



United States
Department of
Agriculture

Natural Resources
Conservation
Service

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

Soil Survey of Hill County, Montana Part I



How to Use This Soil Survey

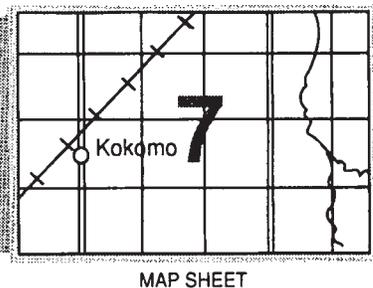
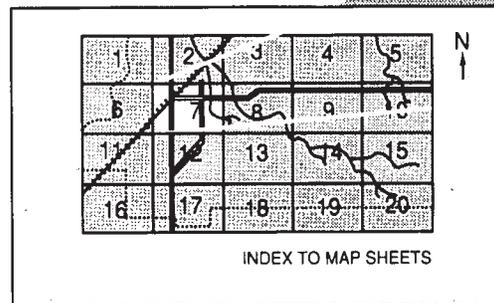
This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the detailed soil map units and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. 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.

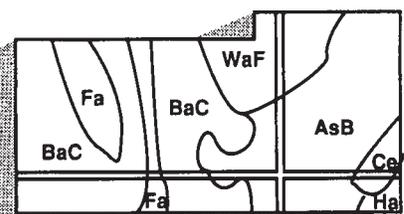
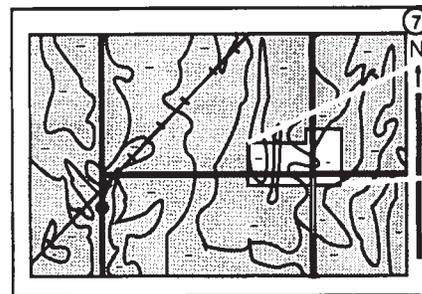
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet and turn to that sheet.

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



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

A **State Soil Geographic Data Base (STATSGO)** is available for this survey area. This



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

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 use. 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.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1991. Soil names and descriptions were approved in 1994. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1991. This survey was made cooperatively by the Natural Resources Conservation Service; United States Department of the Interior, Bureau of Indian Affairs; and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Hill County Conservation District and the Chippewa-Cree Tribal Council.

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: Wheat field in Hill County, Montana. Bear Paw Mountains are in the background.

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

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Foreword

This soil survey contains information that can be used in land-planning programs in Hill County. 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. The location of each soil is shown on the detailed soil maps. Each soil in the county is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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State Conservationist
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Soil survey of Hill County, Montana

Fieldwork by Bruce C. Evans, John M. Galbraith, Stephen C. Herriman, Donna L. Hinz, James M. Hoag, and Gregory L. Snell, Natural Resources Conservation Service.

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

How This Survey Was Made

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

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

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil

scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles 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 county and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the county, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior

of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

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

General Nature of the County

This soil survey updates the following surveys: "Soil Survey (Reconnaissance of the Northern Plains of Montana)," published in 1929; "Beaver Creek Park," published in 1969; "Havre Area," published in 1971; and "Soil Survey of Rocky Boy's Indian Reservation," published in 1984. This survey provides additional information and has larger maps that show the soils in greater detail.

Hill County is in north-central Montana (fig. 1). It has a total area of about 2,917 square miles, or 1,866,600 acres. The Canadian provinces of Alberta and Saskatchewan are to the north. Blaine County is to the east, Chouteau County to the south, and Liberty County to the west of Hill County.

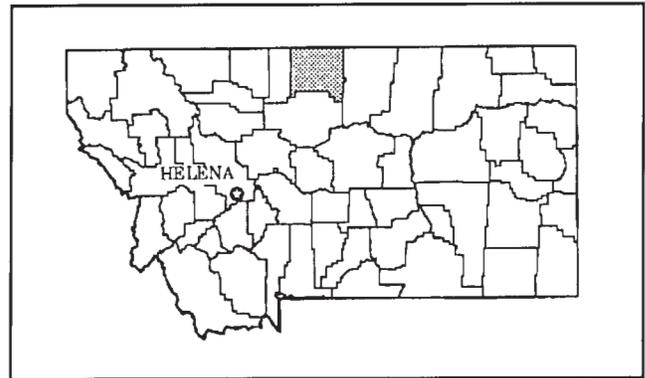


Figure 1.—Location of Hill County in Montana.

Hill County has two incorporated towns, Havre and Hingham. Other small towns include Kremlin, Gildford, Rudyard, Inverness, and Box Elder.

About 65 percent of the county is cropland, 33 percent is rangeland, and 2 percent is woodland. Hill County is recognized for its agricultural production of spring wheat, winter wheat, and barley. It is consistently among the top 10 counties in the state for production of these crops. Livestock production, including cattle, hogs, and sheep, is also an important contributor to the agricultural production in the county.

The Milk River drains most of Hill County; however, the southwestern corner is drained by the Marias River. Other drainages include Beaver, Big Sandy, Bullhook, Little Box Elder, Lodge, and Sage Creeks.

Most of the county lies in the northern glaciated uplands. This means the present landscape was formed by the glaciers. The Bear Paw Mountains in the southeast corner of the county formed from volcanic activity.

Industry, Transportation, and Recreation

The major industry in the county is agriculture, and businesses in the area are primarily related to agriculture.

Burlington Northern Railroad maintains a division headquarters in Havre. Also located in Havre is the Northern Montana College. It offers both 2- and 4-year programs. Additionally, the United States Air Force has a radar facility north of Havre, and there is some production of gas and oil in the county. Medical services for Hill County and the Hi-Line area are provided by the Northern Montana Hospital. The tourism industry brings many people through this area.

Havre is a major transportation center on the Hi-Line. Through here the Burlington Northern Railroad

moves local agricultural products and interstate shipments of goods that are destined for global markets. Amtrak provides rail passenger service. U.S. Highway 2 is the east-to-west route along the northern United States border. U.S. Highway 87 connects Havre with Great Falls and points south. There is also an extensive system of “farm to market” roads. The Wild Horse and the Willow Creek are two Canadian ports of entry in Hill County. There are also daily bus and air services to major connections.

Hill County is home to Beaver Creek Park and the Fresno Reservoir. The Bear Paw Ski Bowl is south of Havre in the Bear Paw Mountains, Beaver Creek Park is located 10 miles south of Havre, and the Fresno Reservoir is 15 miles northwest of Havre. These three places provide recreational opportunities for the people of north-central Montana.

Created in 1916, Beaver Creek Park is the largest county park in the United States. It was originally part of the Fort Assiniboine Military Reservation. The park is 1 mile wide and 17 miles long, and follows along Beaver Creek in the Bear Paw Mountains.

Four of Havre’s early businessmen initially filed mining claims on land that later became the Beaver Creek Park. When they donated it as a playground for people of the area, Havre was designated as the original custodian. Many cultural features at the park were built by the Civilian Conservation Corps in the 1930s. In 1947 Hill County purchased the park. Over the years many local groups have contributed to improvement of the park.

Beaver Creek Park has two man-made lakes, Bearpaw Lake and the Lower Lake. Fishing, swimming, picnicking, and camping are enjoyed by the park visitors. There are numerous hiking and horseback riding trails that also serve as cross-country ski trails in the winter.

In the 1930s the Fresno Reservoir was built for irrigation use. Six Hi-Line towns depend on this lake for their water supply. This lake features fishing, swimming, picnicking, and camping.

Physiography, Drainage, Ground Water Resources, Oil and Gas, and Economic Deposits

Hill County, in central Montana, is adjacent to the Canadian Border. It is within the Great Plains physiographic province near the southern margin of the glaciated Missouri Plateau. Most of the county consists of a relatively flat, rolling till plain dissected by pronounced southeast-trending drainages.

Surface elevations on the glaciated uplands range from 2,450 feet above sea level, where the Milk River enters Blaine County, to 3,390 feet near Inverness. Near the Milk River a stairstepping sequence of benches has developed, with elevations increasing toward the mountains. Many streams entering the Milk River have cut through glacial till to the underlying sedimentary rocks.

The Bear Paw Mountains are in the southeastern corner of the county approximately 15 miles south of Havre. Surface elevations range from 2,700 feet at the base of Baldy Mountain to 6,916 feet at the top. Black Mountain has an elevation of 6,332 feet. Peaks that are between 4,000 and 5,000 feet include Haystack Mountain, Mount Reynolds, Number One Mountain, and Otis Mountain.

The Bear Paw Mountains contain two outstanding erosional levels that were established in the late Tertiary period. They include higher pediment surfaces that slope from an elevation of 4,600 feet at the mountain front, to broad, gravel-capped surfaces in the foothills; and lower, gravel-capped terraces above the present valley floors.

Hill County contains two major rivers. The Milk River flows southeast through the northern half of the county. It controls most of the drainage. The Marias River flows east and south through the southwest corner of the county. The present streams developed on glacial till and do not necessarily reflect the drainage pattern of the previous surface.

Milk River is 60 to 70 feet wide and follows a meandering course through a preglacial channel of the Missouri River. At low water it is a sluggish stream entrenched 15 to 20 feet below its flood plain. Major tributaries of the Milk River include, from west to east, Sage, Big Sandy, Beaver, Bullhook, Little Boxelder, and Lodge Creeks. Sage, Big Sandy, and Lodge Creeks drain the plains area. The others originate in the Bear Paw Mountains. Major tributaries to Sage Creek include Little Sage and O’Brien Coulee Creeks. Lodge Creek flows into the Milk River east of the county border.

The Marias River controls drainage in the southwest portion of Hill County. It has no tributaries in Hill County; however, Black Coulee Creek and its tributary Flat Coulee Creek do flow into the Marias southeast of the county border. Most of the current drainages follow coulees and outwash channels of glacial meltwaters. Most coulees and channels host intermittent streams. The Chain of Lakes is part of the preglacial channel of Milk River. Big Sandy Flats and Big Sandy Creek are in the preglacial channel of the Missouri River.

Ground water resources in the county have been developed primarily from Judith River and the Eagle Formations, as well as from alluvial channels and older glacial outwash deposits. The Eagle Formation is used in the southwest corner of the county where the overlying Judith River Formation has been eroded away, and in the extreme northwest corner near Goldstone. Water from the Eagle has total dissolved solids (TDS) concentrations ranging from 980 to 7,400 mg/l. The lowest TDS concentrations are in the Goldstone areas where they range between 980 and 1,100 mg/l. Wells drilled in the basal Virgelle Sandstone commonly yield 8 to 20 gallons per minute.

The Judith River Formation is the major source of ground water throughout the county, excluding the Bear Paw Mountains and the southwest quarter where the Formation has been removed by erosion. The Judith River Formation, where it is sufficiently thick and adequately recharged, can normally produce 5 to 15 gallons of water per minute. It is soft water, with sodium bicarbonate predominating. It has total dissolved solids concentrations ranging from 900 to over 25,000 mg/l.

Hill County is within northern Montana's region of oil and gas production, between Great Falls and the Canadian border. The county contains a total of 14 natural gas fields that are currently producing and one producing oil field. The most important gas producer is the Tiger Ridge Field. It extends from eastern Blaine County into Hill County south of Havre. Most of the fields are clustered in the eastern half of Hill County.

Oil and gas are in stratigraphic traps that formed where the porosity of sandstone decreased as it graded into shale, and in structural traps, particularly in small faulted anticlines along the flanks of the Bear Paw Mountain structural uplift. These fields produce oil and gas from the Judith River and the Eagle and Sawtooth Formations. The Sawtooth Formation is the basal formation of the Lower Jurassic-aged Ellis Group. It consists of fine grained sandstone and siltstone, and underlies the surficial formations at depths greater than 3,000 feet.

The economic deposits of Hill County include sand and gravel, small coal seams, and thin beds of bentonite. Only the sand and gravel have been commercially mined.

Geology

The oldest rocks exposed in Hill County are sedimentary formations deposited during the Lower Cretaceous Period, beginning approximately 135 million years ago. They were deposited on the sea

floor and coastal plains during alternating periods of emergence and submergence of a shallow sea. These repeated marine invasions deposited an alternating sequence of marine shales on the sea floor, and brackish and fresh water shales and sandstones on the coastal plain.

The marine migrations continued without interruption until 90 million years ago, in the late Cretaceous Period, when uplift of the Rocky Mountains began. Deposition continued in the county until 50 million years ago, when it was interrupted by volcanic activity during the Eocene Epoch of the Tertiary Period. This activity formed the Bear Paw Mountains. Sedimentary rocks of the plains dip gently to the northeast and are generally undisturbed except near the Bear Paw Mountains. Igneous activity in the Bear Paw Mountains is unrelated to the Rocky Mountain uplift, as it occurred after a tectonically quiet period of 20 million years.

Volcanism declined toward the end of the Eocene Epoch. The active volcanic area was adjusted by faulting and collapse, creating the rugged topography which exists today. There is evidence that the current surface is 3,000 to 10,000 feet below the original Eocene surface. Only minor faulting or deformation has occurred since then. The last earthquake reported in the county occurred in 1869. It probably originated north of the Milk River in the extreme eastern part of the county.

The landscape of Hill County was further modified by a glacier period that ended approximately 10,000 years ago. Glaciers were an important influence on the geologic history of the county; most of its soils and landforms are glacial features.

Bear Paw Mountains

The Bear Paw Mountains consist of two separate deeply eroded volcanic fields. They are separated by the Bear Paw Arch, a northeast- to east-trending band of deformed and metamorphosed Cretaceous-aged sediments. This band is an anticlinal structure 2 to 8 miles wide, running through the southeastern tip of the county.

The volcanics consist of a pile of igneous rocks approximately 1,500 feet thick. They contain a wide assortment of intrusive and extrusive rock types, including some rare potassium- and sodium-rich varieties. Included in these rock types is shonkinite, a dark, potassium-rich rock. It was named for Shonkin, a small town to the southwest, located in the Highwood Mountains. Typical volcanic soils include the Whitlash, Perma, and Belain series.

The extrusive rocks of the county consist of lava flows and pyroclastic ("broken by fire") deposits that are the result of explosive volcanic activity. Volcanic blocks thrown from the erupting lava are as large as 6 feet in diameter. The intrusions occur primarily as dikes and laccoliths (a relatively rare intrusive structure). Laccoliths are sill-like bodies that form when molten material is injected between sedimentary layers. They typically have flat floors and domed roofs.

Dikes, sills, stocks, and laccoliths make up hundreds of intrusive bodies in the Bear Paw Mountains. Most of the exposed dikes run parallel to the axis of the Bear Paw Arch, indicating regional tension operating from northwest to southeast. Radiometric dating has documented ages between 44 and 64 million years for igneous rocks of the Bear Paw Mountains.

Glaciation

Most of the landforms, drainage patterns, and associated soil development are the direct result of continental glaciation. During the four major ice ages of the late Pleistocene Epoch Successive, ice sheets advanced across north-central Montana in a generally southeastern direction. These were up to 1,000 feet thick. Four different ages of till have been recognized in Hill County. Most soils formed in the Illinoian or Wisconsin tills, or in a combination of both. The older Illinoian till has iron and manganese staining and tends to be denser than the Wisconsin till.

These ice sheets extended into Montana at least as far as the present channel of the Missouri River, eroding the existing surface and depositing widespread blankets of till. They did not completely override the Bear Paw Mountains but flowed around them, hugging the northern and western flanks. They deposited lateral moraines along the mountains and dammed the streams emerging from them. Glaciers pushed the Missouri River from its course of the Milk River to its existing channel, thus changing its final destination from Hudson Bay to the Gulf of Mexico.

Geologic Units

The sequence of rocks exposed in Hill County begins with sedimentary formations which were deposited during the Lower Cretaceous Period of the Mesozoic Era. These formations are summarized below and listed in order of decreasing age.

The classification of rock units based on their lithology is, from largest to smallest: group, formation, and member. For example, formations are subdivided into members.

Cretaceous System (135 to 165 million years).

The Colorado Group contains the oldest rocks exposed in the county. It is an extensive unit consisting of marine shales, and is 2,500 feet thick in some parts of Montana. In Hill County it outcrops only in the Bear Paw Arch, and has been metamorphosed by igneous activity in that area.

The Montana Group directly overlies the Colorado Group. It is subdivided into the Telegraph Creek, Eagle Sandstone, Claggett Shale, Judith River, Bearpaw Shale, and Fox Hills Formations. Its total thickness ranges from 2,000 to 2,400 feet. The Telegraph Creek Formation has not been separately mapped in this county.

The Eagle Formation does not crop out in Hill County but is used extensively as an aquifer in areas where it is near the surface. It is 300 to 500 feet thick and consists of alternating beds of sandstone and shale, with minor amounts of coal. The basal Virgelle Sandstone Member is highly permeable and the water it contains can be highly mineralized.

Claggett Shale underlies the extreme southwest corner of Hill County. It consists primarily of a brownish-gray marine shale, and is 250 to 600 feet thick in this area. It contains beds of bentonite that are up to 2 feet thick, and erodes to badlands topography where exposed. Typical soils derived from this formation include the Neldore and Bascovy series.

The Judith River Formation is in most of the central portion of the county. It consists of tan crossbedded sandstone and gray shale with minor amounts of lignite. It was deposited in fresh water and brackish water. It is 400 to 600 feet thick and is used extensively as a regional aquifer. The water can be highly mineralized. Where exposed, it weathers to spectacular badlands containing sodic slick spots. These badlands occur along the Milk River and its tributary coulees. Soils derived from this formation typically include the Cabbart, Delpoint, Yamacall, and Benz series.

Bearpaw Shale overlies the Judith River Formation and is the surface bedrock in the northeast corner of the county. It consists of gray-to-black marine shale with numerous limestone and iron-rich concretions and bentonite seams. It ranges in thickness from 800 to 1,300 feet and represents the last marine inundation in Montana. Typical soils derived from this formation include the Neldore, Bascovy, and Weingart series.

The overlying Cretaceous-aged Fox Hills Sandstone and the younger Tertiary-aged sedimentary formations are in limited amounts in southeastern Hill County. They are composed of freshwater sandstones

and shales, and outcrop in the disturbed belt surrounding the Bear Paw Mountains.

Quaternary System (1.6 million years to present). The mantle of glacial deposits overlying most of the county consists of consolidated clayey till intermixed with glaciofluvial outwash deposits. The till is unsorted, with material ranging from clay size to boulders up to 3 feet in diameter. The till mantle ranges in thickness from 2 to 300 feet. Much of the clayey calcareous till was derived locally from Cretaceous-aged sediments outcropping in the area. Most of the included cobbles and boulders, however, were transported from northern Canada. Wind-blown loess was deposited over the till to a depth of about 2 feet. Most of this was subsequently eroded away and is now alluvial deposits within the stream channels and coulees. Typical alluvial soils include the Yamacall, Havre, and Glendive series.

In some locations knob and kettle topography has developed in the till. It consists of 10-foot high knobs from 30 to 50 feet in diameter, and is surrounded by shallow rounded kettles. Streamlined hills called drumlins are also located throughout the county, oriented in both southeast and southwest directions. These ellipsoidal till deposits are usually in parallel groups and can be stratified. Typical soils include the Hillon, Joplin, and Kevin series, occurring on knobs and drumlins, and the Phillips and Nishon series on kettles.

As ice sheets melted glaciofluvial materials were deposited, leaving a variety of localized deposits of silt, sand, and gravel. They generally consist of light colored unconsolidated silt, sand, and gravel, and are often on the floors of narrow sinuous valleys cut in the till. Outwash deposits also occur as eskers. These are sinuous ridges of stratified sand and gravel.

They can be up to 1 mile long, 30 feet wide, and 10 feet high. As ice sheets retreated between the major glacial advances, silt was deposited in temporary lakes along Sage Creek in the Guildford area. It occurs as layers of light yellow to buff, even-bedded, massive silt deposits. Typical high-energy glaciofluvial soils include the Degrand, Cozberg, Attewan, and Tinsley series. Typical low-energy glaciofluvial soils include the Kremlin, Chinook, Hingham, Yamacall, and Lonna series.

Morainal ridges occur throughout the county as well. These are typically closely spaced low ridges, and are comprised of unstratified material. Eskers and drumlins are oriented in the direction of ice and meltwater movement. Morainal ridges (washboard moraines) are usually oriented in groups perpendicular to the retreating glacier.

Climate

The "Temperature and Precipitation" table gives data for the county as recorded at Fort Assiniboine, Guilford, Havre, Rudyard, and Simpson, Montana for the period 1961 to 1990. The "Freeze Dates in Spring and Fall" table shows probable dates of the first freeze in fall and the last freeze in spring. The "Growing Season" table provides data on probable length of the growing season. Growing degree days, as shown in the table, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal growing degree accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Temperature and Precipitation

(Recorded in the period 1961-90 at Fort Assinniboine, Guilford, Havre, Rudyard, and Simpson, Montana)

Month	Temperature (Degrees F)						Precipitation (Inches)					
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have—		Average number of growing degree days*	Average	2 years in 10 will have—		Average number of days with 0.10 inch or more	Average total snowfall	
				Maximum temperature more than—	Minimum temperature less than—			Less than	More than			
FORT ASSINNIBOINE												
January-----	26.7	4.7	15.7	57	-33	7	0.51	0.16	0.82	1	5.4	
February-----	33.8	10.6	22.2	63	-26	12	0.34	0.11	0.53	1	4.5	
March-----	44.7	19.6	32.2	73	-17	48	0.58	0.20	0.93	1	4.0	
April-----	59.2	30.2	44.7	85	4	196	1.00	0.45	1.59	3	1.4	
May-----	70.2	40.4	55.3	92	24	474	1.99	0.71	3.06	4	0.0	
June-----	79.6	48.6	64.1	99	34	711	1.88	0.81	2.79	4	0.0	
July-----	86.9	52.8	69.8	102	40	906	1.41	0.70	2.21	4	0.0	
August-----	86.2	51.3	68.8	103	36	876	1.37	0.34	2.26	2	0.0	
September-----	73.2	41.3	57.3	97	23	508	1.34	0.42	2.10	3	0.0	
October-----	61.9	32.3	47.1	86	8	262	0.60	0.19	0.98	1	0.4	
November-----	42.9	18.7	30.8	70	-16	45	0.38	0.10	0.63	1	3.2	
December-----	30.0	7.5	18.7	59	-33	9	0.55	0.18	0.88	1	6.7	
Yearly:												
Average----	58.0	29.8	43.9	—	—	—	—	—	—	—	—	
Extreme----	111	-49	—	105	-38	—	—	—	—	—	—	
Total-----	—	—	—	—	—	4,055	11.96	8.76	14.81	26	25.6	
GUILFORD												
January-----	26.0	4.0	15.0	56	-33	5	0.40	0.13	0.65	1	5.4	
February-----	33.6	10.5	22.1	62	-24	9	0.25	0.06	0.41	0	2.8	
March-----	43.3	18.9	31.1	71	-18	33	0.50	0.17	0.80	1	3.1	
April-----	57.0	29.4	43.2	83	3	165	0.82	0.28	1.32	2	1.6	
May-----	68.2	39.6	55.9	91	23	430	1.87	0.72	2.83	4	0.2	
June-----	77.2	47.6	62.4	97	32	659	2.09	0.90	3.10	4	0.0	
July-----	84.5	51.6	68.0	100	38	863	1.31	0.47	2.01	3	0.0	
August-----	83.3	50.3	66.8	102	36	831	1.25	0.47	2.06	3	0.0	
September-----	71.1	40.3	55.7	94	22	474	1.18	0.34	1.85	2	0.0	
October-----	60.2	30.8	45.5	84	6	221	0.48	0.16	0.75	1	0.4	
November-----	41.6	17.5	29.6	70	-16	34	0.27	0.10	0.47	1	1.8	
December-----	29.2	6.8	18.0	59	-34	5	0.42	0.11	0.71	1	6.6	
Yearly:												
Average----	56.3	29.0	42.6	—	—	—	—	—	—	—	—	
Extreme----	110	-44	—	103	-37	—	—	—	—	—	—	
Total-----	—	—	—	—	—	3,729	10.83	8.22	13.11	23	21.8	

* See footnote at end of table.

Temperature and Precipitation—Continued

(Recorded in the period 1961-90 at Fort Assinniboine, Guilford, Havre, Rudyard, and Simpson, Montana)

Month	Temperature (Degrees F)						Precipitation (Inches)					
				2 years in 10 will have—		Average number of growing degree days*	2 years in 10 will have—			Average number of days with 0.10 inch or more snowfall		
	Average daily maximum	Average daily minimum	Average	Maximum temperature more than—	Minimum temperature less than—		Average	Less than	More than			
HAVRE												
January-----	24.3	3.3	13.8	57	-35	6	0.54	0.20	0.86	1	8.4	
February-----	32.1	10.2	21.2	62	-27	11	0.36	0.15	0.56	1	5.6	
March-----	42.6	19.7	31.1	72	-17	41	0.66	0.25	1.01	2	7.4	
April-----	56.7	30.8	43.8	84	4	181	0.94	0.39	1.46	2	6.4	
May-----	67.9	41.5	54.7	91	26	458	1.66	0.70	2.57	4	1.4	
June-----	77.4	49.5	63.4	99	35	703	1.76	0.74	2.63	4	0.0	
July-----	85.1	53.9	69.5	102	41	914	1.40	0.39	2.22	3	0.0	
August-----	83.7	52.5	68.1	104	38	871	1.23	0.36	2.08	2	0.0	
September---	70.9	41.9	56.4	96	24	497	1.18	0.29	1.88	2	0.4	
October-----	59.7	31.5	45.6	85	7	226	0.53	0.18	0.82	1	1.9	
November-----	41.3	17.6	29.5	70	-17	38	0.39	0.11	0.63	1	4.7	
December----	28.2	6.6	17.4	59	-36	7	0.54	0.17	0.84	1	7.8	
Yearly:												
Average----	55.8	29.9	42.9	-	-	-	-	-	-	-	-	
Extreme----	111	-52	-	105	-40	-	-	-	-	-	-	
Total-----	-	-	-	-	-	3,953	11.19	8.17	13.94	24	44.1	
RUDYARD												
January-----	25.8	4.0	14.9	58	-31	8	0.39	0.10	0.71	1	7.3	
February-----	32.7	10.4	21.5	62	-25	12	0.25	0.14	0.48	1	3.9	
March-----	41.8	19.2	30.5	69	-15	36	0.42	0.21	0.67	1	4.6	
April-----	55.5	30.2	42.8	82	6	157	0.87	0.26	1.47	2	1.5	
May-----	67.2	40.4	53.8	89	25	403	1.60	0.65	2.40	3	0.3	
June-----	76.1	48.1	62.1	96	34	639	2.16	1.27	3.27	5	0.0	
July-----	83.2	52.1	67.6	99	40	815	1.31	0.45	2.01	3	0.0	
August-----	82.7	51.5	67.1	101	37	815	1.08	0.46	1.60	2	0.0	
September---	69.8	40.7	55.2	94	21	441	1.09	0.26	1.81	2	0.5	
October-----	59.7	32.0	45.9	83	9	222	0.39	0.09	0.70	1	0.7	
November-----	40.7	17.4	29.0	68	-15	33	0.29	0.11	0.55	1	2.4	
December----	29.2	6.2	17.7	59	-33	6	0.39	0.17	0.71	1	5.6	
Yearly:												
Average----	55.4	29.3	42.3	-	-	-	-	-	-	-	-	
Extreme----	106	-43	-	102	-35	-	-	-	-	-	-	
Total-----	-	-	-	-	-	3,586	10.23	7.12	12.25	23	26.8	

* See footnote at end of table.

Temperature and Precipitation--Continued

(Recorded in the period 1961-90 at Fort Assiniboine, Guilford, Havre, Rudyard, and Simpson, Montana)

Month	Temperature (Degrees F)						Precipitation (Inches)					
	Average			2 years in 10 will have--		Average number of growing days*	2 years in 10 will have--			Average number of days with 0.10 inch or more snowfall		
	daily maximum	daily minimum	Average	Maximum temperature more than--	Minimum temperature less than--		Less than	More than	Average			
SIMPSON												
January-----	22.6	-0.1	11.3	55	-35	3	0.31	0.14	0.50	1	5.5	
February-----	30.6	7.0	18.8	59	-29	5	0.23	0.08	0.40	0	3.8	
March-----	41.5	16.8	29.2	70	-20	26	0.41	0.13	0.65	1	5.0	
April-----	56.8	28.1	42.4	83	3	151	0.61	0.17	1.00	1	3.6	
May-----	69.1	38.3	53.7	92	21	425	1.51	0.60	2.27	3	0.3	
June-----	77.8	46.1	61.9	98	31	631	2.02	0.70	3.10	4	0.0	
July-----	85.2	50.4	67.8	101	36	823	1.43	0.42	2.25	3	0.0	
August-----	84.3	49.0	66.6	103	32	819	1.27	0.43	1.97	3	0.0	
September---	71.9	38.3	55.1	95	19	451	1.08	0.36	1.81	2	0.4	
October-----	69.7	28.7	44.2	85	4	192	0.40	0.14	0.70	1	1.1	
November-----	39.9	14.6	27.2	68	-21	23	0.31	0.12	0.56	1	3.9	
December-----	26.8	3.3	15.1	57	-35	4	0.33	0.12	0.51	1	5.2	
Yearly:												
Average----	55.5	26.7	41.1	-	-	-	-	-	-	-	-	
Extreme----	109	-47	-	104	-39	-	-	-	-	-	-	
Total-----	-	-	-	-	-	3,552	9.92	7.35	12.31	21	28.7	

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

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Fort Assinniboine,
Guilford, Havre, Rudyard, and Simpson, Montana)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
FORT ASSINNIBOINE			
Last freezing temperature in spring: (January-July)			
1 year in 10 later than--	May 5	May 19	May 30
2 years in 10 later than--	April 30	May 14	May 25
5 years in 10 later than--	April 21	May 4	May 15
First freezing temperature in fall: (August-December)			
1 year in 10 earlier than--	Sept. 20	Sept. 12	Sept. 4
2 years in 10 earlier than--	Sept. 26	Sept. 17	Sept. 9
5 years in 10 earlier than--	Oct. 7	Sept. 28	Sept. 19
GUILFORD			
Last freezing temperature in spring: (January-July)			
1 year in 10 later than--	May 7	May 22	June 9
2 years in 10 later than--	May 2	May 17	June 3
5 years in 10 later than--	April 22	May 9	May 23

Table 2.--Freeze Dates in Spring and Fall--Continued

(Recorded in the period 1961-90 at Fort Assinniboine, Guilford, Havre, Rudyard, and Simpson, Montana)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
GUILFORD			
First freezing temperature in fall: (August-December)			
1 year in 10 earlier than--	Sept. 18	Sept. 10	Sept. 3
2 years in 10 earlier than--	Sept. 23	Sept. 15	Sept. 8
5 years in 10 earlier than--	Oct. 3	Sept. 24	Sept. 16
HAVRE			
Last freezing temperature in spring: (January-July)			
1 year in 10 later than--	May 1	May 19	May 29
2 years in 10 later than--	April 26	May 13	May 23
5 years in 10 later than--	April 17	May 2	May 12
First freezing temperature in fall: (August-December)			
1 year in 10 earlier than--	Sept. 23	Sept. 14	Sept. 6
2 years in 10 earlier than--	Sept. 28	Sept. 19	Sept. 11
5 years in 10 earlier than--	Oct. 9	Sept. 28	Sept. 20

Table 2.--Freeze Dates in Spring and Fall--Continued

(Recorded in the period 1961-90 at Fort Assinniboine,
Guilford, Havre, Rudyard, and Simpson, Montana)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
RUDYARD			
Last freezing temperature in spring: (January-July)			
1 year in 10 later than--	May 5	May 17	May 30
2 years in 10 later than--	April 30	May 12	May 25
5 years in 10 later than--	April 19	May 3	May 15
First freezing temperature in fall: (August-December)			
1 year in 10 earlier than--	Sept. 18	Sept. 7	Sept. 3
2 years in 10 earlier than--	Sept. 24	Sept. 12	Sept. 7
5 years in 10 earlier than--	Oct. 5	Sept. 22	Sept. 15
SIMPSON			
Last freezing temperature in spring: (January-July)			
1 year in 10 later than--	May 14	May 27	June 21
2 years in 10 later than--	May 9	May 22	June 13
5 years in 10 later than--	April 28	May 13	May 29

Table 2.--Freeze Dates in Spring and Fall--Continued

(Recorded in the period 1961-90 at Fort Assinniboine,
Guilford, Havre, Rudyard, and Simpson, Montana)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
SIMPSON			
First freezing temperature in fall: (August-December)			
1 year in 10 earlier than--	Sept. 10	Sept. 6	Aug. 23
2 years in 10 earlier than--	Sept. 15	Sept. 10	Aug. 28
5 years in 10 earlier than--	Sept. 25	Sept. 18	Sept. 5

Table 3.--Growing Season

(Recorded in the period 1961-90 at Fort Assinniboine, Guilford, Havre, Rudyard, and Simpson, Montana)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
FORT ASSINNIBOINE			
9 years in 10	144	123	105
8 years in 10	152	131	112
5 years in 10	168	146	127
2 years in 10	184	161	141
1 year in 10	192	169	149
GUILFORD			
9 years in 10	143	120	97
8 years in 10	150	126	103
5 years in 10	163	137	115
2 years in 10	176	148	127
1 year in 10	183	153	134
HAVRE			
9 years in 10	152	128	111
8 years in 10	160	135	117
5 years in 10	174	148	129
2 years in 10	188	161	142
1 year in 10	196	168	148

Table 3.--Growing Season--Continued

(Recorded in the period 1961-90 at Fort Assinniboine, Guilford, Havre, Rudyard, and Simpson, Montana)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
RUDYARD			
9 years in 10	146	125	106
8 years in 10	154	132	113
5 years in 10	170	144	126
2 years in 10	186	157	139
1 year in 10	194	163	146
SIMPSON			
9 years in 10	127	108	76
8 years in 10	135	115	84
5 years in 10	150	127	100
2 years in 10	164	140	116
1 year in 10	172	146	124

Formation and Classification of the Soils

This section relates the soils in the county to the major factors of soil formation and describes the system of soil classification. The classification and extent of the soils in this county 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 by temperature and precipitation. In Hill County winters are cold, springs are cool and moist, and summers are hot and dry. Arctic cold waves, and gusty warm southwest winds called Chinooks, are a part of seasonal weather patterns. Erosion and alternate freezing and thawing break rocks into 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. 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 temperatures and low precipitation generally contain less organic matter and are light colored.

The average annual precipitation ranges from about 10 to 12 inches in the majority of the county to 22 inches in the Bear Paw Mountains. The average annual temperature varies from 38 to 45 degrees F.

Living Organisms

Living organisms are active in the formation of soils. Plants, animals, insects, and micro-organisms affect gains or losses in the organic matter in the soil, plant nutrients, and changes in porosity and structure.

Roots, rodents, and insects penetrate the soil and alter its structure. Leaves, roots, and entire plants that remain on the surface layer are changed to humus by

micro-organisms, by chemicals in the soil, and by insects. Fungi and algae also contribute to the decomposition of bedrock. Animals increase porosity by burrowing through the soil and leaving open channels for the movement of water and air. Common rodents in the area are ground squirrels, badgers, prairie dogs, and rabbits.

Vegetation on the plains of Hill County consists of short grasses, mid grasses, and shrubs. Tall grasses, Ponderosa pine, Douglas fir, and lodgepole pine are in the Bear Paw Mountains.

Topography

Topography is determined by glaciation and the age and resistance of geologic formations to erosion by wind and water. It influences soil development through its effect on drainage and runoff.

On uplands the number and distinctness of soil horizons generally decrease as the slope increases. Soils on steep slopes with rapid runoff have many characteristics similar to those of soils formed in arid climates. An example is the Hillon soil that is moderately steep or steep. Most common in Hill County are the nearly level to moderately sloping soils. The Telstad soil, nearly level to moderately sloping, is an example.

Parent Material

Most soils in the county formed in glacial till. Some of the soils formed in alluvium derived from mixed sources, and a few soils formed in material that weathered from shale or sandstone. Soils in the Bear Paw Mountains formed from igneous rocks.

Soils forming in glacial till, such as the loamy Telstad and Joplin series or the clayey Scobey and Kevin series, have a high bulk density. Soils that formed in sandstone and shale, such as the Cabbart and Delpoint series, are generally loamy. Soils forming from shale, like the Neldore and Bascovy series, are clayey. Soils forming in mixed alluvium and derived from glacial till, sandstone, or shale, are loamy. The Havre series is an example of this. Soils that formed from igneous rocks, such as the Perma series, are loamy.

Most soils on the glaciated till plain have accumulated lime, sodium, and other salts from the parent material. These accumulations cause soils to range from neutral to strongly alkaline. Salts and sodium make these soils slightly to moderately saline or sodic. This limits the kind and amount of plant cover on the soil. Soils in the Bear Paw Mountains have no accumulations and are slightly acid to neutral.

Time

Changes taking place in a soil over long periods of time are called soil genesis. Distinct horizons, or layers, develop in the soils as a result of these changes. The length of time parent materials have been in place and exposed to climate and living organisms is generally reflected in the degree to which the soil profile has developed. The kinds and arrangement of layers are called the soil morphology. They are described in terms of color, texture, structure, consistence, thickness, permeability, and chemistry.

Soils are classified as ranging from young to mature. The age of a soil is determined from the thickness of the A horizon, content of clay and organic matter, 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. Havre loam, 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 has occurred.

The Evanston soil formed in parent material similar to the Havre loam, but is much older. This soil formed in alluvium on uplands. It contains enough organic matter to have a dark colored A horizon, it has a distinct clay accumulation in a Bt horizon, and nearly all the carbonates have been leached to a depth of about 13 inches.

Many of the sloping and steep soils and the shallow and very shallow soils appear to have been in the formation process about as long as some of the more developed, less sloping soils. However, erosion has removed the soil as fast as it formed. In this case 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. 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 table "Classification of the Soils" in Parts I and II of this publication shows the classification of the soils in the county. 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 variable 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 (*Arg*, meaning having an argillic horizon, 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, montmorillonitic 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 substratum can differ within a series. An example is the Bearpaw series.

Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Absher-----	Fine, montmorillonitic Typic Natriboralfs
Ambrant-----	Coarse-loamy, mixed, frigid Typic Ustochrepts
Attewan-----	Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls
Bascovy-----	Fine, montmorillonitic, frigid Leptic Udic Haplusterts
Bearpaw-----	Fine, montmorillonitic Typic Argiborolls
Beaverton-----	Loamy-skeletal over sandy or sandy-skeletal, mixed Typic Argiborolls
Belain-----	Coarse-loamy, mixed Typic Haploborolls
Benz-----	Fine-loamy, mixed (calcareous), frigid Aridic Ustorthents
Blacksheep-----	Loamy, mixed (calcareous), frigid, shallow Aridic Ustorthents
Bowery-----	Fine-loamy, mixed Pachic Haploborolls
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
Cozberg-----	Coarse-loamy, mixed Aridic Haploborolls
Creed-----	Fine, montmorillonitic Typic Natriboralfs
Degradand-----	Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls
Delpoint-----	Fine-loamy, mixed, frigid Aridic Ustochrepts
Dimmick-----	Fine, montmorillonitic, frigid Vertic Epiaquolls
Eagleton-----	Fine-loamy, mixed, frigid Cumulic Endoaquolls
Elkner-----	Coarse-loamy, mixed Typic Cryochrepts
Elloam-----	Fine, montmorillonitic Typic Natriboralfs
Enbar-----	Fine-loamy, mixed Cumulic Haploborolls
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
Garlet-----	Loamy-skeletal, mixed Typic Cryochrepts
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
Hedoes-----	Coarse-loamy, mixed Pachic Haploborolls
Hillon-----	Fine-loamy, mixed (calcareous), frigid Aridic Ustorthents
Hingham-----	Coarse-silty, mixed Aridic Haploborolls
Joplin-----	Fine-loamy, mixed Aridic Argiborolls
Kenilworth-----	Fine-loamy, mixed Aridic Argiborolls
Kevin-----	Fine-loamy, mixed Aridic Argiborolls
Kobase-----	Fine, montmorillonitic, frigid Aridic Ustochrepts
Korchea-----	Fine-loamy, mixed (calcareous), frigid Mollic Ustifluvents
Kremlin-----	Fine-loamy, mixed Aridic Haploborolls
Laceycreek-----	Fine loamy, mixed Pachic Udic Argiborolls

Classification of the Soils--Continued

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Lonesome-----	Sandy over loamy, mixed (calcareous), frigid Aridic Ustorthents
Lonna-----	Fine-silty, mixed, frigid Aridic Ustochrepts
Lostriver-----	Fine, montmorillonitic (calcareous), frigid Aridic Ustifluvents
Macar-----	Fine-loamy, mixed, frigid Typic Ustochrepts
Marias-----	Fine, montmorillonitic, frigid Chromic Udic Haplusterts
Marmarth-----	Fine-loamy, mixed Aridic Argiborolls
Marvan-----	Fine, montmorillonitic, frigid Sodic Haplusterts
*McKenzie-----	Fine, montmorillonitic, frigid Chromic Endoaquerts
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
Obrien-----	Fine-loamy, mixed Pachic Haploborolls
Perma-----	Loamy-skeletal, mixed Typic Haploborolls
Phillips-----	Fine, montmorillonitic Typic Eutroboralfs
Scobey-----	Fine, montmorillonitic Aridic Argiborolls
Straw-----	Fine-loamy, mixed Cumulic Haploborolls
Tally-----	Coarse-loamy, mixed Typic Haploborolls
Telstad-----	Fine-loamy, mixed Aridic Argiborolls
Thibadeau-----	Fine-loamy, mixed (calcareous), frigid Oxyaquic Ustifluvents
Toeny-----	Fine, montmorillonitic Typic Natriboralfs
Tinsley-----	Sandy-skeletal, mixed, frigid Typic Ustorthents
Twilight-----	Coarse-loamy, mixed, frigid Aridic Ustochrepts
Vida-----	Fine-loamy, mixed Typic Argiborolls
Waltham-----	Fine, montmorillonitic Typic Natriboralfs
Warwood-----	Fine-loamy, mixed Glossic Cryoboralfs
Weingart-----	Fine, montmorillonitic Typic Natriboralfs
Wheatbelt-----	Very-Fine, montmorillonitic, frigid Sodic Epiaquerts
Whitlash-----	Loamy-skeletal, mixed Lithic Haploborolls
Williams-----	Fine-loamy, mixed Typic Argiborolls
Winkler-----	Loamy-skeletal, mixed, frigid Typic Ustochrepts
Yamacall-----	Fine-loamy, mixed, frigid Aridic Ustochrepts
Yawdim-----	Clayey, montmorillonitic (calcareous), frigid, shallow Aridic Ustorthents
Yetull-----	Mixed, frigid Typic Ustipsamments
Zahill-----	Fine-loamy, mixed (calcareous), frigid Typic Ustorthents

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
13A	McKenzie clay, 0 to 1 percent slopes-----	5,079	0.3
16B	Degrad loam, 0 to 4 percent slopes-----	2,645	0.1
22E	Hillon loam, 15 to 25 percent slopes-----	12,492	0.7
22F	Hillon loam, 25 to 60 percent slopes-----	20,334	1.1
24A	Hanly loamy fine sand, 0 to 2 percent slopes-----	894	0.1
27B	Attewan loam, 0 to 4 percent slopes-----	1,385	0.1
28A	Nishon clay loam, 0 to 1 percent slopes-----	10,082	0.5
30A	Marvan clay, 0 to 2 percent slopes-----	3,365	0.2
30C	Marvan clay, 2 to 8 percent slopes-----	836	*
31A	Ferd loam, 0 to 2 percent slopes-----	2,828	0.2
32A	Kobase clay loam, 0 to 2 percent slopes-----	5,133	0.3
33A	Phillips loam, 0 to 2 percent slopes-----	9,928	0.5
34A	Dimnick clay, 0 to 1 percent slopes-----	4,069	0.2
36A	Chinook fine sandy loam, 0 to 2 percent slopes-----	10,153	0.5
36C	Chinook fine sandy loam, 2 to 8 percent slopes-----	4,173	0.2
37A	Evanston loam, 0 to 2 percent slopes-----	21,330	1.1
51A	Wheatbelt clay, 0 to 1 percent slopes-----	13,996	0.8
53D	Beaverton gravelly loam, 4 to 15 percent slopes-----	460	*
55A	Benz clay loam, 0 to 2 percent slopes-----	1,198	0.1
60A	Havre loam, 0 to 2 percent slopes-----	8,899	0.5
62C	Weingart complex, 2 to 8 percent slopes-----	3,110	0.2
72F	Zahill clay loam, 25 to 60 percent slopes-----	20,197	1.1
74B	Marias silty clay, 0 to 4 percent slopes-----	3,481	0.2
75B	Farnuf loam, 0 to 4 percent slopes-----	745	*
75C	Farnuf loam, 4 to 8 percent slopes-----	742	*
76B	Bowery loam, 0 to 4 percent slopes-----	609	*
76C	Bowery loam, 4 to 8 percent slopes-----	1,479	0.1
76D	Bowery loam, 8 to 15 percent slopes-----	1,282	0.1
78A	Lostriver clay, 0 to 2 percent slopes-----	4,439	0.2
79B	Yamacall loam, 0 to 4 percent slopes-----	2,050	0.1
81A	Glendive fine sandy loam, 0 to 2 percent slopes-----	4,618	0.3
84A	Bullhook clay loam, 0 to 2 percent slopes-----	4,872	0.3
90A	Harlake clay, 0 to 2 percent slopes-----	3,208	0.2
92B	Marmarth loam, 0 to 4 percent slopes-----	1,127	0.1
93D	Tally fine sandy loam, 4 to 15 percent slopes-----	388	*
96B	Fortbenton fine sandy loam, 0 to 4 percent slopes-----	24,270	1.3
96C	Fortbenton fine sandy loam, 4 to 8 percent slopes-----	3,142	0.2
98B	Kremlin loam, 0 to 4 percent slopes-----	20,185	1.1
99A	Thibadeau clay loam, 0 to 2 percent slopes-----	4,562	0.2
110D	Laceycreek loam, 8 to 15 percent slopes-----	1,000	*
115B	Thoeny-Elloam complex, 0 to 4 percent slopes-----	15,222	0.8
171C	Delpoint-Cabbart loams, 2 to 8 percent slopes-----	2,030	0.1
172C	Delpoint complex, 2 to 8 percent slopes-----	3,272	0.2
182F	Garlet-Elkner complex, 25 to 70 percent slopes-----	6,577	0.4
191F	Winkler-Ambrant complex, 25 to 60 percent slopes-----	5,104	0.3
200F	Badland-----	2,326	0.7
203F	Cabba-Rock outcrop complex, 25 to 60 percent slopes-----	630	*
204F	Cabba-Zahill complex, 25 to 60 percent slopes-----	2,723	0.2
205F	Cabba-Macar loams, 15 to 60 percent slopes-----	450	*
211F	Cabbart-Rock outcrop complex, 25 to 60 percent slopes-----	8,576	0.4
212F	Cabbart-Hillon loams, 25 to 60 percent slopes-----	9,378	0.5
213E	Cabbart-Yawdim complex, 8 to 25 percent slopes-----	591	*
221D	Hillon-Kevin clay loams, 8 to 15 percent slopes-----	5,827	0.3
224D	Hillon-Joplin loams, 8 to 15 percent slopes-----	22,250	1.2
241A	Hanly loamy fine sand, 0 to 2 percent slopes, occasionally flooded-----	3,000	0.2
251D	Bascovy-Neldore clays, 2 to 15 percent slopes-----	3,454	0.2
262A	Absher-Gerdrum complex, 0 to 2 percent slopes-----	2,121	0.1
272C	Attewan-Tinsley complex, 2 to 8 percent slopes-----	2,988	0.2
304A	Marvan-Nobe clays, 0 to 2 percent slopes-----	1,311	0.1
309A	Marvan complex, 0 to 2 percent slopes-----	5,551	0.3
311B	Ferd-Creed-Gerdrum complex, 0 to 4 percent slopes-----	15,523	0.8

*See footnote at end of table

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
321A	Kobase clay loam, calcareous, 0 to 2 percent slopes-----	1,987	0.1
331B	Phillips-Elloam complex, 0 to 4 percent slopes-----	163,861	8.8
334B	Phillips-Kevin complex, 0 to 4 percent slopes-----	54,388	2.9
362C	Chinook-Yetull complex, 2 to 10 percent slopes-----	2,250	0.1
375B	Evanston-Lonna loams, 0 to 4 percent slopes-----	2,096	0.1
381A	Ethridge clay loam, 0 to 2 percent slopes-----	11,207	0.6
400F	Rubble land-Rock outcrop complex-----	546	*
402A	Gerdrum-Absher-Creed complex, 0 to 2 percent slopes-----	6,223	0.3
421C	Joplin-Hillon loams, 2 to 8 percent slopes-----	133,630	7.2
441C	Kevin-Hillon clay loams, 2 to 8 percent slopes-----	59,643	3.2
442C	Kevin-Elloam clay loams, 2 to 8 percent slopes-----	15,180	0.8
501B	Telstad-Hillon loams, 0 to 4 percent slopes-----	31,407	1.7
503B	Telstad-Joplin loams, 0 to 4 percent slopes-----	402,831	21.6
503C	Telstad-Joplin loams, 4 to 8 percent slopes-----	8,706	0.5
522A	Elloam-Absher complex, 0 to 2 percent slopes-----	2,738	0.2
530F	Warwood loam, 15 to 45 percent slopes-----	4,086	0.2
561B	Scobey-Kevin clay loams, 0 to 4 percent slopes-----	236,837	12.7
561C	Scobey-Kevin clay loams, 4 to 8 percent slopes-----	6,356	0.3
564B	Scobey-Hillon clay loams, 0 to 4 percent slopes-----	6,986	0.4
571D	Chinook-Cozberg-Yetull fine sandy loams, 4 to 15 percent slopes-----	4,379	0.2
573B	Cozberg-Chinook fine sandy loams, 0 to 4 percent slopes-----	4,778	0.3
603A	Havre-Marlake clay loams, 0 to 2 percent slopes-----	15,035	0.8
604A	Havre-Glendive complex, 0 to 2 percent slopes-----	6,030	0.3
611B	Hingham-Lonna loams, 0 to 4 percent slopes-----	6,981	0.4
661C	Twilight-Blacksheep fine sandy loams, 2 to 8 percent slopes-----	2,894	0.2
671B	Bearpaw-Vida clay loams, 0 to 4 percent slopes-----	20,006	1.1
671C	Bearpaw-Vida clay loams, 4 to 8 percent slopes-----	17,866	1.0
671D	Bearpaw-Vida clay loams, 8 to 15 percent slopes-----	5,214	0.3
674B	Bearpaw-Waltham clay loams, 0 to 4 percent slopes-----	953	0.1
696C	Vida-Zahill-Bearpaw clay loams, 2 to 8 percent slopes-----	9,143	0.5
701D	Yetull-Busby fine sandy loams, 4 to 15 percent slopes-----	1,964	0.1
721E	Zahill-Vida clay loams, 15 to 25 percent slopes-----	10,758	0.6
722D	Zahill-Vida clay loams, 8 to 15 percent slopes-----	4,925	0.3
725F	Zahill-Rock outcrop complex, 25 to 60 percent slopes-----	5,414	0.3
729F	Zahill-O'Brien clay loams, 15 to 60 percent slopes-----	16,669	0.9
732C	Yetull-Lonesome loamy fine sands, 0 to 8 percent slopes-----	3,201	0.2
761D	Hedoes-Belain loams, 4 to 15 percent slopes-----	331	*
761F	Hedoes-Belain loams, 15 to 35 percent slopes-----	2,208	0.1
763E	Laceycreek loam, moist, 8 to 25 percent slopes-----	10,281	0.6
791C	Yamacall-Hillon loams, 2 to 8 percent slopes-----	1,738	0.1
795C	Yamacall-Benz clay loams, 2 to 8 percent slopes-----	4,671	0.3
799C	Yamacall clay loam, 2 to 8 percent slopes-----	2,413	0.1
801B	Williams-Vida loams, 0 to 4 percent slopes-----	1,220	*
801C	Williams-Vida loams, 4 to 8 percent slopes-----	3,176	0.2
812A	Glendive fine sandy loam, calcareous, 0 to 2 percent slopes-----	895	0.1
831A	Straw-Korchea loams, 0 to 2 percent slopes-----	1,525	0.1
832A	Nesda complex, 0 to 2 percent slopes-----	343	*
833A	Enbar-Straw-Eagleton loams, 0 to 2 percent slopes-----	4,812	0.3
842A	Bullhook-Nobe complex, 0 to 2 percent slopes-----	1,887	0.1
883F	Perma-Whitlash complex, 25 to 70 percent slopes-----	26,345	1.4
892F	Whitlash-Belain-Rock outcrop complex, 25 to 60 percent slopes-----	1,115	0.1
895F	Whitlash-Perma-Rock outcrop complex, 25 to 70 percent slopes-----	3,198	0.2
896F	Perma-Whitlash, cool-Rock outcrop complex, 25 to 70 percent slopes-----	13,327	0.7
899F	Zahill-Rock outcrop-Whitlash complex, 15 to 60 percent slopes-----	10,409	0.6
911F	Belain-Whitlash, moist-Hedoes complex, 15 to 60 percent slopes-----	8,808	0.5
915F	Belain-Whitlash-Hedoes complex, 15 to 45 percent slopes-----	9,635	0.5
951B	Kenilworth-Fortbenton fine sandy loams, 0 to 4 percent slopes-----	16,535	0.9
962B	Fortbenton loam, 0 to 4 percent slopes-----	29,324	1.6
965B	Fortbenton-Chinook fine sandy loams, 0 to 6 percent slopes-----	13,159	0.7
968C	Fortbenton-Hillon complex, 2 to 8 percent slopes-----	14,985	0.8
968D	Hillon-Fortbenton complex, 8 to 25 percent slopes-----	2,229	0.1

*See footnote at end of table

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
971F	Neldore-Bascovy silty clays, 25 to 60 percent slopes-----	2,412	0.1
974F	Neldore-Hillon complex, 25 to 70 percent slopes-----	4,340	0.2
DA	Denied access-----	3,840	0.2
M-W	Miscellaneous water-----	20	*
W	Water-----	10,562	0.6
	Total-----	1,866,600	100.0

* Less than 0.1 percent. The combined extent of the soils assigned an asterisk in the "Percent" column is about 1.1 percent of the county.

Soil Series and Detailed Map Units

In this section, arranged in alphabetical order, each soil series recognized in the county 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 county is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (U.S. Dep. Agric., 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (U.S. Dep. Agric., 1975). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units on the detailed maps in Part III of this survey represent the soils or miscellaneous areas in the county. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given in Part II of this survey.

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

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree

of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, saline is a phase of the Marvan 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. Telstad-Joplin loams, 0 to 4 percent slopes is an example.

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

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

For general and detailed information about managing each map unit, see the following sections in Part II of this publication:

- "Range" section
- "Agronomy" section
- "Recreation" section
- "Wildlife Habitat" section
- "Engineering" and "Soil Properties" sections
- "Forest Land" section

Absher Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Moderately well drained

Permeability: Very slow (0.06 inch/hour)

Landform: Till plains and stream terraces

Parent material: Glacial till and alluvium

Slope range: 0 to 2 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Typic Natriboralfs

Typical Pedon

Absher clay, in an area of Gerdrum-Absher-Creed complex, 0 to 2 percent slopes, in rangeland; 900 feet south and 2,100 feet east of the northwest corner of sec. 16, T. 35 N., R. 10 E.

E—0 to 2 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak medium platy structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine pores; neutral; abrupt smooth boundary.

Btn—2 to 8 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to strong medium subangular blocky; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine pores; common distinct clay films on faces of peds; mildly alkaline; clear wavy boundary.

Btknyz—8 to 12 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; many distinct clay films on faces of peds; few fine masses of gypsum and other salts; slightly effervescent; moderately alkaline; clear wavy boundary.

Bknyz1—12 to 20 inches; light brownish gray (10YR 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; common very fine pores; few medium soft masses of lime; few fine masses of gypsum and other salts; strongly effervescent; moderately alkaline; clear wavy boundary.

Bknyz2—20 to 34 inches; light gray (2.5Y 7/2) clay, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; common very fine pores; common medium soft masses of lime; few fine soft masses of gypsum and other salts; strongly effervescent; moderately alkaline; clear wavy boundary.

Bknyz3—34 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very

fine roots; common very fine pores; common medium soft masses of lime; common medium soft masses of gypsum and other salts; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F (60 to 68 degrees, summer)

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to Bknyz horizon: 6 to 20 inches

E horizon

Hue—2.5Y, 10YR, or 7.5YR
Value—6 or 7 dry; 3, 4, or 5 moist
Chroma—1, 2, or 3
Clay content—40 to 55 percent
Electrical conductivity—4 to 8 mmhos/cm
Reaction—pH 6.6 to 8.4

Btn horizon

Hue—2.5Y, 7.5YR, or 10YR
Value—4, 5, or 6 dry; 4 or 5 moist
Chroma—1, 2, or 3
Texture—Silty clay, clay, or clay loam
Clay content—35 to 60 percent
Content of 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 8.4

Btknyz horizon

Hue—2.5Y, 10YR, or 7.5YR
Value—4, 5, or 6 dry; 4 or 5 moist
Chroma—2 or 3
Texture—Clay loam, clay, or silty clay
Clay content—35 to 50 percent
Content of rock fragments—0 to 20 percent pebbles
Calcium carbonate equivalent—5 to 15 percent
Electrical conductivity—8 to 16 mmhos/cm
Sodium adsorption ratio—18 to 70
Gypsum—1 to 5 percent
Reaction—pH 7.9 to 9.6

Bknyz horizon

Hue—2.5Y, 10YR, or 7.5YR
Value—5, 6, or 7 dry; 4, 5, or 6 moist
Chroma—2, 3, or 4
Texture—Clay loam, silty clay, clay, or silty clay loam

Clay content—35 to 50 percent
Content of rock fragments—0 to 20 percent pebbles
Calcium carbonate equivalent—4 to 15 percent
Electrical conductivity—16 to 30 mmhos/cm
Sodium adsorption ratio—23 to 70
Gypsum—1 to 5 percent
Reaction—pH 7.9 to 9.6

262A—Absher-Gerdrum complex, 0 to 2 percent slopes

Setting

Landform: Absher—till plains; Gerdrum—till plains

Position on landform: Absher—microlows; Gerdrum—microhighs

Slope: Absher—0 to 2 percent; Gerdrum—0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Absher and similar soils: 60 percent
Gerdrum and similar soils: 25 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
Marvan and similar soils: 0 to 6 percent
Benz and similar soils: 0 to 5 percent
Soils that have slopes more than 2 percent: 0 to 3 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: About 4.0 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: About 6.0 inches

Ambrant Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid in the upper 0 to 33 inches (2.0 to 6.0 inches/hour); rapid below this depth (6.0 to 20.0 inches/hour)
Landform: Mountains
Parent material: Colluvium
Slope range: 25 to 60 percent
Annual precipitation: 17 to 20 inches
Annual air temperature: 40 to 43 degrees F
Frost-free period: 70 to 90 days

Taxonomic Class: Coarse-loamy, mixed, frigid Typic Ustochrepts

Typical Pedon

Ambrant sandy loam, in an area of Winkler-Ambrant complex, 25 to 60 percent slopes, in woodland; 1,400 feet south and 600 feet west of the northeast corner of sec. 28, T. 28 N., R. 17 E.

Oi—2 inches to 0; forest litter of slightly decomposed needles, twigs, and leaves.

E1—0 to 6 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, slightly sticky and nonplastic; common very fine roots; many very fine pores; slightly acid; clear wavy boundary.

E2—6 to 18 inches; pale brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 4/3) moist; weak very fine subangular blocky structure; loose, nonsticky and nonplastic; common very fine roots; 20 percent pebbles; neutral; clear wavy boundary.

E and Bt—18 to 33 inches; 80 percent light brownish gray (10YR 6/2) gravelly coarse sandy loam, dark grayish brown (10YR 4/2) moist (E part); 20 percent grayish brown (10YR 5/2) sandy loam lamellae, dark grayish brown (10YR 4/2) moist (Bt part); weak very fine granular structure; loose, nonsticky and nonplastic; common very fine roots; 20 percent pebbles; neutral; gradual wavy boundary.

2C—33 to 60 inches; light brownish gray (10YR 6/2) very gravelly loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; 35 percent pebbles; moderately acid.

Range in Characteristics

E1 horizon

Value—5, 6, or 7 dry; 3 or 4 moist
 Chroma—2 or 3
 Clay content—5 to 15 percent
 Content of rock fragments—0 to 15 percent—0 to 5 percent cobbles, stones, or boulders, 0 to 10 percent angular pebbles
 Reaction—pH 5.6 to 7.3

E2 horizon

Hue—10YR or 2.5Y
 Value—6 or 7 dry; 4 or 5 moist
 Chroma—1, 2, or 3
 Texture—Coarse sandy loam or loamy coarse sand
 Clay content—5 to 15 percent
 Content of rock fragments—0 to 35 percent—0 to 10 percent cobbles, stones, or boulders, 5 to 35 percent angular pebbles
 Reaction—pH 5.6 to 7.3

E and Bt horizons

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

2C horizon

Hue—10YR or 2.5Y
 Value—5, 6, or 7 dry; 4 or 5 moist
 Chroma—1, 2, 3, or 4
 Texture—Coarse sandy loam, coarse sand, loamy coarse sand, sand, or loamy sand
 Clay content—0 to 5 percent
 Content of rock fragments—15 to 60 percent—10 to 25 percent cobbles and stones, 10 to 45 percent angular pebbles
 Reaction—pH 5.6 to 7.3

Attewan Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Moderate in the upper 0 to 27 inches (0.6 to 2.0 inches/hour); rapid below this depth (6.0 to 20.0 inches/hour)

Landform: Kames, eskers, and stream terraces

Parent material: Glacial outwash

Slope range: 0 to 8 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

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

Typical Pedon

Attewan loam, 0 to 4 percent slopes, in an area of rangeland; 2,100 feet south and 200 feet east of the northwest corner of sec. 28, T. 32 N., R. 15 E.

A—0 to 6 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and plastic; common very fine roots; neutral; clear smooth boundary.

Bt1—6 to 11 inches; brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate very coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, sticky and plastic; common very fine roots; common very fine pores; many faint clay films on faces of pedis; mildly alkaline; clear wavy boundary.

Bt2—11 to 17 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 3/3) moist; weak very coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, sticky and plastic; common very fine roots; common very fine pores; common faint clay films on faces of pedis; mildly alkaline; gradual wavy boundary.

Bk—17 to 27 inches; light gray (10YR 7/2) loam, pale brown (10YR 6/3) moist; moderate medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine pores; many fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

2C1—27 to 31 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; few

very fine roots; 60 percent pebbles; lime coatings on underside of pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

2C2—31 to 37 inches; pale brown (10YR 6/3) very gravelly loamy sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; 40 percent pebbles; lime coatings on underside of pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

2C3—37 to 60 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; 55 percent pebbles; lime coatings on underside of pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics*A 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

Content of rock fragments—0 to 15 percent—0 to 5 percent greater than 3-inch stones and cobbles, 0 to 10 percent less than 3-inch pebbles

Reaction—pH 6.1 to 7.3

Bt horizon

Hue—10YR or 2.5Y

Value—4, 5, or 6 dry; 3 or 4 moist

Chroma—2 or 3

Texture—Clay loam, sandy clay loam, or loam

Clay content—20 to 35 percent

Content of rock fragments—0 to 25 percent—0 to 5 percent greater than 3-inch stones and cobbles, 0 to 20 percent less than 3-inch pebbles

Reaction—pH 6.6 to 7.8

Bk horizon

Hue—10YR or 2.5Y

Value—5, 6, 7, or 8 dry; 4, 5, or 6 moist

Chroma—2, 3, 4, or 6

Texture—Loam, clay loam, silt loam, sandy clay loam, or sandy loam

Clay content—15 to 30 percent

Content of rock fragments—0 to 30 percent—0 to 5 percent stones and cobbles, 0 to 25 percent pebbles

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.4 to 8.4

2C horizon

Hue—2.5Y or 10YR
 Value—4, 5, or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Texture—Loamy sand, sand, loamy coarse sand,
 or coarse sand
 Clay content—0 to 10 percent
 Content of rock fragments—35 to 75 percent—
 0 to 15 percent stones and cobbles, 35 to 60
 percent pebbles
 Reaction—pH 7.4 to 8.4

27B—Attewan loam, 0 to 4 percent slopes**Setting**

Landform: Stream terraces
Slope: 0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Attewan and similar soils: 85 percent

Minor Components

Tinsley and similar soils: 0 to 4 percent
 Yetull and similar soils: 0 to 3 percent
 Soils that have limy surface layers: 0 to 5 percent
 Soils that have slopes more than 4 percent: 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: Glacial outwash
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 5.0 inches

272C—Attewan-Tinsley complex, 2 to 8 percent slopes**Setting**

Landform: Attewan—kames and eskers; Tinsley—
 kames and eskers
Position on landform: Attewan—back slopes and foot
 slopes; Tinsley—shoulders

Slope: Attewan—2 to 8 percent; Tinsley—2 to 8
 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition**Major Components**

Attewan and similar soils: 60 percent

Tinsley and similar soils: 25 percent

Minor Components

Yetull and similar soils: 0 to 3 percent
 Tinsley, extremely gravelly: 0 to 5 percent
 Soils that have slopes more than 8 percent: 0 to 7
 percent

Major Component Description**Attewan**

Surface layer texture: 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: About 5.0 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: About 1.5 inches

200F—Badland**Setting**

Landform: Hills
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Badland: 85 percent

Minor Components

Cabbart and similar soils: 0 to 8 percent
 Havre and similar soils: 0 to 2 percent

Benz and similar soils: 0 to 2 percent
Nobe and similar soils: 0 to 3 percent

Major Component Description

Definition: Steep or very steep, barren land dissected by many intermittent drainage channels

Dominant parent material: Semiconsolidated sedimentary beds

Flooding: None

Bascovy Series

Depth class: Moderately deep (20 to 40 inches)

Drainage class: Well drained

Permeability: Very slow (0.06 inch/hour)

Landform: Hills

Parent material: Semiconsolidated shale

Slope range: 2 to 60 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic, frigid Leptic Udic Haplusterts

Typical Pedon

Bascovy silty clay, in an area of Neldore-Bascovy silty clays, 25 to 60 percent slopes, in rangeland; 1,200 feet north and 1,250 feet east of the southwest corner of sec. 6, T. 34 N., R. 16 E.

A1—0 to 1 inch; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; strong very fine granular structure; slightly hard, firm, very sticky and very plastic; few very fine and fine roots; few very fine pores; neutral; abrupt smooth boundary.

A2—1 to 5 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine and fine roots; common very fine pores; neutral; clear smooth boundary.

Bw—5 to 11 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine pores; slightly acid; clear wavy boundary.

Bssy—11 to 15 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak coarse

subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine pores; few slickensides intersecting at 40 degrees from horizontal; common fine masses and threads of gypsum; slightly acid; clear wavy boundary.

BC—15 to 26 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak fine and medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; strongly acid; gradual wavy boundary.

Cr—26 to 60 inches; gray (N 6/0) semiconsolidated shale, very dark grayish brown (2.5Y 3/2) moist; few fine masses of gypsum; strongly acid.

Range in Characteristics

Depth to Cr horizon: 20 to 40 inches

A horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 3, 4, or 5 moist

Chroma—1, 2, or 3

Texture—Clay or silty clay

Clay content—40 to 60 percent

Electrical conductivity—0 to 4 mmhos/cm

Reaction—pH 6.6 to 8.4

Bw horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—1, 2, or 3

Texture—Clay or silty clay

Clay content—40 to 60 percent

Electrical conductivity—0 to 4 mmhos/cm

Reaction—pH 6.1 to 8.4

Bssy horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—1, 2, or 3

Texture—Clay or silty clay

Clay content—40 to 60 percent

Gypsum—1 to 5 percent

Electrical conductivity—0 to 4 mmhos/cm

Reaction—pH 6.1 to 8.4

BC horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—1 or 2

Texture—Clay or silty clay

Clay content—40 to 60

Electrical conductivity—0 to 8 mmhos/cm

Reaction—pH 5.1 to 8.4

251D—Bascovy-Neldore clays, 2 to 15 percent slopes

Setting

Landform: Bascovy—hills; Neldore—hills
Position on landform: Bascovy—back slopes and foot slopes; Neldore—shoulders
Slope: Bascovy—2 to 15 percent; Neldore—2 to 15 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 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 3 percent
 Marvan, saline soils: 0 to 3 percent
 Weingart and similar soils: 0 to 3 percent
 Soils that have slopes more than 15 percent: 0 to 4 percent
 Very shallow soils: 0 to 1 percent
 Areas of rock outcrop: 0 to 1 percent

Major Component Description

Bascovy

Surface layer texture: Clay
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 4.0 inches

Neldore

Surface layer texture: Clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 2.3 inches

Bearpaw 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 and hills
Parent material: Glacial till
Slope range: 0 to 15 percent
Annual precipitation: 13 to 17 inches
Annual air temperature: 41 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine, montmorillonitic Typic Argiborolls

Typical Pedon

Bearpaw clay loam, in an area of Bearpaw-Vida clay loams, 0 to 4 percent slopes, in cropland; 2,400 feet north and 2,200 feet west of the southeast corner of sec. 21, T. 30 N., R. 15 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong very fine granular structure; hard, firm, sticky and plastic; many very fine roots; many very fine pores; neutral; abrupt smooth boundary.

Bt—5 to 13 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate fine and medium prismatic structure parting to strong fine and medium subangular blocky; very hard, extremely firm, very sticky and very plastic; many very fine roots; many very fine pores; many distinct clay films on faces of peds; neutral; clear smooth boundary.

Bk1—13 to 21 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine roots; many very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—21 to 41 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, firm, very sticky and plastic; few very fine roots; many very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—41 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; very hard, firm, very sticky and very plastic; many very fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline.

Range in Characteristics*Ap horizon*

Value—3, 4, or 5 dry; 2 or 3 moist
 Chroma—2 or 3
 Clay content—27 to 35 percent
 Content of rock fragments—0 to 15 percent—0
 to 5 percent cobbles, 0 to 10 percent pebbles
 Reaction—pH 6.1 to 7.8

Bt horizon

Value—4 or 5 dry; 3 or 4 moist
 Chroma—2 or 3
 Texture—Clay loam or clay
 Clay content—35 to 50 percent
 Content of rock fragments—0 to 20 percent—0
 to 5 percent cobbles, 0 to 15 percent pebbles
 Reaction—pH 6.6 to 7.8

Bk horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2 or 3
 Texture—Clay loam, silty clay loam, or clay
 Clay content—30 to 45 percent
 Content of rock fragments—0 to 20 percent—0
 to 5 percent cobbles, 0 to 15 percent pebbles
 Calcium carbonate equivalent—5 to 15 percent
 Reaction—pH 7.4 to 8.4

671B—Bearpaw-Vida clay loams, 0 to 4 percent slopes**Setting**

Landform: Bearpaw—till plains; Vida—till plains
Position on landform: Bearpaw—foot slopes; Vida—
 back slopes
Slope: Bearpaw—0 to 4 percent; Vida—0 to 4 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition**Major Components**

Bearpaw and similar soils: 60 percent
 Vida and similar soils: 25 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Zahill and similar soils: 0 to 8 percent
 Obrien and similar soils: 0 to 2 percent
 Bearpaw clay: 0 to 1 percent
 Soils that have slopes more than 4 percent: 0 to 3
 percent

Major Component Description**Bearpaw**

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: About 9.3 inches

Vida

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: About 8.1 inches

671C—Bearpaw-Vida clay loams, 4 to 8 percent slopes**Setting**

Landform: Bearpaw—till plains; Vida—till plains
Position on landform: Bearpaw—foot slopes; Vida—
 back slopes (fig. 2)
Slope: Bearpaw—4 to 8 percent; Vida—4 to 8 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition**Major Components**

Bearpaw and similar soils: 55 percent
 Vida and similar soils: 30 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Zahill and similar soils: 0 to 8 percent
 Bearpaw clay: 0 to 1 percent
 Soils that have slopes less than 4 percent: 0 to 1
 percent
 Obrien and similar soils: 0 to 1 percent
 Soils that have slopes more than 8 percent: 0 to 3
 percent

Major Component Description**Bearpaw**

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till



Figure 2.—Map unit 671C, Bearpaw-Vida clay loams, 4 to 8 percent slopes in the foreground. Map unit 191F, Winkler-Ambrant complex, 25 to 60 percent slopes in the background with forest land native plant cover type.

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 9.3 inches

Vida

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: About 8.1 inches

671D—Bearpaw-Vida clay loams, 8 to 15 percent slopes

Setting

Landform: Bearpaw—hills; Vida—hills

Position on landform: Bearpaw—back slopes; Vida—shoulders

Slope: Bearpaw—8 to 15 percent; Vida—8 to 15 percent

Mean annual precipitation: 13 to 17 inches

Frost-free period: 90 to 110 days

Composition

Major Components

Bearpaw and similar soils: 50 percent

Vida and similar soils: 35 percent

Minor Components

Zahill and similar soils: 0 to 8 percent

Bearpaw clay: 0 to 1 percent

Vida loam: 0 to 1 percent

Obrien and similar soils: 0 to 1 percent

Soils that have slopes more than 15 percent: 0 to 1 percent

Soils that have slopes less than 8 percent: 0 to 3 percent

Major Component Description

Bearpaw

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: About 9.3 inches

Vida

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: About 8.1 inches

674B—Bearpaw-Waltham clay loams, 0 to 4 percent slopes

Setting

Landform: Bearpaw—till plains; Waltham—till plains
Position on landform: Bearpaw—microhighs;
 Waltham—microlows
Slope: Bearpaw—0 to 4 percent; Waltham—0 to 4 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Bearpaw and similar soils: 65 percent
 Waltham and similar soils: 20 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Bearpaw clay: 0 to 6 percent
 Soils that have slopes more than 4 percent: 0 to 8 percent

Major Component Description

Bearpaw

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: About 9.3 inches

Waltham

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: About 7.8 inches

Beaverton Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Moderate in the upper 0 to 16 inches (0.6 to 2.0 inches/hour); rapid below this depth (6.0 to 20.0 inches/hour)
Landform: Kames and eskers
Parent material: Glacial outwash
Slope range: 4 to 15 percent
Annual precipitation: 13 to 17 inches
Annual air temperature: 41 to 44 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, 4 to 15 percent slopes, in an area of cropland; 1,600 feet south and 2,400 feet east of the southwest corner of sec. 35, T. 31 N., R. 16 E.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, very friable, sticky and plastic; many very fine roots; common very fine pores; 5 percent cobbles, 15 percent pebbles; neutral; abrupt smooth boundary.
 Bt1—4 to 13 inches; brown (10YR 4/3) very gravelly clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; many very fine roots; common very fine pores; many faint clay films on faces of peds; 15 percent cobbles, 25 percent pebbles; neutral; clear wavy boundary.

Bt2—13 to 16 inches; brown (10YR 5/3) very gravelly sandy clay loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common very fine roots; common very fine pores; common faint clay films on faces of peds; 20 percent cobbles, 25 percent pebbles; neutral; clear wavy boundary.

2Bk1—16 to 23 inches; grayish brown (10YR 5/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; common very fine roots; 25 percent cobbles, 30 percent pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

2Bk2—23 to 60 inches; light brownish gray (10YR 6/2) very gravelly sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; 25 percent cobbles, 30 percent pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Ap horizon

Hue—2.5Y, 10YR, or 7.5YR
 Value—4 or 5 dry; 2 or 3 moist
 Chroma—2 or 3
 Clay content—15 to 27 percent
 Content of rock fragments—5 to 35 percent—
 0 to 5 percent stones, 0 to 5 percent cobbles,
 5 to 25 percent pebbles
 Reaction—pH 6.6 to 7.8

Bt horizon

Hue—2.5Y, 10YR, or 7.5YR
 Value—4 or 5 dry; 2, 3, or 4 moist
 Chroma—2 or 3
 Texture—Clay loam or sandy clay loam
 Clay content—25 to 35 percent
 Content of rock fragments—35 to 60 percent—
 0 to 5 percent stones, 0 to 30 percent cobbles,
 15 to 45 percent pebbles
 Reaction—pH 6.6 to 7.8

2Bk1 horizon

Hue—2.5Y, 10YR, or 7.5YR
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Loamy sand or sand
 Clay content—0 to 10 percent
 Content of rock fragments—35 to 80 percent—
 0 to 10 percent stones, 0 to 35 percent cobbles,
 15 to 60 percent pebbles

Calcium carbonate equivalent—5 to 15 percent
 Reaction—pH 7.4 to 8.4

2Bk2 horizon

Hue—2.5Y, 10YR, or 7.5YR
 Value—5 or 6 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Loamy sand or sand
 Clay content—0 to 10 percent
 Content of rock fragments—35 to 80 percent—
 0 to 5 percent stones, 0 to 35 percent cobbles,
 15 to 65 percent pebbles
 Calcium carbonate equivalent—3 to 12 percent
 Reaction—pH 7.4 to 8.4

53D—Beaverton gravelly loam, 4 to 15 percent slopes

Setting

Landform: Kames and eskers
Slope: 4 to 15 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Beaverton and similar soils: 85 percent

Minor Components

Beaverton loam soils: 0 to 5 percent
 Tinsley and similar soils: 0 to 7 percent
 Soils that have slopes more than 15 percent: 0 to 2 percent
 Soils that have slopes less than 4 percent: 0 to 1 percent

Major Component Description

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: About 3.2 inches

Belain 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: Igneous rock

Slope range: 4 to 60 percent

Annual precipitation: 15 to 19 inches

Annual air temperature: 40 to 43 degrees F

Frost-free period: 70 to 100 days

Taxonomic Class: Coarse-loamy, mixed Typic Haploborolls

Typical Pedon

Belain loam, in an area of Hedoes-Belain loams, 4 to 15 percent slopes, in an area of rangeland; 300 feet south and 1,200 feet west of the northeast corner of sec. 6, T. 30 N., R. 16 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and plastic; many very fine roots; common very fine pores; slightly acid; clear smooth boundary.

Bw1—3 to 12 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and plastic; many very fine roots; common very fine pores; slightly acid; clear wavy boundary.

Bw2—12 to 18 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine roots; 25 percent pebbles; neutral; clear wavy boundary.

Bk1—18 to 27 inches; grayish brown (2.5Y 5/2) gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, loose, nonsticky and nonplastic; few very fine roots; 30 percent pebbles; common distinct lime coatings on pebbles; neutral; clear wavy boundary.

Bk1—27 to 32 inches; grayish brown (2.5Y 5/2) very gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, loose, nonsticky and nonplastic; few very fine roots; 45 percent pebbles; common distinct lime coatings on pebbles; neutral; abrupt wavy boundary.

R—32 inches; igneous rock.

Range in Characteristics

Depth to bedrock: 20 to 40 inches

A horizon

Hue—7.5YR, 10YR, or 2.5Y

Value—4 or 5 dry; 2 or 3 moist

Chroma—2 or 3

Clay content—15 to 20 percent

Content of rock fragments—0 to 15 percent—
0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction—pH 6.1 to 7.8

Bw horizon

Hue—7.5YR, 10YR, or 2.5Y

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

Chroma—2, 3, or 4

Clay content—10 to 18 percent

Texture—Sandy loam or loam

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

Reaction—pH 6.6 to 8.4

Bk horizon

Hue—7.5YR, 10YR, or 2.5Y

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

Clay content—10 to 18 percent

Chroma—2, 3, or 4

Texture—Loam or sandy loam

Content of rock fragments—15 to 45 percent—
0 to 5 percent cobbles, 15 to 40 percent pebbles

Lime coats or casts—Few to common or faint to prominent

Calcium carbonate equivalent—1 to 10 percent

Reaction—pH 7.4 to 8.4

911F—Belain-Whitlash, moist-Hedoes complex, 15 to 60 percent slopes

Setting

Landform: Belain—hills; Whitlash—hills; Hedoes—hills

Position on landform: Belain—back slopes; Whitlash—shoulders; Hedoes—foot slopes

Slope: Belain—25 to 60 percent; Whitlash—25 to 60 percent; Hedoes—15 to 35 percent

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 100 days

Composition

Major Components

Belain and similar soils: 35 percent

Whitlash and similar soils: 30 percent

Hedoes and similar soils: 20 percent

Minor Components

Laceycreek and similar soils: 0 to 3 percent

Perma and similar soils: 0 to 4 percent
 Soils that have slopes more than 60 percent: 0 to 3 percent
 Soils that have slopes less than 15 percent: 0 to 3 percent
 Areas of rock outcrop: 0 to 2 percent

Major Component Description

Belain

Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 3.5 inches

Whitlash

Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Forest land
Flooding: None
Available water capacity: About 1.7 inches

Hedoes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 7.1 inches

915F—Belain-Whitlash-Hedoes complex, 15 to 45 percent slopes

Setting

Landform: Belain—hills; Whitlash—hills; Hedoes—hills
Position on landform: Belain—back slopes; Whitlash—shoulders; Hedoes—foot slopes
Slope: Belain—25 to 45 percent; Whitlash—25 to 45 percent; Hedoes—15 to 35 percent
Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition

Major Components

Belain and similar soils: 35 percent
 Whitlash and similar soils: 30 percent
 Hedoes and similar soils: 20 percent

Minor Components

Whitlash, cool soils: 0 to 5 percent
 Lacey Creek and similar soils: 0 to 3 percent
 Perma and similar soils: 0 to 2 percent
 Soils that have slopes more than 45 percent: 0 to 2 percent
 Soils that have slopes less than 15 percent: 0 to 2 percent
 Areas of rock outcrop: 0 to 1 percent

Major Component Description

Belain

Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 3.5 inches

Whitlash

Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 1.7 inches

Hedoes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 7.1 inches

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 or stream terraces
Parent material: Alluvium
Slope range: 0 to 8 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Benz clay loam, in an area of Yamacall-Benz clay loams, 2 to 8 percent slopes, in rangeland; 1,000 feet south and 2,400 feet east of the northwest corner of sec. 27, T. 29 N., R. 8 E.

A—0 to 2 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure; hard, friable, sticky and plastic; common very fine roots; many very fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bn—2 to 12 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, friable, sticky and plastic; common very fine roots; many very fine pores; slightly effervescent; strongly alkaline; clear wavy boundary.

Bkn—12 to 26 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine pores; few fine soft masses of lime; strongly effervescent; strongly alkaline; clear wavy boundary.

Bknyz1—26 to 52 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, very sticky and plastic; few very fine roots; few very fine pores; few fine soft masses of lime; common fine seams of gypsum and other salts; strongly effervescent; very strongly alkaline; gradual wavy boundary.

Bknyz2—52 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine pores; few fine soft masses of lime; few fine masses of gypsum and other salts; strongly effervescent; strongly alkaline.

Range in Characteristics

Control section: 10 to 40 inches
Content of clay in the control section: 18 to 35 percent

A horizon

Hue—2.5Y or 10YR
 Value—5, 6, or 7 dry; 3, 4, or 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
 Reaction—pH 7.4 to 9.0

B horizon

Hue—5Y, 2.5Y, or 10YR
 Value—5, 6, 7, or 8 dry; 4, 5, or 6 moist
 Chroma—2 or 3
 Texture—Loam, clay loam, silt loam, or fine sandy loam
 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—2 to 5 percent
 Reaction—pH 8.5 to 9.6

55A—Benz clay loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Benz and similar soils: 85 percent

Minor Components

Thibadeau and similar soils: 0 to 1 percent
 Gerdrum and similar soils: 0 to 5 percent
 Yetull and similar soils: 0 to 2 percent
 Yamacall and similar soils: 0 to 3 percent
 Nobe and similar soils: 0 to 1 percent
 Benz loam: 0 to 3 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
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: About 6.4 inches

Blacksheep Series

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Permeability: Moderate (0.6 to 2.0 inches/hour)
Landform: Sedimentary plains
Parent material: Semiconsolidated, sandy sedimentary beds
Slope range: 2 to 8 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Blacksheep fine sandy loam, in an area of Twilight-Blacksheep fine sandy loams, 2 to 8 percent slopes, in rangeland; 700 feet south and 2,400 feet east of the northwest corner of sec. 5, T. 32 N., R. 11 E.

A—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—6 to 12 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine pores; few fine masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—12 to 17 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine pores; few fine masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Cr—17 to 60 inches; pale brown (10YR 6/3) semiconsolidated sandstone, dark brown (10YR 4/3) moist; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 44 to 47 degrees F
Moisture control section: Between 8 inches and the paralithic contact; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 5 degrees F or higher
Depth to Cr horizon: 10 to 20 inches

A horizon

Hue—2.5Y, 7.5YR, or 10YR
 Value—5, 6, or 7 dry; 4 or 5 moist
 Chroma—2 or 3
 Clay content—5 to 15 percent
 Reaction—pH 7.4 to 8.4

Bk horizon

Hue—2.5Y, 7.5YR, or 10YR
 Value—5, 6, or 7 dry; 5 or 6 moist
 Chroma—2 or 3
 Texture—Very fine sandy loam, fine sandy loam, sandy loam, or loamy fine sand
 Clay content—5 to 15 percent
 Calcium carbonate equivalent—5 to 10 percent
 Reaction—pH 7.9 to 8.4

Bowery 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: 0 to 15 percent
Annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 43 degrees F
Frost-free period: 70 to 100 days

Taxonomic Class: Fine-loamy, mixed Pachic Haploborolls

Typical Pedon

Bowery loam, 8 to 15 percent slopes, in an area of rangeland; 300 feet south and 2,500 feet east of the northwest corner of sec. 25, T. 30 N., R. 16 E.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak very fine granular structure; soft, very friable, sticky and plastic; many very fine roots, many very fine pores; 5 percent pebbles; slightly acid; clear smooth boundary.

A2—7 to 24 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots, common very fine pores; slightly acid; clear wavy boundary.

Bw1—24 to 44 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots, common very fine pores; neutral; gradual wavy boundary.

Bw2—44 to 60 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak very fine subangular blocky structure; soft, very friable, sticky and slightly plastic; few very fine roots, common very fine pores; 5 percent cobbles, 15 percent pebbles; neutral.

Range in Characteristics

Soil temperature: 42 to 45 degrees F

Moisture control section: Between 4 and 12 inches

Mollic epipedon thickness: 16 to 37 inches

Depth to lime: Deeper than 60 inches

A horizon

Hue—10YR or 2.5Y

Value—3 or 4 dry

Chroma—2 or 3

Clay content—18 to 27 percent

Content of rock fragments—0 to 15 percent pebbles

Reaction—pH 6.1 to 7.3

Bw1 horizon

Hue—10YR or 2.5Y

Value—4 or 5 dry; 3 or 4 moist

Chroma—2, 3, or 4

Clay content—18 to 27 percent

Content of rock fragments—0 to 15 percent pebbles

Reaction—pH 6.1 to 7.3

Bw2 horizon

Hue—10YR or 2.5Y

Value—4 or 5 dry

Chroma—2, 3, or 4

Texture—Loam or fine sandy loam

Clay content—10 to 27 percent

Content of rock fragments—10 to 25 percent—
10 to 20 percent pebbles, 0 to 5 percent cobbles

Bulk density—1.4 to 1.55

Reaction—pH 6.1 to 7.3

76B—Bowery loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans

Slope: 0 to 4 percent

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 100 days

Composition

Major Components

Bowery and similar soils: 85 percent

Minor Components

Hedoes fine sandy loam: 0 to 6 percent

Farnuf and similar soils: 0 to 5 percent

Soils that have slopes more than 4 percent: 0 to 4 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: About 10.6 inches

76C—Bowery loam, 4 to 8 percent slopes

Setting

Landform: Alluvial fans

Slope: 4 to 8 percent

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 100 days

Composition

Major Components

Bowery and similar soils: 85 percent

Minor Components

Hedoes fine sandy loam: 0 to 5 percent

Farnuf and similar soils: 0 to 5 percent

Soils that have slopes less than 4 percent: 0 to 2 percent

Soils that have slopes more than 8 percent: 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: About 10.6 inches

76D—Bowery loam, 8 to 15 percent slopes

Setting

Landform: Alluvial fans
Slope: 8 to 15 percent
Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition

Major Components

Bowery and similar soils: 85 percent

Minor Components

Belain and similar soils: 0 to 5 percent
 Hedoes fine sandy loam: 0 to 3 percent
 Farnuf and similar soils: 0 to 2 percent
 Soils that have slopes more than 15 percent: 0 to 3 percent
 Soils that have slopes less 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: About 10.6 inches

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: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Bullhook clay loam, 0 to 2 percent slopes, in an area of rangeland; 1,300 feet south and 50 feet east of the northwest corner of sec. 2, T. 35 N., R. 12 E.

- A—0 to 3 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak very fine granular structure; hard, firm, sticky and plastic; common very fine roots; common very fine pores; strongly effervescent; strongly alkaline; clear smooth boundary.
- C—3 to 8 inches; grayish brown (2.5Y 5/2) clay loam consisting of thin strata of loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; common very fine roots; common very fine pores; strongly effervescent; very strongly alkaline; clear wavy boundary.
- Cyz—8 to 60 inches; grayish brown (2.5Y 5/2) clay loam consisting of thin strata of loam or fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; common very fine roots; common very fine pores; common fine small masses and seams of gypsum and other salts; strongly effervescent; very strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at 20 inches is 41 degrees F or above

A horizon

Hue—10YR or 2.5Y
 Value—5, 6, or 7 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Clay content—27 to 40 percent
 Electrical conductivity—2 to 8 mmhos/cm
 Sodium adsorption ratio—8 to 13
 Calcium carbonate equivalent—5 to 10 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, 3, or 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
 Reaction—pH 7.4 to 9.6

Cyz horizon

Hue—10YR or 2.5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 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 7.9 to 9.6
 Other features—Gypsum and other salts are inherent in the parent material

84A—Bullhook clay loam, 0 to 2 percent slopes**Setting**

Landform: Flood plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Bullhook and similar soils: 85 percent

Minor Components

Thibadeau and similar soils: 0 to 1 percent
 Nobe and similar soils: 0 to 4 percent
 Havre and similar soils: 0 to 4 percent
 Bullhook, occasionally flooded: 0 to 2 percent
 Hanly and similar soils: 0 to 4 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: Rare
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: About 8.5 inches

842A—Bullhook-Nobe complex, 0 to 2 percent slopes**Setting**

Landform: Bullhook—flood plains; Nobe—flood plains
Slope: Bullhook—0 to 2 percent; Nobe—0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Bullhook and similar soils: 45 percent
 Nobe and similar soils: 40 percent

Minor Components

Somewhat poorly drained soils: 0 to 2 percent
 Havre and similar soils: 0 to 7 percent
 Soils that have slopes more than 2 percent: 0 to 6 percent

Major Component Description**Bullhook**

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
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: About 8.5 inches

Nobe

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
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: About 4.1 inches

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: Hills

Parent material: Alluvium and eolian deposits

Slope range: 4 to 15 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

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

Typical Pedon

Busby fine sandy loam, in an area of Yetull-Busby fine sandy loams, 4 to 15 percent slopes, in cropland; 300 feet north and 2,500 feet west of the southeast corner of sec. 34, T. 36 N., R. 10 E.

Ap—0 to 4 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—4 to 14 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; violently effervescent; moderately alkaline; clear wavy boundary.

Bk1—14 to 29 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak fine angular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—29 to 41 inches; light gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

BC—41 to 60 inches; light gray (2.5Y 7/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; single grain;

soft, very friable, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 8 and 24 inches; dry in all parts between four-tenths and five-tenths of the cumulative days when the soil temperature at 20 inches is 41 degrees F or above

Depth to Bk horizon: 10 to 20 inches

A horizon

Hue—10YR or 2.5Y

Value—5 or 6 dry; 3 or 4 moist

Chroma—2, 3, or 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, 3, or 4

Texture—Fine sandy loam, sandy loam, or loam

Clay content—10 to 18 percent

Reaction—pH 7.4 to 8.4

Bk horizon

Hue—10YR, 2.5Y, or 5Y

Value—6 or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Fine sandy loam or sandy loam

Clay content—10 to 18 percent

Effervescence—Strong to violent

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.4 to 8.4

C horizon

Hue—10YR or 2.5Y

Value—6 or 7 dry; 5 or 6 moist

Chroma—2, 3, or 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

Reaction—pH 7.9 to 8.4

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: Semiconsolidated sedimentary beds

Slope range: 15 to 60 percent

Annual precipitation: 13 to 19 inches

Annual air temperature: 40 to 44 degrees F

Frost-free period: 70 to 110 days

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

Typical Pedon

Cabba loam, in an area of Cabba-Macar loams, 15 to 60 percent slopes, in rangeland; 2,200 feet south and 1,350 feet east of the northwest corner of sec. 31, T. 29 N., R. 15 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—3 to 8 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—8 to 15 inches; light gray (10YR 7/2) loam, olive (5Y 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; many fine soft masses of lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

Cr—15 to 60 inches; light gray (10YR 7/2) semiconsolidated sedimentary bedrock, olive (5Y 5/3) moist; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches or to the paralithic contact; frozen November through March, dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees or higher

Depth to Cr horizon: 10 to 20 inches

Other features: The chromas of 1 are lithochromic

A horizon

Hue—10YR or 2.5Y

Value—3, 4, 5, or 6 dry; 3 or 4 moist

Chroma—1, 2, 3, or 4

Clay content—10 to 27 percent

Electrical conductivity—0 to 4 mmhos/cm

Effervescence—None to violent

Calcium carbonate equivalent—5 to 10 percent

Reaction—pH 7.4 to 9.0

Bk horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, 7, or 8 dry; 4, 5, 6, or 7 moist

Chroma—1, 2, 3, 4, or 6

Texture—Loam, silt loam, clay loam, or silty clay loam

Clay content—20 to 35 percent

Calcium carbonate equivalent—5 to 15 percent

Electrical conductivity—0 to 8 mmhos/cm

Reaction—pH 7.4 to 9.0

Cr horizon

Reaction—pH 7.4 to 8.4

Other features—This horizon consists of interbedded layers of silt, sand, and clay, or a mixture of the three. 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.

205F—Cabba-Macar loams, 15 to 60 percent slopes

Setting

Landform: Cabba—hills; Macar—hills

Position on landform: Cabba—shoulders; Macar—back slopes

Slope: Cabba—15 to 60 percent; Macar—15 to 60 percent

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 100 days

Composition

Major Components

Cabba and similar soils: 50 percent

Macar and similar soils: 35 percent

Minor Components

Farnuf and similar soils: 0 to 3 percent

Tally and similar soils: 0 to 5 percent
 Soils more than 20 inches deep: 0 to 4 percent
 Soils that have slopes less than 15 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: Semiconsolidated sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 2.5 inches

Macar

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 9.3 inches

203F—Cabba-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform: Cabba—hills; Rock outcrop—hills
Position on landform: Cabba—shoulders; Rock outcrop—back slopes (fig. 3)
Slope: 25 to 60 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days



Figure 3.—Map unit 203F, Cabba-Rock outcrop complex, 25 to 60 percent slopes.

Composition

Major Components

Cabba and similar soils: 45 percent

Rock outcrop: 40 percent

Minor Components

Tally and similar soils: 0 to 1 percent

Korchea and similar soils: 0 to 1 percent

Macar and similar soils: 0 to 5 percent

Soils that have slopes less than 25 percent: 0 to 4 percent

Soils that have slopes more than 60 percent: 0 to 1 percent

Very shallow soils: 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: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 2.5 inches

Rock outcrop

Definition: Exposures of siltstone bedrock

Flooding: None

204F—Cabba-Zahill complex, 25 to 60 percent slopes

Setting

Landform: Cabba—hills; Zahill—hills

Position on landform: Cabba—back slopes; Zahill—shoulders

Slope: Cabba—25 to 60 percent; Zahill—25 to 60 percent

Mean annual precipitation: 13 to 17 inches

Frost-free period: 90 to 110 days

Composition

Major Components

Cabba and similar soils: 45 percent

Zahill and similar soils: 40 percent

Minor Components

Korchea and similar soils: 0 to 1 percent

Tally and similar soils: 0 to 5 percent

Macar and similar soils: 0 to 3 percent

Soils that have slopes less than 25 percent: 0 to 4 percent

Soils that have slopes more than 60 percent: 0 to 1 percent

Areas of rock outcrop: 0 to 1 percent

Major Component Description

Cabba

Surface layer texture: Loam

Depth class: Shallow (10 to 20 inches)

Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 2.5 inches

Zahill

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: About 9.7 inches

Cabbart Series

Depth class: Shallow (10 to 20 inches)

Drainage class: Well drained

Permeability: Moderate (0.6 to 2.0 inches/hour)

Landform: Hills and sedimentary plains

Parent material: Semiconsolidated sedimentary beds

Slope range: 2 to 60 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

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

Typical Pedon

Cabbart loam, in an area of Delpoint-Cabbart loams, 2 to 8 percent slopes, in cropland; 2,100 feet south and 2,100 feet east of the northwest corner of sec. 28, T. 31 N., R. 11 E.

Ap—0 to 6 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) moist; weak fine and medium subangular blocky structure parting to

moderate very fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine roots; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bk—6 to 15 inches; light gray (2.5Y 7/2) loam, light yellowish brown (2.5Y 6/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few very fine roots; many very fine pores; many fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

BC—15 to 18 inches; pale yellow (2.5Y 7/4) loam, light yellowish brown (2.5Y 6/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few very fine roots; common very fine pores; violently effervescent; strongly alkaline; gradual smooth boundary.

Cr—18 to 60 inches; light yellowish brown (2.5Y 6/4) semiconsolidated sedimentary beds, light brownish gray (2.5Y 6/2) moist; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 to 12 inches or to the paralithic contact; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is greater than 41 degrees F

Depth to Cr horizon: 10 to 20 inches

A horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 3, 4, or 5 moist

Chroma—2, 3, or 4

Clay content—18 to 27 percent

Electrical conductivity—0 to 4 mmhos/cm

Calcium carbonate equivalent—5 to 10 percent

Reaction—pH 7.4 to 9.0

Bk horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, 7, or 8 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Clay content—18 to 27 percent

Structure—Massive, prismatic, or blocky

Content of rock fragments—0 to 45 percent—0 to 15 percent hard pebbles, 0 to 45 percent soft pebbles

Electrical conductivity—0 to 4 mmhos/cm

Sodium adsorption ratio—1 to 5

Calcium carbonate equivalent—15 to 25 percent

Reaction—pH 7.4 to 9.0

BC horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, 7, or 8 dry; 4, 5, or 6 moist

Chroma—3 or 4

Texture—Loam, clay loam, silt loam, or silty clay loam

Clay content—18 to 35 percent

Content of rock fragments—0 to 45 percent—0 to 15 percent hard pebbles, 0 to 45 percent soft pebbles

Electrical conductivity—0 to 8 mmhos/cm

Sodium adsorption ratio—1 to 5

Gypsum—0 to 5 percent

Reaction—pH 7.4 to 9.0

212F—Cabbart-Hillon loams, 25 to 60 percent slopes

Setting

Landform: Cabbart—hills; Hillon—hills

Position on landform: Cabbart—back slopes; Hillon—shoulders

Slope: Cabbart—25 to 60 percent; Hillon—25 to 60 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Cabbart and similar soils: 45 percent

Hillon and similar soils: 40 percent

Minor Components

Blacksheep and similar soils: 0 to 3 percent

Yawdim and similar soils: 0 to 5 percent

Havre and similar soils: 0 to 1 percent

Soils that have slopes less than 25 percent: 0 to 4 percent

Soils that have slopes more than 60 percent: 0 to 1 percent

Areas of rock outcrop: 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: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 3.3 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: About 10.0 inches

211F—Cabbart-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform: Cabbart—hills; Rock outcrop—hills

Position on landform: Cabbart—shoulders; Rock outcrop—back slopes

Slope: 25 to 60 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Cabbart and similar soils: 45 percent

Rock outcrop: 40 percent

Minor Components

Blacksheep and similar soils: 0 to 2 percent

Yawdim and similar soils: 0 to 5 percent

Havre and similar soils: 0 to 1 percent

Delpoint and similar soils: 0 to 4 percent

Soils that have slopes more than 60 percent: 0 to 1 percent

Very shallow soils: 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: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 3.3 inches

Rock outcrop

Definition: Exposures of siltstone bedrock

Flooding: None

213E—Cabbart-Yawdim complex, 8 to 25 percent slopes

Setting

Landform: Cabbart—hills; Yawdim—hills

Position on landform: Cabbart—back slopes; Yawdim—back slopes

Slope: Cabbart—8 to 25 percent; Yawdim—8 to 25 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Cabbart and similar soils: 50 percent

Yawdim and similar soils: 35 percent

Minor Components

Blacksheep and similar soils: 0 to 3 percent

Delpoint and similar soils: 0 to 5 percent

Very shallow soils: 0 to 1 percent

Soils that have slopes less than 8 percent: 0 to 1 percent

Soils that have slopes more than 25 percent: 0 to 4 percent

Areas of rock outcrop: 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: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 3.3 inches

Yawdim

Surface layer texture: Clay

Depth class: Shallow (10 to 20 inches)

Drainage class: Well drained

Dominant parent material: Semiconsolidated shale residuum

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 2.5 inches

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: Till plains, alluvial fans, stream terraces, and hills

Parent material: Alluvium and eolian deposits

Slope range: 0 to 15 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-loamy, mixed Aridic Haploborolls

Typical Pedon

Chinook fine sandy loam, 2 to 8 percent slopes, in an area of rangeland; 1,300 feet north and 1,200 feet east of the southwest corner of sec. 27, T. 32 N., R. 15 E.

A—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many very fine pores; neutral; clear smooth boundary.

Bw1—4 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; many fine roots; few very fine pores; mildly alkaline; gradual smooth boundary.

Bw2—11 to 21 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine prismatic structure parting to weak fine subangular blocky; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few very fine pores; mildly alkaline; gradual smooth boundary.

Bk1—21 to 31 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few very fine pores; few fine threads of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—31 to 41 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few very fine pores; few fine threads of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

BC—41 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; nonsticky and nonplastic; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 8 to 24 inches

Mollic epipedon thickness: 7 to 15 inches thick

Depth to Bk horizon: 10 to 35 inches

A horizon

Hue—10YR or 2.5Y

Value—2 or 3 moist

Chroma—2 or 3

Clay content—5 to 18 percent

Content of rock fragments—0 to 35 percent pebbles

Reaction—pH 6.6 to 8.4

Bw horizon

Hue—10YR or 2.5Y

Value—4, 5, or 6 dry; 3, 4 or 5 moist

Chroma—2, 3, or 4

Texture—Fine sandy loam or sandy loam

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

Content of rock fragments—0 to 15 percent pebbles

Reaction—pH 6.6 to 8.4

Bk1 horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Fine sandy loam or sandy loam

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

Content of rock fragments—0 to 15 percent pebbles

Calcium carbonate equivalent—3 to 15 percent

Reaction—pH 6.6 to 9.0

Bk2 horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Fine sandy loam or sandy loam
 Clay content—5 to 18 percent and more than 50 percent medium, fine, and coarser sand
 Content of rock fragments—0 to 15 percent pebbles
 Calcium carbonate equivalent—5 to 15 percent—few and common masses and threads of lime
 Reaction—pH 6.6 to 9.0

C horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—fine sandy loam, sandy loam, loamy fine sand, or loamy sand
 Clay content—5 to 15 percent
 Content of rock fragments—0 to 15 percent pebbles
 Reaction—pH 7.4 to 9.0

36A—Chinook fine sandy loam, 0 to 2 percent slopes**Setting**

Landform: Alluvial fans and stream terraces
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Chinook and similar soils: 85 percent

Minor Components

Busby and similar soils: 0 to 4 percent
 Kenilworth and similar soils: 0 to 4 percent
 Soils that have loamy material below 40 inches: 0 to 4 percent
 Soils that have slopes more than 2 percent: 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

Flooding: None
Available water capacity: About 7.8 inches

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

Landform: Alluvial fans and stream terraces
Slope: 2 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Chinook and similar soils: 85 percent

Minor Components

Yetull and similar soils: 0 to 2 percent
 Busby and similar soils: 0 to 6 percent
 Soils that have slopes more than 8 percent: 0 to 4 percent
 Soils that have slopes less than 2 percent: 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
Flooding: None
Available water capacity: About 7.8 inches

571D—Chinook-Cozberg-Yetull fine sandy loams, 4 to 15 percent slopes**Setting**

Landform: Chinook—hills; Cozberg—hills; Yetull—hills
Slope: Chinook—4 to 15 percent; Cozberg—4 to 15 percent; Yetull—4 to 15 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Chinook and similar soils: 35 percent
 Cozberg and similar soils: 25 percent
 Yetull and similar soils: 25 percent

Minor Components

Tinsley and similar soils: 0 to 3 percent
 Evanston, calcareous soils: 0 to 3 percent
 Busby and similar soils: 0 to 2 percent
 Soils that have slopes less than 4 percent: 0 to 2 percent
 Soils that have slopes more than 15 percent: 0 to 5 percent

Major Component Description**Chinook**

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: About 7.8 inches

Cozberg

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: About 5.0 inches

Yetull

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 4.2 inches

362C—Chinook-Yetull complex, 2 to 10 percent slopes**Setting**

Landform: Chinook—hills; Yetull—hills
Position on landform: Chinook—back slopes; Yetull—shoulders
Slope: Chinook—2 to 10 percent; Yetull—2 to 10 percent
Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition**Major Components**

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

Minor Components

Busby and similar soils: 0 to 7 percent
 Cozberg and similar soils: 0 to 3 percent
 Areas of duneland: 0 to 2 percent
 Blowout areas: 0 to 3 percent

Major Component Description**Chinook**

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Eolian deposits
Flooding: None
Available water capacity: About 7.8 inches

Yetull

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 3.6 inches

Cozberg Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid in the upper 0 to 24 inches (2.0 to 6.0 inches/hour), rapid below this depth (6.0 to 20.0 inches/hour)
Landform: Stream terraces or hills
Parent material: Alluvium or eolian deposits
Slope range: 0 to 15 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-loamy, mixed Aridic Haploborolls

Typical Pedon

Cozberg fine sandy loam, in an area of Cozberg-Chinook fine sandy loams, 0 to 4 percent slopes, in

cropland; 500 feet north and 1,000 feet west of the southeast corner of sec. 23, T. 36 N., R. 12 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few very fine pores; neutral; abrupt wavy boundary.

Bw—7 to 17 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; common fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; few fine pores; mildly alkaline; clear wavy boundary.

Bk—17 to 24 inches; light gray (10YR 7/2) fine sandy loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; few fine pores; many fine soft masses of lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

2C1—24 to 42 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; few fine pores; lime coatings on underside of sand grains; violently effervescent; moderately alkaline; clear wavy boundary.

2C2—42 to 60 inches; very pale brown (10YR 7/3) gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; 25 percent pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Ap horizon

Value—2 or 3 moist
 Chroma—2 or 3
 Clay content—10 to 20 percent
 Content of rock fragments—0 to 10 percent pebbles
 Reaction—pH 6.6 to 7.8

Bw horizon

Value—3 or 4 moist
 Chroma—2 or 3
 Texture—Fine sandy loam, very fine sandy loam, or sandy loam
 Clay content—10 to 18 percent
 Content of rock fragments—0 to 15 percent
 Reaction—pH 6.6 to 7.8

Bk horizon

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Fine sandy loam, sandy loam, or very fine sandy loam

Clay content—10 to 18 percent

Content of rock fragments—0 to 15 percent

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.4 to 8.4

2C horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Loamy sand, sand, loamy coarse sand, or coarse sand

Clay content—0 to 10 percent

Content of rock fragments—0 to 35 percent pebbles

Reaction—pH 7.4 to 8.4

573B—Cozberg-Chinook fine sandy loams, 0 to 4 percent slopes

Setting

Landform: Cozberg—stream terraces; Chinook—stream terraces

Slope: Cozberg—0 to 4 percent; Chinook—0 to 4 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Cozberg and similar soils: 45 percent

Chinook and similar soils: 40 percent

Minor Components

Busby and similar soils: 0 to 5 percent

Evanston, calcareous soils: 0 to 3 percent

Degrad and similar soils: 0 to 2 percent

Soils that have slopes more than 4 percent: 0 to 5 percent

Major Component Description

Cozberg

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: About 5.0 inches

Chinook

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Alluvium

Flooding: None

Available water capacity: About 7.8 inches

Creed Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Slow (0.06 to 0.2 inch/hour)

Landform: Stream terraces

Parent material: Alluvium

Slope range: 0 to 4 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Typic
Natriboralfs

Typical Pedon

Creed loam, in an area of Ferd-Creed-Gerdrum complex, 0 to 4 percent slopes, in rangeland; 900 feet south and 1,800 feet west of the northeast corner of sec. 1, T. 30 N., R. 10 E.

- A—0 to 2 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak very fine platy structure parting to strong very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; few very fine pores; neutral; clear smooth boundary.
- E—2 to 7 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak coarse platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine pores; neutral; clear smooth boundary.
- Btn1—7 to 9 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium and coarse columnar structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; common very fine roots; many very fine pores; many distinct clay films on faces of peds; neutral; clear smooth boundary.
- Btn2—9 to 16 inches; light brownish gray (10YR 6/2) clay, very dark grayish brown (10YR 3/2) moist;

strong fine and medium prismatic structure parting to strong medium subangular blocky; very hard, very firm, very sticky and very plastic; many very fine roots; common very fine pores; many distinct clay films on faces of peds; neutral; clear wavy boundary.

- Bkn—16 to 29 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; few fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.
- Bknyz—29 to 60 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, firm, very sticky and very plastic; few very fine roots; many very fine pores; few fine and medium soft masses and threads of lime; few fine masses of gypsum and other salts; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at 20 inches is 41 degrees F or above

Depth to secondary lime: 10 to 20 inches

Depth to gypsum and other salts: 22 to 30 inches

A horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—2 or 3

Clay content—20 to 27 percent

Content of rock fragments—0 to 15 percent
pebbles

Reaction—pH 6.1 to 8.4

E horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, 6, or 7 moist

Chroma—2 or 3

Clay content—20 to 27 percent

Content of rock fragments—0 to 15 percent
pebbles

Reaction—pH 6.1 to 8.4

Btn horizon

Hue—10YR, 2.5Y, or 5Y

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

Chroma—2 or 3

Texture—Clay loam, silty clay loam, clay, or silty clay
 Clay content—35 to 55 percent
 Content of rock fragments—0 to 15 percent pebbles
 Electrical conductivity—2 to 4 mmhos/cm; sandy substratum phase 0 to 2 mmhos/cm
 Sodium adsorption ratio—8 to 13
 Reaction—pH 6.6 to 9.0

Bkn, Bknyz horizons

Hue—10YR, 2.5Y, or 5Y
 Value—4, 5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Silty clay loam, clay loam, sandy clay loam, loam, or clay
 Content of rock fragments—0 to 15 percent pebbles
 Clay content—25 to 45 percent
 Calcium carbonate equivalent—5 to 15 percent
 Electrical conductivity—4 to 16 mmhos/cm
 Sodium adsorption ratio—13 to 25
 Gypsum—0 to 2 percent
 Reaction—pH 7.9 to 9.0

Degrad Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Moderate in the upper 0 to 26 inches (0.6 to 2.0 inches/hour); rapid below this depth (6.0 to 20.0 inches/hour)
Landform: Stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Degrad loam, 0 to 4 percent slopes, in an area of cropland; 500 feet north and 1,300 feet east of the southwest corner of sec. 18, T. 31 N., R. 11 E.

Ap—0 to 6 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to moderate very fine and fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; mildly alkaline; abrupt smooth boundary.

Bt1—6 to 9 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine and medium subangular blocky; hard, friable, sticky and plastic; many very fine roots, many very fine pores; many faint clay films on faces of peds; neutral; clear smooth boundary.

Bt2—9 to 15 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine pores; many faint clay films on faces of peds; neutral; clear wavy boundary.

Bk—15 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; hard, friable, sticky and plastic; many very fine roots; many very fine pores; many fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

2C1—26 to 48 inches; light brownish gray (2.5Y 6/2) loamy sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine pores; lime coatings on underside of pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

2C2—48 to 60 inches; light brownish gray (2.5Y 6/2) sand, grayish brown (2.5Y 5/2) moist; single grain, loose, nonsticky and nonplastic; many very fine pores; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Moisture control section: Between 4 and 12 inches; dry in some part six-tenths or more of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Mollic epipedon thickness: 7 to 16 inches
Depth to calcic horizon: 10 to 23 inches
Depth to C 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
 Content of 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—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)
 Content of 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, 5, or 6 moist
 Chroma—2 or 3
 Texture—Sandy clay loam, loam, or clay loam
 Clay content—15 to 30 percent
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles, 0 to 10 percent pebbles
 Electrical conductivity—less than 4 mmhos/cm
 Calcium carbonate equivalent—15 to 40 percent
 Reaction—pH 7.4 to 8.4

2C horizon

Hue—10YR or 2.5Y
 Value—5, 6, or 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
 Content of rock fragments—0 to 35 percent—
 0 to 5 percent cobbles, 0 to 30 percent pebbles
 Calcium carbonate equivalent—8 to 15 percent
 Reaction—pH 7.9 to 8.4

16B—Degrand loam, 0 to 4 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Degrad and similar soils: 85 percent

Minor Components

Cozberg and similar soils: 0 to 4 percent
 Busby and similar soils: 0 to 6 percent
 Yamacall, calcareous soils: 0 to 2 percent
 Soils that have slopes more than 4 percent: 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: About 5.2 inches

Delpoint 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
Parent material: Semiconsolidated sedimentary beds
Slope range: 2 to 8 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Delpoint loam, in an area of Delpoint complex, 2 to 8 percent slopes, in cropland; 1,000 feet north and 1,000 feet east of the southwest corner of sec. 30, T. 36 N., R. 10 E.

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5R 4/2) moist; weak fine and moderate subangular blocky structure parting to strong very fine granular; soft, very friable, slightly sticky and plastic; few very fine roots; many very fine pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—5 to 14 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) 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 pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—14 to 20 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—20 to 34 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, firm, sticky and plastic; few very fine roots; many very fine pores; many fine soft masses of lime; violently effervescent; strongly alkaline; gradual smooth boundary.

Cr—34 to 60 inches; gray (5Y 6/1) semiconsolidated sedimentary beds, olive gray (5Y 5/2) moist; 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

Depth to Cr horizon: 20 to 40 inches

Soil phases: Calcareous (more than 5 percent lime)

A horizon

Hue—10YR or 2.5Y

Value—5 or 6 dry; 3, 4, or 5 moist

Chroma—2, 3, or 4

Clay content—18 to 27 percent

Content of rock fragments—0 to 5 percent pebbles

Effervescence—None to strong

Reaction—pH 6.6 to 8.4

Other features—When mixed to 7 inches the surface will not meet the requirements for a mollic epipedon

Bw horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Loam, clay loam, or silty clay loam

Clay content—18 to 35 percent clay

Content of rock fragments—0 to 15 percent pebbles

Effervescence—None to violent

Reaction—pH 6.6 to 8.4

Bk horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Loam, sandy loam, clay loam, or silty clay loam

Clay content—18 to 35 percent clay

Content of rock fragments—0 to 15 percent pebbles

Calcium carbonate equivalent—5 to 30 percent; there is not more than a 5 percent difference in calcium carbonate equivalent, or by volume of secondary carbonates in the underlying horizon of material to meet the requirements of a calcic horizon

Effervescence—Strong or violent

Reaction—pH 7.9 to 9.0

172C—Delpoint complex, 2 to 8 percent slopes

Setting

Landform: Delpoint—sedimentary plains; Delpoint—sedimentary plains

Position on landform: Delpoint—shoulders; Delpoint—back slopes

Slope: Delpoint—2 to 8 percent; Delpoint—2 to 8 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Delpoint, calcareous and similar soils: 50 percent

Delpoint and similar soils: 35 percent

Minor Components

Twilight and similar soils: 0 to 5 percent

Yawdim and similar soils: 0 to 3 percent

Cabbart and similar soils: 0 to 2 percent

Marmarth and similar soils: 0 to 3 percent

Evanston and similar soils: 0 to 2 percent

Major Component Description

Delpoint, calcareous

Surface layer texture: Loam

Depth class: Moderately deep (20 to 40 inches)

Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 5.5 inches

Delpoint

Surface layer texture: Loam

Depth class: Moderately deep (20 to 40 inches)

Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 5.5 inches

Phase: Calcareous

171C—Delpoint-Cabbart loams, 2 to 8 percent slopes

Setting

Landform: Delpoint—sedimentary plains; Cabbart—sedimentary plains

Position on landform: Delpoint—back slopes; Cabbart—shoulders

Slope: Delpoint—2 to 8 percent; Cabbart—2 to 8 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Delpoint and similar soils: 55 percent
Cabbart and similar soils: 30 percent

Minor Components

Twilight and similar soils: 0 to 3 percent
Blacksheep and similar soils: 0 to 4 percent
Yamacall, calcareous soils: 0 to 7 percent
Very shallow soils: 0 to 1 percent

Major Component Description

Delpoint

Surface layer texture: Loam

Depth class: Moderately deep (20 to 40 inches)

Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 5.5 inches

Cabbart

Surface layer texture: Loam

Depth class: Shallow (10 to 20 inches)

Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 3.3 inches

DA—Denied access

Composition

Major Components

Denied access: 100 percent

Major Component Description

Definition: Areas where mapping access was denied by landowner

Dimmick Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Very poorly drained

Permeability: Very slow (0.06 inch/hour)

Landform: Closed depressions

Parent material: Alluvium

Slope range: 0 to 1 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic, frigid Vertic Epiaquolls

Typical Pedon

Dimmick clay, 0 to 1 percent slopes, in an area of cropland; 100 feet north and 100 feet east of the southwest corner of sec. 19, T. 34 N., R. 15 E.

Ap—0 to 3 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; common fine faint yellowish brown (10YR 5/4) redox concentrations; strong very fine and fine angular blocky structure; very hard, very firm, very sticky and very plastic; many very fine and fine roots; few very fine pores; slightly acid; clear wavy boundary.

Ag—3 to 21 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; common fine faint yellowish brown (10YR 5/4) redox concentrations; weak fine angular blocky structure; very hard, very firm, very sticky and very plastic; many fine and common very fine roots; few very fine pores; neutral; clear wavy boundary.

Cg1—21 to 42 inches; light gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; massive; common medium faint yellowish brown (10YR 5/4) redox concentrations; very hard, very firm, very sticky and very plastic; common fine roots; few very fine pores; slightly effervescent; mildly alkaline; gradual wavy boundary.

Cg2—42 to 60 inches; light gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; common medium faint yellowish brown (10YR 5/4) redox concentrations; massive; very hard, very firm, very sticky and very plastic; strongly effervescent; mildly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Depth to lime: 20 to 40 inches
Depth to water table: Pooled to 12 inches

A horizon

Hue—10YR, 2.5Y or 5Y
 Value—2 or 3 moist; 4 or 5 dry
 Chroma—1 or 2
 Clay content—40 to 50 percent
 Reaction—pH 6.1 to 7.8

C horizon

Hue—2.5Y, or 5Y
 Value—4, 5, 6, 7, or 8 moist or dry
 Chroma—0, 1, 2, or 3
 Texture—Clay or silty clay
 Clay content—40 to 60 percent clay
 Reaction—pH 6.6 to 8.4

34A—Dimmick clay, 0 to 1 percent slopes

Setting

Landform: Closed depressions
Slope: 0 to 1 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Dimmick and similar soils: 85 percent

Minor Components

McKenzie and similar soils: 0 to 10 percent
 Scobey and similar soils: 0 to 3 percent
 Marias and similar soils: 0 to 2 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
Ponding: Long
Available water capacity: About 10.3 inches

Eagleton Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Poorly drained
Permeability: Moderate (0.6 to 2.0 inches/hour)
Landform: Flood plains
Parent material: Alluvium

Slope range: 0 to 2 percent
Annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 70 to 110 days

Taxonomic Class: Fine-loamy, mixed, frigid Cumulic Endoaquolls

Typical Pedon

Eagleton loam, in an area of Enbar-Straw-Eagleton loams, 0 to 2 percent slopes, in rangeland; 800 feet south and 1,900 feet west of the northeast corner of sec. 18, T. 29 N., R. 17 E.

A—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; common fine and medium distinct yellowish brown (10YR 5/6) redox concentrations; weak fine granular structure; slightly hard, very friable, sticky and slightly plastic; many very fine and fine roots; many very fine pores; neutral; clear smooth boundary.

C1—7 to 21 inches; dark gray (10YR 4/1) stratified loam and clay loam, very dark gray (10YR 3/1) moist; many fine and medium distinct yellowish brown (10YR 5/4) redox concentrations; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; common fine and many very fine roots; many very fine pores; neutral; clear wavy boundary.

C2—21 to 37 inches; dark grayish brown (10YR 4/2) stratified loam and clay loam, very dark grayish brown (10YR 3/2) moist; many fine and medium distinct yellowish brown (10YR 5/4) redox concentrations; massive; hard, friable, sticky and plastic; common very fine roots; common very fine pores; mildly alkaline; clear wavy boundary.

Cg—37 to 60 inches; gray (5Y 5/1) stratified loam, clay loam, and fine sandy loam, dark gray (5Y 4/1) moist; many fine and medium distinct yellowish brown (10YR 5/4) redox concentrations; massive; hard, friable, sticky and plastic; few very fine roots; common very fine pores; neutral.

Range in Characteristics

Depth to seasonal high water table: 12 to 24 inches

A horizon

Value—3, 4, or 5 dry; 2 or 3 moist
 Clay content—18 to 27 percent
 Reaction—pH 6.6 to 7.8

C and Cg horizons

Hue—10YR, 5Y, or N
 Value—4 or 5 dry; 2, 3, 4, or 5 moist
 Chroma—0, 1, or 2

Redoximorphic features: None to common; Hue 10YR; Value 5 or 6 dry, 4 moist; Chroma 4 or 6
 Texture—Loam or clay loam consisting of thin layers of sandy loam, fine sandy loam, sandy clay loam, clay loam, or silty clay loam
 Clay content—18 to 35 percent
 Reaction—pH 6.6 to 7.8

Elkner Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Somewhat excessively drained

Permeability: Moderately rapid in the upper 0 to 36 inches (2.0 to 6.0 inches/hour); rapid below this depth (6.0 to 20.0 inches/hour)

Landform: Mountains

Parent material: Colluvium

Slope range: 25 to 70 percent

Annual precipitation: 20 to 22 inches

Annual air temperature: 38 to 40 degrees F

Frost-free period: 50 to 70 days

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

Typical Pedon

Elkner sandy loam, in an area of Garlet-Elkner complex, 25 to 70 percent slopes, in woodland; 150 feet south and 2,000 feet west of the northeast corner of sec. 24, T. 28 N., R. 16 E.

Oi—2 inches to 0; forest litter of slightly decomposed needles, twigs, and leaves.

E1—0 to 6 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak medium granular structure; loose, very friable, nonsticky and nonplastic; many fine and medium roots; many very fine and fine pores; moderately acid; clear smooth boundary.

E2—6 to 16 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak moderate subangular blocky structure; soft, very friable, nonsticky and nonplastic; many medium and fine roots; slightly acid; clear wavy boundary.

E and Bt—16 to 36 inches; 80 percent pale brown (10YR 6/3) coarse sandy loam, brown (10YR 5/3) moist (E part); 20 percent brown (10YR 5/3) sandy loam lamellae, dark brown (10YR 4/3) moist (Bt part); weak medium granular structure; soft, nonsticky and nonplastic; common very fine and fine roots; common fine pores; slightly acid; clear wavy boundary.

BC—36 to 60 inches; light yellowish brown (10YR 6/4) gravelly loamy coarse sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; few very fine roots, 10 percent cobbles, 10 percent pebbles; slightly acid.

Range in Characteristics

E horizon

Value—6 or 7 dry; 3, 4, or 5 moist

Chroma—2, 3, or 4

Clay content—5 to 10 percent

Content of rock fragments—0 to 15 percent—
0 to 5 percent cobbles, stones, or boulders,
0 to 10 percent pebbles

Reaction—pH 5.6 to 6.5

E and Bt horizons

Hue—E part—10YR; B part—10YR or 2.5Y

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

B part—4 or 5 dry and 4 or 5 moist

Chroma—E part—2, 3, or 4; B part—3 or 4

Texture—Coarse sandy loam or sandy loam

Clay content—5 to 10 percent, lamellae has less than 3 percent increase in clay

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

Reaction—pH 5.6 to 6.5

BC horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 3, 4, or 5 moist

Chroma—2, 3, or 4

Texture—Loamy coarse sand or coarse sandy loam

Clay content—0 to 5 percent

Structure—Single grain to subangular blocky

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

Reaction—pH 5.6 to 7.3

Other features—The dark colors are lithochromic

Elloam Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Very slow (0.06 inch/hour)

Landform: Till plains

Parent material: Glacial till

Slope range: 0 to 8 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Typic
Natriboralfs

Typical Pedon

Elloam clay loam, in an area of Phillips-Elloam complex, 0 to 4 percent slopes, in rangeland; 300 feet north and 100 feet west of the southeast corner of sec. 16, T. 36 N., R. 10 E.

E—0 to 4 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak very fine platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine pores; neutral; abrupt smooth boundary.

Bt1—4 to 7 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; strong medium and coarse columnar structure parting to strong fine angular blocky; very hard, very firm, very sticky and very plastic; many very fine roots, common very fine pores; many distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt2—7 to 13 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium and coarse angular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots; many very fine pores; many faint clay films on faces of peds; moderately alkaline; clear wavy boundary.

Bkn—13 to 18 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, very sticky and plastic; few very fine roots; many very fine pores; common fine soft masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bknyz1—18 to 33 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine pores; common medium soft masses of lime; few fine masses of gypsum and other salts; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bknyz2—33 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure parting to moderate fine angular blocky; very hard, firm, very sticky and plastic; few very fine roots; many very fine pores; few fine soft masses of lime; common fine masses of gypsum and other salts; slightly effervescent; strongly alkaline.

Range in Characteristics

E horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—2 or 3

Clay content—20 to 27 percent

Content of rock fragments—0 to 15 percent—
0 to trace stones, 0 to 5 percent cobbles,
0 to 10 percent pebbles

Electrical conductivity—0 to 2 mmhos/cm

Reaction—pH 6.1 to 7.8

Other features—The surface layer is crusted in the natural state and is also crusted where cultivated

Bt horizon

Hue—10YR or 2.5Y

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

Chroma—2 or 3

Texture—Clay loam or clay

Clay content—35 to 55 percent

Structure—Strong or medium columnar, prismatic,
or blocky

Content of rock fragments—0 to 15 percent—
0 to trace cobbles, 0 to 15 percent pebbles

Sodium adsorption ratio—8 to 25

Electrical conductivity—2 to 8 mmhos/cm

Reaction—pH 6.6 to 9.0

Other features—Pedons that have less than 15 percent ESP have more exchangeable Mg plus sodium than calcium plus exchange acidity at pH 8.2

Bkn horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2 or 3

Texture—Clay loam or clay

Clay content—30 to 45 percent

Content of rock fragments—0 to 15 percent—
0 to trace cobbles, 0 to 15 percent pebbles

Sodium adsorption ratio—13 to 25

Electrical conductivity—4 to 8 mmhos/cm

Reaction—pH 7.9 to 9.0

Bknyz horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—1, 2, or 3

Texture—Loam or clay loam

Clay content—25 to 40 percent

Content of rock fragments—0 to 15 percent—
0 to trace cobbles, 0 to 15 percent pebbles

Sodium adsorption ratio—13 to 25

Electrical conductivity—8 to 16 mmhos/cm
Reaction—pH 7.9 to 9.0

522A—Elloam-Absher complex, 0 to 2 percent slopes

Setting

Landform: Elloam—till plains; Absher—till plains
Position on landform: Elloam—microhighs; Absher—
microlows
Slope: Elloam—0 to 2 percent; Absher—0 to 2
percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Elloam and similar soils: 50 percent
Absher and similar soils: 35 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
Hillon and similar soils: 0 to 5 percent
Thoeny and similar soils: 0 to 5 percent
Soils that have slopes more than 2 percent: 0 to 4
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: About 6.5 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: About 3.9 inches

Enbar Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Somewhat poorly drained
Permeability: Moderate (0.6 to 2.0 inches/hour)
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Annual precipitation: 13 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 70 to 110 days

Taxonomic Class: Fine-loamy, mixed Cumulic
Haploborolls

Typical Pedon

Enbar loam, in an area of Enbar-Straw-Eagleton loams, 0 to 2 percent slopes, in rangeland; 2,400 feet south and 100 feet east of the northwest corner of sec. 18, T. 30 N., R. 16 E.

- A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; slightly hard, very friable, sticky and slightly plastic; few fine roots, many very fine roots; many very fine pores; mildly alkaline; clear smooth boundary.
- A2—7 to 23 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, very friable, sticky and slightly plastic; many very fine roots, common very fine pores; mildly alkaline; clear wavy boundary.
- C—23 to 30 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; many fine distinct dark yellowish brown (10YR 4/6) redox concentrations; massive; hard, friable, sticky and plastic; common very fine roots; few very fine pores; effervescent; moderately alkaline; clear wavy boundary.
- Cg1—30 to 53 inches; gray (5Y 5/1) stratified loam and clay loam, dark gray (5Y 4/1) moist; many fine and medium prominent yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) redox concentrations; massive; hard, friable, sticky and plastic; few very fine roots; few very fine pores; effervescent; moderately alkaline; gradual wavy boundary.
- Cg2—53 to 60 inches; gray (5Y 5/1) stratified loam, sandy loam and clay loam, dark gray (5Y 4/1) moist; many fine and medium prominent yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) redox concentrations; massive; hard, friable,

slightly sticky and slightly plastic; few very fine roots; few very fine pores; effervescent; moderately alkaline.

Range in Characteristics

Water table: 36 to 60 inches

A horizon

Hue—5YR, 7.5YR, or 10YR
Value—4 or 5 dry; 2 or 3 moist
Chroma—1, 2, 4, or 6
Clay content—18 to 27 percent
Content of rock fragments—0 to 15 percent pebbles
Reaction—pH 6.6 to 8.4

C horizon

Hue—10YR, 2.5Y, or 5Y
Value—4, 5, or 6 dry; 4 or 5 moist
Chroma—1 or 2
Redox concentrations—Few to common, 10YR 5/4, 10YR 4/6, or 10YR 4/4
Texture—Loam or clay loam
Clay content—18 to 30 percent
Content of rock fragments—0 to 15 percent pebbles
Effervescence—Strong or violent
Reaction—pH 7.9 to 8.4

Cg horizon

Hue—10YR, 2.5Y, or 5Y
Value—4, 5, or 6 dry; 4 or 5 moist
Chroma—0, 1, or 2
Redox concentrations—Few to common, 10YR 3/4, 10YR 5/6, or 10YR 6/6
Texture—Loam with stratification of sandy loam, silty clay loam, and clay loam
Clay content—18 to 27 percent
Content of rock fragments—0 to 15 percent pebbles
Effervescence—Strong or violent
Reaction—pH 7.9 to 8.4

833A—Enbar-Straw-Eggleton loams, 0 to 2 percent slopes

Setting

Landform: Enbar—flood plains; Straw—flood plains; Eggleton—flood plains
Slope: Enbar—0 to 2 percent; Straw—0 to 2 percent; Eggleton—0 to 2 percent
Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition

Major Components

Enbar and similar soils: 35 percent
Straw and similar soils: 30 percent
Eggleton and similar soils: 20 percent

Minor Components

Eggleton, frequently flooded: 0 to 2 percent
Nesda and similar soils: 0 to 4 percent
Hanly and similar soils: 0 to 2 percent
Havre and similar soils: 0 to 5 percent
Soils that have slopes more than 2 percent: 0 to 2 percent

Major Component Description

Enbar

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: Occasional
Water table: Apparent
Available water capacity: About 10.0 inches

Straw

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: About 10.7 inches

Eggleton

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Water table: Apparent
Available water capacity: About 10.6 inches

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, or drainageways

Parent material: Alluvium
Slope range: 0 to 2 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Aridic
 Argiborolls

Typical Pedon

Ethridge clay loam, 0 to 2 percent slopes, in an area of cropland; 500 feet south and 500 feet east of the northwest corner of sec. 4, T. 30 N., R. 14 E.

- Ap—0 to 7 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable, sticky and plastic; many very fine and fine roots; many fine pores; neutral; abrupt wavy boundary.
- Bt1—7 to 10 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong coarse prismatic structure parting to strong fine angular blocky; extremely hard, very firm, very sticky and very plastic; common very fine and fine roots; common fine pores; many distinct clay films on faces of peds; neutral; clear wavy boundary.
- Bt2—10 to 15 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; extremely hard, very firm, very sticky and very plastic; common fine and medium roots; common fine pores; common distinct clay films on faces of peds; neutral; clear wavy boundary.
- Bk—15 to 33 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure; hard, firm, sticky and very plastic; few fine and medium roots; few fine and medium pores; common medium soft masses of lime; moderately alkaline; strongly effervescent; clear wavy boundary.
- Bky—33 to 60 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; massive; very hard, firm, very sticky and very plastic; few fine and medium roots; few fine pores; common medium filaments of lime; few fine masses of gypsum; 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 14 inches; may include all or part of the Bt horizon

Depth to Bk horizon: 10 to 20 inches

Ap horizon

Hue—10YR or 2.5Y
 Value—2 or 3 moist
 Chroma—2 or 3
 Clay content—27 to 35 percent
 Content of 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, 3, or 4
 Texture—Clay, silty clay, clay loam, or silty clay loam
 Clay content—35 to 45 percent
 Content of rock fragments—0 to 5 percent pebbles
 Reaction—pH 6.6 to 8.4

Bk horizon

Hue—10YR or 2.5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Clay, silty clay loam, clay loam, or silty clay
 Clay content—30 to 45 percent
 Content of rock fragments—0 to 5 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, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Clay loam, silt loam, loam, or silty clay loam (these textures consist of strata of finer and coarser materials)
 Clay content—25 to 40 percent
 Content of rock fragments—0 to 5 percent pebbles
 Electrical conductivity—0 to 4 mmhos/cm
 Calcium carbonate equivalent—5 to 15 percent
 Gypsum—1 to 3 percent
 Reaction—pH 7.4 to 8.4

381A—Ethridge clay loam, 0 to 2 percent slopes

Setting

Landform: Alluvial fans, stream terraces, and drainageways

Slope: 0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Ethridge and similar soils: 85 percent

Minor Components

Kobase, calcareous soils: 0 to 3 percent

Marias and similar soils: 0 to 1 percent

Degradand and similar soils: 0 to 9 percent

Soils that have slopes more than 2 percent: 0 to 2 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: About 9.8 inches

Evanston Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Moderate (0.6 to 2.0 inches/hour)

Landform: Till plains, drainageways, alluvial fans, and stream terraces

Parent material: Alluvium

Slope range: 0 to 4 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Evanston loam, 0 to 2 percent slopes, in an area of cropland; 1,200 feet north and 900 feet east of the southwest corner of sec. 35, T. 30 N., R. 10 E.

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

Bt—7 to 18 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium and coarse prismatic structure parting to strong

medium subangular blocky; hard, firm, sticky and plastic; many very fine roots; many very fine pores; common distinct clay films on faces of peds; neutral; clear smooth boundary.

Bk1—18 to 28 inches; light gray (10YR 7/2) clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—28 to 40 inches; light yellowish brown (2.5Y 6/4) loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and plastic; common very fine roots; many very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—40 to 60 inches; light yellowish brown (2.5Y 6/4) loam, grayish brown (2.5Y 5/2) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and plastic; few very fine roots; common very fine pores; common fine soft masses of lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 15 inches

Depth to Bk horizon: 8 to 20 inches

A horizon

Hue—2.5Y through 7.5YR

Value—3, 4, or 5 dry; 2 or 3 moist

Chroma—2 or 3 dry and moist

Clay content—20 to 27 percent

Reaction—pH 6.6 to 7.8

Bt horizon

Hue—2.5Y through 7.5YR

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

Chroma—2, 3, or 4 dry and moist

Texture—Clay loam, sandy clay loam, or loam

Clay content—25 to 35 percent

Reaction—pH 6.6 to 7.8

Bk horizon

Hue—2.5Y through 7.5YR

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—3 or 4 dry and moist

Texture—Loam, clay loam, or sandy clay loam

Clay content—20 to 35 percent

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.9 to 8.4

37A—Evanston loam, 0 to 2 percent slopes

Setting

Landform: Alluvial fans, stream terraces, and drainageways

Slope: 0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Evanston and similar soils: 85 percent

Minor Components

Kremlin and similar soils: 0 to 1 percent

Yamacall, calcareous soils: 0 to 4 percent

Degrad and similar soils: 0 to 8 percent

Soils that have slopes more than 2 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: About 9.7 inches

375B—Evanston-Lonna loams, 0 to 4 percent slopes

Setting

Landform: Evanston—till plains; Lonna—till plains

Position on landform: Evanston—foot slopes; Lonna—back slopes

Slope: Evanston—0 to 4 percent; Lonna—0 to 4 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Evanston and similar soils: 55 percent

Lonna and similar soils: 30 percent

Minor Components

Chinook and similar soils: 0 to 3 percent

Ethridge and similar soils: 0 to 5 percent

Yamacall, calcareous soils: 0 to 3 percent

Busby and similar soils: 0 to 4 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: About 9.7 inches

Lonna

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: About 9.7 inches

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: 0 to 8 percent

Annual precipitation: 13 to 17 inches

Annual air temperature: 41 to 44 degrees F

Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic Argiborolls

Typical Pedon

Farnuf loam, 4 to 8 percent slopes, in an area of rangeland; 600 feet south and 1,800 feet east of the northwest corner of sec. 35, T. 30 N., R. 15 E.

A—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; medium very fine granular structure; slightly hard, very friable, sticky and plastic; many very fine roots; many fine pores; neutral; clear smooth boundary.

Bt—9 to 18 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, sticky and plastic; many very fine roots, many

very fine pores; common faint clay films on faces of pedis; neutral; clear smooth boundary.

Bk1—18 to 26 inches; light brownish gray (10YR 6/2) clay loam, brown (10YR 5/3) moist; moderate fine and medium angular blocky structure; very hard, friable, sticky and plastic; many fine roots; many very fine pores; common fine soft masses and seams of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—26 to 38 inches; light brownish gray (10YR 6/2) clay loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine pores; common fine soft masses and seams of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk3—38 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine pores; common fine and medium soft 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

Depth to Bk horizon: 10 to 25 inches

A horizon

Hue—2.5Y or 10YR

Value—3, 4, or 5 dry; 2 or 3 moist

Chroma—2 or 3

Clay content—15 to 27 percent

Content of 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 horizon

Hue—2.5Y, 10YR, or 7.5YR

Value—3, 4, 5, or 6 dry; 2, 3, or 4 moist

Chroma—2, 3, or 4

Texture—Loam, clay loam, or silty clay loam

Clay content—25 to 35 percent

Content of rock fragments—0 to 15 percent
pebbles

Reaction—pH 6.1 to 7.8

Other features—Some pedons have a thin Btk
horizon

Bk horizon

Hue—2.5Y, 10YR, or 7.5YR

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Fine sandy loam, loam, silt loam, silty
clay loam, or clay loam

Clay content—20 to 30 percent

Content of rock fragments—0 to 15 percent
pebbles

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.4 to 8.4

75B—Farnuf loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans

Slope: 0 to 4 percent

Mean annual precipitation: 13 to 17 inches

Frost-free period: 90 to 110 days

Composition

Major Components

Farnuf and similar soils: 85 percent

Minor Components

Bowery and similar soils: 0 to 7 percent

Farnuf, calcareous soils: 0 to 4 percent

Soils that have slopes more than 4 percent: 0 to 4
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: About 9.8 inches

75C—Farnuf loam, 4 to 8 percent slopes

Setting

Landform: Alluvial fans

Slope: 4 to 8 percent

Mean annual precipitation: 13 to 17 inches

Frost-free period: 90 to 110 days

Composition

Major Components

Farnuf and similar soils: 85 percent

Minor Components

Bowery and similar soils: 0 to 5 percent

Farnuf, calcareous soils: 0 to 5 percent
 Soils that have slopes more than 8 percent: 0 to 3 percent
 Soils that have slopes less than 4 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: About 9.8 inches

Ferd 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 and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Glossic Eutroboralfs

Typical Pedon

Ferd loam, in an area of Ferd-Creed-Gerdrum complex, 0 to 4 percent slopes, in cropland; 150 feet north and 1,600 feet west of the southeast corner of sec. 13, T. 32 N., R. 13 E.

Ap—0 to 4 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate very fine granular structure; soft, very friable, sticky and slightly plastic; common very fine roots; neutral; clear smooth boundary.
 E/Bt—4 to 7 inches; 60 percent light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist (E part); 40 percent grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist (B part); moderate very thin platy structure parting to moderate very fine granular; soft, very friable, sticky and slightly plastic; common very fine roots; many very fine pores; few faint clay films on ped faces; neutral; abrupt smooth boundary.

Bt—7 to 15 inches; grayish brown (10YR 5/2) clay, dark brown (10YR 3/3) moist; moderate fine and medium prismatic structure parting to strong fine and medium subangular blocky; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine pores; many faint clay films on faces of peds; neutral; clear wavy boundary.

Bk1—15 to 27 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium prismatic structure parting to strong fine and medium subangular blocky; hard, firm, sticky and very plastic; common very fine roots; many very fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—27 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong fine and medium subangular blocky structure; hard, firm, sticky and very plastic; few very fine roots; many very fine pores; many fine soft masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bky—42 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and very plastic; many very fine pores; common fine soft masses of lime; few fine seams of gypsum; violently effervescent; strongly alkaline.

Range in Characteristics

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

E/Bt horizon

Hue—10YR or 2.5Y
 Texture—Loam, clay loam, or silty clay loam
 Clay content—22 to 35 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
 Electrical conductivity—less than 2 mmhos/cm
 Reaction—pH 6.6 to 8.4

Bk1 and Bk2 horizons

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
 Sodium adsorption ratio—0 to 13
 Electrical conductivity—2 to 8 mmhos/cm
 Reaction—pH 7.9 to 9.0

Bky 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
 Sodium adsorption ratio—8 to 13
 Electrical conductivity—4 to 8 mmhos/cm
 Gypsum—1 to 3 percent
 Reaction—pH 8.4 to 9.6

31A—Ferd loam, 0 to 2 percent slopes***Setting***

Landform: Till plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Ferd and similar soils: 85 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Creed and similar soils: 0 to 5 percent
 Ethridge and similar soils: 0 to 7 percent
 Soils that have slopes more than 2 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: About 9.6 inches

311B—Ferd-Creed-Gerdrum complex, 0 to 4 percent slopes***Setting***

Landform: Ferd—stream terraces; Creed—stream terraces; Gerdrum—stream terraces
Position on landform: Ferd—microhighs; Creed—microlows; Gerdrum—microlows
Slope: Ferd—0 to 4 percent; Creed—0 to 4 percent; Gerdrum—0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Ferd and similar soils: 35 percent
 Creed and similar soils: 25 percent
 Gerdrum and similar soils: 25 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Ethridge and similar soils: 0 to 6 percent
 Kobase, calcareous soils: 0 to 3 percent
 Soils that have sandy layers below 40 inches: 0 to 5 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: About 9.6 inches

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: About 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: About 6.0 inches

Fortbenton Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid in the upper 0 to 26 inches (2.0 to 6.0 inches/hour); slow below this depth (0.06 to 0.2 inch/hour)
Landform: Till plains and hills
Parent material: Glaciofluvial deposits
Slope range: 0 to 25 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed Aridic
 Haploborolls

Typical Pedon

Fortbenton fine sandy loam, 0 to 4 percent slopes, in an area of cropland; 1,300 feet north and 1,000 feet west of the southeast corner of sec. 34, T. 34 N., R. 11 E.

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

Bw1—6 to 11 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine roots; few very fine pores; neutral; clear wavy boundary.

Bw2—11 to 26 inches; yellowish brown (10YR 5/4) fine sandy loam, dark brown (10YR 4/3) moist; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine pores; neutral; abrupt wavy boundary.

2Bk1—26 to 40 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine pores; common

fine soft masses and threads of lime; violently effervescent; moderately alkaline, abrupt wavy boundary.

2Bk2—40 to 53 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

2Bk3—53 to 60 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine pores; common fine soft masses of lime; violently effervescent; strongly alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 15 inches
Depth to the Bk horizon: 15 to 30 inches

Ap horizon

Hue—10YR or 2.5Y
 Value—4 or 5 dry
 Chroma—2 or 3
 Texture—Fine sandy loam or loam
 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, 3, or 4
 Texture—Fine sandy loam or sandy loam
 Clay content—5 to 18 percent
 Reaction—pH 6.6 to 7.8

2Bk horizon

Hue—10YR or 2.5Y
 Value—6 or 7 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Texture—Clay loam, silty clay loam, or silt loam
 Clay content—27 to 35 percent
 Calcium carbonate equivalent—5 to 15 percent
 Electrical conductivity—0 to 2 mmhos/cm
 Reaction—pH 7.9 to 8.4

96B—Fortbenton fine sandy loam, 0 to 4 percent slopes**Setting**

Landform: Till plains
Slope: 0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Fortbenton and similar soils: 85 percent

Minor Components

Chinook and similar soils: 0 to 8 percent
 Soils that have slopes more than 4 percent: 0 to 5 percent
 Hillon 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: Glaciofluvial deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 9.7 inches

96C—Fortbenton fine sandy loam, 4 to 8 percent slopes**Setting**

Landform: Till plains
Slope: 4 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Fortbenton and similar soils: 85 percent

Minor Components

Chinook and similar soils: 0 to 7 percent
 Hillon and similar soils: 0 to 3 percent
 Soils that have slopes less than 4 percent: 0 to 1 percent
 Soils that have slopes more than 8 percent: 0 to 4 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: Glaciofluvial deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 9.7 inches

962B—Fortbenton loam, 0 to 4 percent slopes**Setting**

Landform: Till plains
Slope: 0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Fortbenton and similar soils: 85 percent

Minor Components

Fortbenton fine sandy loam: 0 to 4 percent
 Kenilworth and similar soils: 0 to 6 percent
 Hillon and similar soils: 0 to 2 percent
 Soils that have slopes more than 4 percent: 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: Glaciofluvial deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 9.6 inches

965B—Fortbenton-Chinook fine sandy loams, 0 to 6 percent slopes**Setting**

Landform: Fortbenton—till plains; Chinook—till plains;
Position on landform: Fortbenton—back slopes;
 Chinook—back slopes
Slope: Fortbenton—0 to 6 percent; Chinook—0 to 6 percent

Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

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

Minor Components

Kremlin and similar soils: 0 to 8 percent
 Hillon and similar soils: 0 to 3 percent
 Joplin gravelly loam: 0 to 4 percent

Major Component Description

Fortbenton

Surface layer texture: Fine sandy 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: About 9.7 inches

Chinook

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
Flooding: None
Available water capacity: About 7.8 inches

968C—Fortbenton-Hillon complex, 2 to 8 percent slopes

Setting

Landform: Fortbenton—till plains; Hillon—till plains
Position on landform: Fortbenton—back slopes;
 Hillon—shoulders
Slope: Fortbenton—2 to 8 percent; Hillon—2 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Fortbenton and similar soils: 50 percent
 Hillon and similar soils: 35 percent

Minor Components

Joplin gravelly loam: 0 to 5 percent
 Fortbenton, calcareous soils: 0 to 5 percent

Soils that have slopes more than 8 percent: 0 to 5 percent

Major Component Description

Fortbenton

Surface layer texture: Fine sandy 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: About 9.7 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: About 10.0 inches

Garlet Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Moderately rapid (2.0 to 6.0 inches/hour)
Landform: Mountains
Parent material: Colluvium
Slope range: 25 to 70 percent
Annual precipitation: 20 to 22 inches
Annual air temperature: 38 to 40 degrees F
Frost-free period: 50 to 70 days

Taxonomic Class: Loamy-skeletal, mixed Typic Cryochrepts

Typical Pedon

Garlet cobbly loam, in an area of Garlet-Elkner complex, 25 to 70 percent slopes, in woodland; 150 feet south and 2,500 feet west of the northeast corner of sec. 29, T. 28 N., R. 16 E.

Oi—2 to 0 inches; forest litter of slightly decomposed needles, twigs, and leaves.
 E1—0 to 4 inches; brown (10YR 5/3) cobbly loam, brown (10YR 4/3) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine and fine pores; 10 percent pebbles, 35 percent cobbles; moderately acid; clear smooth boundary.

E2—4 to 16 inches; brown (10YR 5/3) extremely cobbly loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly phastic; common fine and medium roots; common fine pores; 5 percent pebbles, 60 percent cobbles; slightly acid; clear wavy boundary.

Bw/E—16 to 28 inches; 80 percent yellowish brown (10YR 5/4) extremely cobbly sandy clay loam, dark yellowish brown (10YR 4/4) moist (B part), 20 percent light yellowish brown (10YR 6/4) yellowish brown (10YR 5/4) moist (E part); weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine pores; 5 percent pebbles, 65 percent cobbles; slightly acid; clear wavy boundary.

C—28 to 60 inches; light yellowish brown (10YR 6/4) extremely cobbly sandy clay loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; 5 percent pebbles; 65 percent cobbles; slightly acid.

Range in Characteristics

E1 horizon

Hue—10YR
Value—5 or 6 dry; 4 or 5 moist
Chroma—1, 2, or 3
Clay content—10 to 25 percent
Content of rock fragments—15 to 35 percent—
10 to 15 percent cobbles and stones, 5 to
20 percent pebbles
Reaction—pH 5.6 to 6.5

E2 horizon

Hue—10YR or 7.5YR
Value—5, 6, or 7 dry; 4, 5, or 6 moist
Chroma—2, 3, 4
Texture—Loam or sandy loam
Clay content—10 to 25 percent
Content of rock fragments—35 to 85 percent—
10 to 40 percent cobbles and stones, 25 to
60 percent pebbles
Reaction—pH 5.6 to 6.5

Bw/E horizon

Hue—B part—10YR or 7.5YR; E part—10YR
or 7.5YR
Value—B part—6 or 7 dry and 4 or 5 moist;
E part—5 or 6 dry and 4 or 5 moist
Chroma—2, 3, or 4
Texture—Sandy clay loam, sandy loam, or
loam

Clay content—10 to 25 percent
Content of rock fragments—40 to 80 percent—
15 to 40 percent cobbles and stones, 25 to
60 percent pebbles
Reaction—pH 5.6 to 7.8
Other features—Some pedons have E/B horizons

C horizon

Hue—10YR, 2.5Y, or 7.5YR
Value—6 or 7 dry; 5 or 6 moist
Chroma—2, 3, 4
Texture—Loam, sandy loam, or sandy clay loam
Clay content—5 to 25 percent
Content of rock fragments—45 to 80 percent
Reaction—pH 6.1 to 8.4

182F—Garlet-Elkner complex, 25 to 70 percent slopes

Setting

Landform: Garlet—mountains; Elkner—mountains
Position on landform: Garlet—back slopes; Elkner—
back slopes
Slope: Garlet—25 to 70 percent; Elkner—25 to 70
percent
Mean annual precipitation: 20 to 22 inches
Frost-free period: 50 to 70 days

Composition

Major Components

Garlet and similar soils: 50 percent
Elkner and similar soils: 35 percent

Minor Components

Warwood and similar soils: 0 to 5 percent
Soils that have bedrock at 10 to 60 inches: 0 to 7
percent
Soils that are very gravelly below 30 inches: 0 to 2
percent
Areas of rubble land: 0 to 1 percent

Major Component Description

Garlet

Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: About 4.5 inches

Elkner

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Colluvium
Native plant cover type: Forest land
Flooding: None
Available water capacity: About 4.5 inches

Gerdrum Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Very slow (0.06 inch/hour)
Landform: Till plains and stream terraces
Parent material: Alluvium
Slope range: 0 to 4 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Typic
 Natriboralfs

Typical Pedon

Gerdrum clay loam, in an area of Gerdrum-Absher-Creed complex, 0 to 2 percent slopes, in rangeland; 100 feet south and 950 feet east of the northwest corner of sec. 1, T. 36 N., R. 8 E.

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

Btn1—3 to 11 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong coarse columnar structure parting to strong medium angular blocky; very hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; many distinct clay films on faces of peds; mildly alkaline; clear smooth boundary.

Btn2—11 to 19 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; strong coarse prismatic structure parting to strong medium angular blocky; very hard, firm, very sticky and very plastic; common very fine roots; common very fine pores; many distinct clay films on faces of peds; moderately alkaline; clear wavy boundary.

Bknyz1—19 to 28 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine pores; common fine and medium soft masses and threads of lime; common fine masses of gypsum and other salts; strongly effervescent; strongly alkaline; gradual wavy boundary.

Bknyz2—28 to 36 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine pores; common fine soft masses of lime; common fine masses of gypsum and other salts; violently effervescent; strongly alkaline; gradual wavy boundary.

Bknyz3—36 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine pores; common fine soft masses of lime; common fine masses of gypsum and other salts; violently effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at 20 inches is 41 degrees F or above

Depth to Bknyz horizon: 10 to 28 inches

E horizon

Hue—10YR or 2.5Y

Value—6 or 7 dry; 4, 5, or 6 moist

Chroma—2 or 3

Clay content—27 to 40 percent

Content of rock fragments—0 to 15 percent pebbles

Reaction—pH 6.6 to 7.8

Btn1 horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Clay, silty clay, or silty clay loam

Clay content—35 to 55 percent

Content of rock fragments—0 to 10 percent pebbles

Structure—Fine to coarse columnar or medium or coarse blocky

Hardness—Extremely or very hard when dry

Electrical conductivity—1 to 8 mmhos/cm

Sodium adsorption ratio—10 to 20; pedons with sodium adsorption ratio of less than 13 have more exchangeable magnesium plus sodium than calcium plus exchange acidity at pH 8.2.

Reaction—pH 7.4 to 9.0

Btn2 horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Clay, silty clay, or silty clay loam

Clay content—35 to 55 percent

Content of rock fragments—0 to 10 percent pebbles

Structure—Fine to coarse prismatic or medium or coarse blocky

Hardness—Extremely or very hard when dry

Electrical conductivity—1 to 8 mmhos/cm

Sodium adsorption ratio—10 to 20; pedons with sodium adsorption ratio of less than 13 have more exchangeable magnesium plus sodium than calcium plus exchange acidity at pH 8.2.

Reaction—pH 7.4 to 9.0

Bknyz horizon

Hue—10YR, 2.5Y, or 5Y

Value—4, 5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Clay loam, sandy clay loam, clay, or silty clay

Clay content—30 to 50 percent

Content of 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

402A—Gerdrum-Absher-Creed complex, 0 to 2 percent slopes

Setting

Landform: Gerdrum—stream terraces; Absher—stream terraces; Creed—stream terraces

Position on landform: Gerdrum—microlows; Absher—microlows; Creed—microhighs

Slope: Gerdrum—0 to 2 percent; Absher—0 to 2 percent; Creed—0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Gerdrum and similar soils: 40 percent

Absher and similar soils: 25 percent

Creed and similar soils: 20 percent

Minor Components

Nishon and similar soils: 0 to 1 percent

Hillon and similar soils: 0 to 6 percent

Soils that have slopes more than 2 percent: 0 to 2 percent

Soils that have sandy layers below 40 inches: 0 to 6 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: About 6.0 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: About 3.9 inches

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: About 6.6 inches

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: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Glendive fine sandy loam, 0 to 2 percent slopes, rarely flooded, in an area of rangeland; 2,100 feet north and 1,600 feet east of the southwest corner of sec. 29, T. 31 N., R. 14 E.

A—0 to 6 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; neutral; clear smooth boundary.

C1—6 to 12 inches; grayish brown (10YR 5/2) stratified loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—12 to 60 inches; light brownish gray (2.5Y 6/2) stratified fine sandy loam, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Moisture control section: Between 8 and 24 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Soil phases: Flooded or sandy surface

A horizon

Hue—10YR, 2.5Y, or 5Y
 Value—4, 5, or 6 dry; 3, 4, or 5 moist
 Chroma—2 or 3
 Clay content—5 to 15 percent
 Reaction—pH 6.6 to 8.4

C horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Loam, silt loam, sandy loam, or fine sandy loam
 Clay content—5 to 18 percent
 Content of rock fragments—0 to 15 percent pebbles
 Reaction—pH 7.4 to 8.4

81A—Glendive fine sandy loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Glendive and similar soils: 85 percent

Minor Components

Glendive, occasionally flooded: 0 to 2 percent
 Hanly and similar soils: 0 to 2 percent
 Havre and similar soils: 0 to 3 percent
 Glendive, calcareous soils: 0 to 5 percent
 Soils that have slopes more than 2 percent: 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
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: About 7.6 inches

812A—Glendive fine sandy loam, calcareous, 0 to 2 percent slopes

Setting

Landform: Flood plains

Slope: 0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Glendive and similar soils: 85 percent

Minor Components

Glendive, occasionally flooded: 0 to 2 percent

Hanly and similar soils: 0 to 2 percent

Glendive loam soils: 0 to 9 percent

Soils that have slopes more than 2 percent: 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: Rare

Available water capacity: About 8.1 inches

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: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Sandy, mixed, frigid Aridic Ustifluvents

Typical Pedon

Hanly loamy fine sand, 0 to 2 percent slopes, in an area of cropland; 500 feet north and 5,000 feet east of the southwest corner of sec. 36, T. 31 N., R. 16 E.

Ap—0 to 7 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist;

moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; neutral; abrupt smooth boundary.

C1—7 to 17 inches; light brownish gray (2.5Y 6/2) stratified loamy fine sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots, few very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

C2—17 to 44 inches; light brownish gray (2.5Y 6/2) stratified loamy fine sand with thin layers of fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; hard, very friable, nonsticky and nonplastic; few very fine roots, few very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C3—44 to 60 inches; grayish brown (2.5Y 5/2) stratified fine sandy loam and loamy fine sand, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline.

Range in Characteristics

Ap horizon

Hue—2.5Y or 10YR

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2 or 3

Clay content—5 to 10 percent

Reaction—ph 6.6 to 8.4

C horizon

Hue—10YR, 2.5Y, or 5YR

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2 to 4

Clay content—5 to 10 percent

Reaction—ph 6.6 to 8.4

24A—Hanly loamy fine sand, 0 to 2 percent slopes

Setting

Landform: Flood plains

Slope: 0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Hanly and similar soils: 85 percent

Minor Components

Hanly fine sand: 0 to 5 percent
 Glendive, calcareous soils: 0 to 4 percent
 Hanly, occasionally flooded: 0 to 2 percent
 Soils that have slopes more than 2 percent: 0 to 4 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: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: About 5.7 inches

241A—Hanly loamy fine sand, 0 to 2 percent slopes, occasionally flooded**Setting**

Landform: Flood plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Hanly and similar soils: 85 percent

Minor Components

Somewhat poorly drained soils: 0 to 1 percent
 Hanly fine sandy loam: 0 to 5 percent
 Hanly, rarely flooded: 0 to 3 percent
 Hanly, frequently flooded: 0 to 2 percent
 Soils that have slopes more than 2 percent: 0 to 2 percent
 Glendive, calcareous soils: 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: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: About 5.7 inches

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: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic (calcareous), frigid Aridic Ustifluvents

Typical Pedon

Harlake clay, 0 to 2 percent slopes, in an area of cropland; 2,400 feet north and 800 feet west of the southeast corner of sec. 4, T. 32 N., R. 17 E.

- Ap—0 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common very fine roots; neutral; abrupt smooth boundary.
- C1—10 to 32 inches; light brownish gray (2.5Y 6/2) stratified clay and clay loam, dark grayish brown (2.5Y 5/2) moist; massive; very hard, firm, very sticky and very plastic; few very fine roots, few very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.
- C2—32 to 60 inches; light brownish gray (2.5Y 6/2) stratified clay and clay loam, grayish brown (10YR 5/2) moist; massive; very hard, firm, very sticky and very plastic; strongly effervescent; moderately 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, 5, or 6 dry; 4 or 5 moist
 Chroma—2 or 3
 Texture—Clay loam or clay
 Clay content—27 to 55 percent
 Reaction—pH 6.6 to 8.4

C1 horizon

Hue—10YR, 2.5Y, or 5Y

Value—4, 5, 6, or 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, and silty clay
 Clay content—35 to 60 percent
 Reaction—pH 7.4 to 8.4

C2 horizon

Hue—10YR, 2.5Y, or 5Y
 Value—4, 5, 6, or 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, and silty clay
 Clay content—35 to 60 percent
 Reaction—pH 7.4 to 9.0

90A—Harlake clay, 0 to 2 percent slopes**Setting**

Landform: Flood plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Harlake and similar soils: 85 percent

Minor Components

Harlake, calcareous soils: 0 to 10 percent
 Havre, occasionally flooded: 0 to 2 percent
 Soils that have slopes more than 2 percent: 0 to 3 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: About 9.6 inches

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: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Havre loam, 0 to 2 percent slopes, in an area of rangeland; 2,300 feet north and 700 feet west of the southeast corner of sec. 18, T. 37 N., R. 16 E.

- A—0 to 5 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and plastic; many very fine roots and few fine roots; neutral; clear smooth boundary.
- C1—5 to 31 inches; grayish brown (2.5Y 5/2) stratified loam and fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, slightly sticky and plastic; many very fine roots; many very fine pores; slightly effervescent; moderately alkaline; clear wavy boundary.
- C2—31 to 55 inches; grayish brown (2.5Y 5/2) stratified fine sandy loam and loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.
- C3—55 to 60 inches; grayish brown (2.5Y 5/2) stratified fine sandy loam and clay loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Ap 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—15 to 40 percent
 Effervescence—None to strong
 Reaction—pH 6.1 to 8.4

C1 horizon

Hue—10YR, 2.5Y, or 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—1 to 10 percent
 Effervescence—Slight or strong
 Reaction—pH 7.4 to 8.4

C2 and C3 horizons

Hue—10YR, 2.5Y, or 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—1 to 10 percent
 Effervescence—Slight or strong
 Reaction—pH 7.4 to 8.4

60A—Havre loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Havre and similar soils: 85 percent

Minor Components

Havre, calcareous soils: 0 to 9 percent
 Glendive and similar soils: 0 to 2 percent
 Havre, occasionally flooded: 0 to 1 percent
 Soils that have slopes more than 2 percent: 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: Rare
Available water capacity: About 9.7 inches

604A—Havre-Glendive complex, 0 to 2 percent slopes

Setting

Landform: Havre—flood plains; Glendive—flood plains (fig. 4)
Slope: Havre—0 to 2 percent; Glendive—0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Havre and similar soils: 45 percent
 Glendive and similar soils: 40 percent

Minor Components

Somewhat poorly drained soils: 0 to 1 percent
 Harlake and similar soils: 0 to 3 percent
 Havre, calcareous soils: 0 to 6 percent
 Havre, frequently flooded: 0 to 1 percent
 Glendive, rarely flooded: 0 to 2 percent
 Soils that have slopes more than 2 percent: 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: Occasional
Available water capacity: About 9.7 inches

Glendive

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: Occasional
Available water capacity: About 7.2 inches



Figure 4.—Map unit 604A, Havre-Glendive complex, 0 to 2 percent slopes along the Milk River flood plain. Map unit 212F, Cabbart-Hillon loams, 25 to 60 percent slopes, surrounds this unit.

603A—Havre-Harlake clay loams, 0 to 2 percent slopes

Setting

Landform: Havre—flood plains; Harlake—flood plains

Slope: Havre—0 to 2 percent; Harlake—0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Havre and similar soils: 45 percent

Harlake and similar soils: 40 percent

Minor Components

Havre, occasionally flooded: 0 to 2 percent

Havre loam: 0 to 11 percent

Soils that have slopes more than 2 percent: 0 to 2 percent

Major Component Description

Havre

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: About 9.6 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: About 9.6 inches

Hedoes Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Moderate in the upper 0 to 34 inches (0.6 to 2.0 inches/hour); moderately rapid below this depth (2.0 to 6.0 inches/hour)
Landform: Hills
Parent material: Colluvium
Slope range: 4 to 35 percent
Annual precipitation: 15 to 19 inches
Annual air temperature: 40 to 43 degrees F
Frost-free period: 70 to 100 days

Taxonomic Class: Coarse-loamy, mixed Pachic Haploborolls

Typical Pedon

Hedoes loam, in an area of Hedoes-Belain loams, 15 to 35 percent slopes, in rangeland; 1,000 feet north and 2,250 feet west of the southeast corner of sec. 20, T. 28 N., R. 15 E.

- A—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; neutral; clear smooth boundary.
- Bw1—5 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; neutral; clear wavy boundary.
- Bw2—10 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine and common coarse roots; many fine pores; neutral; clear wavy boundary.
- Bw3—14 to 18 inches; brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; weak moderate subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many fine pores; neutral; gradual wavy boundary.
- Bw4—18 to 34 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable,

nonsticky and nonplastic; few fine roots; common fine pores; neutral; clear wavy boundary.
 2C—34 to 60 inches; brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; loose; very friable, nonsticky and nonplastic; few fine roots; common fine and coarse pores; 40 percent pebbles; mildly alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 20 inches

A horizon

Hue—7.5YR, 10YR, or 2.5Y
 Value—4 or 5 dry; 2 or 3 moist
 Chroma—2 or 3
 Clay content—10 to 15 percent
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles, 0 to 10 percent pebbles
 Reaction—pH 6.6 to 7.3

Bw horizon

Hue—7.5YR, 10YR, or 2.5Y
 Value—4 or 5 dry; 2, 3, or 4 moist
 Chroma—2 or 3
 Texture—Loam or sandy loam
 Clay content—5 to 15 percent
 Content of rock fragments—0 to 20 percent—
 0 to 10 percent cobbles, 0 to 10 percent pebbles
 Reaction—pH 6.6 to 8.4
 Other features—Some pedons have a cambic C horizon

2C horizon

Hue—7.5YR, 10YR, or 2.5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2 or 3
 Texture—Sandy loam or coarse sandy loam
 Clay content—0 to 10 percent
 Content of rock fragments—30 to 60 percent
 Reaction—pH 7.4 to 8.4

761D—Hedoes-Belain loams, 4 to 15 percent slopes

Setting

Landform: Hedoes—hills; Belain—hills
Position on landform: Hedoes—back slopes; Belain—shoulders
Slope: Hedoes—4 to 15 percent; Belain—4 to 15 percent
Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition

Major Components

Hedoes and similar soils: 50 percent
Belain and similar soils: 35 percent

Minor Components

Bowery and similar soils: 0 to 5 percent
Whitlash and similar soils: 0 to 3 percent
Farnuf and similar soils: 0 to 3 percent
Soils with salts: 0 to 1 percent
Soils that have slopes less than 4 percent: 0 to 2 percent
Soils that have slopes more than 15 percent: 0 to 1 percent

Major Component Description

Hedoes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 7.1 inches

Belain

Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 3.5 inches

761F—Hedoes-Belain loams, 15 to 35 percent slopes

Setting

Landform: Hedoes—hills; Belain—hills
Position on landform: Hedoes—back slopes; Belain—shoulders
Slope: Hedoes—15 to 35 percent; Belain—15 to 35 percent
Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition

Major Components

Hedoes and similar soils: 45 percent
Belain and similar soils: 40 percent

Minor Components

Bowery and similar soils: 0 to 5 percent
Whitlash and similar soils: 0 to 5 percent
Soils that have slopes less than 15 percent: 0 to 2 percent
Soils that have slopes more than 35 percent: 0 to 2 percent
Areas of rock outcrop: 0 to 1 percent

Major Component Description

Hedoes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 7.1 inches

Belain

Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 3.5 inches

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 and hills
Parent material: Glacial till
Slope range: 0 to 70 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Hillon loam, in an area of Hillon-Joplin loams, 8 to 15 percent slopes, in rangeland; 2,200 feet south and 500 feet west of the northeast corner of sec. 32, T. 32 N., R. 15 E.

Ap—0 to 3 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; moderate very fine granular structure; slightly hard, very friable, slightly sticky and plastic; many

very fine and common fine roots; common very fine pores; mildly alkaline; clear smooth boundary.

Bk1—3 to 16 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, sticky and plastic; many very fine and common fine roots; many very fine pores; many fine and medium soft masses of lime; violently effervescent; strongly alkaline; clear wavy boundary.

Bk2—16 to 29 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine pores; common fine and medium soft masses of lime; violently effervescent; strongly alkaline; clear wavy boundary.

By—29 to 60 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots in upper part; few very fine pores; common fine and medium seams and masses of gypsum; strongly effervescent; strongly alkaline.

Range in Characteristics

Ap horizon

Hue—10YR or 2.5Y

Value—5 or 6 dry; 3, 4, or 5 moist

Chroma—2 or 3

Texture—Loam or clay loam

Clay content—20 to 35 percent

Content of rock fragments—0 to 25 percent—
0 to 10 percent cobbles and stones, 0 to 15 percent pebbles

Calcium carbonate equivalent—0 to 10 percent

Effervescence—None to violent

Reaction—pH 7.4 to 8.4

Bk horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—20 to 35 percent with 25 to 35 percent fine and coarser sand

Content of rock fragments—0 to 15 percent pebbles

Bulk density—1.55 to 1.75 g/ccm

Calcium carbonate equivalent—5 to 15 percent

Effervescence—Strong or violent

Reaction—pH 7.9 to 9.0

By horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—20 to 35 percent with 25 to 35 percent fine and coarser sand

Content of rock fragments—0 to 15 percent pebbles

Bulk density—1.55 to 1.75 g/ccm

Calcium carbonate equivalent—2 to 12 percent

Effervescence—Strong to violent

Reaction—pH 7.9 to 9.0

22E—Hillon loam, 15 to 25 percent slopes

Setting

Landform: Hills

Slope: 15 to 25 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Hillon and similar soils: 85 percent

Minor Components

Chinook and similar soils: 0 to 2 percent

Delpoint, calcareous soils: 0 to 3 percent

Hillon clay loam: 0 to 7 percent

Marias and similar soils: 0 to 1 percent

Soils that have slopes more than 25 percent: 0 to 1 percent

Soils that have slopes less than 15 percent: 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: About 10.0 inches

22F—Hillon loam, 25 to 60 percent slopes**Setting**

Landform: Hills
Slope: 25 to 60 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Hillon and similar soils: 85 percent

Minor Components

Havre, occasionally flooded: 0 to 1 percent
 Delpoint, calcareous soils: 0 to 2 percent
 Tinsley and similar soils: 0 to 3 percent
 Chinook and similar soils: 0 to 6 percent
 Soils that have slopes less than 25 percent: 0 to 2 percent
 Area of rock outcrop: 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: About 10.0 inches

968D—Hillon-Fortbenton complex, 8 to 25 percent slopes**Setting**

Landform: Hillon—hills; Fortbenton—hills
Position on landform: Hillon—shoulders; Fortbenton—back slopes
Slope: Hillon—8 to 25 percent; Fortbenton—8 to 25 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Hillon and similar soils: 45 percent
 Fortbenton and similar soils: 40 percent

Minor Components

Chinook and similar soils: 0 to 8 percent
 Busby and similar soils: 0 to 3 percent
 Hillon gravelly loam: 0 to 2 percent
 Soils that have slopes more than 25 percent: 0 to 1 percent
 Soils that have slopes less than 8 percent: 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: About 10.0 inches

Fortbenton

Surface layer texture: Fine sandy 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: About 9.7 inches

224D—Hillon-Joplin loams, 8 to 15 percent slopes**Setting**

Landform: Hillon—hills; Joplin—hills
Position on landform: Hillon—shoulders; Joplin—back slopes
Slope: Hillon—8 to 15 percent; Joplin—8 to 15 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Hillon and similar soils: 50 percent
 Joplin and similar soils: 35 percent

Minor Components

Kevin and similar soils: 0 to 5 percent
 Fortbenton and similar soils: 0 to 3 percent

Chinook and similar soils: 0 to 2 percent
 Soils that have slopes more than 15 percent: 0 to 1 percent
 Soils that have slopes less than 8 percent: 0 to 2 percent
 Hillon gravelly loam: 0 to 2 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: About 10.0 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: About 9.2 inches

221D—Hillon-Kevin clay loams, 8 to 15 percent slopes

Setting

Landform: Hillon—hills; Kevin—hills
Position on landform: Hillon—shoulders; Kevin—back slopes
Slope: Hillon—8 to 15 percent; Kevin—8 to 15 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Hillon and similar soils: 50 percent
 Kevin and similar soils: 35 percent

Minor Components

Joplin and similar soils: 0 to 5 percent
 Fortbenton and similar soils: 0 to 1 percent
 Scobey and similar soils: 0 to 4 percent
 Soils that have slopes more than 15 percent: 0 to 1 percent
 Soils that have slopes less than 8 percent: 0 to 2 percent
 Hillon gravelly loam: 0 to 2 percent

Major Component Description

Hillon

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: About 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: About 9.7 inches

Hingham Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Moderate (0.6 to 2.0 inches/hour)
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 4 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-silty, mixed Aridic Haploborolls

Typical Pedon

Hingham loam, in an area of Hingham-Lonna loams, 0 to 4 percent slopes, in an area of cropland; 500 feet north and 1,000 feet west of the southeast corner of sec. 21, T. 32 N., R. 11 E.

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

Bw—7 to 14 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; soft, very friable, sticky and slightly plastic; many very fine roots; many very fine pores; neutral; clear smooth boundary.

Bk1—14 to 22 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; moderate fine and medium subangular blocky

structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; few fine soft seams of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—22 to 35 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; few fine soft seams of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—35 to 60 inches; light brownish gray (2.5Y 6/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few very fine pores; few fine soft seams of lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in some part six-tenths or more of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Mollic epipedon thickness: 7 to 10 inches

Depth to Bk horizon: 10 to 16 inches

Ap horizon

Hue—10YR or 2.5Y

Value—2 or 3 moist

Chroma—2 or 3

Clay content—7 to 18 percent

Reaction—pH 6.1 to 7.8

Bw horizon

Hue—10YR or 2.5Y

Value—4, 5, or 6 dry; 3 or 4 moist

Chroma—2, 3, or 4

Texture—Silt loam, loam, or very fine sandy loam

Clay content—5 to 18 percent

Reaction—pH 6.1 to 7.8

Bk horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Silt loam or very fine sandy loam

Clay content—5 to 18 percent

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.9 to 8.4

611B—Hingham-Lonna loams, 0 to 4 percent slopes

Setting

Landform: Hingham—lake plains; Lonna—lake plains

Position on landform: Hingham—foot slopes; Lonna—back slopes

Slope: Hingham—0 to 4 percent; Lonna—0 to 4 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Hingham and similar soils: 50 percent

Lonna and similar soils: 35 percent

Minor Components

Kremlin and similar soils: 0 to 2 percent

Chinook and similar soils: 0 to 8 percent

Hingham very fine sandy loam: 0 to 2 percent

Soils that have slopes more than 4 percent: 0 to 3 percent

Major Component Description

Hingham

Surface layer texture: 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: About 10.2 inches

Lonna

Surface layer texture: 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: About 9.7 inches

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 and hills

Parent material: Glacial till

Slope range: 0 to 15 percent

Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed Aridic
 Argiborolls

Typical Pedon

Joplin loam, in an area of Joplin-Hillon loams, 2 to 8 percent slopes, in cropland; 800 feet south and 500 feet east of the northwest corner of sec. 24, T. 35 N., R. 15 E.

Ap—0 to 5 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; mildly alkaline; abrupt smooth boundary.

Bt—5 to 9 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; common fine and very fine roots; common fine pores; common distinct clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bk—9 to 26 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; common very fine pores; common medium soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bky—26 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine pores; common soft masses of lime; few fine masses of gypsum; violently effervescent; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 9 inches
Depth to the Bk horizon: Less than 10 inches
Depth to the Bky horizon: 26 to 60 inches

Ap horizon

Hue—10YR or 2.5Y
 Chroma—2 or 3
 Clay content—10 to 27 percent
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles, 0 to 10 percent pebbles
 Calcium carbonate equivalent—0 to 5 percent
 Reaction—pH 6.6 to 8.4

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
 Content of rock fragments—0 to 15 percent
 pebbles
 Reaction—pH 6.6 to 8.4

Bk 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
 Content of rock fragments—0 to 35 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 or 3
 Texture—Loam or clay loam
 Clay content—18 to 32 percent
 Content of rock fragments—0 to 35 percent
 pebbles
 Bulk density—1.6 to 1.8 gr/cm
 Reaction—pH 7.4 to 8.4

421C—Joplin-Hillon loams, 2 to 8 percent slopes

Setting

Landform: Joplin—till plains; Hillon—till plains

Position on landform: Joplin—back slopes; Hillon—shoulders

Slope: Joplin—2 to 8 percent; Hillon—2 to 8 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Joplin and similar soils: 50 percent
 Hillon and similar soils: 35 percent

Minor Components

Kevin and similar soils: 0 to 9 percent
 Fortbenton and similar soils: 0 to 3 percent

Chinook and similar soils: 0 to 1 percent
Soils that have slopes more than 8 percent: 0 to 2 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: About 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: About 10.0 inches

Kenilworth 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: Glaciofluvial deposits
Slope range: 0 to 4 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed Aridic
Argiborolls

Typical Pedon

Kenilworth fine sandy loam, in an area of Kenilworth-Fortbenton fine sandy loams, 0 to 4 percent slopes, in cropland; 2,640 feet south and 50 feet west of the northeast corner of sec. 20, T. 36 N., R. 13 E.

Ap—0 to 8 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; many very fine roots; few fine pores; neutral; abrupt smooth boundary.

Bt—8 to 16 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate

coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; common distinct clay films on faces of peds; mildly alkaline; clear smooth boundary.

2Bk1—16 to 26 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; hard, firm, sticky and plastic; few very fine roots; few very fine pores; common fine soft masses of lime; strongly effervescent; strongly alkaline; clear smooth boundary.

2Bk2—26 to 34 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine pores; many fine and medium soft masses of lime; strongly effervescent; strongly alkaline; clear smooth boundary.

2Bk3—34 to 48 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine pores; common fine and medium soft masses of lime; strongly effervescent; strongly alkaline; clear smooth boundary.

2Bky—48 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few very fine roots; few very fine pores; few fine soft masses of lime; common fine soft masses of gypsum; strongly effervescent; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 15 inches

Depth to the Bk horizon: 10 to 26 inches

Ap horizon

Value—4 or 5 dry; 2 or 3 moist

Chroma—2 or 3

Clay content—5 to 18 percent

Reaction—pH 6.6 to 7.8

Bt horizon

Value—4 or 5 dry; 3 or 4 moist

Chroma—2 or 3

Texture—Fine sandy loam or sandy clay loam

Clay content—15 to 30 percent and more than 45 percent fine and coarser sand

Reaction—pH 6.6 to 7.8

2Bk 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 35 percent
 Content of rock fragments—0 to 5 percent
 pebbles
 Calcium carbonate equivalent—5 to 15 percent
 Reaction—pH 7.4 to 9.0

951B—Kenilworth-Fortbenton fine sandy loams, 0 to 4 percent slopes

Setting

Landform: Kenilworth—till plains; Fortbenton—till plains
Slope: Kenilworth—0 to 4 percent; Fortbenton—0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Kenilworth and similar soils: 60 percent
 Fortbenton and similar soils: 25 percent

Minor Components

Fortbenton loam soils: 0 to 3 percent
 Hillon and similar soils: 0 to 3 percent
 Evanston and similar soils: 0 to 8 percent
 Soils that have slopes more than 4 percent: 0 to 1 percent

Major Component Description

Kenilworth

Surface layer texture: Fine sandy 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: About 10.2 inches

Fortbenton

Surface layer texture: Fine sandy 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: About 9.7 inches

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 and hills
Parent material: Glacial till
Slope range: 0 to 15 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Kevin clay loam, in an area of Scobey-Kevin clay loams, 0 to 4 percent slopes, in cropland; 1,700 feet south and 2,100 feet west of the northeast corner of sec. 9, T. 30 N., R. 13 E.

- Ap—0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine pores; mildly alkaline; abrupt smooth boundary.
- Bt—6 to 9 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; moderate fine and medium prismatic structure parting to strong fine subangular blocky; hard, firm, sticky and plastic; few very fine roots; few very fine pores; many distinct clay films on faces of peds; mildly alkaline; clear smooth boundary.
- Bk1—9 to 26 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots; many very fine pores; many fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk2—26 to 47 inches; light yellowish brown (10YR 6/4) clay loam, light olive brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, sticky and plastic; few very fine roots; many very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.
- Bky—47 to 60 inches; dark grayish brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky and very plastic; few very fine roots; common very fine pores; few fine soft masses of lime; common fine

masses of gypsum; strongly effervescent; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 12 inches

Depth to the Bk horizon: Less than 10 inches

Ap horizon

Hue—10YR, 2.5Y, or 5Y

Chroma—2 or 3

Clay content—27 to 32 percent

Content of rock fragments—0 to 15 percent—

0 to 10 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 6.6 to 7.8

Bt horizon

Hue—10YR, 2.5Y, or 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

Content of rock fragments—0 to 15 percent

Reaction—pH 6.6 to 8.4

Bk horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—2 or 3

Clay content—27 to 35 percent

Content of rock fragments—0 to 15 percent
pebbles

Bulk density—1.6 to 1.8 gram/cm

Calcium carbonate equivalent—.5 to 15 percent

Reaction—pH 7.4 to 8.4

Bky horizon

Hue—10YR, 5Y, or 2.5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—2, 3, or 4

Clay content—27 to 35 percent

Content of rock fragments—0 to 15 percent

Bulk density—1.6 to 1.8 gram/cm

Calcium carbonate equivalent—1 to 10 percent

Gypsum—0 to 2 percent

Reaction—pH 7.9 to 9.0

442C—Kevin-Elloam clay loams, 2 to 8 percent slopes

Setting

Landform: Kevin—till plains; Elloam—till plains

Position on landform: Kevin—back slopes and shoulders; Elloam—back slopes

Slope: Kevin—2 to 8 percent; Elloam—2 to 8 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Kevin and similar soils: 60 percent

Elloam and similar soils: 25 percent

Minor Components

Nishon and similar soils: 0 to 1 percent

Absher and similar soils: 0 to 2 percent

Phillips and similar soils: 0 to 3 percent

Hillon and similar soils: 0 to 5 percent

Soils that have slopes more than 8 percent: 0 to 1 percent

Kevin gravelly loam: 0 to 3 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: About 9.7 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: About 6.5 inches

441C—Kevin-Hillon clay loams, 2 to 8 percent slopes

Setting

Landform: Kevin—till plains; Hillon—till plains

Position on landform: Kevin—back slopes; Hillon—shoulders

Slope: Kevin—2 to 8 percent; Hillon—2 to 8 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Kevin and similar soils: 50 percent

Hillon and similar soils: 35 percent

Minor Components

Joplin and similar soils: 0 to 9 percent

Marias and similar soils: 0 to 3 percent

Soils that have slopes more than 8 percent: 0 to 3 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: About 9.7 inches

Hillon

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: About 9.9 inches

Kobase Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Slow (0.06 to 0.2 inch/hour)

Landform: Lake plains

Parent material: Alluvium

Slope range: 0 to 2 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic, frigid Aridic Ustochrepts

Typical Pedon

Kobase clay loam, 0 to 2 percent slopes, in an area of cropland; 1,500 feet south and 1,300 feet east of the northwest corner of sec. 11, T. 31 N., R. 14 E.

Ap—0 to 5 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; strong fine granular structure; slightly hard, firm, sticky and very plastic; common very fine roots; many very fine pores; neutral; clear smooth boundary.

Bw—5 to 12 inches; dark grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and very plastic; common very fine roots; many very fine pores; neutral; abrupt smooth boundary.

Bk1—12 to 19 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; extremely hard, firm, sticky and very plastic; few very fine roots; many very fine pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—19 to 34 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure; hard, firm, sticky and plastic; few very fine roots; common very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—34 to 40 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium prismatic structure; extremely hard, firm, sticky and plastic; few very fine roots; common very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bky—40 to 60 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak fine prismatic structure; extremely hard, firm, sticky and plastic; few very fine roots; common very fine pores; few fine soft masses of lime; few fine masses of gypsum; 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: 12 to 17 inches

Soil phases: Calcareous

Ap horizon

Hue—10YR or 2.5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—2 or 3

Clay content—27 to 40 percent

Content of rock fragments—0 to 5 percent pebbles

Electrical conductivity—0 to 2 mmhos/cm

Reaction—pH 6.6 to 8.4

Bw horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 4 or 5 moist
 Chroma—1, 2, 3, or 4
 Texture—Silty clay loam, silty clay, or clay
 Clay content—35 to 45 percent
 Content of rock fragments—0 to 5 percent pebbles
 Reaction—pH 7.4 to 8.4

Bk1 horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—1, 2, 3, or 4
 Texture—Silty clay loam, silty clay, or clay
 Clay content—35 to 45 percent
 Content of rock fragments—0 to 5 percent pebbles
 Calcium carbonate equivalent—5 to 10 percent
 Reaction—pH 7.4 to 8.4

Bk2 and Bk3 horizons

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Silty clay loam, silty clay, or clay
 Clay content—35 to 45 percent
 Content of rock fragments—0 to 5 percent pebbles
 Calcium carbonate equivalent—5 to 15 percent
 Reaction—pH 7.9 to 8.4

Bky horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—1, 2, 3, or 4
 Texture—Silty clay loam, silty clay, or clay
 Clay content—35 to 45 percent
 Content of 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

32A—Kobase clay loam, 0 to 2 percent slopes**Setting**

Landform: Lake plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Kobase and similar soils: 85 percent

Minor Components

Dimmick and similar soils: 0 to 1 percent
 Ethridge and similar soils: 0 to 5 percent
 Kobase, calcareous soils: 0 to 1 percent
 Marias and similar soils: 0 to 6 percent
 Cozberg 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: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 9.6 inches

321A—Kobase clay loam, calcareous, 0 to 2 percent slopes**Setting**

Landform: Lake plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Kobase and similar soils: 85 percent

Minor Components

McKenzie and similar soils: 0 to 1 percent
 Marias and similar soils: 0 to 5 percent
 Yamacall, calcareous soils: 0 to 6 percent
 Soils that have sandy layers below 40 inches: 0 to 3 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: About 9.6 inches

Korchea 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: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 70 to 100 days

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

Typical Pedon

Korchea loam, in an area of Straw-Korchea loams, 0 to 2 percent slopes, in cropland; 1,000 feet north and 1,000 feet east of the southwest corner of sec. 36, T. 32 N., R. 15 E.

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

C1—6 to 13 inches; grayish brown (10YR 5/2) stratified fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—13 to 22 inches; light brownish gray (10YR 6/2) stratified loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—22 to 60 inches; light brownish gray (10YR 6/2) stratified loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots, common very fine pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Ap horizon

Hue—10YR or 2.5Y
 Value—3, 4, or 5 dry; 2 or 3 moist
 Chroma—2 or 3
 Clay content—18 to 27 percent
 Reaction—pH 6.6 to 8.4.

C horizon

Hue—2.5Y or 10YR, but 5Y is in the range
 Value—4, 5, 6, or 7 dry; 3, 4, 5, or 6 moist
 Chroma—2 to 4

Texture—Loam, silt loam, silty clay loam, clay loam, fine sandy loam, sandy loam, or very fine sandy loam

Clay content—18 to 35 percent

Reaction—pH 7.4 to 8.4

Kremlin 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: 0 to 4 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed Aridic
 Haploborolls

Typical Pedon

Kremlin loam, 0 to 4 percent slopes, in an area of cropland; 1,000 feet south and 1,700 feet east of the northwest corner of sec. 23, T. 30 N., R. 10 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; moderate fine granular structure; soft, very friable, sticky and plastic; many very fine roots; neutral; abrupt smooth boundary.

Bw1—6 to 11 inches; dark grayish brown (2.5Y 4/2) loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, very friable, sticky and plastic; many very fine roots; many very fine pores; neutral; clear smooth boundary.

Bw2—11 to 19 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable, sticky and plastic; many very fine roots; many very fine pores; neutral; clear smooth boundary.

Bk1—19 to 31 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine pores; few fine soft masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—31 to 60 inches; light yellowish brown (2.5Y 6/4) loam, grayish brown (2.5Y 5/2) moist; weak fine

subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine pores; common fine soft 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; dry in some part six-tenths or more of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Mollic epipedon thickness: 7 to 15 inches; in some pedons it includes all or only the upper part of the Bw1 horizon

Depth to Bk horizon: 10 to 24 inches

Ap horizon

Hue—10YR or 2.5Y

Value—2 or 3 moist

Chroma—2 or 3

Clay content—18 to 27 percent

Content of rock fragments—0 to 5 percent pebbles

Reaction—pH 6.1 to 7.8

Bw horizon

Hue—10YR or 2.5Y

Value—4, 5, or 6 dry; 4 or 5 moist

Chroma—2 or 3

Texture—Loam, silt loam, clay loam, or sandy clay loam

Clay content—18 to 32 percent

Content of rock fragments—0 to 5 percent pebbles

Reaction—pH 6.6 to 7.8

Bk1 horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2 or 3

Texture—Loam, silt loam, clay loam, or sandy clay loam

Clay content—18 to 30 percent

Content of rock fragments—0 to 5 percent pebbles

Calcium carbonate equivalent—5 to 15 percent

Effervescence—Strong or violent

Electrical conductivity—0 to 2 mmhos/cm

Reaction—pH 7.4 to 8.4

Bk2 horizon

Hue—10YR, 2.5Y, or 5Y

Value—6, 7, or 8 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Clay content—10 to 25 percent

Content of rock fragments—0 to 5 percent pebbles

Calcium carbonate equivalent—3 to 12 percent

Effervescence—Strong or violent

Electrical conductivity—0 to 4 mmhos/cm

Reaction—pH 7.4 to 8.4

98B—Kremlin loam, 0 to 4 percent slopes

Setting

Landform: Alluvial fans

Slope: 0 to 4 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Kremlin and similar soils: 85 percent

Minor Components

Yamacall, calcareous soils: 0 to 2 percent

Fortbenton and similar soils: 0 to 1 percent

Kremlin clay loam: 0 to 8 percent

Cozberg and similar soils: 0 to 3 percent

Soils that have slopes more than 4 percent: 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: About 10.2 inches

Laceycreek Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Moderate in the upper 0 to 42 inches (0.6 to 2.0 inches/hour); moderately rapid below this depth (2.0 to 6.0 inches/hour)

Landform: Alluvial fans, drainageways

Parent material: Alluvium

Slope range: 8 to 25 percent

Annual precipitation: 15 to 19 inches

Annual air temperature: 40 to 43 degrees F

Frost-free period: 70 to 100 days

Taxonomic Class: Fine-loamy, mixed Pachic Udic
Haploborolls

Typical Pedon

Laceycreek loam, in an area of Laceycreek loam, moist, 8 to 25 percent slopes, in woodland; 2,300 feet north and 200 feet east of the southwest corner of sec. 28, T. 29 N., R. 16 E.

A1—0 to 18 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; strong very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; and few medium and coarse roots; many very fine pores; neutral; clear smooth boundary.

A2—18 to 23 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; common fine and very fine pores; neutral; clear wavy boundary.

Bt1—23 to 30 inches; dark brown (10YR 3/3) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; common faint clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—30 to 42 inches; dark brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; few fine and very fine roots; many very fine and few fine pores; common distinct clay films on faces of peds; neutral; abrupt wavy boundary.

2BC—42 to 60 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and few fine pores; 15 percent pebbles; neutral.

Range in Characteristics

Mollic epipedon thickness: 16 to 60 inches

A1 horizon

Hue—10YR, 2.5Y, or N

Value—3 or 4 dry; 2, 3, or N moist

Chroma—0 or 1

Clay content—15 to 24 percent

Content of rock fragments—0 to 15 percent—

0 to 10 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 6.1 to 7.3

A2 horizon

Hue—10YR, 2.5Y, or N

Value—3 or 4 dry; 2 or 3 moist

Clay content—15 to 24 percent

Content of rock fragments—0 to 15 percent—

0 to 10 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 6.1 to 7.3

Bt1 horizon

Hue—10YR or 2.5Y

Value—3, 4, or 5 dry; 3 moist

Chroma—2 or 3

Texture—Loam or clay loam

Clay content—24 to 35 percent

Content of rock fragments—0 to 10 percent—

0 to 10 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 6.1 to 7.3

Bt2 horizon

Hue—10YR or 2.5Y

Value—4 or 5 dry; 3 or 4 moist

Chroma—2 or 3

Texture—Loam, clay loam, or sandy clay loam

Clay content—20 to 35 percent

Content of rock fragments—0 to 25 percent—

0 to 20 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 6.6 to 7.3

2C horizon

Hue—10YR or 2.5Y

Value—4 or 5 dry; 3 or 4 moist

Chroma—2 or 3

Texture—Sandy loam or loam

Clay content—5 to 20 percent

Content of rock fragments—0 to 20 percent—

0 to 15 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 6.6 to 7.3

110D—Laceycreek loam, 8 to 15 percent slopes

Setting

Landform: Alluvial fans

Slope: 8 to 15 percent

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 100 days

Composition

Major Components

Laceycreek and similar soils: 85 percent

Minor Components

Farnuf and similar soils: 0 to 9 percent
Bowery and similar soils: 0 to 5 percent
Perma cobbly loam: 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: About 10.0 inches

763E—Laceycreek loam, moist, 8 to 25 percent slopes

Setting

Landform: Drainageways
Slope: 8 to 25 percent
Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition

Major Components

Laceycreek and similar soils: 85 percent

Minor Components

Eagleton and similar soils: 0 to 3 percent
Enbar and similar soils: 0 to 6 percent
Belain and similar soils: 0 to 2 percent
Straw and similar soils: 0 to 2 percent
Nesda 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: Forest land
Flooding: None
Available water capacity: About 10.0 inches

Lonesome Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Rapid in the upper 0 to 30 inches (6.0 to 20.0 inches/hour); Slow below this depth (0.06 to 0.2 inch/hour)
Landform: Till plains
Parent material: Eolian deposits over glacial till or lacustrine material
Slope range: 0 to 8 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Sandy over loamy, mixed, frigid
Aridic Ustorthents

Typical Pedon

Lonesome loamy fine sand, in an area of Yetull-Lonesome loamy fine sands, 0 to 8 percent slopes, in rangeland; 1,400 feet south and 1,400 feet west of the northeast corner of sec. 11, T. 36 N., R. 14 E.

- A—0 to 5 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; many very fine roots; neutral; clear smooth boundary.
- Bw—5 to 15 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine roots; neutral; clear smooth boundary.
- Bk1—15 to 30 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine roots; few fine soft seams of lime; strongly effervescent; moderately alkaline; clear smooth boundary.
- 2Bk2—30 to 51 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine roots; common very fine pores; common fine soft masses and seams of lime; violently effervescent; strongly alkaline; clear wavy boundary.
- 2Bk3—51 to 60 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine pores; common fine soft masses of lime; violently effervescent; strongly alkaline.

Range in Characteristics

Depth to the Bk2 horizon: 20 to 40 inches

A horizon

Hue—10YR or 2.5Y
 Value—4 or 5 dry; 3 or 4 moist
 Chroma—2, 3, or 4
 Clay content—5 to 15 percent
 Content of rock fragments—0 to 2 percent pebbles
 Reaction—pH 6.6 to 7.8
 Other features—Some pedons contain A2 horizons 3 to 6 inches thick which when combined with the A horizon meet all the requirements for a mollic epipedon except for organic matter content; the A2 horizon has a loamy fine sand, loamy sand, or fine sand texture

Bw horizon

Hue—10YR or 2.5Y
 Value—5 or 6 dry; 3, 4, or 5 moist
 Chroma—3 or 4
 Texture—Loamy fine sand, loamy sand, or fine sand
 Clay content—5 to 15 percent
 Content of rock fragments—0 to 2 percent
 Reaction—pH 6.6 to 7.8

Bk1 horizon

Hue—10YR or 2.5Y
 Value—5 or 6 dry; 3, 4, or 5 moist
 Chroma—3 or 4
 Texture—Loamy fine sand, loamy sand, or fine sand
 Clay content—5 to 15 percent
 Content of rock fragments—0 to 2 percent
 Calcium carbonate equivalent—5 to 15 percent
 Reaction—pH 7.9 to 8.4

2Bk horizon

Hue—10YR or 2.5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Clay loam, loam, or silty clay loam (contains less than 50 percent fine or coarser sand)
 Clay content—20 to 35 percent
 Content of rock fragments—0 to 5 percent
 Calcium carbonate equivalent—5 to 15 percent
 Electrical conductivity—0 to 4 mmhos/cm
 Sodium adsorption ratio—0 to 13
 Reaction—pH 7.9 to 9.0

Other features—Some pedons have a 2Bky horizon with 1 to 2 percent gypsum; some pedons have thin lenses of fine sandy loam or loam textures between thicker layers of loam or clay loam

Lonna Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Moderate (0.6 to 2.0 inches/hour)

Landform: Till plains and lake plains

Parent material: Alluvium and glaciolacustrine deposits

Slope range: 0 to 4 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine-silty, mixed, frigid Aridic Ustochrepts

Typical Pedon

Lonna loam, in an area of Hingham-Lonna loams, 0 to 4 percent slopes, in cropland; 200 feet north and 2,100 feet west of the southeast corner of sec. 8, T. 31 N., R. 12 E.

Ap—0 to 6 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) moist; weak medium and fine subangular blocky structure parting to weak very fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—6 to 11 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk1—11 to 28 inches; pale brown (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; many fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—28 to 52 inches; light gray (2.5Y 7/2) silt loam, light yellowish brown (2.5Y 6/4) moist; moderate

very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; common fine soft masses of lime; strongly effervescent; strongly alkaline.

BC—52 to 60 inches: light gray (2.5Y 7/2) very fine sandy loam, light yellowish brown (2.5Y 6/4) moist; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and slightly plastic; few very fine roots; common very fine pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to Bk horizon: 10 to 12 inches

Ap horizon

Hue—10YR or 2.5Y

Value—5 or 6 dry; 3, 4, or 5 moist

Chroma—2, 3, or 4

Clay content—18 to 27 percent

Effervescence—Slight or strong

Calcium carbonate equivalent—5 to 10 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, 3, or 4

Texture—Silt loam or silty clay loam

Clay content—18 to 35 percent

Effervescence—Slight or strong

Calcium carbonate equivalent—5 to 10 percent

Reaction—pH 7.4 to 8.4

Bk1 horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Silt loam or silty clay loam

Clay content—18 to 35 percent

Calcium carbonate equivalent—5 to 15 percent

Electrical conductivity—2 to 8 mmhos/cm

Sodium adsorption ratio—1 to 13

Effervescence—Strong or violent

Reaction—pH 7.9 to 9.0

Bk2 horizon

Hue—10YR or 2.5Y

Value—5, 6, 7, or 8 dry; 4, 5, 6, or 7 moist

Chroma—2, 3, or 4

Texture—Silt loam or silty clay loam

Clay content—18 to 35 percent

Calcium carbonate equivalent—5 to 15 percent

Electrical conductivity—2 to 8 mmhos/cm

Sodium adsorption ratio—1 to 13

Effervescence—Strong or violent

Reaction—pH 7.9 to 9.0

C horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Very fine sandy loam, loam, silt loam, or silty clay loam (may be stratified)

Clay content—10 to 35 percent

Electrical conductivity—2 to 16 mmhos/cm

Sodium adsorption ratio—10 to 30

Effervescence—Strong or violent

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.9 to 9.0

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: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic (calcareous), frigid Aridic Ustifluvents

Typical Pedon

Lostriver clay, 0 to 2 percent slopes, in an area of rangeland; 800 feet north and 800 feet east of the southwest corner of sec. 3, T. 35 N., R. 12 E.

A—0 to 3 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very fine granular structure; extremely hard, extremely firm, very sticky and very plastic; common very fine roots; many very fine pores; strongly effervescent; strongly alkaline; clear smooth boundary.

C—3 to 9 inches; grayish brown (2.5Y 5/2) stratified clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, extremely firm, very sticky and very plastic; common very fine roots; common very fine pores; strongly effervescent; very strongly alkaline; abrupt wavy boundary.

Cyz—9 to 60 inches; grayish brown (2.5Y 5/2) clay consisting of thin strata of clay loam, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; common very fine pores; common fine masses of gypsum and other salts; strongly effervescent; very strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at 20 inches is 41 degrees F or above

A horizon

Hue—10YR, 2.5Y, or 5Y
 Value—4, 5, or 6 dry; 3, 4, or 5 moist
 Chroma—2 or 3
 Clay content—40 to 55 percent clay
 Electrical conductivity—2 to 8 mmhos/cm
 Sodium adsorption ratio—8 to 13
 Calcium carbonate equivalent—0 to 10
 Reaction—pH 7.4 to 9.4

C horizon

Hue—10YR, 2.5Y, or 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—5 to 10
 Reaction—pH 7.4 to 9.6

Cyz horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, or 7 dry; 3, 4, 5, or 6 moist
 Chroma—2, 3, or 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
 Gypsum—2 to 5 percent
 Calcium carbonate equivalent—5 to 10
 Reaction—pH 7.4 to 9.6
 Other features—Gypsum and other salts are inherent in the parent material; some profiles have thin strata of sandy material below 40 inches

78A—Lostriver clay, 0 to 2 percent slopes

Setting

Landform: Flood plains

Slope: 0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Lostriver and similar soils: 85 percent

Minor Components

Harlake and similar soils: 0 to 9 percent

Havre, occasionally flooded: 0 to 1 percent

Nobe and similar soils: 0 to 2 percent

Soils that have slopes more than 2 percent: 0 to 3 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

Salt affected: Saline within 30 inches

Sodium affected: Sodic within 30 inches

Available water capacity: About 8.5 inches

Macar Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Moderate (0.6 to 2.0 inches/hour)

Landform: Hills

Parent material: Colluvium

Slope range: 15 to 60 percent

Annual precipitation: 15 to 19 inches

Annual air temperature: 40 to 43 degrees F

Frost-free period: 70 to 100 days

Taxonomic Class: Fine-loamy, mixed, frigid Typic Ustochrepts

Typical Pedon

Macar loam, in an area of Cabba-Macar loams, 15 to 60 percent slopes, in rangeland; 2,300 feet south and 950 feet east of the northwest corner of sec. 31, T. 29 N., R. 15 E.

A—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; mildly alkaline; abrupt smooth boundary.

Bw—4 to 12 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine pores; mildly alkaline; abrupt wavy boundary.

Bk1—12 to 22 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; common fine pores; common medium soft masses of lime; strongly effervescent; mildly alkaline; clear wavy boundary.

Bk2—22 to 37 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine and fine roots; common fine pores; common medium soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

BC—37 to 60 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few very fine roots; few very fine pores; violently effervescent, moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches

Depth to the Bk horizon: 11 to 24 inches

Ap horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 3, 4, or 5 moist

Chroma—2 or 3

Clay content—18 to 27 percent

Content of 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

Bw horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 3, 4, or 5 moist

Chroma—2, 3, 4, or 6

Texture—Loam, clay loam, or silty clay loam

Clay content—18 to 35 percent

Content of rock fragments—0 to 5 percent
pebbles

Effervescence—None to slight

Electrical conductivity—0 to 2 mmhos/cm

Reaction—pH 6.6 to 8.4

Bk1 horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, 4, or 6

Texture—Clay loam, loam, or silty clay loam

Clay content—18 to 35 percent

Content of rock fragments—0 to 5 percent
pebbles

Effervescence—Slight or strong

Calcium carbonate equivalent—8 to 15 percent

Electrical conductivity—0 to 2 mmhos/cm

Reaction—pH 7.4 to 8.4

Bk2 horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, 4, or 6

Texture—Clay loam, loam, silt loam, sandy clay loam, or silty clay loam (some fine strata of sandy loam and fine sandy loam are in some pedons)

Clay content—18 to 35 percent with 35 to 55 percent fine sand and coarser

Content of rock fragments—0 to 10 percent
pebbles

Effervescence—Strong or violent

Calcium carbonate equivalent—8 to 15 percent

Electrical conductivity—0 to 2 mmhos/cm

Reaction—pH 7.4 to 8.4

C horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, 4, or 6

Texture—Loam, silt loam, or silty clay loam consisting of strata of very fine sandy loam, sandy clay loam, and silt loam

Clay content—15 to 30 percent

Content of rock fragments—0 to 10 percent pebbles
 Effervescence—Strong or violent
 Calcium carbonate equivalent—5 to 12 percent
 Electrical conductivity—0 to 2 mmhos/cm
 Reaction—pH 7.9 to 9.0

Marias Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Very slow (0.06 inch/hour)
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 4 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic, frigid
 Chromic Udic Haplusterts

Typical Pedon

Marias silty clay, 0 to 4 percent slopes, in an area of cropland; 1,300 feet south and 650 feet west of the northeast corner of sec. 10, T. 31 N., R. 14 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong fine granular structure; slightly hard, friable, very sticky and very plastic; common very fine roots; common very fine pores; strongly effervescent; mildly alkaline; abrupt smooth boundary.

Bw—6 to 17 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong fine angular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bss—17 to 30 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, very sticky and very plastic; few very fine roots; few very fine pores; common slickensides intersecting at 20 to 30 degrees from horizontal; strongly effervescent; moderately alkaline; gradual smooth boundary.

By—30 to 60 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine pores; common fine threads of gypsum; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to By horizon: 20 to 45 inches

Linear extensibility: .06 to .10 in the upper 30 inches of soil; cracks 1-1/2 inches or more wide to 20 inches

Ap horizon

Hue—10YR, 2.5Y, or 5Y
 Value—4, 5, or 6 dry; 3, 4, or 5 moist
 Chroma—1, 2, or 3
 Clay content—40 to 60 percent
 Electrical conductivity—0 to 4 mmhos/cm
 Sodium adsorption ratio—1 to 4
 Calcium carbonate equivalent—1 to 10 percent
 Reaction—pH 7.4 to 8.4.

Bw horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2 or 3
 Texture—Clay or silty clay
 Clay content—35 to 60 percent clay
 Electrical conductivity—0 to 4 mmhos/cm
 Sodium adsorption ratio—1 to 4
 Calcium carbonate equivalent—1 to 10 percent
 Reaction—pH 7.9 to 8.4

Bss horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2 or 3
 Texture—Clay or silty clay
 Clay content—35 to 60 percent clay
 Slickensides: Common or many
 Electrical conductivity—0 to 4
 Sodium adsorption ratio—1 to 4
 Calcium carbonate equivalent—1 to 10 percent
 Reaction—pH 7.9 to 9.0

By horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5 or 6 dry; 3, 4, or 5 moist
 Chroma—1, 2, or 3
 Texture—Clay or silty clay
 Clay content—35 to 60
 Gypsum—1 to 6 percent
 Electrical conductivity—2 to 4 mmhos/cm above a depth of 30 inches; 2 to 8 mmhos/cm below 30 inches

Sodium adsorption ratio—1 to 4 above 30 inches;
4 to 13 below 30 inches
Calcium carbonate equivalent—2 to 10 percent
Reaction—pH 7.9 to 9.0

74B—Marias silty clay, 0 to 4 percent slopes

Setting

Landform: Lake plains
Slope: 0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Marias and similar soils: 85 percent

Minor Components

Dimmick and similar soils: 0 to 2 percent
Marvan and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 2 percent
Scobey and similar soils: 0 to 8 percent

Major Component Description

Surface layer texture: Silty clay
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: About 8.5 inches

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
Parent material: Semiconsolidated sedimentary beds
Slope range: 0 to 4 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Marmarth loam, 0 to 4 percent slopes, in an area of cropland; 2,400 feet north and 900 feet east of the southwest corner of sec. 25, T. 36 N., R. 9 E.

Ap—0 to 6 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak very fine granular; soft, very friable, sticky and plastic; common very fine roots; mildly alkaline; abrupt 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 moderate fine and medium subangular blocky; hard, firm, sticky and plastic; common very fine roots; few very fine pores; few faint clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bk—13 to 30 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; few very fine pores; common fine soft masses of lime; slightly effervescent; moderately alkaline; gradual wavy boundary.

Cr—30 to 60 inches; light brownish gray (2.5Y 6/2) semiconsolidated sedimentary beds, olive brown (2.5Y 4/4) moist; slightly effervescent; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to Cr horizon: 20 to 40 inches
Depth to the Bk horizon: 11 to 27 inches

A horizon

Value—3, 4, or 5 moist
Chroma—2 or 3
Clay content—20 to 27 percent
Reaction—pH 6.1 to 7.3

Bt horizon

Hue—10YR or 2.5Y
Value—3, 4, 5, or 6 moist
Chroma—2, 3, or 4
Texture—Loam, clay loam, or sandy clay loam
Clay content—18 to 35 percent
Reaction—pH 6.1 to 7.8

Bk horizon

Hue—2.5Y or 5Y
Value—5, 6, or 7 dry; 4, 5, or 6 moist
Chroma—2, 3, or 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: Semiconsolidated sandstone or stratified semiconsolidated sandstone and siltstone

92B—Marmarth loam, 0 to 4 percent slopes

Setting

Landform: Sedimentary plains

Slope: 0 to 4 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Marmarth and similar soils: 85 percent

Minor Components

Cabbart and similar soils: 0 to 2 percent

Delpoint, calcareous soils: 0 to 3 percent

Delpoint and similar soils: 0 to 7 percent

Soils that have slopes more than 4 percent: 0 to 3 percent

Major Component Description

Surface layer texture: Loam

Depth class: Moderately deep (20 to 40 inches)

Drainage class: Well drained

Dominant parent material: Semiconsolidated sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 5.0 inches

Marvan Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Very slow (0.06 inch/hour)

Landform: Alluvial fans and lake plains

Parent material: Alluvium and glaciolacustrine deposits

Slope range: 0 to 8 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic, frigid Sodic Haplusterts

Typical Pedon

Marvan clay, 0 to 2 percent slopes, in an area of

rangeland; 1,850 feet south and 2,700 feet west of the northeast corner of sec. 3, T. 37 N., R. 12 E.

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

Bw—4 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine and medium roots; many very fine and fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

Bssy—13 to 32 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; common medium and coarse roots; common very fine and fine pores; few slickensides intersecting at 40 degrees from horizontal; few fine masses of gypsum; strongly effervescent; moderately alkaline; clear wavy boundary.

Bnssyz—32 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine pores; few slickensides intersecting at 40 degrees from horizontal; common fine masses of gypsum and other salts; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Depth to Bssy horizon: 10 to 24 inches

Soil phases: Saline

A horizon

Hue—2.5Y or 5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—2, 3, or 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 4
 Calcium carbonate equivalent—1 to 5 percent
 Reaction—pH 7.4 to 9.0

Bw horizon

Hue—2.5Y or 5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 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 4 to 8 (where the SAR is below 8 the sodium plus magnesium is greater than calcium plus exchange acidity)
 Calcium carbonate equivalent—1 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, 3, or 4
 Texture—Clay or silty clay
 Clay content—45 to 60 percent
 Gypsum—1 to 5 percent
 Electrical conductivity—4 to 16 mmhos/cm; ECs are less than 8 above a depth of 35 inches
 Sodium adsorption ratio—13 to 38
 Calcium carbonate equivalent—1 to 10 percent
 Reaction—pH 7.9 to 9.0

Bnssyz horizon

Hue—2.5 or 5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Texture—Clay or silty clay that includes thin layers of silty clay loam and silt loam material
 Clay content—45 to 60 percent
 Gypsum—1 to 5 percent
 Electrical conductivity—8 to 16 mmhos/cm
 Sodium adsorption ratio—13 to 38
 Calcium carbonate equivalent—1 to 10 percent
 Reaction—pH 7.9 to 9.0

30A—Marvan clay, 0 to 2 percent slopes**Setting**

Landform: Lake plains

Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Marvan and similar soils: 85 percent

Minor Components

McKenzie and similar soils: 0 to 1 percent
 Marvan, saline soils: 0 to 7 percent
 Kobase and similar soils: 0 to 7 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: None
Salt affected: Saline within 30 inches
Available water capacity: About 6.8 inches

30C—Marvan clay, 2 to 8 percent slopes**Setting**

Landform: Alluvial fans
Slope: 2 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Marvan and similar soils: 85 percent

Minor Components

Marvan, saline soils: 0 to 5 percent
 Kobase and similar soils: 0 to 5 percent
 Soils that have slopes less than 2 percent: 0 to 4 percent
 Soils that have slopes more than 8 percent: 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: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Available water capacity: About 6.8 inches

309A—Marvan complex, 0 to 2 percent slopes

Setting

Landform: Marvan, saline—Lake plains; Marvan—
 Lake plains
Slope: Marvan, saline—0 to 2 percent; Marvan—0 to
 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Marvan, saline and similar soils: 55 percent
 Marvan and similar soils: 30 percent

Minor Components

Nishon and similar soils: 0 to 2 percent
 Nobe and similar soils: 0 to 6 percent
 Benz and similar soils: 0 to 5 percent
 Soils that have slopes more than 2 percent: 0 to 2
 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: Glaciolacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: About 6.3 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
Available water capacity: About 6.8 inches

304A—Marvan-Nobe clays, 0 to 2 percent slopes

Setting

Landform: Marvan—lake plains; Nobe—lake plains
Position on landform: Marvan—microlows;
 Nobe—microhighs
Slope: Marvan—0 to 2 percent; Nobe—0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Marvan and similar soils: 55 percent
 Nobe and similar soils: 30 percent

Minor Components

Somewhat poorly drained soils: 0 to 2 percent
 Benz and similar soils: 0 to 10 percent
 Soils that have slopes more than 2 percent: 0 to 3
 percent

Major Component Description

Marvan

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: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: About 6.3 inches

Nobe

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Dominant parent material: Glaciolacustrine deposits
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: About 4.2 inches

McKenzie Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Poorly drained
Permeability: Very slow (0.06 inch/hour)

Landform: Closed depressions

Parent material: Alluvium

Slope range: 0 to 1 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic, frigid
Chromic Endoaquerts

Typical Pedon

McKenzie clay, 0 to 1 percent slopes, in an area of rangeland; 1,000 feet north and 2,600 feet west of the southeast corner of sec. 10, T. 35 N., R. 12 E.

A—0 to 5 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few fine faint olive yellow (2.5Y 6/6) mottles; weak coarse subangular blocky structure parting to weak fine granular structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; strongly effervescent; strongly alkaline; clear smooth boundary.

Byz—5 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few faint olive yellow (2.5Y 6/6) mottles; moderate very coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; few fine seams of gypsum and other salts; strongly effervescent; strongly alkaline; gradual wavy boundary.

Cyz—20 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few faint olive yellow (2.5Y 6/6) mottles; massive; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; common fine seams of gypsum and other salts; strongly effervescent; strongly alkaline.

Range in Characteristics

Depth to water table: +.5 to 1 foot

Taxonomic note: This soil is a taxadjunct to the McKenzie series and classifies as fine, montmorillonitic (calcareous), frigid Vertic Epiaquerts. It does not have the required slickensides, cracks, or water table characteristics of Chromic Endoaquerts.

A horizon

Hue—5Y, 2.5Y, or 10YR

Value—4 or 5 moist; 4, 5, or 6 dry

Chroma—1 or 2

Clay content—40 to 60 percent

Electrical conductivity—8 to 16 mmhos/cm

Reaction—pH 8.5 to 9.0

Byz 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—8 to 16 mmhos/cm

Reaction—8.5 to 9.0

Cyz horizon

Hue—2.5Y or 5Y

Value—4, 5, or 6 moist; 5, 6, or 7 dry

Chroma—1, 2, or 3

Clay content—40 to 60 percent

Electrical conductivity—8 to 16 mmhos/cm

Reaction—pH 8.5 to 9.0.

13A—McKenzie clay, 0 to 1 percent slopes

Setting

Landform: Closed depressions

Slope: 0 to 1 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

McKenzie and similar soils: 85 percent

Minor Components

Dimmick and similar soils: 0 to 10 percent

Wheatbelt and similar soils: 0 to 2 percent

Soils that are loamy throughout: 0 to 1 percent

Marvan, saline 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: Alluvium

Native plant cover type: Rangeland

Flooding: None

Ponding: Long

Salt affected: Saline within 30 inches

Available water capacity: About 4.5 inches

M-W—Miscellaneous Water**Composition****Major Components**

Miscellaneous water: 100 percent

Major Component Description

Definition: Areas of sewage lagoons, industrial waste pits, and fish hatcheries, etc.

Neldore 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: Semiconsolidated shale

Slope range: 2 to 70 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

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

Typical Pedon

Neldore clay, in an area of Bascovy-Neldore clays, 2 to 15 percent slopes, in rangeland; 1,800 feet south and 1,600 feet west of the northeast corner of sec. 7, T. 30 N., R. 10 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, very firm, very sticky and very plastic; many very fine and few fine roots; neutral; clear smooth boundary.

C1—3 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; many very fine roots; common very fine pores; mildly alkaline; gradual smooth boundary.

C2—10 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; 25 percent soft thin shale chips; mildly alkaline; gradual smooth boundary.

Cr—16 to 60 inches; gray (N 6/0) semiconsolidated shale, very dark grayish brown (2.5Y 3/2) moist;

few fine masses of gypsum between the shale plates; neutral.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or above

Depth to shale: 10 to 20 inches

A horizon

Hue—10YR, 2.5Y, or 5Y

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

Chroma—1 or 2

Texture—Clay or silty clay

Clay content—40 to 50 percent

Content of rock fragments—0 to 10 percent—0 to 5 percent stones and cobbles, 0 to 5 percent pebbles. In some pedons the stones, cobbles, and pebbles are from a thin glacial mantle that has been eroded away.

Reaction—pH 5.6 to 7.8

C1 horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—1 or 2; 4 or 6 for stains of shale

Texture—Clay or silty clay

Clay content—40 to 60 percent

Content of rock fragments—5 to 35 percent—5 to 25 percent soft shale fragments, 0 to 10 percent hard shale fragments

Electrical conductivity—0 to 4 mmhos/cm

Reaction—pH 5.6 to 7.8

C2 horizon

Hue—10YR, 2.5Y, or 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

Electrical conductivity—0 to 4 mmhos/cm

Content of rock fragments—65 to 90 percent shale fragments—65 to 75 percent soft shale fragments, 0 to 15 percent hard shale fragments

Reaction—pH 5.6 to 7.8

Other features—Gypsum crystals are few to common at the shale contact and in the lower 1- to 2-inches of the C2 horizon

Cr horizon

Other features—The shale fragments are extremely hard or very hard when dry and extremely firm or very firm when moist
Reaction—pH 5.1 to 7.3

971F—Neldore-Bascovy silty clays, 25 to 60 percent slopes**Setting**

Landform: Neldore—hills; Bascovy—hills
Position on landform: Neldore—shoulders; Bascovy—back slopes
Slope: Neldore—25 to 60 percent; Bascovy—25 to 60 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Neldore and similar soils: 45 percent
Bascovy and similar soils: 40 percent

Minor Components

Marvan and similar soils: 0 to 5 percent
Harlake and similar soils: 0 to 1 percent
Yawdim and similar soils: 0 to 4 percent
Areas of badland: 0 to 4 percent
Areas of rock outcrop: 0 to 1 percent

Major Component Description**Neldore**

Surface layer texture: Silty clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 2.3 inches

Bascovy

Surface layer texture: Silty clay
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 4.0 inches

974F—Neldore-Hillon complex, 25 to 70 percent slopes**Setting**

Landform: Neldore—hills; Hillon—hills
Position on landform: Neldore—back slopes; Hillon—shoulders
Slope: Neldore—25 to 70 percent; Hillon—25 to 70 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Neldore and similar soils: 45 percent
Hillon and similar soils: 40 percent

Minor Components

Havre, occasionally flooded: 0 to 1 percent
Blacksheep and similar soils: 0 to 3 percent
Bascovy and similar soils: 0 to 7 percent
Areas of badland: 0 to 3 percent
Areas of rock outcrop: 0 to 1 percent

Major Component Description**Neldore**

Surface layer texture: Silty clay
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 2.3 inches

Hillon

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: About 9.9 inches

Nesda Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Moderate in the upper 0 to 14 inches (0.6 to 2.0 inches/hour); rapid below this depth (6.0 to 20.0 inches/hour)

Landform: Flood plains

Parent material: Alluvium

Slope range: 0 to 2 percent

Annual precipitation: 15 to 19 inches

Annual air temperature: 40 to 43 degrees F

Frost-free period: 70 to 100 days

Taxonomic Class: Sandy-skeletal, mixed Fluventic Haploborolls

Typical Pedon

Nesda very gravelly sandy loam, in an area of Nesda complex, 0 to 2 percent slopes, in woodland; 700 feet north and 2,300 feet west of the southeast corner of sec. 28, T. 29 N., R. 16 E.

A1—0 to 6 inches; dark grayish brown (2.5Y 4/2) very gravelly sandy loam, very dark grayish brown (2.5Y 3/2) moist; strong very fine granular structure; loose, nonsticky and nonplastic; few medium and many fine and very fine roots; few very fine pores; 40 percent pebbles, 10 percent cobbles; neutral; clear smooth boundary.

A2—6 to 13 inches; dark grayish brown (2.5Y 4/2) extremely gravelly sandy loam, very dark grayish brown (2.5Y 3/2) moist; single grain; loose, nonsticky and nonplastic; few medium and many fine and very fine roots; 60 percent pebbles, 5 percent cobbles; neutral; clear wavy boundary.

2C—13 to 60 inches; grayish brown (2.5Y 5/2) extremely gravelly sand, dark grayish brown (2.5Y 4/2) moist; massive; loose, nonsticky and nonplastic; few fine and many very fine roots; 55 percent pebbles, 10 percent cobbles, 5 percent stones; mildly 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

Soil phases: Occasionally flooded

A1 and A2 horizons

Hue—10YR, 2.5Y, or 5Y

Value—3, 4, or 5 dry; 2 or 3 moist

Chroma—1, 2, or 3

Texture—Loam or sandy loam

Clay content—10 to 20 percent

Content of rock fragments—15 to 60 percent—
0 to 15 percent stones and cobbles, 15 to 45
percent pebbles

Calcium carbonate equivalent—0 to 5 percent

Reaction—pH 6.6 to 7.8

2C horizon

Hue—10YR, 2.5Y, or 5Y

Value—4, 5, 6, or 7 dry; 3, 4, or 5 moist

Chroma—1, 2, 3, or 4

Texture—Sand or loamy sand

Clay content—0 to 10 percent

Content of 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

832A—Nesda complex, 0 to 2 percent slopes

Setting

Landform: Nesda—flood plains; Nesda—flood plains

Slope: Nesda—0 to 2 percent; Nesda—0 to 2 percent

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 100 days

Composition

Major Components

Nesda and similar soils: 45 percent

Nesda and similar soils: 40 percent

Minor Components

Eagleton and similar soils: 0 to 2 percent

Nesda, frequently flooded: 0 to 3 percent

Enbar and similar soils: 0 to 3 percent

Straw and similar soils: 0 to 7 percent

Major Component Description

Nesda

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: About 2.9 inches

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: Forest land
Flooding: Rare
Available water capacity: About 3.5 inches

Nishon Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Poorly drained
Permeability: Very slow (0.06 inch/hour)
Landform: Closed depressions
Parent material: Alluvium
Slope range: 0 to 1 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic, frigid Typic Albaqualfs

Typical Pedon

Nishon clay loam, 0 to 1 percent slopes, in an area of cropland; 300 feet south and 300 feet east of the northwest corner of sec. 6, T. 34 N., R. 12 E.

Ap—0 to 6 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; few fine prominent dark yellowish brown (10YR 4/4) redox concentrations; strong medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; slightly acid; abrupt wavy boundary.

Btg—6 to 24 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; few medium distinct dark yellowish brown (10YR 4/4) redox concentrations; moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; common distinct clay films on faces of peds and lining pores; mildly alkaline; clear wavy boundary.

Bkg1—24 to 39 inches; light gray (5Y 6/1) clay loam, dark gray (5Y 4/1) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine pores; common fine, medium and coarse soft masses and threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—39 to 50 inches; light gray (5Y 6/1) clay loam, dark gray (5Y 4/1) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine pores; common fine, medium and coarse soft masses and threads of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bkg3—50 to 60 inches; light gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; weak coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline.

Range in Characteristics

Depth to water table: 1 to 3 feet
Depth to the Bk horizon: 16 to 34 inches

Ap horizon

Hue—2.5Y or 10YR
 Value—5, 6, or 7 dry; 4 or 5 moist
 Chroma—1 or 2
 Redox concentrations—Few to common (10YR 5/3, 4/3, or 4/4)
 Clay content—27 to 35 percent
 Reaction—pH 6.1 to 8.4

Btg horizon

Hue—10YR, 2.5Y, or 5Y
 Value—4, 5, or 6 dry; 3 or 4 moist
 Chroma—0, 1, or 2
 Redox concentrations—Few to common (10YR 5/3, 4/3, 4/4 or 2.5Y 5/2, 5/3)
 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, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2 or 3
 Texture—Clay loam, clay, or silty clay
 Clay content—35 to 55 percent
 Calcium carbonate equivalent—1 to 15 percent
 Gypsum—1 to 3 percent
 Reaction—pH 7.4 to 9.0

28A—Nishon clay loam, 0 to 1 percent slopes

Setting

Landform: Closed depressions
Slope: 0 to 1 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Nishon and similar soils: 85 percent

Minor Components

Dimmick and similar soils: 0 to 10 percent

McKenzie and similar soils: 0 to 3 percent

Phillips 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

Ponding: Long

Available water capacity: About 9.3 inches

Nobe Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Very slow (0.06 inch/hour)

Landform: Flood plains and lake plains

Parent material: Alluvium and glaciolacustrine deposits

Slope range: 0 to 2 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic (calcareous), frigid Oxyaquic Ustorthents

Typical Pedon

Nobe clay, in an area of Bullhook-Nobe complex, 0 to 2 percent slopes, in rangeland; 100 feet north and 50 feet west of the southeast corner of sec. 7, T. 30 N., R. 14 E.

E—0 to 1 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate very coarse platy structure parting to weak coarse subangular blocky; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine pores; strongly 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 columnar structure parting to strong medium subangular blocky; hard, firm, very sticky and very plastic; many very fine roots; common very fine pores; common faint clay films on faces of peds; strongly alkaline; abrupt wavy boundary.

Byz1—4 to 17 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine

and medium subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; few very fine pores; common medium masses of gypsum and other salts; strongly effervescent; moderately alkaline; gradual wavy boundary.

Byz2—17 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular structure; very hard, firm, sticky and very plastic; few very fine roots; common fine masses of gypsum and other salts; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 to 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F

Depth to saturated zone: 24 to 60 inches for 1 to 4 months in the spring

E horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 3, 4, or 5 moist

Chroma—2 or 3

Clay content—40 to 60 percent

Electrical conductivity—4 to 8 mmhos/cm

Sodium adsorption ratio—0 to 13

Calcium carbonate equivalent—1 to 5 percent

Reaction—pH 6.6 to 8.4

Bt horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2 or 3

Texture—Clay, silty clay, or silty clay loam

Clay content—40 to 50 percent

Electrical conductivity—4 to 8 mmhos/cm

Sodium adsorption ratio—0 to 30

Calcium carbonate equivalent—1 to 5 percent

Reaction—pH 6.6 to 8.4

Byz1 horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 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

Gypsum—1 to 6 percent

Sodium adsorption ratio—13 to 40 percent

Calcium carbonate equivalent—1 to 5 percent
Reaction—pH 7.9 to 10.0

Byz2 horizon

Hue—10YR, 2.5Y, or 5Y
Value—5, 6, or 7 dry; 4, 5, or 6 moist
Chroma—2 or 3
Texture—Clay, silty clay, or silty clay loam that is stratified with loam, clay loam, and silt loam
Clay content—35 to 60 percent
Electrical conductivity—16 to 30 mmhos/cm
Gypsum—1 to 6
Sodium adsorption ratio—15 to 70
Calcium carbonate equivalent—1 to 5 percent
Reaction—pH 7.9 to 10.0

O'Brien Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Slow (0.06 to 0.2 inch/hour)

Landform: Hills

Parent material: Glacial till

Slope range: 15 to 60 percent

Annual precipitation: 13 to 17 inches

Annual air temperature: 41 to 44 degrees F

Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Pachic
Haploborolls

Typical Pedon

O'Brien clay loam, in an area of Zahill-O'Brien clay loams, 15 to 60 percent slopes, in rangeland; 550 feet north and 2,250 feet west of the southeast corner of sec. 7, T. 30 N., R. 17 E.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, firm, sticky and plastic; many very fine roots; many very fine pores; neutral; clear smooth boundary.

A2—5 to 21 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine pores; neutral; clear wavy boundary.

Bk1—21 to 37 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; common very fine pores; common fine soft

masses and threads of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—37 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots; common very fine pores; many fine soft masses and threads of lime; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 43 to 46 degrees F

Moisture control section: Between 4 and 12 inches

Mollic epipedon thickness: 16 to 33 inches

Depth to Bk horizon: 16 to 33 inches

A1 horizon

Hue—10YR or 2.5Y

Value—3 or 4 dry; 2 or 3 moist

Clay content—27 to 35 percent

Reaction—pH 6.6 to 7.3

A2 horizon

Hue—10YR or 2.5Y

Value—3 or 4 dry; 2 or 3 moist

Clay content—27 to 35 percent

Reaction—pH 6.6 to 7.3

Bk1 horizon

Hue—10YR or 2.5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Clay loam or loam

Clay content—18 to 35 percent

Calcium carbonate equivalent—5 to 15 percent

Electrical conductivity—less than 4 mmhos/cm

Reaction—pH 7.9 to 8.4

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 loam

Clay content—18 to 35 percent

Bulk density—1.55 to 1.75

Calcium carbonate equivalent—5 to 15 percent

Electrical conductivity—less than 4 mmhos/cm

Reaction—pH 7.9 to 9.0

Perma Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Somewhat excessively drained

Permeability: Moderate in the upper 0 to 30 inches

(0.6 to 2.0 inches/hour); moderately rapid below this depth (2.0 to 6.0 inches/hour)

Landform: Mountains

Parent material: Colluvium

Slope range: 25 to 70 percent

Annual precipitation: 15 to 22 inches

Annual air temperature: 40 to 43 degrees F

Frost-free period: 70 to 100 days

Taxonomic Class: Loamy-skeletal, mixed Typic Haploborolls

Typical Pedon

Perma cobbly loam, in an area of Perma-Whitlash complex, 25 to 70 percent slopes, in an area of rangeland; 300 feet north and 1,000 feet west of the southeast corner of sec. 17, T. 28 N., R. 16 E.

A—0 to 10 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine pores; 15 percent pebbles, 15 percent cobbles; neutral; clear smooth boundary.

Bw1—10 to 20 inches; grayish brown (10YR 5/2) very cobbly loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine pores; 15 percent pebbles, 25 percent cobbles; neutral; gradual wavy boundary.

Bw2—20 to 30 inches; grayish brown (10YR 5/2) very cobbly loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine pores; 25 percent pebbles, 25 percent cobbles; neutral; clear wavy boundary.

BC—30 to 60 inches; pale brown (10YR 6/3) extremely cobbly sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky and nonplastic; few very fine roots; 25 percent pebbles, 25 percent cobbles, 15 percent stones; neutral.

Range in Characteristics

Mollic epipedon thickness: 10 to 15 inches

A horizon

Value—4 or 5 dry; 2 or 3 moist

Chroma—2 or 3

Clay content—7 to 20 percent

Content of rock fragments—15 to 35 percent—
0 to 15 percent cobbles, stones, and boulders;
15 to 20 percent pebbles
Reaction—pH 6.6 to 7.3

Bw horizon

Hue—10YR or 7.5YR

Value—5 or 6 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Loam or sandy loam

Clay content—7 to 20 percent

Content of rock fragments—35 to 85 percent—
0 to 50 percent cobbles and stones, 25 to
65 percent pebbles

Reaction—pH 6.6 to 7.8

C horizon

Hue—10YR or 7.5YR

Value—6 or 7 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Loam, loamy sand, or sandy loam

Clay content—0 to 15 percent

Content of rock fragments—60 to 85 percent—
10 to 50 percent cobbles and stones, 50 to
65 percent pebbles

Reaction—pH 6.6 to 7.8

883F—Perma-Whitlash complex, 25 to 70 percent slopes

Setting

Landform: Perma—mountains; Whitlash—mountains

Position on landform: Perma—back slopes;
Whitlash—shoulders

Slope: Perma—25 to 70 percent; Whitlash—25 to
70 percent

Mean annual precipitation: 15 to 22 inches

Frost-free period: 70 to 100 days

Composition

Major Components

Perma and similar soils: 50 percent

Whitlash and similar soils: 35 percent

Minor Components

Perma very cobbly loam: 0 to 6 percent

Perma gravelly loam: 0 to 2 percent

Hedoes and similar soils: 0 to 3 percent

Soils with ponderosa pine: 0 to 1 percent

Areas of rubble land: 0 to 2 percent

Areas of rock outcrop: 0 to 1 percent

Major Component Description**Perma**

Surface layer texture: Cobbly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 4.1 inches

Whitlash

Surface layer texture: Cobbly sandy loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 1.4 inches

896F—Perma-Whitlash, cool-Rock outcrop complex, 25 to 70 percent slopes

Setting

Landform: Perma—mountains; Whitlash—mountains; Rock outcrop—mountains
Position on landform: Perma—back slopes; Whitlash—shoulders; Rock outcrop—shoulders
Slope: Perma—25 to 70 percent; Whitlash—25 to 70 percent
Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition**Major Components**

Perma and similar soils: 35 percent
 Whitlash and similar soils: 30 percent
 Rock outcrop: 20 percent

Minor Components

Hedoes and similar soils: 0 to 3 percent
 Belain and similar soils: 0 to 4 percent
 Soils that have slopes less than 25 percent: 0 to 5 percent
 Areas of rubble land: 0 to 3 percent

Major Component Description**Perma**

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 4.1 inches

Whitlash

Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Forest land
Flooding: None
Available water capacity: About 1.7 inches

Rock outcrop

Definition: Exposures of igneous and metamorphic bedrock
Flooding: None

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: Glacial till
Slope range: 0 to 4 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Typic Eutroboralfs

Typical Pedon

Phillips loam, in an area of Phillips-Elloam complex, 0 to 4 percent slopes, in rangeland; 300 feet north and 100 feet west of the southeast corner of sec. 16, T. 36 N., R. 10 E.

A—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, sticky and plastic; many very fine roots; many very fine pores; neutral; clear smooth boundary.

E—4 to 10 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium and coarse platy structure parting to weak medium subangular; hard, friable, sticky and plastic; many very fine roots; common very fine pores; neutral; abrupt smooth boundary.

Bt—10 to 20 inches; brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to strong fine subangular blocky; very hard, very firm, very sticky and very plastic; common distinct clay films on faces of peds; many very fine roots; common very fine pores; neutral; clear wavy boundary.

Bk1—20 to 30 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; weak medium and coarse subangular blocky structure; very hard, very firm, very sticky and plastic; few very fine roots; common very fine pores; common fine and medium soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—30 to 40 inches; light brownish gray (2.5Y 6/2) clay loam, light olive brown (2.5Y 5/4) moist; weak medium and coarse subangular blocky structure; very hard, firm, very sticky and plastic; few very fine roots; few very fine pores; many large soft masses of lime; violently effervescent; strongly alkaline; gradual wavy boundary.

By—40 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; weak medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; common very fine pores; few fine masses of gypsum; strongly effervescent; strongly alkaline.

Range in Characteristics

Moisture control section: 35 to 45 percent

Depth to the Bk horizon: 12 to 20 inches

Depth to the By horizon: 30 to 40 inches

A horizon

Hue—10YR or 2.5Y

Value—5 dry; 3 or 4 moist

Chroma—2 or 3

Clay content—15 to 27 percent

Content of rock fragments—0 to 15 percent—

0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction—pH 6.1 to 7.3

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

Content of rock fragments—0 to 15 percent—

0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction—pH 6.1 to 7.3

Other features—Some pedons have an E/B horizon

Bt 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—35 to 45 percent

Content of 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

Bk1 and Bk2 horizons

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—25 to 40 percent

Content of 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

Sodium adsorption ratio—0 to 13

Reaction—pH 7.4 to 9.0

By horizon

Hue—10YR or 2.5Y

Value—5 or 6 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—20 to 35 percent

Content of rock fragments—0 to 15 percent—

0 to 5 percent cobbles, 0 to 10 percent pebbles

Electrical conductivity—4 to 8 mmhos/cm

Gypsum—1 to 3 percent

Sodium adsorption ratio—0 to 13

Bulk density—More than 1.6g/cc

Reaction—pH 7.4 to 9.0

33A—Phillips loam, 0 to 2 percent slopes

Setting

Landform: Till plains

Slope: 0 to 2 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Phillips and similar soils: 85 percent

Minor Components

Nishon and similar soils: 0 to 2 percent
 Thoeny and similar soils: 0 to 3 percent
 Scobey and similar soils: 0 to 8 percent
 Hillon 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: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 9.7 inches

331B—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
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Phillips and similar soils: 60 percent
 Elloam and similar soils: 25 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Scobey and similar soils: 0 to 6 percent
 Hillon and similar soils: 0 to 3 percent
 Absher and similar soils: 0 to 1 percent
 Soils that have slopes more than 4 percent: 0 to 4 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: About 9.6 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: About 6.5 inches

334B—Phillips-Kevin complex, 0 to 4 percent slopes

Setting

Landform: Phillips—till plains; Kevin—till plains
Position on landform: Phillips—foot slopes; Kevin—back slopes
Slope: Phillips—0 to 2 percent; Kevin—2 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Phillips and similar soils: 55 percent
 Kevin and similar soils: 30 percent

Minor Components

Nishon and similar soils: 0 to 2 percent
 Scobey and similar soils: 0 to 9 percent
 Hillon and similar soils: 0 to 2 percent
 Elloam and similar soils: 0 to 1 percent
 Soils that have slopes more than 4 percent: 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: About 9.7 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: About 9.7 inches

400F—Rubble land-Rock outcrop complex**Setting**

Landform: Rubble land—mountains; Rock outcrop—mountains
Position on landform: Rubble land—back slopes and foot slopes; Rock outcrop—shoulders and summits
Mean annual precipitation: 15 to 22 inches
Frost-free period: 50 to 100 days

Composition**Major Components**

Rubble land: 45 percent
 Rock outcrop: 40 percent

Minor Components

Areas supporting trees: 0 to 15 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
Dominant parent material: Material weathered from igneous rocks
Flooding: None

Rock outcrop

Definition: Exposures of bare bedrock
Dominant parent material: Material weathered from igneous rocks
Flooding: None

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: Glacial till
Slope range: 0 to 8 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Aridic Argiborolls

Typical Pedon

Scobey clay loam, in an area of Scobey-Kevin clay loams, 0 to 4 percent slopes, in cropland; 2,400 feet north and 2,500 feet east of the southwest corner of sec. 7, T. 35 N., R. 8 E.

Ap—0 to 6 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine pores; mildly alkaline; clear smooth boundary.

Bt—6 to 14 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; strong medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine pores; many faint clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bk1—14 to 21 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; common very fine roots; few very fine pores; common medium soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—21 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; few very fine pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bky—42 to 60 inches; grayish brown (2.5Y 5/3) clay loam, dark grayish brown (2.5Y 4/3) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; few very fine soft masses of lime; common fine masses of gypsum; strongly effervescent; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to the Bk horizon: 10 to 16 inches
Depth to the Bky horizon: 30 to 60 inches

Ap horizon

Hue—10YR or 2.5Y
 Chroma—2 or 3
 Clay content—27 to 35 percent
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles and stones, trace to
 10 percent pebbles
 Reaction—pH 6.1 to 7.8

Bt horizon

Hue—10YR or 2.5Y
 Value—4, 5, or 6 dry; 3 or 4 moist
 Chroma—2 or 3
 Texture—Clay loam or clay
 Clay content—35 to 45 percent
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles, trace to 10 percent
 pebbles
 Reaction—pH 6.6 to 8.4

Bk1 and Bk2 horizons

Hue—10YR or 2.5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Clay content—30 to 40 percent
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles, trace to 10 percent
 pebbles
 Calcium carbonate equivalent—5 to 15 percent
 Reaction—pH 7.4 to 8.4
 Other features—Some pedons have a Btk horizon

Bky horizon

Hue—10YR or 2.5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2 or 3
 Clay content—30 to 40 percent
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles, trace to 10 percent
 pebbles
 Calcium carbonate equivalent—5 to 12 percent
 Sodium adsorption ratio—1 to 8
 Gypsum—1 to 6 percent
 Reaction—pH 7.4 to 9.0
 Other features—Some pedons have a By or C
 horizon below a depth of 40 inches

564B—Scobey-Hillon clay loams, 0 to 4 percent slopes**Setting**

Landform: Scobey—till plains; Hillon—till plains
Position on landform: Scobey—foot slopes; Hillon—
 back slopes

Slope: Scobey—0 to 4 percent; Hillon—0 to 4 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition**Major Components**

Scobey and similar soils: 45 percent

Hillon and similar soils: 40 percent

Minor Components

Nishon and similar soils: 0 to 1 percent

Marias and similar soils: 0 to 7 percent

Soils that are not deep-plowed: 0 to 2 percent

Soils that have slopes more than 4 percent: 0 to 5
 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: About 9.9 inches

Hillon

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: About 9.9 inches

561B—Scobey-Kevin clay loams, 0 to 4 percent slopes**Setting**

Landform: Scobey—till plains; Kevin—till plains

Position on landform: Scobey—foot slopes; Kevin—
 back slopes

Slope: Scobey—0 to 4 percent; Kevin—0 to 4 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition**Major Components**

Scobey and similar soils: 55 percent

Kevin and similar soils: 30 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Hillon and similar soils: 0 to 6 percent
 Phillips and similar soils: 0 to 3 percent
 Kevin, calcareous soils: 0 to 4 percent
 Soils that have slopes more than 4 percent: 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: About 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: About 9.7 inches

561C—Scobey-Kevin clay loams, 4 to 8 percent slopes**Setting**

Landform: Scobey—till plains; Kevin—till plains
Position on landform: Scobey—foot slopes; Kevin—back slopes
Slope: Scobey—4 to 8 percent; Kevin—4 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Scobey and similar soils: 50 percent
 Kevin and similar soils: 35 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Hillon and similar soils: 0 to 9 percent
 Marias and similar soils: 0 to 1 percent
 Soils that have slopes more than 8 percent: 0 to 3 percent
 Soils that have slopes less than 4 percent: 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: About 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: About 9.7 inches

Straw 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: 15 to 19 inches
Annual air temperature: 40 to 44 degrees F
Frost-free period: 70 to 100 days

Taxonomic Class: Fine-loamy, mixed Cumulic Haploborolls

Typical Pedon

Straw loam, in an area of Enbar-Straw-Eagleton loams, 0 to 2 percent slopes, in cropland; 800 feet south and 1,400 feet east of the northwest corner of sec. 12, T. 31 N., R. 16 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) 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; many very fine pores; mildly alkaline; abrupt smooth boundary.

A2—7 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; mildly alkaline; gradual wavy boundary.

A3—13 to 25 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium granular structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1—25 to 41 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

2C2—41 to 60 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; massive; loose, nonsticky and nonplastic; few very fine roots; 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: 16 to 40 inches

A horizon

Hue—10YR or 2.5Y

Value—3 or 4 dry; 2 or 3 moist

Chroma—2 or 3

Clay content—20 to 27 percent

Content of rock fragments—0 to 10 percent pebbles

Calcium carbonate equivalent—0 to 5 percent

Reaction—pH 6.6 to 8.4

C1 horizon

Hue—10YR or 2.5Y

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

Chroma—2, 3, or 4

Texture—Loam, silt loam, silty clay loam, or clay loam

Clay content—20 to 27 percent with less than 15 to 35 percent fine and coarser sand

Content of rock fragments—0 to 10 percent pebbles

Calcium carbonate equivalent—0 to 5 percent

Reaction—pH 6.6 to 8.4

2C horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2 or 3

Clay content—22 to 35 percent

Content of rock fragments—0 to 10 percent pebbles

Calcium carbonate equivalent—2 to 12 percent

Reaction—pH 7.4 to 8.4

831A—Straw-Korchea loams, 0 to 2 percent slopes

Setting

Landform: Straw—flood plains; Korchea—flood plains

Slope: Straw—0 to 2 percent; Korchea—0 to 2 percent

Mean annual precipitation: 15 to 19 inches

Frost-free period: 70 to 100 days

Composition

Major Components

Straw and similar soils: 45 percent

Korchea and similar soils: 40 percent

Minor Components

Eagleton and similar soils: 0 to 2 percent

Korchea sandy loam: 0 to 3 percent

Nesda and similar soils: 0 to 5 percent

Havre and similar soils: 0 to 5 percent

Major Component Description

Straw

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: About 10.7 inches

Korchea

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: About 10.1 inches

Tally Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

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

Landform: Till plains or hills

Parent material: Alluvium or eolian deposits

Slope range: 4 to 15 percent

Annual precipitation: 13 to 17 inches

Annual air temperature: 41 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Coarse-loamy, mixed Typic
 Haploborolls

Typical Pedon

Tally fine sandy loam, 4 to 15 percent slopes, in an area of cropland; 50 feet north and 1,300 feet east of the southwest corner of sec. 20, T. 30 N., R. 16 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; common very fine pores; neutral; abrupt wavy boundary.

Bw1—8 to 13 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine pores; neutral; gradual wavy boundary.

Bw2—13 to 31 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; few very fine pores; neutral; abrupt wavy boundary.

Bk1—31 to 44 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; loose, nonsticky and nonplastic; few fine threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—44 to 60 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; loose, nonsticky and nonplastic; common fine threads of lime; violently 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 16 inches
Depth to Bk horizon: 15 to 35 inches

Ap horizon

Hue—2.5Y, 10YR, or 7.5YR
 Value—3, 4, or 5 dry; 2, 3, or 4 moist
 Chroma—2 or 3
 Clay content—10 to 20 percent

Content of rock fragments—0 to 15 percent pebbles
 Reaction—pH 6.1 to 7.8.

Bw1 horizon

Hue—7.5YR, 10YR, or 2.5Y
 Value—4 or 5 dry; 2 or 3 moist
 Chroma—2 or 3
 Texture—Fine sandy loam or sandy loam
 Clay content—5 to 18 percent
 Content of rock fragments—0 to 15 percent pebbles
 Reaction—pH 6.6 to 8.4

Bw2 horizon

Hue—7.5YR, 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
 Content of rock fragments—0 to 15 percent pebbles
 Reaction—pH 6.6 to 8.4

Bk horizon

Hue—10YR, 2.5Y, or 7.5YR
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Loamy fine sand, loamy sand, fine sand, fine sandy loam, or sandy loam
 Clay content—5 to 18 percent
 Calcium carbonate equivalent—5 to 15 percent
 Content of rock fragments—0 to 15 percent pebbles above 40 inches, 0 to 25 percent below 40 inches
 Reaction—pH 7.4 to 8.4

93D—Tally fine sandy loam, 4 to 15 percent slopes

Setting

Landform: Hills
Slope: 4 to 15 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Tally and similar soils: 85 percent

Minor Components

Farnuf and similar soils: 0 to 7 percent
 Hedges and similar soils: 0 to 5 percent

Soils that have slopes more than 15 percent: 0 to 2 percent

Soils that have slopes less than 4 percent: 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 or eolian material

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 7.9 inches

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

Parent material: Glacial till

Slope range: 0 to 8 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine-loamy, mixed Aridic Argiborolls

Typical Pedon

Telstad loam, in an area of Telstad-Joplin loams, 0 to 4 percent slopes, in an area of cropland; 1,100 feet south and 1,400 feet east of the northwest corner of sec. 18, T. 30 N., R. 13 E.

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

Bt—6 to 12 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak coarse and very coarse prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; common faint clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bk1—12 to 30 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; few very fine pores; few fine soft

masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—30 to 40 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; few very fine pores; few fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Bky—40 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; few very fine pores; few fine soft masses of lime; few fine soft masses of gypsum; strongly effervescent; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 15 inches

Depth to the Bk horizon: 10 to 20 inches

Ap horizon

Hue—10YR or 2.5Y

Chroma—2 or 3

Clay content—18 to 27 percent

Content of 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—10YR or 2.5Y

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

Chroma—2 or 3

Texture—Loam or clay loam

Clay content—25 to 35 percent

Content of 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, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2 or 3

Texture—Loam or clay loam

Clay content—20 to 32

Content of rock fragments—0 to 10 percent—

0 to 2 percent cobbles, 0 to 8 percent pebbles

Electrical conductivity—2 to 4 mmhos/cm

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.9 to 8.4

Bk2 horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam
 Clay content—20 to 32 percent
 Content of 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—2 to 4 mmhos/cm
 Bulk density air dry: 1.7 or more
 Reaction—pH 7.9 to 8.4

By horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Texture—Loam or clay loam
 Clay content—20 to 32 percent
 Content of 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—2 to 4 mmhos/cm
 Gypsum—0 to 3 percent
 Bulk density—1.7 or more
 Reaction—pH 7.9 to 9.0

501B—Telstad-Hillon loams, 0 to 4 percent slopes

Setting

Landform: Telstad—till plains; Hillon—till plains
Position on landform: Telstad—foot slopes; Hillon—
 back slopes
Slope: Telstad—0 to 4 percent; Hillon—0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Telstad and similar soils: 45 percent
 Hillon and similar soils: 40 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Soils that are not deep-plowed: 0 to 2 percent
 Hillon clay loam: 0 to 7 percent
 Soils that have slopes more than 4 percent: 0 to 5 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: About 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: About 10.0 inches

503B—Telstad-Joplin loams, 0 to 4 percent slopes

Setting

Landform: Telstad—till plains; Joplin—till plains (fig. 5)
Position on landform: Telstad—foot slopes; Joplin—
 back slopes
Slope: Telstad—0 to 4 percent; Joplin—0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Telstad and similar soils: 55 percent
 Joplin and similar soils: 30 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Hillon and similar soils: 0 to 6 percent
 Kremlin and similar soils: 0 to 4 percent
 Scobey and similar soils: 0 to 1 percent
 Joplin, calcareous soils: 0 to 1 percent
 Soils that have slopes more than 4 percent: 0 to 2 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: About 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: About 9.2 inches

503C—Telstad-Joplin loams, 4 to 8 percent slopes**Setting**

Landform: Telstad—till plains; Joplin—till plains
Position on landform: Telstad—foot slopes; Joplin—back slopes
Slope: Telstad—4 to 8 percent; Joplin—4 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Telstad and similar soils: 50 percent
 Joplin and similar soils: 35 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Hillon and similar soils: 0 to 6 percent
 Joplin, calcareous soils: 0 to 2 percent
 Scobey clay loam: 0 to 3 percent
 Soils that have slopes more than 8 percent: 0 to 2 percent
 Soils that have slopes less than 4 percent: 0 to 1 percent

Major Component Description**Telstad**

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



Figure 5.—Field windbreaks on map unit 503B, Telstad-Joplin loams, 0 to 4 percent slopes.

Drainage class: Well drained
Dominant parent material: Till
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 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: About 9.2 inches

Thibadeau 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: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

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

Typical Pedon

Thibadeau clay loam, 0 to 2 percent slopes, in an area of rangeland; 1,600 feet north and 600 feet east of the southwest corner of sec. 11, T. 35 N., R. 12 E.

- A—0 to 2 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak very fine granular structure; soft, very friable, sticky and plastic; many very fine roots; common very fine pores; strongly alkaline; clear smooth boundary.
- C—2 to 14 inches; grayish brown (2.5Y 5/2) clay loam consisting of thin strata of loam and fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; many very fine roots; common very fine pores; strongly effervescent; strongly alkaline; clear wavy boundary.
- Cyz—14 to 60 inches; light olive brown (2.5Y 5/4) clay loam consisting of thin strata of loam and fine sandy loam, olive brown (2.5Y 4/4) moist; many fine distinct yellowish brown (10YR 5/6) redox concentrations; massive; hard, friable, sticky and

plastic; few very fine roots; common very fine pores; common fine masses and seams of gypsum and other salts; strongly effervescent; very strongly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Moisture control section: Between 4 and 12 inches; depth to water table is 24 to 42 inches

A horizon

Hue—10YR or 2.5Y
 Value—5, 6, or 7 dry; 3, 4, or 5 moist
 Chroma—2, 3, or 4
 Clay content—27 to 40 percent
 Electrical conductivity—8 to 16 mmhos/cm
 Sodium adsorption ratio—8 to 20
 Reaction—pH 7.9 to 9.6

C horizon

Hue—10YR or 2.5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Texture—Clay loam, loam, or silty clay loam with or without thin strata of loam, clay loam, silty clay loam, fine sandy loam, or silt loam
 Clay content—18 to 35 percent
 Electrical conductivity—8 to 16 mmhos/cm
 Sodium adsorption ratio—13 to 20
 Reaction—pH 7.9 to 9.6

Cyz horizon

Hue—10YR or 2.5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—3 or 4
 Texture—Clay loam, loam or silty clay loam with or without thin strata 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
 Reaction—pH 7.9 to 9.6

99A—Thibadeau clay loam, 0 to 2 percent slopes

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Thibadeau and similar soils: 85 percent

Minor Components

Poorly drained soils: 0 to 10 percent

Lostriver and similar soils: 0 to 1 percent

Bullhook and similar soils: 0 to 1 percent

Thibadeau, frequently flooded: 0 to 1 percent

Soils that have slopes more than 2 percent: 0 to 1 percent

Hanly 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: Somewhat poorly drained

Dominant parent material: Alluvium

Native plant cover type: Rangeland

Flooding: Occasional

Water table: Apparent

Salt affected: Saline within 30 inches

Sodium affected: Sodic within 30 inches

Available water capacity: About 8.4 inches

Thoeny Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Well drained

Permeability: Very slow (0.06 inch/hour)

Landform: Till plains

Parent material: Glacial till

Slope range: 0 to 4 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Typic Natriboralfs

Typical Pedon

Thoeny loam, in an area of Thoeny-Elloam complex, 0 to 4 percent slopes, in rangeland; 2,600 feet south and 1,600 feet east of the northwest corner of sec. 23, T. 36 N., R. 10 E.

E1—0 to 3 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak very thin platy structure parting to strong very fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; few very fine pores; mildly alkaline; clear smooth boundary.

E2—3 to 6 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak very thin platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine pores; mildly alkaline; abrupt smooth boundary.

Btn1—6 to 10 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; moderate medium columnar structure parting to moderate medium angular blocky; very hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; many distinct clay films on faces of peds; strongly alkaline; clear smooth boundary.

Btn2—10 to 14 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm, very sticky and very plastic; many very fine roots; common very fine pores; many distinct clay films on faces of peds; strongly alkaline; clear wavy boundary.

Bkn1—14 to 20 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; moderate medium subangular structure; very hard, firm, sticky and plastic; common very fine roots; many very fine pores; many very fine and fine masses of lime; violently effervescent; strongly alkaline; gradual smooth boundary.

Bkn2—20 to 27 inches; light gray (5Y 7/2) clay loam, light olive gray (5Y 6/2) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots; many very fine pores; many very fine and fine masses of lime; violently effervescent; strongly alkaline; gradual smooth boundary.

Bkny—27 to 60 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine pores; few fine and medium soft masses and threads of lime; few fine masses of gypsum; violently effervescent; strongly alkaline.

Range in Characteristics

Depth to the Bk horizon: 12 to 20 inches

Depth to the Bky horizon: 24 to 36 inches

E horizon

Value—5 or 6 dry; 4 or 5 moist

Chroma—2 or 3

Clay content—15 to 27 percent

Content of 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
 Sodium adsorption ratio—5 to 20
 Electrical conductivity—4 to 8 mmhos/cm
 Skeletans: Unstained sand and silt grains range from very few to common faint on vertical faces of peds
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles and stones, 0 to 10 percent pebbles
 Structure—Strong to medium columnar, prismatic, or blocky
 Reaction—pH 7.4 to 9.0

Bkn horizon

Hue—10YR or 2.5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2 or 3
 Texture—Clay or clay loam
 Clay content—35 to 50 percent
 Content of 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 or more exchangeable magnesium plus sodium than calcium plus exchange acidity
 Calcium carbonate equivalent—5 to 10 percent
 Reaction—pH 7.4 to 9.0

Bkny horizon

Hue—2.5Y or 5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2 or 3
 Texture—Clay or clay loam
 Clay content—35 to 50 percent
 Bulk density—1.55 gr/ccm and greater
 Content of 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 or more exchangeable magnesium plus sodium than calcium plus exchange acidity
 Gypsum—1 to 3 percent
 Reaction—pH 7.9 to 9.0

115B—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
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Thoeny and similar soils: 50 percent
 Elloam and similar soils: 35 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Absher and similar soils: 0 to 8 percent
 Hillon and similar soils: 0 to 4 percent
 Soils that have slopes more than 4 percent: 0 to 2 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: About 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: About 6.5 inches

Tinsley Series

Depth class: Very deep (greater than 60 inches)

Drainage class: Excessively drained

Permeability: Rapid (6.0 to 20.0 inches/hour)

Landform: Kames and eskers

Parent material: Glacial outwash

Slope range: 2 to 8 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Sandy-skeletal, mixed, frigid Typic Ustorthents

Typical Pedon

Tinsley gravelly sandy loam, in an area of Attewan-Tinsley complex, 2 to 8 percent slopes, in rangeland; 2,700 feet south and 800 feet west of the northeast corner of sec. 28, T. 32 N., R. 15 E.

A—0 to 7 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable, nonsticky and slightly plastic; many coarse and fine roots; few fine pores; 15 percent pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—7 to 13 inches; grayish brown (10YR 5/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose, nonsticky and nonplastic; many coarse and fine roots; few fine pores; 45 percent pebbles, 5 percent cobbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—13 to 40 inches; light gray (10YR 7/2) extremely gravelly sand, light brownish gray (10YR 6/2) moist; single grain; loose, nonsticky and nonplastic; common fine roots; few very fine pores; 45 percent pebbles, 25 percent cobbles; violently effervescent; moderately alkaline; gradual wavy boundary.

C3—40 to 60 inches; light brownish gray (10YR 6/2) very gravelly sand, grayish brown (10YR 5/2) moist; single grained; loose, nonsticky and nonplastic; few fine roots; 35 percent pebbles, 5 percent cobbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 12 and 35 inches; frozen November through March

A horizon

Hue—10YR or 2.5Y

Value—4 or 5 dry; 3 or 4 moist

Chroma—2, 3, or 4

Clay content—5 to 10 percent

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

Reaction—pH 7.4 to 8.4

C horizon

Hue—10YR or 2.5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Sand or loamy sand

Clay content—0 to 10 percent

Content of rock fragments—35 to 70 percent—
5 to 25 percent stones and cobbles, 30 to
45 percent pebbles

Reaction—pH 7.4 to 8.4.

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: Sedimentary plains

Parent material: Semiconsolidated, sandy
sedimentary beds

Slope range: 2 to 8 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Coarse-loamy, mixed Aridic Ustochrepts

Typical Pedon

Twilight fine sandy loam, in an area of Twilight-Blacksheep fine sandy loams, 2 to 8 percent slopes, in cropland; 1,700 feet south and 2,000 feet west of the northeast corner of sec. 10, T. 32 N., R. 11 E.

Ap—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; neutral; abrupt smooth boundary.

Bw—6 to 14 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak very fine granular; slightly hard, very friable,

nonsticky and nonplastic; common fine and very fine roots; neutral; clear wavy boundary.

Bk1—14 to 24 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many fine masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—24 to 29 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many fine masses of lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

Cr—29 to 60 inches; light brownish gray (2.5Y 6/2) semiconsolidated sandstone, grayish brown (2.5Y 5/2) moist; violently effervescent; moderately alkaline.

Range in Characteristics

Control section: 0 to 29 inches

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

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, 6, or 7 dry; 4, 5, or 6 moist

Chroma—1, 2, 3, or 4

Texture—Fine sandy loam or sandy loam

Clay content—5 to 18 percent

Calcium carbonate equivalent—5 to 10 percent

Reaction—pH 7.4 to 8.4

661C—Twilight-Blacksheep fine sandy loams, 2 to 8 percent slopes

Setting

Landform: Twilight—sedimentary plains;

Blacksheep—sedimentary plains

Position on landform: Twilight—back slopes;

Blacksheep—shoulders

Slope: Twilight—2 to 8 percent; Blacksheep—2 to 8 percent

Mean annual precipitation: 10 to 13 inches

Frost-free period: 105 to 120 days

Composition

Major Components

Twilight and similar soils: 55 percent

Blacksheep and similar soils: 30 percent

Minor Components

Busby and similar soils: 0 to 3 percent

Yetull, calcareous soils: 0 to 2 percent

Very shallow soils: 0 to 2 percent

Soils that have slopes more than 8 percent: 0 to 8 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: Semiconsolidated, sandy sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 4.1 inches

Blacksheep

Surface layer texture: Fine sandy loam

Depth class: Shallow (10 to 20 inches)

Drainage class: Well drained

Dominant parent material: Semiconsolidated, sandy sedimentary beds

Native plant cover type: Rangeland

Flooding: None

Available water capacity: About 2.5 inches

Vida 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 and hills

Parent material: Glacial till

Slope range: 0 to 25 percent

Annual precipitation: 13 to 17 inches

Annual air temperature: 41 to 44 degrees F

Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic Argiborolls

Typical Pedon

Vida clay loam, in an area of Bearpaw-Vida clay loams, 0 to 4 percent slopes, in cropland; 2,150 feet south and 2,200 feet west of the northeast corner of sec. 21, T. 30 N., R. 15 E.

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

Bt—5 to 8 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to strong fine and medium subangular blocky; extremely hard, extremely firm, very sticky and very plastic; many very fine roots; many very fine pores; many faint clay films on faces of peds and lining pores; neutral; clear smooth boundary.

Bk1—8 to 23 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, very firm, very sticky and very plastic; many very fine roots; many very fine pores; common fine soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—23 to 42 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; weak fine and medium subangular structure; very hard, very firm, very sticky and very plastic; common very fine roots; many very fine pores; common fine soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk3—42 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; weak fine and medium subangular structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; few fine soft masses of lime; strongly effervescent; strongly alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 10 inches

Depth to the Bk horizon: 6 to 10 inches

Ap horizon

Value—3 or 4 dry, 2 or 3 moist

Chroma—2 or 3

Texture—Loam or clay loam

Clay content—15 to 30 percent

Content of rock fragments—0 to 15 percent—
0 to 5 percent cobbles and stones, 0 to 10 percent pebbles

Reaction—pH 6.6 to 7.8

Bt horizon

Hue—10YR

Value—4 or 5 dry; 3 or 4 moist

Chroma—2 or 3

Texture—Loam, clay loam, or clay

Clay content—25 to 35 percent

Content of rock fragments—0 to 15 percent—
0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction—pH 6.6 to 7.8

Bk1 horizon

Hue—10YR or 2.5Y

Value—6 or 7 dry; 5 or 6 moist

Chroma—2 or 3

Texture—Loam or clay loam

Clay content—25 to 35 percent

Content of 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

Bk2 and Bk3 horizons

Hue—10YR or 2.5Y

Value—6 or 7 dry; 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—25 to 35 percent

Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles, 0 to 10 percent pebbles
 Calcium carbonate equivalent—2 to 12 percent
 Gypsum—0 to 5 percent
 Reaction—pH 7.9 to 8.4

696C—Vida-Zahill-Bearpaw clay loams, 2 to 8 percent slopes

Setting

Landform: Vida—till plains; Zahill—till plains;
 Bearpaw—till plains
Position on landform: Vida—back slopes; Zahill—
 shoulders; Bearpaw—foot slopes
Slope: Vida—2 to 8 percent; Zahill—2 to 8 percent;
 Bearpaw—2 to 8 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Vida and similar soils: 35 percent
 Zahill and similar soils: 30 percent
 Bearpaw and similar soils: 20 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Williams and similar soils: 0 to 9 percent
 Zahill gravelly loam: 0 to 2 percent
 Soils that have slopes more than 8 percent: 0 to 3
 percent

Major Component Description

Vida

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: About 8.1 inches

Zahill

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: About 9.6 inches

Bearpaw

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: About 9.3 inches

Waltham Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Very slow (0.06 inch/hour)
Landform: Till plains
Parent material: Glacial till
Slope range: 0 to 4 percent
Annual precipitation: 13 to 17 inches
Annual air temperature: 41 to 44 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine, montmorillonitic Typic
 Natriboralfs

Typical Pedon

Waltham clay loam, in an area of Bearpaw-Waltham clay loams, 0 to 4 percent slopes, in rangeland; 500 feet north and 200 feet west of the southeast corner of sec. 4, T. 31 N., R. 16 E.

- E—0 to 2 inches; light gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine platy structure; hard, firm, sticky and plastic; common very fine and fine roots; common very fine and fine pores; mildly alkaline; abrupt smooth boundary.
- Bt—2 to 10 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium and coarse columnar structure parting to strong fine and medium subangular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots; common very fine and fine pores; many distinct clay films on faces of peds; mildly alkaline; clear smooth boundary.
- Btkn—10 to 17 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to strong fine and medium subangular blocky; very hard, firm, very sticky and very plastic; few very fine and fine roots; common very fine and fine pores; few faint clay films on faces of peds; common fine

soft masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bknyz1—17 to 25 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine pores; many fine soft masses of lime; common fine masses of gypsum and other salts; strongly effervescent; moderately alkaline; clear smooth boundary.

Bknyz2—25 to 60 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, firm, sticky and plastic; few very fine pores; many fine soft masses of lime; many fine masses of gypsum and other salts; strongly effervescent; strongly alkaline.

Range in Characteristics

Depth to the Btkn horizon: 10 to 16 inches

Depth to the Bknyz horizon: 16 to 35 inches

E horizon

Hue—2.5Y or 10YR

Value—6 or 7 dry; 4 or 5 moist

Chroma—2 or 3

Clay content—27 to 40 percent

Content of rock fragments—0 to 5 percent pebbles

Electrical conductivity—0 to 2 mmhos/cm

Sodium adsorption ratio—0 to 4

Reaction—pH 6.6 to 8.4

Other features—In some pedons there is a 1- or 2-inch A horizon with granular structure above the E horizon

Bt horizon

Hue—2.5Y or 10YR

Value—4 or 5 dry; 3 or 4 moist

Chroma—2 or 3

Texture—Clay loam or clay

Clay content—45 to 60 percent

Content of rock fragments—0 to 5 percent pebbles

Electrical conductivity—0 to 2 mmhos/cm

Sodium adsorption ratio—4 to 13

Reaction—pH 7.4 to 8.4

Btkn horizon

Hue—2.5Y or 10YR

Value—5 or 6 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Clay loam or clay

Clay content—35 to 45 percent

Content of rock fragments—0 to 5 percent mainly pebbles

Electrical conductivity—0 to 4 mmhos/cm

Sodium adsorption ratio—13 to 25

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.9 to 9.0

Bkny horizon

Hue—2.5Y or 10YR

Value—5, 6, or 7 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Clay loam

Clay content—27 to 40 percent

Content of rock fragments—0 to 5 percent pebbles

Electrical conductivity—4 to 16 mmhos/cm

Sodium adsorption ratio—4 to 20

Gypsum—3 to 5 percent

Calcium carbonate equivalent—5 to 10 percent

Reaction—pH 7.4 to 9.0

Warwood 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

Slope range: 15 to 45 percent

Annual precipitation: 20 to 22 inches

Annual air temperature: 38 to 40 degrees F

Frost-free period: 50 to 70 days

Taxonomic Class: Fine-loamy, mixed Glossic Cryoboralfs

Typical Pedon

Warwood loam, 15 to 45 percent slopes, in a woodland area; 1,100 feet south and 1,800 feet west of the northeast corner of sec. 22, T. 28 N., R. 16 E.

O_i—3 inches to 0; forest litter of slightly decomposed needles, twigs, and leaves.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; many fine and very fine and few medium and coarse roots; many fine and very fine pores; slightly acid; clear wavy boundary.

E—4 to 10 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; moderate fine

subangular blocky structure parting to moderate fine granular; slightly hard, very friable, nonsticky and nonplastic; common fine and many very fine roots; many very fine pores; slightly acid; clear wavy boundary.

E/Bt—10 to 15 inches; 80 percent light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist tongues (E part); 20 percent grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist (Bt part); moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine and common fine pores; common faint clay films in pores and bridging sand grains; slightly acid; clear wavy boundary.

Bt/E—15 to 20 inches; 60 percent is grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist tongues (Bt part); 40 percent is light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist (E part); moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine and common fine pores; common distinct clay films on faces of peds and in pores of Bt part; slightly acid; clear wavy boundary.

Bt1—20 to 45 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to strong medium angular blocky; very hard, firm, sticky and plastic; common very fine roots; many very fine pores; many distinct clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—45 to 60 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure; very hard, friable, sticky and plastic; few very fine roots; many very fine pores; few faint clay films on faces of peds; neutral.

Range in Characteristics

Depth to the argillic horizon: 4 to 20 inches

A horizon

Value—4 or 5 dry; 2 or 3 moist
Clay content—20 to 27 percent
Content of rock fragments—5 to 15 percent—
5 to 10 percent pebbles, 0 to 5 percent cobbles
Reaction—pH 5.6 to 6.5

E horizon

Value—5 or 6 dry; 4 or 5 moist
Chroma—2 or 3

Texture—Loam or sandy loam

Clay content—15 to 27 percent

Content of rock fragments—5 to 15 percent—
5 to 15 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 5.6 to 6.5

E/Bt horizon

Value—E part—5 or 6 dry and 4 moist; Bt part—
4 or 5 dry and 3 or 4 moist

Chroma—2 or 3

Texture—Sandy loam, loam, or sandy clay
loam (mixed)

Clay content—18 to 30 percent

Content of rock fragments—5 to 15 percent—
5 to 15 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 5.6 to 6.5

Bt/E horizon

Value—Bt part—4 or 5 dry and 3 or 4 moist;
E part—5 or 6 dry and 4 moist

Chroma—2 or 3

Texture—Sandy clay loam or clay loam (mixed)

Clay content—20 to 35 percent

Content of rock fragments—5 to 15 percent—
5 to 15 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 5.6 to 6.5

Bt1 horizon

Value—5 or 6 dry; 3 or 4 moist

Chroma—2 or 3

Clay content—27 to 35 percent

Content of rock fragments—5 to 25 percent—
5 to 20 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 6.1 to 7.3

Bt2 horizon

Value—5 or 6 dry; 3 or 4 moist

Chroma—2 or 3

Texture—Clay loam or sandy clay loam

Clay content—20 to 35 percent

Content of rock fragments—5 to 25 percent—
5 to 20 percent pebbles, 0 to 5 percent cobbles

Reaction—pH 6.1 to 7.3

530F—Warwood loam, 15 to 45 percent slopes

Setting

Landform: Mountains

Slope: 15 to 45 percent

Mean annual precipitation: 20 to 22 inches

Frost-free period: 50 to 70 days

Composition

Major Components

Warwood and similar soils: 85 percent

Minor Components

Elkner and similar soils: 0 to 3 percent

Garlet and similar soils: 0 to 3 percent

Soils that are 20 to 40 inches to rock: 0 to 3 percent

Soils that have slopes more than 45 percent: 0 to 1 percent

Soils that have slopes less than 15 percent: 0 to 4 percent

Areas of rubble land: 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: Colluvium

Native plant cover type: Forest land

Flooding: None

Available water capacity: About 9.4 inches

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: Slow (0.06 to 0.2 inch/hour)

Landform: Sedimentary plains

Parent material: Semiconsolidated shale residuum

Slope range: 2 to 8 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Fine, montmorillonitic Typic Natriboralfs

Typical Pedon

Weingart clay, in an area of Weingart complex, 2 to 8 percent slopes, in rangeland; 2,000 feet south and

2,200 feet west of the northeast corner of sec. 13, T. 30 N., R. 11 E.

E—0 to 2 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate very fine platy structure parting to weak very fine granular; slightly hard, friable, sticky and plastic; many very fine roots; few very fine pores; mildly alkaline; clear smooth boundary.

Btn—2 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; many very fine roots; common very fine pores; violently effervescent; strongly alkaline; clear smooth boundary.

Bknyz—10 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; extremely hard, extremely firm, very sticky and very plastic; many very fine roots; few very fine pores; many fine soft threads of lime; many fine threads of gypsum and other salts; violently effervescent; moderately alkaline; clear smooth boundary.

Bnyz—16 to 22 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, extremely firm, very sticky and very plastic; common very fine roots; few very fine pores; moderately alkaline; clear smooth boundary.

Cr—22 to 60 inches; olive (5Y 4/4) semiconsolidated shale, olive gray (5Y 4/2) moist; few fine threads of gypsum; moderately alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F

Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature is 41 degrees F or above

Depth to Bk horizon: 8 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, 6, or 7 dry; 3, 4, 5, or 6 moist

Chroma—2 or 3

Texture—Clay or clay loam

Clay content—27 to 45 percent

Content of 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, 3, or 4
Texture—Clay, silty clay, or sandy clay
Clay content—40 to 60 percent
Content of 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

Bknyz horizon

Hue—2.5Y or 5Y
Value—5 or 6 dry; 4 or 5 moist
Chroma—1, 2, 3, or 4
Texture—Clay, silty clay, clay loam, or silty clay
loam
Clay content—35 to 55 percent
Content of 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—1 to 5 percent
Calcium carbonate equivalent—5 to 15 percent
Reaction—pH 7.9 to 9.6

Bnyz horizon

Hue—10YR, 2.5Y, or 5Y
Value—5 or 6 dry; 4 or 5 moist
Chroma—1, 2, 3, or 4
Texture—Clay, silty clay, clay loam, or silty clay
loam
Clay content—35 to 55 percent
Content of rock fragments—60 to 75 percent—
5 to 30 percent hard shale, 45 to 55 percent
soft shale
Electrical conductivity—4 to 16 mmhos/cm
Sodium adsorption ratio—13 to 30
Gypsum—1 to 5 percent
Reaction—pH 7.9 to 9.6

Cr horizon

Material: Mostly semiconsolidated shale with some
interbedded shale and sandstone

**62C—Weingart complex, 2 to 8 percent
slopes*****Setting***

Landform: Weingart—sedimentary plains; Weingart,
thin surface—sedimentary plains
Position on landform: Weingart—microhighs;
Weingart, thin surface—microlows
Slope: Weingart—2 to 8 percent; Weingart, thin
surface—2 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Weingart and similar soils: 50 percent
Weingart, thin surface and similar soils: 35 percent

Minor Components

Creed and similar soils: 0 to 5 percent
Bascovy and similar soils: 0 to 2 percent
Neldore and similar soils: 0 to 3 percent
Hillon and similar soils: 0 to 2 percent
Soils that have slopes more than 8 percent: 0 to 3
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: Semiconsolidated shale
residuum
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: About 2.7 inches

Weingart, thin surface

Surface layer texture: Clay
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale
residuum
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches

Sodium affected: Sodic within 30 inches
Available water capacity: About 2.5 inches

Wheatbelt Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Poorly drained
Permeability: Very slow (0.06 inch/hour)
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 1 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Very-fine, montmorillonitic, frigid
 Sodic Epiaquerts

Typical Pedon

Wheatbelt clay, 0 to 1 percent slopes, in an area of rangeland; 2,300 feet north and 2,100 feet west of the southeast corner of sec. 17, T. 37 N., R. 13 E.

Ag—0 to 2 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; strong very coarse granular structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few very fine pores; moderately alkaline; clear smooth boundary.

Bnssg—2 to 16 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; moderate very fine and fine angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few very fine pores; common slickensides intersecting at 30 to 45 degrees from horizontal; strongly alkaline; clear wavy boundary.

Bnssyg1—16 to 38 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; moderate fine and medium angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine pores; common slickensides intersecting at 30 to 45 degrees from horizontal; many fine masses of gypsum; strongly alkaline; gradual wavy boundary.

Bnssyg2—38 to 60 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; moderate fine and medium angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine pores; many slickensides intersecting at 30 to 60 degrees from horizontal; common fine masses of gypsum; strongly alkaline.

Range in Characteristics

Soil temperature: 44 to 47 degrees F
Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees or higher
Depth to Bnssg horizon: 1 to 30 inches
Depth to Bnssyg horizon: 5 to 30 inches
Water table: Ponded, +0.5 to 1.0 foot during part of the growing season in most years
Other features: When dry, this soil has cracks that are at least 1/2 inch wide at a depth of 20 inches; some pedons have a Bng horizon

Ag 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 or 3 moist
 Texture—Clay or silty clay
 Clay content—60 to 85 percent
 Electrical conductivity—2 to 8 mmhos/cm
 Sodium adsorption ratio—13 to 30
 Reaction—pH 7.9 to 9.0

Bnssyg horizon

Value—4 or 5 dry; 2.5, 3, or 4 moist
 Texture—Clay or silty clay
 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

51A—Wheatbelt clay, 0 to 1 percent slopes

Setting

Landform: Lake plains
Slope: 0 to 1 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Wheatbelt and similar soils: 85 percent

Minor Components

Soils with loamy layers below 40 inches: 0 to 6 percent

McKenzie and similar soils: 0 to 5 percent

Soils that have slopes more than 1 percent: 0 to 1 percent

Marvan, saline soils: 0 to 3 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

Ponding: Long

Salt affected: Saline within 30 inches

Sodium affected: Sodic within 30 inches

Available water capacity: About 7.0 inches

Whitlash Series

Depth class: Shallow (10 to 20 inches)

Drainage class: Well drained

Permeability: Moderate (0.6 to 2.0 inches/hour)

Landform: Hills and mountains

Parent material: Igneous rocks

Slope range: 15 to 70 percent

Annual precipitation: 13 to 22 inches

Annual air temperature: 40 to 43 degrees F

Frost-free period: 70 to 110 days

Taxonomic Class: Loamy-skeletal, mixed Lithic Haploborolls

Typical Pedon

Whitlash gravelly loam, in an area of Belain-Whitlash, moist-Hedoes complex, 15 to 60 percent slopes, in rangeland; 2,200 feet south and 2,300 feet west of the northeast corner of sec. 24, T. 29 N., R. 14 E.

A—0 to 2 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and plastic; many very fine roots; many very fine pores; 15 percent pebbles; neutral; clear smooth boundary.

Bw1—2 to 7 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; soft, very friable, sticky and plastic; many very fine roots; many very fine pores; 20 percent pebbles; neutral; clear wavy boundary.

Bw2—7 to 17 inches; grayish brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky and plastic; common very fine roots; 45 percent pebbles; neutral; abrupt wavy boundary.

R—17 inches; igneous rock.

Range in Characteristics

Depth to bedrock: 10 to 20 inches

A horizon

Value—3 or 4 dry; 2 or 3 moist

Chroma—1, 2, or 3

Texture—Loam or sandy loam

Clay content—10 to 27 percent and less than 35 percent fine and coarser sand

Content of rock fragments—15 to 35 percent—15 to 20 percent pebbles or channers, 0 to 15 percent cobbles, flagstones, or stones

Reaction—pH 6.1 to 7.3

Bw horizon

Value—4 or 5 dry; 3 or 4 moist

Chroma—2 or 3

Texture—Loam, sandy clay loam, or sandy loam

Clay content—10 to 27 percent and less than 35 percent fine and coarser sand

Content of rock fragments—35 to 80 percent—15 to 60 percent pebbles or channers, 5 to 50 percent cobbles, flagstones, or stones

Reaction—pH 6.1 to 7.3

Other features—Some pedons have a C horizon

892F—Whitlash-Belain-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform: Whitlash—hills; Belain—hills; Rock outcrop—hills

Position on landform: Whitlash—shoulders; Belain—back slopes; Rock outcrop—shoulders

Slope: Whitlash—25 to 60 percent; Belain—25 to 45 percent

Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition

Major Components

Whitlash and similar soils: 35 percent
 Belain and similar soils: 30 percent
 Rock outcrop: 20 percent

Minor Components

Soils with ponderosa pine: 0 to 5 percent
 Hedges and similar soils: 0 to 3 percent
 Whitlash stony sandy loam: 0 to 5 percent
 Areas of rubble land: 0 to 2 percent

Major Component Description

Whitlash

Surface layer texture: Gravelly sandy loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 1.4 inches

Belain

Surface layer texture: Loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 3.5 inches

Rock outcrop

Definition: Exposures of igneous and metamorphic bedrock
Flooding: None

895F—Whitlash-Perma-Rock outcrop complex, 25 to 70 percent slopes

Setting

Landform: Whitlash—mountains; Perma—mountains; Rock outcrop—mountains
Position on landform: Whitlash—shoulders; Perma—back slopes; Rock outcrop—shoulders

Slope: Whitlash—25 to 70 percent; Perma—25 to 70 percent

Mean annual precipitation: 15 to 19 inches
Frost-free period: 70 to 100 days

Composition

Major Components

Whitlash and similar soils: 35 percent
 Perma and similar soils: 30 percent
 Rock outcrop: 20 percent

Minor Components

Hedges and similar soils: 0 to 2 percent
 Belain and similar soils: 0 to 5 percent
 Soils that have slopes less than 25 percent: 0 to 6 percent
 Soils that have slopes more than 70 percent: 0 to 1 percent
 Areas of rubble land: 0 to 1 percent

Major Component Description

Whitlash

Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 1.7 inches

Perma

Surface layer texture: Gravelly loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Colluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 4.1 inches

Rock outcrop

Definition: Exposures of igneous and metamorphic bedrock
Flooding: None

Williams 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: Glacial till

Slope range: 0 to 8 percent

Annual precipitation: 13 to 17 inches

Annual air temperature: 41 to 44 degrees F

Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Typic
Argiborolls

Typical Pedon

Williams loam, in an area of Williams-Vida loams, 0 to 4 percent slopes, in rangeland; 500 feet north and 550 west of the southeast corner of sec. 24, T. 30 N., R. 16 E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak medium angular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine pores; neutral; clear smooth boundary.

Bt1—4 to 9 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; many very fine and fine roots; many very fine pores; common faint clay films on faces of peds; neutral; clear wavy boundary.

Bt2—9 to 14 inches; dark brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; common fine and medium roots; many very fine pores; common faint clay films on faces of peds; neutral; clear wavy boundary.

Bk1—14 to 23 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine roots; common very fine pores; common medium soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—23 to 41 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; moderate medium subangular blocky structure; hard; firm; sticky and plastic; few fine roots; common very fine pores; many medium soft masses and threads of lime; violently effervescent; moderately alkaline; clear wavy boundary.

Bky—41 to 60 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine pores; common medium soft masses of lime; few fine masses of gypsum; strongly effervescent; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 15 inches

Depth to the Bk horizon: 10 to 30 inches

A horizon

Value—3, 4, or 5 dry; 2 or 3 moist

Clay content—15 to 27 percent

Reaction—pH 6.6 to 7.8

Bt horizon

Hue—10YR or 2.5Y

Value—4, 5, or 6 dry; 2, 3, 4, or 5 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—24 to 35 percent clay

Reaction—pH 6.6 to 7.8

Bk horizon

Hue—10YR, 2.5Y, or 5Y

Value—4, 5, 6, 7, or 8 dry; 3, 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—22 to 35 percent

Calcium carbonate equivalent—5 to 15 percent

Reaction—pH 7.9 to 8.4

Bky horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, 7, or 8 dry; 3, 4, 5, or 6 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—22 to 35 percent

Calcium carbonate equivalent—5 to 15 percent

Gypsum—1 to 3 percent

Reaction—7.9 to 8.4

801B—Williams-Vida loams, 0 to 4 percent slopes

Setting

Landform: Williams—till plains; Vida—till plains

Position on landform: Williams—foot slopes; Vida—back slopes

Slope: Williams—0 to 4 percent; Vida—0 to 4 percent

Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Williams and similar soils: 60 percent
 Vida and similar soils: 25 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Zahill and similar soils: 0 to 8 percent
 Obrien and similar soils: 0 to 2 percent
 Bearpaw and similar soils: 0 to 1 percent
 Soils that have slopes more than 4 percent: 0 to 3 percent

Major Component Description

Williams

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: About 10.4 inches

Vida

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: About 8.2 inches

801C—Williams-Vida loams, 4 to 8 percent slopes

Setting

Landform: Williams—till plains; Vida—till plains
Position on landform: Williams—foot slopes; Vida—back slopes
Slope: Williams—4 to 8 percent; Vida—4 to 8 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Williams and similar soils: 55 percent
 Vida and similar soils: 30 percent

Minor Components

Nishon and similar soils: 0 to 1 percent
 Zahill and similar soils: 0 to 8 percent
 Bearpaw and similar soils: 0 to 1 percent
 Obrien and similar soils: 0 to 1 percent
 Soils that have slopes less than 4 percent: 0 to 1 percent
 Soils that have slopes more than 8 percent: 0 to 3 percent

Major Component Description

Williams

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: About 10.4 inches

Vida

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: About 8.2 inches

Winkler Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid (2.0 to 6.0 inches/hour)
Landform: Mountains
Parent material: Colluvium
Slope range: 25 to 60 percent
Annual precipitation: 17 to 20 inches
Annual air temperature: 40 to 43 degrees F
Frost-free period: 70 to 90 days

Taxonomic Class: Loamy-skeletal, mixed, frigid
 Typic Ustochrepts

Typical Pedon

Winkler gravelly sandy loam, in an area of Winkler-Ambrant complex, 25 to 60 percent slopes, in woodland; 50 feet north and 900 feet east of the southwest corner of sec. 35, T. 29 N., R. 15 E.

Oi—3 to 0 inches; forest litter of slightly decomposed needles, twigs, and leaves.

E1—0 to 7 inches; light brownish gray (10YR 6/2) gravelly sandy loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; slightly hard, very friable, slightly sticky and slightly plastic; few coarse and many fine and medium roots; common fine pores; 20 percent pebbles; neutral; gradual wavy boundary.

E2—7 to 15 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many medium and fine roots; common very fine pores; 40 percent pebbles; neutral; gradual wavy boundary.

E and Bt—15 to 33 inches; 75 percent is light brownish gray (10YR 6/2) extremely gravelly sandy loam, grayish brown (10YR 5/2) moist (E part); 25 percent is brown (10YR 5/3) sandy loam lamellae, brown (10YR 4/3) moist (Bt part); weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many medium and fine roots; common very fine pores; 55 percent pebbles, 10 percent cobbles; slightly acid; gradual wavy boundary.

C—33 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; 60 percent pebbles, 15 percent cobbles; neutral.

Range in Characteristics

E1 horizon

Hue—7.5YR or 10YR
 Value—6, 7, or 8 dry; 5, 6, or 7 moist
 Chroma—2, 3, or 4
 Clay content—5 to 15 percent
 Content of rock fragments—15 to 35 percent—
 0 to 5 percent angular cobbles, 10 to 30
 percent angular pebbles
 Reaction—pH 6.1 to 7.3

E2 horizon

Hue—2.5Y, 7.5YR, or 10YR
 Value—6, 7, or 8 dry; 5, 6, or 7 moist
 Chroma—2, 3, or 4
 Texture—Sandy loam or loam
 Clay content—5 to 15 percent

Content of rock fragments—35 to 70 percent—
 0 to 10 percent angular cobbles, 35 to 60
 percent angular pebbles
 Reaction—pH 5.6 to 7.3

E and Bt horizon

Hue—E part—2.5Y, 7.5YR, or 10YR; B part—
 2.5Y, 5YR, 7.5YR, or 10YR
 Value—E part—6, 7, or 8 dry and 5, 6, or 7 moist;
 B part—4, 5, or 6 dry and 4 or 5 moist
 Chroma—E part—2, 3, or 4; B part—3 or 4
 Texture—Fine sandy loam, sandy loam, or loam
 Clay content—5 to 15 percent, lamellae have less
 than 5 percent increase in clay
 Content of rock fragments—60 to 85 percent—
 10 to 25 percent angular cobbles, 50 to 60
 percent angular pebbles
 Reaction—pH 5.6 to 6.5

C horizon

Hue—7.5YR or 10YR
 Value—5, 6, or 7 dry; 4 or 5 moist
 Chroma—2 or 3
 Texture—Sandy loam or fine sandy loam
 Clay content—5 to 15 percent
 Content of rock fragments—60 to 85 percent—
 10 to 25 percent angular cobbles, 50 to 60
 percent angular pebbles
 Reaction—pH 5.6 to 7.3

191F—Winkler-Ambrant complex, 25 to 60 percent slopes

Setting

Landform: Winkler—mountains; Ambrant—
 mountains; Winkler, dry—mountains
Position on landform: Winkler—back slopes;
 Ambrant—back slopes; Winkler, dry—back slopes
Slope: Winkler—25 to 60 percent; Ambrant—25 to 60
 percent; Winkler, dry—25 to 60 percent
Mean annual precipitation: 17 to 20 inches
Frost-free period: 70 to 90 days

Composition

Major Components

Winkler and similar soils: 35 percent
 Ambrant and similar soils: 25 percent
 Winkler, dry and similar soils: 25 percent

Minor Components

Winkler loam: 0 to 6 percent

Soils with bedrock at less than 60 inches: 0 to 7 percent

Soils that have slopes more than 60 percent: 0 to 1 percent

Areas of rubble land: 0 to 1 percent

Major Component Description**Winkler**

Surface layer texture: Gravelly sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat excessively drained

Dominant parent material: Colluvium

Native plant cover type: Forest land

Flooding: None

Available water capacity: About 2.9 inches

Ambrant

Surface layer texture: Sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat excessively drained

Dominant parent material: Colluvium

Native plant cover type: Forest land

Flooding: None

Available water capacity: About 4.2 inches

Winkler, dry

Surface layer texture: Gravelly sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat excessively drained

Dominant parent material: Colluvium

Native plant cover type: Forest land

Flooding: None

Available water capacity: About 2.9 inches

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 and sedimentary plains

Parent material: Alluvium

Slope range: 0 to 8 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

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

Typical Pedon

Yamacall loam, 0 to 4 percent slopes, in an area of cropland; 1,100 feet north and 350 feet east of the southwest corner of sec. 22, T. 32 N., R. 16 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—6 to 18 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—18 to 40 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; common medium and fine soft masses of lime; violently effervescent; strongly alkaline; gradual wavy boundary.

Bk2—40 to 60 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; few very fine pores; common fine soft masses of lime; 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

Ap horizon

Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 dry; 3, 4, or 5 moist

Chroma—2, 3, or 4

Texture—Loam or clay loam

Clay content—18 to 35 percent

Content of rock fragments—0 to 15 percent—

0 to 5 percent cobbles, 0 to 10 percent pebbles

Reaction—pH 7.4 to 8.4

Bw horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Loam, clay loam, or silt loam
 Clay content—18 to 35 percent with 15 to 35 percent fine sand and coarser
 Content of rock fragments—0 to 15 percent—
 0 to 5 percent cobbles, 0 to 10 percent pebbles
 Effervescence—None to strong
 Reaction—pH 6.6 to 8.4

Bk horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, 7, or 8 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Loam, clay loam, or silt loam
 Clay content—18 to 35 percent with 15 to 35 percent fine sand and coarser
 Content of 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
 Effervescence—Strong or violent
 Reaction—pH 7.9 to 9.0

799C—Yamacall clay loam, 2 to 8 percent slopes**Setting**

Landform: Alluvial fans
Slope: 2 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Yamacall and similar soils: 85 percent

Minor Components

Kobase, calcareous soils: 0 to 2 percent
 Yamacall loam soils: 0 to 8 percent
 Benz and similar soils: 0 to 2 percent
 Soils that have slopes more than 8 percent: 0 to 3 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: About 10.3 inches

79B—Yamacall loam, 0 to 4 percent slopes**Setting**

Landform: Alluvial fans
Slope: 0 to 4 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Yamacall and similar soils: 85 percent

Minor Components

Kremlin and similar soils: 0 to 5 percent
 Havre, rarely flooded: 0 to 1 percent
 Marvan and similar soils: 0 to 4 percent
 Soils that have slopes more than 4 percent: 0 to 3 percent
 Yamacall clay loam 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: About 10.3 inches

795C—Yamacall-Benz clay loams, 2 to 8 percent slopes**Setting**

Landform: Yamacall—alluvial fans; Benz—alluvial fans
Slope: Yamacall—2 to 8 percent; Benz—2 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Yamacall and similar soils: 50 percent
 Benz and similar soils: 35 percent

Minor Components

Kobase, calcareous soils: 0 to 3 percent
 Marvan and similar soils: 0 to 4 percent
 Delpoint, calcareous soils: 0 to 2 percent

Yamacall loam: 0 to 5 percent
Soils that have slopes more than 8 percent: 0 to 1 percent

Major Component Description

Yamacall

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: About 10.3 inches

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: About 6.4 inches

791C—Yamacall-Hillon loams, 2 to 8 percent slopes

Setting

Landform: Yamacall—sedimentary plains; Hillon—till plains
Position on landform: Yamacall—back slopes; Hillon—back slopes
Slope: Yamacall—2 to 8 percent; Hillon—2 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition

Major Components

Yamacall and similar soils: 50 percent
Hillon and similar soils: 35 percent

Minor Components

Busby and similar soils: 0 to 10 percent
Joplin and similar soils: 0 to 3 percent
Soils that have slopes more than 8 percent: 0 to 2 percent

Major Component Description

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: About 10.3 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: About 10.0 inches

Yawdim 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: Semiconsolidated shale residuum
Slope range: 8 to 25 percent
Annual precipitation: 10 to 13 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 105 to 120 days

Taxonomic Class: Clayey, montmorillonitic (calcareous), frigid, shallow Aridic Ustorthents

Typical Pedon

Yawdim clay, in an area of Cabbart-Yawdim complex, 8 to 25 percent slopes, in rangeland; 50 feet north and 2,500 feet west of the southeast corner of sec. 23, T. 29 N., R. 8 E.

A—0 to 2 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, firm, very sticky and plastic; common very fine roots; few very fine pores; slightly effervescent; mildly alkaline; clear smooth boundary.

C1—2 to 11 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; hard, firm, very sticky and plastic; common very fine roots; common very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—11 to 15 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong very thin and thin platy structure; slightly hard, firm, very sticky and plastic; common very fine roots; few very fine pores; 50 percent soft fine shale chips; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cr—15 to 60 inches; light brownish gray (2.5Y 6/2) semiconsolidated shale, grayish brown (2.5Y 5/2) moist; few medium masses of gypsum; mildly alkaline.

Range in Characteristics

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

Clay content—40 to 50 percent

Reaction—pH 6.6 to 7.8

C horizon

Hue—10YR, 2.5Y, or 5Y

Value—5, 6, 7, or 8 dry; 4, 5, or 6 moist

Chroma—1, 2, 3, or 4

Clay content—35 to 50 percent

Reaction—pH 7.4 to 8.4

Cr horizon

Material: Semiconsolidated shale

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 and hills

Parent material: Alluvium and eolian deposits

Slope range: 0 to 15 percent

Annual precipitation: 10 to 13 inches

Annual air temperature: 42 to 45 degrees F

Frost-free period: 105 to 120 days

Taxonomic Class: Mixed, frigid Typic

Ustipsamments

Typical Pedon

Yetull loamy fine sand, in an area of Yetull-Lonesome loamy fine sands, 0 to 8 percent slopes, in rangeland; 200 feet north and 600 feet west of the southeast corner of sec. 32, T. 30 N., R. 10 E.~

A—0 to 8 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; strong

fine granular structure; soft, loose, nonsticky and nonplastic; many very fine and fine roots; many very fine pores; neutral; clear smooth boundary.

C1—8 to 23 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; many very fine roots; many very fine pores; violently effervescent; moderately alkaline; clear smooth boundary.

C2—23 to 37 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; common very fine and fine roots; many very fine pores; violently effervescent; moderately alkaline; gradual smooth boundary.

C3—37 to 60 inches; light brownish gray (2.5Y 6/2) loamy sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine pores; violently effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees

Moisture control section: Between 12 and 35 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher

Soil phase: Calcareous

A horizon

Hue—10YR to 2.5Y

Value—5 or 6 dry; 3 or 4 moist

Chroma—2, 3, or 4

Texture—Loamy fine sand or fine sandy loam

Clay content—0 to 10 percent

Content of rock fragments—0 to 15 percent—

0 to 5 percent cobbles, 0 to 10 percent pebbles

Calcium carbonate equivalent—0 to 10 percent

Effervescence—None to strong

Reaction—pH 6.6 to 8.4

C1 horizon

Hue—10YR or 2.5Y

Value—4, 5, or 6 dry; 4 or 5 moist

Chroma—2, 3, or 4

Texture—Sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand

Clay content—0 to 10 percent

Content of rock fragments—0 to 15 percent pebbles

Calcium carbonate equivalent—1 to 10 percent

Effervescence—Slight or strong

Reaction—pH 7.4 to 8.4

C2 horizon

Hue—10YR or 2.5Y
 Value—4, 5, or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Texture—Sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand
 Clay content—0 to 10 percent
 Content of rock fragments—0 to 15 percent pebbles
 Calcium carbonate equivalent—3 to 10 percent
 Effervescence—Slight, strong, or violent
 Reaction—pH 7.4 to 8.4

C3 horizon

Hue—10YR or 2.5Y
 Value—4, 5, or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Texture—Sand, fine sand, loamy sand, loamy coarse sand, loamy fine sand, or coarse sand
 Clay content—0 to 10 percent
 Effervescence—Strong or violent
 Calcium carbonate equivalent—3 to 10 percent
 Reaction—pH 7.4 to 8.4

701D—Yetull-Busby fine sandy loams, 4 to 15 percent slopes**Setting**

Landform: Yetull—hills; Busby—hills
Position on landform: Yetull—back slopes; Busby—back slopes
Slope: Yetull—4 to 15 percent; Busby—4 to 15 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Yetull and similar soils: 45 percent
 Busby and similar soils: 40 percent

Minor Components

Fortbenton and similar soils: 0 to 4 percent
 Yamacall, calcareous soils: 0 to 3 percent
 Tinsley and similar soils: 0 to 3 percent

Major Component Description**Yetull**

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained

Dominant parent material: Alluvium or eolian material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 4.2 inches

Busby

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: About 7.3 inches

732C—Yetull-Lonesome loamy fine sands, 0 to 8 percent slopes**Setting**

Landform: Yetull—till plains; Lonesome—till plains
Position on landform: Yetull—back slopes; Lonesome—back slopes
Slope: Yetull—0 to 8 percent; Lonesome—0 to 8 percent
Mean annual precipitation: 10 to 13 inches
Frost-free period: 105 to 120 days

Composition**Major Components**

Yetull and similar soils: 45 percent
 Lonesome and similar soils: 40 percent

Minor Components

Yetull, calcareous soils: 0 to 5 percent
 Fortbenton and similar soils: 0 to 4 percent
 Soils that have slopes more than 8 percent: 0 to 3 percent
 Areas that are seeped: 0 to 1 percent
 Areas of duneland: 0 to 1 percent
 Blowout areas: 0 to 1 percent

Major Component Description**Yetull**

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian deposits
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 3.6 inches

Lonesome

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Eolian over till or lacustrine material
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 7.7 inches

Zahill Series

Depth class: Very deep (greater than 60 inches)
Drainage class: Well drained
Permeability: Moderately slow (0.2 to 0.6 inches/hour) above 28 inches; slow (0.06 to 0.2 inches/hour) below this depth
Landform: Till plains and hills
Parent material: Glacial till
Slope range: 2 to 60 percent
Annual precipitation: 13 to 17 inches
Annual air temperature: 42 to 45 degrees F
Frost-free period: 90 to 110 days

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

Typical Pedon

Zahill clay loam, in an area of Zahill-O'Brien clay loams, 15 to 60 percent slopes, in rangeland; 500 feet south and 900 feet west of the northeast corner of sec. 2, T. 31 N., R. 17 E.

- A—0 to 3 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 4/2) moist; weak very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; mildly alkaline; clear smooth boundary.
- Bk1—3 to 14 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; common very fine roots; common very fine pores; common medium soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.
- Bk2—14 to 28 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; few very fine roots; few very fine pores; common medium soft masses of lime; violently

effervescent; moderately alkaline; gradual wavy boundary.

- Bky—28 to 60 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine soft masses of lime; few fine masses of gypsum; strongly effervescent; strongly alkaline.

Range in Characteristics*A horizon*

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Loam or clay loam
 Clay content—20 to 35 percent
 Content of rock fragments—0 to 15 percent—0 to 5 percent cobbles and stones, 0 to 10 percent pebbles
 Reaction—pH 7.4 to 8.4

Bk horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5, 6, or 7 dry; 4, 5, or 6 moist
 Chroma—2, 3, or 4
 Texture—Loam or clay loam
 Clay content—25 to 35 percent
 Content of rock fragments—0 to 15 percent—0 to 5 percent stones or cobbles, 0 to 10 percent pebbles
 Calcium carbonate equivalent—8 to 15 percent
 Effervescence—Strong or violent
 Reaction—pH 7.4 to 8.4

Bky horizon

Hue—10YR, 2.5Y, or 5Y
 Value—5 or 6 dry; 4 or 5 moist
 Chroma—2, 3, or 4
 Texture—Loam or clay loam
 Clay content—20 to 35 percent
 Content of rock fragments—0 to 15 percent—0 to 5 percent stones or cobbles, 0 to 10 percent pebbles
 Effervescence—Slight or strong
 Gypsum—1 to 5 percent
 Reaction—pH 7.4 to 9.0

72F—Zahill clay loam, 25 to 60 percent slopes**Setting**

Landform: Hills
Slope: 25 to 60 percent

Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Zahill and similar soils: 85 percent

Minor Components

Korchea and similar soils: 0 to 1 percent
 Vida and similar soils: 0 to 6 percent
 Bedrock at 10 to 60 inches: 0 to 4 percent
 Soils that have slopes less than 25 percent: 0 to 2 percent
 Soils that have slopes more than 60 percent: 0 to 1 percent
 Areas of rock outcrop: 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: About 9.6 inches

729F—Zahill-Obrien clay loams, 15 to 60 percent slopes

Setting

Landform: Zahill—hills; Obrien—hills
Position on landform: Zahill—back slopes; Obrien—back slopes
Slope: Zahill—15 to 60 percent; Obrien—15 to 60 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Zahill and similar soils: 45 percent
 Obrien and similar soils: 40 percent

Minor Components

Poorly drained soils: 0 to 2 percent
 Obrien loam: 0 to 9 percent
 Soils that have slopes less than 15 percent: 0 to 3 percent
 Soils that have slopes more than 60 percent: 0 to 1 percent

Major Component Description

Zahill

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: About 9.6 inches

Obrien

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: About 9.7 inches

725F—Zahill-Rock outcrop complex, 25 to 60 percent slopes

Setting

Landform: Zahill—hills; Rock outcrop—hills
Position on landform: Zahill—back slopes; Rock outcrop—shoulders
Slope: 25 to 60 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Zahill and similar soils: 60 percent
 Rock outcrop: 25 percent

Minor Components

Korchea and similar soils: 0 to 1 percent
 Obrien and similar soils: 0 to 2 percent
 Whitlash and similar soils: 0 to 5 percent
 Soils with ponderosa pine: 0 to 2 percent
 Soils that have slopes more than 60 percent: 0 to 1 percent
 Soils that have slopes less than 25 percent: 0 to 4 percent

Major Component Description

Zahill

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: About 9.6 inches

Rock outcrop

Definition: Exposures of igneous and metamorphic bedrock
Flooding: None

899F—Zahill-Rock outcrop-Whitlash complex, 15 to 60 percent slopes

Setting

Landform: Zahill—hills; Rock outcrop—hills; Whitlash—hills
Position on landform: Zahill—foot slopes; Rock outcrop—shoulders; Whitlash—back slopes and shoulders
Slope: Zahill—15 to 60 percent; Whitlash—15 to 60 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Zahill and similar soils: 35 percent
 Rock outcrop: 30 percent
 Whitlash and similar soils: 20 percent

Minor Components

O'Brien and similar soils: 0 to 6 percent
 Soils with ponderosa pine: 0 to 4 percent
 Soils that have slopes less than 15 percent: 0 to 1 percent
 Soils that have slopes more than 60 percent: 0 to 4 percent

Major Component Description

Zahill

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: About 9.6 inches

Rock outcrop

Definition: Exposures of igneous and metamorphic bedrock
Flooding: None

Whitlash

Surface layer texture: Gravelly loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Material weathered from igneous rocks
Native plant cover type: Rangeland
Flooding: None
Available water capacity: About 1.7 inches

721E—Zahill-Vida clay loams, 15 to 25 percent slopes

Setting

Landform: Zahill—hills; Vida—hills
Position on landform: Zahill—shoulders; Vida—back slopes
Slope: Zahill—15 to 25 percent; Vida—15 to 25 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Zahill and similar soils: 50 percent
 Vida and similar soils: 35 percent

Minor Components

Soils that have bedrock at 20 to 60 inches: 0 to 2 percent
 Vida loam: 0 to 5 percent
 Zahill gravelly loam: 0 to 4 percent
 Soils that have slopes more than 25 percent: 0 to 1 percent
 Soils that have slopes less than 15 percent: 0 to 3 percent

Major Component Description

Zahill

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: About 9.6 inches

Vida

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: About 8.1 inches

722D—Zahill-Vida clay loams, 8 to 15 percent slopes

Setting

Landform: Zahill—hills; Vida—hills
Position on landform: Zahill—shoulders; Vida—back slopes
Slope: Zahill—8 to 15 percent; Vida—8 to 15 percent
Mean annual precipitation: 13 to 17 inches
Frost-free period: 90 to 110 days

Composition

Major Components

Zahill and similar soils: 45 percent
 Vida and similar soils: 40 percent

Minor Components

Zahill gravelly loam: 0 to 8 percent
 Vida loam: 0 to 5 percent
 Soils that have slopes more than 15 percent: 0 to 2 percent

Major Component Description

Zahill

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: About 9.6 inches

Vida

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: About 8.1 inches

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Glossary

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.

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hill slopes. Back slopes in profile are commonly steep and linear and descend to a foot slope. In terms of gradational process, back slopes are erosional forms produced mainly by mass wasting and running water.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

- Bedrock-floored plain.** An extensive nearly level to gently rolling or moderately sloping area that is underlain by hard bedrock and has a slope of 0 to 8 percent.
- Bench terrace.** A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.
- Blowout.** A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.
- Board foot.** A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 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.
- Casteps.** 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.

Foot slope. The geomorphic component that forms the inner, gently inclined surface at the base of a hill slope. The surface profile is dominantly concave. In terms of gradational processes, a foot slope is a transition zone between an upslope site of erosion (back slope) and a downslope site of deposition (toe slope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

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.

Percolates 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:

Ultra acid	less than 3.5
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 county.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant or dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading onto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slickens. Accumulations of fine textured material, such as material separated in placer-mine and ore-mill operations. Slickens from ore mills commonly consist of freshly ground rock that has undergone chemical treatment during the milling process.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is loamy or clayey, is slippery when wet, and is low in productivity.

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 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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from 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.
- Toe slope.** The outermost inclined surface at the base of a hill. Toe slopes 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 depression 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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