

USDA United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
Minnesota Agricultural
Experiment Station

Soil Survey of Lac qui Parle County, Minnesota

Part I



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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.

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.

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

Major fieldwork for this soil survey was completed in 1993. Soil names and descriptions were approved in 1994. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1993. This survey was made cooperatively by the Natural Resources Conservation Service and the Minnesota Agricultural Experiment Station. Assistance was provided by the Agricultural Extension Service, the Minnesota Department of Natural Resources, and the Soil and Water Conservation Board. The survey was partially funded by the Legislative Commission for Minnesota Resources and by Lac qui Parle County. It is part of the technical assistance furnished to the Lac qui Parle Soil and Water Conservation District.

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

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

Cover: This terrace, in an area of Sisseton and Heimdal soils, has a grassed back slope. Terraces reduce the hazard of water erosion.

Contents

Part I

| | |
|--|-----|
| Index to series | iv |
| Index to map units | v |
| Summary of tables | vii |
| Foreword | ix |
| How this survey was made | 1 |
| General nature of the county | 2 |
| Settlement and history | 2 |
| Farming | 3 |
| Transportation facilities | 3 |
| Geologic history and geomorphology | 3 |
| Climate | 4 |
| Formation and classification of the soils | 7 |
| Soil series and detailed soil map units | 15 |
| References | 97 |
| Glossary | 99 |

Part II (For page numbers, see Contents in Part II)

Detailed soil map unit legend
Summary of tables

Agronomy

- Crops and pasture
- Crop yield estimates
- Land capability classification
- Prime farmland
- Erosion factors
- Windbreaks and environmental plantings

Recreation

Wildlife habitat

Engineering

- Building site development
- Sanitary facilities
- Waste management
- Construction materials
- Water management

Soil properties

- Engineering index properties
- Physical and chemical properties
- Water features
- Soil features

References

Glossary

Issued November 1997

Index to Series

| | | | |
|------------------------|----|------------------------|----|
| Arvilla series..... | 16 | Marysland series..... | 56 |
| Barnes series..... | 18 | McIntosh series..... | 57 |
| Bearden series..... | 19 | Mehurin series..... | 59 |
| Bigstone series..... | 20 | Normania series..... | 60 |
| Burr series..... | 21 | Oldham series..... | 61 |
| Buse series..... | 22 | Parle series..... | 62 |
| Calco series..... | 25 | Parnell series..... | 64 |
| Colvin series..... | 27 | Perella series..... | 65 |
| Darnen series..... | 28 | Poinsett series..... | 66 |
| Doland series..... | 29 | Quam series..... | 68 |
| Dovray series..... | 31 | Rauville series..... | 69 |
| Du Page series..... | 32 | Rolfe series..... | 70 |
| Egeland series..... | 33 | Rothsay series..... | 71 |
| Embden series..... | 35 | Seaforth series..... | 72 |
| Esmond series..... | 36 | Sinai series..... | 73 |
| Forada series..... | 38 | Sioux series..... | 74 |
| Fordville series..... | 39 | Sisseton series..... | 75 |
| Forman series..... | 40 | Spottswood series..... | 77 |
| Fulda series..... | 41 | Storden series..... | 78 |
| Glencoe series..... | 42 | Svea series..... | 80 |
| Glyndon series..... | 43 | Sverdrup series..... | 82 |
| Hamerly series..... | 44 | Swanlake series..... | 84 |
| Hamlet series..... | 45 | Swenoda series..... | 84 |
| Hantho series..... | 46 | Tara series..... | 86 |
| Harps series..... | 47 | Vallers series..... | 87 |
| Hawick series..... | 50 | Ves series..... | 88 |
| Heimdal series..... | 50 | Waubay series..... | 90 |
| Lakepark series..... | 51 | Webster series..... | 91 |
| Lamoure series..... | 52 | Yellowbank series..... | 92 |
| Langhei series..... | 53 | Zell series..... | 94 |
| La Prairie series..... | 54 | Zumbro series..... | 95 |
| Malachy series..... | 55 | | |

Index to Map Units

| | | | |
|--|----|---|----|
| 31D2—Storden loam, 12 to 18 percent slopes, eroded | 79 | 314—Spottswood loam | 78 |
| 34—Parnell silty clay loam, depressional | 64 | 338—Waubay silty clay loam..... | 90 |
| 47—Colvin silty clay loam..... | 28 | 339—Fordville loam | 39 |
| 51—La Prairie loam, occasionally flooded | 55 | 341A—Arvilla sandy loam, 0 to 2 percent slopes | 16 |
| 60—Glyndon silt loam | 44 | 341B—Arvilla sandy loam, 2 to 6 percent slopes | 17 |
| 67—Bearden silty clay loam..... | 20 | 341C—Arvilla sandy loam, 6 to 12 percent slopes..... | 17 |
| 70—Svea loam | 81 | 344—Quam silty clay loam..... | 69 |
| 85—Calco silty clay loam, occasionally flooded | 27 | 347—Malachy loam | 56 |
| 108—McIntosh silt loam | 58 | 375—Forada loam | 38 |
| 113—Webster clay loam..... | 91 | 396D2—Sisseton loam, 12 to 18 percent slopes, eroded | 76 |
| 114—Glencoe silty clay loam..... | 43 | 402F—Sioux gravelly loam, 12 to 40 percent slopes..... | 75 |
| 127A—Sverdrup sandy loam, 0 to 2 percent slopes..... | 83 | 418—Lamoure silty clay loam, occasionally flooded..... | 52 |
| 127B—Sverdrup sandy loam, 2 to 6 percent slopes..... | 83 | 421B—Ves loam, 1 to 4 percent slopes | 89 |
| 127C—Sverdrup sandy loam, 6 to 12 percent slopes..... | 83 | 423—Seaforth loam | 73 |
| 137—Dovray silty clay | 32 | 434—Perella silty clay loam | 66 |
| 141A—Egeland sandy loam, 0 to 2 percent slopes..... | 34 | 437F—Buse loam, 18 to 40 percent slopes | 23 |
| 141B—Egeland sandy loam, 2 to 6 percent slopes..... | 34 | 446—Normania clay loam..... | 61 |
| 141C—Egeland loam, 6 to 12 percent slopes | 35 | 450—Rauville silty clay loam, frequently flooded | 70 |
| 168B—Forman clay loam, 2 to 6 percent slopes | 40 | 494B—Darnen loam, 2 to 6 percent slopes | 29 |
| 184—Hamery loam | 45 | 497—Hantho silt loam | 47 |
| 210—Fulda silty clay | 41 | 509—Vallers clay loam, very stony..... | 88 |
| 212A—Sinai silty clay loam, 1 to 3 percent slopes..... | 74 | 574—Du Page loam, occasionally flooded | 33 |
| 212B—Sinai silty clay, 3 to 6 percent slopes..... | 74 | 597—Tara silt loam | 86 |
| 219—Rolfe silt loam..... | 71 | 610—Calco silty clay loam, frequently flooded | 27 |
| 220D2—Langhei loam, 12 to 18 percent slopes, eroded | 53 | 680—Parnell silty clay loam | 65 |
| 236—Vallers clay loam | 87 | 694C2—Zell silt loam, 6 to 12 percent slopes, eroded | 94 |
| 246—Marysland loam | 57 | 706—Bigstone silty clay loam, ponded | 20 |
| 276—Oldham silty clay | 62 | 724—Bigstone silty clay loam | 21 |
| 284B—Poinsett silty clay loam, 1 to 4 percent slopes..... | 67 | 741B—Poinsett-Buse complex, 2 to 6 percent slopes..... | 68 |
| 288F—Esmond loam, 18 to 40 percent slopes | 37 | 748B—Hamlet loam, 1 to 4 percent slopes | 46 |
| 290B—Rothsay silt loam, 1 to 4 percent slopes | 72 | 769A—Mehurin clay loam, 0 to 2 percent slopes | 59 |
| 293B—Swenoda loam, 2 to 6 percent slopes | 85 | 769B—Mehurin clay loam, 2 to 6 percent slopes | 60 |
| | | 774—Svea loam, very stony | 81 |
| | | 777C2—Sisseton-Heimdal complex, 6 to 12 percent slopes, eroded | 76 |

| | | | |
|--|----|--|----|
| 883—Du Page-Zumbro complex, occasionally flooded | 33 | 1107D—Sisseton-Sioux-Heimdal complex, 6 to 18 percent slopes, eroded | 77 |
| 891B—Doland-Buse complex, 3 to 6 percent slopes | 30 | 1108—Harp-Glencoe-Seaforth complex | 48 |
| 902B—Barnes-Buse complex, 2 to 6 percent slopes | 18 | 1222—Parle clay loam | 63 |
| 915C2—Buse-Forman complex, 6 to 12 percent slopes, eroded | 23 | 1233B—Esmond-Heimdal complex, 2 to 6 percent slopes | 37 |
| 942C2—Langhei-Barnes complex, 6 to 12 percent slopes, eroded | 54 | 1266C—Yellowbank-Rock outcrop complex, 1 to 25 percent slopes | 92 |
| 954B—Ves-Swanlake complex, 3 to 6 percent slopes | 89 | 1295B—Doland silt loam, 2 to 4 percent slopes, moderately wet | 31 |
| 954C2—Storden-Ves complex, 6 to 12 percent slopes, eroded | 79 | 1296—Swenoda sandy loam, 0 to 2 percent slopes, moderately wet | 85 |
| 969B—Zell-Rothsay complex, 3 to 6 percent slopes | 94 | 1309C—Buse-Doland complex, 6 to 12 percent slopes, eroded | 24 |
| 1013—Pits, quarry | 66 | 1865C—Buse-Barnes complex, 2 to 12 percent slopes, extremely stony | 24 |
| 1030—Udorthents-Pits, gravel, complex | 87 | 1865F—Buse loam, 12 to 40 percent slopes, extremely stony | 25 |
| 1051—Glencoe silty clay loam, ponded | 43 | 1870—Burr-Calco complex, occasionally flooded | 22 |
| 1106C—Storden-Hawick-Ves complex, 6 to 12 percent slopes, eroded | 80 | 1938—Lakepark loam | 51 |
| | | 1994—Embsden sandy loam | 36 |

Summary of Tables

Part I

| | |
|---|----|
| Temperature and precipitation | 5 |
| Freeze dates in spring and fall | 6 |
| Growing season | 6 |
| Classification of the soils | 11 |
| Acreage and proportionate extent of the soils | 12 |

Part II

(Page numbers are in the Summary of Tables in Part II)

| | |
|---|--|
| Classification of the soils | |
| Acreage and proportionate extent of the soils | |
| Cropland management considerations | |
| Land capability and yields per acre of crops | |
| Prime farmland | |
| Windbreaks and environmental plantings | |
| Windbreak suitability groups | |
| Recreational development | |
| Wildlife habitat | |
| Building site development | |
| Sanitary facilities | |
| Construction materials | |
| Water management | |
| Engineering index properties | |
| Physical properties of the soils | |
| Chemical properties of the soils | |
| Water features | |
| Soil features | |

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Foreword

This soil survey contains information that can be used in land-planning programs in Lac qui Parle County, Minnesota. 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, 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 survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service.

William Hunt
State Conservationist
Natural Resources Conservation Service

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Soil Survey of Lac qui Parle County, Minnesota

By Dave Tufvesson, Minnesota Agricultural Experiment Station

Fieldwork by Joe Kristoff, Ray Genrich, and Peter Weikle, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
the Minnesota Agricultural Experiment Station

How This Survey Was Made

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

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

Individual soils on the landscape commonly merge

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

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

While a soil survey is in progress, samples of some of the soils in the area generally are collected for

laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

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

General Nature of the County

This soil survey updates the survey of Lac qui Parle County published in 1924 (USDA, 1924). It provides additional information and has larger maps, which show the soils in greater detail.

Lac qui Parle County is in west-central Minnesota (fig. 1-1). It has a total land area of 493,000 acres. Madison, the county seat, is in the central part of the county.

Soil scientists were denied access to a few tracts in the county. These areas were mapped using knowledge of the surrounding areas, older soil maps, and aerial photographs. The information on these maps may be

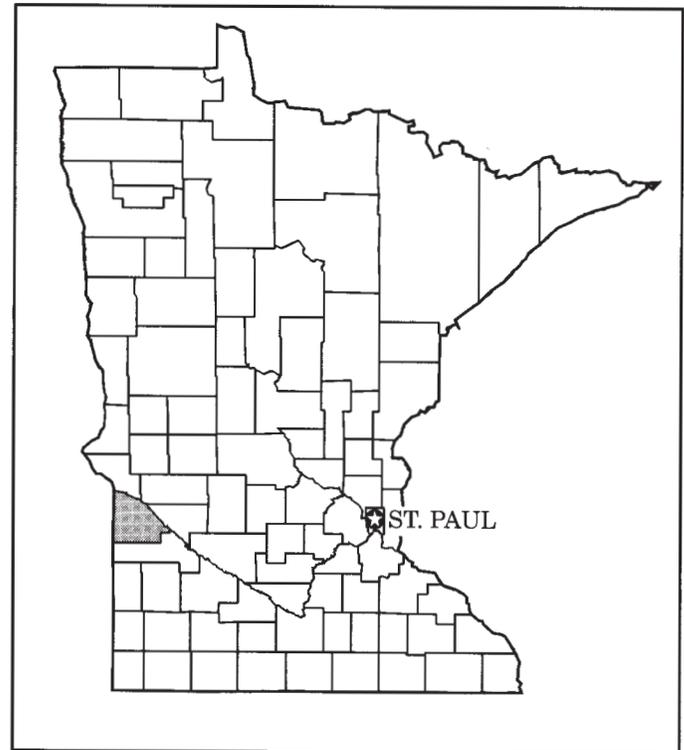


Figure 1-1.—Location of Lac qui Parle County in Minnesota.

less reliable than that provided by the maps in areas where soil scientists had access to the land and could examine the soils.

Settlement and History

The survey area was originally inhabited by the Plains Indians. Fur traders were the first Europeans to venture into the area. The first trading post in the county was established by John Lockwood, as early as 1816, at or near the present site of the Village of Lac qui Parle (Mayer and Dale, 1916). Many voyageurs passing up and down the Minnesota River, en route to and from Manitoba, stopped and traded at the post. In 1835, the Rev. Thomas S. Williamson, M.D., and Alexander Huggins established a Presbyterian mission at Lac qui Parle Village. Lac qui Parle County was established with its present boundaries by an act of the Legislature on March 6, 1871 (Mayer and Dale, 1916). Lac qui Parle Village was selected as the county seat. The towns of Dawson and Madison were established in 1884, when the railroad arrived in the area. In 1889, Madison was named the county seat as the result of a special election.

In 1990, the county had a population of 8,924. It has

seven incorporated towns: Bellingham, Boyd, Dawson, Louisburg, Madison, Marietta, and Nassau. Madison, the largest town, had a population of 1,951. The county derives its name from the long lake through which the Minnesota River flows. The French name of Lac qui Parle, meaning “the lake that talks,” is a translation of the aboriginal name applied to this lake because of echoes thrown back by its bordering bluffs, or, as some say, because of the loud sound of waves dashing on rocky portions of its shore.

Farming

In 1987, there were 972 farms in the county. The average farm size is 423 acres. Farmland makes up 89 percent of the county, and 95 percent of the farmed acreage is used for crops. Soybeans have been the most popular crop for the past several years. In 1987, 821 farmers planted soybeans on 30 percent of the cropland. Soybeans accounted for more than 40 percent of the county’s total harvest (Minnesota Agricultural Statistics Service, 1990). Corn was planted by 780 farmers on 20 percent of the cropland and made up 30 percent of the total bushels harvested. The wheat harvest was about 25 percent of the total harvest. Oats, alfalfa, and other small grain accounted for about 5 percent of the crops harvested in Lac qui Parle County. There were 20,040 head of cattle raised on 295 farms in the county in 1987. About 225 farms raised 59,143 hogs and pigs. Sheep and chickens were raised on 79 local farms. Between 1986 and 1991, about 40,000 acres was enrolled in the USDA Conservation Reserve Program. This acreage represents almost 10 percent of the total cropland in the county.

Transportation Facilities

Two railroads serve Lac qui Parle County. Three U.S. highways and three state highways run through the county. These are U.S. Highways 59, 75, and 212 and State Highways 40, 119, and 275. An airport is located in Madison.

Geologic History and Geomorphology

Three glacial advances and recessions that can be attributed to the climatic fluctuation of the last major stage of the Pleistocene Epoch are recorded in the Quaternary deposits of the county (Matsch, 1972). The first phase of ice activity that has been identified was a glacier advance from the north and northeast from the Lake Superior Basin. This glacier is referred to as the Superior lobe. It deposited a pink to reddish brown, loamy, calcareous, shale-free till, which is called Hawk Creek Till. The till contains a large percentage of rock types from the Lake Superior region, such as red felsite, pink sandstone, gabbro, and even banded Lake

Superior agates. The history of the retreat of this glacial lobe is completely obscured by later glacial deposits.

Renewed ice activity in the north and northwest resulted in another glacial advance. This ice sheet deposited a thick layer of light yellowish brown or light olive brown, loamy, calcareous, shale-free till called the Granite Falls Till. A distinctive characteristic is the stone content. The deposit does not contain shale, and most of the rock fragments are carbonate and granitic pebbles. This glacial depositional event is believed to have taken place between 39,000 and 34,000 years ago (Matsch and others, 1972). The ice lobe retreated to an unknown northerly position, possibly as far as the Alexandria moraine. Because this till is lithologically similar to deposits in the Wadena region, it has been suggested that the Granite Falls Till was deposited by the Wadena lobe.

The last glacier to advance across the area moved southward from the Winnipeg lowland. This ice lobe, called the Des Moines lobe, spread a broad sheet of light yellowish brown to light olive brown, loamy, calcareous, shale-rich till over the county. This till is different from both the Hawk Creek and the Granite Falls Till in that it contains abundant siliceous Cretaceous shale fragments along with carbonate and granite rocks. The source of the shale is thought to be a siliceous, brittle member of the Pierre Shale. This event occurred between 15,000 and 13,000 years ago. The till is called the New Ulm Till and is the most extensive till in Lac qui Parle County (Wright and Ruhe, 1965).

The Des Moines lobe of the late Wisconsin period of glaciation rapidly discharged a tremendous amount of water as it melted. The water flowing from Glacial River Warren, the Pomme de Terre River, the Chippewa River, and the east branch of the Chippewa River became dammed and was of sufficient volume to fill a lake basin about 60 miles long and 40 miles wide. This lake, which covered more than 1 million acres, is called Glacial Lake Benson (Diedrick and Rust, 1975). The southwestern portion of this glacial lake covered much of the eastern part of the survey area and deposited silty and clayey lacustrine sediments. The topography of this area is nearly level to sloping. The lacustrine sediments were deposited while the lake was filled to its greatest height, which corresponds to an elevation of about 1,050 feet (Diedrick and Rust, 1975). The major soils in this area are Colvin, Poinsett, Rothsay, and Zell soils.

In the northwestern part of the county is a nearly level to very steep recessional moraine. This feature has been designated the Big Stone moraine. It developed as the Des Moines lobe retreated. The moraine covers most of Yellow Bank Township and parts of Walter and Perry Townships. The major soils in

these areas are Esmond, Heimdal, Svea, and Parnell soils.

As the Des Moines lobe retreated further, meltwater filled Glacial Lake Agassiz. During its early stages, Lake Agassiz had just one outlet, the Glacial River Warren. This giant river dissected the landscape, creating a large valley now known as the Minnesota River lowlands. Additional meltwater was released several times into the valley until it cut down to Precambrian bedrock. Glacial River Warren left large erratics and boulder-paved till benches corresponding to various breakouts from Glacial Lake Agassiz. These benches are evident along Highway 40, near the Milan bridge, and along Highway 119 before it crosses the Minnesota River flood plain. The major soils are Barnes, Buse, Svea, and Vallers soils.

In the southwestern part of the county is a nearly level to sloping recessional moraine of the Des Moines lobe. This moraine, which has been called the Gary moraine, is on the foot slopes of the Coteau des Prairies and covers parts of Manfred and Mehurin Townships. It is at a slightly lower elevation than the Altamont moraine. The highest elevations in the county are in this area. The major soils are Forman, Mehurin, and Parnell soils.

Outwash sediments that were deposited by running water are scattered throughout the county. Most of them are related to the stagnation and retreat of the Des Moines lobe. These deposits consist mainly of outwash plains, meltwater channels, crevasse fillings, and terrace gravels. The major soils in these areas are Arvilla, Egeland, Embden, Marysland, and Sioux soils.

A narrow glacial lake formed between the higher land of the Gary moraine and the glacial ice to the north. The silty and clayey lacustrine deposits on this lake plain have been mixed with alluvial deposits of rivers and creeks. This area has been referred to as the Florida flats. The major soils are Burr, Calco, Du Page, and Oldham soils.

The majority of the county is covered by a low-relief ground moraine of New Ulm till. This area is nearly level to sloping and has common closed depressions. It was deposited by the actively retreating Des Moines lobe as it withdrew toward the Minnesota River lowland. This

ground moraine is mainly loamy glacial till, but small areas of sand or gravel outwash are on some slopes. The major soils are Harps, Normania, Swanlake, Ves, and Webster soils.

Climate

The three tables at the end of this section give climate data as recorded at Madison in the period 1961 to 1990.

In winter, the average temperature is 16 degrees F and the average daily minimum temperature is 6 degrees. The lowest temperature on record, which occurred at Madison on February 28, 1962, is -32 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 84 degrees. The highest temperature, which occurred at Madison on July 9, 1976, is 105 degrees.

Growing degree days 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 monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 24.04 inches. Of this, about 17.31 inches, or 72 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall on record was 4.47 inches at Madison on June 17, 1992. Thunderstorms occur on about 44 days each year, and most occur in July.

The average seasonal snowfall is 33.6 inches. The greatest snow depth at any one time during the period of record was 49 inches on February 22, 1969. On an average, 79 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 12 inches on March 3, 1985.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The sun shines 68 percent of the time possible in summer and 51 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in April.

TEMPERATURE AND PRECIPITATION

(Recorded in the period 1961-90 at Madison, Minnesota)

| Month | Temperature | | | | | | Precipitation | | | | |
|---------------|-----------------------|-----------------------|---------|-----------------------------------|----------------------------------|--|---------------|---------------------------|-------------|---|------------------|
| | Average daily maximum | Average daily minimum | Average | 2 years in 10 will have-- | | Average number of growing degree days* | Average | 2 years in 10 will have-- | | Average number of days with 0.10 inch or more | Average snowfall |
| | | | | Maximum temperature higher than-- | Minimum temperature lower than-- | | | Less than-- | More than-- | | |
| | ° F | ° F | ° F | ° F | ° F | Units | In | In | In | | In |
| January----- | 23.2 | 1.5 | 12.4 | 52 | -28 | 0 | 0.61 | 0.15 | 1.00 | 1 | 7.7 |
| February----- | 28.9 | 7.4 | 18.2 | 56 | -26 | 3 | .67 | .18 | 1.06 | 1 | 6.9 |
| March----- | 41.1 | 20.5 | 30.8 | 71 | -11 | 43 | 1.48 | .55 | 2.26 | 3 | 8.8 |
| April----- | 58.6 | 33.7 | 46.1 | 88 | 12 | 234 | 2.44 | 1.32 | 3.42 | 5 | 1.9 |
| May----- | 72.5 | 45.6 | 59.0 | 93 | 25 | 590 | 2.84 | 1.42 | 4.08 | 6 | .0 |
| June----- | 81.8 | 55.9 | 68.8 | 98 | 40 | 855 | 3.76 | 1.85 | 5.42 | 6 | .0 |
| July----- | 86.6 | 60.5 | 73.6 | 101 | 44 | 1,036 | 3.25 | 1.46 | 4.79 | 5 | .0 |
| August----- | 84.6 | 57.8 | 71.2 | 100 | 40 | 966 | 2.64 | 1.43 | 3.70 | 4 | .0 |
| September--- | 74.6 | 47.1 | 60.8 | 95 | 26 | 629 | 2.38 | 1.08 | 3.49 | 5 | .0 |
| October----- | 63.4 | 36.7 | 50.0 | 87 | 15 | 331 | 2.28 | .66 | 3.74 | 3 | .3 |
| November----- | 43.9 | 22.7 | 33.3 | 72 | -6 | 49 | 1.14 | .28 | 1.90 | 2 | 4.4 |
| December----- | 28.2 | 8.2 | 18.2 | 55 | -23 | 2 | .56 | .15 | 1.00 | 1 | 5.4 |
| Yearly: | | | | | | | | | | | |
| Average--- | 57.3 | 33.1 | 45.2 | --- | --- | --- | --- | --- | --- | --- | --- |
| Extreme--- | --- | --- | --- | 104 | -30 | --- | --- | --- | --- | --- | --- |
| Total----- | --- | --- | --- | --- | --- | 4,739 | 24.04 | 14.26 | 29.95 | 42 | 35.4 |

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

FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1961-90 at Madison, Minnesota)

| Probability | Temperature | | |
|---|-------------------|-------------------|-------------------|
| | 24 °F or lower | 28 °F or lower | 32 °F or lower |
| Last freezing temperature in spring: | | | |
| 1 year in 10 later than-- | May 1 | May 11 | May 24 |
| 2 years in 10 later than-- | Apr. 26 | May 5 | May 18 |
| 5 years in 10 later than-- | Apr. 15 | Apr. 24 | May 7 |
| First freezing temperature in fall: | | | |
| 1 year in 10 earlier than-- | Sept. 30 | Sept. 21 | Sept. 12 |
| 2 years in 10 earlier than-- | Oct. 6 | Sept. 26 | Sept. 17 |
| 5 years in 10 earlier than-- | Oct. 16 | Oct. 6 | Sept. 26 |

GROWING SEASON

(Recorded in the period 1961-90 at Madison,
Minnesota)

| Probability | Daily minimum temperature during growing season | | |
|---------------|--|-------------------------|-------------------------|
| | Higher than 24 °F | Higher than 28 °F | Higher than 32 °F |
| | Days | Days | Days |
| 9 years in 10 | 156 | 141 | 117 |
| 8 years in 10 | 164 | 148 | 124 |
| 5 years in 10 | 181 | 163 | 139 |
| 2 years in 10 | 198 | 177 | 153 |
| 1 year in 10 | 206 | 185 | 160 |

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification.

Formation of the Soils

Soils form through the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil in a given area are determined by the composition of the parent material; the climate under which the soil material has accumulated; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material (Jenny, 1941). Climate and plant and animal life, chiefly plants, act upon the parent material. The type of parent material and its resistance to weathering determine the kind and degree of soil development. Relief modifies the effect of climate, which in turn influences plant material. Time is needed for changes to occur in the parent material. The amount of time needed depends on the intensity of soil development. All five factors of soil formation are interrelated. The following paragraphs relate the factors of soil formation to the soils in the survey area.

Climate

Given adequate time, climate will eventually dominate the soil-forming process. Temperature and precipitation are the most commonly measured climatic factors that influence soil formation. Climate influences the chemical and physical reactions that are required for the development of soil profiles. Climate also influences the type of natural vegetation that grows in a particular region. Lac qui Parle County has a subhumid continental climate that favored the growth of grassland vegetation.

Temperature influences the physical, chemical, and biological activities that affect mineral weathering and microbial activities in the soils. The rate of chemical and biological processes responsible for soil formation decreases during the winter because mineral weathering or microbial activities do not take place

when the soils are frozen. Alternate freezing and thawing cycles in the fall and spring create expansion and contraction pressures that rupture mineral material and increase the surface area available for mineral weathering. These cycles also play a role in the development of soil structure. Temperature influences the accumulation and decomposition of organic matter in soils. As temperature rises, the rate of organic decomposition and nutrient cycling increases. Temperature controls effective rainfall through its influence on the potential rate of evapotranspiration, which increases as mean annual temperature increases.

Precipitation is essential to soil formation. Water is necessary for plant and animal growth and for the chemical reactions that involve mineral weathering. Water transports colloidal material and dissolved solids from one part of the soil profile to another. It transports the material downward or completely out of the profile through leaching, or it transports soluble salts upward through capillary action.

Living Organisms

The soils in Lac qui Parle County formed under tall prairie grasses. The composition of these grasses varied, depending on local soil and moisture conditions. The dominant grasses were big bluestem, little bluestem, blue grama, sideoats grama, indiagrass, switchgrass, and needlegrass. The prairie vegetation also included many forbs, such as aster, goldenrod, sunflowers, blazingstar, wild rose, and prairie-clover. Reeds, sedges, rushes, and cattails grew on the wetlands. Trees and shrubs grew only in areas adjacent to streams and lakes. Fire played a major role in keeping trees from advancing onto the prairie. It also aided in maintaining diversity in the prairie plant community.

The soils that formed under tall prairie grasses in Lac qui Parle County are classified as Mollisols. Melanization, the darkening of soil by the addition of organic matter, is the dominant soil-forming process in Mollisols. Organic matter is added to Mollisols mainly as a result of the annual death of the upper plant parts and

the death or dieback of the roots of prairie vegetation. Most of the growth in grassland plant communities occurs in the roots rather than in the upper plant parts. Therefore, most of the organic matter added to grassland soils is incorporated directly into the soil when the roots die. The roots have an important influence on the structural properties of soils. Growing plant roots exert pressure that forms soil structural units. Channels made by growing plant roots influence air and water movement through the soil.

The function of micro-organisms in the formation of Mollisols is the decomposition of large amounts of the organic matter added to the soils by grassland vegetation. Micro-organisms quickly decompose herbaceous grasses. This process promotes rapid nutrient cycling, which makes nutrients available for uptake by plants. Bacteria are the dominant micro-organisms in Mollisols. Dark humus is the end product of bacterial decomposition. The humus is important in retaining moisture and nutrients in the soil profile and in stabilizing soil structure.

Insect and animal life is important in sizing and reworking organic and mineral material in the soil profile. Insects mix the surface layer. This mixing increases the surface area available for weathering and decomposition of minerals and organic matter. Earthworms decompose organic matter, mix the soil, and leave fertile wormcasts in the soil. Rodents mix the soil and form channels that influence air and water movement through the soil. They are most active in well drained to excessively drained soils.

Human activities have an important influence on soil formation. These activities include altering drainage, maintaining fertility, changing vegetation, altering runoff rates, and altering the rate of water infiltration. Farming and land-clearing activities affect some soil-forming processes. If areas of farmland are left unprotected, accelerated erosion may result. This erosion subsequently affects the formation of soils.

Relief

Relief is an important factor in soil formation because it affects drainage, aeration, and erosion. Differences in relief can account for the development of different soils in similar parent material. Because relief influences runoff and drainage, it can affect the types of vegetation and the chemical changes on and in the soil. Excessive runoff reduces the amount of water that is available to leach the soil and for use by plants, and it can increase the risk of erosion.

Topographic position on the landscape affects the drainage class of the soil. For example, the drainage class of Ves, Normania, Webster, and Glencoe soils

generally is predictable because each of these soils is in a particular landscape position. The well drained Ves soils are on sloping side slopes; the moderately well drained Normania soils are on concave foot slopes and flats; the poorly drained Webster soils are in drainageways; and the very poorly drained Glencoe soils are in depressions.

Parent Material

The soils in Lac qui Parle County formed in parent material deposited by the Des Moines lobe of the Late Wisconsin Glaciation. The Des Moines lobe protruded from a continental ice sheet in the Winnipeg lowland of southern Manitoba and moved through the Red River and Minnesota River preglacial lowlands, eventually reaching southern Iowa. Throughout its course in the survey area, the Des Moines lobe deposited calcareous, light olive brown glacial till. Glacial till derived mostly from limestone and shale, such as Des Moines lobe till, is dominantly loam, has a high pH, is calcareous, and is dominated by montmorillonite in the clay fraction.

Most of the soils in the county formed in glacial till that was deposited directly by glacial ice. Other soils formed in deposits derived from glacial till that were sorted and redeposited by water.

The Big Stone moraine is a recessional moraine that occurs in the northwest corner of the county. It is a nearly level to very steep moraine that covers most of Yellow Bank Township and parts of Walter and Perry Townships. The supra ablation till in this area is commonly stratified with loamy, silty, and sandy materials. Esmond, Heimdal, Svea, and Parnell soils are the major soils that formed in this loamy glacial till.

The Gary moraine is also a recessional moraine. It occurs in the southwest corner of the county. It is on the foot slopes of the Coteau des Prairies and covers parts of Manfred and Mehurin Townships. It is at a slightly lower elevation than the Altamont moraine and contains the highest elevations in the county. The basal till on this moraine typically has a uniform clay loam texture with very little stratification. Forman, Mehurin, and Parnell soils are the major soils that formed in this loamy glacial till.

A ground moraine was deposited over a majority of the county by the actively retreating Des Moines lobe as it withdrew toward the Minnesota River Valley. The landscape is characterized low relief and poor surface drainage. Slopes are complex and range from nearly level to sloping. The ground moraine is underlain mainly by loamy glacial till. Small areas of sand and gravel outwash are on some slopes on the ground moraine. Harps, Normania, Swanlake, Ves, and Webster soils are the major soils in these areas.



Figure I-2.—The level and nearly level landscape of Glacial Lake Benson looking down from an elevation of 1,050 feet.

The retreat of the Des Moines lobe was accompanied by the release of large volumes of meltwater. The sediment-rich meltwater drained and formed two glacial lakes in the county. One formed as a long and narrow glacial lake between the higher land of the Gary moraine and the glacial ice to the north. This area starts near Marietta and run southeast into Yellow Medicine County. Burr, Calco, and Du Page soils are the major soils in this area. The other glacial lake was much larger and covered more than 1 million acres in parts of many counties. It is known as Glacial Lake Benson. Only the eastern side of Lac qui Parle County was

influenced by this glacial lake. When the lake was at its fullest, it deposited silty and clayey lacustrine sediments. The 1,050-foot elevation line corresponds to the lake's greatest height in Lac qui Parle County (fig. I-2). The topography is nearly level to sloping. Colvin, Poinsett, Rothsay, and Zell are the major soils.

Scattered throughout the county are outwash sediments that were deposited by running meltwater from the Des Moines lobe. The sediments were sorted by particle size, depending on the velocity of the meltwater and the sediment load. Arvilla and Sioux soils formed in sandy and gravelly outwash on meltwater

channel terraces. Fordville soils formed in loamy material over gravelly outwash on the meltwater channel terraces. Marysland soils formed in loamy material over sandy outwash in the mainstream of the meltwater channels.

Alluvial sediments were deposited along the many rivers and streams in the county. Calco and Du Page soils formed in silty and loamy sediments. Zumbro soils formed in sandy sediments, mainly on the inside edge of the river oxbows.

Time

Time is required for the transformation of parent material into a natural body that has genetically related horizons. The length of time required depends on the other soil-forming factors. The relative maturity of a soil is indicated by the degree of profile development. Immature soils are not characterized by complete horizon development. Fully developed soil profiles have A, B, and C horizons that have formed during a sufficient period of time under favorable conditions.

Most of the soils in Lac qui Parle County have fully developed profiles. The length of time that the soil-forming processes have been active in the county corresponds to the retreat of the Des Moines lobe. In terms of geologic time, the soils in the county are young. The soil-forming processes and profile development began after the glacial ice melted.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). 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 classification and extent of the soils in this survey area are shown in the tables "Classification of the Soils" and "Acreage and Proportionate Extent of the Soils," which are at the end of this section. The categories of classification are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, 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 Endoaquolls (*Endo*, meaning within, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Endoaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Endoaquolls.

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.

CLASSIFICATION OF THE SOILS

| Soil name | Family or higher taxonomic class |
|-----------------|---|
| Arvilla----- | Sandy, mixed Udic Haploborolls |
| Barnes----- | Fine-loamy, mixed Udic Haploborolls |
| Bearden----- | Fine-silty, frigid Aeric Calciaquolls |
| Bigstone----- | Fine-silty, mixed (calcareous), frigid Cumulic Endoaquolls |
| Burr----- | Fine, mesic Typic Calciaquolls |
| Buse----- | Fine-loamy, mixed Udorthentic Haploborolls |
| Calco----- | Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls |
| Colvin----- | Fine-silty, frigid Typic Calciaquolls |
| Darnen----- | Fine-loamy, mixed Pachic Udic Haploborolls |
| Dovray----- | Fine, montmorillonitic, frigid Cumulic Haplaquolls |
| Du Page----- | Fine-loamy, mixed, mesic Cumulic Hapludolls |
| Egeland----- | Coarse-loamy, mixed Udic Haploborolls |
| Emlden----- | Coarse-loamy, mixed Pachic Udic Haploborolls |
| Esmond----- | Coarse-loamy, mixed Udorthentic Haploborolls |
| Forada----- | Coarse-loamy, mixed, frigid Typic Endoaquolls |
| Fordville----- | Fine-loamy over sandy or sandy-skeletal, mixed Pachic Udic Haploborolls |
| Forman----- | Fine-loamy, mixed Udic Argiborolls |
| Fulda----- | Fine, montmorillonitic, frigid Vertic Epiaquolls |
| Glencoe----- | Fine-loamy, mixed, mesic Cumulic Haplaquolls |
| Glyndon----- | Coarse-silty, frigid Aeric Calciaquolls |
| Hamerly----- | Fine-loamy, frigid Aeric Calciaquolls |
| Hamlet----- | Fine-loamy, mixed Aquic Haploborolls |
| Hantho----- | Coarse-silty, mixed Pachic Udic Haploborolls |
| Harps----- | Fine-loamy, mesic Typic Calciaquolls |
| Hawick----- | Sandy, mixed, mesic Entic Hapludolls |
| Heimdal----- | Coarse-loamy, mixed Udic Haploborolls |
| La Prairie----- | Fine-loamy, mixed Cumulic Udic Haploborolls |
| Lakepark----- | Fine-loamy, mixed, frigid Cumulic Haplaquolls |
| Lamoure----- | Fine-silty, mixed (calcareous), frigid Cumulic Haplaquolls |
| Langhei----- | Fine-loamy, mixed (calcareous), frigid Typic Udorthents |
| Malachy----- | Coarse-loamy, mixed Pachic Udic Haploborolls |
| Marysland----- | Fine-loamy over sandy or sandy-skeletal, frigid Typic Calciaquolls |
| McIntosh----- | Fine-silty, frigid Aeric Calciaquolls |
| Mehurin----- | Fine, montmorillonitic Aquic Argiborolls |
| Normania----- | Fine-loamy, mixed, mesic Aquic Haplustolls |
| Oldham----- | Fine, montmorillonitic (calcareous), frigid Cumulic Haplaquolls |
| Parle----- | Fine-loamy, mixed (calcareous), frigid Cumulic Endoaquolls |
| Parnell----- | Fine, montmorillonitic, frigid Typic Argiaquolls |
| Perella----- | Fine-silty, mixed, frigid Typic Epiaquolls |
| Poinsett----- | Fine-silty, mixed Udic Haploborolls |
| Quam----- | Fine-silty, mixed, frigid Cumulic Haplaquolls |
| Rauville----- | Fine-silty, mixed (calcareous), frigid Cumulic Haplaquolls |
| Rolfe----- | Fine, montmorillonitic, mesic Typic Argialbolls |
| Rothsay----- | Coarse-silty, mixed Udic Haploborolls |
| Seaforth----- | Fine-loamy, mixed, mesic Aquic Calciustolls |
| Sinai----- | Fine, montmorillonitic Udertic Haploborolls |
| Sioux----- | Sandy-skeletal, mixed Udorthentic Haploborolls |
| Sisseton----- | Coarse-loamy, mixed, frigid Typic Eutrochrepts |
| Spottswood----- | Fine-loamy over sandy or sandy-skeletal, mixed Pachic Udic Haploborolls |
| Storden----- | Fine-loamy, mixed (calcareous), mesic Typic Udorthents |
| Svea----- | Fine-loamy, mixed Pachic Udic Haploborolls |
| Sverdrup----- | Sandy, mixed Udic Haploborolls |
| Swanlake----- | Fine-loamy, mixed, mesic Entic Hapludolls |
| Swenoda----- | Coarse-loamy, mixed Pachic Udic Haploborolls |
| Tara----- | Fine-silty, mixed Pachic Udic Haploborolls |
| Vallars----- | Fine-loamy, frigid Typic Calciaquolls |
| Ves----- | Fine-loamy, mixed, mesic Udic Haplustolls |
| Waubay----- | Fine-silty, mixed Pachic Udic Haploborolls |
| Webster----- | Fine-loamy, mixed, mesic Typic Haplaquolls |
| Yellowbank----- | Loamy, mixed Ruptic-Lithic Haploborolls |
| Zell----- | Coarse-silty, mixed Udorthentic Haploborolls |
| Zumbro----- | Sandy, mixed, mesic Entic Hapludolls |

ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

| Map symbol | Soil name | Acres | Percent |
|------------|--|--------|---------|
| 31D2 | Storden loam, 12 to 18 percent slopes, eroded----- | 148 | * |
| 34 | Parnell silty clay loam, depressional----- | 7,265 | 1.5 |
| 47 | Colvin silty clay loam----- | 8,192 | 1.6 |
| 51 | La Prairie loam, occasionally flooded----- | 5,143 | 1.0 |
| 60 | Glyndon silt loam----- | 989 | 0.2 |
| 67 | Bearden silty clay loam----- | 3,795 | 0.8 |
| 70 | Svea loam----- | 9,562 | 1.9 |
| 85 | Calco silty clay loam, occasionally flooded----- | 14,033 | 2.8 |
| 108 | McIntosh silt loam----- | 772 | 0.2 |
| 113 | Webster clay loam----- | 9,347 | 1.9 |
| 114 | Glencoe silty clay loam----- | 5,646 | 1.1 |
| 127A | Sverdrup sandy loam, 0 to 2 percent slopes----- | 537 | 0.1 |
| 127B | Sverdrup sandy loam, 2 to 6 percent slopes----- | 7,999 | 1.6 |
| 127C | Sverdrup sandy loam, 6 to 12 percent slopes----- | 440 | 0.1 |
| 137 | Dovray silty clay----- | 6,320 | 1.3 |
| 141A | Egeland sandy loam, 0 to 2 percent slopes----- | 925 | 0.2 |
| 141B | Egeland sandy loam, 2 to 6 percent slopes----- | 4,699 | 0.9 |
| 141C | Egeland loam, 6 to 12 percent slopes----- | 292 | 0.1 |
| 168B | Forman clay loam, 2 to 6 percent slopes----- | 5,279 | 1.1 |
| 184 | Hamerly loam----- | 5,739 | 1.2 |
| 210 | Fulda silty clay----- | 6,313 | 1.3 |
| 212A | Sinai silty clay loam, 1 to 3 percent slopes----- | 1,940 | 0.4 |
| 212B | Sinai silty clay, 3 to 6 percent slopes----- | 668 | 0.1 |
| 219 | Rolfe silt loam----- | 1,791 | 0.4 |
| 220D2 | Langhei loam, 12 to 18 percent slopes, eroded----- | 581 | 0.1 |
| 236 | Vallers clay loam----- | 11,005 | 2.2 |
| 246 | Marysland loam----- | 7,159 | 1.4 |
| 276 | Oldham silty clay----- | 3,967 | 0.8 |
| 284B | Poinsett silty clay loam, 1 to 4 percent slopes----- | 3,673 | 0.7 |
| 288F | Esmond loam, 18 to 40 percent slopes----- | 214 | * |
| 290B | Rothsay silt loam, 1 to 4 percent slopes----- | 8,221 | 1.6 |
| 293B | Swenoda loam, 2 to 6 percent slopes----- | 1,535 | 0.3 |
| 314 | Spottswood loam----- | 378 | 0.1 |
| 338 | Waubay silty clay loam----- | 12,900 | 2.6 |
| 339 | Fordville loam----- | 2,050 | 0.4 |
| 341A | Arvilla sandy loam, 0 to 2 percent slopes----- | 532 | 0.1 |
| 341B | Arvilla sandy loam, 2 to 6 percent slopes----- | 4,670 | 0.9 |
| 341C | Arvilla sandy loam, 6 to 12 percent slopes----- | 880 | 0.2 |
| 344 | Quam silty clay loam----- | 5,065 | 1.0 |
| 347 | Malachy loam----- | 1,061 | 0.2 |
| 375 | Forada loam----- | 911 | 0.2 |
| 396D2 | Sisseton loam, 12 to 18 percent slopes, eroded----- | 932 | 0.2 |
| 402F | Sioux gravelly loam, 12 to 40 percent slopes----- | 312 | 0.1 |
| 418 | Lamoure silty clay loam, occasionally flooded----- | 8,895 | 1.8 |
| 421B | Ves loam, 1 to 4 percent slopes----- | 13,262 | 2.7 |
| 423 | Seaforth loam----- | 4,376 | 0.9 |
| 434 | Perella silty clay loam----- | 9,670 | 1.9 |
| 437F | Buse loam, 18 to 40 percent slopes----- | 939 | 0.2 |
| 446 | Normania clay loam----- | 14,961 | 3.0 |
| 450 | Rauville silty clay loam, frequently flooded----- | 7,604 | 1.5 |
| 494B | Darnen loam, 2 to 6 percent slopes----- | 2,050 | 0.4 |
| 497 | Hantho silt loam----- | 6,119 | 1.2 |
| 509 | Vallers clay loam, very stony----- | 1,744 | 0.3 |
| 574 | Du Page loam, occasionally flooded----- | 7,310 | 1.5 |
| 597 | Tara silt loam----- | 4,799 | 1.0 |
| 610 | Calco silty clay loam, frequently flooded----- | 4,032 | 0.8 |
| 680 | Parnell silty clay loam----- | 4,957 | 1.0 |
| 694C2 | Zell silt loam, 6 to 12 percent slopes, eroded----- | 616 | 0.1 |
| 706 | Bigstone silty clay loam, ponded----- | 4,154 | 0.8 |
| 724 | Bigstone silty clay loam----- | 1,330 | 0.3 |
| 741B | Poinsett-Buse complex, 2 to 6 percent slopes----- | 7,253 | 1.5 |
| 748B | Hamlet loam, 1 to 4 percent slopes----- | 7,776 | 1.6 |

See footnote at end of table.

ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

| Map symbol | Soil name | Acres | Percent |
|------------|---|---------|---------|
| 769A | Mehurin clay loam, 0 to 2 percent slopes----- | 4,978 | 1.0 |
| 769B | Mehurin clay loam, 2 to 6 percent slopes----- | 1,156 | 0.2 |
| 774 | Svea loam, very stony----- | 1,758 | 0.4 |
| 777C2 | Sisseton-Heimdal complex, 6 to 12 percent slopes, eroded----- | 2,324 | 0.5 |
| 883 | Du Page-Zumbro complex, occasionally flooded----- | 497 | 0.1 |
| 891B | Doland-Buse complex, 3 to 6 percent slopes----- | 7,088 | 1.4 |
| 902B | Barnes-Buse complex, 2 to 6 percent slopes----- | 11,044 | 2.2 |
| 915C2 | Buse-Forman complex, 6 to 12 percent slopes, eroded----- | 759 | 0.2 |
| 942C2 | Langhei-Barnes complex, 6 to 12 percent slopes, eroded----- | 1,347 | 0.3 |
| 954B | Ves-Swanlake complex, 3 to 6 percent slopes----- | 39,944 | 8.0 |
| 954C2 | Storden-Ves complex, 6 to 12 percent slopes, eroded----- | 4,311 | 0.9 |
| 969B | Zell-Rothsay complex, 3 to 6 percent slopes----- | 7,023 | 1.4 |
| 1013 | Pits, quarry----- | 26 | * |
| 1030 | Udorthents-Pits, gravel, complex----- | 411 | 0.1 |
| 1051 | Glencoe silty clay loam, ponded----- | 4,778 | 1.0 |
| 1106C | Storden-Hawick-Ves complex, 6 to 12 percent slopes, eroded----- | 595 | 0.1 |
| 1107D | Sisseton-Sioux-Heimdal complex, 6 to 18 percent slopes, eroded----- | 561 | 0.1 |
| 1108 | Harps-Glencoe-Seaforth complex----- | 46,433 | 9.3 |
| 1222 | Parle clay loam----- | 24,577 | 4.9 |
| 1233B | Esmond-Heimdal complex, 2 to 6 percent slopes----- | 14,851 | 2.9 |
| 1266C | Yellowbank-Rock outcrop complex, 1 to 25 percent slopes----- | 108 | * |
| 1295B | Doland silt loam, 2 to 4 percent slopes, moderately wet----- | 1,746 | 0.4 |
| 1296 | Swenoda sandy loam, 0 to 2 percent slopes, moderately wet----- | 600 | 0.1 |
| 1309C | Buse-Doland complex, 6 to 12 percent slopes, eroded----- | 1,544 | 0.3 |
| 1865C | Buse-Barnes complex, 2 to 12 percent slopes, extremely stony----- | 2,948 | 0.6 |
| 1865F | Buse loam, 12 to 40 percent slopes, extremely stony----- | 849 | 0.2 |
| 1870 | Burr-Calco complex, occasionally flooded----- | 17,273 | 3.5 |
| 1938 | Lakepark loam----- | 4,189 | 0.8 |
| 1994 | Embden sandy loam----- | 4,455 | 0.9 |
| | Water----- | 4,400 | 0.8 |
| | Total----- | 498,300 | 100.0 |

* Less than 0.1 percent.

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Soil Series and Detailed Soil Map Units

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

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, 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. The principal hazards and limitations to be considered in planning for specific uses are described in Part II of this survey.

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, Arvilla sandy loam, 0 to 2 percent slopes, is a phase of the Arvilla series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are called complexes. 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. Harps-Glencoe-Seaforth complex is an example.

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

The table "Acreage and Proportionate Extent of the Soils" in Parts I and II of this survey 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.

Various land use regulations of Federal, state, and local governments may impose special restrictions on the use of soils. Examples include protection of soil from erosion, protection of wetlands, and permits for the installation of septic tank absorption fields. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations for various land uses. The landowner or land user has the responsibility of identifying and complying with existing laws and regulations.

Arvilla Series

Depth class: Very deep

Drainage class: Somewhat excessively drained

Permeability: Upper part—moderately rapid; lower part—rapid or very rapid

Landform: Outwash plains

Parent material: Glacial outwash

Slope range: 0 to 12 percent

Taxonomic class: Sandy, mixed Udic Haploborolls

Typical Pedon

Arvilla sandy loam, 2 to 6 percent slopes, 150 feet north and 650 feet west of the southeast corner of sec. 3, T. 118 N., R. 46 W.; lat. 45 degrees 03 minutes 08 seconds N. and long. 96 degrees 23 minutes 48 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) sandy loam, very

dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; very friable; few fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

A—10 to 13 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; very friable; few fine roots; 2 percent gravel; neutral; clear smooth boundary.

Bw—13 to 20 inches; dark brown (10YR 4/3) sandy loam; weak medium and fine subangular blocky structure; very friable; few fine roots; 3 percent gravel; neutral; clear smooth boundary.

2C—20 to 60 inches; brown (10YR 5/3) gravelly coarse sand; single grain; loose; few light gray (10YR 7/2) carbonate coatings on rock fragments; 15 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 14 to 25 inches

Thickness of the mollic epipedon: 8 to 16 inches

Depth to sand and gravel: 14 to 25 inches

Ap and A horizons:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—sandy loam

Content of rock fragments—0 to 10 percent

Bw horizon:

Hue—2.5Y or 10YR

Value—2 to 4

Chroma—2 to 4

Texture—sandy loam or coarse sandy loam

Content of rock fragments—0 to 10 percent

2C horizon:

Hue—2.5Y or 10YR

Value—4 or 5

Chroma—2 to 4

Texture—coarse sand, sand, or the gravelly analogs of these textures

Content of rock fragments—5 to 35 percent

341A—Arvilla sandy loam, 0 to 2 percent slopes

Composition

Arvilla and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Outwash plains

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 4.3 inches

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

Inclusions

- Marysland and similar soils
- Forada and similar soils
- Spottswood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

341B—Arvilla sandy loam, 2 to 6 percent slopes**Composition**

Arvilla and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Summits and back slopes
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 3.4 inches

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

such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Marysland and similar soils
- Spottswood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

341C—Arvilla sandy loam, 6 to 12 percent slopes**Composition**

Arvilla and similar soils: About 90 percent
 Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Back slopes and shoulders
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches

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

Inclusions

- Marysland and similar soils
- Spottswood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Barnes Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate or moderately slow

Landform: Moraines

Parent material: Till

Slope range: 2 to 12 percent

Taxonomic class: Fine-loamy, mixed Udic Haploborolls

Taxadjunct features: The Barnes soil in map unit 942C2 has a thinner surface layer than is defined as the range for the series. This soil is classified as fine-loamy, mixed, frigid Typic Eutrochrepts.

Typical Pedon

Barnes loam, in an area of Barnes-Buse complex, 2 to 6 percent slopes, 2,100 feet east and 500 feet north of the southwest corner of sec. 28, T. 117 N., R. 46 W.; lat. 44 degrees 54 minutes 29 seconds N. and long. 96 degrees 25 minutes 38 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; 2 percent gravel; slightly alkaline; abrupt smooth boundary.

Bw—10 to 21 inches; dark brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few fine roots; 2 percent gravel; slightly alkaline; clear wavy boundary.

Bk1—21 to 31 inches; olive brown (2.5Y 4/4) loam; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; few strong brown (7.5YR 5/6) iron masses; 2 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—31 to 40 inches; light olive brown (2.5Y 5/4) loam; few fine prominent yellowish brown (10YR 5/6) relict iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; 4 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—40 to 60 inches; light olive brown (2.5Y 5/4) loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations and few fine distinct grayish brown (2.5Y 5/2) iron depletions; massive; friable; few light brownish gray (2.5Y 6/2) lime accumulations; 4 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 12 to 31 inches

Thickness of the mollic epipedon: 7 to 16 inches

Content of rock fragments: 1 to 10 percent, by volume, throughout the profile

Percent of surface covered with stones: 3 to 15 percent in some pedons

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—loam

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 5

Chroma—2 to 4

Texture—loam

Bk horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam

C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam

902B—Barnes-Buse complex, 2 to 6 percent slopes

Composition

Barnes and similar soils: About 50 percent

Buse and similar soils: About 35 percent

Inclusions: About 15 percent

Setting

Landform: Moraines

Position on the landform: Barnes—summits and back slopes; Buse—shoulders

Slope range: Barnes—2 to 6 percent; Buse—3 to 6 percent

Component Description

Barnes

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

Buse

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

Inclusions

- Lakepark and similar soils
- Parnell and similar soils
- Hamerly and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Bearden Series

Depth class: Very deep

Drainage class: Somewhat poorly drained

Permeability: Moderate to slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 1 to 3 percent

Taxonomic class: Fine-silty, frigid Aeric Calciaquolls

Typical Pedon

Bearden silty clay loam, 2,300 feet south and 150 feet west of the northeast corner of sec. 13, T. 118 N., R. 43 W.; lat. 45 degrees 01 minute 50 seconds N. and long. 96 degrees 21 minutes 21 seconds W.

Ap—0 to 11 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—11 to 18 inches; dark grayish brown (2.5Y 4/2) silt loam; weak medium and fine subangular blocky structure; friable; few fine roots; few grayish brown (2.5Y 5/2) lime accumulations; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—18 to 28 inches; olive brown (2.5Y 4/4) silt loam; few fine faint light olive brown (2.5Y 5/4) iron concentrations; weak medium subangular blocky

structure; friable; few fine roots; few grayish brown (2.5Y 5/2) lime accumulations; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk3—28 to 46 inches; light olive brown (2.5Y 5/4) silt loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations and common fine grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline; gradual smooth boundary.

BC—46 to 57 inches; light olive brown (2.5Y 5/4) silt loam; many medium distinct light olive brown (2.5Y 5/6) and common fine prominent yellowish brown (10YR 5/6) iron concentrations and common fine grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few dark brown (7.5YR 3/2) iron masses; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—57 to 60 inches; light olive brown (2.5Y 5/4) silt loam; common fine prominent yellowish brown (10YR 5/6) and common fine distinct light olive brown (2.5Y 5/6) iron concentrations and common fine grayish brown (2.5Y 5/2) iron depletions; massive; friable; few dark brown (7.5YR 3/2) iron masses; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 7 to 20 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR or 2.5Y

Value—2 or 3

Chroma—1

Texture—silty clay loam

Bk horizon:

Hue—10YR to 5Y

Value—3 to 5

Chroma—1 to 4

Texture—silty clay loam or silt loam

C horizon:

Hue—2.5Y or 5Y

Value—4 to 7

Chroma—2 to 4

Texture—silty clay loam, silt loam, or very fine sandy loam

67—Bearden silty clay loam**Composition**

Bearden and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Knolls

Slope range: 1 to 3 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 2 to 4 feet

Available water capacity to 60 inches or root-limiting layer: About 11.5 inches

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

Inclusions

- Colvin and similar soils
- Perella and similar soils
- Glyndon and similar soils
- Waubay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Bigstone Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Moderately slow or moderate

Landform: Moraines and glacial lake plains

Parent material: Alluvium and till

Slope range: 0 to 1 percent

Taxonomic class: Fine-silty, mixed (calcareous), frigid Cumulic Endoaquolls

Typical Pedon

Bigstone silty clay loam, ponded, 2,900 feet west and 800 feet south of the northeast corner of sec. 8, T. 119 N., R. 45 W.; lat. 45 degrees 08 minutes 09 seconds N.

and long. 96 degrees 19 minutes 06 seconds W.

A1—0 to 18 inches; black (5Y 2.5/1) silty clay loam, very dark gray (N 3/0) dry; weak fine subangular blocky structure; friable; common fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

A2—18 to 34 inches; black (5Y 2.5/1) silty clay loam, very dark gray (5Y 3/1) dry; weak fine subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

A3—34 to 45 inches; black (5Y 2.5/1) silty clay loam, very dark gray (5Y 3/1) dry; many coarse distinct olive gray (5Y 4/2) iron depletions; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

2A4—45 to 54 inches; very dark gray (5Y 3/1) clay loam, dark gray (5Y 4/1) dry; many medium distinct dark olive gray (5Y 3/2) iron depletions; weak fine subangular blocky structure; friable; 1 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

2Cg—54 to 60 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct gray (N 5/0) iron depletions, common fine prominent greenish gray (5G 5/1) iron depletions, and common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 24 to 60 inches

Depth to till: 30 to 60 inches

A or Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam

Content of rock fragments—none

2Cg horizon:

Hue—2.5Y or 5Y

Value—4 or 5

Chroma—1 or 2

Texture—clay loam or loam

Content of rock fragments—2 to 8 percent

706—Bigstone silty clay loam, ponded**Composition**

Bigstone and similar soils: About 70 percent

Inclusions: About 30 percent

Setting

Landform: Depressions
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium and till
Flooding: None
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches

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

Inclusions

- Colvin and similar soils
- Quam and similar soils
- Vallerys and similar soils
- Oldham and similar soils

724—Bigstone silty clay loam**Composition**

Bigstone and similar soils: About 70 percent
 Inclusions: About 30 percent

Setting

Landform: Depressions
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium and till
Flooding: None
Available water capacity to 60 inches or root-limiting layer: About 11.3 inches

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

Inclusions

- Colvin and similar soils
- Quam and similar soils
- Vallerys and similar soils
- Oldham and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Burr Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic class: Fine, mesic Typic Calciaquolls

Typical Pedon

Burr silty clay loam, in an area of Burr-Calco complex, occasionally flooded, 300 feet east and 1,900 feet south of the northwest corner of sec. 14, T. 118 N., R. 46 W.; lat. 45 degrees 11 minutes 56 seconds N. and long. 96 degrees 23 minutes 34 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine roots; few shell fragments; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Aky—9 to 15 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; common fine roots; few shell fragments; few light gray (10YR 6/1) lime accumulations; common gray (10YR 5/1) gypsum crystals; strongly effervescent; moderately alkaline; clear wavy boundary.

Ay—15 to 23 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; common fine roots; few shell fragments; common gray (10YR 5/1) gypsum crystals; strongly effervescent; moderately alkaline; clear wavy boundary.

A—23 to 40 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak medium and moderate fine subangular blocky structure; friable; few fine roots; few shell fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

ACg—40 to 45 inches; very dark grayish brown (2.5Y 3/2) silty clay, dark grayish brown (2.5Y 4/2) dry; common fine distinct olive brown (2.5Y 4/4) iron concentrations and few fine faint dark grayish brown (2.5Y 4/2) iron depletions; weak medium and

moderate fine subangular blocky structure; friable; few fine roots; few shell fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg—45 to 60 inches; dark gray (5Y 4/1) silty clay; common fine prominent olive brown (2.5Y 4/4) iron concentrations; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 20 to 48 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR to 5Y

Value—2 or 3

Chroma—1

Texture—silty clay loam

Aky horizon:

Hue—10YR to 5Y

Value—2 or 3

Chroma—1

Texture—silty clay loam or silty clay

Ay horizon:

Hue—10YR to 5Y

Value—2 or 3

Chroma—1

Texture—silty clay loam or silty clay

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay or silty clay loam

ACg horizon:

Hue—10YR to 5Y or neutral

Value—3 to 5

Chroma—0 to 2

Texture—silty clay or silty clay loam

Cg horizon:

Hue—5Y

Value—4 to 6

Chroma—1 to 3

Texture—silty clay or silty clay loam

1870—Burr-Calco complex, occasionally flooded

Composition

Burr and similar soils: About 50 percent

Calco and similar soils: About 30 percent

Inclusions: About 20 percent

Setting

Landform: Flats

Slope range: 0 to 2 percent

Component Description

Burr

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Frequency of flooding: Occasional

Depth to the water table: 1 to 3 feet

Available water capacity to 60 inches or root-limiting layer: About 9.9 inches

Calco

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Alluvium

Frequency of flooding: Occasional

Seasonal high water table: At the surface to 1 foot below the surface

Available water capacity to 60 inches or root-limiting layer: About 12.9 inches

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

Inclusions

- Du Page and similar soils
- Soils that are frequently flooded
- Marsyland and similar soils
- Oldham and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Buse Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate and moderately slow

Landform: Moraines

Parent material: Till

Slope range: 3 to 40 percent

Taxonomic class: Fine-loamy, mixed Udic Calciborolls

Typical Pedon

Buse loam, in an area of Buse-Forman complex, 6 to 12 percent slopes, eroded, 1,000 feet west and 200 feet north of the southeast corner of sec. 19, T. 116 N., R. 46 W.; lat. 44 degrees 50 minutes 07 seconds N. and long. 96 degrees 26 minutes 37 seconds W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; few fine roots; 2 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—7 to 14 inches; dark brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; few fine roots; common light gray (2.5Y 7/1) lime accumulations; 3 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—14 to 28 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; few fine roots; few light gray (10YR 6/1) lime accumulations; 4 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk3—28 to 60 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; few light gray (10YR 6/1) lime accumulations; 4 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 7 to 10 inches

Content of rock fragments: 2 to 12 percent, by volume, throughout the profile

Percent of surface covered with stones: 3 to 15 percent in some pedons

Ap or A horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—loam

Bk horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam

437F—Buse loam, 18 to 40 percent slopes**Composition**

Buse and similar soils: About 70 percent

Inclusions: About 30 percent

Setting

Landform: Moraines

Position on the landform: Back slopes and shoulders

Slope range: 18 to 40 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

Inclusions

- Lakepark and similar soils
- Lamoure and similar soils
- Barnes and similar soils
- Langhei and similar soils

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

915C2—Buse-Forman complex, 6 to 12 percent slopes, eroded**Composition**

Buse and similar soils: About 50 percent

Forman and similar soils: About 35 percent

Inclusions: About 15 percent

Setting

Landform: Moraines

Position on the landform: Buse—shoulders; Forman—summits and back slopes

Slope range: 6 to 12 percent

Component Description**Buse**

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

Forman

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

Inclusions

- Parnell and similar soils
- Mehurin and similar soils
- Svea and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1309C—Buse-Doland complex, 6 to 12 percent slopes, eroded

Composition

Buse and similar soils: About 45 percent
 Doland and similar soils: About 35 percent
 Inclusions: About 20 percent

Setting

Landform: Moraines
Position on the landform: Buse—shoulders; Doland—summits and back slopes
Slope range: 6 to 12 percent

Component Description

Buse

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

Doland

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 11 inches

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

Inclusions

- Perella and similar soils
- Quam and similar soils
- Tara and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1865C—Buse-Barnes complex, 2 to 12 percent slopes, extremely stony

Composition

Buse and similar soils: About 55 percent
 Barnes and similar soils: About 30 percent
 Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Buse—shoulders; Barnes—summits and back slopes
Slope range: Buse—3 to 12 percent; Barnes—2 to 12 percent

Component Description

Buse

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None

Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches

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

Inclusions

- Lakepark and similar soils
- Darnen and similar soils
- Vallerys and similar soils

Major Uses of the Unit

- Pasture (fig. I-3)

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1865F—Buse loam, 12 to 40 percent slopes, extremely stony

Composition

Buse and similar soils: About 70 percent
 Inclusions: About 30 percent

Setting

Landform: Moraines
Position on the landform: Shoulders
Slope range: 12 to 40 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

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

Inclusions

- Lakepark and similar soils
- Langhei and similar soils
- Barnes and similar soils
- Lamoure and similar soils

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Calco Series

Depth class: Very deep
Drainage class: Very poorly drained and poorly drained
Permeability: Moderate
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Taxonomic class: Fine-silty, mixed (calcareous), mesic Cumulic Endoaquolls

Typical Pedon

Calco silty clay loam, occasionally flooded, 300 feet east and 1,300 feet south of the northwest corner of sec. 13, T. 117 N., R. 45 W.; lat. 44 degrees 56 minutes 48 seconds N. and long. 96 degrees 14 minutes 44 seconds W.

- Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.
- A1—10 to 28 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.
- A2—28 to 45 inches; black (5Y 2.5/1) silty clay loam, very dark gray (5Y 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.
- Bg—45 to 55 inches; very dark gray (5Y 3/1) silty clay loam, dark gray (5Y 4/1) dry; weak coarse and medium subangular blocky structure; friable; strongly effervescent; moderately alkaline; gradual smooth boundary.



Figure I-3.—Pasture in an area of Buse-Barnes complex, 2 to 12 percent slopes, extremely stony. Because of the stones on the surface, the use of these soils is limited to pasture.

Cg—55 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct light olive brown (2.5Y 5/4) iron concentrations; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile
Thickness of the mollic epipedon: 30 to 60 inches
Content of rock fragments: None

Ap horizon:
 Hue—10YR to 5Y or neutral
 Value—2
 Chroma—0 or 1
 Texture—silty clay loam

A horizon:
 Hue—10YR to 5Y or neutral
 Value—2 or 3
 Chroma—0 to 2

Texture—silty clay loam

Bg horizon:

Hue—10YR to 5Y

Value—3 to 6

Chroma—0 to 2

Texture—silty clay loam

Cg horizon:

Hue—10YR to 5Y or neutral

Value—3 to 6

Chroma—0 to 2

Texture—silty clay loam or silt loam

85—Calco silty clay loam, occasionally flooded

Composition

Calco and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Flood plains

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Alluvium

Frequency of flooding: Occasional

Seasonal high water table: At the surface to 1 foot below the surface

Available water capacity to 60 inches or root-limiting layer: About 13.1 inches

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

Inclusions

- Burr and similar soils
- Du Page and similar soils
- Soils that are frequently flooded

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

610—Calco silty clay loam, frequently flooded

Composition

Calco and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Flood plains

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Alluvium

Frequency of flooding: Frequent

Seasonal high water table: At the surface to 1 foot below the surface

Available water capacity to 60 inches or root-limiting layer: About 12.8 inches

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

Inclusions

- Burr and similar soils
- Du Page and similar soils
- Soils that are subject to occasional flooding

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Colvin Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderate or moderately slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 1 percent

Taxonomic class: Fine-silty, frigid Typic Calciaquolls

Typical Pedon

Colvin silty clay loam, 1,200 feet east and 100 feet north of the southwest corner of sec. 36, T. 120 N., R. 45 W.; lat. 45 degrees 09 minutes 10 seconds N. and long. 96 degrees 14 minutes 29 seconds W.

Ap—0 to 10 inches; black (N 2/0) silty clay loam, very

dark gray (N 3/0) dry; weak medium subangular blocky structure; friable; common fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bkg1—10 to 18 inches; olive gray (5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/8) iron concentrations; weak medium and fine subangular blocky structure; friable; few fine roots; few light gray (2.5Y 7/2) lime accumulations; few light gray (5Y 6/1) gypsum crystals; strongly effervescent; moderately alkaline; clear wavy boundary.

Bkg2—18 to 25 inches; gray (5Y 5/1) silty clay loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium and fine subangular blocky structure: friable; few fine roots; common light gray (2.5Y 7/2) lime accumulations; few light gray (5Y 6/1) gypsum crystals; violently effervescent; moderately alkaline; clear wavy boundary.

Cg—25 to 60 inches; olive gray (5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) iron concentrations and common fine faint gray (5Y 5/1) iron depletions; massive; friable; few dark brown (7.5YR 3/2) iron masses; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 7 to 24 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam

Bkg horizon:

Hue—10YR to 5Y or neutral

Value—3 to 7

Chroma—0 to 2

Texture—silty clay loam or silt loam

Cg horizon:

Hue—2.5Y or 5Y

Value—3 to 6

Chroma—1 to 4

Texture—silty clay loam or silt loam

47—Colvin silty clay loam

Composition

Colvin and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Drainageways and flats

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Seasonal high water table: At the surface to 1 foot below the surface

Available water capacity to 60 inches or root-limiting layer: About 10.9 inches

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

Inclusions

- Bearden and similar soils
- Parle and similar soils
- Fulda and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Darnen Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Moraines

Parent material: Colluvium and till

Slope range: 2 to 6 percent

Taxonomic class: Fine-loamy, mixed Pachic Udic Haploborolls

Typical Pedon

Darnen loam, 2 to 6 percent slopes, 400 feet south and 200 feet east of the northwest corner of sec. 20, T. 119 N., R. 43 W.; lat. 45 degrees 06 minutes 31 seconds N. and long. 96 degrees 04 minutes 56 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; slightly alkaline; abrupt smooth boundary.

A1—10 to 21 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

A2—21 to 26 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; slightly alkaline; gradual wavy boundary.

AB—26 to 32 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

Bw—32 to 44 inches; dark brown (10YR 3/3) loam, dark brown (10YR 4/3) dry; weak medium subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

2Bk1—44 to 54 inches; light olive brown (2.5Y 5/3) loam; weak medium and fine subangular blocky structure; friable; many light brownish gray (2.5Y 6/2) lime accumulations; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk2—54 to 60 inches; light olive brown (2.5Y 5/3) loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak coarse subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; 2 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 46 inches

Thickness of the mollic epipedon: 24 to 48 inches

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—loam

Content of rock fragments—none

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loam

Content of rock fragments—none

Bw horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 to 4

Texture—loam or clay loam

Content of rock fragments—none

2Bk horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 to 4

Texture—loam or clay loam

Content of rock fragments—0 to 5 percent

494B—Darnen loam, 2 to 6 percent slopes

Composition

Darnen and similar soils: About 70 percent

Inclusions: About 30 percent

Setting

Landform: Moraines

Position on the landform: Foot slopes and toe slopes

Slope range: 2 to 6 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Alluvium or colluvium and till

Flooding: None

Depth to the water table: 2.5 to 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 11.4 inches

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

Inclusions

- Lakepark and similar soils
- Barnes and similar soils
- Hamerly and similar soils
- Svea and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Doland Series

Depth class: Very deep

Drainage class: Well drained and moderately well drained

Permeability: Moderate

Landform: Moraines

Parent material: Glaciolacustrine deposits and till
Slope range: 2 to 12 percent
Taxonomic class: Fine-loamy, mixed Udic Haploborolls

Typical Pedon

Doland silt loam, 2 to 4 percent slopes, moderately wet, 500 feet east and 500 feet south of the northwest corner of sec. 14, T. 119 N., R. 44 W.; lat. 45 degrees 07 minutes 20 seconds N. and long. 96 degrees 08 minutes 34 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bw—8 to 23 inches; dark brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bk1—23 to 28 inches; light olive brown (2.5Y 5/4) silt loam; weak fine subangular blocky structure; friable; few fine roots; few light gray (2.5Y 7/2) lime accumulations; strongly effervescent; moderately alkaline; clear smooth boundary.

2Bk2—28 to 42 inches; light olive brown (2.5Y 5/4) loam; weak medium subangular blocky structure; friable; few fine roots; few light gray (2.5Y 7/2) lime accumulations; 3 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

2Bk3—42 to 60 inches; light olive brown (2.5Y 5/4) clay loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations and light brownish gray (2.5Y 6/2) iron depletions; weak medium subangular blocky structure; friable; few light gray (2.5Y 7/2) carbonate coatings on rock fragments; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 15 to 35 inches

Thickness of the mollic epipedon: 7 to 15 inches

Depth to till: 15 to 30 inches

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—silt loam

Content of rock fragments—none

Bw horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 to 4

Texture—silt loam or silty clay loam

Content of rock fragments—none

Bk horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 to 4

Texture—silt loam or silty clay loam

Content of rock fragments—none

2Bk horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—2 to 4

Texture—clay loam or loam

Content of rock fragments—2 to 7 percent

2C horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam or clay loam

Content of rock fragments—2 to 7 percent

891B—Doland-Buse complex, 3 to 6 percent slopes

Composition

Doland and similar soils: About 45 percent

Buse and similar soils: About 25 percent

Inclusions: About 30 percent

Setting

Landform: Moraines

Position on the landform: Doland—summits and back slopes; Buse—shoulders

Slope range: 3 to 6 percent

Component Description

Doland

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 11.4 inches

Buse

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

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

Inclusions

- Perella and similar soils
- Quam and similar soils
- Poinsett and similar soils
- Tara and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1295B—Doland silt loam, 2 to 4 percent slopes, moderately wet

Composition

Doland and similar soils: About 80 percent

Inclusions: About 20 percent

Setting

Landform: Moraines

Position on the landform: Summits and back slopes

Slope range: 2 to 4 percent

Component Description

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 4 to 6 feet

Available water capacity to 60 inches or root-limiting layer: About 11 inches

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

Inclusions

- Perella and similar soils
- Quam and similar soils
- Tara and similar soils

Major Uses of the Unit

- Cropland
- Hayland

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Dovray Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Slow and very slow

Landform: Moraines and glacial lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 1 percent

Taxonomic class: Fine, montmorillonitic, frigid Vertic Epiaquolls

Typical Pedon

Dovray silty clay, 2,300 feet north and 300 feet west of the southeast corner of sec. 34, T. 120 N., R. 45 W.; lat. 45 degrees 09 minutes 33 seconds N. and long. 96 degrees 15 minutes 50 seconds W.

Ap—0 to 10 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

A—10 to 25 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak medium subangular blocky structure; firm; few fine roots; slightly alkaline; gradual wavy boundary.

Bg1—25 to 40 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; few fine distinct olive brown (2.5Y 4/4) iron concentrations; weak medium subangular blocky structure; firm; few fine roots; slightly alkaline; clear wavy boundary.

Bg2—40 to 47 inches; olive gray (5Y 4/2) silty clay; common fine distinct light olive brown (2.5Y 5/4) iron concentrations; weak fine subangular blocky structure; firm; slightly alkaline; gradual wavy boundary.

Cg—47 to 60 inches; olive gray (5Y 5/2) silty clay; few fine prominent yellowish brown (2.5Y 5/8) and common fine prominent light olive brown (2.5Y 5/4) iron concentrations; massive; firm; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches

Thickness of the mollic epipedon: 24 to 54 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay or clay

Bg horizon:

Hue—2.5Y or 5Y

Value—3 to 6

Chroma—1 or 2

Texture—silty clay or clay

Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—silty clay or clay

137—Dovray silty clay

Composition

Dovray and similar soils: About 80 percent

Inclusions: About 20 percent

Setting

Landform: Depressions

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Available water capacity to 60 inches or root-limiting layer: About 9 inches

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

Inclusions

- Colvin and similar soils
- Fulda and similar soils
- Oldham and similar soils
- Perella and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Du Page Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Flood plains

Parent material: Alluvium

Slope range: 0 to 2 percent

Taxonomic class: Fine-loamy, mixed, mesic Cumulic Hapludolls

Typical Pedon

Du Page loam, occasionally flooded, 1,800 feet south and 50 feet west of the northeast corner of sec. 14, T. 117 N., R. 45 W.; lat. 44 degrees 56 minutes 42 seconds N. and long. 96 degrees 14 minutes 50 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A1—10 to 27 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.

A2—27 to 46 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.

C1—46 to 52 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; massive; friable; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—52 to 60 inches; dark grayish brown (10YR 4/2) sandy loam; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 24 to 52 inches

Content of rock fragments: 0 to 5 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loam

A horizon:

Hue—10YR
 Value—2 or 3
 Chroma—1 to 3
 Texture—loam

C horizon:

Hue—10YR
 Value—3 or 4
 Chroma—1 to 4
 Texture—loam or sandy loam

574—Du Page loam, occasionally flooded***Composition***

Du Page and similar soils: About 85 percent
 Inclusions: About 15 percent

Setting

Landform: Flood plains
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Frequency of flooding: Occasional
Depth to the water table: 4 to 6 feet
Available water capacity to 60 inches or root-limiting layer: About 12.7 inches

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

Inclusions

- Calco and similar soils
- Malachy and similar soils
- Zumbro and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

883—Du Page-Zumbro complex, occasionally flooded***Composition***

Du Page and similar soils: About 55 percent

Zumbro and similar soils: About 30 percent
 Inclusions: About 15 percent

Setting

Landform: Flood plains
Slope range: 0 to 2 percent

Component Description**Du Page**

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Frequency of flooding: Occasional
Depth to the water table: 4 to 6 feet
Available water capacity to 60 inches or root-limiting layer: About 12 inches

Zumbro

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Frequency of flooding: Occasional
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 5.8 inches

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

Inclusions

- Calco and similar soils
- Fordville and similar soils
- Malachy and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Egeland Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Outwash plains
Parent material: Glacial outwash
Slope range: 0 to 12 percent

Taxonomic class: Coarse-loamy, mixed Udic
Haploborolls

Typical Pedon

Egeland sandy loam, 2 to 6 percent slopes, 2,300 feet east and 100 feet north of the southwest corner of sec. 25, T. 117 N., R. 46 W.; lat. 44 degrees 54 minutes 24 seconds N. and long. 96 degrees 21 minutes 53 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

A—9 to 13 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw1—13 to 20 inches; dark brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw2—20 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw3—28 to 45 inches; yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

C—45 to 60 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 14 to 45 inches

Thickness of the mollic epipedon: 8 to 16 inches

Ap and A horizons:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—sandy loam or loam

Content of rock fragments—0 to 3 percent

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 5

Chroma—1 to 4

Texture—sandy loam or loamy sand

Content of rock fragments—0 to 10 percent

C horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—2 to 4

Texture—loamy sand, loamy fine sand, or sandy loam

Content of rock fragments—0 to 10 percent

141A—Egeland sandy loam, 0 to 2 percent slopes

Composition

Egeland and similar soils: About 80 percent

Inclusions: About 20 percent

Setting

Landform: Outwash plains

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 7.1 inches

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

Inclusions

- Marysland and similar soils
- Arvilla and similar soils
- Embden and similar soils
- Forada and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

141B—Egeland sandy loam, 2 to 6 percent slopes

Composition

Egeland and similar soils: About 80 percent

Inclusions: About 20 percent

Setting

Landform: Outwash plains

Position on the landform: Summits and back slopes

Slope range: 2 to 6 percent

Component Description

Surface layer texture: Sandy loam

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 7 inches

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

Inclusions

- Marysland and similar soils
- Arvilla and similar soils
- Embden and similar soils
- Forada and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

141C—Egeland loam, 6 to 12 percent slopes

Composition

Egeland and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Outwash plains

Position on the landform: Back slopes and shoulders

Slope range: 6 to 12 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 6.9 inches

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

Inclusions

- Marysland and similar soils
- Arvilla and similar soils
- Embden and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Embden Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderately rapid

Landform: Outwash plains

Parent material: Glacial outwash

Slope range: 0 to 2 percent

Taxonomic class: Coarse-loamy, mixed Pachic Udic Haploborolls

Typical Pedon

Embden sandy loam, 1,000 feet west and 300 feet north of the southeast corner of sec. 4, T. 118 N., R. 46 W.; lat. 45 degrees 03 minutes 09 seconds N. and long. 96 degrees 25 minutes 06 seconds W.

Ap—0 to 7 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

A—7 to 17 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw1—17 to 20 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine roots; few very dark brown (10YR 2/2) organic coatings on faces of peds; neutral; clear wavy boundary.

Bw2—20 to 30 inches; dark brown (10YR 4/3) sandy loam; few fine faint yellowish brown (10YR 5/4) iron concentrations; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine roots; slightly alkaline; gradual wavy boundary.

Bw3—30 to 49 inches; dark yellowish brown (10YR 4/4) sandy loam; common fine distinct yellowish brown (10YR 5/6) iron concentrations; weak medium

subangular blocky structure; very friable; few fine roots; slightly alkaline; clear wavy boundary.

C—49 to 60 inches; yellowish brown (10YR 5/4) loamy sand; common fine prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) iron concentrations and few fine prominent grayish brown (2.5Y 5/2) iron depletions; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 60 inches

Thickness of the mollic epipedon: 16 to 35 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—sandy loam

A horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—sandy loam

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 4

Chroma—1 to 4

Texture—sandy loam or fine sandy loam

C horizon:

Hue—10YR to 5Y

Value—4 to 6

Chroma—1 to 4

Texture—sandy loam or fine sandy loam

1994—Embden sandy loam

Composition

Embden and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Outwash plains

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: 4 to 6 feet

Available water capacity to 60 inches or root-limiting layer: About 8.9 inches

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

Inclusions

- Marysland and similar soils
- Egeland and similar soils
- Forada and similar soils
- Sverdrup and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Esmond Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate and moderately rapid

Landform: Moraines

Parent material: Till

Slope range: 3 to 40 percent

Taxonomic class: Coarse-loamy, mixed Udorthentic Haploborolls

Typical Pedon

Esmond loam, in an area of Esmond-Heimdal complex, 2 to 6 percent slopes, 400 feet east and 1,400 feet south of the northwest corner of sec. 19, T. 119 N., R. 45 N.; lat. 45 degrees 06 minutes 22 seconds N. and long. 96 degrees 21 minutes 06 seconds W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; few fine roots; few brown (10YR 5/3) streaks; 2 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 18 inches; brown (10YR 5/3) loam; weak medium subangular blocky structure; friable; few fine roots; common light gray (10YR 7/2) lime accumulations; 2 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—18 to 32 inches; light olive brown (2.5Y 5/4) loam; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; 4 percent gravel; strongly

effervescent; moderately alkaline; clear wavy boundary.

C1—32 to 41 inches; light olive brown (2.5Y 5/4) sandy loam; few fine prominent yellowish brown (10YR 5/6) relict iron concentrations; massive; friable; few light brownish gray (2.5Y 6/2) carbonate coatings on rock fragments; 4 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—41 to 60 inches; light olive brown (2.5Y 5/4) loam; few fine prominent yellowish brown (10YR 5/6) relict iron concentrations; massive; friable; few light brownish gray (2.5Y 6/2) carbonate coatings on rock fragments; few yellowish red (5YR 4/6) iron masses; 4 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile
Thickness of the mollic epipedon: 7 to 10 inches

Ap horizon:

Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam
Content of rock fragments—1 to 3 percent

Bk horizon:

Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—stratified loam and sandy loam
Content of rock fragments—1 to 10 percent

C horizon:

Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—stratified loam, sandy loam, and silt loam
Content of rock fragments—1 to 10 percent

288F—Esmond loam, 18 to 40 percent slopes

Composition

Esmond and similar soils: About 70 percent
Inclusions: About 30 percent

Setting

Landform: Moraines
Position on the landform: Back slopes and shoulders
Slope range: 18 to 40 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 11 inches

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

Inclusions

- Lakepark and similar soils
- Lamoure and similar soils
- Heimdal and similar soils
- Sisseton and similar soils

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1233B—Esmond-Heimdal complex, 2 to 6 percent slopes

Composition

Esmond and similar soils: About 50 percent
Heimdal and similar soils: About 35 percent
Inclusions: About 15 percent

Setting

Landform: Moraines

Position on the landform: Esmond—shoulders;
Heimdal—summits and back slopes

Slope range: Esmond—3 to 6 percent; Heimdal—2 to 6 percent

Component Description

Esmond

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 11.1 inches

Heimdal

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches

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

Inclusions

- Egeland and similar soils
- Hamerly and similar soils
- Lakepark and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Forada Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderate or moderately rapid; lower part—rapid
Landform: Outwash plains
Parent material: Glacial outwash
Slope range: 0 to 2 percent
Taxonomic class: Coarse-loamy, mixed, frigid Typic Endoaquolls

Typical Pedon

Forada loam, 1,400 feet east and 2,200 feet north of the southwest corner of sec. 26, T. 119 N., R. 46 W.; lat. 45 degrees 05 minutes 15 seconds N. and long. 96 degrees 23 minutes 17 seconds W.

- Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; slightly alkaline; abrupt smooth boundary.
- A—10 to 21 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; slightly alkaline; clear wavy boundary.
- Bg—21 to 35 inches; dark grayish brown (2.5Y 4/2) sandy loam; few fine distinct olive brown (2.5Y 4/4) iron concentrations and few fine faint grayish brown

- (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; slightly alkaline; gradual wavy boundary.
- 2Cg1—35 to 49 inches; grayish brown (2.5Y 5/2) sand; few fine distinct light olive brown (2.5Y 5/4) iron concentrations; single grain; loose; 1 percent gravel; slightly alkaline; clear wavy boundary.
- 2Cg2—49 to 60 inches; grayish brown (2.5Y 5/2) sand; common fine distinct light olive brown (2.5Y 5/4) iron concentrations; single grain; loose; 1 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 50 inches
Thickness of the mollic epipedon: 10 to 24 inches
Depth to sand and gravel: 20 to 40 inches

Ap horizon:

Hue—10YR to 5Y or neutral
 Value—2 or 3
 Chroma—0 to 2
 Texture—loam
 Content of rock fragments—0 to 10 percent

A horizon:

Hue—10YR to 5Y or neutral
 Value—2 or 3
 Chroma—0 to 2
 Texture—loam
 Content of rock fragments—0 to 10 percent

Bg horizon:

Hue—10YR to 5Y
 Value—4 or 5
 Chroma—1 or 2
 Texture—sandy loam or loamy sand
 Content of rock fragments—0 to 10 percent

2Cg horizon:

Hue—10YR to 5Y
 Value—4 to 6
 Chroma—1 to 6
 Texture—sand or coarse sand
 Content of rock fragments—1 to 15 percent

375—Forada loam

Composition

Forada and similar soils: About 75 percent
 Inclusions: About 25 percent

Setting

Landform: Drainageways and flats
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: 1 to 3 feet
Available water capacity to 60 inches or root-limiting layer: About 8.1 inches

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

Inclusions

- Egeland and similar soils
- Embden and similar soils
- Marysland and similar soils
- Malachy and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Fordville Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—moderate; lower part—rapid
Landform: Outwash plains
Parent material: Glacial outwash
Slope range: 0 to 3 percent
Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed Pachic Udic Haploborolls

Typical Pedon

Fordville loam, 200 feet east and 500 feet north of the southwest corner of sec. 9, T. 116 N., R. 46 W.; lat. 44 degrees 51 minutes 54 seconds N. and long. 96 degrees 19 minutes 53 seconds W.

- Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.
- Bw1—9 to 16 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.
- Bw2—16 to 21 inches; dark brown (10YR 3/3) loam, dark brown (10YR 4/3) dry; weak medium and fine

subangular blocky structure; friable; few fine roots; 1 percent gravel; neutral; clear wavy boundary.

2C—21 to 60 inches; dark brown (10YR 4/3) gravelly sand; single grain; loose; few light gray (10YR 6/1) carbonate coatings on rock fragments; 20 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Thickness of the mollic epipedon: 16 to 30 inches
Depth to sand and gravel: 20 to 40 inches

Ap horizon:

Hue—10YR
 Value—2 or 3
 Chroma—1
 Texture—loam
 Content of rock fragments—none

Bw horizon:

Hue—10YR
 Value—2 to 4
 Chroma—1 to 4
 Texture—loam or clay loam
 Content of rock fragments—0 to 5 percent

2C horizon:

Hue—10YR or 2.5Y
 Value—3 to 6
 Chroma—2 to 4
 Texture—sand, loamy sand, or the gravelly and very gravelly analogs of these textures
 Content of rock fragments—20 to 40 percent

339—Fordville loam

Composition

Fordville and similar soils: About 80 percent
 Inclusions: About 20 percent

Setting

Landform: Outwash plains
Slope range: 0 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 5.6 inches

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

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

Inclusions

- Marysland and similar soils
- Spottswood and similar soils
- Sverdrup and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Forman Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderately slow

Landform: Moraines

Parent material: Till

Slope range: 2 to 12 percent

Taxonomic class: Fine-loamy, mixed Udic Argiborolls

Typical Pedon

Forman clay loam, 2 to 6 percent slopes, 500 feet north and 700 feet east of the southwest corner of sec. 8, T. 118 N., R. 46 W.; lat. 45 degrees 02 minutes 18 seconds N. and long. 96 degrees 26 minutes 58 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common medium roots; 2 percent gravel; neutral; abrupt smooth boundary.

Bt1—9 to 13 inches; dark grayish brown (10YR 4/2) clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 2 percent gravel; neutral; clear wavy boundary.

Bt2—13 to 16 inches; dark brown (10YR 4/3) clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; 2 percent gravel; neutral; clear wavy boundary.

Bt3—16 to 25 inches; dark brown (10YR 4/3) clay loam; weak fine subangular blocky structure; friable; few fine roots; few faint dark grayish brown (10YR 4/2)

clay films in pores; 2 percent gravel; neutral; clear wavy boundary.

Bk1—25 to 30 inches; light olive brown (2.5Y 5/4) clay loam; weak medium subangular blocky structure; friable; few fine roots; common light gray (10YR 7/1) lime accumulations; 2 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—30 to 60 inches; light olive brown (2.5Y 5/4) clay loam; few fine prominent strong brown (7.5YR 5/6) relict iron concentrations; weak medium subangular blocky structure; friable; few light gray (10YR 6/1) lime accumulations; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 13 to 26 inches

Thickness of the mollic epipedon: 9 to 16 inches

Content of rock fragments: 2 to 8 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—clay loam

Bt horizon:

Hue—10YR or 2.5Y

Value—3 or 4

Chroma—1 to 3

Texture—clay loam

Bk horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—2 to 4

Texture—clay loam or loam

168B—Forman clay loam, 2 to 6 percent slopes

Composition

Forman and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Moraines

Position on the landform: Summits and back slopes

Slope range: 2 to 6 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

Inclusions

- Parnell and similar soils
- Buse and similar soils
- Mehurin and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Fulda Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic class: Fine, montmorillonitic, frigid Vertic Epiaquolls

Typical Pedon

Fulda silty clay, 2,500 feet south and 900 feet east of the northwest corner of sec. 35, T. 120 N., R. 45 W.; lat. 45 degrees 09 minutes 39 seconds N. and long. 96 degrees 15 minutes 50 seconds W.

Ap—0 to 10 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

A—10 to 13 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak medium and fine subangular blocky structure; firm; few fine roots; slightly alkaline; clear wavy boundary.

Bg1—13 to 21 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; common fine prominent olive brown (2.5Y 4/4) iron concentrations; weak medium and fine subangular blocky structure; firm; few fine roots; slightly alkaline; clear wavy boundary.

Bg2—21 to 28 inches; olive gray (5Y 4/2) silty clay;

common fine prominent light olive brown (2.5Y 5/4) iron concentrations; weak medium and fine subangular blocky structure; firm; few fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

Cg1—28 to 40 inches; olive gray (5Y 5/2) silty clay; common fine prominent light olive brown (2.5Y 5/6) iron concentrations; massive; firm; few light gray (2.5Y 7/2) gypsum crystals; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cg2—40 to 60 inches; olive gray (5Y 5/2) silty clay; many fine prominent yellowish brown (10YR 5/6) iron concentrations and common fine faint gray (5Y 5/1) iron depletions; massive; firm; few light gray (2.5Y 7/2) gypsum crystals; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 42 inches

Thickness of the mollic epipedon: 12 to 24 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay

Bg horizon:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—silty clay, silty clay loam, or clay

Cg horizon:

Hue—2.5Y or 5Y

Value—5 or 6

Chroma—1 or 2

Texture—silty clay or silty clay loam

210—Fulda silty clay

Composition

Fulda and similar soils: About 65 percent

Inclusions: About 35 percent

Setting

Landform: Drainageways and flats

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1 to 3 feet
Available water capacity to 60 inches or root-limiting layer: About 10 inches

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

Inclusions

- Colvin and similar soils
- Dovray and similar soils
- Oldham and similar soils
- Perella and similar soils
- Sinai and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Glencoe Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow or moderate
Landform: Moraines
Parent material: Alluvium and till
Slope range: 0 to 1 percent
Taxonomic class: Fine-loamy, mixed, mesic Cumulic Endoaquolls

Typical Pedon

Glencoe silty clay loam, 1,100 feet west and 200 feet south of the northeast corner of sec. 27, T. 116 N., R. 44 W.; lat. 44 degrees 50 minutes 01 second N. and long. 96 degrees 08 minutes 15 seconds W.

Ap—0 to 12 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; 1 percent gravel; neutral; abrupt smooth boundary.

A1—12 to 21 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak medium and fine subangular blocky structure; friable; common fine

roots; 1 percent gravel; neutral; clear wavy boundary.

A2—21 to 40 inches; very dark gray (N 3/0) silty clay loam, dark gray (N 4/0) dry; few fine prominent strong brown (7.5YR 5/6) iron concentrations; weak medium prismatic structure parting to moderate fine subangular blocky; friable; common fine roots; few black (N 2/0) organic coatings on faces of peds; 1 percent gravel; neutral; clear wavy boundary.

2Bg1—40 to 50 inches; olive gray (5Y 4/2) clay loam; few fine faint olive gray (5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium and moderate fine subangular blocky structure; friable; few fine roots; few very dark grayish brown (2.5Y 3/2) organic coatings on faces of peds; 1 percent gravel; slightly alkaline; clear wavy boundary.

2Bg2—50 to 55 inches; dark gray (5Y 4/1) loam; common fine distinct olive gray (5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few yellowish red (5YR 4/6) iron masses; 2 percent gravel; slightly alkaline; gradual wavy boundary.

2Cg—55 to 60 inches; olive gray (5Y 5/2) loam; many medium prominent strong brown (7.5YR 5/6) iron concentrations; massive; friable; few yellowish red (5YR 4/6) iron masses; 2 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches

Thickness of the mollic epipedon: 24 to 46 inches

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam

Content of rock fragments—none

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam or clay loam

Content of rock fragments—none

2Bg horizon:

Hue—2.5Y or 5Y

Value—4 or 5

Chroma—1 or 2

Texture—clay loam, loam, or silty clay loam

Content of rock fragments—0 to 5 percent

2Cg horizon:

Hue—2.5Y or 5Y
 Value—4 to 6
 Chroma—2 to 4
 Texture—loam or clay loam
 Content of rock fragments—2 to 8 percent

114—Glencoe silty clay loam**Composition**

Glencoe and similar soils: About 75 percent
 Inclusions: About 25 percent

Setting

Landform: Depressions
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium and till
Flooding: None
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches

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

Inclusions

- Harps and similar soils
- Normania and similar soils
- Rolfe and similar soils
- Seaforth and similar soils
- Webster and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1051—Glencoe silty clay loam, ponded**Composition**

Glencoe and similar soils: About 85 percent
 Inclusions: About 15 percent

Setting

Landform: Depressions
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium and till
Flooding: None
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches

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

Inclusions

- Harps and similar soils
- Rolfe and similar soils
- Webster and similar soils

Glyndon Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Upper part—moderate; lower part—moderately rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic class: Coarse-silty, frigid Aeric Calciaquolls

Typical Pedon

Glyndon silt loam, 150 feet north and 200 feet east of the southwest corner of sec. 33, T. 120 N., R. 45 W.; lat. 45 degrees 09 minutes 13 seconds N. and long. 96 degrees 18 minutes 24 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—10 to 18 inches; dark grayish brown (10YR 4/2) silt loam; weak medium and fine subangular blocky structure; friable; few fine roots; few light gray (10YR 7/2) lime accumulations; few light brownish gray (10YR 6/2) gypsum crystals; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—18 to 32 inches; light olive brown (2.5Y 5/4) very fine sandy loam; common fine prominent yellowish

brown (10YR 5/6) iron concentrations and few fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—32 to 60 inches; yellowish brown (10YR 5/4) very fine sandy loam; many fine prominent yellowish brown (10YR 5/8) iron concentrations and grayish brown (2.5Y 5/2) iron depletions; massive; friable; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 7 to 16 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—silt loam

Bk horizon:

Hue—10YR to 5Y

Value—4 to 7

Chroma—1 to 4

Texture—silt loam or very fine sandy loam

C horizon:

Hue—10YR to 5Y

Value—4 to 6

Chroma—2 to 4

Texture—very fine sandy loam, silt loam, or very fine sand

60—Glyndon silt loam

Composition

Glyndon and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Knolls

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 1.5 to 3.0 feet

Available water capacity to 60 inches or root-limiting layer: About 10.8 inches

A typical soil series description with range in

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

Inclusions

- Perella and similar soils
- Colvin and similar soils
- Hantho and similar soils
- Bearden and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hamerly Series

Depth class: Very deep

Drainage class: Somewhat poorly drained

Permeability: Upper part—moderate; lower part—moderate or moderately slow

Landform: Moraines

Parent material: Till

Slope range: 1 to 3 percent

Taxonomic class: Fine-loamy, frigid Aeric Calcicquolls

Typical Pedon

Hamerly loam, 900 feet south and 1,200 feet east of the northwest corner of sec. 28, T. 120 N., R. 46 W.; lat. 45 degrees 10 minutes 37 seconds N. and long. 96 degrees 25 minutes 50 seconds W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; 3 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—9 to 19 inches; grayish brown (2.5Y 5/2) loam; weak medium and fine subangular blocky structure; friable; few fine roots; common light gray (2.5Y 7/2) lime accumulations; 3 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—19 to 29 inches; light olive brown (2.5Y 5/4) loam; weak medium and fine subangular blocky structure; friable; few fine roots; common light gray (2.5Y 7/2) lime accumulations; 3 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk3—29 to 60 inches; light olive brown (2.5Y 5/4) loam;

common fine distinct light olive brown (2.5Y 5/6) iron concentrations and few fine distinct grayish brown (2.5Y 5/2) iron depletions; weak coarse and medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 4/6) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 7 to 16 inches

Content of rock fragments: 1 to 10 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR or 2.5Y

Value—2 or 3

Chroma—1 or 2

Texture—loam

Bk horizon:

Hue—10YR to 5Y

Value—3 to 7

Chroma—1 to 4

Texture—loam or clay loam

184—Hamerly loam

Composition

Hamerly and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Knolls

Slope range: 1 to 3 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 2 to 4 feet

Available water capacity to 60 inches or root-limiting layer: About 10.5 inches

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

Inclusions

- Vallers and similar soils
- Buse and similar soils
- Esmond and similar soils
- Svea and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hamlet Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—moderate; lower part—moderate or moderately slow

Landform: Moraines

Parent material: Till

Slope range: 1 to 4 percent

Taxonomic class: Fine-loamy, mixed Aquic Haploborolls

Typical Pedon

Hamlet loam, 1 to 4 percent slopes, 1,200 feet north and 400 feet west of the southeast corner of sec. 24, T. 117 N., R. 46 W.; lat. 44 degrees 55 minutes 27 seconds N. and long. 96 degrees 21 minutes 17 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common fine roots; 1 percent gravel; neutral; abrupt smooth boundary.

Bw1—10 to 14 inches; dark yellowish brown (10YR 3/4) loam; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; neutral; clear wavy boundary.

Bw2—14 to 22 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; neutral; clear wavy boundary.

Bw3—22 to 33 inches; dark yellowish brown (10YR 4/4) loam; few fine distinct yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few yellowish red (5YR 5/8) iron masses; 3 percent gravel; slightly alkaline; clear wavy boundary.

Bk—33 to 38 inches; olive brown (2.5Y 4/3) loam; few fine distinct yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; common light gray (10YR 7/1) lime accumulations; few yellowish red (5YR 5/8) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—38 to 60 inches; light olive brown (2.5Y 5/4) loam; common fine distinct grayish brown (2.5Y 5/2) iron

depletions and few fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; few yellowish red (5YR 5/8) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 16 to 35 inches

Thickness of the mollic epipedon: 7 to 16 inches

Content of rock fragments: 1 to 7 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—loam

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 4

Chroma—2 to 4

Texture—loam

Bk horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam

C horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2 to 6

Texture—loam

748B—Hamlet loam, 1 to 4 percent slopes

Composition

Hamlet and similar soils: About 70 percent

Inclusions: About 30 percent

Setting

Landform: Moraines

Position on the landform: Summits and back slopes

Slope range: 1 to 4 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 3 to 5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.5 inches

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

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

Inclusions

- Buse and similar soils
- Lakepark and similar soils
- Parnell and similar soils
- Svea and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hantho Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 1 to 3 percent

Taxonomic class: Coarse-silty, mixed Pachic Udic Haploborolls

Typical Pedon

Hantho silt loam, 100 feet east and 300 feet north of the southwest corner of sec. 1, T. 119 N., R. 44 W.; lat. 45 degrees 08 minutes 21 seconds N. and long. 96 degrees 14 minutes 55 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; common fine roots; neutral; abrupt smooth boundary.

Bw1—10 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

Bw2—16 to 22 inches; dark brown (10YR 3/3) silt loam, dark brown (10YR 4/3) dry; weak medium subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

Bk1—22 to 28 inches; grayish brown (2.5Y 5/2) silt loam; weak medium subangular blocky structure; friable; few fine roots; many light gray (2.5Y 7/2) lime accumulations; violently effervescent; moderately alkaline; clear wavy boundary.

- Bk2**—28 to 36 inches; light olive brown (2.5Y 5/4) very fine sandy loam; few fine distinct grayish brown (2.5Y 5/2) iron depletions and few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline; clear wavy boundary.
- C1**—36 to 47 inches; light olive brown (2.5Y 5/4) very fine sandy loam; common fine distinct grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; few dark reddish brown (5YR 2.5/2) iron masses; strongly effervescent; moderately alkaline; clear wavy boundary.
- C2**—47 to 60 inches; light olive brown (2.5Y 5/4) very fine sandy loam; many fine distinct grayish brown (2.5Y 5/2) iron depletions and many fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few dark reddish brown (5YR 2.5/2) iron masses; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 14 to 32 inches

Thickness of the mollic epipedon: 16 to 24 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—silt loam

Bw horizon:

Hue—10YR or 2.5Y

Value—3 or 4

Chroma—2 or 3

Texture—very fine sandy loam or silt loam

Bk horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2 to 6

Texture—very fine sandy loam or silt loam

C horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2 to 6

Texture—very fine sandy loam or silt loam

497—Hantho silt loam

Composition

Hantho and similar soils: About 70 percent

Inclusions: About 30 percent

Setting

Landform: Flats

Slope range: 1 to 3 percent

Component Description

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 3 to 5 feet

Available water capacity to 60 inches or root-limiting layer: About 12.1 inches

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

Inclusions

- Perella and similar soils
- Quam and similar soils
- Glyndon and similar soils
- Rothsay and similar soils
- Waubay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Harps Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderate

Landform: Moraines

Parent material: Till

Slope range: 0 to 1 percent

Taxonomic class: Fine-loamy, mesic Typic Calciaquolls

Typical Pedon

Harps loam, in an area of Harps-Glencoe-Seaforth complex, 1,900 feet east and 150 feet north of the southwest corner of sec. 16, T. 116 N., R. 42 W.; lat. 44

degrees 50 minutes 57 seconds N. and long. 96 degrees 55 minutes 18 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; common fine roots; 1 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Ak—9 to 16 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; common gray (10YR 5/1) lime accumulations; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg1—16 to 21 inches; grayish brown (2.5Y 5/2) loam; few fine faint dark grayish brown (2.5Y 4/2) iron depletions; weak medium and fine subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—21 to 27 inches; grayish brown (2.5Y 5/2) loam; few fine faint dark grayish brown (2.5Y 4/2) iron depletions and few fine prominent light olive brown (2.5Y 5/6) iron concentrations; weak medium and fine subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; 1 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bkg3—27 to 38 inches; grayish brown (2.5Y 5/2) loam; few fine faint dark grayish brown (2.5Y 4/2) iron depletions and few fine prominent light olive brown (2.5Y 5/6) iron concentrations; weak coarse and medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 4/6) iron masses; 1 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg1—38 to 52 inches; grayish brown (2.5Y 5/2) loam; common fine faint dark grayish brown (2.5Y 4/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few grayish brown (2.5Y 5/2) gypsum crystals; common yellowish red (5YR 4/6) iron masses; 1 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg2—52 to 60 inches; grayish brown (2.5Y 5/2) loam; many fine faint dark grayish brown (2.5Y 4/2) iron depletions and many fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; few light brownish gray (2.5Y 6/2) lime

accumulations; many strong brown (7.5YR 4/6) iron masses; 1 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 12 to 24 inches

Content of rock fragments: 1 to 5 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—loam

Ak horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—loam

Bkg horizon:

Hue—10YR to 5Y

Value—5 or 6

Chroma—1 or 2

Texture—clay loam or loam

1108—Harps-Glencoe-Seaforth complex

Composition

Harps and similar soils: About 35 percent

Glencoe and similar soils: About 25 percent

Seaforth and similar soils: About 20 percent

Inclusions: About 20 percent

Setting

Landform: Harps—rims of depressions and flats;

Glencoe—depressions; Seaforth—knolls (fig. 1-4)

Slope range: Harps—0 to 1 percent; Glencoe—0 to 1 percent; Seaforth—1 to 3 percent

Component Description

Harps

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 1 to 3 feet

Available water capacity to 60 inches or root-limiting layer: About 11.1 inches

Glencoe

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained



Figure I-4.—An area of Harps-Glencoe-Seaforth complex. The Glencoe soil is in the ponded depression, the Harps soil is on the rim of the depression and on flats, and the Seaforth soil is on knolls.

Dominant parent material: Alluvium and till

Flooding: None

Available water capacity to 60 inches or root-limiting layer: About 11.1 inches

Seaforth

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 3 to 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.8 inches

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

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

Inclusions

- Normania and similar soils
- Rolfe and similar soils
- Ves and similar soils
- Webster and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hawick Series

Depth class: Very deep

Drainage class: Excessively drained

Permeability: Rapid or very rapid

Landform: Moraines

Parent material: Glacial outwash

Slope range: 6 to 12 percent

Taxonomic class: Sandy, mixed, mesic Entic Hapludolls

Typical Pedon

Hawick gravelly sandy loam, in an area of Storden-Hawick-Ves complex, 6 to 12 percent slopes, eroded, 2,500 feet south and 1,100 feet east of the northwest corner of sec. 20, T. 117 N., R. 43 W.; lat. 44 degrees 55 minutes 42 seconds N. and long. 96 degrees 04 minutes 45 seconds W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) gravelly sandy loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; few fine roots; 15 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bw—9 to 20 inches; dark brown (10YR 4/3) gravelly loamy sand; weak coarse subangular blocky structure; very friable; few fine roots; 25 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

C1—20 to 30 inches; dark brown (10YR 4/3) gravelly sand; single grain; loose; 30 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—30 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; 34 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 20 inches

Thickness of the mollic epipedon: 7 to 14 inches

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1 to 3

Texture—gravelly sandy loam

Content of rock fragments—3 to 25 percent

Bw horizon:

Hue—10YR

Value—3 or 4

Chroma—3 or 4

Texture—loamy sand, sand, or the gravelly analogs of these textures

Content of rock fragments—3 to 25 percent

C horizon:

Hue—10YR

Value—3 to 6

Chroma—2 to 6

Texture—coarse sand, sand, or the gravelly analogs of these textures

Content of rock fragments—3 to 35 percent

Heimdal Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Moraines

Parent material: Till

Slope range: 2 to 18 percent

Taxonomic class: Coarse-loamy, mixed Udic Haploborolls

Typical Pedon

Heimdal loam, in an area of Esmond-Heimdal complex, 2 to 6 percent slopes, 350 feet east and 1,400 feet south of the northwest corner of sec. 19, T. 119 N., R. 45 W.; lat. 45 degrees 06 minutes 22 seconds N. and long. 96 degrees 21 minutes 07 seconds W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; 3 percent gravel; neutral; abrupt smooth boundary.

Bw1—9 to 19 inches; dark brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; friable; few fine roots; 3 percent gravel; slightly alkaline; clear wavy boundary.

Bw2—19 to 25 inches; dark yellowish brown (10YR 4/4) loam; weak medium and fine subangular blocky structure; friable; few fine roots; few yellowish red (5YR 4/6) iron masses; 3 percent gravel; slightly alkaline; clear wavy boundary.

Bk—25 to 35 inches; grayish brown (2.5Y 5/2) loam; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 4/6) iron masses; 4 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C—35 to 60 inches; light olive brown (2.5Y 5/4) loam; massive; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 5/6) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 12 to 26 inches

Thickness of the mollic epipedon: 7 to 16 inches

Content of rock fragments: 1 to 10 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR
Value—2 or 3
Chroma—1
Texture—loam

Bw horizon:

Hue—10YR or 2.5Y
Value—2 to 5
Chroma—2 to 4
Texture—loam or sandy loam

Bk horizon:

Hue—2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—stratified loam and sandy loam

C horizon:

Hue—2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—stratified loam and sandy loam

Lakepark Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderately slow

Landform: Moraines

Parent material: Alluvium and till

Slope range: 1 to 3 percent

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

Typical Pedon

Lakepark loam, 200 feet south and 300 feet east of the northwest corner of sec. 28, T. 120 N., R. 46 W.; lat. 45 degrees 10 minutes 57 seconds N. and long. 96 degrees 26 minutes 01 second W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; few fine roots; slightly alkaline; abrupt smooth boundary.

A1—10 to 19 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

A2—19 to 26 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

Bg—26 to 37 inches; dark grayish brown (2.5Y 4/2) loam; few fine distinct olive brown (2.5Y 4/4) iron

concentrations and few fine faint grayish brown (2.5Y 5/2) iron depletions; weak medium and fine subangular blocky structure; friable; few fine roots; 1 percent gravel; slightly alkaline; clear wavy boundary.

Bkg—37 to 60 inches; grayish brown (2.5Y 5/2) loam; common fine distinct light olive brown (2.5Y 5/4) iron concentrations and few fine distinct gray (5Y 5/1) iron depletions; weak medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; 1 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 25 to 50 inches

Thickness of the mollic epipedon: 24 to 36 inches

Ap horizon:

Hue—10YR to 5Y or neutral
Value—2 or 3
Chroma—0 or 1
Texture—loam
Content of rock fragments—0 to 5 percent

A horizon:

Hue—10YR to 5Y or neutral
Value—2 or 3
Chroma—0 or 1
Texture—loam, clay loam, or silty clay loam
Content of rock fragments—0 to 5 percent

Bg horizon:

Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—loam or clay loam
Content of rock fragments—0 to 5 percent

Bkg horizon:

Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loam or clay loam
Content of rock fragments—2 to 8 percent

1938—Lakepark loam

Composition

Lakepark and similar soils: About 70 percent
Inclusions: About 30 percent

Setting

Landform: Drainageways

Slope range: 1 to 3 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium or colluvium and till
Flooding: None
Depth to the water table: 1 to 3 feet
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches

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

Inclusions

- Darnen and similar soils
- Hamerly and similar soils
- Parnell and similar soils
- Vallers and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Lamoure Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow or moderate
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Taxonomic class: Fine-silty, mixed (calcareous), frigid
 Cumulic Endoaquolls

Typical Pedon

Lamoure silty clay loam, occasionally flooded, 80 feet south and 700 feet east of the northwest corner of sec. 3, T. 118 N., R. 46 W.; lat. 45 degrees 03 minutes 56 seconds N. and long. 96 degrees 24 minutes 41 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

A1—9 to 33 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; strongly effervescent; moderately

alkaline; gradual smooth boundary.

A2—33 to 44 inches; black (5Y 2.5/1) silty clay loam, very dark gray (5Y 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.

A3—44 to 55 inches; very dark gray (5Y 3/1) silty clay loam, dark gray (5Y 4/1) dry; weak medium subangular blocky structure; friable; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg—55 to 60 inches; dark grayish brown (2.5Y 4/2) loam; few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 24 to more than 60 inches

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam

Content of rock fragments—none

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam or silt loam

Content of rock fragments—none

Cg horizon:

Hue—2.5Y or 5Y

Value—2 to 6

Chroma—1 or 2

Texture—silty clay loam, silt loam, or loam

Content of rock fragments—0 to 3 percent

418—Lamoure silty clay loam, occasionally flooded

Composition

Lamoure and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Flood plains

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained
Dominant parent material: Alluvium
Frequency of flooding: Occasional
Seasonal high water table: At the surface to 1.5 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 11.3 inches

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

Inclusions

- La Prairie and similar soils
- Marysland and similar soils
- Rauville and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Langhei Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate or moderately slow
Landform: Moraines
Parent material: Till
Slope range: 6 to 18 percent
Taxonomic class: Fine-loamy, mixed, frigid Typic Eutrochrepts

Typical Pedon

Langhei loam, 12 to 18 percent slopes, eroded, 1,700 feet east and 600 feet north of the southwest corner of sec. 18, T. 119 N., R. 43 W.; lat. 45 degrees 06 minutes 44 seconds N. and long. 96 degrees 05 minutes 50 seconds W.

Ap—0 to 6 inches; dark grayish brown (2.5Y 4/2) loam, light brownish gray (2.5Y 6/2) dry; weak medium subangular blocky structure; friable; few fine roots; common mixing of olive brown (2.5Y 4/4) subsoil material; 5 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk—6 to 16 inches; olive brown (2.5Y 4/4) loam; few fine prominent yellowish brown (10YR 5/6) relict iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few light

brownish gray (2.5Y 6/2) lime accumulations; 5 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—16 to 60 inches; olive brown (2.5Y 4/4) loam; common fine prominent yellowish brown (10YR 5/6) relict iron concentrations and few fine distinct grayish brown (2.5Y 5/2) relict iron depletions; massive; friable; few light brownish gray (2.5Y 6/2) lime accumulations; 5 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Content of rock fragments: 2 to 10 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—1 or 2

Texture—loam

Bk horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam or clay loam

C horizon:

Hue—2.5Y

Value—4 to 7

Chroma—2 to 4

Texture—loam or clay loam

220D2—Langhei loam, 12 to 18 percent slopes, eroded

Composition

Langhei and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Moraines

Position on the landform: Back slopes and shoulders

Slope range: 12 to 18 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

A typical soil series description with range in

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

Inclusions

- Lakepark and similar soils
- Lamoure and similar soils
- Barnes and similar soils
- Buse and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

942C2—Langhei-Barnes complex, 6 to 12 percent slopes, eroded

Composition

Langhei and similar soils: About 55 percent

Barnes and similar soils: About 30 percent

Inclusions: About 15 percent

Setting

Landform: Moraines

Position on the landform: Langhei—shoulders; Barnes—summits and back slopes

Slope range: 6 to 12 percent

Component Description

Langhei

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.3 inches

Barnes

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

A typical soil series description with range in

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

Inclusions

- Lakepark and similar soils
- Darnen and similar soils
- Svea and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

La Prairie Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Flood plains

Parent material: Alluvium

Slope range: 0 to 2 percent

Taxonomic class: Fine-loamy, mixed Cumulic Udic Haploborolls

Typical Pedon

La Prairie loam, occasionally flooded, 100 feet east and 1,650 feet south of the northwest corner of sec. 10, T. 118 N., R. 46 W.; lat. 45 degrees 02 minutes 48 seconds N. and long. 96 degrees 24 minutes 51 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A1—9 to 18 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; slightly effervescent; moderately alkaline; gradual smooth boundary.

A2—18 to 38 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bw—38 to 50 inches; dark brown (10YR 3/3) loam, dark brown (10YR 4/3) dry; weak medium subangular blocky structure; friable; few fine roots; strongly

effervescent; moderately alkaline; gradual smooth boundary.

C—50 to 60 inches; dark brown (10YR 4/3) loam; few fine distinct yellowish brown (10YR 5/4) iron concentrations; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 30 inches

Thickness of the mollic epipedon: 24 to 54 inches

Ap horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—loam

Content of rock fragments—0 percent

A horizon:

Hue—10YR or neutral

Value—2 or 3

Chroma—0 or 1

Texture—loam or silt loam

Content of rock fragments—0 percent

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 4

Chroma—1 to 3

Texture—loam or silt loam

Content of rock fragments—0 percent

C horizon:

Hue—10YR to 5Y

Value—3 to 5

Chroma—1 to 4

Texture—loam or silt loam

Content of rock fragments—0 to 3 percent

51—La Prairie loam, occasionally flooded

Composition

La Prairie and similar soils: About 90 percent

Inclusions: About 10 percent

Setting

Landform: Flood plains

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Alluvium

Frequency of flooding: Occasional

Depth to the water table: 3.5 to 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 11.5 inches

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

Inclusions

- Lamoure and similar soils
- Rauville and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Malachy Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—moderate or moderately rapid; lower part—rapid

Landform: Outwash plains

Parent material: Glacial outwash

Slope range: 0 to 3 percent

Taxonomic class: Coarse-loamy, mixed Pachic Udic Haploborolls

Typical Pedon

Malachy loam, 200 feet south and 300 feet east of the northwest corner of sec. 5, T. 119 N., R. 46 W.; lat. 45 degrees 09 minutes 09 seconds N. and long. 96 degrees 26 minutes 56 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

A—10 to 18 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—18 to 25 inches; dark yellowish brown (10YR 4/4) sandy loam; few fine faint dark brown (7.5YR 4/4) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (10YR 6/2) lime accumulations;

strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—25 to 30 inches; brown (10YR 5/3) sandy loam; few fine distinct dark brown (7.5YR 4/4) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few grayish brown (10YR 5/2) lime accumulations; strongly effervescent; moderately alkaline; gradual smooth boundary.

2Bk3—30 to 40 inches; brown (10YR 5/3) loamy sand; common fine distinct dark brown (7.5YR 4/4) iron concentrations; weak medium subangular blocky structure; very friable; few grayish brown (10YR 5/2) lime accumulations; strongly effervescent; moderately alkaline; gradual smooth boundary.

2C—40 to 60 inches; yellowish brown (10YR 5/4) loamy sand; many fine prominent yellowish brown (10YR 5/8) iron concentrations and many fine distinct gray (10YR 5/1) iron depletions; massive; very friable; common yellowish red (5YR 4/6) iron masses; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 16 to 24 inches

Depth to sand and gravel: 24 to 40 inches

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loam

Content of rock fragments—0 to 10 percent

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loam or sandy loam

Content of rock fragments—0 to 10 percent

Bk horizon:

Hue—10YR or 2.5Y

Value—3 to 6

Chroma—2 to 4

Texture—loam, sandy loam, or fine sandy loam

Content of rock fragments—0 to 10 percent

2Bk horizon:

Hue—10YR or 2.5Y

Value—3 to 6

Chroma—2 to 4

Texture—loamy sand, loamy fine sand, or fine sand

Content of rock fragments—0 to 16 percent

2C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 6

Texture—loamy coarse sand, loamy sand, gravelly loamy sand, or sand

Content of rock fragments—0 to 16 percent

347—Malachy loam

Composition

Malachy and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Knolls and flats

Slope range: 0 to 3 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: 3 to 5 feet

Available water capacity to 60 inches or root-limiting layer: About 7.4 inches

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

Inclusions

- Marysland and similar soils
- Embden and similar soils
- Spottswood and similar soils
- Sverdrup and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Marysland Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—moderate; lower part—rapid

Landform: Outwash plains

Parent material: Glacial outwash

Slope range: 0 to 2 percent

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, frigid Typic Calciaquolls

Typical Pedon

Marysland loam, 300 feet north and 1,000 feet east of the southwest corner of sec. 35, T. 116 N., R. 46 W.; lat. 44 degrees 48 minutes 21 seconds N. and long. 96 degrees 22 minutes 43 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Ak—9 to 17 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; few gray (10YR 5/1) lime accumulations; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg—17 to 25 inches; very dark gray (N 3/0) loam; common fine distinct light olive brown (2.5Y 5/4) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; few dark brown (7.5YR 3/2) iron masses; violently effervescent; moderately alkaline; clear wavy boundary.

2Cg—25 to 60 inches; grayish brown (2.5Y 5/2) gravelly coarse sand; common fine prominent yellowish brown (10YR 5/6) iron concentrations; single grain; loose; few light brownish gray (2.5Y 6/2) carbonate coatings on rock fragments; 17 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 7 to 30 inches

Depth to sand and gravel: 20 to 40 inches

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—loam

Content of rock fragments—0 to 3 percent

Ak horizon:

Hue—10YR to 5Y

Value—2 or 3

Chroma—1

Texture—loam

Content of rock fragments—0 to 3 percent

Bkg horizon:

Hue—10YR to 5Y or neutral

Value—3 to 6

Chroma—0 to 2

Texture—loam or clay loam

Content of rock fragments—0 to 7 percent

2Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 or 2

Texture—sand, coarse sand, loamy sand, or the gravelly analogs of these textures

Content of rock fragments—7 to 35 percent

246—Marysland loam

Composition

Marysland and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Outwash plains, flats, and drainageways

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: 1.0 to 2.5 feet

Available water capacity to 60 inches or root-limiting layer: About 6.3 inches

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

Inclusions

- Egeland and similar soils
- Forada and similar soils
- Malachy and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

McIntosh Series

Depth class: Very deep

Drainage class: Somewhat poorly drained

Permeability: Moderately slow or moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 1 to 3 percent

Taxonomic class: Fine-silty, frigid Aquic Calciborolls

Typical Pedon

McIntosh silt loam, 600 feet north and 30 feet east of the southwest corner of sec. 2, T. 119 N., R. 45 W.; lat. 45 degrees 08 minutes 23 seconds N. and long. 96 degrees 16 minutes 00 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—9 to 19 inches; olive brown (2.5Y 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common grayish brown (2.5Y 5/2) lime accumulations; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—19 to 27 inches; light olive brown (2.5Y 5/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk3—27 to 30 inches; light olive brown (2.5Y 5/4) silt loam; few fine distinct grayish brown (2.5Y 5/2) iron depletions and few fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline; clear smooth boundary.

2Bk4—30 to 43 inches; olive brown (2.5Y 4/4) loam; few fine distinct grayish brown (2.5Y 5/2) iron depletions and common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak medium subangular blocky structure; friable; common light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 4/6) iron masses; 5 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

2Bk5—43 to 55 inches; olive brown (2.5Y 4/4) loam; common fine distinct grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; common light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 4/6) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

2C—55 to 60 inches; olive brown (2.5Y 4/4) loam; common fine distinct grayish brown (2.5Y 5/2) iron

depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; few grayish brown (2.5Y 5/2) lime accumulations; few yellowish red (5YR 4/6) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 7 to 16 inches

Depth to till: 24 to 40 inches

Ap horizon:

Hue—10YR or 2.5Y

Value—2 or 3

Chroma—1 or 2

Texture—silt loam

Content of rock fragments—none

Bk horizon:

Hue—2.5Y or 10YR

Value—4 to 6

Chroma—1 to 4

Texture—silt loam or silty clay loam

Content of rock fragments—none

2Bk horizon:

Hue—2.5Y

Value—4 to 6

Chroma—3 or 4

Texture—loam or clay loam

Content of rock fragments—2 to 7 percent

2C horizon:

Hue—2.5Y

Value—4 to 6

Chroma—3 to 6

Texture—loam or clay loam

Content of rock fragments—2 to 7 percent

108—McIntosh silt loam

Composition

McIntosh and similar soils: About 80 percent

Inclusions: About 20 percent

Setting

Landform: Knolls

Slope range: 1 to 3 percent

Component Description

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 2 to 4 feet
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches

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

Inclusions

- Perella and similar soils
- Colvin and similar soils
- Bearden and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Mehurin Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately slow or slow;
 lower part—moderately slow or moderate
Landform: Moraines
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic class: Fine, montmorillonitic Aquertic
 Argiborolls

Typical Pedon

Mehurin clay loam, 0 to 2 percent slopes, 300 feet east and 300 feet north of the southwest corner of sec. 33, T. 118 N., R. 46 W.; lat. 44 degrees 58 minutes 50 seconds N. and long. 96 degrees 26 minutes 00 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; neutral; abrupt smooth boundary.

Bt1—9 to 14 inches; dark brown (10YR 3/3) clay loam, dark brown (10YR 4/3) dry; few fine distinct dark yellowish brown (10YR 4/6) iron concentrations; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 1 percent gravel; neutral; clear wavy boundary.

Bt2—14 to 21 inches; dark brown (10YR 4/3) clay loam;

common fine distinct dark yellowish brown (10YR 4/6) iron concentrations and few fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; 1 percent gravel; neutral; clear wavy boundary.

Bk1—21 to 29 inches; olive brown (2.5Y 4/4) clay loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations and common fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; 2 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—29 to 60 inches; olive brown (2.5Y 4/4) clay loam; many fine prominent yellowish brown (10YR 5/6) iron concentrations and gray (5Y 5/1) iron depletions; weak coarse and medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 4/6) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 14 to 36 inches
Thickness of the mollic epipedon: 8 to 16 inches
Content of rock fragments: 1 to 3 percent, by volume, throughout the profile

Ap horizon:
 Hue—10YR
 Value—2 or 3
 Chroma—1
 Texture—clay loam

Bt horizon:
 Hue—10YR or 2.5Y
 Value—3 to 5
 Chroma—2 to 4
 Texture—clay loam, silty clay, or clay

Bk horizon:
 Hue—2.5Y
 Value—4 to 6
 Chroma—2 to 4
 Texture—clay loam or loam

769A—Mehurin clay loam, 0 to 2 percent slopes

Composition

Mehurin and similar soils: About 75 percent
 Inclusions: About 25 percent

Setting

Landform: Flats

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 2 to 4 feet

Available water capacity to 60 inches or root-limiting layer: About 10.2 inches

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

Inclusions

- Forman and similar soils
- Hamerly and similar soils
- Parnell and similar soils
- Svea and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

769B—Mehurin clay loam, 2 to 6 percent slopes

Composition

Mehurin and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Moraines

Position on the landform: Summits and back slopes

Slope range: 2 to 6 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 2 to 4 feet

Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

Inclusions

- Forman and similar soils
- Hamerly and similar soils
- Parnell and similar soils
- Svea and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Normania Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Moraines

Parent material: Till

Slope range: 1 to 3 percent

Taxonomic class: Fine-loamy, mixed, mesic Aquic Hapludolls

Typical Pedon

Normania clay loam, 100 feet west and 100 feet north of the southeast corner of sec. 32, T. 116 N., R. 44 W.; lat. 44 degrees 48 minutes 19 seconds N. and long. 96 degrees 10 minutes 32 seconds W.

Ap—0 to 11 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common fine roots; 3 percent gravel; neutral; abrupt smooth boundary.

AB—11 to 14 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; few fine roots; few dark grayish brown (2.5Y 4/2) wormcasts; 3 percent gravel; neutral; clear smooth boundary.

Bw1—14 to 20 inches; dark grayish brown (2.5Y 4/2) clay loam; few fine distinct olive brown (2.5Y 4/4) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; 3 percent gravel; neutral; clear smooth boundary.

Bw2—20 to 23 inches; olive brown (2.5Y 4/4) clay loam;

few fine faint light olive brown (2.5Y 5/4) iron concentrations and few fine distinct dark grayish brown (2.5Y 4/2) iron depletions; weak medium subangular blocky structure; friable; few fine roots; 3 percent gravel; slightly alkaline; clear smooth boundary.

Bk1—23 to 28 inches; olive brown (2.5Y 4/4) loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations and few fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; 3 percent gravel; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—28 to 48 inches; olive brown (2.5Y 4/4) loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations and common fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; common light brownish gray (2.5Y 6/2) lime accumulations; 3 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—48 to 60 inches; olive brown (2.5Y 4/4) loam; many fine distinct light olive brown (2.5Y 5/6) iron concentrations and common fine prominent gray (5Y 5/1) iron depletions; massive; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 4/6) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 30 inches

Thickness of the mollic epipedon: 10 to 20 inches

Content of rock fragments: 3 to 7 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—clay loam

Bw horizon:

Hue—10YR or 2.5Y

Value—3 or 4

Chroma—2 to 4

Texture—clay loam or loam

Bk horizon:

Hue—2.5Y

Value—4 or 5

Chroma—2 to 4

Texture—loam or clay loam

446—Normania clay loam

Composition

Normania and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Flats

Slope range: 1 to 3 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 2.5 to 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 10.3 inches

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

Inclusions

- Glencoe and similar soils
- Webster and similar soils
- Seaforth and similar soils
- Ves and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Oldham Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Slow or moderately slow

Landform: Moraines and glacial lake plains

Parent material: Alluvium and till

Slope range: 0 to 1 percent

Taxonomic class: Fine, montmorillonitic (calcareous), frigid Vertic Epiaquolls

Typical Pedon

Oldham silty clay, 1,500 feet north and 200 feet east of the southwest corner of sec. 26, T. 117 N., R. 46 W.; lat. 44 degrees 54 minutes 38 seconds N. and long. 96

degrees 23 minutes 36 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; few shell fragments; strongly effervescent; slightly alkaline; abrupt smooth boundary.

A—10 to 17 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak medium and fine subangular blocky structure; friable; few fine roots; few shell fragments; strongly effervescent; slightly alkaline; clear wavy boundary.

Bg1—17 to 25 inches; very dark gray (N 3/0) silty clay, dark gray (N 4/0) dry; common fine distinct dark grayish brown (2.5Y 4/2) iron depletions; weak medium and fine subangular blocky structure; friable; few fine roots; few shell fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

Bg2—25 to 34 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; common fine faint olive gray (5Y 4/2) iron depletions; weak medium and fine subangular blocky structure; friable; few shell fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

Bg3—34 to 55 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; common fine faint olive gray (5Y 4/2) iron depletions; weak medium prismatic structure parting to weak fine subangular blocky; friable; few shell fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

2Cg—55 to 60 inches; olive gray (5Y 4/2) clay loam; common fine prominent light olive brown (2.5Y 5/6) iron concentrations; massive; friable; 1 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 24 to 60 inches

Depth to till: 40 to 60 inches

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay

Content of rock fragments—none

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay

Content of rock fragments—none

Bg horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay or silty clay loam

Content of rock fragments—none

Cg horizon:

Hue—2.5Y or 5Y

Value—3 to 5

Chroma—1 or 2

Texture—clay loam or silty clay loam

Content of rock fragments—0 to 3 percent

276—Oldham silty clay

Composition

Oldham and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Depressions

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Alluvium and till

Flooding: None

Available water capacity to 60 inches or root-limiting layer: About 10 inches

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

Inclusions

- Colvin and similar soils
- Dovray and similar soils
- Fulda and similar soils
- Bigstone and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Parle Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Upper part—moderately slow or moderate;
lower part—moderate to rapid

Landform: Moraines

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic class: Fine-loamy, mixed (calcareous), frigid
Cumulic Endoaquolls

Typical Pedon

Parle clay loam, 2,000 feet east and 250 feet north of the southwest corner of sec. 4, T. 117 N., R. 43 W.; lat. 44 degrees 57 minutes 57 seconds N. and long. 96 degrees 03 minutes 18 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

A1—9 to 17 inches; very dark gray (5Y 3/1) clay loam, dark gray (5Y 4/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; 2 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

A2—17 to 26 inches; very dark grayish brown (2.5Y 3/2) clay loam, dark grayish brown (2.5Y 4/2) dry; weak medium subangular blocky structure; friable; few fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

Bkg1—26 to 34 inches; grayish brown (2.5Y 5/2) loam; common fine faint dark grayish brown (2.5Y 4/2) iron depletions and few fine prominent light olive brown (2.5Y 5/6) iron concentrations; weak coarse subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—34 to 42 inches; grayish brown (2.5Y 5/2) loam; many fine prominent light olive brown (2.5Y 5/6) and few fine prominent yellowish brown (10YR 5/8) iron concentrations; weak coarse subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline; clear wavy boundary.

Bkg3—42 to 50 inches; grayish brown (2.5Y 5/2) fine sandy loam; few fine faint dark grayish brown (2.5Y 4/2) iron depletions and few fine prominent light olive brown (2.5Y 5/6) iron concentrations; weak coarse subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; slightly effervescent; slightly alkaline; clear smooth boundary.

2Cg—50 to 60 inches; dark grayish brown (2.5Y 4/2) loamy fine sand; many fine prominent yellowish

brown (10YR 5/8) iron concentrations and few fine faint grayish brown (2.5Y 5/2) iron depletions; single grain; loose; few black (10YR 2/1) iron masses; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Thickness of the mollic epipedon: 24 to 46 inches

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—clay loam

Content of rock fragments—0 to 2 percent

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 to 2

Texture—clay loam, loam, or silt loam

Content of rock fragments—0 to 2 percent

Bkg horizon:

Hue—2.5Y or 5Y

Value—3 to 6

Chroma—1 or 2

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

Content of rock fragments—0 to 2 percent

2Cg horizon:

Hue—2.5Y or 5Y

Value—4 or 5

Chroma—1 or 2

Texture—loamy fine sand, loamy sand, fine sandy loam, sandy loam, or loam

Content of rock fragments—0 to 10 percent

1222—Parle clay loam

Composition

Parle and similar soils: About 80 percent

Inclusions: About 20 percent

Setting

Landform: Drainageways and flats

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 10.2 inches

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

Inclusions

- Bigstone and similar soils
- Hamerly and similar soils
- Vallers and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Parnell Series

Depth class: Very deep

Drainage class: Very poorly drained and poorly drained

Permeability: Slow

Landform: Moraines and glacial lake plains

Parent material: Colluvium and till

Slope range: 0 to 2 percent

Taxonomic class: Fine, montmorillonitic, frigid Vertic Argiaquolls

Typical Pedon

Parnell silty clay loam, depressional, 2,000 feet south and 2,600 feet west of the northeast corner of sec. 7, T. 119 N., R. 45 W.; lat. 45 degrees 07 minutes 52 seconds N. and long. 96 degrees 20 minutes 18 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; common fine roots; slightly acid; abrupt smooth boundary.

A—10 to 18 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; few very dark gray (10YR 3/1) silt coatings on faces of peds; slightly acid; clear wavy boundary.

Btg1—18 to 27 inches; very dark grayish brown (10YR 3/2) silty clay, dark grayish brown (10YR 4/2) dry; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium prismatic structure parting to moderate fine subangular blocky; friable;

few fine roots; common distinct very dark brown (10YR 2/2) clay films on faces of peds; few yellowish red (5YR 5/6) iron masses; slightly acid; clear wavy boundary.

Btg2—27 to 38 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine prominent strong brown (7.5YR 5/8) iron concentrations and few fine faint grayish brown (2.5Y 5/2) iron depletions; weak medium prismatic structure parting to moderate fine subangular blocky; friable; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; clear wavy boundary.

Btg3—38 to 60 inches; olive gray (5Y 4/2) silty clay loam; common fine prominent yellowish brown (10YR 5/8) iron concentrations and common fine faint olive gray (5Y 5/2) iron depletions; weak medium and fine subangular blocky structure; friable; few faint very dark grayish brown (2.5Y 3/2) clay films on faces of peds; few dark brown (7.5YR 3/2) iron masses; neutral.

Range in Characteristics

Depth to carbonates: 35 to more than 60 inches

Thickness of the mollic epipedon: 24 to 60 inches

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam

Content of rock fragments—none

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—silty clay loam

Content of rock fragments—none

Btg horizon:

Hue—10YR to 5Y

Value—2 to 4

Chroma—1 or 2

Texture—silty clay, silty clay loam, clay loam, or loam

Content of rock fragments—0 to 3 percent

34—Parnell silty clay loam, depressional

Composition

Parnell and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Depressions

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Alluvium and till

Flooding: None

Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

Inclusions

- Hamerly and similar soils
- Lakepark and similar soils
- Vallers and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

680—Parnell silty clay loam

Composition

Parnell and similar soils: About 80 percent

Inclusions: About 20 percent

Setting

Landform: Drainageways

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Alluvium or colluvium and till

Flooding: None

Depth to the water table: 1 to 3 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

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

Inclusions

- Forman and similar soils
- Lakepark and similar soils
- Vallers and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Perella Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderately slow or moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 1 percent

Taxonomic class: Fine-silty, mixed, frigid Typic Endoaquolls

Typical Pedon

Perella silty clay loam, 2,700 feet east and 500 feet north of the southwest corner of sec. 32, T. 120 N., R. 44 W.; lat. 45 degrees 09 minutes 14 seconds N. and long. 96 degrees 12 minutes 53 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

A—8 to 16 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bg—16 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.

Bkg—25 to 30 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent light olive brown (2.5Y 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cg1—30 to 35 inches; light olive brown (2.5Y 5/4) silt loam; few fine distinct light olive brown (2.5Y 5/6) iron concentrations; massive; friable; few fine roots;

strongly effervescent; moderately alkaline; gradual wavy boundary.

Cg2—35 to 60 inches; light olive brown (2.5Y 5/4) silty clay loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations and grayish brown (2.5Y 5/2) iron depletions; massive; friable; few fine roots; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 16 to 36 inches

Thickness of the mollic epipedon: 10 to 24 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR to 5Y

Value—2 or 3

Chroma—1

Texture—silty clay loam

A horizon:

Hue—10YR to 5Y

Value—2 or 3

Chroma—1

Texture—silty clay loam

Bg horizon:

Hue—10YR to 5Y or neutral

Value—2 to 4

Chroma—0 to 3

Texture—silty clay loam or silt loam

Bkg horizon:

Hue—10YR to 5Y or neutral

Value—2 to 5

Chroma—0 to 3

Texture—silty clay loam or silt loam

Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 to 4

Texture—silty clay loam or silt loam

434—Perella silty clay loam

Composition

Perella and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Drainageways and flats

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet

Available water capacity to 60 inches or root-limiting layer: About 11.6 inches

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

Inclusions

- Bearden and similar soils
- Colvin and similar soils
- Dovray and similar soils
- Fulda and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1013—Pits, quarry

Composition

Pits: 95 percent

Inclusions: About 5 percent

Component Description

Surface material: Unweathered bedrock

Flooding: None

Depth to the water table: More than 6 feet

Inclusions

- Yellowbank and similar soils

Poinsett Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 1 to 6 percent

Taxonomic class: Fine-silty, mixed Udic Haploborolls

Typical Pedon

Poinsett silty clay loam, 1 to 4 percent slopes, 2,500 feet south and 75 feet west of the northeast corner of sec. 27, T. 120 N., R. 45 W.; lat. 45 degrees 10

minutes 29 seconds N. and long. 96 degrees 16 minutes 07 seconds W.

- Ap**—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.
- A**—8 to 12 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.
- Bw1**—12 to 15 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common fine roots; neutral; gradual wavy boundary.
- Bw2**—15 to 20 inches; dark grayish brown (10YR 4/2) silty clay loam; weak medium subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.
- Bk1**—20 to 26 inches; dark grayish brown (2.5Y 4/2) silt loam; weak fine subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; violently effervescent; moderately alkaline; clear wavy boundary.
- Bk2**—26 to 36 inches; light olive brown (2.5Y 5/4) silt loam; weak medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few grayish brown (2.5Y 5/2) gypsum crystals; strongly effervescent; moderately alkaline; gradual wavy boundary.
- C**—36 to 60 inches; olive brown (2.5Y 4/4) silt loam; few fine prominent light gray (10YR 6/1) relict iron depletions and few fine distinct light olive brown (2.5Y 5/6) relict iron concentrations; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 15 to 30 inches
Thickness of the mollic epipedon: 8 to 16 inches
Content of rock fragments: None

Ap horizon:
 Hue—10YR
 Value—2 or 3
 Chroma—1
 Texture—silty clay loam

A horizon:
 Hue—10YR
 Value—2 or 3
 Chroma—1
 Texture—silty clay loam

Bw horizon:
 Hue—10YR or 2.5Y
 Value—2 to 4

Chroma—1 to 4
 Texture—silty clay loam or silt loam

Bk horizon:
 Hue—2.5Y or 10YR
 Value—4 to 6
 Chroma—2 to 4
 Texture—silt loam or silty clay loam

C horizon:
 Hue—2.5Y
 Value—4 to 6
 Chroma—2 to 4
 Texture—silt loam or silty clay loam

284B—Poinsett silty clay loam, 1 to 4 percent slopes

Composition

Poinsett and similar soils: About 75 percent
 Inclusions: About 25 percent

Setting

Landform: Collapsed lake plain
Position on the landform: Summits and back slopes
Slope range: 1 to 4 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 11.1 inches

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

Inclusions

- Parnell and similar soils
- Perella and similar soils
- Buse and similar soils
- Waubay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

741B—Poinsett-Buse complex, 2 to 6 percent slopes

Composition

Poinsett and similar soils: About 45 percent
 Buse and similar soils: About 30 percent
 Inclusions: About 25 percent

Setting

Landform: Moraines
Position on the landform: Poinsett—summits and back slopes; Buse—shoulders
Slope range: Poinsett—2 to 6 percent; Buse—3 to 6 percent

Component Description

Poinsett

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 11.8 inches

Buse

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches

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

Inclusions

- Parnell and similar soils
- Perella and similar soils
- Waubay and similar soils
- Zell and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Quam Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow
Landform: Moraines
Parent material: Alluvium
Slope range: 0 to 1 percent
Taxonomic class: Fine-silty, mixed, frigid Cumulic Endoaquolls

Typical Pedon

Quam silty clay loam, 150 feet north and 150 feet west of the southeast corner of sec. 23, T. 117 N., R. 43 W.; lat. 44 degrees 55 minutes 16 seconds N. and long. 96 degrees 00 minutes 08 seconds W.

- Ap—0 to 9 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.
- A1—9 to 36 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak fine subangular blocky structure; friable; few fine roots; slightly alkaline; clear smooth boundary.
- A2—36 to 54 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; few fine distinct very dark grayish brown (2.5Y 3/2) iron depletions; weak fine subangular blocky structure; friable; few fine roots; slightly alkaline; clear wavy boundary.
- Cg—54 to 60 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct olive (5Y 5/4) and few fine prominent dark brown (7.5YR 4/4) iron concentrations; massive; friable; few light gray (2.5Y 7/2) lime accumulations; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 60 inches
Thickness of the mollic epipedon: 24 to 60 inches
Depth to till: 38 to more than 60 inches

Ap horizon:

Hue—10YR to 5Y or neutral
 Value—2
 Chroma—0 or 1
 Texture—silty clay loam
 Content of rock fragments—none

A horizon:

Hue—10YR to 5Y or neutral
 Value—2 or 3
 Chroma—0 or 1
 Texture—silty clay loam or silt loam
 Content of rock fragments—none

Cg horizon:

Hue—2.5Y or 5Y
 Value—4 or 5
 Chroma—1 or 2
 Texture—silty clay loam, silt loam, or clay loam
 Content of rock fragments—0 to 7 percent

344—Quam silty clay loam**Composition**

Quam and similar soils: About 75 percent
 Inclusions: About 25 percent

Setting

Landform: Depressions
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium and till
Flooding: None
Available water capacity to 60 inches or root-limiting layer: About 11.3 inches

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

Inclusions

- Bigstone and similar soils
- Parle and similar soils
- Vallery and similar soils
- Parnell and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Rauville Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderate or moderately slow;
 lower part—moderately rapid

Landform: Flood plains

Parent material: Alluvium

Slope range: 0 to 1 percent

Taxonomic class: Fine-silty, mixed (calcareous), frigid
 Cumulic Endoaquolls

Typical Pedon

Rauville silty clay loam, frequently flooded, 100 feet south and 700 feet east of the northwest corner of sec. 4, T. 118 N., R. 46 W.; lat. 45 degrees 03 minutes 09 seconds N. and long. 96 degrees 25 minutes 06 seconds W.

A1—0 to 10 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak medium subangular blocky structure; friable; common fine roots; few shell fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

A2—10 to 36 inches; black (5Y 2.5/1) silty clay loam, very dark gray (5Y 3/1) dry; weak coarse subangular blocky structure; friable; few fine roots; few shell fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

A3—36 to 42 inches; very dark gray (5Y 3/1) silty clay loam, dark gray (5Y 4/1) dry; weak coarse subangular blocky structure; friable; few fine roots; few shell fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg—42 to 60 inches; dark gray (5Y 4/1) silty clay loam; common fine prominent olive brown (2.5Y 4/4) iron concentrations; massive; friable; few shell fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile
Thickness of the mollic epipedon: 24 to more than 60 inches

Content of rock fragments: None

A horizon:

Hue—10YR to 5Y or neutral
 Value—2 or 3
 Chroma—0 to 2
 Texture—silty clay loam

Cg horizon:

Hue—10YR to 5Y or neutral
 Value—4 or 5
 Chroma—0 to 2
 Texture—silty clay loam, silt loam, clay loam, or loam

450—Rauville silty clay loam, frequently flooded

Composition

Rauville and similar soils: About 70 percent

Inclusions: About 30 percent

Setting

Landform: Flood plains

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Very poorly drained

Dominant parent material: Alluvium

Frequency of flooding: Frequent

Available water capacity to 60 inches or root-limiting layer: About 11.9 inches

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

Inclusions

- Bigstone and similar soils
- Darnen and similar soils
- Lamoure and similar soils
- La Prairie and similar soils

Rolfe Series

Depth class: Very deep

Drainage class: Very poorly drained

Permeability: Slow

Landform: Moraines

Parent material: Alluvium and till

Slope range: 0 to 1 percent

Taxonomic class: Fine, montmorillonitic, mesic Vertic Argialbolls

Typical Pedon

Rolfe silt loam, 300 feet north and 1,200 feet west of the southeast corner of sec. 34, T. 116 N., R. 44 W.; lat. 44 degrees 48 minutes 21 seconds N. and long. 96 degrees 08 minutes 20 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

A—10 to 15 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak medium subangular

blocky structure; friable; few fine roots; neutral; clear wavy boundary.

E—15 to 22 inches; dark gray (10YR 4/1) silt loam; weak medium platy structure parting to weak fine subangular blocky; friable; few fine roots; common gray (10YR 5/1) silt coatings on faces of peds; neutral; clear wavy boundary.

Btg1—22 to 28 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct very dark gray (10YR 3/1) clay films on faces of peds; few strong brown (7.5YR 5/6) iron masses; neutral; clear wavy boundary.

Btg2—28 to 34 inches; olive gray (5Y 4/2) clay; few fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; common strong brown (7.5YR 5/6) iron masses; neutral; clear wavy boundary.

2Btg3—34 to 50 inches; olive gray (5Y 5/2) clay loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; common faint very dark grayish brown (2.5Y 3/2) clay films on faces of peds; many yellowish red (5YR 4/6) iron masses; 3 percent gravel; neutral; gradual wavy boundary.

2Cg—50 to 60 inches; olive gray (5Y 5/2) clay loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; many yellowish red (5YR 4/6) iron masses; 3 percent gravel; slightly alkaline.

Range in Characteristics

Depth to carbonates: 42 to more than 60 inches

Thickness of the mollic epipedon: 10 to 24 inches

Depth to till: 28 to more than 60 inches

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—silt loam

Content of rock fragments—0 to 3 percent

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—silt loam

Content of rock fragments—0 to 3 percent

E horizon:

Hue—10YR
 Value—4 to 6
 Chroma—1
 Texture—silt loam
 Content of rock fragments—0 to 3 percent

Btg horizon:

Hue—10YR to 5Y
 Value—3 to 6
 Chroma—1 or 2
 Texture—silty clay or clay
 Content of rock fragments—0 to 3 percent

2Btg horizon:

Hue—10YR to 5Y
 Value—3 to 6
 Chroma—1 or 2
 Texture—clay loam
 Content of rock fragments—1 to 7 percent

2Cg horizon:

Hue—5Y
 Value—4 to 6
 Chroma—1 or 2
 Texture—clay loam or loam
 Content of rock fragments—1 to 7 percent

219—Rolfe silt loam**Composition**

Rolfe and similar soils: About 75 percent
 Inclusions: About 25 percent

Setting

Landform: Depressions
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium and till
Flooding: None
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

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

Inclusions

- Glencoe and similar soils
- Harps and similar soils
- Seaforth and similar soils

- Webster and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Rothsay Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 1 to 6 percent
Taxonomic class: Coarse-silty, mixed Udic Haploborolls

Typical Pedon

Rothsay silt loam, 1 to 4 percent slopes, 600 feet north and 75 feet west of the southeast corner of sec. 29, T. 120 N., R. 44 W.; lat. 45 degrees 10 minutes 10 seconds N. and long. 96 degrees 11 minutes 11 seconds W.

- Ap—0 to 10 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.
- Bw1—10 to 15 inches; dark brown (10YR 3/3) very fine sandy loam, dark brown (10YR 4/3) dry; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.
- Bw2—15 to 25 inches; dark yellowish brown (10YR 4/4) very fine sandy loam; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.
- Bk—25 to 35 inches; brown (10YR 5/3) very fine sandy loam; weak fine subangular blocky structure; very friable; few fine roots; few light gray (10YR 7/1) lime accumulations; strongly effervescent; moderately alkaline; clear wavy boundary.
- C—35 to 60 inches; brown (10YR 5/3) silt; common fine prominent yellowish brown (10YR 5/8) relict iron concentrations; massive; very friable; few light gray (10YR 6/1) lime accumulations; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 12 to 30 inches
Thickness of the mollic epipedon: 8 to 16 inches
Content of rock fragments: None

Ap horizon:

Hue—10YR
Value—2 or 3
Chroma—1
Texture—silt loam

Bw horizon:

Hue—10YR
Value—3 to 5
Chroma—2 to 4
Texture—very fine sandy loam, silt loam, or silt

Bk horizon:

Hue—10YR
Value—4 to 6
Chroma—2 to 4
Texture—very fine sandy loam, silt loam, or silt

C horizon:

Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—very fine sandy loam, silt loam, or silt

290B—Rothsay silt loam, 1 to 4 percent slopes

Composition

Rothsay and similar soils: About 70 percent
Inclusions: About 30 percent

Setting

Landform: Collapsed lake plain
Position on the landform: Summits and back slopes
Slope range: 1 to 4 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 12.6 inches

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

Inclusions

- Perella and similar soils
- Quam and similar soils
- Hantho and similar soils
- Zell and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Seaforth Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 1 to 3 percent
Taxonomic class: Fine-loamy, mixed, mesic Aquic Calciudolls

Typical Pedon

Seaforth clay loam, in an area of Harps-Glencoe-Seaforth complex, 600 feet east and 200 feet north of the southwest corner of sec. 21, T. 116 N., R. 44 W.; lat. 44 degrees 50 minutes 04 seconds N. and long. 96 degrees 10 minutes 19 seconds W.

- Ap—0 to 9 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common fine roots; 1 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.
- Bk1—9 to 14 inches; dark grayish brown (2.5Y 4/2) loam; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (10YR 6/2) lime accumulations; 2 percent gravel; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk2—14 to 20 inches; grayish brown (2.5Y 5/2) loam; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (10YR 6/2) lime accumulations; 3 percent gravel; violently effervescent; moderately alkaline; clear smooth boundary.
- Bk3—20 to 30 inches; light olive brown (2.5Y 5/4) loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few light gray (10YR 6/2) lime accumulations; 3 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.
- C—30 to 60 inches; yellowish brown (2.5Y 5/4) loam; few fine distinct grayish brown (2.5Y 5/2) iron concentrations; massive; friable; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 8 to 20 inches

Content of rock fragments: 3 to 8 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—clay loam or loam

Bk horizon:

Hue—2.5Y or 10YR

Value—4 or 5

Chroma—2 to 4

Texture—loam or clay loam

423—Seaforth loam**Composition**

Seaforth and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Knolls

Slope range: 1 to 3 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 3 to 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.9 inches

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

Inclusions

- Harps and similar soils
- Glencoe and similar soils
- Normania and similar soils
- Swanlake and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Sinai Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Slow or very slow

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 1 to 6 percent

Taxonomic class: Fine, montmorillonitic Udertic Haploborolls

Typical Pedon

Sinai silty clay loam, 1 to 3 percent slopes, 2,300 feet west and 1,200 feet south of the northeast corner of sec. 28, T. 119 N., R. 44 W.; lat. 45 degrees 05 minutes 29 seconds N. and long. 96 degrees 10 minutes 30 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

A—10 to 17 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw—17 to 24 inches; very dark grayish brown (2.5Y 3/2) silty clay, dark grayish brown (2.5Y 4/2) dry; moderate fine subangular blocky structure; friable; few fine roots; common black (10YR 2/1) tongues; neutral; clear wavy boundary.

Bk1—24 to 34 inches; dark grayish brown (2.5Y 4/2) silty clay; few fine faint grayish brown (2.5Y 5/2) iron depletions; moderate fine subangular blocky structure; friable; few fine roots; few light gray (2.5Y 7/2) lime accumulations; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—34 to 60 inches; light olive brown (2.5Y 5/4) silty clay; few fine distinct grayish brown (2.5Y 5/2) iron depletions and few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium and fine subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 17 to 35 inches

Thickness of the mollic epipedon: 16 to 25 inches

Content of rock fragments: None

Ap and A horizons:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—silty clay loam or silty clay

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 4

Chroma—1 to 3

Texture—silty clay loam or silty clay

Bk horizon:

Hue—10YR to 5Y

Value—3 to 6

Chroma—1 to 6

Texture—silty clay loam or silty clay

212A—Sinai silty clay loam, 1 to 3 percent slopes

Composition

Sinai and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Flats

Slope range: 1 to 3 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 3.5 to 5.0 feet

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

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

Inclusions

- Dovray and similar soils
- Fulda and similar soils
- Poinsett and similar soils
- Waubay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

212B—Sinai silty clay, 3 to 6 percent slopes

Composition

Sinai and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Flats and side slopes

Slope range: 3 to 6 percent

Component Description

Surface layer texture: Silty clay

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 8.8 inches

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

Inclusions

- Dovray and similar soils
- Fulda and similar soils
- Poinsett and similar soils
- Waubay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Sioux Series

Depth class: Very deep

Drainage class: Excessively drained

Permeability: Rapid or very rapid

Landform: Outwash plains and moraines

Parent material: Glacial outwash

Slope range: 10 to 40 percent

Taxonomic class: Sandy-skeletal, mixed Udorthentic Haploborolls

Typical Pedon

Sioux gravelly loam, 12 to 40 percent slopes, 2,600 feet north and 1,300 feet west of the southeast corner of sec. 20, T. 119 N., R. 46 W.; lat. 45 degrees 06

minutes 11 seconds N. and long. 96 degrees 26 minutes 21 seconds W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) gravelly loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; few fine roots; 20 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

AC—7 to 10 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky structure; friable; few fine roots; 25 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—10 to 33 inches; dark brown (10YR 4/3) very gravelly coarse sand; single grain; loose; few light brownish gray (10YR 6/2) carbonate coatings on rock fragments; 40 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—33 to 60 inches; yellowish brown (10YR 5/4) very gravelly coarse sand; single grain; loose; common strong brown (7.5YR 4/6) iron stains; few light brownish gray (10YR 6/2) carbonate coatings on rock fragments; 50 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 8 inches

Thickness of the mollic epipedon: 7 to 14 inches

Depth to sand and gravel: 6 to 14 inches

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—gravelly loam

Content of rock fragments—15 to 35 percent

AC horizon:

Hue—10YR

Value—3 or 4

Chroma—2 or 3

Texture—sandy loam, loam, or the gravelly analogs of these textures

Content of rock fragments—15 to 35 percent

C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—coarse sand, sand, loamy sand, or the very gravelly analogs of these textures

Content of rock fragments—35 to 65 percent

402F—Sioux gravelly loam, 12 to 40 percent slopes

Composition

Sioux and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Outwash plains

Position on the landform: Back slopes and shoulders

Slope range: 12 to 40 percent

Component Description

Surface layer texture: Gravelly loam

Depth class: Very deep (more than 60 inches)

Drainage class: Excessively drained

Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 3.5 inches

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

Inclusions

- Lamoure and similar soils
- Esmond and similar soils
- Sverdrup and similar soils

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Sisseton Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Moraines

Parent material: Till

Slope range: 6 to 18 percent

Taxonomic class: Coarse-loamy, mixed, frigid Typic Eutrochrepts

Typical Pedon

Sisseton loam, in an area of Sisseton-Heimdal complex, 6 to 12 percent slopes, eroded, 500 feet south and 300 feet east of the northwest corner of sec. 28, T. 120 N., R. 46 W.; lat. 45 degrees 10 minutes 49 seconds N.

and long. 96 degrees 26 minutes 01 second W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; weak medium and fine subangular blocky structure; friable; few fine roots; mixing of olive brown (2.5Y 4/4) subsoil material; 2 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—6 to 20 inches; olive brown (2.5Y 4/4) loam; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; 3 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—20 to 24 inches; light olive brown (2.5Y 5/4) sandy loam; weak medium subangular blocky structure; very friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; 2 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—24 to 46 inches; light olive brown (2.5Y 5/4) loam; common fine prominent yellowish brown (10YR 5/8) relict iron concentrations; massive; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 5/8) iron masses; 4 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—46 to 60 inches; light olive brown (2.5Y 5/4) sandy loam; few fine prominent yellowish brown (10YR 5/8) relict iron concentrations; massive; very friable; 2 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Ap horizon:

Hue—10YR

Value—2 to 5

Chroma—2 or 3

Texture—loam

Content of rock fragments—1 to 7 percent

Bk horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam, sandy loam, or silt loam

Content of rock fragments—1 to 10 percent

C horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—stratified loam, sandy loam, or silt loam

Content of rock fragments—1 to 10 percent

396D2—Sisseton loam, 12 to 18 percent slopes, eroded

Composition

Sisseton and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Moraines

Position on the landform: Back slopes and shoulders

Slope range: 12 to 18 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.1 inches

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

Inclusions

- Lakepark and similar soils
- Darnen and similar soils
- Heimdal and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

777C2—Sisseton-Heimdal complex, 6 to 12 percent slopes, eroded

Composition

Sisseton and similar soils: About 60 percent

Heimdal and similar soils: About 30 percent

Inclusions: About 10 percent

Setting

Landform: Moraines

Position on the landform: Sisseton—shoulders;

Heimdal—summits and back slopes

Slope range: 6 to 12 percent

Component Description**Sisseton**

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.2 inches

Heimdal

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 9.4 inches

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

Inclusions

- Lakepark and similar soils
- Darnen and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1107D—Sisseton-Sioux-Heimdal complex, 6 to 18 percent slopes, eroded**Composition**

Sisseton and similar soils: About 30 percent

Sioux and similar soils: About 30 percent

Heimdal and similar soils: About 25 percent

Inclusions: About 15 percent

Setting

Landform: Moraines

Position on the landform: Sisseton—shoulders; Sioux—shoulders and summits; Heimdal—summits and back slopes

Slope range: 6 to 18 percent

Component Description**Sisseton**

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.3 inches

Sioux

Surface layer texture: Gravelly loam

Depth class: Very deep (more than 60 inches)

Drainage class: Excessively drained

Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 5 inches

Heimdal

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 9.5 inches

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

Inclusions

- Lakepark and similar soils
- Darnen and similar soils
- Sverdrup and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Spottswood Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Upper part—moderate; lower part—rapid

Landform: Outwash plains

Parent material: Glacial outwash

Slope range: 0 to 2 percent

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed Pachic Udic Haploborolls

Typical Pedon

Spottswood loam, 50 feet south and 1,400 feet east of the northwest corner of sec. 19, T. 124 N., R. 48 W., in Big Stone County, Minnesota; lat. 42 degrees 32 minutes 41 seconds N. and long. 96 degrees 44 minutes 06 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

Bw1—8 to 19 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw2—19 to 22 inches; dark grayish brown (10YR 4/2) clay loam; weak coarse prismatic structure parting to weak medium and fine subangular blocky; friable; neutral; gradual wavy boundary.

Bw3—22 to 32 inches; dark grayish brown (2.5Y 4/2) loam; common fine and medium distinct light olive brown (2.5Y 5/6) iron concentrations; weak coarse prismatic structure; friable; neutral; clear smooth boundary.

2C—32 to 60 inches; grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) gravelly sand; single grain; loose; 30 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 18 to 34 inches

Thickness of the mollic epipedon: 16 to 30 inches

Depth to sand or gravel: 20 to 40 inches

Ap and A horizons:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—loam

Content of rock fragments—0 to 3 percent

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 4

Chroma—1 or 2

Texture—loam or clay loam

Content of rock fragments—0 to 3 percent

2C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—coarse sand, sand, or the gravelly and

very gravelly analogs of these textures

Content of rock fragments—15 to 65 percent

314—Spottswood loam

Composition

Spottswood and similar soils: About 70 percent

Inclusions: About 30 percent

Setting

Landform: Outwash plains

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: 3 to 5 feet

Available water capacity to 60 inches or root-limiting layer: About 7.7 inches

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

Inclusions

- Marysland and similar soils
- Arvilla and similar soils
- Fordville and similar soils
- Malachy and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Storden Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Moraines

Parent material: Till

Slope range: 6 to 18 percent

Taxonomic class: Fine-loamy, mixed, mesic Typic Eutrochrepts

Typical Pedon

Storden loam, in an area of Storden-Ves complex, 6 to 12 percent slopes, eroded, 2,400 feet east and 800 feet north of the southwest corner of sec. 31, T. 116 N., R. 44 W.; lat. 44 degrees 48 minutes 27 seconds N. and long. 96 degrees 12 minutes 21 seconds W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; few fine roots; few brown (10YR 5/3) streaks; 2 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—5 to 15 inches; brown (10YR 5/3) loam; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (10YR 6/2) lime accumulations; few yellowish red (5YR 4/8) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—15 to 60 inches; light olive brown (2.5Y 5/4) loam; weak coarse subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 5/8) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Ap horizon:

Hue—10YR

Value—4 or 5

Chroma—2 or 3

Texture—loam

Content of rock fragments—1 to 3 percent

Bk horizon:

Hue—10YR or 2.5Y

Value—5 or 6

Chroma—2 to 6

Texture—loam or clay loam

Content of rock fragments—2 to 10 percent

31D2—Storden loam, 12 to 18 percent slopes, eroded**Composition**

Storden and similar soils: About 65 percent

Inclusions: About 35 percent

Setting

Landform: Moraines

Position on the landform: Back slopes and shoulders

Slope range: 12 to 18 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

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

Inclusions

- Webster and similar soils
- Calco and similar soils
- Normania and similar soils
- Swanlake and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

954C2—Storden-Ves complex, 6 to 12 percent slopes, eroded**Composition**

Storden and similar soils: About 50 percent

Ves and similar soils: About 30 percent

Inclusions: About 20 percent

Setting

Landform: Moraines

Position on the landform: Storden—shoulders; Ves—summits and back slopes

Slope range: 6 to 12 percent

Component Description**Storden**

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

Ves

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

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

Inclusions

- Webster and similar soils
- Harps and similar soils
- Normania and similar soils
- Seaforth and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1106C—Storden-Hawick-Ves complex, 6 to 12 percent slopes, eroded**Composition**

Storden and similar soils: About 35 percent
 Hawick and similar soils: About 30 percent
 Ves and similar soils: About 25 percent
 Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Storden—shoulders; Hawick—shoulders and summits; Ves—summits and back slopes
Slope range: 6 to 12 percent

Component Description**Storden**

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

Hawick

Surface layer texture: Gravelly sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 3 inches

Ves

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

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

Inclusions

- Webster and similar soils
- Normania and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Svea Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderate; lower part—moderate or moderately slow
Landform: Moraines
Parent material: Till
Slope range: 0 to 3 percent
Taxonomic class: Fine-loamy, mixed Pachic Udic Haploborolls

Typical Pedon

Svea loam, 2,100 feet south and 2,150 feet east of the northwest corner of sec. 2, T. 119 N., R. 46 W.; lat. 45

degrees 08 minutes 50 seconds N. and long. 96 degrees 23 minutes 09 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; 1 percent gravel; neutral; abrupt smooth boundary.

Bw1—10 to 16 inches; very dark grayish brown (2.5Y 3/2) loam, dark grayish brown (2.5Y 4/2) dry; weak medium and fine subangular blocky structure; friable; few fine roots; 1 percent gravel; neutral; clear wavy boundary.

Bw2—16 to 26 inches; dark grayish brown (2.5Y 4/2) loam; few fine prominent light olive brown (2.5Y 5/6) iron concentrations; weak medium and fine subangular blocky structure; friable; few fine roots; 3 percent gravel; slightly alkaline; clear wavy boundary.

Bk1—26 to 30 inches; light olive brown (2.5Y 5/4) loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations and few fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; 4 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk2—30 to 60 inches; light olive brown (2.5Y 5/4) loam; many fine prominent yellowish brown (10YR 5/6) iron concentrations and many fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few dark brown (7.5YR 3/2) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 16 to 30 inches

Thickness of the mollic epipedon: 16 to 24 inches

Content of rock fragments: 1 to 10 percent, by volume, throughout the profile

Percent of surface covered with stones: 0.1 to 3.0 percent in some pedons

Ap horizon:

Hue—10YR or 2.5Y

Value—2 or 3

Chroma—1

Texture—loam

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 4

Chroma—1 to 4

Texture—loam or clay loam

Bk horizon:

Hue—2.5Y or 10YR

Value—4 to 6

Chroma—1 to 4

Texture—loam or clay loam

70—Svea loam

Composition

Svea and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Flats

Slope range: 0 to 3 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 4 to 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.9 inches

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

Inclusions

- Vallery and similar soils
- Parnell and similar soils
- Barnes and similar soils
- Hamerly and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

774—Svea loam, very stony

Composition

Svea and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Flats

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 4 to 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.8 inches

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

Inclusions

- Vallers and similar soils
- Parnell and similar soils
- Barnes and similar soils
- Buse and similar soils

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Sverdrup Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Upper part—moderately rapid; lower part—rapid

Landform: Outwash plains

Parent material: Glacial outwash

Slope range: 0 to 12 percent

Taxonomic class: Sandy, mixed Udic Haploborolls

Typical Pedon

Sverdrup sandy loam, 2 to 6 percent slopes, 700 feet east and 400 feet south of the northwest corner of sec. 2, T. 116 N., R. 46 W.; lat. 44 degrees 53 minutes 47 seconds N. and long. 96 degrees 22 minutes 32 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; very friable; common fine roots; neutral; abrupt smooth boundary.

A—9 to 12 inches; very dark brown (10YR 2/2) sandy

loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; common fine roots; neutral; clear wavy boundary.

Bw1—12 to 18 inches; dark yellowish brown (10YR 3/4) sandy loam; weak fine subangular blocky structure; very friable; common fine roots; neutral; gradual wavy boundary.

2Bw2—18 to 21 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; few fine roots; 1 percent gravel; neutral; clear wavy boundary.

2C1—21 to 33 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few fine roots; 1 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

2C2—33 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 15 to 44 inches

Thickness of the mollic epipedon: 8 to 16 inches

Depth to sand: 14 to 24 inches

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—sandy loam

Content of rock fragments—0 to 3 percent

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—sandy loam

Content of rock fragments—0 to 3 percent

Bw horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 to 4

Texture—sandy loam or fine sandy loam

Content of rock fragments—0 to 3 percent

2Bw horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 to 4

Texture—loamy sand or sand

Content of rock fragments—0 to 5 percent

2C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—sand, fine sand, or loamy sand

Content of rock fragments—0 to 5 percent

127A—Sverdrup sandy loam, 0 to 2 percent slopes**Composition**

Sverdrup and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 5.7 inches

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

Inclusions

- Marysland and similar soils
- Embden and similar soils
- Forada and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

127B—Sverdrup sandy loam, 2 to 6 percent slopes**Composition**

Sverdrup and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains
Position on the landform: Summits and back slopes
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Dominant parent material: Glacial outwash

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 4.2 inches

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

Inclusions

- Marysland and similar soils
- Embden and similar soils
- Forada and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

127C—Sverdrup sandy loam, 6 to 12 percent slopes**Composition**

Sverdrup and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Back slopes and shoulders
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches

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

Inclusions

- Marysland and similar soils
- Swenoda and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Chroma—1 or 2

Texture—loam

Bk horizon:

Hue—2.5Y or 10YR

Value—4 to 6

Chroma—3 to 6

Texture—loam or clay loam

Swanlake Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Moraines

Parent material: Till

Slope range: 3 to 6 percent

Taxonomic class: Fine-loamy, mixed, mesic Typic Calciudolls

Typical Pedon

Swanlake loam, in an area of Ves-Swanlake complex, 3 to 6 percent slopes, 1,850 feet north and 75 feet west of the southeast corner of sec. 34, T. 116 N., R. 44 W.; lat. 44 degrees 48 minutes 36 seconds N. and long. 96 degrees 08 minutes 03 seconds W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; common fine roots; common olive brown (2.5Y 4/4) streaks; 2 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—8 to 29 inches; olive brown (2.5Y 4/4) loam; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; 2 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bk2—29 to 60 inches; olive brown (2.5Y 4/4) loam; few fine distinct light olive brown (2.5Y 5/6) and few fine prominent yellowish red (5YR 4/6) relict iron concentrations; weak coarse subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 7 to 14 inches

Content of rock fragments: 1 to 10 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR

Value—2 or 3

Swenoda Series

Depth class: Very deep

Drainage class: Well drained or moderately well drained

Permeability: Upper part—moderately rapid; lower part—moderately slow or moderate

Landform: Moraines

Parent material: Glaciofluvial outwash and till

Slope range: 0 to 6 percent

Taxonomic class: Coarse-loamy, mixed Pachic Udic Haploborolls

Typical Pedon

Swenoda loam, 2 to 6 percent slopes, 1,650 feet north and 175 feet east of the southwest corner of sec. 35, T. 117 N., R. 46 W.; lat. 44 degrees 53 minutes 48 seconds N. and long. 96 degrees 23 minutes 03 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

Bw1—10 to 16 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw2—16 to 25 inches; dark brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

2Bk1—25 to 32 inches; light olive brown (2.5Y 5/4) loam; weak fine subangular blocky structure; friable; few fine roots; common light gray (2.5Y 7/2) lime accumulations; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk2—32 to 60 inches; olive brown (2.5Y 4/4) clay loam; common fine distinct grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few yellowish red (5YR 5/8) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics*Depth to carbonates:* 20 to 40 inches*Thickness of the mollic epipedon:* 16 to 24 inches*Depth to till:* 20 to 40 inches**Ap horizon:**

Hue—10YR

Value—2 or 3

Chroma—1

Texture—loam or sandy loam

Content of rock fragments—0 to 3 percent

Bw horizon:

Hue—10YR or 2.5Y

Value—2 to 4

Chroma—1 to 4

Texture—sandy loam or fine sandy loam

Content of rock fragments—0 to 3 percent

2Bk horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—2 to 6

Texture—loam or clay loam

Content of rock fragments—0 to 7 percent

293B—Swenoda loam, 2 to 6 percent slopes**Composition**

Swenoda and similar soils: About 75 percent

Inclusions: About 25 percent

Setting*Landform:* Outwash plains*Position on the landform:* Summits and back slopes*Slope range:* 2 to 6 percent**Component Description***Surface layer texture:* Loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Glacial outwash and till*Flooding:* None*Depth to the water table:* More than 6 feet*Available water capacity to 60 inches or root-limiting layer:* About 10.5 inches

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

Inclusions

- Marysland and similar soils
- Barnes and similar soils

- Egeland and similar soils
- Embden and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1296—Swenoda sandy loam, 0 to 2 percent slopes, moderately wet**Composition**

Swenoda and similar soils: About 75 percent

Inclusions: About 25 percent

Setting*Landform:* Outwash plains*Slope range:* 0 to 2 percent**Component Description***Surface layer texture:* Sandy loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Moderately well drained*Dominant parent material:* Glacial outwash and till*Flooding:* None*Depth to the water table:* 2.5 to 4.0 feet*Available water capacity to 60 inches or root-limiting layer:* About 10.2 inches

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

Inclusions

- Egeland and similar soils
- Embden and similar soils
- Marysland and similar soils
- Svea and similar soils
- Sverdrup and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Tara Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits and till

Slope range: 0 to 2 percent

Taxonomic class: Fine-silty, mixed Pachic Udic
Haploborolls

Typical Pedon

Tara silt loam, 600 feet south and 200 feet west of the northeast corner of sec. 15, T. 119 N., R. 44 W.; lat. 45 degrees 07 minutes 18 seconds N. and long. 96 degrees 08 minutes 45 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

Bw1—10 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw2—16 to 25 inches; olive brown (2.5Y 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bk1—25 to 36 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine faint grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few light gray (10YR 7/1) lime accumulations; strongly effervescent; moderately alkaline; clear wavy boundary.

2Bk2—36 to 60 inches; dark grayish brown (2.5Y 4/2) clay loam; common fine faint grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; 4 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 36 inches

Thickness of the mollic epipedon: 16 to 30 inches

Depth to till: 25 to 40 inches

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—silt loam

Content of rock fragments—none

Bw horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—2 to 4

Texture—silt loam or silty clay loam

Content of rock fragments—none

Bk horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—silt loam or silty clay loam

Content of rock fragments—none

2Bk horizon:

Hue—2.5Y

Value—4 to 6

Chroma—2 to 4

Texture—loam or clay loam

Content of rock fragments—3 to 10 percent

597—Tara silt loam**Composition**

Tara and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Flats

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits and till

Flooding: None

Depth to the water table: 3 to 5 feet

Available water capacity to 60 inches or root-limiting layer: About 11.3 inches

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

Inclusions

- Perella and similar soils
- Quam and similar soils
- Doland and similar soils
- McIntosh and similar soils

Major Uses of the Unit

- Cropland
- Hayland

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1030—Udorthents-Pits, gravel, complex

Composition

Udorthents: 50 percent
Pits: 35 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains

Component Description

Udorthents

Dominant parent material: Glacial outwash

Pits, gravel

Dominant parent material: Glacial outwash

Inclusions

- Arvilla and similar soils
- Hawick and similar soils
- Sioux and similar soils

Vallers Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderately slow

Landform: Moraines

Parent material: Till

Slope range: 0 to 2 percent

Taxonomic class: Fine-loamy, frigid Typic Calciaquolls

Typical Pedon

Vallers clay loam, 100 feet west and 1,200 feet north of the southeast corner of sec. 3, T. 119 N., R. 46 W.; lat. 45 degrees 08 minutes 34 seconds N. and long. 96 degrees 23 minutes 41 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; 2 percent gravel; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A—10 to 15 inches; very dark gray (N 3/0) clay loam, dark gray (N 4/0) dry; weak medium and fine subangular blocky structure; friable; few fine roots; 2 percent gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

Bkg1—15 to 22 inches; dark grayish brown (2.5Y 4/2)

clay loam; few fine distinct light olive brown (2.5Y 5/4) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—22 to 30 inches; olive gray (5Y 5/2) clay loam; common fine prominent yellowish brown (10YR 5/8) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; few dark brown (7.5YR 3/2) iron masses; 2 percent gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

Bkg3—30 to 60 inches; gray (5Y 5/1) clay loam; many fine prominent yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure; friable; few light brownish gray (2.5Y 6/2) lime accumulations; few dark brown (7.5YR 3/2) iron masses; 2 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Calcareous throughout the profile

Thickness of the mollic epipedon: 8 to 24 inches

Percent of surface covered with stones: 0.1 to 3.0 percent in some pedons

Ap horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—clay loam

Content of rock fragments—0 to 3 percent

A horizon:

Hue—10YR to 5Y or neutral

Value—2 or 3

Chroma—0 or 1

Texture—clay loam

Content of rock fragments—2 to 7 percent

Bkg horizon:

Hue—10YR to 5Y

Value—3 to 6

Chroma—1 or 2

Texture—clay loam, silty clay loam, or loam

Content of rock fragments—2 to 7 percent

236—Vallers clay loam

Composition

Vallers and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Rims of depressions, flats, and drainageways

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 1.0 to 2.5 feet

Available water capacity to 60 inches or root-limiting layer: About 11 inches

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

Inclusions

- Hamerly and similar soils
- Lakepark and similar soils
- Parnell and similar soils
- Svea and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

509—Vallers clay loam, very stony

Composition

Vallers and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Rims of depressions, flats, and drainageways

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 1.0 to 2.5 feet

Available water capacity to 60 inches or root-limiting layer: About 11 inches

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

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

Inclusions

- Barnes and similar soils
- Hamerly and similar soils
- Lakepark and similar soils
- Parnell and similar soils

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Ves Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Moraines

Parent material: Till

Slope range: 1 to 12 percent

Taxonomic class: Fine-loamy, mixed, mesic Calcic Hapludolls

Typical Pedon

Ves loam, 1 to 4 percent slopes, 400 feet west and 1,600 feet south of the northeast corner of sec. 33, T. 116 N., R. 44 W.; lat. 44 degrees 48 minutes 55 seconds N. and long. 96 degrees 08 minutes 03 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

Bw1—10 to 16 inches; dark brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; few fine roots; few dark brown (10YR 3/3) organic coatings on faces of peds; 2 percent gravel; neutral; clear wavy boundary.

Bw2—16 to 25 inches; light olive brown (2.5Y 5/4) loam; weak medium subangular blocky structure; friable; few fine roots; 2 percent gravel; slightly alkaline; clear wavy boundary.

Bk1—25 to 36 inches; light olive brown (2.5Y 5/4) loam; weak medium subangular blocky structure; friable; few fine roots; few light gray (2.5Y 7/2) lime accumulations; 3 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—36 to 60 inches; light olive brown (2.5Y 5/4) loam; weak coarse subangular blocky structure; friable;

few light brownish gray (2.5Y 6/2) lime accumulations; few strong brown (7.5YR 5/6) iron masses; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 16 to 30 inches

Thickness of the mollic epipedon: 7 to 20 inches

Content of rock fragments: 2 to 7 percent, by volume, throughout the profile

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loam

Bw horizon:

Hue—10YR or 2.5Y

Value—3 to 5

Chroma—3 or 4

Texture—loam or clay loam

Bk horizon:

Hue—2.5Y or 10YR

Value—4 to 6

Chroma—3 or 4

Texture—loam or clay loam

421B—Ves loam, 1 to 4 percent slopes

Composition

Ves and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Moraines

Position on the landform: Summits and back slopes

Slope range: 1 to 4 percent

Component Description

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.5 inches

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

Inclusions

- Harps and similar soils

- Glencoe and similar soils
- Normania and similar soils
- Swanlake and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

954B—Ves-Swanlake complex, 3 to 6 percent slopes

Composition

Ves and similar soils: About 45 percent

Swanlake and similar soils: About 30 percent

Inclusions: About 25 percent

Setting

Landform: Moraines

Position on the landform: Ves—summits and back slopes; Swanlake—shoulders

Slope range: 3 to 6 percent

Component Description

Ves

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches

Swanlake

Surface layer texture: Loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Till

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 11.1 inches

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

Inclusions

- Harps and similar soils

- Glencoe and similar soils
- Normania and similar soils
- Seaforth and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Waubay Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderate

Landform: Lake plains

Parent material: Glaciolacustrine deposits

Slope range: 0 to 2 percent

Taxonomic class: Fine-silty, mixed Pachic Udic Haploborolls

Typical Pedon

Waubay silty clay loam, 2,400 feet south and 100 feet east of the northwest corner of sec. 24, T. 119 N., R. 44 W.; lat. 45 degrees 06 minutes 11 seconds N. and long. 96 degrees 07 minutes 25 seconds W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

A—7 to 12 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bw1—12 to 16 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, dark grayish brown (2.5Y 4/2) dry; weak medium and fine subangular blocky structure; friable; few fine roots; few olive brown (2.5Y 4/4) wormcasts; neutral; clear wavy boundary.

Bw2—16 to 23 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct light olive brown (2.5Y 5/4) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.

Bk—23 to 34 inches; light olive brown (2.5Y 5/4) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) iron depletions and few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; few light gray (2.5Y 7/2) lime accumulations; strongly effervescent; moderately

alkaline; clear wavy boundary.

C—34 to 60 inches; light olive brown (2.5Y 5/4) silt loam; common fine distinct grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 36 inches

Thickness of the mollic epipedon: 16 to 30 inches

Content of rock fragments: None

Ap horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—silty clay loam

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1

Texture—silty clay loam

Bw horizon:

Hue—10YR or 2.5Y

Value—3 or 4

Chroma—2 or 3

Texture—silty clay loam or silt loam

Bk horizon:

Hue—2.5Y

Value—4 or 5

Chroma—2 to 4

Texture—silty clay loam or silt loam

338—Waubay silty clay loam

Composition

Waubay and similar soils: About 75 percent

Inclusions: About 25 percent

Setting

Landform: Flats

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: 3.5 to 5.0 feet

Available water capacity to 60 inches or root-limiting layer: About 11 inches

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

Inclusions

- Parnell and similar soils
- Perella and similar soils
- Bearden and similar soils
- Poinsett and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Webster Series

Depth class: Very deep

Drainage class: Poorly drained

Permeability: Moderate

Landform: Moraines

Parent material: Till

Slope range: 0 to 2 percent

Taxonomic class: Fine-loamy, mixed, mesic Typic Endoaquolls

Typical Pedon

Webster clay loam, 200 feet east and 2,590 feet south of the northwest corner of sec. 12, T. 118 N., R. 45 W.; lat. 45 degrees 02 minutes 45 seconds N. and long. 96 degrees 14 minutes 48 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; 1 percent gravel; neutral; abrupt smooth boundary.

A—9 to 20 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; 1 percent gravel; neutral; clear smooth boundary.

Bg—20 to 34 inches; grayish brown (2.5Y 5/2) clay loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak fine subangular blocky structure; friable; 1 percent gravel; neutral; gradual smooth boundary.

Cg—34 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; 1

percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 30 to 50 inches

Thickness of the mollic epipedon: 14 to 20 inches

Ap horizon:

Hue—10YR, 2.5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—clay loam

Content of rock fragments—1 to 3 percent

A horizon:

Hue—10YR, 2.5Y, or neutral

Value—2 or 3

Chroma—0 or 1

Texture—clay loam

Content of rock fragments—1 to 3 percent

Bg horizon:

Hue—2.5Y or 5Y

Value—4 or 5

Chroma—1 or 2

Texture—clay loam or loam

Content of rock fragments—1 to 3 percent

Cg horizon:

Hue—2.5Y or 5Y

Value—4 to 6

Chroma—1 to 3

Texture—loam or clay loam

Content of rock fragments—1 to 7 percent

113—Webster clay loam

Composition

Webster and similar soils: About 80 percent

Inclusions: About 20 percent

Setting

Landform: Drainageways and flats

Slope range: 0 to 2 percent

Component Description

Surface layer texture: Clay loam

Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained

Dominant parent material: Till

Flooding: None

Depth to the water table: 1 to 2 feet

Available water capacity to 60 inches or root-limiting layer: About 10.8 inches

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

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

Inclusions

- Glencoe and similar soils
- Harps and similar soils
- Normania and similar soils
- Seaforth and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Yellowbank Series

Depth class: Very shallow to moderately deep

Drainage class: Somewhat excessively drained

Permeability: Moderate or moderately rapid

Landform: Bedrock-controlled terraces

Parent material: Alluvium over granite or gneiss

Slope range: 1 to 25 percent

Taxonomic class: Loamy, mixed Ruptic-Lithic
Haploborolls

Typical Pedon

Yellowbank loam, in an area of Yellowbank-Rock outcrop complex, 1 to 25 percent slopes, 250 feet north and 120 feet east of the southwest corner of sec. 11, T. 120 N., R. 45 W.; lat. 44 degrees 42 minutes 43 seconds N. and long. 96 degrees 16 minutes 02 seconds W.

A1—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; many fine roots; 2 percent gravel; moderately acid; clear smooth boundary.

A2—7 to 12 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; common fine roots; 3 percent gravel; strongly acid; clear smooth boundary.

Bw—12 to 16 inches; dark yellowish brown (10YR 3/4) sandy loam; weak medium and fine subangular blocky structure; friable; common fine roots; 11 percent gravel; strongly acid; abrupt smooth boundary.

2R—16 inches; granitic gneiss.

Range in Characteristics

Depth to carbonates: 8 to 30 inches

Thickness of the mollic epipedon: 8 to 30 inches

Depth to bedrock: 8 to 30 inches

Content of rock fragments: 0 to 10 percent, by volume, throughout the profile

A1 horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loam

A2 horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—loam or silt loam

Bw horizon:

Hue—10YR

Value—3 or 4

Chroma—1 to 4

Texture—loam or sandy loam

1266C—Yellowbank-Rock outcrop complex, 1 to 25 percent slopes

Composition

Yellowbank and similar soils: About 60 percent

Rock outcrop: About 25 percent (fig. I-5)

Inclusions: About 15 percent

Setting

Landform: Terraces

Slope range: 1 to 25 percent

Component Description

Yellowbank

Surface layer texture: Loam

Depth class: Shallow (10 to 20 inches)

Drainage class: Somewhat excessively drained

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 3.2 inches

Rock outcrop

Definition: Bare exposures of unweathered bedrock

Flooding: None

Depth to the water table: More than 6 feet

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

Inclusions

- Lamoure and similar soils



Figure I-5.—An area of Yellowbank-Rock outcrop complex, 1 to 25 percent slopes. This map unit is best suited to pasture and wildlife habitat.

- Svea and similar soils
- Vallerys and similar soils

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Zell Series*Depth class:* Very deep*Drainage class:* Well drained*Permeability:* Moderate*Landform:* Lake plains*Parent material:* Glaciolacustrine deposits*Slope range:* 3 to 12 percent*Taxonomic class:* Coarse-silty, mixed Udorthentic
Haploborolls**Typical Pedon**

Zell silt loam, in an area of Zell-Rothsay complex, 3 to 6 percent slopes, 810 feet north and 75 feet west of the southeast corner of sec. 20, T. 120 N., R. 44 W.; lat. 45 degrees 11 minutes 03 seconds N. and long. 96 degrees 11 minutes 11 seconds W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; common fine roots; common olive brown (2.5Y 4/4) streaks; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bk1—9 to 13 inches; olive brown (2.5Y 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common light brownish gray (2.5Y 6/2) lime accumulations; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—13 to 21 inches; olive brown (2.5Y 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline; gradual wavy boundary.

C—21 to 60 inches; light olive brown (2.5Y 5/4) silt; common fine prominent yellowish brown (10YR 5/6) relict iron concentrations and gray (10YR 5/1) relict iron depletions; massive; very friable; few light brownish gray (2.5Y 6/2) lime accumulations; strongly effervescent; moderately alkaline.

Range in Characteristics*Depth to carbonates:* Calcareous throughout the profile*Thickness of the mollic epipedon:* 7 to 15 inches*Content of rock fragments:* None*Ap horizon:*

Hue—10YR

Value—2 or 3

Chroma—1

Texture—silt loam

Bk horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

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

C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—2 to 4

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

694C2—Zell silt loam, 6 to 12 percent slopes, eroded**Composition**

Zell and similar soils: About 80 percent

Inclusions: About 20 percent

Setting*Landform:* Collapsed lake plains*Position on the landform:* Back slopes and shoulders*Slope range:* 6 to 12 percent**Component Description***Surface layer texture:* Silt loam*Depth class:* Very deep (more than 60 inches)*Drainage class:* Well drained*Dominant parent material:* Glaciolacustrine deposits*Flooding:* None*Depth to the water table:* More than 6 feet*Available water capacity to 60 inches or root-limiting layer:* About 10.7 inches

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

Inclusions

- Perella and similar soils
- Egeland and similar soils
- Rothsay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

969B—Zell-Rothsay complex, 3 to 6 percent slopes**Composition**

Zell and similar soils: About 45 percent

Rothsay and similar soils: About 25 percent

Inclusions: About 30 percent

Setting

Landform: Collapsed lake plains

Position on the landform: Zell—shoulders; Rothsay—summits and back slopes

Slope range: 3 to 6 percent

Component Description

Zell

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 10.8 inches

Rothsay

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)

Drainage class: Well drained

Dominant parent material: Glaciolacustrine deposits

Flooding: None

Depth to the water table: More than 6 feet

Available water capacity to 60 inches or root-limiting layer: About 12.6 inches

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

Inclusions

- Perella and similar soils
- Quam and similar soils
- Egeland and similar soils
- Hantho and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Zumbro Series

Depth class: Very deep

Drainage class: Well drained

Permeability: Rapid

Landform: Flood plains

Parent material: Alluvium

Slope range: 0 to 2 percent

Taxonomic class: Sandy, mixed, mesic Entic Hapludolls

Typical Pedon

Zumbro sandy loam, in an area of Du Page-Zumbro complex, occasionally flooded, 330 feet east and 3,750 feet north of the southwest corner of sec. 35, T. 115 N., R. 39 W., in Yellow Medicine County, Minnesota; lat. 44 degrees 43 minutes 37 seconds N. and long. 96 degrees 31 minutes 17 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; friable; 3 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

A—10 to 16 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; very friable; 3 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bw—16 to 35 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak very fine and fine subangular blocky structure; loose; 2 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

C1—35 to 50 inches; banded dark brown (10YR 4/3) and very dark grayish brown (10YR 3/2) loamy sand; very dark grayish brown (10YR 3/2) crushed, grayish brown (10YR 5/2) dry; single grain; coarse; loose; 2 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.

C2—50 to 60 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; common snail-shell fragments; 7 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 20 inches

Thickness of the mollic epipedon: 24 to 50 inches

Ap horizon:

Hue—10YR

Value—2

Chroma—1 or 2

Texture—sandy loam

Content of rock fragments—0 to 3 percent

A horizon:

Hue—10YR

Value—2 or 3

Chroma—1 or 2

Texture—sandy loam, loamy sand, or loamy fine sand

Content of rock fragments—0 to 3 percent

Bw horizon:

Hue—10YR

Value—2 to 4

Chroma—2 to 4

Texture—sand, fine sand, loamy sand, or loamy fine sand

Content of rock fragments—0 to 10 percent

C horizon:

Hue—10YR

Value—4 to 6

Chroma—2 to 5

Texture—sand, fine sand, or coarse sand

Content of rock fragments—0 to 15 percent

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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.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

| | |
|----------------|-------------|
| Very low | 0 to 3 |
| Low | 3 to 6 |
| Moderate | 6 to 9 |
| High | more than 9 |

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.

Basal till. Compact 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, and 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-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.
- Catena.** A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.
- Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.
- Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.
- Catsteps.** Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.
- 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 through the 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.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay depletions.** Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.
- 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.
- Climax plant community.** The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.
- Coarse textured soil.** Sand or loamy sand.
- Cobble (or cobblestone).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.
- Cobbly soil material.** Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.
- Colluvium.** Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Complex slope.** Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.
- Complex, soil.** A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.
- 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.
- 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 surface after planting in order to reduce the hazard of water erosion; in areas where wind erosion is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its 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.

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.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep soils, 20 to 40 inches; shallow soils, 10 to 20 inches; and very shallow soils, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

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 or high 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 most field crops are affected. 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 under natural conditions. 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. Poor drainage is 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 for rice) under natural conditions.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact 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 generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

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.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. 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 1 mile

to more than 100 miles in length and from 10 to 100 feet in height.

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.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

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. It 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 generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

Foot slope. The geomorphic component that forms the inner, gently inclined surface at the base of a hill slope. The surface is dominantly concave. In terms of gradational processes, a foot slope is a transition zone between an upslope site of erosion (back slope) and a downslope site of deposition (toe slope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift. 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. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits. 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.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 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. Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

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-chroma zones. Zones having chroma of 3 or more. Typical color in areas of iron concentrations.

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 6 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.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A

horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-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.

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.

Iron concentrations. High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

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.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low-chroma zones. Zones having chroma of 2 or less. Typical color in areas of iron depletions.

Low-residue crops. Such crops 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.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

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.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform 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. 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).

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.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

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.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

| | |
|----------------------|-----------------------|
| Very low | less than 0.5 percent |
| Low | 0.5 to 1.0 percent |
| Moderately low | 1.0 to 2.0 percent |
| Moderate | 2.0 to 4.0 percent |
| High | 4.0 to 8.0 percent |
| Very high | more than 8.0 percent |

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

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.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

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 movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water 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.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Burning an area under conditions of weather and soil moisture and at the time of day that 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.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

| | |
|------------------------------|----------------|
| Extremely acid | less than 4.5 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Moderately acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |
| Neutral | 6.6 to 7.3 |
| Slightly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

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.

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.

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.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles

deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks,

prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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 substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of rock 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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single 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 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 restricts roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

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). Otherwise suitable soil material too thin for the specified use.

Till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Till plain. An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill. Toe slopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an 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 uprooting and tipping over of trees by the wind.

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