 60 inches; grayish brown (2.5Y 5/2) loam with thin strata of fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

#### *A horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: loam, clay loam, or clay

Clay content: 15 to 55 percent

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 6.1 to 8.4

#### *C1 horizon*

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: loam, silt loam, or clay loam which consist of strata of silt loam, fine sandy loam, silty clay loam, and clay loam

Clay content: 18 to 35 percent

Calcium carbonate equivalent: 2 to 10 percent

Electrical conductivity: 0 to 4 mmhos/cm

Sodium adsorption ratio: 0 to 13

Reaction: pH 7.4 to 9.0

#### *C2 horizon*

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: loam, silt loam, or clay loam which consists of strata of silt loam, fine sandy loam, silty clay loam, and clay loam

Clay content: 18 to 35 percent

Calcium carbonate equivalent: 2 to 10 percent

Electrical conductivity: 0 to 4 mmhos/cm

Sodium adsorption ratio: 0 to 13

Reaction: pH 7.4 to 9.0

## 603A—Havre clay, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Havre and similar soils: 90 percent

#### Minor Components

Harlake and similar soils: 0 to 2 percent

Glendive and similar soils: 0 to 2 percent

Bullhook and similar soils: 0 to 2 percent

Strongly saline soils: 0 to 2 percent

Lallie and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* Rare

*Available water capacity:* Mainly 9.5 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 60A—Havre loam, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Havre and similar soils: 90 percent

#### Minor Components

Harlake and similar soils: 0 to 5 percent  
 Bullhook and similar soils: 0 to 3 percent  
 Lallie and similar soils: 0 to 2 percent

#### Major Component Description

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Available water capacity:* Mainly 9.7 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 601A—Havre-Harlake-Glendive complex, 0 to 2 percent slopes

#### Setting

##### *Landform:*

Havre—Flood plains  
 Harlake—Flood plains  
 Glendive—Flood plains

##### *Slope:*

Havre—0 to 2 percent  
 Harlake—0 to 2 percent  
 Glendive—0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Havre and similar soils: 35 percent  
 Harlake and similar soils: 30 percent  
 Glendive and similar soils: 25 percent

#### Minor Components

Occasionally flooded soils: 0 to 2 percent  
 Fine sandy loam surface layers: 0 to 2 percent  
 Clay surface layers: 0 to 2 percent  
 Bullhook and similar soils: 0 to 2 percent  
 Lostriver and similar soils: 0 to 2 percent

#### Major Component Description

##### Havre

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Available water capacity:* Mainly 9.7 inches

##### Harlake

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Available water capacity:* Mainly 9.2 inches

##### Glendive

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Available water capacity:* Mainly 8.8 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Hillon Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Till plains, hills, escarpments

*Parent material:* Till

*Slope range:* 2 to 65 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed (calcareous), frigid Aridic Ustorthents

## Typical Pedon

Hillon loam, in an area of Joplin-Hillon loams, 2 to 8 percent slopes, in cropland, 50 feet east and 2,000 feet south of the northwest corner of sec. 17, T. 29 N., R. 30 E.

Ap—0 to 3 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—3 to 8 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; few fine and medium masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—8 to 26 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; many fine and medium masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bky—26 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; few fine distinct yellowish brown (10YR 5/6) relict mottles; few fine masses of lime and gypsum crystals; violently effervescent; strongly alkaline.

## Range in Characteristics

*Soil temperature:* 41 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bk horizon:* 3 to 9 inches

### Ap horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 20 to 27 percent

Rock fragments: 0 to 25 percent-0 to 10 percent cobbles and stones, 0 to 15 percent pebbles

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 8.4

### Bk horizons

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loam or clay loam

Clay content: 20 to 35 percent with 25 to 35 percent fine and coarser sand

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 9.0

### Bky horizon

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loam or clay loam

Clay content: 20 to 35 percent with 25 to 35 percent fine and coarser sand

Rock fragments: 0 to 15 percent pebbles

Bulk density: 1.55 to 1.75 g/ccm

Calcium carbonate equivalent: 5 to 15 percent

Gypsum: 1 to 5 percent

Sodium adsorption ratio: 1 to 20

Electrical conductivity: 0 to 8

Reaction: pH 7.9 to 9.0

### 1022F—Hillon-Cabbart-Rock outcrop association, 15 to 65 percent slopes

#### Setting

##### Landform:

Hillon—Escarpments  
Cabbart—Escarpments  
Rock outcrop—Escarpments

##### Position on landform:

Hillon—Shoulders  
Cabbart—Backslopes  
Rock outcrop—Backslopes

##### Slope:

Hillon—15 to 65 percent  
Cabbart—15 to 65 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Hillon and similar soils: 40 percent  
Cabbart and similar soils: 30 percent  
Rock outcrop: 15 percent

##### Minor Components

Kevin and similar soils: 0 to 4 percent  
Twilight and similar soils: 0 to 3 percent  
Yamacall and similar soils: 0 to 3 percent  
Neldore and similar soils: 0 to 2 percent  
Bascovy and similar soils: 0 to 2 percent  
Shallow sandy soils: 0 to 1 percent

#### Major Component Description

##### Hillon

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 10.0 inches

##### Cabbart

*Surface layer texture:* Loam  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Interbedded sandstone and shale residuum  
*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 2.8 inches

#### Rock outcrop

*Definition:* Areas of exposed 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 220E—Hillon-Joplin cobbly loams, 8 to 35 percent slopes

#### Setting

##### Landform:

Hillon—Hills  
Joplin—Hills

##### Position on landform:

Hillon—Backslopes and shoulders  
Joplin—Backslopes and foot slopes

##### Slope:

Hillon—8 to 35 percent  
Joplin—8 to 25 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Hillon and similar soils: 50 percent  
Joplin and similar soils: 35 percent

##### Minor Components

Very cobbly surface layers: 0 to 5 percent  
Kevin and similar soils: 0 to 5 percent  
Sunburst and similar soils: 0 to 5 percent

#### Major Component Description

##### Hillon

*Surface layer texture:* Cobbly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till

*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.7 inches

### Joplin

*Surface layer texture:* Cobbly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 224D—Hillon-Joplin gravelly loams, 8 to 15 percent slopes

### Setting

#### *Landform:*

Hillon—Hills  
 Joplin—Hills

#### *Position on landform:*

Hillon—Backslopes and shoulders  
 Joplin—Footslopes

#### *Slope:*

Hillon—8 to 15 percent  
 Joplin—8 to 15 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Hillon and similar soils: 55 percent  
 Joplin and similar soils: 30 percent

#### Minor Components

Very cobbly surface layers: 0 to 5 percent  
 Hillon and similar soils: 0 to 3 percent

Kevin and similar soils: 0 to 3 percent  
 Slopes greater than 15 percent: 0 to 3 percent  
 Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Hillon

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.8 inches

#### Joplin

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1221F—Hillon-Kevin association, 15 to 45 percent slopes

### Setting

#### *Landform:*

Hillon—Hills  
 Kevin—Hills

#### *Position on landform:*

Hillon—Backslopes and shoulders  
 Kevin—Footslopes

#### *Slope:*

Hillon—15 to 45 percent  
 Kevin—15 to 25 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Hillon and similar soils: 55 percent

Kevin and similar soils: 20 percent

### Minor Components

Scobey and similar soils: 0 to 10 percent

Sunburst and similar soils: 0 to 5 percent

Cabbart and similar soils: 0 to 5 percent

Bascovy and similar soils: 0 to 3 percent

Neldore and similar soils: 0 to 2 percent

### Major Component Description

#### Hillon

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.8 inches

#### Kevin

*Surface layer texture:* Gravelly clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 8.9 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 221E—Hillon-Kevin complex, 15 to 25 percent slopes

## Setting

*Landform:*

Hillon—Hills

Kevin—Hills

*Position on landform:*

Hillon—Backslopes and shoulders

Kevin—Footslopes

*Slope:*

Hillon—15 to 25 percent

Kevin—15 to 25 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Hillon and similar soils: 55 percent

Kevin and similar soils: 30 percent

### Minor Components

Very cobbly surface layers: 0 to 10 percent

Sunburst and similar soils: 0 to 3 percent

Scobey and similar soils: 0 to 2 percent

### Major Component Description

#### Hillon

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.8 inches

#### Kevin

*Surface layer texture:* Gravelly clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 8.9 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 221D—Hillon-Kevin complex, 8 to 15 percent slopes

### Setting

#### Landform:

Hillon—Hills

Kevin—Hills

#### Position on landform:

Hillon—Backslopes and shoulders

Kevin—Footslopes

#### Slope:

Hillon—8 to 15 percent

Kevin—8 to 15 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Hillon and similar soils: 50 percent

Kevin and similar soils: 35 percent

#### Minor Components

Sunburst and similar soils: 0 to 4 percent

Slopes greater than 15 percent: 0 to 4 percent

Scobey and similar soils: 0 to 3 percent

Very cobbly surface layers: 0 to 3 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Hillon

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.8 inches

#### Kevin

*Surface layer texture:* Gravelly clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 8.9 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Joplin Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Till plains, hills

*Parent material:* Till

*Slope range:* 0 to 25 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Aridic Argiborolls

### Typical Pedon

Joplin loam, in an area of Telstad-Joplin loams, 2 to 8 percent slopes, in cropland, 2,300 feet west and 1,400 feet south of the northeast corner of sec. 33, T. 30 N., R. 28 E.

Ap—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly alkaline; abrupt smooth boundary.

Bt—4 to 8 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium angular blocky; hard, very friable, sticky and plastic; many fine and very fine roots; many very fine tubular pores; many faint clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk1—8 to 15 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very friable, sticky and plastic; common very fine roots; many very fine tubular pores; common fine and medium masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—15 to 29 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist;

weak fine and medium subangular blocky structure; hard, very friable, sticky and plastic; few very fine roots; many very fine tubular pores; many medium and coarse masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

**Bk3**—29 to 60 inches; light brownish gray (2.5 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure; hard, friable, sticky and plastic; many very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 10 inches thick

*Depth to Bk horizon:* 7 to 10 inches

#### *Ap horizon*

Hue: 10YR or 2.5Y

Chroma: 2 or 3

Clay content: 10 to 27 percent

Rock fragments: 0 to 35 percent-0 to 15 percent cobbles, 0 to 20 percent pebbles

Reaction: pH 6.6 to 7.8

#### *Bt horizon*

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: loam or clay loam

Clay content: 25 to 35 percent

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.6 to 7.8

#### *Bk1 and Bk2 horizons*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: loam or clay loam

Clay content: 18 to 32 percent

Rock fragments: 0 to 35 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

#### *Bk3 horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: loam or clay loam

Clay content: 18 to 32 percent

Rock fragments: 0 to 35 percent pebbles

Moist bulk density: 1.55 to 1.75 gr/cm

Gypsum: 0 to 3 percent

Electrical conductivity: 0 to 4 mmhos/cm

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 9.0

## 426C—Joplin-Hillon gravelly loams, 2 to 8 percent slopes

### Setting

#### *Landform:*

Joplin—Till plains

Hillon—Till plains

#### *Position on landform:*

Joplin—Foothills

Hillon—Backslopes and shoulders

#### *Slope:*

Joplin—2 to 8 percent

Hillon—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Joplin and similar soils: 55 percent

Hillon and similar soils: 30 percent

#### Minor Components

Very cobbly surface layers: 0 to 5 percent

Kevin and similar soils: 0 to 3 percent

Slopes greater than 8 percent: 0 to 3 percent

Thoeny and similar soils: 0 to 2 percent

Elloam and similar soils: 0 to 1 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Joplin

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.2 inches

#### Hillon

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.8 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 421C—Joplin-Hillon loams, 2 to 8 percent slopes

### Setting

*Landform:*

Joplin—Till plains  
 Hillon—Till plains

*Position on landform:*

Joplin—Foothills  
 Hillon—Backslopes and shoulders

*Slope:*

Joplin—2 to 8 percent  
 Hillon—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Joplin and similar soils: 55 percent  
 Hillon and similar soils: 30 percent

#### Minor Components

Slopes greater than 8 percent: 0 to 4 percent  
 Kevin and similar soils: 0 to 3 percent  
 Thoeny and similar soils: 0 to 3 percent  
 Elloam and similar soils: 0 to 2 percent  
 Cobbly surface layers: 0 to 2 percent  
 Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Joplin

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained

*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.3 inches

#### Hillon

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 424D—Joplin-Telstad loams, 8 to 15 percent slopes

### Setting

*Landform:*

Joplin—Hills  
 Telstad—Hills

*Position on landform:*

Joplin—Backslopes  
 Telstad—Foothills

*Slope:*

Joplin—8 to 15 percent  
 Telstad—8 to 15 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Joplin and similar soils: 55 percent  
 Telstad and similar soils: 30 percent

#### Minor Components

Hillon and similar soils: 0 to 5 percent  
 Kevin and similar soils: 0 to 3 percent

Slopes greater than 15 percent: 0 to 3 percent  
 Thoeny and similar soils: 0 to 2 percent  
 Elloam and similar soils: 0 to 1 percent  
 Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Joplin

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.3 inches

#### Telstad

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

#### Judith Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour) in the upper 31 inches; moderately rapid (2.0 to 6.0 inches/hour) below  
*Landform:* Alluvial fans, relict stream terraces  
*Parent material:* Alluvium from limestone  
*Slope range:* 0 to 8 percent  
*Annual precipitation:* 14 to 17 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Fine-loamy, carbonatic Typic Calciborolls

### Typical Pedon

Judith loam, in an area of Martinsdale-Judith loams, 0 to 4 percent slopes, in rangeland, 1,400 feet east and 1,650 feet south of the northwest corner of sec. 24, T. 25 N., R. 23 E.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; strong fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; 5 percent pebbles and 5 percent cobbles; slightly effervescent; slightly alkaline; clear wavy boundary.

Bw—6 to 11 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to strong fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; many very fine tubular pores; 5 percent pebbles; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk1—11 to 21 inches; white (10YR 8/2) clay loam, very pale brown (10YR 7/3) moist; moderate fine and medium subangular blocky structure; hard, very friable, sticky and plastic; common fine and very fine roots; many very fine tubular pores; 10 percent pebbles; disseminated lime, many fine and medium masses of lime, continuous distinct lime coatings on rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—21 to 31 inches; very pale brown (10YR 7/3) gravelly clay loam, light yellowish brown (10YR 6/4) moist; moderate fine and medium subangular blocky structure; hard, very friable, sticky and plastic; few fine and very fine roots; many very fine tubular pores; 15 percent pebbles and 5 percent cobbles; disseminated lime, common fine and medium masses of lime, continuous distinct lime coatings on rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk3—31 to 60 inches; very pale brown (10YR 7/3) very gravelly clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, very friable, sticky and plastic; few very fine roots; many very fine tubular pores; 30 percent pebbles and 10 percent cobbles; disseminated lime, common fine

masses of lime, continuous distinct lime coatings on rock fragments; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 41 to 46 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 12 inches

*Depth to calcic horizon:* 9 to 12 inches

*Depth to 2Bk3 horizon:* mainly 23 to 32 inches, but ranges from 23 to 38 inches

#### *A horizon*

Hue: 7.5YR to 2.5Y

Value: 4 or 5 dry, 2 or 3 moist

Chroma: 1 to 3

Clay content: 18 to 27 percent

Rock fragments: 5 to 15 percent-0 to 5 percent cobbles, 5 to 10 percent pebbles

Calcium carbonate content: 0 to 5 percent

Reaction: pH 7.4 to 8.4

#### *Bw horizon*

Hue: 7.5YR to 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: loam or clay loam

Clay content: 18 to 35 percent

Rock fragments: 5 to 35 percent-0 to 10 percent cobbles, 5 to 25 percent pebbles

Calcium carbonate content: 5 to 40 percent

Reaction: pH 7.9 to 8.4

#### *Bk1 and Bk2 horizons*

Hue: 7.5YR to 2.5Y

Value: 7 or 8 dry, 5 to 7 moist

Chroma: 2 to 4

Texture: loam or clay loam

Clay content: 18 to 35 percent (10 to 20 percent noncarbonate clay)

Rock fragments: 5 to 35 percent-0 to 10 percent cobbles, 5 to 25 percent pebbles

Calcium carbonate content: 40 to 60 percent

Reaction: pH 7.9 to 8.4

#### *2Bk3 horizon*

Hue: 7.5YR to 2.5Y

Value: 6 to 8 dry; 5 to 7 moist

Chroma: 2 to 4

Texture: loam, clay loam, or sandy clay loam

Clay content: 18 to 35 percent (10 to 20 percent noncarbonate clay)

Rock fragments: 35 to 80 percent-10 to 20 percent cobbles, 25 to 60 percent pebbles

Calcium carbonate content: 40 to 60 percent  
Reaction: pH 7.9 to 9.0

## 731C—Judith-Windham complex, 2 to 8 percent slopes

### Setting

#### *Landform:*

Judith—Alluvial fans

Windham—Alluvial fans

#### *Slope:*

Judith—2 to 8 percent

Windham—2 to 8 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

### Composition

#### Major Components

Judith and similar soils: 45 percent

Windham and similar soils: 40 percent

#### Minor Components

Binna and similar soils: 0 to 3 percent

Cobbly surface layers: 0 to 3 percent

Stony surface layers: 0 to 3 percent

Soils with less lime: 0 to 2 percent

Martinsdale and similar soils: 0 to 2 percent

Slopes greater than 8 percent: 0 to 2 percent

### Major Component Description

#### Judith

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Limestone alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 6.4 inches

#### Windham

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Limestone alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Kevin Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Till plains, hills

*Parent material:* Till

*Slope range:* 2 to 25 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Aridic  
Argiborolls

### Typical Pedon

Kevin clay loam, in an area of Scobey-Kevin clay loams, 2 to 8 percent slopes, in cropland, 2,300 feet south and 500 feet west of the northeast corner of sec. 9, T. 37 N., R. 32 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, sticky and plastic; common fine and very fine roots; neutral; abrupt smooth boundary.

Bt—6 to 9 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, friable, sticky and plastic; common fine and very fine roots; common very fine tubular pores; many faint clay films on faces of peds; neutral; clear wavy boundary.

Bk1—9 to 20 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, sticky and plastic; few fine and very fine roots; common very fine tubular pores; common fine and medium masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—20 to 33 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few fine and very fine roots; common very fine tubular pores; common fine and few medium masses of lime; few lignite chips; violently effervescent; moderately alkaline; gradual wavy boundary.

Bky—33 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak very coarse prismatic structure; very hard, firm, sticky and plastic; few very fine tubular pores; few fine masses of lime; few fine and medium masses of gypsum crystals; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 10 inches

*Depth to Bk horizon:* 7 to 10 inches

*A horizon*

Hue: 10YR to 5Y

Chroma: 2 or 3

Clay content: 27 to 35 percent

Rock fragments: 0 to 60 percent-0 to 50 percent pebbles, 0 to 30 percent cobbles

Reaction: pH 6.6 to 7.8

*Bt horizon*

Hue: 10YR to 5Y

Value: 4 or 5 dry, 3 or 4 moist

Chroma: 2 or 3

Texture: clay loam or clay

Clay content: 35 to 45 percent

Rock fragments: 0 to 15 percent pebbles

Reaction: pH 6.6 to 8.4

*Bk horizons*

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 27 to 35 percent

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

*Bky horizon*

Hue: 10YR to 2.5Y

Value: 5 or 6 dry, 4 or 5 moist

Chroma: 2 to 4

Clay content: 27 to 35 percent

Rock fragments: 0 to 15 percent

Moist bulk density: 1.55 to 1.75 gram/cm  
 Calcium carbonate equivalent: 5 to 15 percent  
 Gypsum: 1 to 5 percent  
 Reaction: pH 7.9 to 9.0

### 442C—Kevin-Hillon complex, 2 to 8 percent slopes

#### Setting

##### Landform:

Kevin—Till plains  
 Hillon—Till plains

##### Position on landform:

Kevin—Footslopes  
 Hillon—Backslopes and shoulders

##### Slope:

Kevin—2 to 8 percent  
 Hillon—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Kevin and similar soils: 55 percent  
 Hillon and similar soils: 30 percent

##### Minor Components

Scobey and similar soils: 0 to 5 percent  
 Cobbly surface layers: 0 to 3 percent  
 Slopes greater than 8 percent: 0 to 2 percent  
 Thoeny and similar soils: 0 to 2 percent  
 Nishon and similar soils: 0 to 2 percent  
 Absher and similar soils: 0 to 1 percent

#### Major Component Description

##### Kevin

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.2 inches

##### Hillon

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 1333C—Kevin-Phillips-Elloam association, 2 to 15 percent slopes

#### Setting

##### Landform:

Kevin—Sedimentary plains and hills  
 Phillips—Till plains  
 Elloam—Till plains

##### Position on landform:

Kevin—Backslopes and shoulders  
 Phillips—Footslopes and toeslopes  
 Elloam—Microlows

##### Slope:

Kevin—2 to 15 percent  
 Phillips—2 to 8 percent  
 Elloam—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Kevin and similar soils: 45 percent  
 Phillips and similar soils: 30 percent  
 Elloam and similar soils: 15 percent

##### Minor Components

Hillon and similar soils: 0 to 5 percent  
 Absher and similar soils: 0 to 4 percent  
 Nishon and similar soils: 0 to 1 percent

#### Major Component Description

##### Kevin

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.2 inches

### Phillips

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.4 inches

### Elloam

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1443E—Kevin-Scobey-Nishon association, 0 to 25 percent slopes

### Setting

#### *Landform:*

Kevin—Sedimentary plains and hills  
 Scobey—Till plains  
 Nishon—Closed depressions

#### *Position on landform:*

Kevin—Backslopes and shoulders  
 Scobey—Footslopes and toeslopes

#### *Slope:*

Kevin—2 to 25 percent  
 Scobey—0 to 15 percent  
 Nishon—0 to 2 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Kevin and similar soils: 40 percent  
 Scobey and similar soils: 25 percent  
 Nishon and similar soils: 10 percent

#### Minor Components

Hillon and similar soils: 0 to 6 percent  
 Very cobbly surface layers: 0 to 6 percent  
 Slopes greater than 25 percent: 0 to 6 percent  
 Thoeny and similar soils: 0 to 3 percent  
 Absher and similar soils: 0 to 2 percent  
 Dimmick and similar soils: 0 to 2 percent

### Major Component Description

#### Kevin

*Surface layer texture:* Gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.9 inches

#### Scobey

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

#### Nishon

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Poorly drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Water table:* Apparent  
*Ponding:* long  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1441D—Kevin-Scobey-Phillips association, 2 to 15 percent slopes

### Setting

#### Landform:

Kevin—Sedimentary plains and hills  
Scobey—Till plains  
Phillips—Till plains

#### Position on landform:

Kevin—Backslopes and shoulders  
Scobey—Backslopes and footslopes  
Phillips—Footslopes and toeslopes

#### Slope:

Kevin—2 to 15 percent  
Scobey—2 to 15 percent  
Phillips—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Kevin and similar soils: 35 percent  
Scobey and similar soils: 25 percent  
Phillips and similar soils: 20 percent

#### Minor Components

Hillon and similar soils: 0 to 5 percent  
Cobbly surface layers: 0 to 5 percent  
Slopes greater than 15 percent: 0 to 3 percent  
Thoeny and similar soils: 0 to 3 percent  
Absher and similar soils: 0 to 2 percent  
Nishon and similar soils: 0 to 2 percent

### Major Component Description

#### Kevin

*Surface layer texture:* Gravelly clay loam  
*Depth class:* Very deep (more than 60 inches).  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.9 inches

#### Scobey

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

#### Phillips

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.4 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 444C—Kevin-Sunburst clay loams, 2 to 8 percent slopes

### Setting

#### Landform:

Kevin—Till plains  
Sunburst—Till plains

#### Position on landform:

Kevin—Backslopes and footslopes  
Sunburst—Backslopes and shoulders

#### Slope:

Kevin—2 to 8 percent  
Sunburst—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Kevin and similar soils: 55 percent  
Sunburst and similar soils: 30 percent

**Minor Components**

Very cobbly surface layers: 0 to 5 percent  
 Slopes greater than 8 percent: 0 to 3 percent  
 Joplin and similar soils: 0 to 3 percent  
 Nishon and similar soils: 0 to 2 percent  
 Thoeny and similar soils: 0 to 1 percent  
 Absher and similar soils: 0 to 1 percent

**Major Component Description****Kevin**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.2 inches

**Sunburst**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.2 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**446D—Kevin-Sunburst very gravelly clay loams, 8 to 15 percent slopes****Setting***Landform:*

Kevin—Hills  
 Sunburst—Hills

*Position on landform:*

Kevin—Footslopes  
 Sunburst—Backslopes and shoulders

*Slope:*

Kevin—8 to 15 percent  
 Sunburst—8 to 15 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

**Composition****Major Components**

Kevin and similar soils: 55 percent  
 Sunburst and similar soils: 30 percent

**Minor Components**

Hillon and similar soils: 0 to 5 percent  
 Very cobbly surface layers: 0 to 5 percent  
 Slopes greater than 15 percent: 0 to 4 percent  
 Nishon and similar soils: 0 to 1 percent

**Major Component Description****Kevin**

*Surface layer texture:* Very gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.6 inches

**Sunburst**

*Surface layer texture:* Very gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.0 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**Kobase Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Slow (0.06 to 0.2 inch/hour)  
*Landform:* Alluvial fans, lake plains, hills  
*Parent material:* Alluvium, glaciolacustrine deposits

*Slope range:* 0 to 15 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic, frigid Aridic Ustochrepts

### Typical Pedon

Kobase silty clay loam, 0 to 4 percent slopes, in cropland, 1,500 feet east and 2,100 feet north of the southwest corner of sec. 4, T. 31 N., R. 34 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; hard, friable, sticky and plastic; many very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bw—6 to 16 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, very sticky and plastic; common very fine roots; common very fine tubular pores; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—16 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; very hard, firm, very sticky and plastic; few very fine roots; few very fine tubular pores; common fine masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary

Bky—32 to 60 inches; grayish brown (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few fine threads and few medium masses of lime; common fine masses of gypsum crystals; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to Bk horizon:* 12 to 17 inches  
*Depth to Bky horizon:* 20 to 40 inches

*Note:* Some pedons have thin strata of silt loam or loam below depths of 40 inches and a BCy or Byz horizon.

*Ap horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 or 3  
 Texture: silty clay loam or silty clay  
 Clay content: 27 to 45 percent  
 Rock fragments: 0 to 5 percent pebbles  
 Calcium carbonate equivalent: 0 to 10 percent  
 Reaction: pH 7.4 to 8.4

*Bw horizon*

Hue: 10YR to 5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: silty clay loam, silty clay, or clay  
 Clay content: 35 to 45 percent  
 Rock fragments: 0 to 5 percent pebbles  
 Calcium carbonate equivalent: 2 to 10 percent  
 Reaction: pH 7.4 to 8.4

*Bk horizon*

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 to 4  
 Texture: silty clay loam, silty clay, or clay  
 Clay content: 35 to 45 percent  
 Rock fragments: 0 to 5 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.9 to 9.0

*Bky horizon*

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 to 4  
 Texture: silty clay loam, silty clay, or clay  
 Clay content: 27 to 45 percent  
 Rock fragments: 0 to 5 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Gypsum: 1 to 5 percent  
 Reaction: pH 7.9 to 9.0

## 32B—Kobase silty clay loam, 0 to 4 percent slopes

### Setting

*Landform:* Lake plains  
*Slope:* 0 to 4 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Kobase and similar soils: 90 percent

**Minor Components**

Kobase clay: 0 to 5 percent  
 Slightly saline soils: 0 to 3 percent  
 Ethridge and similar soils: 0 to 2 percent

**Major 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:* Mainly 9.7 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**320A—Kobase silty clay, 0 to 2 percent slopes****Setting**

*Landform:* Lake plains  
*Slope:* 0 to 2 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

**Composition****Major Components**

Kobase and similar soils: 90 percent

**Minor Components**

Moderately saline soils: 0 to 5 percent  
 Moderately sodic soils: 0 to 2 percent  
 Wet loamy soils: 0 to 3 percent

**Major Component Description**

*Surface layer texture:* Silty clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Glaciolacustrine deposits  
*Native plant cover type:* Rangeland

*Flooding:* None

*Water table:* Apparent

*Available water capacity:* 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**323B—Kobase-Marvan-Weingart complex, 0 to 4 percent slopes****Setting**

*Landform:*

Kobase—Alluvial fans

Marvan—Alluvial fans

Weingart, thin—Sedimentary plains

*Position on landform:*

Kobase—Backslopes and footslopes

Marvan—Toeslopes

Weingart, thin—Backslopes

*Slope:*

Kobase—0 to 4 percent

Marvan—0 to 4 percent

Weingart, thin—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

**Composition****Major Components**

Kobase and similar soils: 35 percent

Marvan and similar soils: 25 percent

Weingart, Thin and similar soils: 25 percent

**Minor Components**

Vanda and similar soils: 0 to 5 percent

Yamacall and similar soils: 0 to 5 percent

Gravelly surface layers: 0 to 5 percent

**Major Component Description****Kobase**

*Surface layer texture:* Silty clay loam

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

*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.7 inches

### **Marvan**

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 7.0 inches

### **Weingart, thin**

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **322C—Kobase-Megonot silty clay loams, 2 to 8 percent slopes**

### **Setting**

#### *Landform:*

Kobase—Lake plains  
 Megonot—Lake plains

#### *Position on landform:*

Kobase—Footslopes and toeslopes  
 Megonot—Backslopes and shoulders

#### *Slope:*

Kobase—2 to 8 percent  
 Megonot—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### **Composition**

#### **Major Components**

Kobase and similar soils: 60 percent  
 Megonot and similar soils: 30 percent

#### **Minor Components**

Yawdim and similar soils: 0 to 5 percent  
 Clay surface layers: 0 to 3 percent  
 Saline and sodic soils: 0 to 2 percent

### **Major Component Description**

#### **Kobase**

*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:* Mainly 9.7 inches

#### **Megonot**

*Surface layer texture:* Silty clay loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

### **Lallie Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Very poorly drained  
*Permeability:* Slow (0.06 to 0.2 inch/hour)  
*Landform:* Oxbows  
*Parent material:* Alluvium

*Slope range:* 0 to 1 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic  
 (calcareous), frigid Vertic Fluvaquents

### Typical Pedon

Lallie clay loam, 0 to 1 percent slopes, in rangeland, 1,500 feet west and 2,400 feet north of the southeast corner sec. 9, T. 30 N., R. 30 E.

A—0 to 2 inches; very dark brown (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; hard, friable, sticky and plastic; many very fine roots; slightly alkaline; abrupt smooth boundary.

Cg1—2 to 16 inches; grayish brown (2.5Y 5/2) silty clay loam with thin strata of loam and clay loam, light brownish gray (2.5Y 6/2) dry; common fine distinct yellowish brown (10YR 5/6) dry redox concentrations; massive; hard, friable, sticky and plastic; many very fine roots; common very fine and few fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg2—16 to 23 inches; dark grayish brown (2.5Y 4/2) silty clay loam with thin strata of loam and silty clay, light brownish gray (2.5Y 6/2) dry; few fine distinct yellowish brown (10YR 5/6) dry redox concentrations; massive; very hard, firm, very sticky and plastic; common very fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cg3—23 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay with few thin strata of clay loam, light brownish gray (2.5Y 6/2) dry; few fine faint light olive brown (2.5Y 5/4) dry redox concentrations; massive; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; slightly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Notes:* Layers of coarser materials are below 40 inches in some pedons. Silt loam strata up to 6 inches thick are in some pedons.

#### A horizon

Hue: 10YR to 5Y  
 Value: 2 to 4 moist; 3 to 6 dry

Chroma: 1 or 2  
 Clay content: 27 to 40 percent  
 Electrical conductivity: 0 to 8 mmhos/cm  
 Calcium carbonate equivalent: 0 to 5 percent  
 Reaction: pH 6.6 to 9.0

#### C horizons

Hue: 2.5Y, 5Y, or neutral  
 Value: 3 to 6 moist; 4 to 8 dry  
 Chroma: 2 or less  
 Texture: silty clay loam or silty clay.  
 Clay content: 35 to 60 percent  
 Electrical conductivity: 0 to 8 mmhos/cm  
 Calcium carbonate equivalent: 2 to 10 percent  
 Reaction: pH 7.4 to 9.0

## 901A—Lallie clay loam, 0 to 1 percent slopes

### Setting

*Landform:* Oxbows  
*Slope:* 0 to 1 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Lallie and similar soils: 95 percent

#### Minor Components

Poorly drained loamy soils: 0 to 3 percent  
 Strongly saline soils: 0 to 1 percent  
 Strongly sodic soils: 0 to 1 percent

### Major Component Description

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Very poorly drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Water table:* Apparent  
*Ponding:* long  
*Salt affected:* Saline within 30 inches  
*Available water capacity:* Mainly 7.7 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Landusky Series

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

*Drainage class:* Excessively drained

*Permeability:* Rapid (6.0 to 20.0 inches/hour)

*Landform:* Mountains

*Parent material:* Material weathered from igneous rocks

*Slope range:* 25 to 60 percent

*Annual precipitation:* 18 to 24 inches

*Annual air temperature:* 38 to 43 degrees F

*Frost-free period:* 70 to 100 days

**Taxonomic Class:** Fragmental, mixed, frigid Typic Ustorthents

### Typical Pedon

Landusky extremely cobbly loam, in an area of Mocmont-Landusky complex, 25 to 60 percent slopes, in woodland, 450 feet east and 2,100 feet south of the northwest corner of sec. 24, T. 25 N., R. 24 E.

Oi—1 inch to 0; forest litter of slightly decomposed needles, twigs, and moss.

A—0 to 2 inches; dark grayish brown (10YR 4/2) extremely cobbly loam, very dark brown (10YR 2/2) moist; strong fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots, common medium and coarse roots; 30 percent pebbles and 60 percent cobbles; slightly acid; clear smooth boundary.

Bw—2 to 9 inches; pale brown (10YR 6/3) extremely cobbly loam, brown (10YR 5/3) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots, common medium and coarse roots; 25 percent pebbles and 40 percent cobbles; strongly acid; clear wavy boundary.

2C—9 to 60 inches; fractured hard igneous rock with large voids; common faint clay films and other soil material on upper surfaces of some rock fragments; few fine and very fine roots; soil material is moderately acid.

### Range in Characteristics

*Soil temperature:* 40 to 45 degrees F

*Moisture control section:* between 4 and 10 inches

### A horizon

Value: 4 or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Clay content: 20 to 27 percent

Rock fragments: 60 to 90 percent-35 to 60 percent cobbles; 25 to 35 percent pebbles

Reaction: pH 6.1 to 6.5

### Bw horizon

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: loam or sandy loam

Clay content: 15 to 27 percent

Rock fragments: 60 to 90 percent-35 to 60 percent cobbles; 25 to 35 percent pebbles

Reaction: pH 5.1 to 6.5

### 2C horizon

Material: fragmental material consisting of angular igneous cobbles and pebbles

## Lardell Series

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

*Drainage class:* Poorly drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Flood plains

*Parent material:* Alluvium

*Slope range:* 0 to 2 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed, frigid Aquollic Salorthids

### Typical Pedon

Lardell clay loam, 0 to 2 percent slopes, in rangeland, 1,200 feet east and 1,700 feet north of the southwest corner of sec. 11, T. 30 N., R. 29 E.

Az—0 to 4 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; hard, friable, sticky and plastic; few very fine roots; many fine salt crystals; slightly effervescent; very strongly alkaline; clear smooth boundary.

Bz1—4 to 16 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; many fine salt crystals; slightly effervescent; strongly alkaline; gradual wavy boundary.

Bz2—16 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic;

common very fine tubular pores; many fine salt crystals; slightly effervescent; strongly alkaline

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to salic horizon:* 4 to 8 inches  
*Depth to seasonal high water table:* 18 to 36 inches

#### *Az horizon*

Hue: 10YR, 2.5Y, 5Y, or N  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 1 or 2  
 Clay content: 27 to 40 percent  
 Electrical conductivity: greater than 16 mmhos/cm  
 Sodium adsorption ratio: 8 to 50  
 Calcium carbonate equivalent: 1 to 5 percent  
 Reaction: pH 7.9 to 9.6

#### *Bz1 horizon*

Hue: 10YR, 2.5Y, 5Y, or N  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 1 to 3  
 Texture: silty clay loam or clay loam  
 Clay content: 27 to 35 percent  
 Electrical conductivity: 16 to 50 mmhos/cm  
 Salt content: 2 to 3 percent  
 Sodium adsorption ratio: 13 to 80  
 Calcium carbonate equivalent: 2 to 10 percent  
 Reaction: pH 8.5 to 9.6

#### *Bz2 horizon*

Hue: 10YR, 2.5Y, 5Y, or N  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 1 to 4  
 Texture: silty clay loam, silt loam, loam, or clay loam that may be stratified with fine sandy loam  
 Clay content: 18 to 35 percent  
 Electrical conductivity: 16 to 50 mmhos/cm  
 Salt content: 1 to 2 percent  
 Sodium adsorption ratio: 13 to 30  
 Calcium carbonate equivalent: 2 to 10 percent  
 Reaction: pH 8.5 to 9.6

## 49A—Lardell clay loam, 0 to 2 percent slopes

### Setting

*Landform:* Flood plains  
*Slope:* 0 to 2 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Lardell and similar soils: 90 percent

### Minor Components

Poorly drained clayey soils: 0 to 5 percent  
 Slightly saline soils: 0 to 3 percent  
 Slightly sodic soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Poorly drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Water table:* Apparent  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Lostriver Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Slow (0.06 to 0.2 inch/hour)  
*Landform:* Flood plains  
*Parent material:* Alluvium  
*Slope range:* 0 to 2 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic (calcareous), frigid Aridic Ustifluvents

### Typical Pedon

Lostriver clay, in an area of Harlake-Lostriver clays, 0 to 2 percent slopes, in rangeland, 1,900 feet east and 1,700 feet south of the northwest corner of sec. 4, T. 30 N., R. 32 E.

Ayz—0 to 6 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium granular structure; hard, friable, sticky and plastic; common fine and very fine roots; common fine masses of gypsum and other salt crystals; slightly effervescent; moderately alkaline; clear smooth boundary.

Cyz1—6 to 21 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; common fine and very fine roots; common very fine tubular pores; few fine masses of gypsum and other salt crystals; slightly effervescent; moderately alkaline; gradual wavy boundary.

Cyz2—21 to 38 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; few fine masses and threads of gypsum and other salt crystals; slightly effervescent; strongly alkaline; gradual wavy boundary.

Cyz3—38 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; common very fine tubular pores; few fine masses of gypsum and other salt crystals; slightly effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Notes:* Gypsum and other salts are inherent in the parent material. Some profiles have thin strata of sandy material below 40 inches.

#### *Ayz horizon*

Hue: 10YR to 5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 40 to 55 percent

Electrical conductivity: 2 to 8 mmhos/cm

Sodium adsorption ratio: 8 to 13

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 7.4 to 9.4

#### *Cyz1 horizon*

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay loam, silty clay loam, clay or silty clay with or without thin strata of loam, clay loam, or silty clay loam

Clay content: 35 to 55 percent clay

Electrical conductivity: 4 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 20

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 7.4 to 9.6

#### *Cyz2, Cyz3 horizons*

Hue: 10YR to 5Y

Value: 5 to 7 dry; 3 to 6 moist

Chroma: 2 to 4

Texture: clay loam, silty clay loam, clay or silty clay with or without thin strata of loam, clay loam, or silty clay loam

Clay content: 35 to 55 percent clay

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Calcium carbonate equivalent: 5 to 10 percent

Gypsum: 2 to 5 percent

Reaction: pH 7.4 to 9.6

## 902A—Lostriver-Bullhook complex, 0 to 2 percent slopes

### Setting

#### *Landform:*

Lostriver—Flood plains

Bullhook—Flood plains

#### *Slope:*

Lostriver—0 to 2 percent

Bullhook—0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Lostriver and similar soils: 50 percent

Bullhook and similar soils: 40 percent

#### Minor Components

Strongly saline soils: 0 to 3 percent

Strongly sodic soils: 0 to 2 percent

Harlake and similar soils: 0 to 3 percent

Havre and similar soils: 0 to 2 percent

### Major Component Description

#### Lostriver

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* Rare

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 8.6 inches

### **Bullhook**

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* Rare

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 8.7 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

### **Macmeal Series**

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

*Drainage class:* Well drained

*Permeability:* Moderately slow (0.2 to 0.6 inch/hour)

*Landform:* Mountains

*Parent material:* Colluvium from igneous rocks

*Slope range:* 25 to 60 percent

*Annual precipitation:* 17 to 22 inches

*Annual air temperature:* 38 to 43 degrees F

*Frost-free period:* 80 to 100 days

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

### **Typical Pedon**

Macmeal gravelly loam, warm, in an area of Macmeal complex, 25 to 60 percent slopes, in woodland (burned over), 750 feet west and 1,650 feet south of the northeast corner of sec. 19, T. 25 N., R. 24 E.

A—0 to 1 inch; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; many fine

and very fine and few medium roots; 20 percent pebbles and 5 percent cobbles; neutral; abrupt smooth boundary.

E—1 to 8 inches; light brownish gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to strong fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; many very fine irregular pores; 20 percent pebbles and 5 percent cobbles; neutral; clear wavy boundary.

Bt1—8 to 21 inches; yellowish brown (10YR 5/4) very gravelly clay loam, dark yellowish brown (10YR 4/4) moist; strong fine subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine and few medium roots, many very fine tubular pores; common skeletal on faces of peds in upper 2 inches; many distinct clay films on faces of peds; 30 percent pebbles and 15 percent cobbles; neutral; clear wavy boundary.

Bt2—21 to 33 inches; brown (10YR 5/3) extremely gravelly clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine and few medium roots; many very fine tubular pores; many distinct clay films on faces of peds; 45 percent pebbles and 20 percent cobbles; neutral; clear wavy boundary.

Bk—33 to 60 inches; pale brown (10YR 6/3) extremely cobbly clay loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; hard, very friable, sticky and plastic; few very fine, fine, and medium roots; common very fine tubular pores; 40 percent pebbles and 30 percent cobbles; disseminated lime, few fine masses of lime, continuous distinct lime coatings on lower surfaces of rock fragments; strongly effervescent; slightly alkaline.

### **Range in Characteristics**

*Soil temperature:* 38 to 44 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bk horizon:* 24 to 55 inches

*A horizon*

Hue: 10YR or 7.5YR

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Clay content: 10 to 25 percent

Rock fragments: 15 to 35 percent-5 to 10 percent cobbles; 10 to 30 percent pebbles

Reaction: pH 6.1 to 7.3

Note: Some pedons do not have an A horizon.

*E horizon*

Hue: 10YR or 7.5YR

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Clay content: 10 to 25 percent

Rock fragments: 15 to 35 percent-5 to 10 percent cobbles; 10 to 30 percent pebbles

Reaction: pH 6.1 to 7.3

*Bt horizon*

Hue: 10YR or 7.5YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 or 4

Clay content: 27 to 35 percent

Rock fragments: 35 to 70 percent-5 to 20 percent cobbles; 30 to 50 percent pebbles

Reaction: pH 6.1 to 7.3

*Bk horizon*

Hue: 10YR or 7.5YR

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Clay content: 27 to 35 percent

Rock fragments: 45 to 75 percent-10 to 30 percent cobbles; 35 to 50 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

## 84F—Macmeal complex, 25 to 60 percent slopes

### Setting

*Landform:*

Macmeal, warm—Mountains

Macmeal—Mountains

*Position on landform:*

Macmeal, warm—Backslopes and footslopes

Macmeal—Backslopes and footslopes

*Slope:*

Macmeal, warm—25 to 60 percent, southwest aspect

Macmeal—25 to 60 percent, northeast aspect

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

*Mean annual precipitation:* 17 to 22 inches

*Frost-free period:* 80 to 100 days

## Composition

### Major Components

Macmeal, warm and similar soils: 45 percent

Macmeal and similar soils: 40 percent

### Minor Components

Shallow soils: 0 to 5 percent

Moderately deep soils: 0 to 3 percent

Mocmont and similar soils: 0 to 2 percent

Whitecow and similar soils: 0 to 2 percent

Silverchief and similar soils: 0 to 1 percent

Rock outcrop: 0 to 2 percent

### Major Component Description

#### Macmeal, warm

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Igneous colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 4.3 inches

#### Macmeal

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Igneous colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Marmarth Series

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour)

*Landform:* Sedimentary plains, hills  
*Parent material:* Interbedded sandstone and shale residuum  
*Slope range:* 0 to 15 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Aridic Argiborolls

### Typical Pedon

Marmarth loam, in an area of Twilight-Cabbart-Marmarth association, 4 to 15 percent slopes, in rangeland, 700 feet north and 300 feet west of the southeast corner of sec. 27, T. 24 N., R. 33 E.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; clear smooth boundary.

Bt1—4 to 14 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine tubular pores; common faint clay films on faces of peds; neutral; clear smooth boundary.

Bt2—14 to 18 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, friable, sticky and plastic; many very fine roots; common very fine tubular pores; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Bk—18 to 32 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; common fine seams and masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cr—32 to 60 inches; light gray (2.5Y 7/2) interbedded sandstone and shale; grayish brown (2.5Y 5/2) moist; few very fine roots between plates in upper part; strongly effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Mollic epipedon thickness:* 7 to 16 inches  
*Depth to Bk horizon:* 12 to 24 inches  
*Depth to Cr horizon:* 20 to 40 inches

*A horizon*  
 Chroma: 2 or 3  
 Clay content: 20 to 27 percent  
 Reaction: pH 6.1 to 7.3

*Bt horizons*  
 Hue: 10YR or 2.5Y  
 Value: 4 or 5 dry; 3 or 4 moist  
 Chroma: 2 to 4  
 Texture: loam, clay loam, or sandy clay loam  
 Clay content: 20 to 35 percent  
 Reaction: 6.1 to 7.8

*Bk horizon*  
 Hue: 2.5Y or 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 to 4  
 Texture: loam, fine sandy loam, or clay loam  
 Clay content: 15 to 30 percent  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.4 to 8.4

*Cr horizon*  
 Material: soft sandstone or interbedded soft sandstone and shale

### Martinsdale Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderately slow (0.2 to 0.6 inch/hour)  
*Landform:* Relict stream terraces  
*Parent material:* Alluvium  
*Slope range:* 0 to 4 percent  
*Annual precipitation:* 14 to 17 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Fine-loamy, mixed Typic Argiborolls

### Typical Pedon

Martinsdale loam, in an area of Martinsdale-Judith loams, 0 to 4 percent slopes, in cropland, 1,400 feet north and 900 feet west of the southeast corner of sec. 29, T. 25 N., R. 23 E.

- Ap**—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 5 percent pebbles and few cobbles; neutral; clear smooth boundary.
- Bt**—6 to 13 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine and medium subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots; many very fine and few fine tubular pores; many distinct clay films on faces of peds; neutral; clear wavy boundary.
- Bk1**—13 to 20 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to strong fine and medium subangular blocky; very hard, friable, sticky and plastic; common very fine roots; many very fine and few fine tubular pores; many fine and medium masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk2**—20 to 44 inches; light gray (2.5Y 7/2) clay loam, yellowish brown (2.5Y 5/4) moist; moderate fine and medium subangular blocky structure; very hard, very friable, sticky and plastic; few very fine roots; many very fine and few fine tubular pores; 5 percent pebbles; many fine masses of lime, common distinct lime coatings on rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk3**—44 to 60 inches; light gray (2.5Y 7/2) gravelly clay loam, grayish brown (2.5Y 5/2) moist; massive; very hard, very friable, slightly sticky and slightly plastic; many very fine tubular pores; 20 percent pebbles and 5 percent cobbles; disseminated lime, common distinct lime coatings on rock fragments; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 41 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Mollic epipedon thickness:* 7 to 16 inches and includes all or part of the Bt1 horizon  
*Depth to Bk horizon:* 11 to 30 inches  
*Ap horizon*  
 Hue: 7.5YR or 10YR  
 Value: 4 or 5 dry; 2 or 3 moist  
 Chroma: 2 or 3  
 Clay content: 18 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles; 0 to 10 percent pebbles  
 Reaction: pH 6.6 to 7.8

#### *Bt horizon*

Hue: 7.5YR or 10YR  
 Value: 4 or 5 dry; 3 or 4 moist  
 Chroma: 2 to 4  
 Texture: sandy clay loam, loam, clay loam  
 Clay content: 25 to 35 percent  
 Rock fragments: 0 to 15 percent-0 to 5 percent cobbles; 0 to 10 percent pebbles  
 Reaction: pH 6.6 to 8.4

#### *Bk1 and Bk2 horizons*

Hue: 10YR or 2.5Y  
 Value: 6 to 8 dry; 4 to 7 moist  
 Chroma: 2 to 4  
 Texture: loam, clay loam, sandy clay loam, or sandy loam  
 Clay content: 20 to 35 percent  
 Calcium carbonate equivalent: 15 to 35 percent  
 Rock fragments: 0 to 25 percent-0 to 5 percent cobbles; 0 to 20 percent pebbles  
 Reaction: pH 7.4 to 9.0

#### *Bk3 horizon*

Hue: 2.5Y or 10YR  
 Value: 5 to 8 dry; 4 to 7 moist  
 Chroma: 2 to 4  
 Texture: loam, sandy loam, clay loam, or sandy clay loam  
 Clay content: 15 to 30 percent  
 Rock fragments: 0 to 60 percent-0 to 5 percent cobbles; 0 to 55 percent pebbles  
 Calcium carbonate equivalent: 10 to 20 percent  
 Reaction: pH 7.4 to 9.0

## 511B—Martinsdale-Judith loams, 0 to 4 percent slopes

### Setting

#### *Landform:*

Martinsdale—Relict stream terraces  
 Judith—Relict stream terraces

#### *Position on landform:*

Martinsdale—Treads  
 Judith—Treads

#### *Slope:*

Martinsdale—0 to 4 percent  
 Judith—0 to 4 percent

#### *Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

## Composition

### Major Components

Martinsdale and similar soils: 50 percent  
Judith and similar soils: 35 percent

### Minor Components

Cobbly surface layers: 0 to 3 percent  
Stony surface layers: 0 to 2 percent  
Windham and similar soils: 0 to 5 percent  
Danvers and similar soils: 0 to 5 percent

## Major Component Description

### Martinsdale

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.6 inches

### Judith

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Limestone alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 6.4 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Marvan Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Very slow: .06 inch/hour)  
*Landform:* Alluvial fans, stream terraces, drainageways  
*Parent material:* Alluvium  
*Slope range:* 0 to 15 percent  
*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic, frigid Sodic Haplusterts

## Typical Pedon

Marvan clay, 0 to 2 percent slopes, in rangeland, 1,600 feet east and 1,900 feet south of the northwest corner of sec. 33, T. 25 N., R. 32 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; common fine and very fine roots; common vertical surface cracks; slightly effervescent; moderately alkaline; clear smooth boundary.

Bss—4 to 19 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; strong coarse prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; common fine and medium roots; few very fine tubular pores; common vertical cracks with intersecting slickensides; slightly effervescent; strongly alkaline; clear wavy boundary.

Bssy—19 to 36 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine and medium roots; few very fine tubular pores; few intersecting slickensides; common fine masses of gypsum crystals; slightly effervescent; moderately alkaline; gradual irregular boundary.

Byz—36 to 60 inches; light brownish gray (2.5Y 6/2) clay with few very thin strata of silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine and very fine roots; few very fine tubular pores; common fine seams and masses of gypsum and other salt crystals; slightly effervescent; strongly alkaline.

## Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to Bssy horizon:* 10 to 24 inches

### A horizon

Hue: 2.5Y or 5Y  
Value: 5 or 6 dry, 4 or 5 moist  
Chroma: 2 to 4  
Clay content: 40 to 60 percent

Electrical conductivity: 0 to 8 mmhos/cm; saline phase is 2 to 8 mmhos/cm  
Sodium adsorption ratio: 0 to 13; saline phase is 4 to 13

Calcium carbonate equivalent: 1 to 5 percent  
Reaction: pH 7.4 to 9.0

#### *Bss horizon*

Hue: 2.5Y or 5Y  
Value: 5 or 6 dry, 4 or 5 moist  
Chroma: 2 to 4  
Texture: clay or silty clay  
Clay content: 45 to 60 percent  
Electrical conductivity: 2 to 8 mmhos/cm  
Sodium adsorption ratio: 4 to 13; saline phase is 8 to 13

Calcium carbonate equivalent: 2 to 10 percent  
Reaction: pH 7.9 to 9.0

#### *Bssy horizon*

Hue: 2.5Y or 5Y  
Value: 5 or 6 dry; 4 or 5 moist  
Chroma: 2 to 4  
Texture: clay or silty clay  
Clay content: 45 to 60 percent  
Electrical conductivity: 2 to 16 mmhos/cm (EC is less than 8 above a depth of 35 inches); saline phase is 8 to 16

Sodium adsorption ratio: 13 to 38  
Gypsum: 1 to 5 percent  
Calcium carbonate equivalent: 2 to 10 percent  
Reaction: pH 7.9 to 9.0

#### *Byz horizon*

Hue: 2.5Y or 5Y  
Value: 5 or 6 dry, 4 or 5 moist  
Chroma: 2 to 4  
Texture: clay or silty clay that includes thin layers of silty clay loam and silt loam material  
Clay content: 45 to 60 percent  
Electrical conductivity: 8 to 16 mmhos/cm  
Sodium adsorption ratio: 13 to 38  
Gypsum: 1 to 5 percent  
Calcium carbonate equivalent: 2 to 10 percent  
Reaction: pH 7.9 to 9.0

### **30A—Marvan clay, 0 to 2 percent slopes**

#### **Setting**

*Landform:* Alluvial fans, stream terraces, and drainageways  
*Slope:* 0 to 2 percent  
*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### **Composition**

#### **Major Components**

Marvan and similar soils: 90 percent

#### **Minor Components**

Marvan clay, saline: 0 to 3 percent  
Kobase and similar soils: 0 to 3 percent  
Vanda and similar soils: 0 to 2 percent  
Bowdoin and similar soils: 0 to 2 percent

### **Major Component Description**

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 7.0 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

### **301C—Marvan complex, 2 to 8 percent slopes**

#### **Setting**

*Landform:*  
Marvan, saline—Alluvial fans, stream terraces, and drainageways  
Marvan—Alluvial fans, stream terraces, and drainageways  
*Position on landform:*  
Marvan, saline—Foothills and toeslopes  
Marvan—Backslopes and foothills  
*Slope:*  
Marvan, saline—2 to 8 percent  
Marvan—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Marvan, saline and similar soils: 50 percent  
 Marvan and similar soils: 35 percent

#### Minor Components

Vanda and similar soils: 0 to 5 percent  
 Vaeda and similar soils: 0 to 5 percent  
 Bascovy and similar soils: 0 to 5 percent

### Major Component Description

#### Marvan, saline

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.2 inches

#### Marvan

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 7.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1030D—Marvan-Gerdrum association, 2 to 15 percent slopes

### Setting

#### *Landform:*

Marvan—Alluvial fans and stream terraces  
 Gerdrum—Alluvial fans and stream terraces

#### *Slope:*

Marvan—2 to 15 percent  
 Gerdrum—2 to 8 percent

#### *Elevation:* 2,170 to 3,400 feet

#### *Mean annual precipitation:* 11 to 14 inches

#### *Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Marvan and similar soils: 50 percent  
 Gerdrum and similar soils: 25 percent

#### Minor Components

Bascovy and similar soils: 0 to 10 percent  
 Vanda and similar soils: 0 to 5 percent  
 Vaeda and similar soils: 0 to 5 percent  
 Absher and similar soils: 0 to 5 percent

### Major Component Description

#### Marvan

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 7.0 inches

#### Gerdrum

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 302B—Marvan-Vanda clays, 0 to 8 percent slopes

### Setting

#### Landform:

- Marvan, saline—Alluvial fans, stream terraces, and drainageways
- Vanda—Alluvial fans, stream terraces, and drainageways

#### Position on landform:

- Marvan, saline—Backslopes and footslopes
- Vanda—Footslopes and toeslopes

#### Slope:

- Marvan, saline—0 to 8 percent
- Vanda—0 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Marvan, saline and similar soils: 50 percent  
Vanda and similar soils: 35 percent

#### Minor Components

Bascovy and similar soils: 0 to 10 percent  
Kobase and similar soils: 0 to 5 percent

### Major Component Description

#### Marvan, saline

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 6.2 inches

#### Vanda

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## McKenzie Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Poorly drained  
*Permeability:* Very slow: .06 inch/hour  
*Landform:* Closed depressions  
*Parent material:* Alluvium  
*Slope range:* 0 to 2 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic, frigid  
Chromic Endoaquert

### Typical Pedon

McKenzie clay, 0 to 2 percent slopes, in rangeland, 1,800 feet east and 300 feet north of the southwest corner of sec. 11, T. 31 N., R. 31 E.

A—0 to 3 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; one-half inch vesicular crust and strong fine subangular blocky structure below crust; very hard, friable, very sticky and very plastic;

common fine and very fine roots; few very fine tubular pores; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bw—3 to 8 inches; olive gray (5Y 4/2) silty clay, olive gray (5Y 5/2) dry; strong fine subangular blocky structure; very hard, friable, very sticky and very plastic; common fine and very fine roots; few very fine tubular pores; slightly effervescent; moderately alkaline; clear wavy boundary.

Bg—8 to 22 inches; dark gray (5Y 4/1) silty clay, gray (5Y 6/1) dry; moderate fine subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bkg—22 to 60 inches; gray (5Y 5/1) silty clay, gray (5Y 6/1) dry; moderate fine subangular blocky structure; extremely hard, firm, very sticky and very plastic; few very fine tubular pores; few fine masses of lime; violently effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Linear extensibility:* 6.0 cm or more

*Note:* Crystals of gypsum and other salts are in some pedons. Redox concentrations of yellow or brown are below depths of 24 inches in some pedons. McKenzie soils in the Phillips County area do not have slickensides that meet the requirements for Endoaquerts and the water table is from surface ponding. They classify as Vertic Epiaquerts. These differences do not significantly affect the use or management.

#### *A horizon*

Hue: 5Y to 10YR

Value: 4 or 5 moist; 4 to 6 dry

Chroma: 1 or 2

Clay content: 40 to 60 percent

Electrical conductivity: 2 to 8 mmhos/cm

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 6.6 to 9.0

#### *Bw horizon*

Hue: 2.5Y or 5Y

Value: 4 or 5 moist; 5 or 6 dry

Chroma: 1 or 2

Texture: clay or silty clay

Clay content: 40 to 60 percent

Electrical conductivity: 2 to 8 mmhos/cm

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 6.6 to 9.0

#### *Bg and Bkg horizons*

Hue: 2.5Y or 5Y

Value: 4 to 6 moist; 5 to 7 dry

Chroma: 1 to 3

Texture: clay or silty clay

Clay content: 40 to 60 percent

Electrical conductivity: 2 to 8 mmhos/cm

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.9 to 9.0

## 29A—McKenzie clay, 0 to 2 percent slopes

### Setting

*Landform:* Closed depressions

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

McKenzie and similar soils: 95 percent

#### Minor Components

Dimmick and similar soils: 0 to 2 percent

Poorly drained nonsaline soils: 0 to 2 percent

Strongly saline soils: 0 to 1 percent

### Major Component Description

*Surface layer texture:* Clay

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

*Drainage class:* Poorly drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Water table:* Apparent

*Ponding:* long

*Salt affected:* Saline within 30 inches

*Available water capacity:* Mainly 9.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Megonot Series

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Lake plains, hills

*Parent material:* Shale residuum

*Slope range:* 2 to 15 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic, frigid Aridic  
Ustochrepts

### Typical Pedon

Megonot silty clay loam, in an area of Kobase-Megonot silty clay loams, 2 to 8 percent slopes, in rangeland, 1,300 feet west and 1,000 feet north of the southeast corner of sec. 2, T. 32 N., R. 32 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine and few medium roots; slightly effervescent; slightly alkaline; clear wavy boundary.

Bw—4 to 14 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, sticky and plastic; common fine and very fine and few medium roots; few very fine tubular pores; strongly effervescent; slightly alkaline; clear wavy boundary.

Bky1—14 to 20 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few fine and very fine roots; few very fine tubular pores; many fine and few medium masses of lime; few medium masses of gypsum crystals; violently effervescent; moderately alkaline; clear wavy boundary.

Bky2—20 to 28 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few fine and very fine roots; few very fine tubular pores; 15 percent soft shale chips; common fine masses of lime and gypsum crystals; strongly effervescent; moderately alkaline.

Cr—28 to 60 inches; grayish brown (2.5Y 5/2) semiconsolidated shale, dark grayish brown (2.5Y 4/2) moist; slightly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 41 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bky horizon:* 11 to 27 inches

*Depth to Cr horizon:* 20 to 40 inches

*A horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 35 to 40 percent

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 6.6 to 7.8

*Bw horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: silty clay loam, clay loam, or silty clay

Clay content: 35 to 45 percent

Rock fragments: 0 to 15 percent hard shale

fragments, 0 to 15 percent soft shale fragments

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 7.4 to 8.4

*Bky1 horizon*

Hue: 2.5Y or 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: silty clay loam, clay loam, or silty clay

Clay content: 35 to 45 percent

Coarse fragments: 0 to 15 percent hard shale

fragments, 0 to 15 percent soft shale fragments

Gypsum: 1 to 5 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

*Bky2 horizon*

Hue: 2.5Y or 5Y

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 2 or 3

Texture: silty clay loam, clay loam, or silty clay

Clay content: 35 to 45 percent

Rock fragments: 10 to 50 percent soft shale

fragments; 5 to 30 percent hard shale fragments

Gypsum: 1 to 5 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 6.6 to 8.4

## 96D—Megonot-Kobase silty clay loams, 8 to 15 percent slopes

### Setting

#### Landform:

Megonot—Hills  
Kobase—Hills

#### Position on landform:

Megonot—Backslopes and shoulders  
Kobase—Footslopes and toeslopes

#### Slope:

Megonot—8 to 15 percent  
Kobase—8 to 15 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Megonot and similar soils: 50 percent  
Kobase and similar soils: 35 percent

#### Minor Components

Yawdim and similar soils: 0 to 5 percent  
Marvan and similar soils: 0 to 5 percent  
Slopes greater than 15 percent: 0 to 5 percent

### Major Component Description

#### Megonot

*Surface layer texture:* Silty clay loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 3.5 inches

#### Kobase

*Surface layer texture:* Silty clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.7 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 200F—Mined land

### Composition

#### Major Components

Mined land: 95 percent

### Major Component Description

*Definition:* Areas where soil and underlying bedrock have been removed to access ore for processing. These areas are highly disturbed.

## Mocmont Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour)  
*Landform:* Mountains  
*Parent material:* Colluvium from igneous rocks  
*Slope range:* 25 to 60 percent  
*Annual precipitation:* 17 to 25 inches  
*Annual air temperature:* 38 to 43 degrees F  
*Frost-free period:* 80 to 100 days

**Taxonomic Class:** Loamy-skeletal, mixed Glossic Eutroboralfs

### Typical Pedon

Mocmont gravelly loam, cool, in an area of Mocmont-Tolex complex, 25 to 60 percent slopes, in woodland, 900 feet south and 800 feet east of the northwest corner of sec. 5, T. 25 N., R. 25 E.

Oi—2 inches to 0; forest litter of partially decomposed needles and twigs.

A—0 to 2 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots, common medium and coarse roots; 20 percent pebbles and 10 percent cobbles; moderately acid; clear wavy boundary.

E—2 to 9 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; strong fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and

very fine roots, few medium and coarse roots; 20 percent pebbles and 10 percent cobbles; strongly acid; clear wavy boundary.

E/Bt—9 to 16 inches; E part (70 percent) light gray (10YR 7/2) very gravelly loam, grayish brown (10YR 5/2) moist; Bt part (30 percent) light yellowish brown (10YR 6/4) very gravelly clay loam, olive brown (10YR 4/4) moist; moderate fine subangular blocky structure parting to strong medium granular; slightly hard, very friable, sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and few fine tubular pores; few distinct clay films on faces of peds and rock fragments; 30 percent pebbles and 10 percent cobbles; strongly acid; clear wavy boundary.

Bt1—16 to 27 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, light olive brown (10YR 5/4) moist; strong fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common very fine, fine, and medium roots; common very fine and few fine tubular pores; many distinct clay films on faces of peds and rock fragments; 35 percent pebbles and 15 percent cobbles; strongly acid; gradual wavy boundary.

Bt2—27 to 45 inches; light yellowish brown (10YR 6/4) extremely cobbly clay loam, light olive brown (10YR 5/4) moist; strong fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine, fine, and medium roots; common very fine and few fine tubular pores; many distinct clay films on faces of peds and rock fragments; 35 percent pebbles and 25 percent cobbles; strongly acid; gradual wavy boundary.

BC—45 to 60 inches; light yellowish brown (10YR 6/4) extremely cobbly sandy clay loam, olive brown (10YR 4/4) moist; weak fine subangular blocky structure; hard, very friable, sticky and slightly plastic; few fine and very fine roots; many very fine and few fine tubular and irregular pores; few faint clay films on faces of peds and rock fragments; 45 percent pebbles and 30 percent cobbles; strongly acid.

### Range in Characteristics

*Soil temperature:* 42 to 45 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to argillic horizon:* 10 to 24 inches

*A horizon*

Hue: 7.5YR or 10YR

Value: 3 or 4 moist

Chroma: 2 or 3

Texture: loam or sandy loam

Clay content: 10 to 20 percent

Rock fragments: 15 to 60 percent-0 to 30 percent angular cobbles, 15 to 50 percent angular pebbles or channers

Reaction: pH 5.1 to 6.5

*E horizon*

Hue: 7.5YR or 10YR

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: loam or sandy loam

Clay content: 10 to 20 percent

Rock fragments: 10 to 60 percent-0 to 30 percent angular cobbles, 10 to 50 percent angular pebbles or channers

Reaction: pH 5.1 to 6.5

*E/Bt horizon*

Hue: 7.5YR or 10YR

Value: *E part:* 6 or 7 dry, 4 or 5 moist; *Bt part:* 5 to 7 dry, 4 or 5 moist

Chroma: 2, 3, or 4

Texture: *E part:* sandy loam or loam; *Bt part:* loam or clay loam

Clay content: *E part:* 10 to 20 percent, *Bt part:* 25 to 35 percent

Rock fragments: 35 to 60 percent-10 to 30 percent angular cobbles, 25 to 55 percent angular pebbles or channers

Reaction: pH 5.1 to 6.5

*Bt horizons*

Hue: 5YR to or 10YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 3 to 6

Texture: loam, clay loam, or sandy clay loam

Clay content: 20 to 35 percent

Rock fragments: 35 to 85 percent-10 to 30 percent angular cobbles, 25 to 55 percent angular pebbles or channers

Reaction: pH 5.1 to 6.5

*BC horizon*

Hue: 5YR to 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 to 6

Texture: loam, sandy loam or sandy clay loam

Clay content: 10 to 25 percent

Rock fragments: 60 to 90 percent-25 to 40 percent cobbles and stones, 35 to 50 percent angular pebbles or channers

Reaction: pH 5.1 to 6.5

## 120F—Mocmont complex, 25 to 60 percent slopes

### Setting

#### *Landform:*

Mocmont, cool—Mountains  
Mocmont—Mountains

#### *Position on landform:*

Mocmont, cool—Backslopes and footslopes  
Mocmont—Backslopes and footslopes

#### *Slope:*

Mocmont, cool—25 to 60 percent, northeast aspect  
Mocmont—25 to 60 percent, southwest aspect

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

*Mean annual precipitation:* 17 to 25 inches

*Frost-free period:* 80 to 100 days

### Composition

#### Major Components

Mocmont, cool and similar soils: 50 percent  
Mocmont and similar soils: 40 percent

#### Minor Components

Shallow soils: 0 to 3 percent  
Moderately deep soils: 0 to 2 percent  
Very gravelly loamy sand soils: 0 to 2 percent  
Very cobbly surface layers: 0 to 2 percent  
Stony surface layers: 0 to 1 percent

### Major Component Description

#### Mocmont, cool

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 3.6 inches

#### Mocmont

*Surface layer texture:* Very gravelly sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 122F—Mocmont-Landusky complex, 25 to 60 percent slopes

### Setting

#### *Landform:*

Mocmont, cool—Mountains  
Landusky—Mountains

#### *Position on landform:*

Mocmont, cool—Backslopes and footslopes  
Landusky—Shoulders and summits

#### *Slope:*

Mocmont, cool—25 to 60 percent  
Landusky—25 to 60 percent

*Elevation:* 4,600 to 5,600 feet

*Mean annual precipitation:* 17 to 25 inches

*Frost-free period:* 80 to 100 days

### Composition

#### Major Components

Mocmont, Cool and similar soils: 60 percent  
Landusky and similar soils: 30 percent

#### Minor Components

Tolex and similar soils: 0 to 3 percent  
Moderately deep soils: 0 to 3 percent  
Rubble land: 0 to 2 percent  
Rock outcrop: 0 to 2 percent

### Major Component Description

#### Mocmont, cool

*Surface layer texture:* Very cobbly loam  
*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 3.1 inches

### **Landusky**

*Surface layer texture:* Extremely cobbly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Dominant parent material:* Material weathered from igneous rocks  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 0.3 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **121F—Mocmont-Tolex complex, 25 to 60 percent slopes**

### **Setting**

#### *Landform:*

Mocmont—Mountains  
 Mocmont, cool—Mountains  
 Tolex—Mountains

#### *Position on landform:*

Mocmont—Backslopes and footslopes  
 Mocmont, cool—Backslopes and footslopes  
 Tolex—Shoulders and summits

#### *Slope:*

Mocmont—25 to 60 percent, southwest aspect  
 Mocmont, cool—25 to 60 percent, northeast aspect  
 Tolex—25 to 60 percent

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

*Mean annual precipitation:* 17 to 25 inches

*Frost-free period:* 80 to 100 days

### **Composition**

#### **Major Components**

Mocmont and similar soils: 40 percent  
 Mocmont, cool and similar soils: 30 percent  
 Tolex and similar soils: 20 percent

#### **Minor Components**

Mocmont very cobbly loam: 0 to 2 percent  
 Landusky and similar soils: 0 to 2 percent  
 Stony surface layers: 0 to 2 percent  
 Very gravelly loamy sand soils: 0 to 1 percent  
 Slopes less than 25 percent: 0 to 2 percent  
 Rock outcrop: 0 to 1 percent

### **Major Component Description**

#### **Mocmont**

*Surface layer texture:* Very gravelly sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 3.2 inches

#### **Mocmont, cool**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Igneous colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 3.6 inches

#### **Tolex**

*Surface layer texture:* Channery loam  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Igneous residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 1.3 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Neldore Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Hills, escarpments, sedimentary plains

*Parent material:* Shale residuum

*Slope range:* 2 to 65 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Clayey, montmorillonitic, nonacid, frigid, shallow Aridic Ustorthents

## Typical Pedon

Neldore clay, in an area of Bascovy-Neldore-Weingart clays, 8 to 25 percent slopes, in rangeland, 2,200 feet north and 100 feet east of the southwest corner of sec. 17, T. 26 N., R. 27 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong very fine granular structure; hard, friable, very sticky and very plastic; common fine and very fine roots; neutral; clear wavy boundary.

C—3 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and very fine roots; common very fine tubular pores; neutral; clear wavy boundary.

Cy—8 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few fine and very fine roots; few very fine tubular pores; 20 percent soft shale fragments; few fine masses of gypsum crystals; neutral; gradual wavy boundary.

Cr—15 to 60 inches; grayish brown (2.5Y 5/2) semiconsolidated shale, dark grayish brown (2.5Y 4/2) moist; few fine and medium masses of gypsum crystals; neutral.

## Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Cr horizon:* 10 to 20 inches

### A horizon

Hue: 10YR to 5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 1 or 2

Clay content: 40 to 60 percent

Rock fragments: 0 to 10 percent—0 to 5 percent stones and cobbles, 0 to 5 percent pebbles.

Reaction: pH 5.6 to 7.8

### C horizon

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 1 or 2

Texture: clay or silty clay

Clay content: 40 to 60 percent

Rock fragments: 0 to 35 percent—0 to 25 percent soft shale fragments, 0 to 10 percent hard shale fragments

Reaction: pH 5.6 to 7.3

### Cy horizon

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 1 or 2

Textures: clay or silty clay

Clay content: 40 to 60 percent

Rock fragments: 15 to 90 percent shale fragments—15 to 75 percent soft shale fragments, 0 to 15 percent hard shale fragments

Gypsum: 1 to 3 percent

Reaction: pH 5.6 to 7.3

### Cr horizon

Note: The shale fragments are extremely hard or very hard when dry and extremely firm or very firm when moist

Reaction: pH 5.1 through 7.3.

## 973E—Neldore, cool-Bascovy clays, 8 to 35 percent slopes

### Setting

#### Landform:

Neldore, cool—Hills

Bascovy—Hills

#### Position on landform:

Neldore, cool—Backslopes and shoulders

Bascovy—Footslopes

#### Slope:

Neldore, cool—8 to 35 percent

Bascovy—8 to 35 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Neldore, cool and similar soils: 55 percent  
Bascovy and similar soils: 30 percent

### Minor Components

Bascovy with ponderosa pine: 0 to 10 percent  
Marvan and similar soils: 0 to 5 percent

### Major Component Description

#### Neldore, cool

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 2.5 inches

#### Bascovy

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 1973F—Neldore, moist-Neldore-Rock outcrop association, 15 to 60 percent slopes

## Setting

#### Landform:

Neldore, cool—Hills  
Neldore—Hills  
Rock outcrop—Hills

#### Position on landform:

Neldore, cool—Backslopes and footslopes  
Neldore—Backslopes and shoulders  
Rock outcrop—Shoulders and summits

#### Slope:

Neldore, cool—15 to 60 percent, northeast aspect  
Neldore—15 to 60 percent, southwest aspect

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Neldore, cool and similar soils: 35 percent  
Neldore and similar soils: 30 percent  
Rock outcrop: 20 percent

### Minor Components

Bascovy and similar soils: 0 to 5 percent  
Sunburst and similar soils: 0 to 4 percent  
Cabbart and similar soils: 0 to 2 percent  
Delpoint and similar soils: 0 to 2 percent  
Pinebreaks and similar soils: 0 to 2 percent

### Major Component Description

#### Neldore, cool

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 2.5 inches

#### Neldore

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 1.9 inches

#### Rock outcrop

*Definition:* Areas of exposed 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 1251E—Neldore-Bascovy association, 8 to 35 percent slopes

#### Setting

*Landform:*

Neldore—Hills

Bascovy—Hills

*Position on landform:*

Neldore—Backslopes and shoulders

Bascovy—Backslopes and footslopes

*Slope:*

Neldore—8 to 35 percent

Bascovy—8 to 35 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

#### Major Components

Neldore and similar soils: 50 percent

Bascovy and similar soils: 25 percent

#### Minor Components

Marvan and similar soils: 0 to 5 percent

Sunburst and similar soils: 0 to 5 percent

Weingart and similar soils: 0 to 5 percent

Slopes greater than 35 percent: 0 to 5 percent

Very shallow soils: 0 to 3 percent

Rock outcrop: 0 to 2 percent

#### Major Component Description

##### Neldore

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 2.2 inches

##### Bascovy

*Surface layer texture:* Clay

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 97D—Neldore-Bascovy clays, 4 to 15 percent slopes

#### Setting

*Landform:*

Neldore—Sedimentary plains and hills

Bascovy—Sedimentary plains and hills

*Position on landform:*

Neldore—Backslopes and shoulders

Bascovy—Footslopes

*Slope:*

Neldore—4 to 15 percent

Bascovy—4 to 15 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

#### Major Components

Neldore and similar soils: 60 percent

Bascovy and similar soils: 30 percent

#### Minor Components

Marvan and similar soils: 0 to 5 percent

Weingart and similar soils: 0 to 3 percent

Very shallow soils: 0 to 2 percent

#### Major Component Description

##### Neldore

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.2 inches

### **Bascovy**

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **1970F—Neldore-Bascovy-Rock outcrop association, 8 to 60 percent slopes**

### **Setting**

*Landform:*

Neldore—Hills  
 Bascovy—Hills  
 Rock outcrop—Escarpments

*Position on landform:*

Neldore—Backslopes and shoulders  
 Bascovy—Backslopes and footslopes  
 Rock outcrop—Backslopes and shoulders

*Slope:*

Neldore—8 to 60 percent  
 Bascovy—8 to 45 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### **Composition**

#### **Major Components**

Neldore and similar soils: 40 percent  
 Bascovy and similar soils: 30 percent  
 Rock outcrop: 20 percent

#### **Minor Components**

Hillon and similar soils: 0 to 5 percent  
 Weingart and similar soils: 0 to 5 percent

### **Major Component Description**

#### **Neldore**

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.2 inches

#### **Bascovy**

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.3 inches

#### **Rock outcrop**

*Definition:* Areas of exposed 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **971F—Neldore-Cabbart-Tinsley complex, 25 to 65 percent slopes**

### **Setting**

*Landform:*

Neldore—Escarpments  
 Cabbart—Escarpments  
 Tinsley—Escarpments

*Position on landform:*

Neldore—Backslopes and footslopes  
 Cabbart—Backslopes  
 Tinsley—Shoulders and summits

*Slope:*

Neldore—25 to 65 percent

Cabbart—25 to 65 percent

Tinsley—25 to 65 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Neldore and similar soils: 40 percent

Cabbart and similar soils: 30 percent

Tinsley and similar soils: 20 percent

**Minor Components**

Hillon and similar soils: 0 to 2 percent

Sunburst and similar soils: 0 to 2 percent

Bascovy and similar soils: 0 to 2 percent

Delpoint and similar soils: 0 to 2 percent

Very shallow soils: 0 to 1 percent

Rock outcrop: 0 to 1 percent

**Major Component Description****Neldore***Surface layer texture:* Clay*Depth class:* Shallow (10 to 20 inches)*Drainage class:* Well drained*Dominant parent material:* Shale residuum*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 2.2 inches**Cabbart***Surface layer texture:* Loam*Depth class:* Shallow (10 to 20 inches)*Drainage class:* Well drained*Dominant parent material:* Interbedded sandstone  
and shale residuum*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 2.8 inches**Tinsley***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:* Mainly 1.2 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**1976F—Neldore-Pinebreaks-Bascovy association, 15 to 60 percent slopes****Setting***Landform:*

Neldore—Hills

Pinebreaks—Hills

Bascovy—Hills

*Position on landform:*

Neldore—Backslopes and shoulders

Pinebreaks—Backslopes and footslopes

Bascovy—Shoulders and summits

*Slope:*

Neldore—15 to 60 percent, southwest aspect

Pinebreaks—15 to 45 percent, northeast aspect

Bascovy—15 to 45 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Neldore and similar soils: 35 percent

Pinebreaks and similar soils: 25 percent

Bascovy and similar soils: 20 percent

**Minor Components**

Volborg and similar soils: 0 to 10 percent

Very shallow soils: 0 to 5 percent

Rock outcrop: 0 to 5 percent

**Major Component Description****Neldore***Surface layer texture:* Clay*Depth class:* Shallow (10 to 20 inches)*Drainage class:* Well drained*Dominant parent material:* Shale residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 1.9 inches

### **Pinebreaks**

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 2.0 inches

### **Bascovy**

*Surface layer texture:* Clay

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* 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.

## **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **Nesda Series**

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour) in the upper 16 inches; rapid (6.0 to 20.0 inches/hour) below

*Landform:* Flood plains

*Parent material:* Alluvium

*Slope range:* 0 to 4 percent

*Annual precipitation:* 14 to 19 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Sandy-skeletal, mixed Fluventic Haploborolls

## **Typical Pedon**

Nesda gravelly loam, in an area of Nesda complex, 0 to 4 percent slopes, in rangeland, 2,600 feet west and 1,400 feet south of the northeast corner of sec. 21, T. 25 N., R. 25 E.

A1—0 to 7 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; 20 percent pebbles and 5 percent cobbles; slightly alkaline; clear wavy boundary.

A2—7 to 16 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark gray (10YR 3/1) moist; moderate fine granular structure; soft, very friable, slightly sticky and nonplastic; many fine and very fine and few medium pores; 40 percent pebbles and 10 percent cobbles; few thin lime coats on lower surfaces of some rock fragments; matrix noneffervescent; slightly alkaline; clear wavy boundary.

2C1—16 to 30 inches; brown (10YR 5/3) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; common fine and very fine roots; many fine and very fine irregular pores; 60 percent pebbles and 10 percent cobbles; common thin lime coats on lower surfaces of most rock fragments; matrix noneffervescent; slightly alkaline; gradual wavy boundary.

2C2—30 to 60 inches; yellowish brown (10YR 5/4) extremely gravelly sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many fine and very fine irregular pores; 55 percent pebbles and 15 percent cobbles; common thin lime coats on lower surfaces of most rock fragments; slightly effervescent; slightly alkaline.

## **Range in Characteristics**

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 12 and 35 inches

*Mollic epipedon thickness:* 10 to 16 inches

*Depth to 2C horizon:* 10 to 20 inches

*A1 and A2 horizons*

Hue: 10YR to 5Y

Value: 3 to 5 dry; 2 or 3 moist

Chroma: 1 to 3

Texture: loam or sandy loam

Clay content: 10 to 20 percent

Rock fragments: 15 to 60 percent-0 to 15 percent stones and cobbles; 15 to 55 percent pebbles  
 Calcium carbonate equivalent: 0 to 5 percent  
 Reaction: pH 6.6 to 7.8

#### *2C1 horizon*

Hue: 10YR to 5Y  
 Value: 4 to 7 dry; 3 to 5 moist  
 Chroma: 1 to 4  
 Texture: sand or loamy sand  
 Clay content: 0 to 10 percent  
 Rock fragments: 35 to 80 percent-0 to 15 percent stones and cobbles; 35 to 65 percent pebbles  
 Calcium carbonate equivalent: 0 to 5 percent  
 Reaction: pH 7.4 to 8.4

#### *2C2 horizon*

Hue: 10YR to 5Y  
 Value: 4 to 7 dry; 2 to 4 moist  
 Chroma: 2 to 4  
 Texture: sand or loamy sand that may have thin strata of clay loam  
 Clay content: 0 to 10 percent  
 Rock fragments: 35 to 80 percent-0 to 15 percent stones and cobbles; 35 to 65 percent pebbles  
 Calcium carbonate equivalent: 0 to 5 percent  
 Reaction: pH 7.4 to 8.4

### **190B—Nesda complex, 0 to 4 percent slopes**

#### **Setting**

##### *Landform:*

Nesda—Flood plains  
 Nesda, cool—Flood plains

##### *Slope:*

Nesda—0 to 4 percent  
 Nesda, cool—0 to 4 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

#### **Composition**

##### **Major Components**

Nesda and similar soils: 60 percent  
 Nesda, cool and similar soils: 25 percent

##### **Minor Components**

Very cobbly surface layers: 0 to 4 percent  
 Frequently flooded soils: 0 to 2 percent  
 Poorly drained soils: 0 to 2 percent  
 Soils with ponderosa pine: 0 to 3 percent

Douglas-fir on cooler aspects: 0 to 2 percent  
 Mine tailing deposits: 0 to 2 percent

#### **Major Component Description**

##### **Nesda**

*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:* Rangeland  
*Flooding:* Rare  
*Available water capacity:* Mainly 3.8 inches

##### **Nesda, cool**

*Surface layer texture:* Very gravelly sandy loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Forest land  
*Flooding:* Occasional  
*Available water capacity:* Mainly 2.9 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.

#### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

##### **Nishon Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Poorly drained  
*Permeability:* Slow (0.06 to 0.2 inch/hour)  
*Landform:* Closed depressions  
*Parent material:* Alluvium  
*Slope range:* 0 to 2 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic, frigid Typic Albaqualfs

#### **Typical Pedon**

Nishon clay loam, 0 to 2 percent slopes, in rangeland, 1,500 feet west and 1,700 feet south of the northeast corner of sec. 32, T. 30 N., R. 28 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) clay loam, light brownish gray (10YR 6/2) dry; moderate thin platy structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; common fine and few coarse prominent yellowish brown (10YR 5/6) dry redox concentrations; neutral; abrupt smooth boundary.

Btg1—4 to 16 inches; dark gray (10YR 4/1) clay, gray (10YR 6/1) dry; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, very sticky and very plastic; many fine and very fine roots; many very fine and few fine tubular pores; many faint clay films on faces of peds; common fine and medium prominent yellowish brown (10YR 5/6) dry redox concentrations; neutral; clear smooth boundary.

Btg2—16 to 30 inches; dark gray (5Y 4/1) clay, gray (5Y 5/1) dry; weak coarse prismatic structure parting to weak medium subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; many faint clay films on faces of peds; slightly alkaline; clear smooth boundary.

Bkg—30 to 60 inches; dark gray (5Y 4/1) clay, gray (5Y 6/1) dry; weak fine and medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine tubular pores; few fine masses of lime; slightly effervescent; slightly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bkg horizon:* 15 to 35 inches

*Depth to seasonal high water table:* 0 to 24 inches

*Note:* Till is at depths of 40 to 60 inches in some areas.

#### *A horizon*

Hue: 2.5Y or 10YR

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 1 or 2

Redoximorphic features: none to common, distinct to prominent (10YR 5/3, 4/3, 5/4, 5/6) concentrations

Clay content: 27 to 35 percent

Reaction: pH 6.1 to 7.8

#### *Btg horizons*

Hue: 10YR to 5Y

Value: 4 to 6 dry; 3 or 4 moist

Chroma: 0 to 2

Redoximorphic features: none to common, distinct to prominent (10YR 5/3, 4/3, 5/4, 5/6 or 2.5Y 5/2, 5/3) concentrations

Texture: clay or silty clay

Clay content: 40 to 60 percent

Reaction: pH 6.6 to 9.0

#### *Bkg horizon*

Hue: 2.5Y or 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 0 to 3

Redoximorphic features: none to common, distinct to prominent (10YR 4/4, 6/4 moist) concentrations

Texture: clay loam, clay, or silty clay

Clay content: 35 to 55 percent

Calcium carbonate equivalent: 2 to 10 percent

Reaction: 7.4 to 9.0

## 28A—Nishon clay loam, 0 to 2 percent slopes

### Setting

*Landform:* Closed depressions

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Nishon and similar soils: 90 percent

#### Minor Components

Somewhat poorly drained soils: 0 to 5 percent

Nishon clay: 0 to 3 percent

Dimmick and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Clay loam

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

*Drainage class:* Poorly drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Water table:* Apparent

*Ponding:* long

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Nobe Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Moderately well drained  
*Permeability:* Very slow: .06 inch/hour  
*Landform:* Alluvial fans, stream terraces, flood plains  
*Parent material:* Alluvium .  
*Slope range:* 0 to 4 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic  
 (calcareous), frigid Oxyaquic Ustorthents

### Typical Pedon

Nobe clay, in an area of Absher-Nobe clays, 0 to 4 percent slopes, in rangeland, 2,300 feet east and 1,900 feet north of the southwest corner of sec. 36, T. 36 N., R. 31 E.

E—0 to 1 inch; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; weak thin platy structure parting to weak fine granular; hard, friable, sticky and plastic; few very fine roots; common very fine vesicular pores; moderately alkaline; abrupt smooth boundary.

Bt—1 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; common faint clay films on faces of pedis; moderately alkaline; clear smooth boundary.

Byz1—4 to 22 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; disseminated lime; common fine masses of gypsum crystals; few fine masses of other salt crystals; strongly effervescent; strongly alkaline; gradual wavy boundary.

Byz2—22 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine tubular pores; disseminated lime; common fine and few medium masses of gypsum crystals; common fine masses of other salt crystals; strongly alkaline.

### Range in Characteristics

*Soil temperature :* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to Byz horizon:* 4 to 16 inches

#### E horizon

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 3 to 5 moist  
 Chroma: 2 or 3  
 Texture: clay loam (clay where mixed to 7 inches)  
 Clay content: 27 to 40 percent (40 to 50 percent where mixed to 7 inches)  
 Electrical conductivity: 4 to 8 mmhos/cm  
 Sodium adsorption ratio: 4 to 13  
 Calcium carbonate equivalent: 0 to 5 percent  
 Reaction: pH 6.6 to 8.4

#### Bt horizon

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 or 3  
 Texture: clay, silty clay, or silty clay loam  
 Clay content: 35 to 50 percent  
 Electrical conductivity: 4 to 8 mmhos/cm  
 Sodium adsorption ratio: 13 to 30  
 Calcium carbonate equivalent: 0 to 5 percent  
 Reaction: pH 7.9 to 8.4

Note: This horizon in some areas is recognized as having characteristics of an argillic or cambic horizon but does not meet the minimum requirements of thickness for either one.

#### Byz1 horizon

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 or 3  
 Texture: clay, silty clay, or silty clay loam  
 Clay content: 35 to 60 percent  
 Electrical conductivity: 16 to 30 mmhos/cm  
 Sodium adsorption ratio: 13 to 40 percent  
 Gypsum: 1 to 6 percent  
 Calcium carbonate equivalent: 1 to 5 percent  
 Reaction: pH 7.9 to 9.6

*Byz2 horizon*

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: clay, silty clay, or silty clay loam that may be stratified with loam, clay loam, and silt loam

Clay content: 35 to 60 percent

Electrical conductivity: 16 to 30 mmhos/cm

Sodium adsorption ratio: 13 to 70

Gypsum: 1 to 6

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 7.9 to 9.6

**Pendroy Series***Depth class:* Very deep (greater than 60 inches)*Drainage class:* Well drained*Permeability:* Very slow: .06 inch/hour*Landform:* Flood plains*Parent material:* Glaciolacustrine deposits*Slope range:* 0 to 2 percent*Annual precipitation:* 11 to 14 inches*Annual air temperature:* 40 to 45 degrees F*Frost-free period:* 100 to 120 days**Taxonomic Class:** Very-fine, montmorillonitic, frigid  
Chromic Udic Haplusterts**Typical Pedon**

Pendroy clay, 0 to 2 percent slopes, in cropland, 600 feet south and 1,400 feet west of the northeast corner of sec. 9, T. 32 N., R. 27 E.

Ap—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; hard, friable, very sticky and very plastic; common fine and very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bss—4 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few intersecting slickensides; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bssy—20 to 34 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few intersecting slickensides; few fine

masses of gypsum crystals; slightly effervescent; slightly alkaline; gradual wavy boundary.

BCy—34 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; extremely hard, very firm, very sticky and very plastic; few very fine tubular pores; few fine masses of gypsum crystals; slightly effervescent; moderately alkaline.

**Range in Characteristics***Soil temperature:* 42 to 47 degrees F*Moisture control section:* between 4 and 12 inches*Depth to gypsum accumulations:* 20 to 50 inches*Note:* When dry these soils form cracks 1 to 4 inches wide at the surface that extend to depths of 20 inches or more, where they are still 1 cm or more wide.*Ap horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 60 to 75 percent

Electrical conductivity: 0 to 4 mmhos/cm

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 7.4 to 8.4

*Bss horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Clay content: 60 to 75 percent

Slickensides: few to many

Electrical conductivity: 2 to 4 mmhos/cm

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 7.4 to 8.4

*Bssy horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: clay

Clay content: 60 to 75 percent

Slickensides: few to continuous

Electrical conductivity: 2 to 4 mmhos/cm

Gypsum: 2 to 6 percent

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 7.4 to 8.4

*BCy horizon*

Hue: 10YR to 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: silty clay or clay

Clay content: 50 to 65 percent  
 Electrical conductivity: 2 to 4 mmhos/cm  
 Gypsum: 2 to 6 percent  
 Calcium carbonate equivalent: 1 to 5 percent  
 Reaction: pH 7.9 to 8.4

*Slope range:* 0 to 8 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

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

### 43A—Pendroy clay, 0 to 2 percent slopes

#### Setting

*Landform:* Flood plains  
*Slope:* 0 to 2 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Pendroy and similar soils: 85 percent

##### Minor Components

Harlake and similar soils: 0 to 10 percent  
 Saline and sodic soils: 0 to 5 percent

#### Major Component Description

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Glaciolacustrine deposits  
*Native plant cover type:* Rangeland  
*Flooding:* Rare  
*Available water capacity:* Mainly 7.9 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Phillips Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Slow (0.06 to 0.2 inch/hour)  
*Landform:* Till plains  
*Parent material:* Till

#### Typical Pedon

Phillips loam, in an area of Phillips-Elloam-Thoeny association, 0 to 8 percent slopes, in rangeland, 1,400 feet south and 1,500 feet east of the northwest corner of sec. 5, T. 24 N., R. 30 E.

- A—0 to 2 inches; grayish brown (10YR 5/2) loam; dark grayish brown (10YR 4/2) moist; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine and few fine tubular pores; 2 percent pebbles; slightly acid; abrupt smooth boundary.
- E—2 to 6 inches; pale brown (10YR 6/3) loam; dark brown (10YR 4/3) moist; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine and few fine tubular pores; 2 percent pebbles; slightly acid; abrupt smooth boundary.
- Bt1—6 to 11 inches; brown (10YR 5/3) clay; brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky and very plastic; few fine and medium roots between peds; common very fine tubular pores; many distinct clay films on faces of peds; 2 percent pebbles; slightly alkaline; clear smooth boundary.
- Bt2—11 to 15 inches; brown (10YR 5/3) clay; brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky and very plastic; few fine and medium roots between peds; common very fine tubular pores; many distinct clay films on faces of peds; 2 percent pebbles; slightly effervescent in lower part; moderately alkaline; clear wavy boundary.
- Bk—15 to 25 inches; light brownish gray (10YR 6/2) clay loam; dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; common fine and very fine roots; common very fine tubular pores; few fine lignite chips; 2 percent pebbles; common fine and few medium masses of lime; violently

effervescent; strongly alkaline; gradual wavy boundary.

**Bky**—25 to 36 inches; grayish brown (2.5Y 5/2) clay loam; dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure; very hard, firm, sticky and plastic; common fine and very fine roots; common very fine tubular pores; few fine lignite chips; 3 percent pebbles; common fine and medium masses of lime; few fine masses of gypsum crystals; strongly effervescent; moderately alkaline; gradual wavy boundary.

**By**—36 to 60 inches; grayish brown (2.5Y 5/2) clay loam; dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; 5 percent pebbles; stone line at 45 inches with 10 percent pebbles; few fine lignite chips; common fine and medium masses of gypsum crystals; few fine distinct light olive brown (2.5Y 5/4) relict redox concentrations; strongly effervescent; slightly alkaline.

#### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bk horizon:* 12 to 25 inches

*Depth to By horizon:* 30 to 40 inches

#### *A horizon*

Hue: 10YR or 2.5Y

Value: 3 or 4 moist

Chroma: 2 or 3

Clay content: 15 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.1 to 7.3

#### *E horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: loam or sandy loam

Clay content: 15 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.1 to 7.3

#### *Bt1 and Bt2 horizons*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay loam or clay

Clay content: 35 to 45 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Electrical conductivity: 0 to 2 mmhos/cm

Reaction: pH 6.6 to 8.4

#### *Bk horizon*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: loam or clay loam

Clay content: 25 to 40 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Electrical conductivity: 2 to 4 mmhos/cm

Sodium adsorption ratio: 0 to 13

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 9.0

#### *Bky, By horizons*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: loam or clay loam

Clay content: 20 to 35 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Electrical conductivity: 4 to 8 mmhos/cm

Sodium adsorption ratio: 0 to 13

Gypsum: 1 to 3 percent

Calcium carbonate equivalent: 5 to 10 percent

Reaction: pH 7.4 to 9.0

Moist bulk density: 1.55 to 1.75 g/cc

### 33B—Phillips loam, 0 to 4 percent slopes

#### Setting

*Landform:* Till plains

*Slope:* 0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Phillips and similar soils: 90 percent

##### Minor Components

Thoeny and similar soils: 0 to 5 percent

Elloam and similar soils: 0 to 3 percent

Absher and similar soils: 0 to 1 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.4 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 331B—Phillips-Absher complex, 0 to 4 percent slopes

### Setting

#### *Landform:*

Phillips—Till plains  
 Absher—Till plains

#### *Position on landform:*

Phillips—Microhighs  
 Absher—Microlows

#### *Slope:*

Phillips—0 to 4 percent  
 Absher—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Phillips and similar soils: 50 percent  
 Absher and similar soils: 40 percent

#### Minor Components

Elloam and similar soils: 0 to 5 percent  
 Thoeny and similar soils: 0 to 2 percent

Kevin and similar soils: 0 to 2 percent  
 Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Phillips

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.4 inches

#### Absher

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 331C—Phillips-Absher complex, 4 to 8 percent slopes

### Setting

#### *Landform:*

Phillips—Till plains  
 Absher—Till plains

#### *Position on landform:*

Phillips—Microhighs  
 Absher—Microlows

#### *Slope:*

Phillips—4 to 8 percent  
 Absher—4 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Phillips and similar soils: 50 percent

Absher and similar soils: 40 percent

#### Minor Components

Elloam and similar soils: 0 to 4 percent

Kevin and similar soils: 0 to 3 percent

Thoeny and similar soils: 0 to 2 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Phillips

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.4 inches

#### Absher

*Surface layer texture:* Clay

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

*Drainage class:* Moderately well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 4.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 332B—Phillips-Elloam complex, 0 to 4 percent slopes

### Setting

#### Landform:

Phillips—Till plains

Elloam—Till plains

#### Position on landform:

Phillips—Microhighs

Elloam—Microlows

#### Slope:

Phillips—0 to 4 percent

Elloam—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Phillips and similar soils: 50 percent

Elloam and similar soils: 35 percent

#### Minor Components

Kevin and similar soils: 0 to 5 percent

Thoeny and similar soils: 0 to 3 percent

Absher and similar soils: 0 to 3 percent

Slopes greater than 4 percent: 0 to 3 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Phillips

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.4 inches

#### Elloam

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1332C—Phillips-Elloam-Thoeny association, 0 to 8 percent slopes

### Setting

#### *Landform:*

Phillips—Till plains  
 Elloam—Till plains  
 Thoeny—Till plains

#### *Position on landform:*

Phillips—Microhighs  
 Elloam—Microlows  
 Thoeny—Microhighs

#### *Slope:*

Phillips—0 to 8 percent  
 Elloam—0 to 8 percent  
 Thoeny—0 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Phillips and similar soils: 35 percent  
 Elloam and similar soils: 25 percent  
 Thoeny and similar soils: 20 percent

#### Minor Components

Kevin and similar soils: 0 to 10 percent  
 Absher and similar soils: 0 to 9 percent  
 Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Phillips

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)

*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.4 inches

#### Elloam

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 inches

#### Thoeny

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 7.4 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 334C—Phillips-Kevin complex, 2 to 8 percent slopes

### Setting

#### *Landform:*

Phillips—Till plains  
 Kevin—Till plains

#### *Position on landform:*

Phillips—Foothslopes and toeslopes  
 Kevin—Backslopes and shoulders

*Slope:*

Phillips—2 to 8 percent

Kevin—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Phillips and similar soils: 50 percent

Kevin and similar soils: 40 percent

**Minor Components**

Telstad and similar soils: 0 to 3 percent

Slopes less than 2 percent: 0 to 3 percent

Thoeny and similar soils: 0 to 1 percent

Elloam and similar soils: 0 to 1 percent

Absher and similar soils: 0 to 1 percent

Nishon and similar soils: 0 to 1 percent

**Major Component Description****Phillips***Surface layer texture:* Loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Till*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 9.4 inches**Kevin***Surface layer texture:* Clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Till*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**333C—Phillips-Kevin, gravelly complex,  
2 to 8 percent slopes****Setting***Landform:*

Phillips—Till plains

Kevin—Till plains

*Position on landform:*

Phillips—Foothills and toeslopes

Kevin—Backslopes and shoulders

*Slope:*

Phillips—2 to 8 percent

Kevin—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Phillips and similar soils: 50 percent

Kevin and similar soils: 35 percent

**Minor Components**

Very cobbly surface layers: 0 to 9 percent

Thoeny and similar soils: 0 to 2 percent

Elloam and similar soils: 0 to 2 percent

Absher and similar soils: 0 to 1 percent

Nishon and similar soils: 0 to 1 percent

**Major Component Description****Phillips***Surface layer texture:* Loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Till*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 9.4 inches**Kevin***Surface layer texture:* Very gravelly clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Till*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 8.6 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Pinebreaks Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Hills

*Parent material:* Shale residuum

*Slope range:* 15 to 45 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Clayey, montmorillonitic, acid, frigid, shallow Typic Ustorthents

### Typical Pedon

Pinebreaks clay, in an area of Pinebreaks-Neldore clays, 15 to 60 percent slopes, in woodland, 1,600 feet south and 300 feet east of the northwest corner of sec. 30, T. 22 N., R. 24 E.

Oi—1 inch to 0; forest litter of partially decomposed needles, leaves, and twigs.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; hard, very friable, very sticky and very plastic; many fine and very fine roots, few medium and coarse roots; neutral; clear smooth boundary.

Bw—3 to 9 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular blocky structure; very hard, firm, very sticky and very plastic; many fine and very fine roots, few medium and coarse roots; common very fine tubular pores; 25 percent soft shale fragments; moderately acid; clear wavy boundary.

BC—9 to 18 inches; grayish brown (2.5Y 5/2) and light yellowish brown (2.5Y 6/4) clay, dark grayish

brown (2.5Y 4/2) and light olive brown (2.5Y 5/4) moist; weak fine subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and very fine and few medium roots; common very fine tubular pores; 60 percent soft shale fragments; very strongly acid; gradual wavy boundary.

Cr—18 to 60 inches; grayish brown (2.5Y 5/2) semiconsolidated shale, dark grayish brown (2.5Y 4/2) moist; few fine and very fine roots between plates in upper part; very strongly acid.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches.

*Depth to Cr horizon:* 10 to 20 inches.

*Note:* Pinebreaks soils occur on sites having substantially higher effective precipitation than surrounding areas due to the combined influence of north aspects and steep slopes.

#### A horizon

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 1 to 3

Clay content: 40 to 50 percent

Reaction: pH 5.6 to 7.8

#### Bw horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 1 to 3

Texture: clay or silty clay

Clay content: 40 to 60 percent

Rock fragments: 5 to 25 percent soft shale fragments

Reaction: pH 5.6 to 7.8

#### BC horizon

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 1 to 3

Texture: clay or silty clay

Clay content: 40 to 60 percent

Rock fragments: 60 to 90 percent soft shale fragments

Reaction: pH 4.5 to 5.5

#### Cr horizon

Material: the shale fragments are very hard or hard when dry and very firm when moist.

Reaction: pH 4.5 to 5.5

**974F—Pinebreaks-Neldore clays, 15 to 60 percent slopes****Setting***Landform:*

Pinebreaks—Hills

Neldore—Hills

*Position on landform:*

Pinebreaks—Backslopes and footslopes

Neldore—Backslopes and shoulders

*Slope:*

Pinebreaks—15 to 45 percent, northeast aspect

Neldore—15 to 60 percent, southwest aspect

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Pinebreaks and similar soils: 50 percent

Neldore and similar soils: 35 percent

**Minor Components**

Bascovy and similar soils: 0 to 5 percent

Volborg and similar soils: 0 to 3 percent

Neldore soils in rangeland: 0 to 5 percent

Rock outcrop: 0 to 2 percent

**Major Component Description****Pinebreaks***Surface layer texture:* Clay*Depth class:* Shallow (10 to 20 inches)*Drainage class:* Well drained*Dominant parent material:* Shale residuum*Native plant cover type:* Forest land*Flooding:* None*Available water capacity:* Mainly 2.0 inches**Neldore***Surface layer texture:* Clay*Depth class:* Shallow (10 to 20 inches)*Drainage class:* Well drained*Dominant parent material:* Shale residuum*Native plant cover type:* Forest land*Flooding:* None*Available water capacity:* Mainly 1.9 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**610—Pits, bentonite****Setting***Landform:* Sedimentary plains**Composition****Major Components**

Pits, bentonite: 100 percent

**Major Component Description**

*Definition:* Excavations from which bentonite have been mined

**600—Pits, gravel****Composition****Major Components**

Pits, gravel: 85 percent

**Major Component Description**

*Definition:* Excavations from which sand and gravel have been mined

**1400F—Rock outcrop-Arsite association, 8 to 60 percent slopes****Setting***Landform:*

Rock outcrop—Hills

Arsite—Hills

*Position on landform:*

Rock outcrop—Shoulders and summits

Arsite—Backslopes and shoulders

*Slope:*

Arsite—8 to 60 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Rock outcrop: 45 percent

Arsite and similar soils: 35 percent

**Minor Components**

Very shallow soils: 0 to 5 percent

Neldore and similar soils: 0 to 5 percent

Bascovy and similar soils: 0 to 3 percent

Vaeda and similar soils: 0 to 2 percent

Nobe and similar soils: 0 to 5 percent

**Major Component Description****Rock outcrop***Definition:* Areas of exposed bedrock**Arsite***Surface layer texture:* Clay*Depth class:* Shallow (10 to 20 inches)*Drainage class:* Well drained*Dominant parent material:* Shale residuum*Native plant cover type:* Rangeland*Flooding:* None*Salt affected:* Saline within 30 inches*Available water capacity:* Mainly 1.5 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**130F—Rubble land-Mocmont-Rock outcrop complex, 25 to 60 percent slopes****Setting***Landform:*

Rubble land—Mountains

Mocmont, cool—Mountains

Rock outcrop—Mountains

*Position on landform:*

Rubble land—Backslopes and footslopes

Mocmont, cool—Backslopes and footslopes

Rock outcrop—Shoulders and summits

*Slope:*

Mocmont, cool—25 to 60 percent

*Elevation:* 4,600 to 5,600 feet*Mean annual precipitation:* 17 to 22 inches*Frost-free period:* 80 to 100 days**Composition****Major Components**

Rubble land: 50 percent

Mocmont, cool and similar soils: 25 percent

Rock outcrop: 15 percent

**Minor Components**

Tolex and similar soils: 0 to 4 percent

Landusky and similar soils: 0 to 3 percent

Very stony surface layers: 0 to 3 percent

**Major Component Description****Rubble land**

*Definition:* Areas with more than 90 percent of the surface covered by stones and boulders, supporting little or no vegetation

**Mocmont, cool***Surface layer texture:* Very cobbly loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Igneous colluvium*Native plant cover type:* Forest land*Flooding:* None*Available water capacity:* Mainly 3.1 inches**Rock outcrop***Definition:* Areas of exposed 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Savage Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Alluvial fans, stream terraces

*Parent material:* Alluvium

*Slope range:* 0 to 15 percent

*Annual precipitation:* 14 to 17 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Fine, montmorillonitic Typic Argiborolls

### Typical Pedon

Savage silty clay loam, 0 to 4 percent slopes, in rangeland, 2,400 feet east and 1,200 feet south of the northwest corner of sec. 22, T. 25 N., R. 23 E.

A—0 to 3 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, very friable, sticky and plastic; many fine and very fine roots; neutral; clear smooth boundary.

Bt—3 to 14 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, very sticky and very plastic; many fine and very fine roots; common very fine tubular pores; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Bk1—14 to 30 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate

medium subangular blocky; very hard, firm, very sticky and very plastic; many fine and very fine roots; few very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—30 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 16 inches (may include part or all of the argillic horizon)

*Depth to Bk horizon:* 12 to 30 inches

*Note:* Some pedons have By and C horizons below a depth of 36 inches.

*A horizon*

Hue: 7.5YR to 2.5Y

Value: 3, 4, or 5 dry; 2 or 3 moist

Chroma: 2 or 3

Texture: clay loam or silty clay loam

Clay content: 27 to 35 percent

Rock fragments: 0 to 5 percent pebbles

Reaction: pH 6.1 to 7.8

*Bt horizon*

Hue: 7.5YR to 2.5Y

Value: 3 to 5 dry; 2 to 4 moist

Chroma: 2 to 4

Texture: silty clay loam, silty clay, or clay

Clay content: 35 to 50 percent

Rock fragments: 0 to 5 percent pebbles

Reaction: pH 6.1 to 8.4

*Bk horizons*

Hue: 7.5YR through 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: silty clay loam, silty clay, or clay

Clay content: 30 to 45 percent

Rock fragments: 0 to 10 percent-0 to 5 percent cobbles, 0 to 5 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

## 82B—Savage silty clay loam, 0 to 4 percent slopes

### Setting

*Landform:* Alluvial fans and stream terraces

*Slope:* 0 to 4 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

### Composition

#### Major Components

Savage and similar soils: 90 percent

#### Minor Components

Farnuf and similar soils: 0 to 8 percent

Saline and sodic soils: 0 to 2 percent

#### Major Component Description

*Surface layer texture:* Silty clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 82C—Savage silty clay loam, 4 to 8 percent slopes

### Setting

*Landform:* Alluvial fans

*Slope:* 4 to 8 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

## Composition

#### Major Components

Savage and similar soils: 90 percent

#### Minor Components

Farnuf and similar soils: 0 to 8 percent

Saline and sodic soils: 0 to 2 percent

#### Major Component Description

*Surface layer texture:* Silty clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 821D—Savage-Farnuf complex, 8 to 15 percent slopes

### Setting

*Landform:*

Savage—Alluvial fans

Farnuf—Alluvial fans

*Slope:*

Savage—8 to 15 percent

Farnuf—8 to 15 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

### Composition

#### Major Components

Savage and similar soils: 50 percent

Farnuf and similar soils: 35 percent

## Minor Components

Slopes greater than 15 percent: 0 to 5 percent

Moderately deep clayey soils: 0 to 5 percent

Very cobbly surface layers: 0 to 3 percent

Moderately deep loamy soils: 0 to 2 percent

## Major Component Description

### Savage

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.0 inches

### Farnuf

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Saypo Series

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

*Drainage class:* Somewhat poorly drained

*Permeability:* Moderately slow (0.2 to 0.6 inch/hour)

*Landform:* Stream terraces

*Parent material:* Alluvium

*Slope range:* 0 to 2 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Aquic  
Calciborolls

## Typical Pedon

Saypo clay loam, in an area of Binna-Saypo complex, 0 to 4 percent slopes, in rangeland, 1,200 feet west and 600 feet north of the southeast corner of sec. 4, T. 36 N., R. 28 E.

A1—0 to 4 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; strong medium granular structure; slightly hard, very friable, sticky and plastic; many fine and very fine roots; 2 percent pebbles; slightly effervescent (strongly effervescent when mixed to 7 inches); slightly alkaline; clear wavy boundary.

A2—4 to 8 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to strong medium granular; hard, friable, sticky and plastic; many fine and very fine roots; many very fine tubular pores; 2 percent pebbles; few fine masses of lime; strongly effervescent; slightly alkaline; clear wavy boundary.

Bk1—8 to 12 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; few fine and very fine roots; many very fine and few fine tubular pores; 2 percent pebbles; many fine and few medium masses of lime; violently effervescent; slightly alkaline; clear wavy boundary.

Bk2—12 to 22 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine and few fine tubular pores; 2 percent pebbles; common fine faint light olive brown (2.5Y 5/4) dry redox concentrations; many fine and few medium masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk3—22 to 30 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, sticky and plastic; common very fine tubular pores; 2 percent pebbles; common fine prominent yellowish brown (10YR 5/6) dry redox concentrations; many fine and common medium and coarse masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

C1—30 to 45 inches; very pale brown (10YR 7/4) loam with thin strata of sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, very

friable, nonsticky and nonplastic; common very fine tubular pores; 5 percent pebbles; common fine and medium distinct yellowish brown (10YR 5/6) dry redox concentrations; few fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—45 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; common very fine tubular pores; 5 percent pebbles; many fine and medium distinct brownish yellow (10YR 6/6) dry redox concentrations; few fine masses of lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 46 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 12 inches

*Depth to seasonal high water table:* 24 to 42 inches

*Depth to Bk horizon:* 5 to 12 inches

#### A horizons

Hue: 10YR or 2.5Y

Value: 3 or 4 dry; 2 or 3 moist

Chroma: 1 or 2

Clay content: 27 to 35 percent

Rock fragments: 0 to 5 percent pebbles

Calcium carbonate equivalent: 5 to 10 percent

Reaction: 7.4 to 8.4

#### Bk1 horizon

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: clay loam or loam

Clay content: 22 to 35 percent

Rock fragments: 0 to 5 percent pebbles

Calcium carbonate equivalent: 20 to 25 percent

Reaction: pH 7.9 to 8.4

#### Bk2 and Bk3 horizons

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: clay loam or loam

Clay content: 22 to 35 percent

Rock fragments: 0 to 35 percent-0 to 5 percent cobbles, 0 to 30 percent pebbles

Calcium carbonate equivalent: 30 to 35 percent

Sodium adsorption ratio: 0 to 13

Reaction: pH 7.9 to 9.0

#### C horizons

Hue: 10YR to 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: clay loam or loam

Clay content: 22 to 40 percent

Rock fragments: 5 to 50 percent-0 to 10 percent cobbles, 5 to 40 percent pebbles

Sodium adsorption ratio: 0 to 13

Reaction: pH 7.9 to 9.0

## Scobey Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Till plains

*Parent material:* Till

*Slope range:* 0 to 15 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Aridic Argiborolls

## Typical Pedon

Scobey clay loam, in an area of Scobey-Kevin clay loams, 2 to 8 percent slopes, in cropland, 1,000 feet south and 1,200 feet east of the northwest corner of sec. 17, T. 28 N., R. 31 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; slightly hard, very friable, sticky and plastic; common fine and very fine roots; 5 percent pebbles; neutral; abrupt smooth boundary.

Bt—6 to 16 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium prismatic structure parting to strong fine subangular blocky; very hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; many faint clay films on faces of peds; 5 percent pebbles; slightly alkaline; clear wavy boundary.

Btk—16 to 23 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; few faint clay films on faces of peds; 5 percent pebbles; common fine seams and masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk—23 to 35 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist;

weak medium and coarse prismatic structure parting to weak medium subangular blocky; very hard, friable, sticky and plastic; common very fine tubular pores; 5 percent pebbles; few lignite chips; common fine seams and masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bky—35 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure; very hard, friable, sticky and plastic; few very fine tubular pores; 5 percent pebbles; common fine seams and masses of lime; few fine seams and masses of gypsum crystals; few lignite chips and relict redox concentrations; violently effervescent; moderately alkaline.

#### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Mollic epipedon thickness:* 7 to 16 inches  
*Depth to Bk horizon:* 10 to 18 inches  
*Depth to Bky horizon:* 30 to 55 inches

#### *Ap horizon*

Hue: 10YR or 2.5Y  
 Chroma: 2 or 3  
 Clay content: 27 to 35 percent  
 Rock fragments: 0 to 35 percent-0 to 10 percent cobbles and stones; 0 to 30 percent pebbles  
 Reaction: pH 6.1 to 7.8

#### *Bt horizon*

Hue: 10YR or 2.5Y  
 Value: 4 to 6 dry; 3 or 4 moist  
 Chroma: 2 or 3  
 Texture: clay loam or clay  
 Clay content: 35 to 45 percent  
 Rock fragments: 0 to 15 percent-0 to 5 percent cobbles; 0 to 10 percent pebbles  
 Reaction: pH 6.6 to 7.8

#### *Btk and Bk horizons*

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry, 4 or 5 moist  
 Chroma: 2 to 4  
 Clay content: 30 to 40 percent  
 Rock fragments: 0 to 15 percent-0 to 5 percent cobbles; 0 to 10 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.4 to 8.4

#### *Bky horizon*

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry, 4 or 5 moist

Chroma: 2 to 4

Clay content: 30 to 40 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles; 0 to 10 percent pebbles

Calcium carbonate equivalent: 5 to 12 percent

Sodium adsorption ratio: 1 to 8

Gypsum: 1 to 5 percent

Reaction: pH 7.4 to 9.0

### 56B—Scobey clay loam, 0 to 4 percent slopes

#### Setting

*Landform:* Till plains

*Slope:* 0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

#### Major Components

Scobey and similar soils: 90 percent

#### Minor Components

Kevin and similar soils: 0 to 4 percent  
 Telstad and similar soils: 0 to 2 percent  
 Thoeny and similar soils: 0 to 1 percent  
 Elloam and similar soils: 0 to 1 percent  
 Absher and similar soils: 0 to 1 percent  
 Nishon and similar soils: 0 to 1 percent

#### Major Component Description

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.9 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 562C—Scobey-Elloam clay loams, 2 to 8 percent slopes

### Setting

#### Landform:

Scobey—Till plains  
Elloam—Till plains

#### Position on landform:

Scobey—Microhighs  
Elloam—Microlows

#### Slope:

Scobey—2 to 8 percent  
Elloam—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Scobey and similar soils: 50 percent  
Elloam and similar soils: 40 percent

#### Minor Components

Kevin and similar soils: 0 to 4 percent  
Phillips and similar soils: 0 to 3 percent  
Absher and similar soils: 0 to 2 percent  
Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Scobey

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

#### Elloam

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 567C—Scobey-Elloam-Absher gravelly clay loams, 2 to 8 percent slopes

### Setting

#### Landform:

Scobey—Till plains  
Elloam—Till plains  
Absher—Till plains

#### Position on landform:

Scobey—Microhighs  
Elloam—Microlows  
Absher—Microlows

#### Slope:

Scobey—2 to 8 percent  
Elloam—2 to 8 percent  
Absher—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Scobey and similar soils: 35 percent  
Elloam and similar soils: 30 percent  
Absher and similar soils: 25 percent

#### Minor Components

Kevin and similar soils: 0 to 6 percent  
Slopes greater than 8 percent: 0 to 3 percent  
Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Scobey

*Surface layer texture:* Gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained

*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.7 inches

### **Elloam**

*Surface layer texture:* Gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 inches

### **Absher**

*Surface layer texture:* Gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.0 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.

## **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **563C—Scobey-Kevin clay loams, 2 to 8 percent slopes**

### **Setting**

#### *Landform:*

Scobey—Till plains  
 Kevin—Till plains

#### *Position on landform:*

Scobey—Footslopes and toeslopes  
 Kevin—Backslopes and shoulders

#### *Slope:*

Scobey—2 to 8 percent  
 Kevin—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## **Composition**

### **Major Components**

Scobey and similar soils: 50 percent

Kevin and similar soils: 35 percent

### **Minor Components**

Hillon and similar soils: 0 to 5 percent

Telstad and similar soils: 0 to 5 percent

Nishon and similar soils: 0 to 2 percent

Thoeny and similar soils: 0 to 1 percent

Elloam and similar soils: 0 to 1 percent

Absher and similar soils: 0 to 1 percent

## **Major Component Description**

### **Scobey**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

### **Kevin**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

## **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## 566C—Scobey-Kevin complex, 2 to 8 percent slopes

### Setting

#### Landform:

Scobey—Till plains

Kevin—Till plains

#### Position on landform:

Scobey—Footslopes and toeslopes

Kevin—Backslopes and shoulders

#### Slope:

Scobey—2 to 8 percent

Kevin—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Scobey and similar soils: 50 percent

Kevin and similar soils: 35 percent

#### Minor Components

Hillon and similar soils: 0 to 5 percent

Telstad and similar soils: 0 to 3 percent

Very stony surface layers: 0 to 3 percent

Nishon and similar soils: 0 to 2 percent

Elloam and similar soils: 0 to 1 percent

Thoeny and similar soils: 0 to 1 percent

### Major Component Description

#### Scobey

*Surface layer texture:* Gravelly clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.7 inches

#### Kevin

*Surface layer texture:* Very cobbly clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 8.1 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 564C—Scobey-Kevin-Elloam clay loams, 2 to 8 percent slopes

### Setting

#### Landform:

Scobey—Till plains

Kevin—Till plains

Elloam—Till plains

#### Position on landform:

Scobey—Footslopes and toeslopes

Kevin—Backslopes and shoulders

Elloam—Microlows

#### Slope:

Scobey—2 to 8 percent

Kevin—2 to 8 percent

Elloam—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Scobey and similar soils: 35 percent

Kevin and similar soils: 30 percent

Elloam and similar soils: 20 percent

#### Minor Components

Hillon and similar soils: 0 to 5 percent

Slopes greater than 8 percent: 0 to 3 percent

Thoeny and similar soils: 0 to 3 percent

Absher and similar soils: 0 to 2 percent

Nishon and similar soils: 0 to 2 percent

### Major Component Description

#### Scobey

*Surface layer texture:* Clay loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.9 inches

**Kevin**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.2 inches

**Elloam**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**561B—Scobey-Phillips complex, 0 to 4 percent slopes****Setting***Landform:*

Scobey—Till plains  
 Phillips—Till plains

*Position on landform:*

Scobey—Backslopes and footslopes  
 Phillips—Footslopes and toeslopes

*Slope:*

Scobey—0 to 4 percent  
 Phillips—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Scobey and similar soils: 45 percent  
 Phillips and similar soils: 40 percent

**Minor Components**

Kevin and similar soils: 0 to 5 percent  
 Telstad and similar soils: 0 to 3 percent  
 Thoeny and similar soils: 0 to 3 percent  
 Elloam and similar soils: 0 to 2 percent  
 Absher and similar soils: 0 to 1 percent  
 Nishon and similar soils: 0 to 1 percent

**Major Component Description****Scobey**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

**Phillips**

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.4 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**Silverchief Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderately slow (0.06 to 0.2 inch/hour)  
*Landform:* Mountains  
*Parent material:* Colluvium or alluvium from mixed rock sources  
*Slope range:* 15 to 45 percent  
*Annual precipitation:* 17 to 25 inches  
*Annual air temperature:* 38 to 43 degrees F  
*Frost-free period:* 80 to 100 days

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

### Typical Pedon

Silverchief loam, in an area of Silverchief-Whitecow-Macmeal complex, 15 to 60 percent slopes, in woodland, 1,100 feet south and 1,150 feet east of the northwest corner of sec. 4, T. 25 N., R. 25 E.

Oi—2 inches to 0; forest litter of partially decomposed needles and twigs.

A—0 to 3 inches; brown (7.5YR 5/2) loam, brown (7.5YR 4/4) moist; strong fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots, common medium and few coarse roots; 5 percent small angular pebbles; neutral; abrupt smooth boundary.

E—3 to 8 inches; pinkish gray (7.5YR 7/2) loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure parting to strong fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots, common medium and few coarse roots; many fine and very fine tubular pores; 5 percent small angular pebbles; neutral; clear wavy boundary.

Bt1—8 to 14 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure parting to strong medium granular; very hard, friable, very sticky and very plastic; common very fine, fine, and medium roots, few coarse roots; common very fine tubular pores; 5 percent small angular pebbles; common faint clay films on faces of peds; neutral; clear wavy boundary.

Bt2—14 to 21 inches; light brown (7.5YR 6/4) clay, brown (7.5YR 4/4) moist; strong fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and very fine and few medium roots; common very fine tubular pores; 10 percent angular pebbles; many faint clay films on faces of peds; neutral; gradual wavy boundary.

Bt3—21 to 32 inches; mainly light brown (7.5YR 6/4) with patches of strong brown (7.5YR 5/6) gravelly clay, brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine, fine, and medium roots; common very fine tubular pores; 15 percent pebbles and 5 percent cobbles; many faint clay films on faces of peds; neutral; gradual wavy boundary.

Bk1—32 to 46 inches; very pale brown (10YR 7/3) and yellowish brown (10YR 5/4) very gravelly clay, light yellowish brown (10YR 6/4) and dark yellowish brown (10YR 4/4) moist; weak fine and

medium subangular structure; very hard, firm, very sticky and very plastic; few fine and very fine roots; common very fine tubular pores; 30 percent pebbles and 10 percent cobbles (rock fragments mainly sandstone); common fine seams of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—46 to 60 inches; very pale brown (10YR 7/3) gravelly clay, light yellowish brown (10YR 6/4) moist; weak fine and medium subangular structure; very hard, firm, very sticky and very plastic; few fine and very fine roots, many very fine tubular pores; 25 percent hard shale fragments; common fine seams and masses of lime; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 44 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to calcic horizon:* 20 to 35 inches

#### *A horizon*

Hue: 7.5YR or 10YR

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2, 3, or 4

Clay content: 20 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.1 to 7.3

#### *E horizon*

Hue: 7.5YR or 10YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Clay content: 20 to 27 percent

Rock fragments: 0 to 30 percent-0 to 15 percent cobbles, 0 to 15 percent pebbles

Reaction: pH 6.1 to 7.3

#### *Bt horizons*

Hue: 7.5YR to 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 to 6

Texture: clay, silty clay, or clay loam

Clay content: 35 to 60 percent

Rock fragments: 5 to 35 percent-0 to 15 percent cobbles, 5 to 20 percent pebbles

Reaction: pH 6.6 to 7.8

#### *Bk horizons*

Hue: 7.5YR to 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 3 or 4

Texture: clay, clay loam, or sandy clay loam

Clay content: 30 to 45 percent

Rock fragments: 25 to 50 percent-0 to 15 percent  
 cobbles, 25 to 35 percent pebbles  
 Calcium carbonate equivalent: 15 to 35 percent  
 Reaction: pH 7.4 to 8.4

### 115F—Silverchief-Whitecow-Macmeal complex, 15 to 60 percent slopes

#### Setting

##### Landform:

Silverchief—Mountains  
 Whitecow, warm—Mountains  
 Macmeal—Mountains

##### Position on landform:

Silverchief—Backslopes and footslopes  
 Whitecow, warm—Backslopes and footslopes  
 Macmeal—Backslopes

##### Slope:

Silverchief—15 to 45 percent  
 Whitecow, warm—25 to 60 percent, southwest  
 aspect  
 Macmeal—25 to 60 percent, northeast aspect

Elevation: 4,200 to 4,600 feet

Mean annual precipitation: 17 to 22 inches

Frost-free period: 80 to 100 days

#### Composition

##### Major Components

Silverchief and similar soils: 35 percent  
 Whitecow, warm and similar soils: 30 percent  
 Macmeal and similar soils: 20 percent

##### Minor Components

Deep calcareous clayey soils: 0 to 5 percent  
 Moderately deep soils: 0 to 5 percent  
 Warneke and similar soils: 0 to 5 percent

#### Major Component Description

##### Silverchief

Surface layer texture: Loam  
 Depth class: Very deep (more than 60 inches)  
 Drainage class: Well drained  
 Dominant parent material: Alluvium or colluvium  
 Native plant cover type: Forest land  
 Flooding: None  
 Available water capacity: Mainly 5.7 inches

##### Whitecow, warm

Surface layer texture: Gravelly loam  
 Depth class: Very deep (more than 60 inches)

Drainage class: Well drained  
 Dominant parent material: Limestone colluvium  
 Native plant cover type: Forest land  
 Flooding: None  
 Available water capacity: Mainly 4.1 inches

##### Macmeal

Surface layer texture: Gravelly loam  
 Depth class: Very deep (more than 60 inches)  
 Drainage class: Well drained  
 Dominant parent material: Igneous colluvium  
 Native plant cover type: Forest land  
 Flooding: None  
 Available water capacity: 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

#### Sunburst Series

Depth class: Very deep (greater than 60 inches)  
 Drainage class: Well drained  
 Permeability: Slow (0.06 to 0.2 inch/hour)  
 Landform: Till plains, hills  
 Parent material: Till  
 Slope range: 2 to 45 percent  
 Annual precipitation: 11 to 14 inches  
 Annual air temperature: 40 to 45 degrees F  
 Frost-free period: 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic  
 (calcareous), frigid Aridic Ustorthents

#### Typical Pedon

Sunburst gravelly clay loam, in an area of Sunburst-Kevin gravelly clay loams, 8 to 15 percent slopes, in rangeland, 200 feet west and 1,300 feet north of the southeast corner of sec. 20, T. 33 N., R. 28 E.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to strong fine granular; slightly hard, very friable, sticky and plastic; many fine and very fine roots; 20 percent pebbles; strongly effervescent; slightly alkaline; clear smooth boundary.

**Bk**—4 to 21 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, very sticky and very plastic; many fine and very fine roots; common very fine tubular pores; common fine and few medium masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

**Bky**—21 to 33 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few fine masses of lime; many fine and few medium masses of gypsum crystals; strongly effervescent; moderately alkaline; gradual wavy boundary.

**By**—33 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure; very hard, firm, very sticky and very plastic; few very fine tubular pores; common fine and few coarse masses of gypsum crystals on vertical faces of prisms; slightly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bk horizon:* 2 to 6 inches

*Depth to By horizon:* more than 20 inches

#### *A horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay loam or clay

Clay content: 27 to 50 percent

Rock fragments: 2 to 60 percent-2 to 50 percent pebbles, 0 to 10 percent cobbles

Calcium carbonate equivalent: 1 to 10 percent

Reaction: pH 7.4 to 8.4

#### *Bk horizon*

Hue: 2.5Y or 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: clay, clay loam, silty clay loam

Clay content: 35 to 50 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Electrical conductivity: 2 to 4 mmhos/cm

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 8.4

#### *Bky horizon*

Hue: 2.5Y or 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: clay, clay loam, silty clay

Clay content: 35 to 50 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Electrical conductivity: 2 to 8

Gypsum: 1 to 3 percent

Reaction: pH 7.9 to 9.0

#### *By horizon*

Hue: 2.5Y or 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay, clay loam, silty clay

Clay content: 35 to 50 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Calcium carbonate equivalent: 3 to 12 percent

Electrical conductivity: 2 to 8

Gypsum: 1 to 6 percent

Reaction: pH 7.9 to 8.4

## 924E—Sunburst-Bascovy-Neldore complex, 8 to 35 percent slopes

### Setting

#### *Landform:*

Sunburst—Hills

Bascovy—Hills

Neldore—Hills

#### *Position on landform:*

Sunburst—Backslopes and shoulders

Bascovy—Backslopes and footslopes

Neldore—Backslopes

#### *Slope:*

Sunburst—8 to 35 percent

Bascovy—8 to 35 percent

Neldore—8 to 35 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Sunburst and similar soils: 35 percent  
 Bascovy and similar soils: 30 percent  
 Neldore and similar soils: 20 percent

### Minor Components

Very cobbly surface layers: 0 to 5 percent  
 Slopes less than 8 percent: 0 to 3 percent  
 Weingart and similar soils: 0 to 3 percent  
 Vanda and similar soils: 0 to 2 percent  
 Very shallow soils: 0 to 2 percent

### Major Component Description

#### Sunburst

*Surface layer texture:* Gravelly clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.0 inches

#### Bascovy

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.3 inches

#### Neldore

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.2 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 925C—Sunburst-Bascovy-Weingart complex, 2 to 8 percent slopes

### Setting

#### *Landform:*

Sunburst—Till plains  
 Bascovy—Sedimentary plains  
 Weingart, thin—Sedimentary plains

#### *Position on landform:*

Sunburst—Backslopes and shoulders  
 Bascovy—Backslopes and footslopes  
 Weingart, thin—Microlows

#### *Slope:*

Sunburst—2 to 8 percent  
 Bascovy—2 to 8 percent  
 Weingart, thin—2 to 8 percent

#### *Elevation:* 2,170 to 3,400 feet

#### *Mean annual precipitation:* 11 to 14 inches

#### *Frost-free period:* 100 to 120 days

## Composition

### Major Components

Sunburst and similar soils: 35 percent  
 Bascovy and similar soils: 30 percent  
 Weingart, thin and similar soils: 20 percent

### Minor Components

Neldore and similar soils: 0 to 5 percent  
 Vanda and similar soils: 0 to 5 percent  
 Very cobbly surface layers: 0 to 5 percent

### Major Component Description

#### Sunburst

*Surface layer texture:* Gravelly clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.0 inches

**Bascovy**

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.3 inches

**Weingart, thin**

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**923F—Sunburst-Kevin complex, 15 to 45 percent slopes****Setting***Landform:*

Sunburst—Hills  
 Kevin—Hills

*Position on landform:*

Sunburst—Backslopes and shoulders  
 Kevin—Backslopes and footslopes

*Slope:*

Sunburst—15 to 45 percent  
 Kevin—15 to 25 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Sunburst and similar soils: 50 percent  
 Kevin and similar soils: 35 percent

**Minor Components**

Very cobbly surface layers: 0 to 5 percent  
 Slopes less than 15 percent: 0 to 3 percent  
 Bascovy and similar soils: 0 to 3 percent  
 Neldore and similar soils: 0 to 2 percent  
 Saline and sodic soils: 0 to 2 percent

**Major Component Description****Sunburst**

*Surface layer texture:* Gravelly clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.0 inches

**Kevin**

*Surface layer texture:* Gravelly clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.9 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**923C—Sunburst-Kevin gravelly clay loams, 2 to 8 percent slopes****Setting***Landform:*

Sunburst—Till plains  
 Kevin—Till plains

*Position on landform:*

Sunburst—Backslopes and shoulders

Kevin—Backslopes and footslopes

*Slope:*

Sunburst—2 to 8 percent

Kevin—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Sunburst and similar soils: 50 percent

Kevin and similar soils: 35 percent

**Minor Components**

Very cobbly surface layers: 0 to 9 percent

Thoeny and similar soils: 0 to 3 percent

Elloam and similar soils: 0 to 2 percent

Nishon and similar soils: 0 to 1 percent

**Major Component Description****Sunburst***Surface layer texture:* Gravelly clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Till*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 8.0 inches**Kevin***Surface layer texture:* Gravelly clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Till*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 8.9 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**921D—Sunburst-Kevin gravelly clay loams, 8 to 15 percent slopes****Setting***Landform:*

Sunburst—Hills

Kevin—Hills

*Position on landform:*

Sunburst—Backslopes and shoulders

Kevin—Backslopes and footslopes

*Slope:*

Sunburst—8 to 15 percent

Kevin—8 to 15 percent

*Elevation:* 2,170 to 3,400 feet*Mean annual precipitation:* 11 to 14 inches*Frost-free period:* 100 to 120 days**Composition****Major Components**

Sunburst and similar soils: 50 percent

Kevin and similar soils: 35 percent

**Minor Components**

Very cobbly surface layers: 0 to 7 percent

Thoeny and similar soils: 0 to 3 percent

Elloam and similar soils: 0 to 2 percent

Bascovy and similar soils: 0 to 2 percent

Nishon and similar soils: 0 to 1 percent

**Major Component Description****Sunburst***Surface layer texture:* Gravelly clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Till*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 8.0 inches**Kevin***Surface layer texture:* Gravelly clay loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Till*Native plant cover type:* Rangeland*Flooding:* None*Available water capacity:* Mainly 8.9 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1920F—Sunburst-Neldore association, 15 to 45 percent slopes

### Setting

#### Landform:

Sunburst—Hills  
Neldore—Hills

#### Position on landform:

Sunburst—Backslopes and shoulders  
Neldore—Backslopes and footslopes

#### Slope:

Sunburst—15 to 45 percent  
Neldore—15 to 45 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Sunburst and similar soils: 40 percent

Neldore and similar soils: 35 percent

#### Minor Components

Bascovy and similar soils: 0 to 10 percent

Vaeda and similar soils: 0 to 5 percent

Very gravelly surface layers: 0 to 5 percent

Rock outcrop: 0 to 5 percent

### Major Component Description

#### Sunburst

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 8.1 inches

#### Neldore

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Shale residuum

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 2.2 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 926F—Sunburst-Neldore-Rock outcrop complex, 15 to 45 percent slopes

### Setting

#### Landform:

Sunburst—Hills  
Neldore—Hills  
Rock outcrop—Hills

#### Position on landform:

Sunburst—Backslopes and shoulders  
Neldore—Backslopes and footslopes  
Rock outcrop—Backslopes

#### Slope:

Sunburst—15 to 45 percent  
Neldore—15 to 45 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Sunburst and similar soils: 40 percent

Neldore and similar soils: 30 percent

Rock outcrop: 20 percent

#### Minor Components

Very cobbly surface layers: 0 to 4 percent

Slopes less than 15 percent: 0 to 2 percent

Slopes greater than 45 percent: 0 to 2 percent

Bascovy and similar soils: 0 to 2 percent

### Major Component Description

#### Sunburst

*Surface layer texture:* Gravelly clay

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

*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 8.0 inches

### **Neldore**

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.2 inches

### **Rock outcrop**

*Definition:* Areas of exposed 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

### **Tamaneen Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderately slow (0.2 to 0.6 inch/hour) above 38 inches; moderately rapid (2.0 to 6.0 inches/hour) below  
*Landform:* Relict stream terraces  
*Parent material:* Alluvium  
*Slope range:* 0 to 4 percent  
*Annual precipitation:* 14 to 17 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Fine, montmorillonitic Typic Argiborolls

### **Typical Pedon**

Tamaneen clay loam, (mixed to 7 inches) in an area of Tamaneen-Danvers clay loams, 0 to 4 percent slopes, in rangeland, 1,600 feet south and 2,600 feet west of the northeast corner of sec. 9, T. 24 N., R. 25 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist;

strong fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 5 percent pebbles and cobbles; neutral; clear wavy boundary.

Bt1—3 to 10 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots; common very fine tubular pores; 5 percent pebbles; many distinct clay films on faces of peds; neutral; clear wavy boundary.

Bt2—10 to 16 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to strong fine and medium subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots; common very fine tubular pores; 10 percent pebbles; many distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk—16 to 23 inches; pale brown (10YR 6/3) gravelly clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, very friable, sticky and plastic; common fine and very fine roots; many very fine tubular pores; 15 percent pebbles; many fine masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk1—23 to 38 inches; light gray (10YR 7/2) very gravelly clay loam, light brownish gray (10YR 6/2) moist; weak fine subangular blocky structure; slightly hard, very friable, sticky and plastic; few fine and very fine roots; many very fine tubular pores; 30 percent pebbles and 5 percent cobbles; disseminated lime, common distinct lime coatings on rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

2Bk2—38 to 60 inches; light gray (10YR 7/2) extremely gravelly loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; many very fine tubular pores; 55 percent pebbles and 10 percent cobbles; disseminated lime, common distinct lime coatings on rock fragments; violently effervescent; moderately alkaline.

### **Range in Characteristics**

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 16 inches and includes part or all of the Bt horizon

*Depth to calcic horizon:* 10 to 16 inches

*Depth to the 2Bk horizon:* 17 to 40 inches

*A horizon*

Hue: 10YR or 2.5Y  
 Value: 4 or 5 dry; 2 or 3 moist  
 Chroma: 2 or 3  
 Texture: loam (clay loam when mixed to 7 inches)  
 Clay content: 27 to 35 percent (when mixed to 7 inches)  
 Rock fragments: 0 to 10 percent-0 to trace cobbles, 0 to 10 percent pebbles  
 Reaction: pH 6.6 to 7.8

*Bt horizons*

Hue: 10YR or 2.5Y  
 Value: 4 or 5 dry; 3 or 4 moist  
 Chroma: 2 or 3  
 Texture: silty clay, silty clay loam, or clay loam  
 Clay content: 35 to 50 percent  
 Rock fragments: 0 to 10 percent-0 to trace cobbles, 0 to 10 percent pebbles  
 Reaction: pH 6.6 to 7.8

*Bk horizon*

Hue: 10YR or 2.5Y  
 Value: 5 to 8 dry; 4 to 6 moist  
 Chroma: 2 or 3  
 Texture: clay loam, silty clay, silty clay loam  
 Clay content: 30 to 45 percent  
 Rock fragments: 5 to 20 percent-0 to trace cobbles, 5 to 20 percent pebbles  
 Calcium carbonate equivalent: 20 to 30 percent  
 Reaction: pH 7.4 to 8.4

*2Bk1 horizon*

Hue: 10YR or 2.5Y  
 Value: 6 to 8 dry; 5 to 7 moist  
 Chroma: 2 to 4  
 Texture: clay loam or loam  
 Clay content: 18 to 35 percent  
 Rock fragments: 30 to 45 percent-0 to 10 percent cobbles, 30 to 35 percent pebbles  
 Calcium carbonate equivalent: 25 to 40 percent  
 Reaction: pH 7.9 to 8.4

*2Bk2 horizon*

Hue: 10YR or 2.5Y  
 Value: 6 to 8 dry; 5 to 7 moist  
 Chroma: 2 to 4  
 Textures: sandy loam or loam  
 Clay content: 8 to 25 percent  
 Rock fragments: 60 to 80 percent-5 to 20 percent cobbles, 55 to 60 percent pebbles  
 Calcium carbonate equivalent: 25 to 40 percent  
 Reaction: pH 7.9 to 8.4

**871B—Tamaneen-Danvers clay loams,  
0 to 4 percent slopes****Setting***Landform:*

Tamaneen—Relict stream terraces  
 Danvers—Relict stream terraces

*Position on landform:*

Tamaneen—Treads  
 Danvers—Treads

*Slope:*

Tamaneen—0 to 4 percent  
 Danvers—0 to 4 percent

*Elevation:* 3,400 to 4,400 feet

*Mean annual precipitation:* 14 to 17 inches

*Frost-free period:* 90 to 110 days

**Composition****Major Components**

Tamaneen and similar soils: 55 percent  
 Danvers and similar soils: 30 percent

**Minor Components**

Attewan and similar soils: 0 to 5 percent  
 Martinsdale and similar soils: 0 to 5 percent  
 Very cobbly surface layers: 0 to 3 percent  
 Windham and similar soils: 0 to 2 percent

**Major Component Description****Tamaneen**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 6.2 inches

**Danvers**

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 7.8 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Telstad Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Till plains, hills

*Parent material:* Till

*Slope range:* 0 to 15 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Aridic Argiborolls

### Typical Pedon

Telstad loam, 0 to 4 percent slopes, in cropland, 2,500 feet east and 600 feet north of the southwest corner of sec. 4, T. 29 N., R. 28 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; neutral; abrupt smooth boundary.

Bt1—6 to 10 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine and medium subangular blocky; very hard, friable, sticky and plastic; common fine and very fine roots; common very fine tubular pores; many faint clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bt2—10 to 14 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, sticky and plastic; common fine and very fine roots; common very fine tubular pores; common faint clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk1—14 to 19 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak medium

prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; few fine and very fine roots; many very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—19 to 38 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable, sticky and plastic; few fine and very fine roots; many very fine tubular pores; many fine and common medium masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—38 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure; very hard, firm, sticky and plastic; common very fine tubular pores; few lignite chips; few medium distinct olive yellow (2.5Y 6/6) relict redox concentrations; common fine masses of lime; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Mollic epipedon thickness:* 7 to 15 inches

*Depth to Bk horizon:* 10 to 20 inches

*Ap horizon*

Hue: 10YR or 2.5Y

Chroma: 2 or 3

Clay content: 18 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction: pH 6.6 to 7.8

*Bt horizons*

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Texture: loam or clay loam

Clay content: 25 to 35 percent

Rock fragments: 0 to 10 percent-0 to 2 percent cobbles, 0 to 8 percent pebbles

Reaction: pH 6.6 to 8.4

*Bk1 horizon*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: loam or clay loam

Clay content: 20 to 32  
 Rock fragments: 0 to 10 percent-0 to 2 percent  
 cobbles, 0 to 8 percent pebbles  
 Electrical conductivity: 0 to 2 mmhos/cm  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.9 to 8.4

*Bk2 horizon*

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 2 to 4  
 Texture: loam or clay loam

Clay content: 20 to 32 percent  
 Rock fragments: 0 to 10 percent-0 to 2 percent  
 cobbles, 0 to 8 percent pebbles  
 Calcium carbonate equivalent: 5 to 15 percent  
 Electrical conductivity: 0 to 2 mmhos/cm  
 Reaction: 7.9 to 8.4

*Bk3 horizon*

Hue: 10YR to 5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: loam or clay loam

Clay content: 20 to 32 percent  
 Rock fragments: 0 to 10 percent-0 to 2 percent  
 cobbles, 0 to 8 percent pebbles  
 Calcium carbonate equivalent: 3 to 12 percent  
 Electrical conductivity: 0 to 4 mmhos/cm  
 Gypsum: 0 to 3 percent  
 Air dry bulk density: 1.7 or more  
 Reaction: pH 7.9 to 9.0

## 50B—Telstad loam, 0 to 4 percent slopes

### Setting

*Landform:* Till plains  
*Slope:* 0 to 4 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Telstad and similar soils: 90 percent

#### Minor Components

Joplin and similar soils: 0 to 4 percent  
 Scobey and similar soils: 0 to 2 percent  
 Thoeny and similar soils: 0 to 2 percent

Elloam and similar soils: 0 to 1 percent  
 Nishon and similar soils: 0 to 1 percent

### Major Component Description

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 504C—Telstad-Absher complex, 2 to 8 percent slopes

### Setting

*Landform:*

Telstad—Till plains  
 Absher—Till plains

*Position on landform:*

Telstad—Microhighs  
 Absher—Microlows

*Slope:*

Telstad—2 to 8 percent  
 Absher—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Telstad and similar soils: 50 percent  
 Absher and similar soils: 40 percent

#### Minor Components

Elloam and similar soils: 0 to 3 percent  
 Thoeny and similar soils: 0 to 2 percent  
 Joplin and similar soils: 0 to 2 percent

Scobey and similar soils: 0 to 2 percent  
Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Telstad

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

#### Absher

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Moderately well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 4.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 502C—Telstad-Elloam complex, 2 to 8 percent slopes

### Setting

#### *Landform:*

Telstad—Till plains  
Elloam—Till plains

#### *Position on landform:*

Telstad—Microhighs  
Elloam—Microlows

#### *Slope:*

Telstad—2 to 8 percent  
Elloam—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Telstad and similar soils: 50 percent  
Elloam and similar soils: 35 percent

#### Minor Components

Joplin and similar soils: 0 to 5 percent  
Scobey and similar soils: 0 to 4 percent  
Absher and similar soils: 0 to 3 percent  
Thoeny and similar soils: 0 to 2 percent  
Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Telstad

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

#### Elloam

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 505C—Telstad-Hillon loams, 2 to 8 percent slopes

#### Setting

##### Landform:

Telstad—Till plains

Hillon—Till plains

##### Position on landform:

Telstad—Foothills and toeslopes

Hillon—Backslopes and shoulders

##### Slope:

Telstad—2 to 8 percent

Hillon—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Telstad and similar soils: 60 percent

Hillon and similar soils: 30 percent

##### Minor Components

Joplin and similar soils: 0 to 4 percent

Slopes greater than 8 percent: 0 to 2 percent

Thoeny and similar soils: 0 to 2 percent

Elloam and similar soils: 0 to 1 percent

Nishon and similar soils: 0 to 1 percent

#### Major Component Description

##### Telstad

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 9.9 inches

##### Hillon

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 1503D—Telstad-Joplin association, 0 to 15 percent slopes

#### Setting

##### Landform:

Telstad—Till plains

Joplin—Hills

##### Position on landform:

Telstad—Foothills and toeslopes

Joplin—Backslopes and shoulders

##### Slope:

Telstad—0 to 15 percent

Joplin—0 to 15 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Telstad and similar soils: 45 percent

Joplin and similar soils: 30 percent

##### Minor Components

Hillon and similar soils: 0 to 10 percent

Scobey and similar soils: 0 to 8 percent

Elloam and similar soils: 0 to 3 percent

Thoeny and similar soils: 0 to 2 percent

Absher and similar soils: 0 to 1 percent

Nishon and similar soils: 0 to 1 percent

#### Major Component Description

##### Telstad

*Surface layer texture:* Loam

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

*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

### **Joplin**

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

## **503C—Telstad-Joplin loams, 2 to 8 percent slopes**

### **Setting**

#### *Landform:*

Telstad—Till plains  
 Joplin—Till plains

#### *Position on landform:*

Telstad—Foothills and toeslopes  
 Joplin—Backslopes and shoulders

#### *Slope:*

Telstad—2 to 8 percent  
 Joplin—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### **Composition**

#### **Major Components**

Telstad and similar soils: 50 percent  
 Joplin and similar soils: 35 percent

#### **Minor Components**

Hillon and similar soils: 0 to 5 percent  
 Scobey and similar soils: 0 to 5 percent  
 Thoeny and similar soils: 0 to 2 percent  
 Elloam and similar soils: 0 to 1 percent  
 Absher and similar soils: 0 to 1 percent  
 Nishon and similar soils: 0 to 1 percent

### **Major Component Description**

#### **Telstad**

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.9 inches

#### **Joplin**

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* 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.

### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

#### **Thoeny Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Very slow: .06 inch/hour  
*Landform:* Till plains  
*Parent material:* Till  
*Slope range:* 0 to 8 percent  
*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Typic  
Natriboralfs

### Typical Pedon

Thoeny loam, in an area of Thoeny-Absher complex, 0 to 4 percent slopes, in rangeland, 50 feet south and 1,400 feet east of the northwest corner of sec. 11, T. 26 N., R. 31 E.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; abrupt smooth boundary.

E—3 to 6 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak thin platy structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine tubular pores; many unstained fine sand grains; neutral; abrupt smooth boundary.

Btn—6 to 14 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium columnar structure parting to strong fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; common fine and very fine roots; common very fine tubular pores; many distinct clay films on faces of peds; many skeletalons on tops of columns and common skeletalons on vertical faces of columns in upper 3 inches; strongly alkaline; clear wavy boundary.

Bkn—14 to 25 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; common fine masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bkny—25 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure parting to weak fine and medium subangular blocky; very hard, firm, sticky and plastic; few very fine tubular pores; few fine distinct olive yellow (10YR 5/6) dry relict redox concentrations; few fine masses of lime; common fine masses of gypsum crystals; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bkn horizon:* 10 to 32 inches

*A and E horizons:*

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Clay content: 15 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent  
cobbles and stones, 0 to 10 percent pebbles

Electrical conductivity: 0 to 4 mmhos/cm

Reaction: pH 5.6 to 7.8

*Btn horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay or clay loam

Clay content: 35 to 50 percent

Electrical conductivity: 4 to 8 mmhos/cm

Sodium adsorption ratio: 5 to 20

Rock fragments: 0 to 15 percent-0 to 5 percent  
cobbles and stones, 0 to 10 percent pebbles

Reaction: pH 7.4 to 9.0

*Bkn horizon*

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: clay or clay loam

Clay content: 35 to 50 percent

Rock fragments: 0 to 15 percent-0 to 5 percent  
cobbles and stones, 0 to 10 percent pebbles

Electrical conductivity: 4 to 8 mmhos/cm

Sodium adsorption ratio: 13 to 25

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 9.0

*Bkny horizon*

Hue: 2.5Y or 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Texture: clay or clay loam

Clay content: 35 to 50 percent

Dry bulk density: 1.55 gr/ccm and greater

Rock fragments: 0 to 15 percent-0 to 5 percent  
cobbles and stones, 0 to 10 percent pebbles

Electrical conductivity: 4 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 25

Gypsum: 1 to 3 percent

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 9.0

## 211B—Thoeny-Absher complex, 0 to 4 percent slopes

### Setting

#### Landform:

Thoeny—Till plains

Absher—Till plains

#### Position on landform:

Thoeny—Microhighs

Absher—Microlows

#### Slope:

Thoeny—0 to 4 percent

Absher—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Thoeny and similar soils: 55 percent

Absher and similar soils: 35 percent

#### Minor Components

Phillips and similar soils: 0 to 3 percent

Elloam and similar soils: 0 to 3 percent

Very gravelly surface layers: 0 to 3 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Thoeny

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 7.4 inches

#### Absher

*Surface layer texture:* Clay

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

*Drainage class:* Moderately well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 4.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 212B—Thoeny-Elloam complex, 0 to 4 percent slopes

### Setting

#### Landform:

Thoeny—Till plains

Elloam—Till plains

#### Position on landform:

Thoeny—Microhighs

Elloam—Microlows

#### Slope:

Thoeny—0 to 4 percent

Elloam—0 to 4 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Thoeny and similar soils: 50 percent

Elloam and similar soils: 40 percent

#### Minor Components

Phillips and similar soils: 0 to 3 percent

Absher and similar soils: 0 to 3 percent

Very gravelly surface layers: 0 to 3 percent

Nishon and similar soils: 0 to 1 percent

### Major Component Description

#### Thoeny

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Till

*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 7.4 inches

### Elloam

*Surface layer texture:* Clay loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Till  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.6 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Tinsley Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Excessively drained  
*Permeability:* Rapid (6.0 to 20.0 inches/hour)  
*Landform:* Escarpments, kames and eskers  
*Parent material:* Alluvium, glacial outwash  
*Slope range:* 15 to 65 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

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

### Typical Pedon

Tinsley gravelly sandy loam, in an area of Neldore-Cabbart-Tinsley complex, 25 to 65 percent slopes, in rangeland, 2,100 feet east and 300 feet south of the northwest corner of sec. 32, T. 33 N., R. 30 E.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly 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; 20 percent pebbles; slightly alkaline; clear smooth boundary.

C1—4 to 18 inches; brown (10YR 5/3) very gravelly sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few fine and very fine roots; 40 percent pebbles and 5 percent cobbles; slightly alkaline; clear wavy boundary.

C2—18 to 60 inches; pale brown (10YR 6/3) very gravelly sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; 45 percent pebbles and 5 percent cobbles; thin lime coatings on lower surfaces of rock fragments in upper part; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 12 and 35 inches

#### A horizon

Hue: 10YR or 2.5Y

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 to 4

Clay content: 5 to 10 percent

Rock fragments: 15 to 35 percent-0 to 5 percent stones and cobbles; 15 to 30 percent pebbles

Reaction: pH 6.6 to 7.8

#### C horizons

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: sand or loamy sand

Clay content: 0 to 10 percent

Rock fragments: 35 to 70 percent-5 to 25 percent stones and cobbles; 30 to 45 percent pebbles

Calcium carbonate equivalent: 2 to 10 percent

Reaction: pH 6.6 to 8.4.

### Tolex Series

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour)

*Landform:* Mountains

*Parent material:* Residuum from igneous rocks

*Slope range:* 25 to 60 percent

*Annual precipitation:* 17 to 25 inches

*Annual air temperature:* 38 to 43 degrees F

*Frost-free period:* 80 to 100 days

**Taxonomic Class:** Loamy-skeletal, mixed Lithic Eutroboralfs

### Typical Pedon

Tolex channery loam, in an area of Mocmont-Tolex complex, 25 to 60 percent slopes, in woodland, 1,800 feet west and 300 feet north of the southeast corner of sec. 6, T. 25 N., R. 25 E.

Oi—2 inches to 0; forest litter of partially decomposed needles and twigs.

A—0 to 2 inches; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine and few medium roots; 25 percent channers; slightly acid; abrupt smooth boundary.

E—2 to 5 inches; light gray (10YR 7/2) channery loam, brown (10YR 5/3) moist; strong fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; 30 percent channers; moderately acid; clear wavy boundary.

Bt1—5 to 11 inches; pale brown (10YR 6/3) extremely channery clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; common very fine, fine, and medium roots; many very fine and few fine tubular pores; common faint clay films on faces of peds and some rock fragments; 60 percent channers and 10 percent flagstones; strongly acid; clear wavy boundary.

Bt2—11 to 18 inches; light yellowish brown (10YR 6/4) extremely channery clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; common fine and very fine and few medium roots; many very fine and few fine tubular pores; many faint clay films on faces of peds and rock fragments; 70 percent channers and 10 percent flagstones; strongly acid; clear wavy boundary.

RR—18 inches; fractured igneous bedrock; less than 2 percent soil material in fractures in upper 6 inches.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to bedrock:* 10 to 20 inches

#### *A horizon*

Hue: 5YR to 10YR

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 or 3

Clay content: 15 to 25 percent

Rock fragments: 15 to 35 percent-0 to 10 percent flagstones and stones, 15 to 25 percent channers  
Reaction: pH 5.6 to 6.5

#### *E horizon*

Hue: 5YR to 10YR

Value: 6 or 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: loam or sandy loam

Clay content: 15 to 25 percent

Rock fragments: 15 to 75 percent-0 to 15 percent flagstones, 15 to 60 percent channers

Reaction: pH 5.1 to 6.5

#### *Bt horizons: Hue: 5YR to 10YR*

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 3 to 6

Texture: clay loam or sandy clay loam

Clay content: 27 to 35 percent

Rock fragments: 60 to 80 percent-0 to 10 percent flagstones, 60 to 70 percent channers

Reaction: pH 5.1 to 6.5

### Toston Series

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

*Drainage class:* Somewhat poorly drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Flood plains

*Parent material:* Alluvium

*Slope range:* 0 to 2 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed Typic Natriboralfs

### Typical Pedon

Toston clay loam, in an area of Toston-Nobe complex, 0 to 2 percent slopes, 2,500 feet west and 300 feet north of the southeast corner of sec. 10, T. 37 N., R. 29 E.

A—0 to 2 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; moderately alkaline; abrupt smooth boundary.

Btn—2 to 8 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak fine and medium

columnar structure parting to moderate fine and medium subangular blocky; very hard, friable, sticky and plastic; common fine and very fine and few medium roots; common very fine tubular pores; common faint clay films on faces of peds; many skeletons on tops of columns and common skeletons on vertical faces of columns in upper 3 inches; disseminated lime; strongly effervescent; very strongly alkaline; clear wavy boundary.

**Bknyz**—8 to 24 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine, fine, and medium roots; common very fine tubular pores; few fine masses of lime and disseminated lime; few medium masses of gypsum crystals; many fine masses of other salt crystals; strongly effervescent; very strongly alkaline; gradual wavy boundary.

**Bnyz**—24 to 42 inches; pale brown (10YR 6/3) clay loam with thin strata of fine sandy loam, grayish brown (10YR 5/2) moist; common fine faint brownish yellow (10YR 6/6) dry redox concentrations; massive; very hard, firm, sticky and plastic; few fine and very fine roots; common very fine tubular pores; disseminated lime; few fine masses of gypsum crystals; common fine masses of other salt crystals; strongly effervescent; very strongly alkaline; gradual wavy boundary.

**C**—42 to 60 inches; light brownish gray (2.5Y 6/2) stratified clay and loamy sand, grayish brown (2.5Y 5/2) moist; common fine faint light yellowish brown (10YR 6/4) dry redox concentrations; massive; very hard, firm, very sticky and very plastic; common very fine tubular pores in clay strata; few fine masses of lime in clay strata; common fine masses of gypsum and other salt crystals in clay strata; very strongly alkaline.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to seasonal high water table:* 24 to 42 inches

#### *A horizon*

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 1 to 3

Texture: loam (clay loam when mixed to 7 inches)

Clay content: 18 to 27 percent (27 to 35 percent when mixed to 7 inches)

Electrical conductivity: 4 to 8 mmhos/cm

Reaction: pH 7.9 to 9.0

#### *Btn horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 1 to 3

Texture: silty clay, silty clay loam, or clay loam

Clay content: 35 to 45 percent with 15 to 35 percent sand coarser than very fine sand

Electrical conductivity: 4 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Reaction: pH 8.4 to 9.6

#### *Bknyz horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 1 to 3

Texture: silty clay loam or clay loam

Clay content: 27 to 35 percent with 15 to 35 percent sand coarser than very fine sand

Calcium carbonate equivalent: 5 to 15 percent

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Gypsum: 1 to 5 percent

Reaction: pH 8.4 to 9.6

#### *Bnyz horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 1 to 3

Texture: silt loam, silty clay loam, or clay loam

stratified with silty clay, loam, fine sandy loam, loamy fine sand, or loamy sand

Clay content: 10 to 30 percent with 15 to 35 percent sand coarser than very fine sand

Rock fragments: 0 to 10 percent pebbles

Calcium carbonate equivalent: 2 to 15 percent

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Gypsum: 1 to 5 percent

Reaction: pH 7.9 to 9.6

#### *C horizon*

Hue: 10YR or 2.5Y

Value: 6 or 7 dry; 3 to 5 moist

Chroma: 1 to 3

Texture: stratified clay through loamy sand

Clay content: 10 to 30 percent

Rock fragments: 0 to 10 percent pebbles

Calcium carbonate equivalent: 2 to 15 percent

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Gypsum: 1 to 5 percent

Reaction: pH 7.9 to 9.6

## 1262A—Toston-Nobe complex, 0 to 2 percent slopes

### Setting

#### Landform:

Toston—Flood plains

Nobe—Flood plains

#### Position on landform:

Toston—Microlows

Nobe—Microhighs

#### Slope:

Toston—0 to 2 percent

Nobe—0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Toston and similar soils: 60 percent

Nobe and similar soils: 25 percent

#### Minor Components

Slightly saline loamy soils: 0 to 10 percent

Poorly drained soils: 0 to 5 percent

### Major Component Description

#### Toston

*Surface layer texture:* Loam

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

*Drainage class:* Somewhat poorly drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* Rare

*Water table:* Apparent

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* Mainly 8.7 inches

#### Nobe

*Surface layer texture:* Clay

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

*Drainage class:* Moderately well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* Rare

*Water table:* Apparent

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Twilight Series

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Permeability:* Moderately rapid (2.0 to 6.0 inches/hour)

*Landform:* Hills

*Parent material:* Sandstone residuum

*Slope range:* 4 to 45 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

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

### Typical Pedon

Twilight fine sandy loam, in an area of Twilight-Cabbart-Marmarth association, 4 to 15 percent slopes, in rangeland, 1,000 feet north and 600 feet west of the southeast corner of sec. 27, T. 24 N., R. 33 E.

A—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine and few medium roots; neutral; clear smooth boundary.

Bw—4 to 11 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine and few medium roots; many very fine tubular pores; neutral; clear wavy boundary.

Bk—11 to 22 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine roots;

many very fine tubular pores; few fine threads and masses of lime; violently effervescent; slightly alkaline; gradual wavy boundary.  
 Cr—22 to 60 inches; pale brown (10YR 6/3) semiconsolidated sandstone, brown (10YR 5/3) moist; strongly effervescent; slightly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 8 and 24 inches  
*Depth to Bk horizon:* 10 to 20 inches  
*Depth to Cr horizon:* 20 to 40 inches

#### A horizon

Hue: 10YR or 2.5Y  
 Value: 4 or 5 dry; 3 or 4 moist  
 Chroma: 2 or 3  
 Clay content: 5 to 18 percent  
 Reaction: pH 6.6 to 7.8

#### Bw horizon

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: fine sandy loam or sandy loam  
 Clay content: 5 to 18 percent  
 Reaction: pH 6.6 to 7.8

#### Bk horizon

Hue: 10YR or 2.5Y  
 Value: 5 to 7 dry; 4 to 6 moist  
 Chroma: 1 to 4  
 Texture: fine sandy loam or sandy loam  
 Clay content: 5 to 18 percent  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.4 to 8.4

#### Cr horizon

Material: Semiconsolidated sandstone.

## 1066D—Twilight-Cabbart-Marmarth association, 4 to 15 percent slopes

### Setting

#### Landform:

Twilight—Sedimentary plains and hills  
 Cabbart—Sedimentary plains and hills  
 Marmarth—Sedimentary plains and hills

#### Position on landform:

Twilight—Backslopes and footslopes  
 Cabbart—Shoulders and summits  
 Marmarth—Footslopes

#### Slope:

Twilight—4 to 15 percent  
 Cabbart—4 to 15 percent  
 Marmarth—4 to 15 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Twilight and similar soils: 35 percent  
 Cabbart and similar soils: 25 percent  
 Marmarth and similar soils: 15 percent

#### Minor Components

Yamacall and similar soils: 0 to 5 percent  
 Chinook and similar soils: 0 to 5 percent  
 Shallow to deep clayey soils: 0 to 5 percent  
 Slopes greater than 15 percent: 0 to 5 percent  
 Soils with ponderosa pine: 0 to 3 percent  
 Very shallow soils: 0 to 2 percent

### Major Component Description

#### Twilight

*Surface layer texture:* Fine sandy loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Sandstone residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 3.1 inches

#### Cabbart

*Surface layer texture:* Loam  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Interbedded sandstone and shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.8 inches

#### Marmarth

*Surface layer texture:* Loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Interbedded sandstone and shale residuum  
*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Vaeda Series

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

*Drainage class:* Well drained

*Permeability:* Very slow: .06 inch/hour)

*Landform:* Alluvial fans, stream terraces

*Parent material:* Alluvium

*Slope range:* 0 to 8 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic, nonacid, frigid Aridic Ustorthents

### Typical Pedon

Vaeda clay, 0 to 2 percent slopes, in rangeland, 2,600 feet north and 800 feet west of the southeast corner of sec. 35, T. 31 N., R. 32 E.

E—0 to 1 inch; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure with a thin vesicular crust on the surface; hard, friable, sticky and plastic; few very fine roots; many very fine tubular and vesicular pores; slightly alkaline; abrupt smooth boundary.

Byz1—1 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few fine masses of gypsum and other salt crystals; slightly alkaline; gradual wavy boundary.

Byz2—16 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; extremely hard, firm, very sticky and very plastic;

few very fine tubular pores; common fine masses of gypsum and other salt crystals; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Notes:* Some pedons may have an A horizon that is 1/2 to 1 inch thick. Note: Some pedons have a Bw horizon 3 to 6 inches thick.

#### E horizon

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 or 3

Clay content: 40 to 60 percent

Rock fragments: 0 to 15 percent pebbles

Electrical conductivity: 2 to 4 mmhos/cm

Reaction: pH 5.6 to 7.8

#### Byz1 horizon

Hue: 10YR to 5Y

Value: 5 or 6 dry, 4 or 5 moist

Chroma: 2 or 3

Texture: silty clay loam, silty clay, or clay

Clay content: 35 to 60 percent

Rock fragments: 0 to 15 percent pebbles

Electrical conductivity: 4 to 16 mmhos/cm

Sodium adsorption ratio: 10 to 20

Gypsum: 1 to 5 percent

Reaction: pH 5.1 to 7.8

#### Byz2 horizon

Hue: 10YR to 5Y

Value: 5 or 6 dry, 4 or 5 moist

Chroma: 1 to 3

Texture: silty clay loam, silty clay, or clay

Clay content: 35 to 60 percent

Rock fragments: 0 to 15 percent pebbles

Electrical conductivity: 4 to 16 mmhos/cm

Sodium adsorption ratio: 10 to 20

Gypsum: 1 to 5 percent

Reaction: pH 6.1 to 9.0

### 41A—Vaeda clay, 0 to 2 percent slopes

#### Setting

*Landform:* Alluvial fans and stream terraces

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

## Composition

### Major Components

Vaeda and similar soils: 90 percent

### Minor Components

Marvan and similar soils: 0 to 5 percent

Vanda and similar soils: 0 to 3 percent

Benz and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Vanda Series

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

*Drainage class:* Well drained

*Permeability:* Very slow: .06 inch/hour)

*Landform:* Alluvial fans, stream terraces, drainageways

*Parent material:* Alluvium

*Slope range:* 0 to 8 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic (calcareous), frigid Aridic Ustorthents

### Typical Pedon

Vanda clay, 0 to 2 percent slopes, in rangeland, 2,400 feet east and 2,000 feet south of the northwest corner of sec. 33, T. 31 N., R. 30 E.

E—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; very hard, friable, very sticky and very plastic; common fine and very fine roots; common very fine tubular pores; moderately alkaline; clear wavy boundary.

Bw—4 to 9 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; extremely hard, firm, very sticky and very plastic; common fine and very fine roots; common very fine tubular pores; few fine masses of lime; slightly effervescent; moderately alkaline; clear wavy boundary.

Byz1—9 to 25 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; disseminated lime; common fine and medium masses of gypsum and other salt crystals; strongly effervescent; strongly alkaline; gradual wavy boundary.

Byz2—25 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; extremely hard, very firm, very sticky and very plastic; few very fine tubular pores; disseminated lime; common fine threads and masses of gypsum and other salt crystals; strongly effervescent; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Byz horizon:* 4 to 24 inches

#### E horizon

Hue: 2.5Y or 5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 1 to 3

Clay content: 40 to 60 percent

Electrical conductivity: 2 to 8 mmhos/cm

Sodium adsorption ratio: 20 to 30

Reaction: pH 7.9 to 9.6

#### Bw horizon

Hue: 2.5Y or 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay, silty clay, or silty clay loam

Clay content: 35 to 60 percent

Electrical conductivity: 2 to 8 mmhos/cm

Sodium adsorption ratio: 13 to 30  
Reaction: pH 7.9 to 9.6

*Byz horizons*

Hue: 2.5Y or 5Y

Value: 5 or 6 dry; 4 or 5 moist

Chroma: 2 or 3

Texture: clay, silty clay, or silty clay loam

Clay content: 35 to 60 percent

Gypsum: 1 to 5 percent with total gypsum less than 150

Electrical conductivity: 8 to 16 mmhos/cm

Sodium adsorption ratio: 13 to 30

Gypsum: 1 to 5 percent

Calcium carbonate equivalent: 2 to 10 percent

Reaction: pH 7.9 to 9.6

### 48A—Vanda clay, 0 to 2 percent slopes

#### Setting

*Landform:* Alluvial fans and stream terraces

*Slope:* 0 to 2 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Vanda and similar soils: 90 percent

##### Minor Components

Marvan and similar soils: 0 to 8 percent

Benz and similar soils: 0 to 2 percent

#### Major Component Description

*Surface layer texture:* Clay

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Salt affected:* Saline within 30 inches

*Sodium affected:* Sodic within 30 inches

*Available water capacity:* 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.

## Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Volborg Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Hills

*Parent material:* Shale residuum

*Slope range:* 8 to 60 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Clayey, montmorillonitic, acid, frigid, shallow Aridic Ustorthents

## Typical Pedon

Volborg clay, in an area of Volborg-Rock outcrop association, 8 to 45 percent slopes, in rangeland, 1,300 feet south and 1,800 feet west of the northeast corner of sec 5, T. 34 N., R. 27 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; soft, very friable, very sticky and very plastic; common fine and very fine and few medium roots; 10 percent cobbles on surface; very strongly acid; clear smooth boundary.

C—4 to 12 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, very friable, very sticky and very plastic; common fine and very fine and few medium roots; 70 percent soft shale fragments; very strongly acid; gradual wavy boundary.

Cr—12 to 60 inches; grayish brown (2.5Y 5/2) semiconsolidated shale, dark grayish brown (2.5Y 4/2) moist; few fine roots between plates in upper part; common coarse seams of sulfur (2.5Y 7/6); few distinct brown to dark brown (7.5YR 4/4) iron stains on bottoms of plates; common fine masses of gypsum crystals; extremely acid.

## Range in Characteristics

*Soil temperature:* 41 to 47 degrees F

*Moisture control section:* between 4 and 12 inches.

*Depth to Cr horizon:* 10 to 20 inches.

*Note:* The dark colors in this soil are lithochromic of the parent material. In pedons which are less than 14 inches to the consolidated shale, the pH is 5.5 or less.

*A horizon*

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 1 to 3  
 Clay content: 40 to 50 percent  
 Rock fragments: 0 to 15 percent- 0 to 10 percent cobbles; 0 to 5 percent pebbles  
 Electrical conductivity: 0 to 4 mmhos/cm  
 Sodium adsorption ratio: 0 to 13  
 Reaction: pH 4.5 to 6.5

*C horizon*

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 1 to 3  
 Texture: silty clay loam, silty clay, or clay  
 Clay content: 35 to 50 percent  
 Rock fragments: 0 to 80 percent soft shale fragments  
 Electrical conductivity: 2 to 4 mmhos/cm  
 Sodium adsorption ratio: 0 to 13  
 Reaction: pH 3.6 to 5.5

*Cr horizon*

Material: Semiconsolidated shale  
 Reaction: pH 3.6 to 5.5

**2972F—Volborg-Neldore-Rock outcrop association, 15 to 60 percent slopes**

**Setting**

*Landform:*

Volborg—Hills  
 Neldore—Hills  
 Rock outcrop—Escarpments

*Position on landform:*

Volborg—Backslopes and shoulders  
 Neldore—Backslopes and shoulders  
 Rock outcrop—Backslopes and shoulders

*Slope:*

Volborg—15 to 60 percent, southwest aspect  
 Neldore—15 to 60 percent, northeast aspect

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

**Composition**

**Major Components**

Volborg and similar soils: 35 percent  
 Neldore and similar soils: 30 percent  
 Rock outcrop: 15 percent

**Minor Components**

Bascovy and similar soils: 0 to 5 percent  
 Volborg soils in woodland: 0 to 5 percent  
 Neldore soils in rangeland: 0 to 5 percent  
 Very shallow soils: 0 to 5 percent

**Major Component Description**

**Volborg**

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 1.5 inches

**Neldore**

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 2.3 inches

**Rock outcrop**

*Definition:* Areas of exposed 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

### 1977F—Volborg-Pinebreaks-Rock outcrop association, 15 to 60 percent slopes

#### Setting

##### Landform:

Volborg—Hills  
Pinebreaks—Hills  
Rock outcrop—Hills

##### Position on landform:

Volborg—Backslopes and shoulders  
Pinebreaks—Backslopes and footslopes  
Rock outcrop—Backslopes and shoulders

##### Slope:

Volborg—15 to 60 percent, southwest aspect  
Pinebreaks—15 to 45 percent, northeast aspect

##### Elevation: 2,170 to 3,400 feet

##### Mean annual precipitation: 11 to 14 inches

##### Frost-free period: 100 to 120 days

#### Composition

##### Major Components

Volborg and similar soils: 40 percent  
Pinebreaks and similar soils: 25 percent  
Rock outcrop: 15 percent

##### Minor Components

Bascovy and similar soils: 0 to 10 percent  
Very shallow soils: 0 to 5 percent  
Shallow soils in rangeland: 0 to 5 percent

#### Major Component Description

##### Volborg

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 1.8 inches

##### Pinebreaks

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Forest land

##### *Flooding:* None

*Available water capacity:* Mainly 2.0 inches

#### Rock outcrop

*Definition:* Areas of exposed 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.

#### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### 1972F—Volborg-Rock outcrop association, 8 to 45 percent slopes

#### Setting

##### Landform:

Volborg—Hills  
Rock outcrop—Hills

##### Position on landform:

Volborg—Backslopes and shoulders  
Rock outcrop—Shoulders

##### Slope: 8 to 45 percent

##### Elevation: 2,170 to 3,400 feet

##### Mean annual precipitation: 11 to 14 inches

##### Frost-free period: 100 to 120 days

#### Composition

##### Major Components

Volborg and similar soils: 60 percent  
Rock outcrop: 20 percent

##### Minor Components

Moderately deep clayey soils: 0 to 10 percent  
Saline and sodic soils: 0 to 5 percent  
Slopes greater than 45 percent: 0 to 5 percent

#### Major Component Description

##### Volborg

*Surface layer texture:* Clay  
*Depth class:* Shallow (10 to 20 inches)

*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 1.5 inches

### Rock outcrop

*Definition:* Areas of exposed 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Warneke Series

*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour)  
*Landform:* Mountains  
*Parent material:* Limestone residuum  
*Slope range:* 25 to 70 percent  
*Annual precipitation:* 17 to 22 inches  
*Annual air temperature:* 38 to 43 degrees F  
*Frost-free period:* 80 to 100 days

**Taxonomic Class:** Loamy-skeletal, carbonatic, frigid  
 Lithic Ustochrepts

### Typical Pedon

Warneke gravelly loam, in an area of Warneke-Whitecow-Rock outcrop complex, 25 to 70 percent slopes, in woodland, 500 feet west and 2,500 feet north of the southeast corner of sec. 32, T. 25 N., R. 24 E.

A—0 to 3 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium and coarse roots; 20 percent pebbles and 10 percent cobbles; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk—3 to 15 inches; light brownish gray (10YR 6/2) very gravelly loam, grayish brown (10YR 5/2)

moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium and coarse roots; many very fine irregular pores; 35 percent pebbles and 15 percent cobbles; common distinct lime coatings on lower surfaces of rock fragments; violently effervescent; moderately alkaline; abrupt wavy boundary.

R—15 inches; hard limestone.

### Range in Characteristics

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to bedrock:* 10 to 20 inches

*A horizon*

Hue: 2.5Y or 10YR

Value: 4 to 6 dry; 3 to 5 moist

Chroma: 2 or 3

Clay content: 10 to 25 percent

Rock fragments: 15 to 35 percent-0 to 10 percent cobbles and stones, 15 to 25 percent pebbles

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.4 to 8.4

*Bk horizon*

Hue: 2.5Y or 10YR

Value: 6 or 7 dry; 5 or 6 moist

Chroma: 2 to 4

Texture: loam or silt loam

Clay content: 10 to 25 percent

Rock fragments: 35 to 70 percent-0 to 20 percent cobbles and stones, 35 to 50 percent pebbles

Calcium carbonate equivalent: 40 to 50 percent

Reaction: pH 7.9 to 8.4

### 151F—Warneke-Whitecow-Rock outcrop complex, 25 to 70 percent slopes

#### Setting

*Landform:*

Warneke—Mountains

Whitecow, warm—Mountains

Rock outcrop—Mountains

*Position on landform:*

Warneke—Backslopes and shoulders

Whitecow, warm—Backslopes and footslopes

Rock outcrop—Shoulders and summits

*Slope:*

Warneke—25 to 70 percent

Whitecow, warm—25 to 70 percent, southwest aspect

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

*Mean annual precipitation:* 17 to 22 inches

*Frost-free period:* 80 to 100 days

### Composition

#### Major Components

Warneke and similar soils: 35 percent

Whitecow, warm and similar soils: 30 percent

Rock outcrop: 20 percent

#### Minor Components

Soils with loam profiles: 0 to 5 percent

Douglas-fir on cooler aspects: 0 to 5 percent

Slopes less than 25 percent: 0 to 5 percent

### Major Component Description

#### Warneke

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Limestone residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 1.0 inches

#### Whitecow, warm

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Limestone colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 4.1 inches

#### Rock outcrop

*Definition:* Areas of exposed 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## W—Water

### Composition

#### Major Components

Water: 100 percent

#### Major Component Description

*Definition:* Areas of open water

## Weingart Series

*Depth class:* Moderately deep (20 to 40 inches)

*Drainage class:* Well drained

*Permeability:* Very slow: .06 inch/hour)

*Landform:* Sedimentary plains, hills

*Parent material:* Shale residuum

*Slope range:* 0 to 15 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine, montmorillonitic Typic Natriboralfs

### Typical Pedon

Weingart clay, thin, in an area of Bascovy-Neldore-Weingart clays, 8 to 25 percent slopes, in rangeland, 150 feet south and 1,200 feet west of the northeast corner of sec. 16, T. 35 N., R. 28 E.

E—0 to 2 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to moderate fine granular; slightly hard, very friable, sticky and plastic; common fine and very fine roots; neutral; abrupt smooth boundary.

Btn—2 to 9 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; moderate medium columnar structure parting to moderate fine and medium subangular blocky; extremely hard, firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; common faint clay films on faces of peds; many light gray (10YR 7/2) skeletans on tops of columns and common skeletans on vertical faces of columns; slightly alkaline; clear wavy boundary.

Bkn—9 to 17 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few

very fine roots; common very fine tubular pores; common fine and few medium masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

- Bknyz**—17 to 36 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; disseminated lime; many fine and few medium masses of gypsum and other salt crystals; strongly effervescent; moderately alkaline; gradual wavy boundary.
- Cr**—36 to 60 inches; gray (5Y 5/1) semiconsolidated shale, dark gray (5Y 4/1) moist; few fine distinct yellowish brown (10YR 5/6) iron stains; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to Bkn horizon:* 7 to 16 inches  
*Depth to gypsum and other salts:* 10 to 24 inches  
*Depth to Cr horizon:* 20 to 40 inches

#### *E horizon*

Hue: 10YR or 2.5Y  
 Value: 5 to 7 dry; 3 to 6 moist  
 Chroma: 2 or 3  
 Texture: clay or clay loam when mixed to 7 inches (some uncultivated areas have a thin A horizon that is a loam or silt loam)  
 Clay content: 27 to 45 percent  
 Rock fragments: 0 to 10 percent-0 to 10 percent stones and cobbles, 0 to 5 percent hard shale, 0 to 5 percent soft shale  
 Reaction: pH 5.6 to 7.8

#### *Btn horizon*

Hue: 10YR or 2.5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 2 to 4  
 Texture: clay, silty clay, or sandy clay  
 Clay content: 40 to 60 percent  
 Rock fragments: 0 to 10 percent-0 to 5 percent hard shale, 0 to 5 percent soft shale  
 Electrical conductivity: 2 to 8 mmhos/cm  
 Sodium adsorption ratio: 10 to 30  
 Reaction: pH 6.6 to 9.0

#### *Bkn horizon*

Hue: 10YR to 5Y  
 Value: 5 to 7 dry; 4 or 5 moist  
 Chroma: 2 or 3

Texture: clay loam, silty clay, clay, sandy clay, or silty clay loam

Clay content: 35 to 55 percent  
 Rock fragments: 0 to 10 percent-0 to 5 percent hard shale, 0 to 5 percent soft shale  
 Electrical conductivity: 4 to 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 30  
 Gypsum: 0 to 1 percent  
 Calcium carbonate equivalent: 5 to 15 percent  
 Reaction: pH 7.9 to 9.0

#### *Bknyz horizon*

Hue: 2.5Y or 5Y  
 Value: 5 or 6 dry; 4 or 5 moist  
 Chroma: 1 to 4  
 Texture: clay, silty clay, clay loam, or silty clay loam

Clay content: 35 to 55 percent  
 Rock fragments: 0 to 10 percent-0 to 5 percent hard shale, 0 to 5 percent soft shale  
 Electrical conductivity: 4 to 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 30  
 Calcium carbonate equivalent: 2 to 10 percent  
 Gypsum: 1 to 5 percent  
 Reaction: pH 7.9 to 9.0

#### *Cr horizon*

Material: Semiconsolidated shale or interbedded shale and sandstone  
 Reaction: greater than 7.8

## 59B—Weingart clay loam, 0 to 4 percent slopes

### Setting

*Landform:* Sedimentary plains  
*Slope:* 0 to 4 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Weingart and similar soils: 90 percent

#### Minor Components

Strongly saline soils: 0 to 3 percent  
 Strongly sodic soils: 0 to 2 percent  
 Neldore and similar soils: 0 to 2 percent  
 Elloam and similar soils: 0 to 2 percent  
 Thoeny and similar soils: 0 to 1 percent

### Major Component Description

*Surface layer texture:* Clay loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 860C—Weingart complex, 2 to 8 percent slopes

### Setting

#### *Landform:*

Weingart—Sedimentary plains  
 Weingart, thin—Sedimentary plains

#### *Position on landform:*

Weingart—Microhighs  
 Weingart, thin—Microlows

#### *Slope:*

Weingart—2 to 8 percent  
 Weingart, thin—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Weingart and similar soils: 45 percent  
 Weingart, thin and similar soils: 40 percent

#### Minor Components

Vanda and similar soils: 0 to 5 percent  
 Neldore and similar soils: 0 to 5 percent  
 Bascovy and similar soils: 0 to 2 percent  
 Elloam and similar soils: 0 to 2 percent  
 Thoeny and similar soils: 0 to 1 percent

### Major Component Description

#### Weingart

*Surface layer texture:* Clay loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 3.8 inches

#### Weingart, thin

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 1059E—Weingart-Vaeda-Bascovy association, 4 to 25 percent slopes

### Setting

#### *Landform:*

Weingart—Sedimentary plains and hills  
 Vaeda—Alluvial fans  
 Bascovy—Sedimentary plains and hills

#### *Position on landform:*

Weingart—Microlows  
 Vaeda—Footslopes and toeslopes  
 Bascovy—Backslopes and shoulders

#### *Slope:*

Weingart—4 to 15 percent  
 Vaeda—4 to 8 percent  
 Bascovy—4 to 25 percent

*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Weingart and similar soils: 30 percent  
 Vaeda and similar soils: 30 percent  
 Bascovy and similar soils: 20 percent

#### Minor Components

Neldore and similar soils: 0 to 5 percent  
 Absher and similar soils: 0 to 5 percent  
 Nobe and similar soils: 0 to 5 percent  
 Very gravelly surface layers: 0 to 5 percent

### Major Component Description

#### Weingart

*Surface layer texture:* Clay loam  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 3.8 inches

#### Vaeda

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* Mainly 6.7 inches

#### Bascovy

*Surface layer texture:* Clay  
*Depth class:* Moderately deep (20 to 40 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Wheatbelt Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Poorly drained  
*Permeability:* Very slow: (.06 inch/hour)  
*Landform:* Lake plains  
*Parent material:* Glaciolacustrine deposits  
*Slope range:* 0 to 1 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Very-fine, montmorillonitic, frigid  
 Sodic Epiaquerts

### Typical Pedon

Wheatbelt clay, 0 to 1 percent slopes, in cropland, 1,200 feet west and 1,900 feet south of the northeast corner of sec. 22, T. 31 N., R. 32 E.

- Ap—0 to 6 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; strong fine granular structure; hard, firm, very sticky and very plastic; few fine and very fine roots; moderately alkaline; abrupt smooth boundary.
- Bnssg—6 to 14 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; moderate fine subangular structure; extremely hard, very firm, very sticky and very plastic; few fine and very fine roots; few very fine tubular pores; few intersecting slickensides; few fine masses of salt crystals; moderately alkaline; clear wavy boundary.
- Bnssyzg1—14 to 24 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few intersecting slickensides; common fine seams and masses of gypsum and other salt crystals; strongly alkaline; gradual wavy boundary.
- Bnssyzg2—24 to 60 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; extremely hard, extremely firm, very sticky and very plastic; few very fine tubular pores; few intersecting

slickensides; common fine and few medium masses of gypsum and other salt crystals; strongly alkaline.

### Range in Characteristics

*Soil temperature:* 44 to 47 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to Bnssyzg horizon:* 5 to 30 inches  
*Note:* This soil, when dry, has cracks that are at least 1 cm wide at a depth of 20 inches.

#### *Ap horizon*

Value: 5 dry; 2.5, 3, or 4 moist  
 Clay content: 60 to 85 percent  
 Electrical conductivity: 2 to 8 mmhos/cm  
 Sodium adsorption ratio: 4 to 13  
 Reaction: pH 7.9 to 9.0

#### *Bnssg horizon*

Value: 4 or 5 dry; 2.5, 3 or 4 moist  
 Clay content: 60 to 85 percent  
 Electrical conductivity: 2 to 8 mmhos/cm  
 Sodium adsorption ratio: 8 to 30  
 Reaction: pH 7.9 to 9.0

#### *Bnssyzg horizons:*

Value: 4 or 5 dry; 2.5, 3, or 4 moist  
 Clay content: 60 to 85 percent  
 Electrical conductivity: 8 to 16 mmhos/cm  
 Sodium adsorption ratio: 13 to 30  
 Gypsum: 2 to 5 percent  
 Calcium carbonate equivalent: 0 to 2 percent  
 Reaction: pH 7.9 to 9.0

## 930A—Wheatbelt clay, 0 to 1 percent slopes

### Setting

*Landform:* Lake plains  
*Slope:* 0 to 1 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Wheatbelt and similar soils: 95 percent

#### Minor Components

Bowdoin and similar soils: 0 to 3 percent  
 Harlake and similar soils: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Clay  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Poorly drained  
*Dominant parent material:* Glaciolacustrine deposits  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Water table:* Apparent  
*Ponding:* long  
*Salt affected:* Saline within 30 inches  
*Sodium affected:* Sodic within 30 inches  
*Available water capacity:* 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## Whitecow Series

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Well drained  
*Permeability:* Moderate (0.6 to 2.0 inches/hour)  
*Landform:* Alluvial fans, mountains  
*Parent material:* Alluvium or colluvium from limestone  
*Slope range:* 8 to 70 percent  
*Annual precipitation:* 17 to 22 inches  
*Annual air temperature:* 38 to 43 degrees F  
*Frost-free period:* 80 to 100 days

**Taxonomic Class:** Loamy-skeletal, carbonatic, frigid Calcic Ustochrepts

### Typical Pedon

Whitecow gravelly loam, 8 to 15 percent slopes, in woodland, 2,300 feet east and 2,250 feet north of the southwest corner of sec. 33, T. 25 N., R. 24 E.

Oi—1 inch to 0; forest litter of partially decomposed needles and twigs.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots, common medium and few coarse roots; 20 percent pebbles and 5 percent cobbles; strongly

effervescent; slightly alkaline; clear wavy boundary.

Bw—4 to 16 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots, common medium and few coarse roots; common very fine and few fine tubular pores; 30 percent pebbles and 10 percent cobbles; disseminated lime; violently effervescent; slightly alkaline; clear wavy boundary.

Bk1—16 to 22 inches; light gray (10YR 7/2) very gravelly loam, grayish brown (10YR 5/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; common very fine tubular pores; 35 percent pebbles and 15 percent cobbles; disseminated lime, many fine seams of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—22 to 48 inches; light gray (10YR 7/2) extremely gravelly loam, pale brown (10YR 6/3) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; common very fine tubular pores; 60 percent pebbles and 10 percent cobbles; disseminated lime, many fine seams of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—48 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine tubular pores; 60 percent pebbles and 10 percent cobbles; disseminated lime, common fine seams of lime; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 38 to 42 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to calcic horizon:* 9 to 25 inches

#### A horizon

Value: 4 or 5 dry; 3 or 4 moist

Chroma: 2 or 3

Clay content: 18 to 27 percent

Rock fragments: 15 to 35 percent-0 to 5 percent stones and cobbles, 15 to 30 percent pebbles and channers

Calcium carbonate equivalent: 0 to 5 percent

Reaction: pH 7.4 to 8.4

#### Bw and Bk1 horizons

Hue: 10YR or 2.5Y

Value: 5 to 7 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: loam or clay loam

Clay content: 18 to 35 percent

Rock fragments: 15 to 65 percent-0 to 30 percent stones and cobbles, 15 to 35 percent pebbles and channers

Calcium carbonate equivalent: 35 to 50 percent

Reaction: pH 7.4 to 8.4

#### Bk2 and Bk3 horizons

Hue: 10YR or 2.5Y

Value: 6 to 8 dry; 4 to 7 moist

Chroma: 2 to 4

Texture: loam or clay loam

Clay content: 18 to 35 percent

Rock fragments: 60 to 90 percent-5 to 20 percent stones and cobbles, 55 to 70 percent pebbles and channers

Calcium carbonate equivalent: 40 to 50 percent

Reaction: pH 7.4 to 9.0

## 140F—Whitecow complex, 25 to 60 percent slopes

### Setting

#### Landform:

Whitecow—Mountains

Whitecow, warm—Mountains

#### Position on landform:

Whitecow—Backslopes and footslopes

Whitecow, warm—Backslopes and footslopes

#### Slope:

Whitecow—25 to 60 percent, northeast aspect

Whitecow, warm—25 to 60 percent, southwest aspect

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

*Mean annual precipitation:* 17 to 22 inches

*Frost-free period:* 80 to 100 days

### Composition

#### Major Components

Whitecow and similar soils: 50 percent

Whitecow, warm and similar soils: 35 percent

**Minor Components**

Warneke and similar soils: 0 to 5 percent  
 Macmeal and similar soils: 0 to 5 percent  
 Rock outcrop: 0 to 5 percent

**Major Component Description****Whitecow**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Limestone colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 4.7 inches

**Whitecow, warm**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Limestone colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 4.1 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**160E—Whitecow gravelly loam, 15 to 35 percent slopes****Setting**

*Landform:* Mountains  
*Position on landform:* Footslopes  
*Slope:* 15 to 35 percent  
*Elevation:* 3,800 to 4,400 feet  
*Mean annual precipitation:* 17 to 22 inches  
*Frost-free period:* 80 to 100 days

**Composition****Major Components**

Whitecow, warm and similar soils: 85 percent

**Minor Components**

Judith and similar soils: 0 to 5 percent  
 Slopes greater than 35 percent: 0 to 5 percent  
 Very cobbly surface layers: 0 to 5 percent

**Major Component Description**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Limestone colluvium  
*Native plant cover type:* Forest land  
*Flooding:* None  
*Available water capacity:* Mainly 4.1 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**160D—Whitecow gravelly loam, 8 to 15 percent slopes****Setting**

*Landform:* Alluvial fans  
*Slope:* 8 to 15 percent  
*Elevation:* 3,800 to 4,400 feet  
*Mean annual precipitation:* 17 to 22 inches  
*Frost-free period:* 80 to 100 days

**Composition****Major Components**

Whitecow, warm and similar soils: 90 percent

**Minor Components**

Judith and similar soils: 0 to 5 percent  
 Slopes greater than 15 percent: 0 to 5 percent

**Major Component Description**

*Surface layer texture:* Gravelly loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Limestone alluvium  
*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 4.1 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 139F—Whitecow-Warneke gravelly loams, 25 to 60 percent slopes

### Setting

*Landform:*

Whitecow, warm—Mountains

Warneke—Mountains

*Position on landform:*

Whitecow, warm—Backslopes and footslopes

Warneke—Backslopes and shoulders

*Slope:*

Whitecow, warm—25 to 60 percent, southwest aspect

Warneke—25 to 60 percent

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

*Mean annual precipitation:* 17 to 22 inches

*Frost-free period:* 80 to 100 days

### Composition

#### Major Components

Whitecow, warm and similar soils: 50 percent

Warneke and similar soils: 35 percent

#### Minor Components

Douglas-fir on cooler aspects: 0 to 10 percent

Rock outcrop: 0 to 5 percent

### Major Component Description

#### Whitecow, warm

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Limestone colluvium

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 4.1 inches

#### Warneke

*Surface layer texture:* Gravelly loam

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

*Drainage class:* Well drained

*Dominant parent material:* Limestone residuum

*Native plant cover type:* Forest land

*Flooding:* None

*Available water capacity:* Mainly 1.0 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Windham Series

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour) above 25 inches; moderately rapid (2.0 to 6.0 inches/hour) below

*Landform:* Alluvial fans, hills

*Parent material:* Alluvium from limestone

*Slope range:* 2 to 25 percent

*Annual precipitation:* 14 to 17 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 90 to 110 days

**Taxonomic Class:** Loamy-skeletal, carbonatic Typic Calciborolls

### Typical Pedon

Windham gravelly loam, in an area of Judith-Windham complex, 2 to 8 percent slopes, in rangeland, 2,150 feet east and 1,100 feet north of the southwest corner of sec. 33, T. 25 N., R. 24 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 25 percent pebbles; strongly effervescent; slightly alkaline; clear wavy boundary.

Bk1—5 to 11 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly

plastic; many fine and very fine roots; many very fine tubular pores; 45 percent pebbles; disseminated lime, few fine masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

**Bk2**—11 to 25 inches; very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/3) moist; moderate fine and medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; 45 percent pebbles; many fine masses of lime, disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

**Bk3**—25 to 60 inches; light gray (10YR 7/2) extremely gravelly loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine tubular pores; 60 percent pebbles and 10 percent cobbles; common fine masses of lime, disseminated lime; violently effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 41 to 46 degrees F  
*Moisture control section:* between 4 and 12 inches  
*Depth to calcic horizon:* 5 to 10 inches

#### *A horizon*

Hue: 7.5YR or 10YR  
 Value: 4 or 5 dry; 2 or 3 moist  
 Chroma: 1 to 3  
 Clay content: 18 to 27 percent  
 Rock fragments: 15 to 35 percent-0 to 5 percent cobbles, 15 to 30 percent pebbles  
 Calcium carbonate equivalent: 5 to 10 percent  
 Reaction: pH 7.4 to 8.4

#### *Bk1 horizon*

Hue: 7.5YR to 2.5Y  
 Value: 4 to 6 dry; 3 to 6 moist  
 Chroma: 2 to 4  
 Texture: loam or clay loam  
 Clay content: 18 to 35 percent  
 Rock fragments: 10 to 75 percent-0 to 20 percent cobbles, 10 to 55 percent pebbles  
 Calcium carbonate equivalent: 35 to 60 percent  
 Reaction: pH 7.9 to 8.4

#### *Bk2 horizon*

Hue: 7.5YR to 2.5Y  
 Value: 5 to 8 dry; 4 to 7 moist  
 Chroma: 2 to 4  
 Texture: loam, clay loam, or sandy loam

Clay content: 18 to 35 percent  
 Rock fragments: 35 to 75 percent-0 to 20 percent cobbles; 35 to 55 percent pebbles  
 Calcium carbonate equivalent: 40 to 60 percent  
 Reaction: pH 7.9 to 8.4

#### *Bk3 horizon*

Hue: 7.5YR to 2.5Y  
 Value: 5 to 8 dry; 4 to 7 moist  
 Chroma: 2 to 4  
 Texture: loam, clay loam, or sandy loam  
 Clay content: 18 to 35 percent  
 Rock fragments: 60 to 80 percent-5 to 20 percent cobbles; 55 to 60 percent pebbles  
 Calcium carbonate equivalent: 40 to 60 percent  
 Reaction: pH 7.9 to 8.4

## Yamacall Series

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

*Drainage class:* Well drained

*Permeability:* Moderate (0.6 to 2.0 inches/hour)

*Landform:* Alluvial fans, stream terraces, hills

*Parent material:* Alluvium

*Slope range:* 0 to 35 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Fine-loamy, mixed, frigid Aridic Ustochrepts

## Typical Pedon

Yamacall loam, 2 to 8 percent slopes, in rangeland, 2,600 feet west and 200 feet south of the northeast corner of sec. 27, T. 30 N., R. 27 E.

**A**—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; slightly alkaline; clear smooth boundary.

**Bw**—3 to 11 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine tubular pores; slightly alkaline; clear wavy boundary.

**Bk**—11 to 23 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and

slightly plastic; common very fine roots; many very fine tubular pores; many fine and medium masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

BC—23 to 60 inches; light gray (2.5Y 7/2) loam, olive gray (2.5Y 5/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; disseminated lime; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Bk horizon:* 10 to 20 inches

#### A horizon

Hue: 10YR to 5Y

Value: 5 or 6 dry; 3 to 5 moist

Chroma: 2 to 4

Clay content: 18 to 27 percent

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Calcium carbonate equivalent: 0 to 10 percent

Reaction: pH 6.6 to 8.4

#### Bw horizon

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loam, clay loam, or silt loam

Clay content: 18 to 35 percent with 15 to 35 percent fine sand and coarser

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Calcium carbonate equivalent: 0 to 15 percent

Reaction: pH 6.6 to 8.4

#### Bk horizon

Hue: 10YR to 5Y

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loam, clay loam, or silt loam

Clay content: 18 to 35 percent with 15 to 35 percent fine sand and coarser

Rock fragments: 0 to 15 percent-0 to 5 percent cobbles, 0 to 10 percent pebbles

Electrical conductivity: 0 to 4 mmhos/cm

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 9.0

#### BC horizon

Hue: 10YR to 5Y

Value: 5 to 7 dry; 4 to 6 moist

Chroma: 2 to 4

Texture: loam, sandy loam, clay loam, or silt loam. In

some pedons below a depth of 40 inches the material consists of strata of loam, silt loam, sandy loam, and loamy sand.

Clay content: 10 to 35 percent

Rock fragments: 0 to 25 percent-0 to 5 percent cobbles, 0 to 20 percent pebbles

Electrical conductivity: 0 to 4 mmhos/cm

Calcium carbonate equivalent: 5 to 15 percent

Reaction: pH 7.9 to 9.0

### 792C—Yamacall complex, 2 to 8 percent slopes

#### Setting

##### Landform:

Yamacall, calcareous—Alluvial fans

Yamacall—Alluvial fans

##### Position on landform:

Yamacall, calcareous—Backslopes

Yamacall—Foothills and toeslopes

##### Slope:

Yamacall, calcareous—2 to 8 percent

Yamacall—2 to 8 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

#### Composition

##### Major Components

Yamacall, Calcareous and similar soils: 55 percent

Yamacall and similar soils: 35 percent

##### Minor Components

Busby and similar soils: 0 to 8 percent

Gravelly surface layers: 0 to 2 percent

#### Major Component Description

##### Yamacall, calcareous

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland

*Flooding:* None

*Available water capacity:* Mainly 10.3 inches

##### Yamacall

*Surface layer texture:* Loam

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

*Drainage class:* Well drained

*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.7 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 791E—Yamacall complex, 8 to 35 percent slopes

### Setting

#### *Landform:*

Yamacall, calcareous—Hills  
 Yamacall—Hills

#### *Position on landform:*

Yamacall, calcareous—Backslopes and shoulders  
 Yamacall—Footslopes

#### *Slope:*

Yamacall, calcareous—8 to 35 percent  
 Yamacall—8 to 25 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Yamacall, calcareous and similar soils: 60 percent  
 Yamacall and similar soils: 30 percent

#### Minor Components

Busby and similar soils: 0 to 3 percent  
 Delpoint and similar soils: 0 to 3 percent  
 Twilight and similar soils: 0 to 2 percent  
 Gravelly surface layers: 0 to 2 percent

### Major Component Description

#### Yamacall, calcareous

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium

*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 10.3 inches

### Yamacall

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.7 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

## 79C—Yamacall loam, 2 to 8 percent slopes

### Setting

*Landform:* Alluvial fans  
*Slope:* 2 to 8 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Yamacall and similar soils: 90 percent

#### Minor Components

Calcareous surface layers: 0 to 5 percent  
 Busby and similar soils: 0 to 3 percent  
 Slopes greater than 8 percent: 0 to 2 percent

### Major Component Description

*Surface layer texture:* Loam  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Alluvium  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 9.7 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.

### Management

For management information about this map unit, see appropriate sections in Part II of this publication.

### Yawdim Series

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

*Drainage class:* Well drained

*Permeability:* Slow (0.06 to 0.2 inch/hour)

*Landform:* Hills, escarpments

*Parent material:* Shale residuum

*Slope range:* 8 to 70 percent

*Annual precipitation:* 11 to 14 inches

*Annual air temperature:* 40 to 45 degrees F

*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Clayey, montmorillonitic (calcareous), frigid, shallow Aridic Ustorthents

### Typical Pedon

Yawdim clay loam, in an area of Cabbart-Twilight-Yawdim association, 8 to 35 percent slopes, in rangeland, 2,000 feet east and 800 feet north of the southwest corner of sec. 10, T. 23 N., R. 33 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, very friable, very sticky and plastic; many fine and very fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.

C1—3 to 11 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; many fine and very fine roots; few very fine tubular pores; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2—11 to 17 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, very firm, very sticky and very plastic; common fine and very fine roots; few very fine tubular pores; common fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cr—17 to 60 inches; light gray (5Y 7/2) semiconsolidated shale, olive gray (5Y 5/2) moist;

few very fine roots between plates in upper part; slightly effervescent; slightly alkaline.

### Range in Characteristics

*Soil temperature:* 42 to 47 degrees F

*Moisture control section:* between 4 and 12 inches

*Depth to Cr horizon:* 10 to 20 inches

*A horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 1 or 2

Texture: clay loam or silty clay

Clay content: 27 to 50 percent

Calcium carbonate equivalent: 1 to 5 percent

Reaction: pH 6.6 to 7.8

*C horizons*

Hue: 10YR to 5Y

Value: 5 to 8 dry; 4 to 6 moist

Chroma: 1 to 4

Texture: silty clay loam, clay loam, silty clay or clay

Clay content: 35 to 50 percent

Calcium carbonate equivalent: 3 to 10 percent

Reaction: pH 7.4 to 8.4

### 1971F—Yawdim-Cabbart-Rock outcrop association, 25 to 70 percent slopes

#### Setting

*Landform:*

Yawdim—Escarpments

Cabbart—Escarpments

Rock outcrop—Escarpments

*Position on landform:*

Yawdim—Backslopes and shoulders

Cabbart—Backslopes and shoulders

Rock outcrop—Backslopes and shoulders

*Slope:*

Yawdim—25 to 70 percent

Cabbart—25 to 70 percent

*Elevation:* 2,170 to 3,400 feet

*Mean annual precipitation:* 11 to 14 inches

*Frost-free period:* 100 to 120 days

### Composition

#### Major Components

Yawdim and similar soils: 40 percent

Cabbart and similar soils: 30 percent

Rock outcrop: 15 percent

**Minor Components**

Twilight and similar soils: 0 to 5 percent  
 Delpoint and similar soils: 0 to 5 percent  
 Yamacall and similar soils: 0 to 3 percent  
 Soils with ponderosa pine: 0 to 2 percent

**Major Component Description****Yawdim**

*Surface layer texture:* Silty clay  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.5 inches

**Cabbart**

*Surface layer texture:* Loam  
*Depth class:* Shallow (10 to 20 inches)  
*Drainage class:* Well drained  
*Dominant parent material:* Interbedded sandstone and shale residuum  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 2.8 inches

**Rock outcrop**

*Definition:* Areas of exposed 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.

**Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

**Yetull Series**

*Depth class:* Very deep (greater than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Permeability:* Rapid (6.0 to 20.0 inches/hour)  
*Landform:* Till plains, hills  
*Parent material:* Glaciofluvial deposits  
*Slope range:* 2 to 15 percent  
*Annual precipitation:* 11 to 14 inches  
*Annual air temperature:* 40 to 45 degrees F  
*Frost-free period:* 100 to 120 days

**Taxonomic Class:** Mixed, frigid Typic Ustipsamments

**Typical Pedon**

Yetull loamy fine sand, 2 to 8 percent slopes, in cropland, 1,800 feet north and 100 feet east of the southwest corner of sec. 15, T. 28 N. R. 30 E.

Ap—0 to 8 inches; brown (10YR 5/3) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear wavy boundary.

C1—8 to 16 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; common fine and very fine roots; strongly effervescent; slightly alkaline; gradual wavy boundary.

C2—16 to 60 inches; light yellowish brown (2.5Y 6/4) loamy fine sand, light olive brown (2.5Y 5/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; strongly effervescent; slightly alkaline.

**Range in Characteristics**

*Soil temperature:* 40 to 47 degrees F

*Moisture control section:* between 12 and 35 inches

*A horizon*

Hue: 10YR or 2.5Y

Value: 5 or 6 dry; 3 or 4 moist

Chroma: 2 to 4

Clay content: 0 to 10 percent

Rock fragments: 0 to 10 percent-0 to 5 percent cobbles, 0 to 5 percent pebbles

Reaction: pH 6.6 to 7.8

*C1 horizon*

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand

Clay content: 0 to 10 percent

Rock fragments: 0 to 15 percent pebbles

Calcium carbonate equivalent: 3 to 10 percent

Reaction: pH 7.4 to 8.4

*C2 horizon*

Hue: 10YR or 2.5Y

Value: 4 to 6 dry; 4 or 5 moist

Chroma: 2 to 4

Texture: sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand

Clay content: 0 to 10 percent

Calcium carbonate equivalent: 3 to 10 percent  
Reaction: pH 7.4 to 8.4

### **650C—Yetull loamy fine sand, 2 to 8 percent slopes**

#### **Setting**

*Landform:* Till plains  
*Slope:* 2 to 8 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

#### **Composition**

#### **Major Components**

Yetull and similar soils: 90 percent

#### **Minor Components**

Busby and similar soils: 0 to 8 percent  
Soils with gravelly profiles: 0 to 2 percent

#### **Major Component Description**

*Surface layer texture:* Loamy fine sand  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Glaciofluvial deposits  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 3.6 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.

#### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

### **650D—Yetull loamy fine sand, 8 to 15 percent slopes**

#### **Setting**

*Landform:* Hills  
*Slope:* 8 to 15 percent  
*Elevation:* 2,170 to 3,400 feet  
*Mean annual precipitation:* 11 to 14 inches  
*Frost-free period:* 100 to 120 days

#### **Composition**

#### **Major Components**

Yetull and similar soils: 90 percent

#### **Minor Components**

Busby and similar soils: 0 to 8 percent  
Soils with gravelly profiles: 0 to 2 percent

#### **Major Component Description**

*Surface layer texture:* Loamy fine sand  
*Depth class:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Dominant parent material:* Glaciofluvial deposits  
*Native plant cover type:* Rangeland  
*Flooding:* None  
*Available water capacity:* Mainly 3.6 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.

#### **Management**

For management information about this map unit, see appropriate sections in Part II of this publication.

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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.

**Association, soil.** A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity,

in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low .....	0 to 3.75
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.

**Backslope.** 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 1 foot wide, 1 foot long, and 1 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 the 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 cobbles, and extremely cobbly soil material is more than 60 percent cobbles.

**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.

**Compressible** (in tables). Excessive decrease in volume of soft soil under load.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is

unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

**Conglomerate.** A coarse grained, clastic rock composed of rounded 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 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.

**Dense layer** (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

**Depth 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 individual trees. 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.
- Excess lime** (in tables). Excess carbonates in the soil that restrict the growth of some plants.
- Excess salts** (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.
- Excess sodium** (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.
- Excess sulfur** (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.
- Extrusive rock**. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.
- Fallow**. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.
- Fast intake** (in tables). The rapid movement of water into the soil.
- Fertility, soil**. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.
- Fibric soil material (peat)**. The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.
- Field moisture capacity**. The moisture content of a soil, expressed as a percentage of the 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.
- Footslope**. 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 (backslope) and a downslope site of deposition (toeslope).
- Forb**. Any herbaceous plant not a grass or a sedge.
- Forest cover**. All trees and other woody plants (underbrush) covering the ground in a forest.
- Forest type**. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.
- Fragile** (in tables). A soil that is easily damaged by use or disturbance.
- 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.

**Habitat type.** An aggregation of all land areas capable of producing similar climax plant communities.

**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.

**Increasesers.** Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasesers 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.

**Miscellaneous water.** A sewage lagoon, an industrial waste pit, a fish hatchery, or a similar water area.

**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.

**Poor outlets** (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

**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 .....	3.5 to 4.4
Very strongly acid .....	4.5 to 5.0
Strongly acid .....	5.1 to 5.5
Moderately acid .....	5.6 to 6.0
Slightly acid .....	6.1 to 6.5
Neutral .....	6.6 to 7.3
Slightly alkaline .....	7.4 to 7.8
Moderately alkaline .....	7.9 to 8.4
Strongly alkaline .....	8.5 to 9.0
Very strongly alkaline .....	9.1 and higher

**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

**Salty water (in tables).** Water that is too salty for consumption by livestock.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Sandstone.** Sedimentary rock containing dominantly sand-sized particles.

**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 slope.** 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.
- Shrink-swell** (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.
- Silica.** A combination of silicon and oxygen. The mineral form is called quartz.
- 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.

**Slickspot.** 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.

**Slippage** (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

**Slope.** The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. 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 intake** (in tables). The slow movement of water into the soil.

**Slow refill** (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

**Small stones** (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

**Sodic (alkali) soil.** A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

**Sodicity.** The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of  $\text{Na}^+$  to  $\text{Ca}^{++} + \text{Mg}^{++}$ . 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.

- Strippcropping.** 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 wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.
- Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.
- Subsoiling.** Tilling a soil below normal plow depth, ordinarily to shatter 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.

- Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.
- 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.
- Toeslope.** The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.
- Too arid (in tables).** The soil is dry most of the time, and vegetation is difficult to establish.
- Topsoil.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

**Toxicity** (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

**Trace elements.** Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

**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.

**Unstable fill** (in tables). Risk of caving or sloughing on banks of fill material.

**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.

**Water-spreading.** 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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