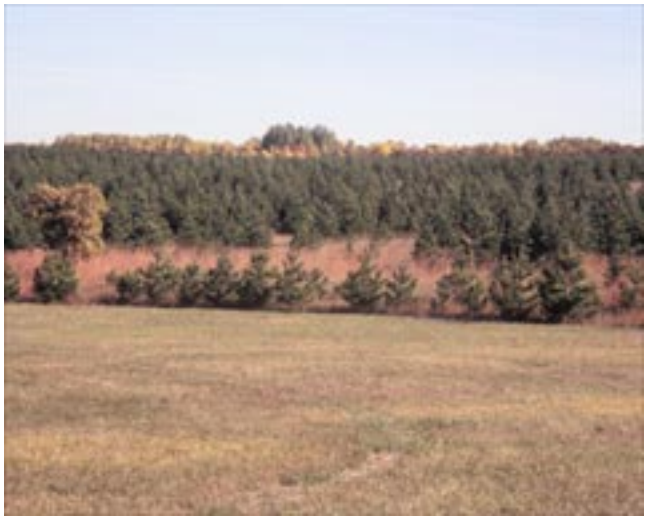
United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Minnesota Agricultural Experiment Station

Soil Survey of Hubbard 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 general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map units in the area on the color-coded map legend, then refer to the section **General Soil Map Units** in Part I of this survey for a general description of the soils in your area.

The **detailed soil maps** 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**. 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 **Contents** in Part I of this survey, which lists the map units and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. Also, see the **Contents** in Part I and Part II for other 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 1994. Soil names and descriptions were approved in 1998. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1994. This survey was made cooperatively by the Natural Resources Conservation Service and the Minnesota Agricultural Experiment Station. It is part of the technical assistance furnished to the Hubbard County Soil and Water Conservation District. Other assistance was provided by the Agricultural Extension Service, the Minnesota Department of Natural Resources, and the Board of Water and Soil Resources. The survey was partially funded by the Legislative Commission for Minnesota Resources and by Hubbard County.

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.

Cover: *Top left*—Natural and scenic areas draw many visitors to the Hubbard County area. *Top right*—Red pine plantations are common in areas of soils that formed in sandy and gravelly outwash. *Bottom left*—Irrigated cropland is a major land use on outwash soils in southern Hubbard County. *Bottom right*—Forest products management is an important industry throughout most of Hubbard County.

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

Contents

Issued 2003

Foreword

This soil survey contains information that can be used in land-planning programs in Hubbard 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. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service.

William Hunt
State Conservationist
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Soil Survey of
Hubbard County, Minnesota

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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; and the kinds of crops and native plants. 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 soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil 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.

Hubbard County is in north-central Minnesota (fig. 1). It has a total area of about 1,000 square miles, or 640,000 acres. Park Rapids, the county seat, is in the southwestern part of the county. The population of Hubbard County in 1990 was 14,939.

The agricultural enterprises in the county are specialty crops, such as potatoes and beans; hay production; and livestock. Forest management also is an important enterprise. Pulpwood, Christmas trees, and saw logs are the main products. Itasca State Park, Paul Bunyan State Forest, and other public lands draw tourists to the region. The large number of lakes in the county offer a variety of recreational opportunities.

This soil survey updates the survey of Hubbard County published in 1935 (McMiller and others, 1935).

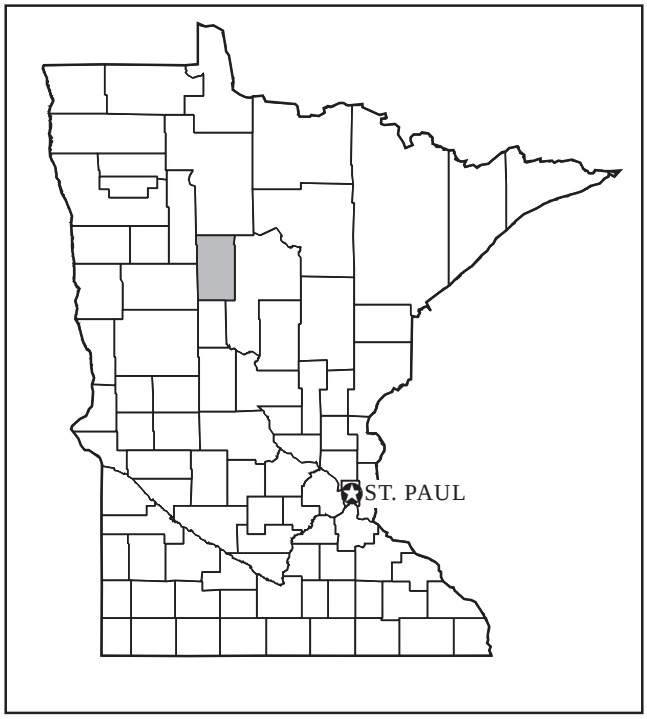


Figure 1.—Location of Hubbard County in Minnesota.

It provides additional information and has larger maps, which show the soils in greater detail.

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 descriptions of soils in these areas may be less accurate than those in areas where soil scientists had access to the land and could carefully examine the soils.

General Nature of the Survey Area

This section gives general information about Hubbard County. It describes history, industry, physiography and relief, drainage, climate, water supply, and geologic history.

History

Early records indicate that the Dakota (Sioux) were established in the survey area. When the Chippewa came from the east, they drove the Sioux farther west. The Chippewa (Pillager and Lake Winnibigoshish bands) inhabited areas around Leech Lake, Cass Lake, and Lake Winnibigoshish. The area now known as Hubbard County was the scene of territorial fights

between the Sioux and Chippewa tribes. These battles continued until 1855, when the Chippewa ceded land rights.

Henry Rowe Schoolcraft and guide Oza Windib (Yellow Head) traveled up the Mississippi River in search of the headwaters. In 1832, they identified the source as Lake Itasca. Soon thereafter, more pioneers traveled through the area, attracted by the timber, pure water, abundant wild game, and fertile lands. During the 1860's and 1870's, the lumber industry was established in Hubbard County. One of the first lumber camps was established around Palmer Lake in 1879.

Settlers arrived in 1879, traveling north from the train stop at Verndale. They came to pursue farming interests in the Shell Prairie area (Hubbard and Park Rapids). Wheat was the first major crop harvested. It was harvested continuously until the productivity of the soils was reduced. Later, better soil management practices, such as crop rotations, were used.

Park Rapids, which later became the county seat, was named by Frank Rice on July 4, 1881, for the park-like groves and the rapids in the Fishhook River. The county was named in honor of Lucius Hubbard, governor of Minnesota from 1882 to 1887.

The first train to Park Rapids arrived in 1891, making the connection between Eagle Bend and Park Rapids complete. The railroad was a vital asset to the early resort owners.

Hubbard County consists of 28 townships. Incorporated cities in the county are Akeley, Lake George, LaPorte, Nevis, and Park Rapids. Unincorporated communities include Arago, Becida, Benedict, Dorset, Emmaville, Guthrie, Hubbard, Kabekona, Nary, Rosby, and Yola. The population of the county in 1990 was 14,939. There are a substantial number of seasonal residents. Besides tourism, the economy is based on agriculture, logging, and light manufacturing.

Industry

Farming in the county dates back to 1879, when wheat and oats were grown around the village of Hubbard. Early settlement and agriculture were concentrated in the southern part of the county. The sandy prairie-influenced soils in this region were converted to cropland with comparatively little work. In 1890, the Federal census showed 194 farms with about 17,000 acres under cultivation; wheat and oats were the major crops. In 1991, about 16 percent of the county was cropland and corn, edible beans, potatoes, small cereal grains, and alfalfa hay were the main crops (fig. 2). Beef cattle, sheep, swine, poultry, and dairy cattle are the major livestock operations.

Irrigation systems were introduced into the county around 1963. About 17,000 acres of cropland was under irrigation in 1992. The number of irrigated fields in the county is expected to increase.

About two-thirds of the county is forested (fig. 3). The majority of the woodland is privately owned. About 39 percent of the forest land is publicly administered. The State of Minnesota administers about 15 percent of the forested acreage.

Major softwood forest types, such as jack pine and red pine, cover about 17 percent of the commercial forest land. The dominant hardwood forest types, aspen and birch, cover about 57 percent of the commercial forest acres. Other forest types are maple-basswood, oaks, black spruce, and tamarack.

Markets for pulp, poles, and saw logs are in the Park Rapids, Bemidji, Cass Lake, Osage, and Menahga areas. An estimated 71,000 cords of wood was harvested in 1991. The Potlatch Corporation mill in the northeast corner of the county processed about 1 million cords of wood in 1991. Christmas tree plantations also contribute to the industry in the county.

Physiography and Relief

Nearly all of the landforms and parent materials in Hubbard County are related to the Wadena Lobe of Late Wisconsin glaciation. Hubbard County can be divided into four distinct geomorphic areas (fig. 4). These are the Guthrie Till Plain Area, the Itasca Moraine Area, the Park Rapids Sand Plain Area, and the Wadena Drumlin Area (Hobbs and Goebel, 1982).

The Guthrie Till Plain Area is a ground moraine feature in the northern third of the county. The Wadena Lobe glacial till materials in this area are dominantly sandy loam. Some areas in the northeastern part of the county have Des Moines Lobe materials deposited on top of the Wadena Lobe till. Des Moines Lobe till typically has loam and clay loam textures and contains a higher percentage of shale fragments than the Wadena Lobe material. The ground moraine is dissected by glacial meltwater drainageways. Slopes are smooth and are short or moderately long. Local relief varies from a few feet in the flats to more than 90 feet along major drainageways.

The Itasca Moraine Area runs from east to west across the central part of the county. This end moraine and disintegration moraine complex is a deposit of the Wadena Lobe. Materials are typically sandy loam glacial till and include significant deposits of sand and gravel. Slopes are complex and moderately steep to very steep. Local relief ranges from 30 feet in small swales to more than 100 feet between hilltops and

Figure 2.—The production of small grain crops and hay is common in northern Hubbard County.

small marshes. Closed depressions are common. The Itasca Moraine makes up about a third of the county.

The Park Rapids Sand Plain Area in the southern third of the county can be further divided into two distinct areas. The more undulating and rolling outwash plain in the lake region north of Park Rapids has smooth to complex slopes that are short or moderately long. Local relief ranges from a few feet between marshes and lakes to more than 100 feet from hilltops to lakeshore. Lake chains are common, and drainage runs generally toward the south. The outwash plain south of Park Rapids is nearly level to gently undulating. Slopes are smooth and are short to long. Local relief generally is less than 10 feet, but it ranges up to 40 feet along drainage channels. Closed depressions are common in this outwash area.

The Wadena Drumlin Area is mostly in Straight River Township. The drumlins were formed by the Wadena Lobe and consist of sandy loam till. Most of the drumlins are buried by outwash deposits carried by meltwaters of the Itasca Moraine. Relief is typically undulating to rolling. Slopes are smooth and are short to long.

The range of relief is quite variable in the county. The highest elevation, about 1,840 feet above sea level, is in the northwest quarter of section 9 in Thorpe Township. The lowest elevation is about 1,300 feet and occurs at several locations along the county line in Lakeport and Hart Lake Townships.

Drainage

The Mississippi River eventually receives all drainage waters from the county. The northern half of the county drains to the north and east. Major drainageways are the Schoolcraft River, the Mississippi River, Hennepin Creek, the Necktie River, and the Kabekona River. The southern half of the county drains to the south through the Crow Wing River and its tributaries. Major tributaries are the Straight River, the Shell River, and the Fishhook River.

Climate

The three tables at the end of this section ("Temperature and Precipitation," "Freeze Dates in Spring and Fall," and "Growing Season") give climate data for the survey area as recorded at Park Rapids in the period 1961 to 1990.

In winter, the average temperature is 9.3 degrees F and the average daily minimum temperature is -1.7 degrees. The lowest temperature on record, which occurred at Park Rapids on February 2, 1996, was -51 degrees. In summer, the average temperature is 66.4 degrees and the average daily maximum temperature is 79.1 degrees. The highest temperature, which occurred at Park Rapids on August 18, 1976, was 101 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 average annual total precipitation is 26.33 inches. Of this, 17.34 inches, or about 66 percent, usually falls in May through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 6.08 inches at Park Rapids on July 18, 1985. Thunderstorms occur on about 33 days each year, and most occur between June and August.

The average seasonal snowfall is 52.1 inches. The greatest snow depth at any one time during the period of record was 41 inches recorded on February 1, 1969. On the average, 123 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 14.0 inches recorded on March 4, 1985.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 65 percent of the time possible in summer and 48

Figure 3.—Most of the survey area is wooded. Jack pine is a typical species in areas of sandy outwash.

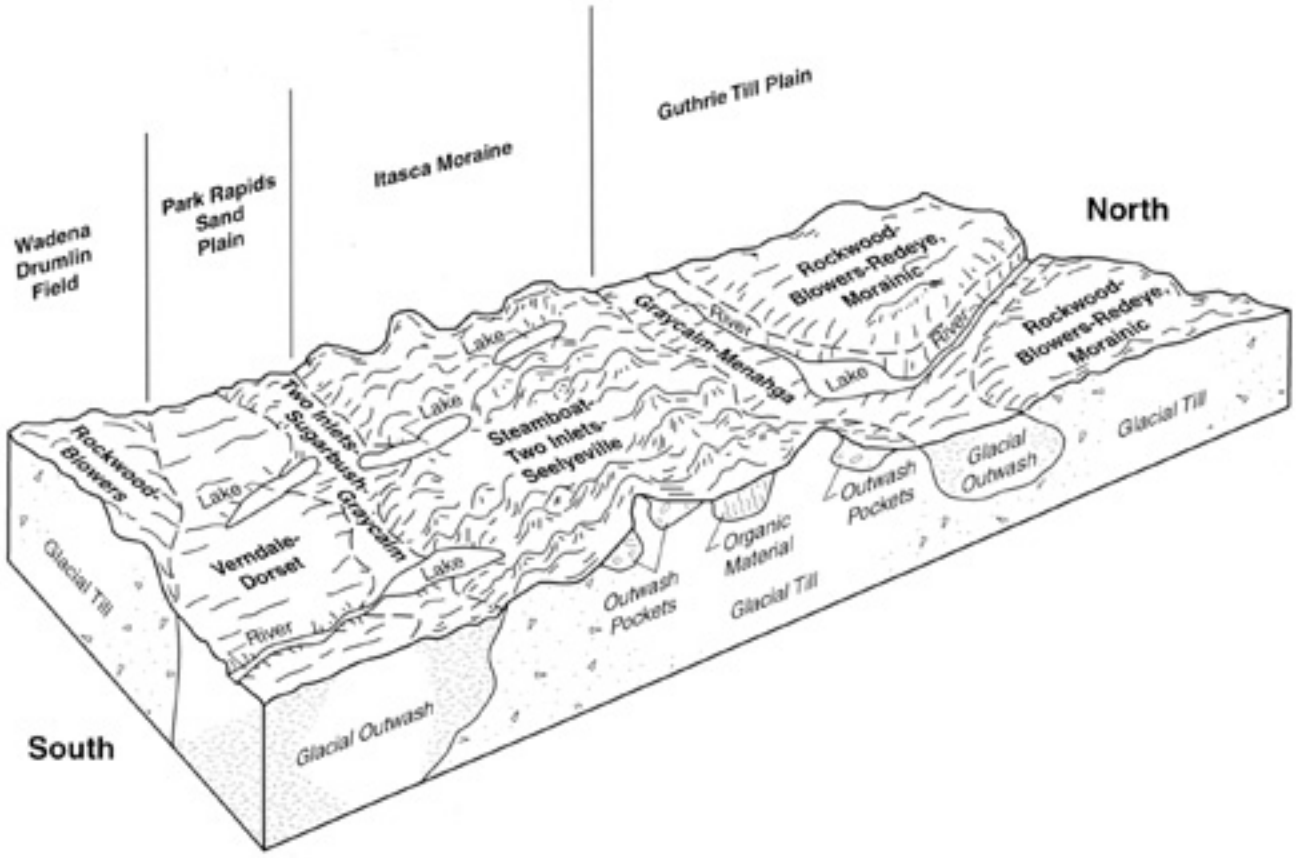


Figure 4.—Pattern of soils and parent material of some of the associations in Hubbard County related to the major geomorphic areas.

percent in winter. The prevailing wind is from the northwest from December to May and from the south the rest of the year. Average windspeed is highest, around 11 miles per hour, from March to May.

Water Supply

Ground water is the major source of drinking water in the county. It is drawn from aquifers, which are saturated layers of sand and/or gravel. The quantity and quality of water drawn vary, depending on the characteristics of each aquifer.

The parent material in northern Hubbard County is mainly glacial till. Aquifers in glacial till occur in random patterns and variable thicknesses. Wells tapped in glacial till must find a viable aquifer in order to produce a significant amount of water. Wells in this part of the county are commonly deeper than in areas of glacial outwash.

Southern Hubbard County is mainly glacial outwash. Wells tapped in these aquifers are generally less than 80 feet deep. Some confined aquifers can occur, commonly confined by clay or silt layers. Ground water in this part of the county is more susceptible to contamination caused by the sand and gravel parent material and the close proximity to the surface. Well water throughout the county is quite hard because of dissolved minerals. Soluble iron also is common.

Geologic History

Precambrian metamorphic and igneous rocks form the lowermost geologic unit in Hubbard County. The depth to these rocks ranges from 200 to more than 400 feet. According to well-drilling logs, Cretaceous sedimentary rocks appear to overlie the Precambrian bedrock in some parts of the county.

Glacial drift of Wisconsin Age forms the uppermost geologic unit in Hubbard County. Most of the soil

materials and landscapes are the result of the advance, retreat, and wasting of the Wadena Lobe. An area in the northeastern part of the county is covered by drift from the Des Moines Lobe.

The Wadena Lobe advanced from a northerly direction, crossing the Winnipeg lowlands in southern Manitoba where it incorporated limestone rocks and deposited loamy materials rich in carbonates (Wright, 1962). Its earliest advance built the Alexandria Moraine west of Hubbard County and the Wadena Drumlin Field. The Wadena Lobe then retreated northward but readvanced to form the Itasca Moraine about 20,000 years ago (Wright, 1972). The glacial till materials in the northern third of the county were compacted by the moving ice sheet of the Wadena Lobe. This glacial till deposit exhibits properties affecting root penetration and water infiltration similar to those of the dense till materials in the Wadena Drumlin Field.

The most recent glacial advance was that of the Des Moines Lobe. This lobe crossed Manitoba, incorporating limestone rocks, and followed the Red River Valley where it picked up shale-rich materials derived from Cretaceous rocks (Sackreiter, 1975). This finer textured material partially buried the earlier Wadena Lobe till in the northeastern part of the county.

Postglacial events have also contributed to the form of the landscape of Hubbard County. Most of the sandy and gravelly materials were deposited by meltwaters from the Wadena Lobe. Stratification of the outwash is common and is related to the relative velocity of the water.

Meltwaters from the St. Croix Moraine in Cass County deposited reddish brown, noncalcareous outwash in the southeastern part of Hubbard County. These outwash materials buried the older Itasca Moraine deposits.

Lacustrine deposits around Akeley indicate the presence of a short-lived glacial lake. Areas of lacustrine materials are also in the Itasca moraine. These are believed to be deposits from small ice-walled lakes.

The most recent deposits are nonglacial in origin and consist of alluvium deposited on flood plains and limnic or organic sediments in lakes and depressions. The organic deposits probably began to accumulate in depressional areas about 4,000 years ago (Norton, 1982).

Temperature and Precipitation

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

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	16.4	-6.2	5.1	43	-39	0	0.67	0.22	1.03	2	11.2
February---	24.0	-0.2	11.9	49	-36	0	.51	.20	.76	1	6.7
March------	36.9	14.5	25.7	63	-23	14	1.25	.68	1.74	3	12.0
April------	54.0	29.2	41.6	83	4	142	2.37	1.09	3.47	5	5.5
May--------	68.0	41.4	54.7	89	21	460	2.65	1.23	3.88	6	.2
June-------	76.5	51.1	63.8	92	34	713	4.27	2.44	5.90	8	.0
July-------	81.7	56.3	69.0	97	39	900	3.75	1.52	5.63	6	.0
August-----	79.3	53.8	66.5	96	35	823	3.75	1.57	5.60	5	.0
September--	68.2	44.3	56.2	90	23	489	2.92	1.34	4.27	5	.0
October----	56.0	33.4	44.7	81	12	201	2.38	.84	3.65	4	1.1
November---	36.3	18.5	27.4	64	-16	19	1.03	.43	1.54	2	5.9
December---	20.7	1.3	11.0	46	-33	1	.79	.35	1.16	2	9.5
Yearly:											
Average---	51.5	28.1	39.8	---	---	---	---	---	---	---	---
Extreme---	---	---	---	98	-40	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,760	26.33	21.79	30.58	49	52.1

* 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 Park Rapids, 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 12	May 22	June 1
2 years in 10 later than--	May 8	May 17	May 28
5 years in 10 later than--	Apr. 29	May 9	May 19
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 22	Sept. 15	Sept. 6
2 years in 10 earlier than--	Sept. 27	Sept. 19	Sept. 10
5 years in 10 earlier than--	Oct. 6	Sept. 28	Sept. 18

Growing Season

(Recorded in the period 1961-90 at Park Rapids, 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	138	124	101
8 years in 10	145	130	108
5 years in 10	159	141	120
2 years in 10	173	152	133
1 year in 10	180	158	140

General Soil Map Units

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

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

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

1. Sol-Nary Association

Setting

Landform and position on the landform: Summits, backslopes, and flats on moraines
Slope range: 1 to 6 percent

Composition

Percent of the survey area: 0.5
Extent of the components in the association:
Sol and similar soils—45 percent
Nary and similar soils—30 percent
Minor soils—25 percent

Soil Properties and Qualities

Sol

Drainage class: Well drained
Parent material: Till
Texture of the surface layer: Fine sandy loam

Nary

Drainage class: Moderately well drained
Parent material: Till
Texture of the surface layer: Fine sandy loam

Minor Soils

- Snellman and similar soils
- Egglake and similar soils
- Cathro and similar soils
- Lupton and similar soils

Major Uses

- Forest land and cropland

2. Snellman-Lengby-Zerkel Association

Setting

Landform and position on the landform: Summits, backslopes, and flats on lake plains, outwash plains, and moraines
Slope range: 1 to 15 percent

Composition

Percent of the survey area: 0.5
Extent of the soils in the association:
Snellman and similar soils—40 percent
Lengby and similar soils—20 percent
Zerkel and similar soils—15 percent
Minor soils—25 percent

Soil Properties and Qualities

Snellman

Drainage class: Well drained
Parent material: Till
Texture of the surface layer: Sandy loam

Lengby

Drainage class: Well drained
Parent material: Glaciolacustrine deposits
Texture of the surface layer: Fine sandy loam

Zerkel

Drainage class: Moderately well drained
Parent material: Glaciolacustrine deposits
Texture of the surface layer: Loam

Minor Soils

- Graycalm and similar soils
- Willosippi and similar soils
- Cathro and similar soils
- Lupton and similar soils

Major Uses

- Forest land and cropland

3. Rockwood-Blowers-Redeye, Morainic, Association

Setting

Landform and position on the landform: Summits, backslopes, shoulders, and flats on moraines (fig. 5)
Slope range: 1 to 30 percent

Composition

Percent of the survey area: 22
Extent of the soils in the association:
Rockwood and similar soils—40 percent
Blowers and similar soils—30 percent
Redeye and similar soils—15 percent
Minor soils—15 percent

Soil Properties and Qualities

Rockwood

Drainage class: Well drained
Parent material: Till
Texture of the surface layer: Fine sandy loam

Blowers

Drainage class: Moderately well drained
Parent material: Till
Texture of the surface layer: Fine sandy loam

Redeye

Drainage class: Well drained
Parent material: Outwash over till

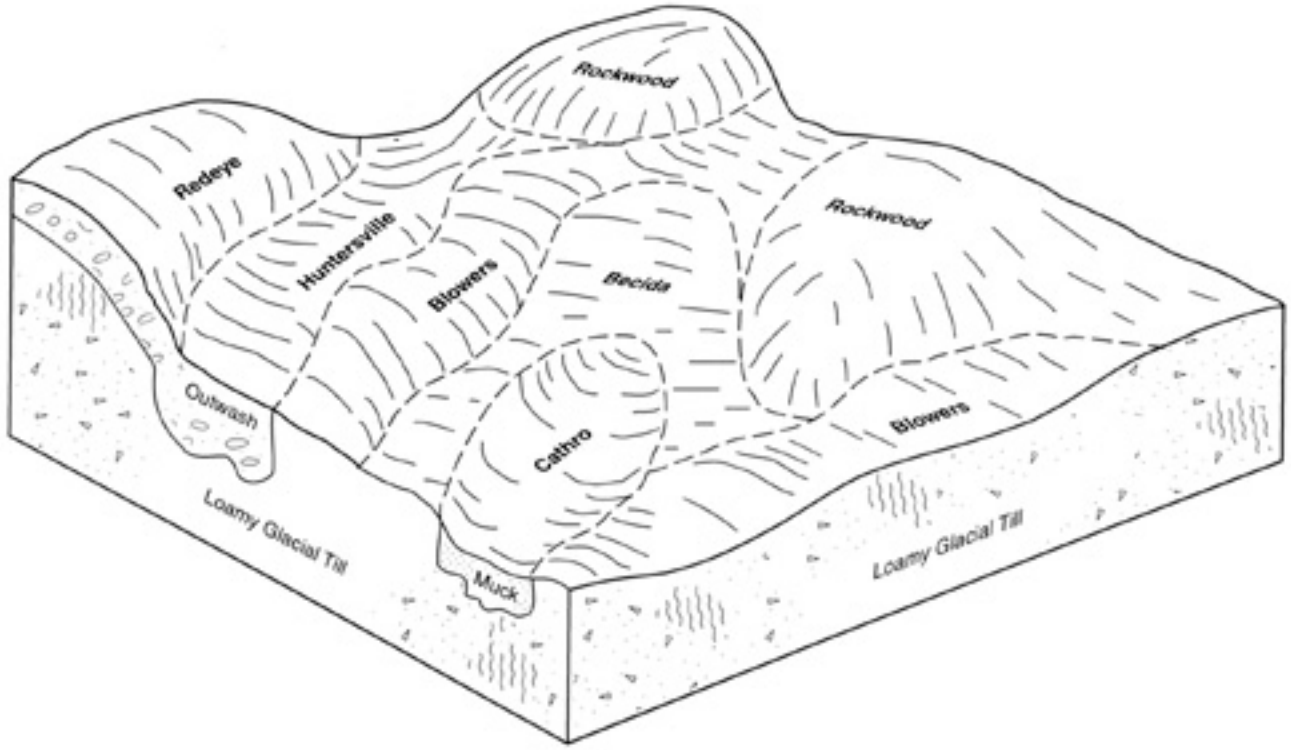


Figure 5.—Typical pattern of soils and parent material in the Rockwood-Blowers-Redeye, morainic, association.

Texture of the surface layer: Loamy sand

Minor Soils

- Two Inlets and similar soils
- Huntersville and similar soils
- Becida and similar soils
- Cathro and similar soils
- Lupton and similar soils

Major Uses

- Forest land, hayland, and pasture

4. Nebish-Beltrami-Braham Association

Setting

Landform and position on the landform: Summits, backslopes, shoulders, and flats on moraines
Slope range: 1 to 12 percent

Composition

Percent of the survey area: 3
Extent of the soils in the association:
Nebish and similar soils—25 percent
Beltrami and similar soils—25 percent
Braham and similar soils—20 percent
Minor soils—30 percent

Soil Properties and Qualities

Nebish

Drainage class: Well drained
Parent material: Till
Texture of the surface layer: Very fine sandy loam

Beltrami

Drainage class: Somewhat poorly drained
Parent material: Till
Texture of the surface layer: Very fine sandy loam

Braham

Drainage class: Well drained
Parent material: Outwash over till
Texture of the surface layer: Loamy fine sand

Minor Soils

- Blomford and similar soils
- Talmoon and similar soils
- Cathro and similar soils
- Lupton and similar soils

Major Uses

- Forest land, cropland, hayland, and pasture

5. Rockwood-Blowers Association

Setting

Landform and position on the landform: Summits, backslopes, shoulders, and flats on drumlins
Slope range: 1 to 20 percent

Composition

Percent of the survey area: 1
Extent of the soils in the association:
Rockwood and similar soils—35 percent
Blowers and similar soils—30 percent
Minor soils—35 percent

Soil Properties and Qualities

Rockwood

Drainage class: Well drained
Parent material: Till
Texture of the surface layer: Sandy loam

Blowers

Drainage class: Moderately well drained
Parent material: Till
Texture of the surface layer: Sandy loam

Minor Soils

- Redeye and similar soils
- Huntersville and similar soils
- Paddock and similar soils
- Cathro and similar soils
- Seelyeville and similar soils

Major Uses

- Forest land, cropland, and pasture

6. Steamboat-Two Inlets-Seelyeville Association

Setting

Landform and position on the landform: Summits, backslopes, shoulders, and depressions on moraines
Slope range: 0 to 65 percent

Composition

Percent of the survey area: 29
Extent of the soils in the association:
Steamboat and similar soils—45 percent
Two Inlets and similar soils—25 percent
Seelyeville and similar soils—20 percent
Minor components—10 percent

Soil Properties and Qualities

Steamboat

Drainage class: Well drained
Parent material: Till
Texture of the surface layer: Sandy loam

Two Inlets

Drainage class: Excessively drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Loamy sand

Seelyeville

Drainage class: Very poorly drained
Parent material: Herbaceous organic materials
Texture of the surface layer: Muck

Minor Components

- Eagleview and similar soils
- Potatolake and similar soils
- Egglake and similar soils
- Cathro and similar soils
- Lupton and similar soils
- Water

Major Uses

- Forest land

7. Sol-Sugarbush Association

Setting

Landform and position on the landform: Summits and backslopes on moraines
Slope range: 1 to 45 percent

Composition

Percent of the survey area: 1
Extent of the soils in the association:
Sol and similar soils—50 percent
Sugarbush and similar soils—20 percent
Minor components—30 percent

Soil Properties and Qualities

Sol

Drainage class: Well drained
Parent material: Till
Texture of the surface layer: Sandy loam

Sugarbush

Drainage class: Well drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Sandy loam

Minor Components

- Two Inlets and similar soils
- Lengby and similar soils
- Wurtsmith and similar soils
- Egglake and similar soils
- Cathro and similar soils
- Lupton and similar soils
- Water

Major Uses

- Forest land

8. Graycalm-Menahga Association

Setting

Landform and position on the landform: Summits, backslopes, shoulders, and flats on outwash plains (fig. 6)
Slope range: 1 to 45 percent

Composition

Percent of the survey area: 13
Extent of the soils in the association:
Graycalm and similar soils—50 percent
Menahga and similar soils—20 percent
Minor soils—30 percent

Soil Properties and Qualities

Graycalm

Drainage class: Somewhat excessively drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Loamy sand

Menahga

Drainage class: Excessively drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Loamy sand

Minor Soils

- Wurtsmith and similar soils
- Meehan and similar soils
- Roscommon and similar soils
- Markey and similar soils
- Lupton and similar soils

Major Uses

- Forest land

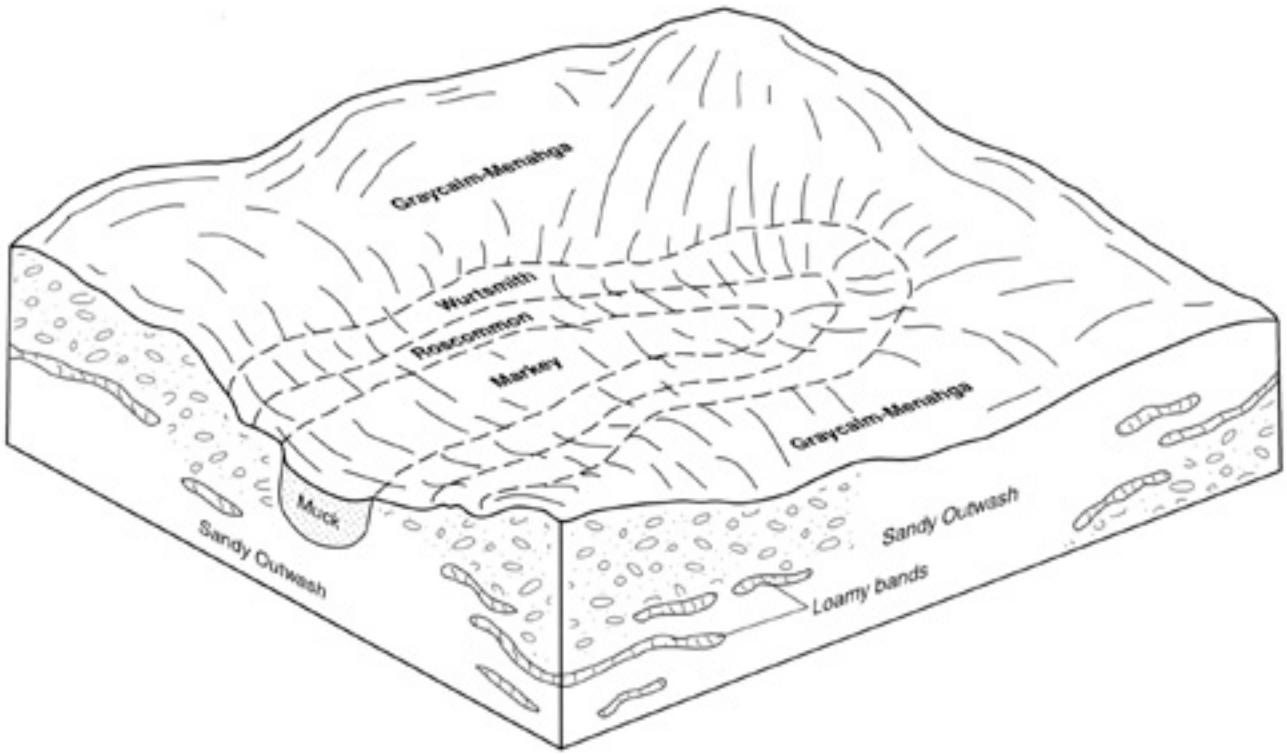


Figure 6.—Typical pattern of soils and parent material in the Graycalm-Menahga association.

9. Two Inlets-Sugarbush-Graycalm Association

Setting

Landform and position on the landform: Summits, backslopes, shoulders, and flats on glacial outwash plains (fig. 7)
Slope range: 0 to 45 percent

Composition

Percent of the survey area: 13
Extent of the soils in the association:
Two Inlets and similar soils—35 percent
Sugarbush and similar soils—30 percent
Graycalm and similar soils—20 percent
Minor soils—15 percent

Soil Properties and Qualities

Two Inlets

Drainage class: Excessively drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Loamy sand

Sugarbush

Drainage class: Well drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Sandy loam

Graycalm

Drainage class: Somewhat excessively drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Loamy sand

Minor Soils

- Bootlake and similar soils
- Wurtsmith and similar soils
- Roscommon and similar soils
- Nidaros and similar soils
- Lupton and similar soils

Major Uses

- Forest land and pasture

Figure 7.—An area of the Two Inlets-Sugarbush-Graycalm association that has been excavated for sand and gravel.

10. Sanburn-Graycalm Association

Setting

Landform and position on the landform: Summits, backslopes, shoulders, and flats on outwash plains
Slope range: 0 to 30 percent

Composition

Percent of the survey area: 7
Extent of the soils in the association:
Sanburn and similar soils—60 percent
Graycalm and similar soils—30 percent
Minor soils—10 percent

Soil Properties and Qualities

Sanburn

Drainage class: Somewhat excessively drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Loamy sand

Graycalm

Drainage class: Somewhat excessively drained
Parent material: Outwash or beach deposits
Texture of the surface layer: Loamy sand

Minor Soils

- Wurtsmith and similar soils
- Roscommon and similar soils
- Nidaros and similar soils
- Seelyeville and similar soils

Major Uses

- Forest land, cropland, and pasture

11. Verndale-Dorset Association

Setting

Landform and position on the landform: Summits, backslopes, shoulders, and flats on outwash plains (fig. 8)

Slope range: 0 to 20 percent

Composition

Percent of the survey area: 8
Extent of the soils in the association:
Verndale and similar soils—40 percent
Dorset and similar soils—30 percent
Minor soils—30 percent

Soil Properties and Qualities

Verndale

Drainage class: Somewhat excessively drained
Parent material: Loamy mantle over sandy outwash or beach deposits
Texture of the surface layer: Sandy loam

Dorset

Drainage class: Somewhat excessively drained
Parent material: Loamy mantle over sandy and gravelly outwash or beach deposits
Texture of the surface layer: Sandy loam

Minor Soils

- Nymore and similar soils
- Corliss and similar soils
- Duelm and similar soils
- Isan and similar soils
- Nidaros and similar soils
- Seelyeville and similar soils

Major Uses

- Cropland, hayland, and pasture

12. Seelyeville-Nidaros-Meehan Association

Setting

Landform and position on the landform: Depressions and flats on outwash plains
Slope range: 0 to 3 percent

Composition

Percent of the survey area: 2
Extent of the soils in the association:
Seelyeville and similar soils—40 percent
Nidaros and similar soils—20 percent
Meehan and similar soils—20 percent
Minor soils—20 percent

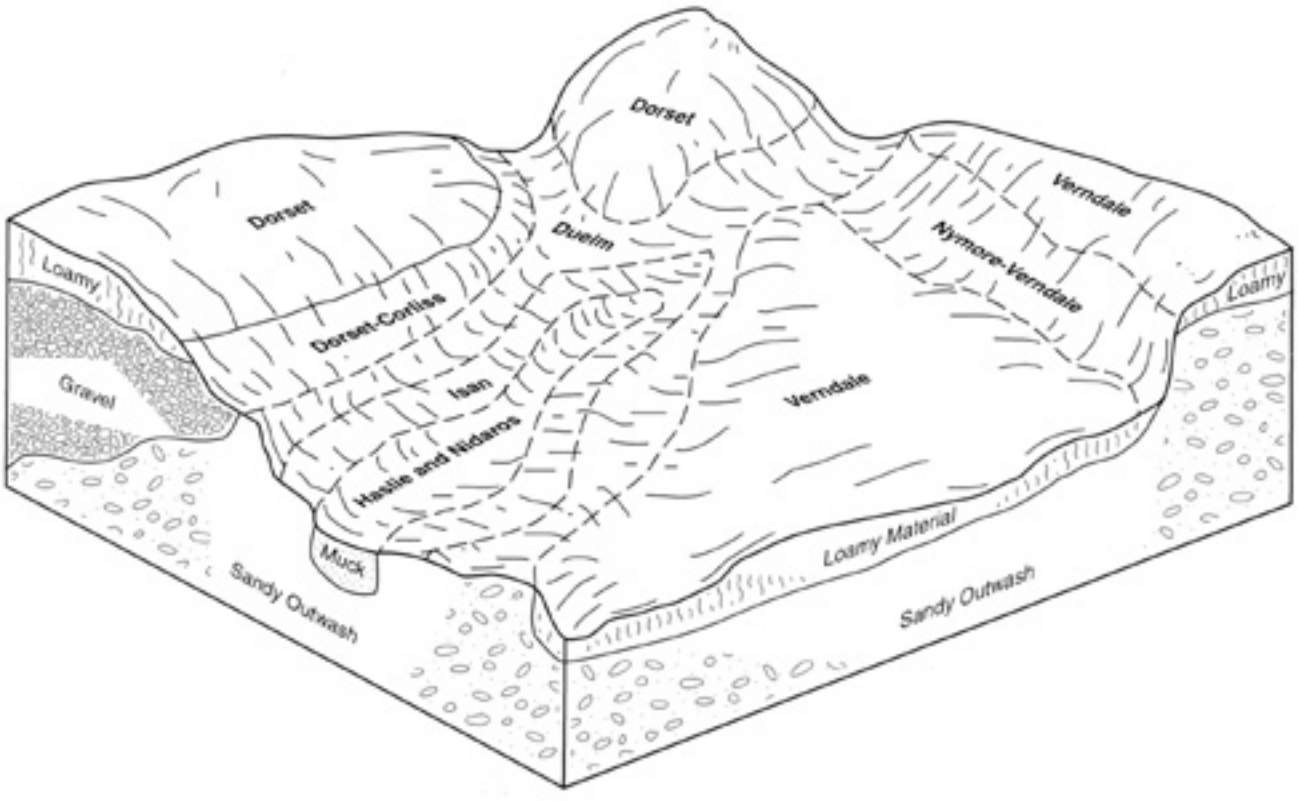


Figure 8.—Typical pattern of soils and parent material in the Verndale-Dorset association.

Soil Properties and Qualities

Seelyeville

Drainage class: Very poorly drained
Parent material: Herbaceous organic materials
Texture of the surface layer: Muck

Nidaros

Drainage class: Very poorly drained
Parent material: Organic materials over outwash
Texture of the surface layer: Muck

Meehan

Drainage class: Somewhat poorly drained
Parent material: Outwash
Texture of the surface layer: Loamy sand

Minor Soils

- Wurtsmith and similar soils
- Roscommon and similar soils
- Graycalm and similar soils

Major Uses

- Wildlife habitat and forest land

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

Soil is produced by the action of soil-forming processes on materials deposited by geological forces (Jenny, 1941). Soil characteristics 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 topography; and the length of time that the forces of soil formation have acted on the parent materials.

The type of parent material and its resistance to weathering determine the kind and degree of soil development. Climatic changes and plants and animals act upon the parent material. Relief modifies the effects of climate, which in turn influences plant material. All of these forces cause alterations in the parent material over geologic time. These alterations result in the development of distinct soil types.

All five factors of soil formation are interrelated. When one factor changes, the other four factors are affected. The following paragraphs describe the factors of soil formation as they relate to the soils in Hubbard County.

Climate

Hubbard County has a cool, subhumid continental climate characterized by cold winters and hot summers. Rainfall and snowmelt dissolve minerals and support biological activity, and the water moves minerals and organic residue into the soil. Temperature influences the kinds of plants and animals in the soil and their rate of growth. Temperature also controls the rate of physical and chemical weathering. Freezing of the soil in winter slows the soil-forming processes. Alternate freezing and thawing cycles break up the parent material, and frost heaving helps to mix the soil material.

Living Organisms

The native vegetation of Hubbard County consisted of five major types (Marshner, 1974). These included aspen-birch, jack pine barrens and openings, white pine-red pine, hardwood forests, and wetlands-brushland-prairie. The majority of the county supported well mixed aspen-birch, jack pine barrens and openings, and white pine-red pine plant communities. The northeastern part of the county supported most of the hardwood forests. The most common species included oak, aspen, birch, elm, ash, and maple. The areas of wetland-brushland-prairie were adjacent to rivers and broad drainageways and in a large, low-relief area in the extreme southeast corner of the county. The wetland component consisted of plant communities ranging from cattails, sedges, and reeds to dense tamarack, black spruce, and northern whitecedar. The brushland-prairie component consisted of shrub and oak/aspen thickets.

These different plant communities influenced the chemical and biological processes of soil formation. Plants primarily influence soil formation by adding raw plant residues to nutrient recycling systems. Generally, soils that formed under deciduous vegetation tend to have a higher base status and lower acidity than soils that formed under dominantly coniferous trees. Also, the chemical composition of plant residues can influence the movement of nutrients through the soil. Vegetation can affect the structure of the soil. The quality and quantity of vegetative cover can affect the soil's erodibility.

Although plants have the greatest influence on soil formation, bacteria, earthworms, and other forms of animal life aid in the weathering of soil materials and the decomposition of organic matter. Earthworms and small burrowing animals help to mix the upper layers of the soil.

The farming and land-clearing activities of humans affect some soil-forming processes and have changed some of the properties and characteristics of the soils in the survey area. Tillage has partially altered the original structure of the soil and has mixed the darker

surface layer with the lighter colored subsoil. Applications of fertilizer have increased the fertility of some soils. Drainage activities affect runoff and infiltration rates. Accelerated erosion on unprotected farmland has reduced the thickness of the surface layer and the content of organic matter.

Topography

Topography is an important factor in soil formation because it affects drainage, infiltration, erosion, and vegetation. In Hubbard County, relief ranges from nearly level to very steep. As the degree of slope increases, the potential for erosion increases and the amount of water available for leaching and for plant use decreases. Slope aspect influences soil moisture and soil temperature. South- and west-facing slopes receive more sunlight than north- and east-facing slopes. Thus, the soils on south- and west-facing slopes tend to be warmer and drier than the soils on north- and east-facing slopes.

Topographic position on the landscape affects natural drainage. Soils that are in the higher positions on the landscape typically are not saturated with water. Soils in the lower positions may have a seasonal high water table and can be saturated for extended periods of time. Soils in depressions are commonly ponded and remain saturated year-round. Soil color is influenced by the drainage class of the soil. Well drained soils normally exhibit brown and yellow colors. Poorly drained soils are normally characterized by duller grays and blues. Soil drainage also affects the type of vegetation that will grow in different positions on the landscape because each plant species or community has inherently different moisture requirements.

Parent Material

The soils in Hubbard County formed in glacial till, in glacial outwash, and in organic material. About 60 percent of the soils formed in glacial till, 30 percent in sandy and gravelly outwash, and 10 percent in organic material.

The three distinct areas of glacial till in Hubbard County reflect the processes of glacial deposition. The central part of the county consists of the Itasca Moraine complex and is characterized by steep, rugged hills typical of an end moraine. This glacial feature produced a variety of landscapes dominated by calcareous sandy loam and loam and local deposits of sand, gravel, and stratified materials. The major soils in this area include Steamboat, Sol, and Two Inlets soils.

The northern one-third of the county consists of a ground moraine formed by active (advancing and/or retreating) ice. This landscape is nearly level to sloping, except along river channels, and is dominated by calcareous sandy loam and loam and an abundance of boulders, stones, and cobbles. The major soils in this area include Rockwood, Blowers, Nebish, and Beltrami soils.

The loamy glacial till in Straight River Township is associated with the Wadena drumlin field. The shape and extent of these drumlins have been altered by deposits of outwash from the Itasca moraine. The landscape is gently sloping and sloping. Blowers, Rockwood, Redeye, and Huntersville are the major soils in this area.

The southern one-third of the county consists of two distinct glacial outwash areas. One area is generally west and southwest of the Crow Wing chain of lakes and was derived from meltwaters of the Itasca Moraine. The landscape is nearly level and gently sloping and is dominated by calcareous sandy and gravelly materials. The major soils in this area include Bootlake, Graycalm, Sugarbush, Two Inlets, Verndale, Nymore, Dorset, and Corliss soils.

The second major area of glacial outwash is generally east and southeast of the Crow Wing chain of lakes and was derived from meltwaters of the St. Croix Moraine in Cass County. The landscape is nearly level and gently sloping and is dominated by acidic sandy and gravelly materials. The major soils in this area include Sanburn, Graycalm, Menahga, and Wurtsmith soils.

The organic materials in Hubbard County were derived from both herbaceous and woody plants, forming two distinctive types of peat. Soils that formed in this material have a high water table. Herbaceous peats dominantly support cattails, reeds, sedges, and willows. Cedar, tamarack, black spruce, alder, and black ash thrive in the woody peats. Because the high water table slows the rate of decomposition, plant materials accumulate faster than they decompose. The organic materials range in thickness from 8 inches to more than 7 feet and are highly or moderately decomposed. The organic soils are in depressions, potholes, and broad drainageways throughout the county. The major organic soils are Seelyeville, Mooselake, Lupton, Nidaros, Markey, and Cathro soils.

More information on the glacial history and parent materials of the county is available under the heading “General Nature of the Survey Area.”

Time

Soil formation is influenced by the length of time during which soils have been exposed to the other soil-forming processes. In geologic terms, the soils of

Hubbard County are young. The processes of soil formation have been active for only the past 10,000 to 20,000 years, since the last glacial period ended. Young soils are generally more fertile and exhibit less development than older soils.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table "Classification of the Soils," which is at the end of this section, shows the classification of the soils in the survey area. The extent of the soils in the survey area is shown in the table "Acreage and Proportionate Extent of the Soils."

The categories of soil classification are defined in the following paragraphs.

ORDER. Twelve 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 sandy, mixed, frigid 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
Akeley	Arenic Eutroboralfs, loamy, mixed, superactive
Baudette	Aquic Eutroboralfs, fine-silty, mixed, superactive
Becida	Mollic Glossaqualfs, coarse-loamy, mixed, superactive, frigid
Beltrami	Aquic Eutroboralfs, fine-loamy, mixed, superactive
Blomford	Arenic Epiaqualfs, loamy, mixed, superactive, frigid
Blowers	Glossaquic Eutroboralfs, coarse-loamy, mixed, superactive
Bootlake	Typic Eutroboralfs, coarse-loamy, mixed, superactive
Bowstring	Fluvaquentic Borosaprists, euic
Braham	Arenic Eutroboralfs, loamy, mixed, superactive
Cathro	Terric Borosaprists, loamy, mixed, euic
Corliss	Typic Udipsamments, mixed, frigid
Dalbo	Aquertic Eutroboralfs, fine, smectitic
Debs	Typic Eutroboralfs, fine-silty, mixed, superactive
Dorset	Udic Argiborolls, coarse-loamy, mixed, superactive
Duelm	Aquic Haploborolls, sandy, mixed
Eagleview	Argic Udipsamments, mixed, frigid
Egglake	Mollic Endoaqualfs, fine-loamy, mixed, superactive, frigid
Evart	Fluvaquentic Endoaquolls, sandy, mixed, frigid
Graycalm	Argic Udipsamments, mixed, frigid
Haslie	Limnic Borosaprists, coprogenous, euic
Huntersville	Aquic Arenic Eutroboralfs, loamy, mixed, superactive
Isan	Typic Endoaquolls, sandy, mixed, frigid
Lengby	Typic Eutroboralfs, fine-loamy, mixed, superactive
Lupton	Typic Borosaprists, euic
Markey	Terric Borosaprists, sandy or sandy-skeletal, mixed, euic
Meehan	Aquic Udipsamments, mixed, frigid
Menahga	Typic Udipsamments, mixed, frigid
Mooselake	Typic Borohemists, euic
Nary	Glossaquic Eutroboralfs, fine-loamy, mixed, superactive
Nebish	Typic Eutroboralfs, fine-loamy, mixed, superactive
Nidaros	Terric Borosaprists, loamy, mixed, euic
Nymore	Typic Udipsamments, mixed, frigid
Paddock	Udollic Epiaqualfs, coarse-loamy, mixed, superactive, frigid
Potatolake	Aquic Eutroboralfs, fine-silty, mixed, superactive
Redeye	Arenic Eutroboralfs, loamy, mixed, superactive
Rifle	Typic Borohemists, euic
Rockwood	Mollic Eutroboralfs, coarse-loamy, mixed, superactive
Rondeau	Limnic Borosaprists, marly, euic
Roscommon	Mollic Psammaquents, mixed, frigid
Runeberg	Typic Endoaquolls, coarse-loamy, mixed, superactive, frigid
Sanburn	Typic Eutroboralfs, coarse-loamy, mixed, superactive
Seelyeville	Typic Borosaprists, euic
Snellman	Typic Eutroboralfs, fine-loamy, mixed, superactive
Sol	Glossic Eutroboralfs, fine-loamy, mixed, superactive
Spooner	Mollic Endoaqualfs, fine-silty, mixed, superactive, frigid
Staples	Arenic Epiaqualfs, loamy, mixed, superactive, frigid
Steamboat	Typic Paleboralfs, coarse-loamy, mixed, superactive
Sugarbush	Typic Eutroboralfs, coarse-loamy, mixed, superactive
Talmoon	Mollic Endoaqualfs, fine-loamy, mixed, superactive, frigid
Two Inlets	Psammentic Eutroboralfs, mixed
Udipsamments	Udipsamments
Udorthents	Udorthents
Verndale	Udic Argiborolls, coarse-loamy, mixed, superactive
Willosippi	Mollic Endoaqualfs, fine-loamy, mixed, superactive, frigid
Wurtsmith	Oxyaquic Udipsamments, mixed, frigid
Zerkel	Glossic Oxyaquic Eutroboralfs, fine-loamy, mixed, superactive
Zimmerman	Argic Udipsamments, mixed, frigid

Acreage and Proportionate Extent of the Soils

(The abbreviation "MAP" stands for mean annual precipitation; the numbers that follow the abbreviation refer to a range in inches)

Map symbol	Soil name	Acres	Percent
82B	Redeye loamy sand, 1 to 6 percent slopes	642	0.1
82C	Redeye loamy sand, 6 to 12 percent slopes	39	*
133B	Dalbo silt loam, 2 to 8 percent slopes	17	*
133C	Dalbo silt loam, 8 to 15 percent slopes	3	*
139B	Huntersville loamy fine sand, 1 to 6 percent slopes	760	0.1
147	Spooner silt loam, 0 to 2 percent slopes	140	*
158B	Zimmerman loamy fine sand, 1 to 6 percent slopes	1,657	0.3
158C	Zimmerman loamy fine sand, 6 to 12 percent slopes	60	*
167A	Baudette silt loam, 1 to 3 percent slopes	295	*
170	Blomford loamy fine sand, 0 to 2 percent slopes	740	0.1
202	Meehan loamy sand, MAP 22-30, 0 to 3 percent slopes	2,898	0.5
207B	Nymore loamy sand, 2 to 6 percent slopes	580	*
207C	Nymore loamy sand, 6 to 12 percent slopes	81	*
207D	Nymore loamy sand, 12 to 20 percent slopes	53	*
260	Duelm loamy sand, 0 to 2 percent slopes	459	*
261	Isan loamy sand, depressional, 0 to 1 percent slopes	466	*
267B	Snellman sandy loam, 2 to 8 percent slopes	563	*
346	Talmoon loam, 0 to 2 percent slopes	491	*
406A	Dorset sandy loam, 0 to 2 percent slopes	207	*
488	Becida fine sandy loam, morainic, 0 to 2 percent slopes, stony	4,766	0.7
526C	Steamboat-Two Inlets-Seelyeville complex, pitted, 0 to 15 percent slopes	65,187	10.2
526E	Steamboat-Two Inlets-Seelyeville complex, pitted, 0 to 35 percent slopes	38,306	6.0
540	Seelyeville muck, depressional, MAP 22-30, 0 to 1 percent slopes	10,127	1.6
541	Rifle mucky peat, depressional, MAP 22-30, 0 to 1 percent slopes	41	*
545	Rondeau muck, depressional, 0 to 1 percent slopes	433	*
567A	Verndale sandy loam, 0 to 2 percent slopes	10,532	1.6
574G	Steamboat-Two Inlets complex, pitted, 35 to 65 percent slopes	3,486	0.5
628	Talmoon muck, depressional, 0 to 1 percent slopes	126	*
672	Willosippi loam, 0 to 2 percent slopes	1,635	0.3
675C	Two Inlets-Eagleview-Steamboat complex, pitted, 3 to 15 percent slopes	23,233	3.6
675E	Two Inlets-Eagleview-Steamboat complex, pitted, 15 to 35 percent slopes	15,750	2.5
675G	Two Inlets-Eagleview-Steamboat complex, pitted, 35 to 65 percent slopes	2,827	0.4
701	Runeberg mucky loam, depressional, 0 to 1 percent slopes	728	0.1
709B	Lengby fine sandy loam, 2 to 8 percent slopes	744	0.1
709C	Lengby fine sandy loam, 8 to 15 percent slopes	94	*
719B	Rondeau muck (seepland), 1 to 6 percent slopes	277	*
731A	Sanburn loamy sand, 0 to 3 percent slopes	8,156	1.3
744B	Debs-Akeley complex, 1 to 8 percent slopes	2,424	0.4
746	Haslie muck, depressional, 0 to 1 percent slopes	122	*
775B	Sugarbush-Two Inlets complex, 1 to 8 percent slopes	14,068	2.2
775C	Sugarbush-Two Inlets complex, 8 to 15 percent slopes	11,030	1.7
778B	Dorset-Corliss complex, 1 to 6 percent slopes	8,251	1.3
778C	Dorset-Corliss complex, 6 to 12 percent slopes	2,276	0.4
797	Mooselake and Lupton soils, 0 to 1 percent slopes	28,717	4.5
799	Seelyeville and Bowstring soils, 0 to 1 percent slopes, frequently flooded	1,357	0.2
820B	Potatolake very fine sandy loam, 1 to 8 percent slopes	3,925	0.6
820C	Potatolake very fine sandy loam, 8 to 15 percent slopes	796	0.1
831C	Akeley-Debs complex, 8 to 15 percent slopes	1,263	0.2
831E	Akeley-Debs complex, 15 to 35 percent slopes	866	0.1
844B	Sanburn-Graycalm complex, 3 to 8 percent slopes	22,150	3.5
867B	Graycalm-Menahga complex, 1 to 8 percent slopes	26,445	4.1
867C	Graycalm-Menahga complex, 8 to 15 percent slopes	4,969	0.8
867E	Graycalm-Menahga complex, 15 to 30 percent slopes	5,527	0.9
867F	Graycalm-Menahga complex, 30 to 45 percent slopes	143	*
1015	Udipsamments (cut and fill land)	371	*
1016	Udorthents, loamy (cut and fill land)	147	*
1021C	Graycalm-Sanburn complex, 8 to 15 percent slopes	6,569	1.0

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
1027	Udorthents, wet substratum (fill land)	171	*
1030	Pits, gravel-Udipsamments complex	706	0.1
1111	Nidaros muck, 0 to 1 percent slopes, frequently flooded	11,207	1.8
1113	Haslie, Seelyeville, and Cathro soils, ponded, 0 to 1 percent slopes	10,408	1.6
1126B	Verndale-Nymore complex, 1 to 6 percent slopes	26,821	4.2
1127A	Bootlake-Graycalm complex, 0 to 2 percent slopes	239	*
1127B	Bootlake-Graycalm complex, 2 to 8 percent slopes	19,992	3.1
1136	Nidaros muck, depressional, 0 to 1 percent slopes	2,311	0.4
1164	Zerkel loam, 1 to 3 percent slopes	703	0.1
1200	Egglake loam, 0 to 2 percent slopes	174	*
1230	Haslie and Nidaros soils, ponded, 0 to 1 percent slopes	5,175	0.8
1238E	Two Inlets-Sugarbush complex, 15 to 30 percent slopes	5,933	0.9
1238F	Two Inlets-Sugarbush complex, 30 to 45 percent slopes	585	*
1244B	Sol-Sugarbush complex, 2 to 8 percent slopes, very stony	2,532	0.4
1244C	Sol-Sugarbush complex, 8 to 15 percent slopes, very stony	2,068	0.3
1244E	Sol-Sugarbush complex, 15 to 30 percent slopes, very stony	1,337	0.2
1247D	Corliss-Dorset complex, 12 to 20 percent slopes	224	*
1248C	Nymore-Verndale complex, 6 to 12 percent slopes	1,836	0.3
1249C	Graycalm-Bootlake complex, 8 to 15 percent slopes	8,133	1.3
1271	Roscommon mucky loamy sand, depressional, MAP 22-30, 0 to 1 percent slopes	1,811	0.3
1272B	Sol fine sandy loam, 2 to 6 percent slopes	780	0.1
1294	Nary fine sandy loam, 1 to 3 percent slopes	347	*
1319B	Rockwood sandy loam, 2 to 6 percent slopes, stony	3,146	0.5
1319C	Rockwood sandy loam, 6 to 12 percent slopes, stony	277	*
1319D	Rockwood sandy loam, 12 to 20 percent slopes, stony	250	*
1320B	Blowers sandy loam, 1 to 5 percent slopes, stony	1,326	0.2
1321	Paddock-Becida complex, 0 to 2 percent slopes, stony	154	*
1332B	Rockwood fine sandy loam, morainic, 3 to 8 percent slopes, stony	41,382	6.5
1332C	Rockwood fine sandy loam, morainic, 8 to 15 percent slopes, stony	5,781	0.9
1332E	Rockwood fine sandy loam, morainic, 15 to 30 percent slopes, stony	1,271	0.2
1334	Huntersville loamy sand, 1 to 3 percent slopes	4,452	0.7
1336	Blowers fine sandy loam, morainic, 1 to 3 percent slopes, stony	28,854	4.5
1356	Water, miscellaneous	135	*
1421B	Rockwood-Two Inlets, morainic, complex, 3 to 8 percent slopes, stony	15,347	2.4
1421C	Rockwood-Two Inlets, morainic, complex, 8 to 15 percent slopes, stony	9,805	1.5
1421E	Rockwood-Two Inlets, morainic, complex, 15 to 30 percent slopes, stony	4,952	0.8
1438B	Braham loamy fine sand, moderately wet, 2 to 6 percent slopes	1,327	0.2
1439	Cathro muck, depressional, MAP 22-30, 0 to 1 percent slopes	497	*
1440B	Redeye loamy sand, morainic, 3 to 8 percent slopes	5,637	0.9
1440C	Redeye loamy sand, morainic, 8 to 15 percent slopes	1,317	0.2
1444	Wurtsmith loamy sand, MAP 22-30, 0 to 3 percent slopes	6,076	0.9
1445	Markey muck, depressional, MAP 22-30, 0 to 1 percent slopes	284	*
1447	Beltrami very fine sandy loam, 1 to 3 percent slopes	3,423	0.5
1450B	Sanburn very stony loamy sand, 1 to 8 percent slopes, bouldery	882	0.1
1450C	Sanburn very stony loamy sand, 8 to 15 percent slopes, bouldery	368	*
1450E	Sanburn very stony loamy sand, 15 to 30 percent slopes, bouldery	229	*
1460B	Nebish very fine sandy loam, moderately wet, 2 to 6 percent slopes	6,780	1.1
1460C	Nebish very fine sandy loam, 6 to 12 percent slopes	494	*
1943	Roscommon loamy sand, MAP 22-30, 0 to 2 percent slopes	2,594	0.4
1956	Staples loamy sand, 0 to 2 percent slopes	1,663	0.3
1968	Evart loam, 0 to 1 percent slopes, occasionally flooded	9	*
1969	Evart-Isan complex, channeled, 0 to 1 percent slopes, frequently flooded	953	0.1
W	Water	48,827	7.6
	Total	640,000	100.0

* Less than 0.05 percent. The combined extent of the soils assigned an asterisk in the "Percent" column is about 1.6 percent of the survey area.

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 associated detailed soil map units.

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, 1999). 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 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. 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, Rockwood sandy loam, 2 to 6 percent slopes, stony, is a phase of the Rockwood series.

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Bootlake-Graycalm complex, 2 to 8 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Mooselake and Lupton soils, 0 to 1 percent slopes, is an undifferentiated group in this survey area.

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

Some map units have the abbreviation “MAP” as part of the map unit name. This abbreviation stands for “mean annual precipitation.” The numbers that follow the abbreviation refer to a range in inches.

The table “Acreage and Proportionate Extent of the Soils” gives the acreage and proportionate extent of each map unit. Other tables (see the Contents in Part II of this survey) 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.

Akeley Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—rapid; lower part—moderate
Landform: Lake plains and moraines
Parent material: Outwash over glaciolacustrine deposits
Slope range: 1 to 35 percent
Taxonomic classification: Loamy, mixed, superactive Arenic Eutroboralfs

Typical Pedon

Akeley loamy sand, in an area of Akeley-Debs complex, 8 to 15 percent slopes, 2,450 feet north and 1,900 feet east of the southwest corner of sec. 26, T. 141 N., R. 32 W., Hubbard County; USGS Crystal Lake quadrangle; lat. 46 degrees 59 minutes 54.2 seconds N. and long. 94 degrees 41 minutes 54.7 seconds W., NAD27:

A—0 to 3 inches; very dark brown (10YR 2/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common very fine to coarse roots throughout; 5 percent gravel; moderately acid; clear smooth boundary.

Bw—3 to 19 inches; yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure parting to single grain; very friable; common very fine to coarse roots throughout; 5 percent gravel; moderately acid; gradual smooth boundary.

E—19 to 49 inches; pale brown (10YR 6/3) sand; single grain; loose; few very fine and fine roots throughout; 5 percent gravel; moderately acid; clear smooth boundary.

2Bt—49 to 56 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; firm; common faint continuous brown (10YR 4/3) clay films on faces of peds and lining pores; slightly acid; clear smooth boundary.

2C1—56 to 64 inches; light olive brown (2.5Y 5/3) silt loam; weak thin platy structure; friable; neutral; gradual smooth boundary.

2C2—64 to 70 inches; light yellowish brown (2.5Y 6/3) loamy very fine sand; weak thin platy structure parting to single grain; very friable; neutral; gradual smooth boundary.

2C3—70 to 80 inches; light yellowish brown (2.5Y 6/3) silt loam; common medium prominent yellowish brown (10YR 5/8) iron concentrations; weak thin platy structure; very friable; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 40 to more than 60 inches

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—0 to 15 percent

B horizon (if it occurs):
Hue—10YR or 7.5YR

Value—4 or 5
Chroma—3 to 6
Texture—loamy sand, loamy coarse sand, loamy fine sand, sand, fine sand, or coarse sand
Content of rock fragments—0 to 15 percent

E horizon (if it occurs):
Hue—10YR
Value—3 to 6
Chroma—1 to 3
Texture—loamy sand, loamy fine sand, loamy coarse sand, sand, fine sand, or coarse sand
Content of rock fragments—0 to 15 percent

C horizon (if it occurs):
Hue—10YR or 7.5YR
Value—5 or 6
Chroma—3 to 6
Texture—sand, fine sand, or coarse sand
Content of rock fragments—0 to 15 percent

2Bt horizon:
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam, silty clay loam, sandy clay loam, or clay loam
Content of rock fragments—0 to 5 percent

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—silt loam, very fine sandy loam, loamy very fine sand, or silt or stratified with these textures
Content of rock fragments—0 to 5 percent

831C—Akeley-Debs complex, 8 to 15 percent slopes

Composition

Akeley and similar soils: About 45 percent
Debs and similar soils: About 40 percent
Inclusions: About 15 percent

Setting

Landform: Lake plains and moraines
Position on the landform: Akeley—backslopes and shoulders; Debs—summits and backslopes
Slope range: 8 to 15 percent

Component Description

Akeley

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash over glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.2 inches (moderate)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Debs

Texture of the surface layer: Silt loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 5.5 percent (high)

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

- Zimmerman and similar soils
- Wurtsmith and similar soils
- Baudette and similar soils
- Spooner and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

831E—Akeley-Debs complex, 15 to 35 percent slopes

Composition

Akeley and similar soils: About 60 percent
Debs and similar soils: About 25 percent
Inclusions: About 15 percent

Setting

Landform: Lake plains and moraines
Position on the landform: Akeley—backslopes and shoulders; Debs—summits and backslopes
Slope range: 15 to 35 percent

Component Description

Akeley

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash over glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.2 inches (moderate)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Debs

Texture of the surface layer: Silt loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 5.5 percent (high)

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

- Zimmerman and similar soils
- Wurtsmith and similar soils
- Baudette and similar soils
- Spooner and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Baudette 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 classification: Fine-silty, mixed, superactive Aquic Eutroboralfs

Typical Pedon

Baudette silt loam, 1 to 3 percent slopes, 1,320 feet west and 50 feet north of the southeast corner of sec. 35, T. 149 N., R. 32 W., Beltrami County; USGS Ten Strike quadrangle; lat. 47 degrees 40 minutes 20 seconds N. and long. 94 degrees 42 minutes 7 seconds W., NAD27:

A—0 to 4 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 6/1) dry; weak fine granular structure; very friable; neutral; clear smooth boundary.
E—4 to 8 inches; grayish brown (10YR 5/2) very fine sandy loam, light gray (10YR 7/2) dry; weak thin platy structure; very friable; neutral; clear smooth boundary.
Bt1—8 to 16 inches; dark brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.
Bt2—16 to 35 inches; olive brown (2.5Y 4/4) 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; moderate fine subangular blocky structure; friable; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.
C—35 to 60 inches; light olive brown (2.5Y 5/4) silt loam; common medium distinct olive yellow (2.5Y 6/6) iron concentrations and common medium distinct grayish brown (2.5Y 5/2) iron depletions; massive; very friable; common fine irregularly shaped soft masses of carbonates in seams; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 14 to 36 inches

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

E horizon:
Hue—10YR
Value—4 to 6
Chroma—1 to 3
Texture—fine sandy loam, very fine sandy loam, loam, or silt loam

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

C horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—silt loam, silt, loam, very fine sandy loam, loamy very fine sand, or very fine sand

167A—Baudette silt loam, 1 to 3 percent slopes

Composition

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

Setting

Landform: Flats and slight rises on lake plains
Slope range: 1 to 3 percent

Component Description

Texture of the surface layer: Silt loam
Depth to bedrock: More than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

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

- Spooner and similar soils
- Debs and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Becida Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderate; lower part—slow or very slow
Landform: Drumlins and moraines
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Coarse-loamy, mixed, superactive, frigid Mollic Glossaqualfs

Typical Pedon

Becida loam, in an area of Paddock-Becida complex, 0 to 2 percent slopes, stony, 2,600 feet west and 400 feet south of the northeast corner of sec. 21, T. 136 N., R. 36 W., Otter Tail County; USGS Sebeka SW quadrangle; lat. 46 degrees 35 minutes 7 seconds N. and long. 95 degrees 13 minutes 42 seconds W., NAD27:

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; friable; common fine and very fine roots; 1 percent gravel; slightly acid; abrupt smooth boundary.
Eg—8 to 13 inches; dark grayish brown (10YR 4/2) fine sandy loam, very pale brown (10YR 7/3) dry; strong thick platy structure; very friable; common fine prominent dark reddish brown (5YR 3/3) and common fine and medium prominent brown (7.5YR 4/4) iron concentrations; few very fine roots; 1 percent gravel; moderately acid; clear wavy boundary.
E/B—13 to 27 inches; 70 percent grayish brown (2.5Y 5/2) sandy loam (Eg), 30 percent brown (10YR 4/3) sandy loam (Bt); weak medium subangular blocky structure; friable; common fine and medium prominent yellowish red (5YR 5/8 and 4/6) iron concentrations; common patchy faint gray (10YR 5/1) clay films on faces of peds; few fine roots; 3 percent gravel; moderately acid; clear wavy boundary.

Btg—27 to 34 inches; grayish brown (2.5Y 5/2) sandy loam; moderate medium subangular blocky structure; friable; common fine and medium prominent strong brown (7.5YR 5/6) and common fine yellowish red (5YR 4/6) iron concentrations; common patchy faint gray (10YR 5/1) and dark brown (10YR 4/3) clay films on faces of peds; 2 percent gravel; moderately acid; clear wavy boundary.

Bt1—34 to 49 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; many medium and coarse prominent strong brown (7.5YR 4/6) iron concentrations and common fine distinct light brownish gray (10YR 6/2) iron depletions; few patchy faint dark grayish brown (10YR 4/2) clay films on faces of peds; few patchy prominent very dark grayish brown (10YR 3/2) iron-manganese stains in pores and on faces of peds; 7 percent gravel; slightly acid; clear wavy boundary.

Bt2—49 to 58 inches; yellowish brown (10YR 5/4) sandy loam; weak coarse subangular blocky structure; friable; few fine and medium distinct light olive brown (2.5Y 5/3) iron depletions; few patchy distinct very dark grayish brown (10YR 3/2) and common discontinuous dark yellowish brown (10YR 4/4) clay films in pores and on faces of peds; 5 percent gravel; slightly acid; clear wavy boundary.

BCd—58 to 80 inches; light olive brown (2.5Y 5/3) sandy loam; massive breaking to moderate platy soil fragments; friable; common medium prominent yellowish brown (10YR 5/6) iron concentrations and many medium and coarse distinct light brownish gray (2.5Y 6/2) iron depletions; 5 percent gravel; neutral.

Range in Characteristics

Depth to carbonates: 40 to more than 80 inches
Depth to dense till: 40 to more than 80 inches
Content of rock fragments: 2 to 15 percent
Other features: Most pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR or 2.5Y
Value—2 or 3
Chroma—1 or 2
Texture—loam or fine sandy loam

E horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—fine sandy loam, sandy loam, or loamy sand

Btg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 to 4
Texture—sandy loam or fine sandy loam

BCd horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—fine sandy loam or sandy loam

488—Becida fine sandy loam, morainic, 0 to 2 percent slopes, stony

Composition

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

Setting

Landform: Swales on moraines
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Water table depth: At the surface to 1 foot below the surface (fig. 9)
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 5.4 inches (low)
Content of organic matter in the surface layer: About 4 percent (high)

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

- Blowers and similar soils
- Cathro and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

Figure 9.—A new road built through an area of Becida fine sandy loam, morainic, 0 to 2 percent slopes, stony. Wetness and surface stoniness are management concerns in areas of this soil.

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

- “Agronomy” section
- “Forest Land” section

Beltrami Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Upper part—moderately rapid or

moderate; lower part—moderate or moderately slow
Landform: Moraines
Parent material: Till
Slope range: 1 to 3 percent
Taxonomic classification: Fine-loamy, mixed, superactive Aquic Eutroboralfs

Typical Pedon

Beltrami very fine sandy loam, 1 to 3 percent slopes, 500 feet south and 550 feet west of the northeast corner of sec. 35, T. 145 N., R. 32 W., Hubbard County; USGS Steamboat Lake quadrangle; lat. 47 degrees 20 minutes 9 seconds N. and long. 94 degrees 41 minutes 40 seconds W., NAD27:

A—0 to 6 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine and very fine roots throughout; 5 percent gravel; neutral; clear smooth boundary.
E—6 to 12 inches; dark grayish brown (10YR 4/2) very fine sandy loam, pale brown (10YR 6/3) dry; weak thin platy structure parting to moderate very fine subangular blocky; very friable; common fine and very fine roots throughout; 5 percent gravel; neutral; clear smooth boundary.
Bt1—12 to 17 inches; brown (10YR 5/3) clay loam; moderate medium subangular blocky structure; firm; common fine and very fine roots throughout; many distinct discontinuous pale brown (10YR 6/3) silt coatings on faces of peds; common distinct discontinuous dark brown (7.5YR 4/2) clay films on faces of peds; 5 percent gravel; neutral; gradual smooth boundary.
Bt2—17 to 24 inches; light olive brown (2.5Y 5/3) clay loam; common fine distinct grayish brown (10YR 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/8) iron concentrations; strong medium subangular blocky structure; firm; common very fine roots throughout; few distinct discontinuous pale brown (10YR 6/3) silt coatings on faces of peds; many distinct discontinuous dark brown (7.5YR 4/2) clay films on faces of peds; few fine and medium masses of iron-manganese accumulation; 5 percent gravel; neutral; gradual wavy boundary.
Bt3—24 to 32 inches; light olive brown (2.5Y 5/3) clay loam; common fine distinct grayish brown (10YR 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/8) iron concentrations; strong coarse subangular blocky structure; firm; common distinct discontinuous dark brown (10YR 4/3) clay films on faces of peds; few fine and medium masses of iron-manganese accumulation; 5 percent gravel; neutral; gradual wavy boundary.
BC—32 to 39 inches; light olive brown (2.5Y 5/3) clay loam; common fine faint grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/8) iron concentrations; moderate coarse subangular blocky structure; firm; few distinct discontinuous dark brown (7.5YR 4/2) clay films on faces of peds; few fine and medium masses of iron-manganese accumulation; few fine masses of carbonate; 5 percent gravel; neutral; gradual wavy boundary.
C1—39 to 65 inches; light olive brown (2.5Y 5/3) loam; common coarse distinct olive gray (5Y 5/2) iron depletions and common coarse prominent yellowish brown (10YR 5/8) iron concentrations; massive; firm; common distinct discontinuous light gray (10YR 7/2) carbonate coatings on faces of peds; very few fine and medium masses of iron-manganese accumulation; very few fine masses of carbonate; 8 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.
C2—65 to 80 inches; light olive brown (2.5Y 5/3) sandy loam; massive; friable; common distinct discontinuous light gray (10YR 7/2) carbonate coatings in root channels and pores; very few fine and medium masses of iron-manganese accumulation; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Content of rock fragments: 2 to 10 percent

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—very fine sandy loam

E horizon:
Hue—10YR
Value—4 to 6
Chroma—1 or 2
Texture—very fine sandy loam, loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam, clay loam, or sandy clay loam

BC horizon:
Hue—10YR or 2.5Y
Value—4 to 6

Chroma—2 to 4
Texture—loam or clay loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam, clay loam, sandy clay loam, or fine sandy loam

1447—Beltrami very fine sandy loam, 1 to 3 percent slopes

Composition

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

Setting

Landform: Flats on moraines
Slope range: 1 to 3 percent

Component Description

Texture of the surface layer: Very fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.1 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Cathro and similar soils
- Talmoon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Blomford Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—rapid; lower part—moderate
Landform: Moraines
Parent material: Outwash over till
Slope range: 0 to 2 percent
Taxonomic classification: Loamy, mixed, superactive, frigid Arenic Epiaqualfs

Typical Pedon

Blomford loamy fine sand, 0 to 2 percent slopes, 2,300 feet south and 150 feet west of the northeast corner of sec. 19, T. 145 N., R. 31 W., Cass County; USGS Steamboat Lake quadrangle; lat. 47 degrees 21 minutes 37 seconds N. and long. 94 degrees 40 minutes 10 seconds W., NAD27:

A—0 to 5 inches; black (10YR 2/1) loamy fine sand, light brownish gray (10YR 6/2) dry; moderate fine granular structure; very friable; many fine to coarse roots throughout; 2 percent gravel; slightly acid; gradual wavy boundary.

Eg—5 to 23 inches; dark brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; many fine and medium distinct grayish brown (10YR 5/2) iron depletions and many fine and medium distinct dark yellowish brown (10YR 3/6) iron concentrations; weak fine granular structure; very friable; many fine and medium roots throughout; 2 percent gravel; slightly acid; abrupt wavy boundary.

2Btg1—23 to 40 inches; dark grayish brown (2.5Y 4/2) clay loam; many medium and coarse distinct dark gray (5Y 4/1) iron depletions and many medium and coarse distinct olive brown (2.5Y 4/4) iron concentrations; strong coarse subangular blocky structure; extremely firm; many very fine to medium roots throughout; common continuous distinct very dark grayish brown (2.5Y 3/2) clay films on faces of peds; few coarse masses of iron accumulation; 12 percent gravel; slightly acid; gradual wavy boundary.

2Btg2—40 to 55 inches; olive gray (5Y 4/2) clay loam; many coarse faint dark gray (5Y 4/1) iron depletions and many coarse prominent olive brown (2.5Y 4/4) iron concentrations; strong coarse subangular blocky structure; extremely firm; common very fine and fine roots throughout; many continuous distinct dark olive gray (5Y 3/2) clay films on faces of peds; few coarse masses of iron accumulation; 12 percent gravel; slightly acid; gradual wavy boundary.

2BCg—55 to 65 inches; light olive brown (2.5Y 5/3)

clay loam; many fine and medium distinct olive gray (5Y 5/2) iron depletions and many fine and medium distinct light olive brown (2.5Y 5/6) iron concentrations; strong coarse subangular blocky structure; very firm; few very fine roots; few discontinuous distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few fine masses of iron accumulation; few fine carbonate threads; 10 percent gravel; neutral; gradual wavy boundary.

2Cg—65 to 80 inches; light olive brown (2.5Y 5/3 and 5/4) clay loam and sandy clay loam; many fine and medium distinct olive gray (5Y 5/2) iron depletions and many fine and medium prominent yellowish brown (10YR 5/8) iron concentrations; massive; very friable; few very fine roots; few fine masses of iron accumulation; few fine carbonate threads; 8 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 36 to 70 inches

A horizon:
- Hue—10YR
- Value—2 to 4
- Chroma—1 or 2
- Texture—loamy sand
- Content of rock fragments—0 to 2 percent

E horizon:
- Hue—10YR or 2.5Y
- Value—4 to 6
- Chroma—1 to 3
- Texture—loamy sand, loamy fine sand, fine sand, or sand
- Content of rock fragments—0 to 2 percent

2Btg horizon:
- Hue—10YR to 5Y
- Value—4 to 6
- Chroma—1 or 2
- Texture—sandy clay loam, clay loam, loam, silty clay loam, or silt loam
- Content of rock fragments—0 to 15 percent

2C horizon:
- Hue—2.5Y or 5Y
- Value—5 or 6
- Chroma—1 to 3
- Texture—sandy clay loam, loam, clay loam, silty clay loam, or silt loam
- Content of rock fragments—0 to 15 percent

170—Blomford loamy fine sand, 0 to 2 percent slopes

Composition

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

Setting

Landform: Swales on moraines
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Loamy fine sand
Depth to bedrock: More than 80 inches
Drainage class: Poorly drained
Dominant parent material: Outwash over till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 7.1 inches (moderate)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

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

- Braham and similar soils
- Talmoon and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Blowers Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderate; lower part—slow or very slow
Landform: Drumlins and moraines
Parent material: Till

Slope range: 1 to 5 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Glossaquic Eutroboralfs

Typical Pedon

Blowers sandy loam, 1 to 5 percent slopes, stony, 42 feet south and 1,340 feet east of the northwest corner of sec. 32, T. 130 N., R. 34 W., Todd County; USGS Browerville SW quadrangle; lat. 46 degrees 2 minutes 1.3 seconds N. and long. 94 degrees 59 minutes 43.3 seconds W., NAD27:

Ap—0 to 6 inches; very dark brown (10YR 2/2) sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; 10 percent gravel; moderately acid; abrupt wavy boundary.
E—6 to 12 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; 10 percent gravel; slightly acid; clear wavy boundary.
E/B—12 to 17 inches; about 70 percent dark grayish brown (10YR 4/2) sandy loam (E), about 30 percent dark yellowish brown (10YR 3/4) sandy loam (B); moderate fine subangular blocky structure; friable; 12 percent gravel; moderately acid; clear wavy boundary.
B/E—17 to 27 inches; about 70 percent yellowish brown (10YR 5/6) sandy loam (B), about 30 percent grayish brown (10YR 5/2) sandy loam (E); moderate medium subangular blocky structure; friable; common distinct very dark grayish brown (10YR 3/2) clay films in pores and common faint dark yellowish brown (10YR 3/4) clay films on faces of peds; 13 percent gravel; moderately acid; clear wavy boundary.
Bt—27 to 34 inches; yellowish brown (10YR 5/4) sandy loam; common fine distinct grayish brown (10YR 5/2) iron depletions; moderate thick platy structure parting to moderate fine subangular blocky; firm; many distinct very dark brown (10YR 2/2) clay films in pores and common distinct dark brown (10YR 3/3) clay films on faces of peds; 14 percent gravel; neutral; clear wavy boundary.
BC—34 to 40 inches; yellowish brown (10YR 5/4) sandy loam; moderate medium platy structure; firm; common distinct dark brown (10YR 4/3) clay films in pores; few fine irregularly shaped light gray (10YR 7/2) segregated lime filaments; 13 percent gravel; slightly effervescent; slightly alkaline; abrupt wavy boundary.
Cd—40 to 60 inches; yellowish brown (10YR 5/4) sandy loam; massive breaking to moderate platy soil fragments; very firm; fine irregularly shaped light gray (10YR 7/2) segregated lime in seams; 12 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 32 to 60 inches
Depth to dense till: 40 to 60 inches
Content of rock fragments: 2 to 15 percent
Other features: Most pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR or 2.5Y
Value—2 or 3
Chroma—1 to 3
Texture—sandy loam or fine sandy loam

E horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 or 3
Texture—sandy loam or loamy sand

Bt horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—3 to 6
Texture—sandy loam

Cd horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—3 to 5
Texture—sandy loam or loamy sand

1320B—Blowers sandy loam, 1 to 5 percent slopes, stony

Composition

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

Setting

Landform: Drumlins
Position on the landform: Backslopes and footslopes
Slope range: 1 to 5 percent

Component Description

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet

Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 5.5 inches (low)
Content of organic matter in the surface layer: About 4 percent (high)

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

- Rockwood and similar soils
- Huntersville and similar soils
- Becida and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1336—Blowers fine sandy loam, morainic, 1 to 3 percent slopes, stony

Composition

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

Setting

Landform: Flats on moraines
Slope range: 1 to 3 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 6.4 inches (moderate)
Content of organic matter in the surface layer: About 4 percent (high)

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

- Becida and similar soils
- Rockwood and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Bootlake Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—moderately rapid; lower part—rapid
Landform: Outwash plains
Parent material: Outwash or beach deposits
Slope range: 0 to 15 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Typic Eutroboralfs

Typical Pedon

Bootlake sandy loam, in an area of Bootlake-Graycalm complex, 0 to 2 percent slopes, 1,200 feet west and 1,700 feet south of the northeast corner of sec. 9, T. 139 N., R. 36 W., Becker County; USGS Park Rapids SW quadrangle; lat. 46 degrees 52 minutes 22 seconds N. and long. 95 degrees 13 minutes 49 seconds W., NAD27:

A—0 to 3 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very friable; 2 percent gravel; slightly acid; abrupt smooth boundary.
E—3 to 7 inches; dark brown (10YR 4/3) loamy sand, pale brown (10YR 6/3) dry; weak thin platy structure; very friable; 2 percent gravel; slightly acid; clear smooth boundary.
Bt—7 to 13 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; many thin dark brown (10YR 4/3) clay films on faces of peds; 2 percent gravel; slightly acid; clear smooth boundary.

2Bw—13 to 47 inches; dark yellowish brown (10YR 4/6) coarse sand; single grain; loose; 8 percent gravel; slightly acid; clear smooth boundary.
2C—47 to 80 inches; pale brown (10YR 6/3) coarse sand; single grain; loose; 8 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 60 inches
Content of rock fragments: 0 to 10 percent

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

E horizon:
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—sandy loam, coarse sandy loam, loamy sand, or loamy coarse sand

Bt horizon:
Hue—7.5YR or 10YR
Value—3 or 4
Chroma—3 or 4
Texture—sandy loam, coarse sandy loam, or sandy clay loam

2Bw horizon:
Hue—10YR or 7.5YR
Value—4 to 6
Chroma—4 to 6
Texture—sand or coarse sand

2C horizon:
Hue—10YR
Value—5 or 6
Chroma—3 or 4
Texture—sand or coarse sand

1127A—Bootlake-Graycalm complex, 0 to 2 percent slopes

Composition

Bootlake and similar soils: About 60 percent
Graycalm and similar soils: About 30 percent
Inclusions: About 10 percent

Setting

Landform: Flats on outwash plains
Slope range: 0 to 2 percent

Component Description

Bootlake

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.7 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1127B—Bootlake-Graycalm complex, 2 to 8 percent slopes

Composition

Bootlake and similar soils: About 60 percent
Graycalm and similar soils: About 30 percent

Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Bootlake—backslopes and footslopes; Graycalm—shoulders and summits
Slope range: 2 to 8 percent

Component Description

Bootlake

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.7 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Bowstring Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow to rapid
Landform: Flood plains
Parent material: Organic materials stratified with thin layers of sandy or loamy material
Slope range: 0 to 1 percent
Taxonomic classification: Euic Fluvaquentic Borosaprists

Typical Pedon

Bowstring muck, in an area of Seelyeville and Bowstring soils, 0 to 1 percent slopes, frequently flooded, 2,500 feet north and 2,485 feet west of the southeast corner of sec. 17, T. 35 N., R. 26 W., Sherburne County; USGS Princeton quadrangle; lat. 45 degrees 31 minutes 21 seconds N. and long. 93 degrees 36 minutes 9 seconds W., NAD27:

Oa1—0 to 18 inches; muck, black (10YR 2/1) broken face, rubbed, and pressed; 30 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; friable; mostly herbaceous fiber; moderately acid; gradual wavy boundary.
Oa2—18 to 38 inches; muck, black (N 2/0) broken face, rubbed, and pressed; thin strata of sand; 10 percent fiber, 1 percent rubbed; massive; friable; mostly herbaceous fiber; moderately acid; gradual smooth boundary.
Cg—38 to 47 inches; dark gray (5Y 4/1) fine sand with thin strata of black (N 2/0) muck; massive; very friable; slightly acid; abrupt smooth boundary.
O´a—47 to 80 inches; muck, black (N 2/0) broken face, rubbed, and pressed; mixed with sand grains; 1 percent fiber; friable; massive; slightly acid.

Range in Characteristics

Thickness of the organic material: More than 51 inches

Oa horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—muck

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—2 to 6
Chroma—1 to 3
Texture—sand, fine sand, or loamy sand

Braham Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—rapid; lower part—moderate or moderately slow
Landform: Moraines
Parent material: Outwash over till
Slope range: 2 to 6 percent
Taxonomic classification: Loamy, mixed, superactive Arenic Eutroboralfs

Typical Pedon

Braham loamy fine sand, moderately wet, 2 to 6 percent slopes, 2,440 feet north and 50 feet east of the southwest corner of sec. 27, T. 31 N., R. 22 W., Anoka County; USGS Centerville quadrangle; lat. 45 degrees 8 minutes 43 seconds N. and long. 93 degrees 4 minutes 51 seconds W., NAD27:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; very friable; neutral; abrupt smooth boundary.
E—8 to 24 inches; brown (10YR 5/3) loamy fine sand; weak fine subangular blocky structure; very friable; neutral; clear smooth boundary.
2BE—24 to 29 inches; about 90 percent dark yellowish brown (10YR 4/4) sandy clay loam (B); weak medium prismatic structure parting to moderate medium subangular blocky; firm; about 10 percent common thin coatings of clean sand particles on faces of prisms (E); few dark concretions 1 to 3 mm in size; about 5 percent gravel; neutral; clear wavy boundary.
2Bt1—29 to 38 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many faint dark brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.
2Bt2—38 to 42 inches; dark yellowish brown (10YR 4/4) loam; few fine distinct light brownish gray (10YR 6/2) iron depletions and brownish yellow (10YR 6/6) iron concentrations; moderate coarse subangular blocky structure; friable; very few faint dark brown (10YR 3/3) clay films on vertical fractures and in root channels; few soft dark masses 1 to 3 mm in size; about 5 percent gravel; slightly acid; clear wavy boundary.
2Bk—42 to 60 inches; light olive brown (2.5Y 5/4) loam; weak coarse subangular blocky structure; friable; few soft dark masses 1 to 3 mm in size; few threads of calcium carbonate on faces of fractures; about 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 27 to more than 80 inches
Other features: Some pedons have a B/E or BE horizon, which has colors and textures similar to those of the B and E horizons.

A or Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 to 3
Texture—loamy fine sand
Content of rock fragments—0 to 5 percent

E horizon:
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—2 or 3
Texture—loamy sand, loamy fine sand, sand, or fine sand
Content of rock fragments—0 to 5 percent

2Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—sandy loam, fine sandy loam, sandy clay loam, loam, silt loam, clay loam, or silty clay loam
Content of rock fragments—0 to 10 percent

2Bk or 2C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—sandy clay loam, loam, silt loam, clay loam, or silty clay loam
Content of rock fragments—0 to 10 percent

1438B—Braham loamy fine sand, moderately wet, 2 to 6 percent slopes

Composition

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

Setting

Landform: Moraines
Position on the landform: Summits and backslopes
Slope range: 2 to 6 percent

Component Description

Texture of the surface layer: Loamy fine sand

Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash over till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 8.3 inches (moderate)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Blomford and similar soils
- Nebish and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Cathro Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—moderate or moderately slow
Landform: Moraines and lake plains
Parent material: Organic materials over glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Loamy, mixed, euic Terric Borosaprists

Typical Pedon

Cathro muck, depressional, MAP 22-30, 0 to 1 percent slopes, 200 feet south and 1,900 feet west of the northeast corner of sec. 36, T. 145 N., R. 32 W., Hubbard County; USGS Steamboat Lake quadrangle; lat. 47 degrees 20 minutes 11.6 seconds N. and long. 94 degrees 40 minutes 44.3 seconds W., NAD27:

Oa1—0 to 12 inches; dark brown (7.5YR 3/2) muck; 40 percent fiber, 10 percent rubbed; weak fine granular structure; very friable; common very fine and fine roots throughout; very strongly acid; gradual smooth boundary.
Oa2—12 to 43 inches; very dark brown (10YR 2/2) muck; 25 percent fiber, 5 percent rubbed; weak very thin platy structure; very friable; few very fine roots throughout; very strongly acid; clear smooth boundary.
A—43 to 49 inches; black (10YR 2/1) fine sandy loam; massive; firm; 2 percent gravel; moderately acid; clear smooth boundary.
Cg—49 to 80 inches; dark gray (5Y 4/1) sandy loam; massive; friable; 5 percent gravel; neutral.

Range in Characteristics

Thickness of the organic material: 16 to 51 inches
Content of wood fragments: 0 to 15 percent

Oa horizon:
Hue—7.5YR, 10YR, 5YR, or neutral
Value—2 or 3
Chroma—0 to 3
Texture—muck

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—sandy loam, fine sandy loam, sandy clay loam, loam, or the mucky analogs of these textures

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 to 3
Texture—loam, clay loam, sandy loam, silt loam, or silty clay loam
Content of rock fragments—0 to 15 percent

1439—Cathro muck, depressional, MAP 22-30, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on lake plains and moraines
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches

Drainage class: Very poorly drained
Dominant parent material: Organic materials over glaciolacustrine deposits or till
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 21.0 inches (high)
Content of organic matter in the surface layer: About 72.5 percent (very high)

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

- Seelyeville and similar soils
- Becida and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

Corliss Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid or very rapid
Landform: Outwash plains and valley trains
Parent material: Sandy or gravelly outwash or beach deposits
Slope range: 1 to 20 percent
Taxonomic classification: Mixed, frigid Typic Udipsamments

Typical Pedon

Corliss loamy coarse sand, in an area of Dorset-Corliss complex, 6 to 12 percent slopes, 200 feet south and 820 feet west of the northeast corner of sec. 8, T. 131 N., R. 37 W., Otter Tail County; USGS Parkers Prairie quadrangle; lat. 46 degrees 10 minutes 47 seconds N. and long. 95 degrees 21 minutes 33 seconds W., NAD27:

Ap—0 to 7 inches; very dark brown (10YR 2/2) loamy coarse sand, dark brown (10YR 3/3) dry; weak medium and coarse subangular blocky structure; very friable; few fine roots throughout; 13 percent gravel; slightly acid; abrupt smooth boundary.
Bw—7 to 11 inches; dark brown (10YR 4/3) gravelly loamy coarse sand, yellowish brown (10YR 5/4) dry; single grain; loose; few fine roots throughout; 27 percent gravel; neutral; clear smooth boundary.
Bk—11 to 24 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; few fine roots throughout; few white (10YR 8/2) carbonate coatings on underside of pebbles and rocks; 35 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.
C1—24 to 28 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; 6 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.
C2—28 to 39 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; very few white (10YR 8/2) carbonate coatings on underside of pebbles and rocks; 30 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.
C3—39 to 52 inches; yellowish brown (10YR 5/4) coarse sand; single grain; loose; 7 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.
C4—52 to 60 inches; brown (10YR 5/3) gravelly coarse sand; single grain; loose; very few white (10YR 8/2) carbonate coatings on underside of pebbles and rocks; 30 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Content of rock fragments: 10 to 35 percent

A or Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 to 3
Texture—loamy coarse sand

Bw horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—3 or 4
Texture—loamy sand, loamy coarse sand, sand, coarse sand, or the gravelly analogs of these textures

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—coarse sand, sand, or the gravelly analogs of these textures

1247D—Corliss-Dorset complex, 12 to 20 percent slopes

Composition

Corliss and similar soils: About 60 percent
Dorset and similar soils: About 30 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and valley trains
Position on the landform: Corliss—shoulders and summits; Dorset—backslopes and footslopes
Slope range: 12 to 20 percent

Component Description

Corliss

Texture of the surface layer: Loamy coarse sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Sandy or gravelly outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

Dorset

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy mantle over sandy and gravelly outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.0 inches (low)
Content of organic matter in the surface layer: About 4 percent (high)

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

- Duelm and similar soils

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Dalbo Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderate; next part—slow or moderately slow; lower part—moderately slow or moderate
Landform: Moraines
Parent material: Glaciolacustrine deposits
Slope range: 2 to 15 percent
Taxonomic classification: Fine, smectitic Aquertic Eutroboralfs

Typical Pedon

Dalbo silt loam, 0 to 2 percent slopes, 1,800 feet south and 200 feet east of the northwest corner of sec. 4, T. 142 N., R. 38 W., Becker County; USGS Tulaby Lake quadrangle; lat. 47 degrees 8 minutes 47 seconds N. and long. 95 degrees 30 minutes 29 seconds W., NAD27:

A—0 to 2 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.
E—2 to 6 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; moderate thin platy structure; friable; neutral; clear wavy boundary.
Bt1—6 to 15 inches; dark brown (10YR 4/3) silty clay; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; many thin dark brown (10YR 3/3) clay films on faces of peds and lining pores; neutral; clear wavy boundary.
Bt2—15 to 22 inches; dark brown (10YR 4/3) silty clay; few fine faint dark grayish brown (2.5Y 4/2) iron depletions; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; many thin dark brown (10YR 3/3) clay films on faces of peds and lining pores; neutral; gradual wavy boundary.
BC—22 to 41 inches; olive brown (2.5Y 4/4) silty clay loam; few medium distinct grayish brown (2.5Y 5/2) iron depletions and common medium distinct dark yellowish brown (10YR 4/6) iron concentrations; moderate thin platy structure; friable; slightly acid; clear wavy boundary.
C—41 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam; common medium faint light brownish gray (2.5Y 6/2) iron depletions and common

medium distinct yellowish brown (10YR 5/6) iron concentrations; moderate medium platy soil aggregates; friable; few light gray (10YR 7/2) filaments and threads of segregated lime; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 24 to 42 inches

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

E horizon:
Hue—10YR
Value—4 to 6
Chroma—1 or 2
Texture—silt loam, loam, silty clay loam, very fine sandy loam, or fine sandy loam

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

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—silty clay loam, silty clay, or silt loam

133B—Dalbo silt loam, 2 to 8 percent slopes

Composition

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

Setting

Landform: Flats on moraines
Slope range: 2 to 8 percent

Component Description

Texture of the surface layer: Silt loam
Depth to bedrock: More than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Spooner and similar soils
- Sol and similar soils
- Cathro and similar soils
- Graycalm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

133C—Dalbo silt loam, 8 to 15 percent slopes

Composition

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

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 8 to 15 percent

Component Description

Texture of the surface layer: Silt loam
Depth to bedrock: More than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Spooner and similar soils
- Sol and similar soils
- Cathro and similar soils
- Graycalm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Debs Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Lake plains and moraines
Parent material: Glaciolacustrine deposits
Slope range: 1 to 35 percent
Taxonomic classification: Fine-silty, mixed, superactive Typic Eutroboralfs

Typical Pedon

Debs silt loam, 2 to 8 percent slopes, 2,300 feet east and 1,000 feet north of the southwest corner of sec. 11, T. 145 N., R. 36 W., Clearwater County; USGS Alida quadrangle; lat. 47 degrees 23 minutes 12 seconds N. and long. 95 degrees 13 minutes 1 second W., NAD27:

A—0 to 2 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.
E—2 to 12 inches; brown (10YR 5/3) very fine sandy loam, pale brown (10YR 6/3) dry; weak thin platy structure; very friable; slightly acid; clear smooth boundary.
Bt1—12 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; strong medium subangular blocky structure; firm; many prominent dark brown (10YR 4/3) clay films on faces of peds and lining pores; slightly acid; clear wavy boundary.
Bt2—26 to 32 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; many prominent dark brown (10YR 4/3) clay films on faces of peds and lining pores; slightly acid; clear wavy boundary.
C—32 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam; massive; very friable; common medium irregularly shaped filaments and soft masses of carbonates; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 39 inches
Content of rock fragments: 0 to 2 percent

A or Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—silt loam

E horizon:
Hue—10YR
Value—5 to 7
Chroma—2 to 4
Texture—very fine sand, fine sand, very fine sandy loam, loamy very fine sand, fine sandy loam, loamy fine sand, or silt loam

Bt horizon:
Hue—10YR
Value—4 to 6
Chroma—3 to 6
Texture—silty clay loam, clay loam, or silt loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—4 to 6
Texture—silt loam, very fine sandy loam, loamy very fine sand, or very fine sand

744B—Debs-Akeley complex, 1 to 8 percent slopes

Composition

Debs and similar soils: About 55 percent
Akeley and similar soils: About 25 percent
Inclusions: About 20 percent

Setting

Landform: Lake plains and moraines
Position on the landform: Debs—shoulders and summits; Akeley—backslopes
Slope range: 1 to 8 percent

Component Description

Debs

Texture of the surface layer: Silt loam

Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 5.5 percent (high)

Akeley

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash over glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.2 inches (moderate)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Baudette and similar soils
- Wurtsmith and similar soils
- Spooner and similar soils
- Zimmerman and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Dorset Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Upper part—moderately rapid; lower part—rapid
Landform: Outwash plains and valley trains
Parent material: Loamy mantle over sandy and gravelly outwash or beach deposits
Slope range: 0 to 20 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Udic Argiborolls

Typical Pedon

Dorset sandy loam, 2 to 6 percent slopes, 1,690 feet east and 250 feet north of the southwest corner of sec. 13, T. 134 N., R. 41 W., Otter Tail County; USGS Phelps quadrangle; lat. 46 degrees 24 minutes 46 seconds N. and long. 95 degrees 47 minutes 42 seconds W., NAD27:

Ap—0 to 9 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; many fine and very fine roots; 2 percent gravel; moderately acid; abrupt smooth boundary.
A—9 to 11 inches; very dark brown (10YR 2/2) sandy loam, very dark grayish brown (10YR 3/2) dry; moderate medium subangular blocky structure; friable; few fine and very fine roots; 5 percent gravel; neutral; clear wavy boundary.
Bt1—11 to 15 inches; brown (10YR 4/3) sandy loam; moderate medium subangular blocky structure; friable; many distinct dark brown (10YR 3/3) clay films on faces of peds; few fine and very fine roots; 5 percent gravel; neutral; clear wavy boundary.
Bt2—15 to 20 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; common faint dark yellowish brown (10YR 3/4) clay films on faces of peds; few very fine roots; 10 percent gravel; neutral; clear wavy boundary.
2Bk—20 to 38 inches; olive brown (2.5Y 4/4) gravelly coarse sand; single grain; loose; many carbonate coatings on underside of pebbles; 27 percent gravel; strongly effervescent; moderately alkaline; diffuse wavy boundary.
2C—38 to 80 inches; light olive brown (2.5Y 5/3) gravelly coarse sand; single grain; loose; few carbonate coatings on underside of pebbles; 30 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 15 to 36 inches
Thickness of the mollic epipedon: 7 to 14 inches

Ap horizon:
Hue—10YR
Value—2
Chroma—1 or 2

Texture—sandy loam
Content of rock fragments—0 to 10 percent

Bt horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—3 or 4
Texture—sandy loam, loam, or coarse sandy loam
Content of rock fragments—0 to 10 percent

2Bt horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—3 or 4
Texture—gravelly loamy sand or gravelly loamy coarse sand
Content of rock fragments—15 to 35 percent

2C horizon:
Hue—10YR
Value—3 to 6
Chroma—3 to 6
Texture—gravelly sand or gravelly coarse sand
Content of rock fragments—15 to 35 percent

406A—Dorset sandy loam, 0 to 2 percent slopes

Composition

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

Setting

Landform: Flats on outwash plains
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy mantle over sandy and gravelly outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.0 inches (low)
Content of organic matter in the surface layer: About 4 percent (high)

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

- Corliss and similar soils
- Duelm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

778B—Dorset-Corliss complex, 1 to 6 percent slopes

Composition

Dorset and similar soils: About 60 percent
Corliss and similar soils: About 30 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and valley trains
Position on the landform: Dorset—summits and backslopes; Corliss—shoulders and summits
Slope range: 1 to 6 percent

Component Description

Dorset

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy mantle over sandy and gravelly outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.0 inches (low)
Content of organic matter in the surface layer: About 4 percent (high)

Corliss

Texture of the surface layer: Loamy coarse sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Sandy or gravelly outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Duelm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

778C—Dorset-Corliss complex, 6 to 12 percent slopes

Composition

Dorset and similar soils: About 55 percent
Corliss and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and valley trains
Position on the landform: Dorset—summits and backslopes; Corliss—shoulders and summits
Slope range: 6 to 12 percent

Component Description

Dorset

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy mantle over sandy and gravelly outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.0 inches (low)
Content of organic matter in the surface layer: About 4 percent (high)

Corliss

Texture of the surface layer: Loamy coarse sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Sandy or gravelly outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Duelm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Duelm Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Outwash plains
Parent material: Outwash or beach deposits
Slope range: 0 to 2 percent
Taxonomic classification: Sandy, mixed Aquic Haploborolls

Typical Pedon

Duelm loamy sand, 0 to 2 percent slopes, 1,300 feet south and 55 feet west of the northeast corner of sec. 9, T. 35 N., R. 30 W., Sherburne County; USGS Cable quadrangle; lat. 45 degrees 32 minutes 28 seconds N. and long. 94 degrees 4 minutes 7 seconds W., NAD27:

Ap—0 to 10 inches; black (10YR 2/1) loamy sand,

dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; very friable; few very fine roots; 1 percent gravel; neutral; abrupt smooth boundary.

AB—10 to 16 inches; dark brown (10YR 3/3) loamy sand, grayish brown (10YR 5/2) dry; common fine distinct dark brown (7.5YR 4/4) iron concentrations; weak fine subangular blocky structure; very friable; neutral; gradual wavy boundary.

Bw1—16 to 20 inches; dark yellowish brown (10YR 4/4) coarse sand; many fine prominent reddish brown (5YR 4/4) iron concentrations; single grain; loose; slightly acid; gradual smooth boundary.

Bw2—20 to 30 inches; dark brown (10YR 4/3) coarse sand; many medium distinct dark brown (7.5YR 4/4) iron concentrations and few fine distinct grayish brown (2.5Y 5/2) iron depletions; single grain; loose; 3 percent gravel; slightly acid; gradual smooth boundary.

C1—30 to 37 inches; grayish brown (10YR 5/2) coarse sand; common fine distinct yellowish brown (10YR 5/4) iron concentrations; single grain; loose; 1 percent gravel; slightly acid; gradual wavy boundary.

C2—37 to 80 inches; dark brown (10YR 4/3) coarse sand; common fine faint dark grayish brown (10YR 4/2) iron depletions and few fine prominent dark reddish brown (5YR 3/4) iron concentrations; single grain; loose; neutral.

Range in Characteristics

Depth to carbonates: 40 to 100 inches
Thickness of the mollic epipedon: 10 to 24 inches
Content of rock fragments: 0 to 15 percent

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand

Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—2 to 4
Texture—loamy sand, loamy coarse sand, sand, or coarse sand

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 to 4
Texture—coarse sand or sand

260—Duelm loamy sand, 0 to 2 percent slopes

Composition

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

Setting

Landform: Swales on outwash plains and valley trains
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Moderately well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 4.1 inches (low)
Content of organic matter in the surface layer: About 4 percent (high)

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

- Isan and similar soils
- Verndale and similar soils
- Nymore and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Eagleview Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Rapid
Landform: Moraines

Parent material: Outwash or beach deposits
Slope range: 3 to 65 percent
Taxonomic classification: Mixed, frigid Argic Udipsamments

Typical Pedon

Eagleview loamy sand, in an area of Two Inlets-Eagleview-Steamboat complex, pitted, 3 to 15 percent slopes, 100 feet south and 1,400 feet east of the northwest corner of sec. 17, T. 143 N., R. 35 W., Hubbard County; USGS Lake Itasca quadrangle; lat. 47 degrees 12 minutes 37 seconds N. and long. 95 degrees 8 minutes 49 seconds W., NAD27:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak very fine granular structure; very friable; 2 percent gravel; neutral; clear smooth boundary.
E—4 to 11 inches; brown (10YR 5/3) sand; single grain; loose; 2 percent gravel; neutral; clear smooth boundary.
Bw—11 to 28 inches; yellowish brown (10YR 5/6) sand; single grain; loose; 5 percent gravel; neutral; gradual smooth boundary.
E&Bt—28 to 45 inches; yellowish brown (10YR 5/4) sand (E); single grain; loose; few to many thin lamellae of dark yellowish brown (10YR 4/4) loamy sand (Bt); weak very fine subangular blocky structure; very friable; few clay films between sand grains; 2 percent gravel; neutral; gradual wavy boundary.
C1—45 to 68 inches; 10 percent light yellowish brown (10YR 6/4) sand; single grain; loose; 2 percent gravel; neutral; gradual wavy boundary.
C2—68 to 80 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; 5 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 25 to more than 60 inches
Content of rock fragments: 0 to 10 percent

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—loamy sand

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 or 3
Texture—loamy sand, sand, loamy coarse sand, or coarse sand

Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—4 to 6
Texture—sand or coarse sand

E part of E&Bt horizon:
Hue—10YR
Value—5 or 6
Chroma—2 to 4
Texture—sand or coarse sand

Bt part of E&Bt horizon:
Special feature—layers $^{1}/_{16}$ inch to 2 inches thick with cumulative thickness of less than 6 inches within a depth of 80 inches
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—4 to 6
Texture—loamy sand, loamy coarse sand, sandy loam, or coarse sandy loam

C horizon (if it occurs):
Hue—10YR
Value—5 or 6
Chroma—3 or 4
Texture—sand or coarse sand

Egglake Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, superactive, frigid Mollic Endoaqualfs

Typical Pedon

Egglake loam, 0 to 2 percent slopes, 2,600 feet south and 1,600 feet west of the northeast corner of sec. 2, T. 139 N., R. 38 W., Becker County; USGS Ponsford quadrangle; lat. 46 degrees 52 minutes 58 seconds N. and long. 95 degrees 26 minutes 33 seconds W., NAD27:

A—0 to 4 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; 4 percent gravel and 1 percent cobbles; neutral; clear smooth boundary.
E—4 to 9 inches; grayish brown (2.5Y 5/2) fine sandy loam, gray (10YR 6/1) dry; weak medium platy structure parting to weak fine subangular blocky;

very friable; 7 percent gravel and 1 percent cobbles; neutral; clear smooth boundary.
Btg—9 to 25 inches; grayish brown (2.5Y 5/2) sandy clay loam; weak fine subangular blocky structure; friable; common fine prominent dark reddish brown (5YR 3/4) iron concentrations; few thin very dark grayish brown (10YR 3/2) clay films on faces of peds; 7 percent gravel and 1 percent cobbles; neutral; gradual smooth boundary.
Bg—25 to 34 inches; light brownish gray (2.5Y 6/2) coarse sandy loam; weak medium subangular blocky structure; very friable; common fine prominent yellowish brown (10YR 5/6) iron concentrations; 8 percent gravel and 2 percent cobbles; neutral; clear smooth boundary.
Bkg—34 to 80 inches; mixed light olive gray (5Y 6/2) and light yellowish brown (2.5Y 6/4) coarse sandy loam; weak medium platy structure; very friable; few fine prominent yellowish brown (10YR 5/6) iron concentrations; common light gray (10YR 7/2) segregated lime in filaments and threads; 8 percent gravel and 2 percent cobbles; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to more than 60 inches
Content of rock fragments: 2 to 10 percent
Other features: Some pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loam

E horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—fine sandy loam, loam, or sandy loam

Btg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—sandy clay loam, clay loam, sandy loam, or loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—1 or 2
Texture—fine sandy loam, sandy loam, loam, or coarse sandy loam

1200—Egglake loam, 0 to 2 percent slopes

Composition

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

Setting

Landform: Swales on moraines
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Loam
Depth to bedrock: More than 80 inches
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 8.2 inches (moderate)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Nary and similar soils
- Cathro and similar soils
- Steamboat and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Evart Series

Depth class: Very deep
Drainage class: Very poorly drained and poorly drained
Permeability: Rapid
Landform: Flood plains
Parent material: Sandy alluvium

Slope range: 0 to 1 percent
Taxonomic classification: Sandy, mixed, frigid Fluvaquentic Endoaquolls

Typical Pedon

Evart loam, occasionally flooded, 1,250 feet north and 2,525 feet east of the southwest corner of sec. 2, T. 135 N., R. 33 W., Wadena County; USGS Oylen quadrangle; lat. 46 degrees 31 minutes 53 seconds N. and long. 94 degrees 48 minutes 45 seconds W., NAD27:

Ap—0 to 6 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very thin platy structure; very friable; neutral; abrupt smooth boundary.
A—6 to 11 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; few medium distinct brown (10YR 5/3) iron concentrations; weak very thin platy structure; very friable; few discontinuous dark grayish brown (10YR 4/2) strata; neutral; abrupt smooth boundary.
Cg1—11 to 14 inches; dark grayish brown (2.5Y 4/2) loamy very fine sand, grayish brown (10YR 5/2) dry; common medium distinct gray (10YR 4/1) iron depletions and few medium distinct brown (10YR 5/3) iron concentrations; weak very thin platy structure; very friable; neutral; abrupt smooth boundary.
Cg2—14 to 18 inches; grayish brown (2.5Y 5/2) fine sand; common medium and coarse distinct yellowish brown (10YR 5/6) iron concentrations and few medium faint light brownish gray (2.5Y 6/2) iron depletions; massive; very friable; neutral; clear smooth boundary.
Cg3—18 to 31 inches; light brownish gray (2.5Y 6/2) and light gray (2.5Y 7/2) sand; common medium distinct yellowish brown (10YR 5/6) iron concentrations; single grain; loose; neutral; clear smooth boundary.
Cg4—31 to 42 inches; light brownish gray (2.5Y 6/2) coarse sand; common coarse distinct yellowish brown (10YR 5/4) iron concentrations; single grain; loose; neutral; clear smooth boundary.
Cg5—42 to 60 inches; pinkish gray (7.5YR 6/2) and brown (7.5YR 4/4) coarse sand; common coarse distinct light brownish gray (2.5Y 6/2) iron depletions; single grain; loose; neutral.

Range in Characteristics

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—0 to 5 percent gravel; 0 to 3 percent cobbles

C horizon:
Hue—7.5YR to 5Y
Value—4 to 6
Chroma—2 to 4
Texture—sand, fine sand, loamy sand, coarse sand, or the gravelly analogs of these textures
Content of rock fragments—0 to 25 percent gravel; 0 to 3 percent cobbles

1968—Evart loam, 0 to 1 percent slopes, occasionally flooded

Composition

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

Setting

Landform: Flats on flood plains
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Loam
Depth to bedrock: More than 60 inches
Drainage class: Poorly drained
Dominant parent material: Sandy textured alluvium
Flooding: Occasional
Water table depth: At the surface to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 5.9 inches (low)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

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

- Nidaros and similar soils
- Duelm and similar soils

Major Uses of the Unit

- Forest land

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

- “Forest Land” section

1969—Evart-Isan complex, channeled, 0 to 1 percent slopes, frequently flooded

Composition

Evart and similar soils: About 60 percent
Isan and similar soils: About 25 percent
Inclusions: About 15 percent

Setting

Landform: Evart—depressions on flood plains; Isan—flats on flood plains
Slope range: 0 to 1 percent

Component Description

Evart

Texture of the surface layer: Loam
Depth to bedrock: More than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Sandy textured alluvium
Flooding: Frequent
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 5.9 inches (low)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

Isan

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Poorly drained
Dominant parent material: Sandy outwash or beach deposits
Flooding: Frequent
Depth to the water table: 0.5 foot to 1.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 4.2 inches (low)
Content of organic matter in the surface layer: About 5.5 percent (high)

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

- Nidaros and similar soils
- Duelm and similar soils

Major Uses of the Unit

- Forest land

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

- “Forest Land” section

Graycalm Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Rapid
Landform: Outwash plains
Parent material: Outwash or beach deposits
Slope range: 0 to 45 percent
Taxonomic classification: Mixed, frigid Argic Udipsamments

Typical Pedon

Graycalm loamy sand, in an area of Graycalm-Menahga complex, 1 to 8 percent slopes, 500 feet north and 2,550 feet east of the southwest corner of sec. 18, T. 143 N., R. 32 W., Hubbard County; USGS Laporte quadrangle; lat. 47 degrees 11 minutes 43 seconds N. and long. 94 degrees 46 minutes 50 seconds W., NAD27:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; many medium roots; 2 percent gravel; strongly acid; abrupt smooth boundary.
Bw1—3 to 8 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure parting to single grain; very friable; few fine roots; 2 percent gravel; strongly acid; clear smooth boundary.
Bw2—8 to 20 inches; yellowish brown (10YR 5/4) sand; weak fine subangular blocky structure parting to single grain; very friable; 2 percent gravel; strongly acid; gradual smooth boundary.
E—20 to 39 inches; brown (10YR 5/3) sand; single grain; loose; 2 percent gravel; strongly acid; abrupt wavy boundary.
E&Bt—39 to 80 inches; pale brown (10YR 6/3) sand (E); single grain; loose; few to many thin lamellae of reddish brown (5YR 5/4) loamy sand (Bt); many clay films between sand grains; 2 percent gravel; strongly acid.

Range in Characteristics

Content of rock fragments: 0 to 15 percent

A horizon:
Hue—10YR, 7.5YR, or neutral
Value—2 to 4
Chroma—0 to 3
Texture—loamy sand

Bw horizon:
Hue—7.5YR or 10YR
Value—3 to 7
Chroma—4 to 8
Texture—sand or loamy sand

E horizon (if it occurs):
Hue—10YR
Value—5 to 7
Chroma—2 to 6
Texture—sand or loamy sand

E part of E&Bt horizon:
Colors—similar to those of the E horizon
Textures—similar to those of the E horizon

Bt part of E&Bt horizon:
Special feature—layers 1/16 inch to 2 inches thick with cumulative thickness of less than 6 inches within a depth of 80 inches
Hue—5YR to 10YR
Value—3 to 6
Chroma—4 to 6
Texture—loamy sand or sandy loam

C horizon (if it occurs):
Hue—10YR or 2.5Y
Value—5 to 7
Chroma—2 to 6
Texture—sand or coarse sand

867B—Graycalm-Menahga complex, 1 to 8 percent slopes

Composition

Graycalm and similar soils: About 60 percent
Menahga and similar soils: About 30 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Graycalm—summits and backslopes; Menahga—backslopes and shoulders
Slope range: 1 to 8 percent

Component Description

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Menahga

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

867C—Graycalm-Menahga complex, 8 to 15 percent slopes

Composition

Graycalm and similar soils: About 60 percent
Menahga and similar soils: About 30 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Graycalm—summits and backslopes; Menahga—backslopes and shoulders

Slope range: 8 to 15 percent

Component Description

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Menahga

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

867E—Graycalm-Menahga complex, 15 to 30 percent slopes

Composition

Graycalm and similar soils: About 50 percent
Menahga and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Graycalm—backslopes; Menahga—shoulders and summits
Slope range: 15 to 30 percent

Component Description

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Menahga

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

867F—Graycalm-Menahga complex, 30 to 45 percent slopes

Composition

Graycalm and similar soils: About 50 percent
Menahga and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Graycalm—backslopes; Menahga—shoulders and summits
Slope range: 30 to 45 percent

Component Description

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Menahga

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1021C—Graycalm-Sanburn complex, 8 to 15 percent slopes

Composition

Graycalm and similar soils: About 55 percent
Sanburn and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Graycalm—shoulders and summits; Sanburn—backslopes
Slope range: 8 to 15 percent

Component Description

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Sanburn

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.1 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils

- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1249C—Graycalm-Bootlake complex, 8 to 15 percent slopes

Composition

Graycalm and similar soils: About 55 percent
Bootlake and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Graycalm—shoulders and summits; Bootlake—backslopes
Slope range: 8 to 15 percent

Component Description

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Bootlake

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.7 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Haslie Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderate or moderately rapid; lower part—moderately slow or slow
Landform: Moraines, lake plains, flood plains, and outwash plains
Parent material: Organic material over coprogenous earth sediments
Slope range: 0 to 1 percent
Taxonomic classification: Coprogenous, euic Limnic Borosaprists

Typical Pedon

Haslie muck, depressional, 0 to 1 percent slopes, 1,600 feet north and 2,160 feet west of the southeast corner of sec. 28, T. 147 N., R. 39 W., Polk County; USGS Fosston East quadrangle; lat. 47 degrees 31 minutes 3 seconds N. and long. 95 degrees 37 minutes 40 seconds W., NAD27:

Oa1—0 to 12 inches; muck, black (10YR 2/1) broken face, very dark brown (10YR 2/2) rubbed; about 20 percent fiber, about 5 percent rubbed; weak medium and fine subangular blocky structure parting to weak fine granular; very friable; many fine roots; few snail shells; neutral; gradual wavy boundary.
Oa2—12 to 30 inches; muck, black (10YR 2/1) broken face, very dark brown (10YR 2/2) rubbed; about

30 percent fiber, about 5 percent rubbed; weak fine and medium subangular blocky structure; very friable; common fine roots; few snail shells; neutral; abrupt smooth boundary.

Cg1—30 to 39 inches; mucky silt loam (coprogenous earth), about 70 percent olive gray (5Y 4/2) and about 30 percent olive gray (5Y 5/2); traces of fiber; massive; very friable; common medium distinct very dark gray (5Y 3/1) iron depletions; slightly sticky; about 5 percent snail shells and shell fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cg2—39 to 51 inches; dark olive gray (5Y 3/2) mucky silt loam (coprogenous earth); massive; very friable; common medium distinct olive gray (5Y 5/2) iron depletions; slightly sticky; about 10 percent snail shells and shell fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cg3—51 to 80 inches; olive gray (5Y 4/2) mucky silt loam (coprogenous earth); plant detritus in channels; massive; very friable; few medium distinct olive (5Y 5/3) iron concentrations; slightly sticky; about 7 percent snail shells and shell fragments; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the organic material: 16 to 51 inches
Content of wood fragments: 0 to 15 percent

Oa or Oap horizon:
Hue—10YR, 7.5YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 to 3
Texture—muck

Cg horizon:
Hue—10YR, 2.5Y, 5Y, 5GY, or neutral
Value—2 to 7
Chroma—0 to 3
Texture—mucky silt loam, mucky silty clay loam, or silt loam
Content of shell fragments—0 to 15 percent

746—Haslie muck, depressional, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on moraines and outwash plains
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over coprogenous earth
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 18.8 inches (high)
Content of organic matter in the surface layer: About 75 percent (very high)

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

- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

1113—Haslie, Seelyeville, and Cathro soils, ponded, 0 to 1 percent slopes

Composition

Haslie: Variable
Seelyeville: Variable
Cathro: Variable
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains and moraines
Slope range: 0 to 1 percent

Component Description

Haslie

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over coprogenous earth
Flooding: None
Water table depth: At the surface to 3 feet above the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 16.7 inches (high)
Content of organic matter in the surface layer: About 75 percent (very high)

Seelyeville

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Herbaceous organic material
Flooding: None
Water table depth: At the surface to 3 feet above the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches (high)
Content of organic matter in the surface layer: About 62 percent (very high)

Cathro

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over glaciolacustrine deposits or till
Flooding: None
Water table: At the surface to 3 feet above the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 17.6 inches (high)
Content of organic matter in the surface layer: About 72.5 percent (very high)

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

- Runeberg and similar soils
- Willosippi and similar soils

Major Uses of the Unit

- Wildlife habitat (fig. 10)

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

- "Wildlife Habitat" section

1230—Haslie and Nidaros soils, ponded, 0 to 1 percent slopes

Composition

Haslie: Variable
Nidaros: Variable
Inclusions: About 10 percent

Setting

Landform: Depressions on outwash plains
Slope range: 0 to 1 percent

Component Description

Haslie

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over coprogenous earth
Flooding: None
Water table depth: At the surface to 3 feet above the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 21.6 inches (high)
Content of organic matter in the surface layer: About 75 percent (very high)

Nidaros

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over outwash
Flooding: None
Water table depth: At the surface to 3 feet above the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 18.3 inches (high)
Content of organic matter in the surface layer: About 70 percent (very high)

A typical soil series description with range in

Figure 10.—An area of Haslie, Seelyeville, and Cathro soils, ponded, 0 to 1 percent slopes. Areas of these soils provide important habitat for wetland wildlife.

characteristics is included, in alphabetical 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

- Seelyeville and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- "Wildlife Habitat" section

Huntersville Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—slow or very slow
Landform: Drumlins and moraines
Parent material: Outwash over till
Slope range: 1 to 6 percent
Taxonomic classification: Loamy, mixed, superactive Aquic Arenic Eutroboralfs

Typical Pedon

Huntersville loamy fine sand, 1 to 6 percent slopes, 1,320 feet south and 495 feet west of the northeast

corner of sec. 20, T. 135 N., R. 34 W., Wadena County; USGS Aldrich North quadrangle; lat. 46 degrees 29 minutes 44.5 seconds N. and long. 94 degrees 59 minutes 26.4 seconds W., NAD27:

Ap—0 to 7 inches; very dark gray (10YR 3/1) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; slightly acid; abrupt smooth boundary.

E—7 to 12 inches; dark brown (10YR 4/3) loamy sand, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; very friable; slightly acid; clear smooth boundary.

Bw—12 to 24 inches; yellowish brown (10YR 5/4) loamy sand; few fine prominent light brownish gray (2.5Y 6/2) iron depletions and few fine prominent strong brown (7.5YR 5/6) iron concentrations; weak fine subangular blocky structure; very friable; 20 percent gravel at contact with lower boundary; neutral; clear smooth boundary.

2Bt—24 to 40 inches; yellowish brown (10YR 5/4) sandy loam; common fine distinct grayish brown (10YR 5/2) iron depletions and common fine distinct brownish yellow (10YR 6/6) iron concentrations; moderate medium subangular blocky structure; friable; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds and in pores; 3 percent gravel; neutral; clear wavy boundary.

2Cd1—40 to 64 inches; yellowish brown (10YR 5/4) sandy loam; common medium prominent light brownish gray (2.5Y 6/2) iron depletions and distinct dark yellowish brown (10YR 4/6) concentrations; weak thick platy soil fragments; very firm; 3 percent gravel; neutral; clear smooth boundary.

2Cd2—64 to 80 inches; light yellowish brown (10YR 6/4) sandy loam; common medium or fine faint yellowish brown (10YR 5/4) iron concentrations; weak thick platy soil fragments; very firm; 3 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 40 to more than 60 inches
Depth to dense till: 40 to 60 inches
Content of rock fragments: 0 to 15 percent
Other features: Some pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 to 3
Texture—loamy fine sand or loamy sand

E horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 or 3
Texture—loamy sand, loamy fine sand, sand, or fine sand

Bw horizon:
Hue—10YR
Value—4 to 6
Chroma—3 to 6
Texture—sand or loamy sand

2Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—sandy loam, loam, sandy clay loam, or clay loam

2Cd horizon:
Hue—10YR or 2.5Y
Value—5 to 7
Chroma—2 to 4
Texture—sandy loam or loamy sand

139B—Huntersville loamy fine sand, 1 to 6 percent slopes

Composition

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

Setting

Landform: Drumlins
Position on the landform: Backslopes and footslopes
Slope range: 1 to 6 percent

Component Description

Texture of the surface layer: Loamy fine sand
Depth to bedrock: More than 80 inches
Drainage class: Moderately well drained
Dominant parent material: Outwash over till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 4.1 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Blowers and similar soils
- Wurtsmith and similar soils
- Staples and similar soils
- Redeye and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1334—Huntersville loamy sand, 1 to 3 percent slopes

Composition

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

Setting

Landform: Flats on moraines
Slope range: 1 to 3 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Moderately well drained
Dominant parent material: Outwash over till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 5.6 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Blowers and similar soils
- Wurtsmith and similar soils
- Staples and similar soils
- Redeye and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Isan Series

Depth class: Very deep
Drainage class: Very poorly drained and poorly drained
Permeability: Rapid
Landform: Outwash plains and flood plains
Parent material: Sandy outwash or beach deposits
Slope range: 0 to 1 percent
Taxonomic classification: Sandy, mixed, frigid Typic Endoaquolls

Typical Pedon

Isan loamy sand, depressional, 0 to 1 percent slopes, 1,890 feet south and 100 feet east of the northwest corner of sec. 26, T. 139 N., R. 34 W., Hubbard County; USGS Huntersville quadrangle; lat. 46 degrees 49 minutes 45 seconds N. and long. 94 degrees 57 minutes 12 seconds W., NAD27:

A1—0 to 2 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; many fine roots; 1 percent gravel; moderately acid; abrupt smooth boundary.

A2—2 to 9 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; few fine distinct dark yellowish brown (10YR 3/4) iron concentrations; weak fine subangular blocky structure; very friable; many fine roots; 1 percent gravel; moderately acid; clear smooth boundary.

A3—9 to 11 inches; very dark brown (10YR 2/2) loamy sand, dark gray (10YR 4/1) dry; few fine distinct dark yellowish brown (10YR 3/4) iron concentrations; weak fine subangular blocky structure; very friable; common fine roots; 2 percent gravel; moderately acid; clear smooth boundary.

Bg—11 to 15 inches; dark grayish brown (2.5Y 4/2) loamy sand; few fine prominent dark yellowish brown (10YR 3/4) iron concentrations; weak fine

subangular blocky structure; friable; common fine roots; 2 percent gravel; moderately acid; gradual smooth boundary.
Cg1—15 to 32 inches; grayish brown (2.5Y 5/2) sand; few medium distinct light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; 2 percent gravel; moderately acid; gradual smooth boundary.
Cg2—32 to 45 inches; grayish brown (2.5Y 5/2) coarse sand; common medium distinct light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; 5 percent gravel; moderately acid; gradual smooth boundary.
Cg3—45 to 80 inches; gray (5Y 5/1) coarse sand; common medium prominent light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; 5 percent gravel; slightly acid.

Range in Characteristics

Depth to carbonates: More than 60 inches
Thickness of the mollic epipedon: 10 to 24 inches
Content of rock fragments: 0 to 10 percent

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loamy sand or sandy loam

Bg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—4 or 5
Chroma—0 to 2
Texture—loamy sand, sand, coarse sand, or loamy coarse sand

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—sand or coarse sand

261—Isan loamy sand, depressional, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on outwash plains
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Sandy outwash or beach deposits
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 3.7 inches (low)
Content of organic matter in the surface layer: About 5.5 percent (high)

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

- Duelm and similar soils
- Nidaros and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- "Wildlife Habitat" section

Lengby Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—moderate; lower part—moderately rapid or rapid
Landform: Outwash plains and moraines
Parent material: Glaciolacustrine deposits
Slope range: 2 to 15 percent
Taxonomic classification: Fine-loamy, mixed, superactive Typic Eutroboralfs

Typical Pedon

Lengby fine sandy loam, 2 to 8 percent slopes, 2,400 feet south and 400 feet west of the northeast corner of sec. 25, T. 150 N., R. 36 W., Clearwater County; USGS Bagley Lake quadrangle; lat. 47 degrees 46 minutes 59 seconds N. and long. 95 degrees 11 minutes 43 seconds W., NAD27:

A—0 to 3 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; 1 percent gravel; slightly acid; clear smooth boundary.
E—3 to 11 inches; brown (10YR 5/3) loamy fine sand,

pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; 1 percent gravel; slightly acid; clear wavy boundary.

B/E—11 to 15 inches; about 90 percent dark yellowish brown (10YR 4/4) sandy clay loam (B), about 10 percent brown (10YR 5/3) loamy fine sand (E); moderate medium subangular blocky structure; friable; 2 percent gravel; slightly acid; clear smooth boundary.

Bt1—15 to 22 inches; dark yellowish brown (10YR 4/4) loam; strong medium subangular blocky structure; friable; common distinct dark brown (10YR 4/3) clay films on faces of peds and in pores; 2 percent gravel; neutral; clear wavy boundary.

Bt2—22 to 26 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; common distinct dark brown (10YR 4/3) clay films on faces of peds and in pores; 2 percent gravel; neutral; clear smooth boundary.

C1—26 to 35 inches; light yellowish brown (10YR 6/4) sandy loam; massive; very friable; common medium irregularly shaped seams and soft masses of carbonates; 6 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

C2—35 to 42 inches; light olive brown (2.5Y 5/4) silt loam; massive; very friable; common medium irregularly shaped seams and soft masses of carbonates; strongly effervescent; slightly alkaline; clear wavy boundary.

C3—42 to 48 inches; light olive brown (2.5Y 5/4) fine sandy loam; massive; very friable; common medium irregularly shaped seams and soft masses of carbonates; 4 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

C4—48 to 60 inches; pale brown (10YR 6/3) fine sand; single grain; loose; disseminated carbonates; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 18 to 40 inches
Content of rock fragments: 0 to 15 percent
Other features: Some pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—fine sandy loam

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 to 4
Texture—fine sand, loamy sand, loamy fine sand, sandy loam, or fine sandy loam

Bt horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—3 or 4
Texture—loam, clay loam, fine sandy loam, or sandy clay loam

C horizon:
Hue—2.5Y or 10YR
Value—5 to 7
Chroma—2 to 4
Texture—stratified sand, coarse sand, fine sand, loamy sand, loamy fine sand, sandy loam, fine sandy loam, very fine sandy loam, loam, and silt loam

709B—Lengby fine sandy loam, 2 to 8 percent slopes

Composition

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

Setting

Landform: Outwash plains and moraines
Position on the landform: Summits and backslopes
Slope range: 2 to 8 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 7.5 inches (moderate)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Zerkel and similar soils
- Sol and similar soils
- Willosippi and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

709C—Lengby fine sandy loam, 8 to 15 percent slopes

Composition

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

Setting

Landform: Outwash plains and moraines
Position on the landform: Backslopes and shoulders
Slope range: 8 to 15 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 7.5 inches (moderate)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Zerkel and similar soils
- Sol and similar soils
- Willosippi and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Lupton Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow to moderately rapid
Landform: Lake plains, outwash plains, and moraines
Parent material: Woody organic material
Slope range: 0 to 1 percent
Taxonomic classification: Euic Typic Borosaprists

Typical Pedon

Lupton muck, in an area of Mooselake and Lupton soils, 0 to 1 percent slopes, 1,300 feet north and 1,500 feet east of the southwest corner of sec. 34, T. 143 N., R. 32 W., Hubbard County; USGS Benedict quadrangle; lat. 47 degrees 9 minutes 14 seconds N. and long. 94 degrees 43 minutes 16 seconds W., NAD27:

Oa1—0 to 10 inches; muck, very dark grayish brown (10YR 3/2) broken face, black (N 2/0) rubbed and pressed; about 50 percent fiber, about 15 percent rubbed; weak fine granular structure; very friable; few medium roots; very strongly acid; clear smooth boundary.

Oa2—10 to 22 inches; muck, very dark grayish brown (10YR 3/2) broken face, black (10YR 2/1) rubbed and pressed; about 25 percent fiber, about 15 percent rubbed; weak very fine granular structure; very friable; few coarse roots; strongly acid; gradual smooth boundary.

Oa3—22 to 48 inches; muck, dark brown (7.5YR 3/2) broken face, very dark grayish brown (10YR 3/2) rubbed and pressed; about 40 percent fiber, about 15 percent rubbed; massive; very friable; strongly acid; diffuse wavy boundary.

Oa4—48 to 80 inches; muck, dark brown (7.5YR 3/2) broken face, very dark gray (10YR 3/1) rubbed and pressed; about 25 percent fiber, about 5 percent rubbed; massive; very friable; moderately acid.

Range in Characteristics

Thickness of the organic material: More than 51 inches
Content of wood fragments: 0 to 30 percent

Oa horizon:
Hue—7.5YR, 10YR, 5YR, or neutral
Value—2 or 3
Chroma—0 to 3
Texture—muck

Markey Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—rapid or very rapid
Landform: Lake plains and outwash plains
Parent material: Organic materials over outwash
Slope range: 0 to 1 percent
Taxonomic classification: Sandy or sandy-skeletal, mixed, euic Terric Borosaprists

Typical Pedon

Markey muck, depressional, MAP 22-30, 0 to 1 percent slopes, 1,800 feet north and 1,400 feet west of the southeast corner of sec. 2, T. 145 N., R. 32 W., Hubbard County; USGS Andrusia Lake quadrangle; lat. 47 degrees 24 minutes 0 seconds N. and long. 94 degrees 41 minutes 40 seconds W., NAD27:

Oa1—0 to 15 inches; muck, very dark brown (10YR 2/2) broken face, black (10YR 2/1) rubbed; about 25 percent fiber, about 10 percent rubbed; weak fine granular structure; very friable; 3 percent wood fragments; very strongly acid; clear wavy boundary.
Oa2—15 to 26 inches; muck, black (10YR 2/1) broken face, black (10YR 2/1) rubbed; about 10 percent fiber, about 3 percent rubbed; weak medium platy structure; very friable; strongly acid; abrupt wavy boundary.
Cg1—26 to 55 inches; olive gray (5Y 4/2) sand; single grain; loose; 3 percent gravel; moderately acid; gradual wavy boundary.
Cg2—55 to 80 inches; gray (5Y 5/1) sand; single grain; loose; 3 percent gravel; moderately acid.

Range in Characteristics

Thickness of the organic material: 16 to 51 inches
Content of wood fragments: 0 to 15 percent

Oa horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 to 4
Chroma—0 to 3
Texture—muck

Cg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—4 to 6
Chroma—0 to 4
Texture—sand, fine sand, coarse sand, loamy sand, or gravelly loamy sand
Content of rock fragments—0 to 25 percent

1445—Markey muck, depressional, MAP 22-30, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on lake plains and outwash plains
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over outwash
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 12.3 inches (high)
Content of organic matter in the surface layer: About 70 percent (very high)

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

- Seelyeville and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

Meehan Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Rapid or very rapid
Landform: Outwash plains
Parent material: Outwash
Slope range: 0 to 3 percent
Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Meehan loamy sand, MAP 22-30, 0 to 3 percent slopes, 1,350 feet south and 975 feet west of the northeast corner of sec. 27, T. 143 N., R. 32 W., Hubbard County; USGS Benedict quadrangle; lat. 47 degrees 10 minutes 31.8 seconds N. and long. 94 degrees 42 minutes 37.2 seconds W., NAD27:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; very friable; many medium roots; 1 percent gravel; strongly acid; abrupt smooth boundary.
Bw1—6 to 14 inches; yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure parting to single grain; very friable; many medium roots; 1 percent gravel; strongly acid; clear smooth boundary.
Bw2—14 to 22 inches; pale brown (10YR 6/3) loamy sand; few fine prominent brownish yellow (10YR 6/8) iron concentrations; weak fine subangular blocky structure parting to single grain; very friable; few fine roots; 1 percent gravel; strongly acid; clear wavy boundary.
Bg—22 to 38 inches; light brownish gray (10YR 6/2) sand; many medium prominent reddish yellow (7.5YR 6/8) iron concentrations; single grain; loose; 1 percent gravel; strongly acid; gradual smooth boundary.
Cg1—38 to 62 inches; light gray (10YR 7/2) sand; single grain; loose; 1 percent gravel; moderately acid; gradual smooth boundary.
Cg2—62 to 80 inches; light brownish gray (10YR 6/2) sand; single grain; loose; 1 percent gravel; moderately acid.

Range in Characteristics

Content of rock fragments: 0 to 15 percent

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand

Bw horizon:
Hue—10YR
Value—4 to 6
Chroma—3 to 8
Texture—sand, loamy sand, coarse sand, or loamy coarse sand

Bg horizon (if it occurs):
Hue—10YR
Value—4 to 6
Chroma—2
Texture—sand, loamy sand, coarse sand, loamy coarse sand

Cg horizon:
Hue—10YR or 2.5Y
Value—4 to 7
Chroma—2
Texture—sand or coarse sand

202—Meehan loamy sand, MAP 22-30, 0 to 3 percent slopes

Composition

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

Setting

Landform: Flats and swales on outwash plains
Slope range: 0 to 3 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Outwash
Flooding: None
Depth to the water table: 1.0 to 2.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 4.4 inches (low)
Content of organic matter in the surface layer: About 1.75 percent (moderately low)

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

- Wurtsmith and similar soils

- Roscommon and similar soils
- Markey and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Menahga Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid
Landform: Outwash plains
Parent material: Outwash or beach deposits
Slope range: 1 to 45 percent
Taxonomic classification: Mixed, frigid Typic Udipsamments

Typical Pedon

Menahga loamy sand, in an area of Graycalm-Menahga complex, 1 to 8 percent slopes, 200 feet north and 400 feet west of the southeast corner of sec. 9, T. 143 N., R. 34 W., Hubbard County; USGS Lake George quadrangle; lat. 47 degrees 12 minutes 39.5 seconds N. and long. 94 degrees 59 minutes 5.5 seconds W., NAD27:

A—0 to 3 inches; very dark brown (10YR 2/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine roots; 1 percent gravel; strongly acid; clear smooth boundary.

Bw—3 to 17 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine subangular blocky structure parting to single grain; very friable; common fine roots; 1 percent gravel; strongly acid; clear smooth boundary.

C1—17 to 37 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few coarse roots; 1 percent gravel; moderately acid; gradual smooth boundary.

C2—37 to 64 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; few coarse roots; 1 percent gravel; moderately acid; gradual smooth boundary.

C3—64 to 80 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; few coarse roots; 5 percent gravel; slightly acid.

Range in Characteristics

Content of rock fragments: 0 to 10 percent

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loamy sand

Bw horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—3 to 6
Texture—sand, loamy sand, coarse sand, or loamy coarse sand

C horizon:
Hue—10YR
Value—4 to 6
Chroma—3 to 6
Texture—coarse sand or sand

Mooselake Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderate or moderately rapid
Landform: Moraines, outwash plains, and lake plains
Parent material: Woody organic material
Slope range: 0 to 1 percent
Taxonomic classification: Euic Typic Borohemists

Typical Pedon

Mooselake mucky peat, in an area of Mooselake and Lupton soils, 0 to 1 percent slopes, 2,300 feet south and 2,550 feet east of the northwest corner of sec. 16, T. 145 N., R. 32 W., Hubbard County; USGS Steamboat Lake quadrangle; lat. 47 degrees 22 minutes 28.4 seconds N. and long. 94 degrees 44 minutes 46.5 seconds W., NAD27:

Oe1—0 to 10 inches; mucky peat, very dark brown (10YR 2/2) broken face and rubbed; about 60 percent fiber, about 20 percent rubbed; weak fine subangular blocky structure; very friable; woody fiber; about 15 percent mineral material; about 10 percent wood fragments; very strongly acid; gradual smooth boundary.

Oe2—10 to 34 inches; mucky peat, very dark brown (10YR 2/2) broken face and rubbed; about 75 percent fiber, about 35 percent rubbed; weak fine subangular blocky structure; very friable; woody fiber; about 15 percent mineral material; about 10 percent wood fragments; very strongly acid; gradual smooth boundary.

Oe3—34 to 64 inches; mucky peat, dark brown (7.5YR 3/2) broken face, dark brown (7.5YR 3/4) rubbed; about 60 percent fiber, about 25 percent rubbed; weak fine granular structure; very friable; woody fiber; about 15 percent mineral material; about 5 percent wood fragments; strongly acid; gradual smooth boundary.
Oe4—64 to 80 inches; mucky peat, very dark brown (10YR 2/2) broken face, black (10YR 2/1) rubbed; about 50 percent fiber, about 20 percent rubbed; weak very thin platy structure; very friable; herbaceous fiber; about 2 percent wood fragments; strongly acid.

Range in Characteristics

Thickness of the organic material: More than 51 inches
Content of wood fragments: 0 to 10 percent

Oe horizon:
Hue—5YR to 10YR
Value—2 or 3
Chroma—2 or 3
Texture—mucky peat

797—Mooselake and Lupton soils, 0 to 1 percent slopes

Composition

Mooselake: Variable
Lupton: Variable
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains, outwash plains, and moraines
Slope range: 0 to 1 percent

Component Description

Mooselake

Texture of the surface layer: Mucky peat
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Woody organic material
Flooding: None
Water table depth: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 27.0 inches (high)
Content of organic matter in the surface layer: About 62 percent (very high)

Lupton

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Woody organic material
Flooding: None
Water table depth: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches (high)
Content of organic matter in the surface layer: About 80 percent (very high)

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

- Cathro and similar soils

Major Uses of the Unit

- Forest land

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

- "Forest Land" section

Nary Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Moraines
Parent material: Till
Slope range: 1 to 3 percent
Taxonomic classification: Fine-loamy, mixed, superactive Glossaquic Eutroboralfs

Typical Pedon

Nary fine sandy loam, 1 to 3 percent slopes, 2,600 feet west and 2,300 feet south of the northeast corner of sec. 27, T. 148 N., R. 36 W., Clearwater County; USGS Solway quadrangle; lat. 47 degrees 36 minutes 33 seconds N. and long. 95 degrees 14 minutes 17 seconds W., NAD27:

A—0 to 3 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; 3 percent gravel; 10 percent cobbles; moderately acid; clear smooth boundary.

E—3 to 15 inches; grayish brown (10YR 5/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; very friable; 3 percent gravel; 10 percent cobbles; moderately acid; gradual wavy boundary.
B/E—15 to 24 inches; 70 percent dark yellowish brown (10YR 4/4) sandy clay loam (B), 30 percent grayish brown (10YR 5/2) fine sandy loam (E); few fine distinct yellowish brown (10YR 5/6) iron concentrations; moderate medium subangular blocky structure; friable; 3 percent gravel; 5 percent cobbles; slightly acid; clear wavy boundary.
Bt—24 to 36 inches; dark brown (10YR 4/3) sandy clay loam; common medium faint grayish brown (10YR 5/2) iron depletions and common medium distinct yellowish brown (10YR 5/6) iron concentrations; strong medium subangular blocky structure; friable; common distinct dark brown (10YR 3/3) clay films on faces of peds and lining pores; 5 percent gravel; slightly acid; clear smooth boundary.
C—36 to 60 inches; light olive brown (2.5Y 5/4) sandy loam; common medium distinct grayish brown (2.5Y 5/2) iron depletions and common medium prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; common medium irregularly shaped seams and soft masses of carbonates; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches
Other features: Most pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A or Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—fine sandy loam
Content of rock fragments—2 to 10 percent gravel; 0 to 35 percent cobbles

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 or 3
Texture—loamy sand, loamy fine sand, fine sandy loam, sandy loam, or the cobbly analogs of these textures
Content of rock fragments—2 to 10 percent gravel; 0 to 35 percent cobbles

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—sandy clay loam, fine sandy loam, or loam
Content of rock fragments—2 to 10 percent gravel; 0 to 1 percent cobbles

C horizon:
Hue—2.5Y or 10YR
Value—3 to 6
Chroma—2 to 4
Texture—fine sandy loam or sandy loam
Content of rock fragments—2 to 10 percent gravel; 0 to 1 percent cobbles

1294—Nary fine sandy loam, 1 to 3 percent slopes

Composition

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

Setting

Landform: Flats on moraines
Slope range: 1 to 3 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 8.8 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Sol and similar soils
- Egglake and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Nebish Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—moderate or moderately rapid; lower part—moderate or moderately slow
Landform: Moraines
Parent material: Till
Slope range: 2 to 12 percent
Taxonomic classification: Fine-loamy, mixed, superactive Typic Eutroboralfs

Typical Pedon

Nebish very fine sandy loam, moderately wet, 2 to 6 percent slopes, 1,600 feet north and 1,300 feet east of the southwest corner of sec. 15, T. 145 N., R. 33 W., Hubbard County; USGS Guthrie quadrangle; lat. 47 degrees 22 minutes 18 seconds N. and long. 94 degrees 51 minutes 27 seconds W., NAD27:

A—0 to 6 inches; dark brown (10YR 3/3) very fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many very fine to medium roots throughout; 2 percent gravel; slightly acid; clear smooth boundary.
E—6 to 12 inches; brown (10YR 4/3) very fine sandy loam, very pale brown (10YR 7/3) dry; weak thin platy structure parting to weak very fine subangular blocky; friable; many very fine and fine roots throughout; 2 percent gravel; slightly acid; gradual smooth boundary.
Bt1—12 to 22 inches; yellowish brown (10YR 5/4) loam; moderate fine subangular blocky structure; friable; common very fine roots throughout; few distinct discontinuous brown (7.5YR 4/4) clay films on faces of peds and many distinct discontinuous light yellowish brown (10YR 6/4) silt coatings on faces of peds; 5 percent gravel; moderately acid; gradual smooth boundary.
Bt2—22 to 32 inches; yellowish brown (10YR 5/4) sandy clay loam; moderate medium subangular blocky structure; friable; common very fine roots; common distinct discontinuous brown (7.5YR 4/4) clay films on faces of peds and few distinct discontinuous light yellowish brown (10YR 6/4) silt coatings on faces of peds; 5 percent gravel; moderately acid; gradual wavy boundary.
BC—32 to 37 inches; olive brown (2.5Y 4/4) loam; moderate coarse subangular blocky structure; friable; few distinct discontinuous dark yellowish brown (10YR 4/4) clay films in root channels and lining pores; common fine rounded masses of iron-manganese accumulation; 8 percent gravel; neutral; gradual wavy boundary.
C1—37 to 67 inches; light olive brown (2.5Y 5/3) loam; few fine prominent yellowish brown (10YR 5/8) iron concentrations; massive; friable; few distinct discontinuous light gray (10YR 7/2) carbonate coatings throughout; common fine rounded masses of iron-manganese accumulation; 5 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.
C2—67 to 80 inches; light olive brown (2.5Y 5/4) sandy loam; massive; friable; common distinct discontinuous light gray (10YR 7/2) carbonate coatings throughout; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to more than 60 inches
Content of rock fragments: 2 to 10 percent
Other features: Some pedons have a B/E or BE horizon, which has colors and textures similar to those of the B and E horizons.

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—very fine sandy loam

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 or 3
Texture—very fine sandy loam, sandy loam, fine sandy loam, loamy fine sand, or loamy sand

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

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—3 or 4
Texture—loam or clay loam

1460B—Nebish very fine sandy loam, moderately wet, 2 to 6 percent slopes

Composition

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

Setting

Landform: Moraines
Position on the landform: Summits and backslopes
Slope range: 2 to 6 percent

Component Description

Texture of the surface layer: Very fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Beltrami and similar soils
- Talmoon and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1460C—Nebish very fine sandy loam, 6 to 12 percent slopes

Composition

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

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Texture of the surface layer: Very fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.5 inches (high)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Beltrami and similar soils
- Talmoon and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Nidaros Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—moderate to rapid
Landform: Outwash plains and flood plains
Parent material: Organic materials over outwash
Slope range: 0 to 1 percent
Taxonomic classification: Loamy, mixed, euic Terric Borosaprists

Typical Pedon

Nidaros muck, depressional, 0 to 1 percent slopes, 275 feet east and 1,350 feet north of the southwest

corner of sec. 15, T. 134 N., R. 38 W., Otter Tail County; USGS Heinola quadrangle; lat. 46 degrees 24 minutes 59 seconds N. and long. 95 degrees 28 minutes 6 seconds W., NAD27:

Oa1—0 to 20 inches; muck, black (5YR 2/1) broken face, black (10YR 2/1) rubbed; about 6 percent fiber, about 5 percent rubbed; strong medium granular structure; very friable; fibers are primarily herbaceous; neutral; gradual smooth boundary.
Oa2—20 to 27 inches; muck, black (7.5YR 2/0) broken face and rubbed; about 10 percent fiber, about 2 percent rubbed; strong very thick platy structure; friable; fibers are primarily herbaceous; neutral; clear smooth boundary.
A1—27 to 33 inches; black (2.5Y 2/0) sandy clay loam; massive; neutral; clear smooth boundary.
A2—33 to 38 inches; black (5Y 2.5/1) sandy loam; massive; neutral; abrupt smooth boundary.
2Cg—38 to 80 inches; olive gray (5Y 5/2) sand; single grain; loose; 3 percent gravel; neutral.

Range in Characteristics

Thickness of the organic material: 16 to 51 inches
Content of wood fragments: 0 to 15 percent

Oa horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 to 4
Chroma—0 to 3
Texture—muck

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—sandy loam, fine sandy loam, sandy clay loam, loam, coarse sandy loam, silty clay loam, silt loam, or the mucky analogs of these textures
Content of rock fragments—0 to 10 percent

Cg horizon (if it occurs):
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 to 3
Texture—sandy loam, fine sandy loam, sandy clay loam, loam, coarse sandy loam, silty clay loam, or silt
Content of rock fragments—0 to 10 percent

2Cg horizon:
Hue—2.5Y, 5Y, or neutral
Value—4 to 6
Chroma—0 to 2
Texture—sand, coarse sand, fine sand, loamy sand, or the gravelly analogs of these textures
Content of rock fragments—0 to 35 percent

1111—Nidaros muck, 0 to 1 percent slopes, frequently flooded

Composition

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

Setting

Landform: Flood plains
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over outwash
Flooding: Frequent
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 15.1 inches (high)
Content of organic matter in the surface layer: About 70 percent (very high)

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

- Seelyeville and similar soils
- Roscommon and similar soils
- Bowstring and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

1136—Nidaros muck, depressional, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on outwash plains
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over outwash
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 13.9 inches (high)
Content of organic matter in the surface layer: About 70 percent (very high)

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

- Seelyeville and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- "Wildlife Habitat" section

Nymore Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid
Landform: Outwash plains
Parent material: Outwash or beach deposits
Slope range: 1 to 20 percent
Taxonomic classification: Mixed, frigid Typic Udipsamments

Typical Pedon

Nymore loamy sand, 1 to 3 percent slopes, 225 feet north and 950 feet west of the southeast corner of sec. 30, T. 135 N., R. 34 W., Wadena County; USGS Verndale quadrangle; lat. 46 degrees 28 minutes 16.2 seconds N. and long. 95 degrees 0 minutes 47.1 seconds W., NAD27:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; very friable; slightly acid; abrupt smooth boundary.
BA—8 to 11 inches; brown (10YR 4/3) and dark brown (10YR 3/3) sand; single grain; loose; slightly acid; clear smooth boundary.
Bw1—11 to 23 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; neutral; clear smooth boundary.
Bw2—23 to 33 inches; yellowish brown (10YR 5/4) sand; single grain; loose; 1 percent gravel; neutral; clear smooth boundary.
C—33 to 60 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; slightly acid.

Range in Characteristics

Depth to carbonates: 48 to more than 60 inches
Content of rock fragments: 0 to 10 percent

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—loamy sand

B horizon:
Hue—10YR
Value—3 to 6
Chroma—3 to 6
Texture—loamy sand, loamy coarse sand, sand, or coarse sand

C horizon:
Hue—10YR
Value—5 to 7
Chroma—2 to 6
Texture—sand or coarse sand

207B—Nymore loamy sand, 2 to 6 percent slopes

Composition

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

Setting

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

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Verndale and similar soils
- Duelm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

207C—Nymore loamy sand, 6 to 12 percent slopes

Composition

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

Setting

Landform: Outwash plains
Position on the landform: Shoulders and summits
Slope range: 6 to 12 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Verndale and similar soils
- Duelm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

207D—Nymore loamy sand, 12 to 20 percent slopes

Composition

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

Setting

Landform: Outwash plains
Position on the landform: Backslopes and shoulders
Slope range: 12 to 20 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Verndale and similar soils
- Duelm and similar soils

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1248C—Nymore-Verndale complex, 6 to 12 percent slopes

Composition

Nymore and similar soils: About 55 percent
Verndale and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Nymore—shoulders and summits; Verndale—backslopes
Slope range: 6 to 12 percent

Component Description

Nymore

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

Verndale

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Loamy mantle over sandy outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.5 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Duelm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Paddock Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Upper part—moderate; lower part—very slow
Landform: Drumlins
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Coarse-loamy, mixed, superactive, frigid Udollic Epiaqualfs

Typical Pedon

Paddock fine sandy loam, in an area of Paddock-Becida complex, stony, 2,125 feet south and 175 feet west of the northeast corner of sec. 28, T. 137 N., R. 36 W., Otter Tail County; USGS Sebeka NW quadrangle; lat. 46 degrees 39 minutes 11 seconds N. and long. 95 degrees 13 minutes 35 seconds W., NAD27:

Ap—0 to 8 inches; very dark brown (10YR 2/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; 2 percent gravel; moderately acid; abrupt smooth boundary.
EB—8 to 15 inches; about 80 percent brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; about 20 percent dark yellowish brown (10YR 4/4) sandy loam (B); common medium distinct

grayish brown (2.5Y 5/2) iron depletions and common medium prominent strong brown (7.5YR 5/6) iron concentrations; weak medium subangular blocky structure; very friable; 2 percent gravel; moderately acid; clear smooth boundary.

Bt1—15 to 21 inches; grayish brown (2.5Y 5/2) sandy loam; common coarse prominent strong brown (7.5YR 5/8) and common medium prominent yellowish brown (10YR 5/8) iron concentrations; moderate medium subangular blocky structure; firm; common faint discontinuous grayish brown (10YR 5/2) clay films on faces of peds and in pores; 2 percent gravel; strongly acid; clear smooth boundary.

Bt2—21 to 28 inches; brown (10YR 4/3) sandy loam; common medium distinct grayish brown (2.5Y 5/2) iron depletions and common medium prominent yellowish red (5YR 5/6) iron concentrations; weak fine subangular blocky structure; friable; few faint discontinuous grayish brown (10YR 5/2) clay films between sand grains; 2 percent gravel; strongly acid; clear smooth boundary.

Bt3—28 to 36 inches; dark yellowish brown (10YR 4/4) sandy loam; common coarse prominent grayish brown (2.5Y 5/2) iron depletions and common medium prominent strong brown (7.5YR 5/8) iron concentrations; moderate medium subangular blocky structure; firm; few faint discontinuous dark brown (7.5YR 3/2) clay films in root channels and/or pores; 3 percent gravel; moderately acid; clear wavy boundary.

BC—36 to 40 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; firm; common distinct discontinuous dark brown (7.5YR 3/2) clay films in root channels and/or pores; 3 percent gravel; slightly acid; clear wavy boundary.

Cd1—40 to 46 inches; light olive brown (2.5Y 5/4) sandy loam; moderate thin platy structure; very firm; 3 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

Cd2—46 to 60 inches; light olive brown (2.5Y 5/4) sandy loam; moderate thin platy structure; very firm; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 40 to more than 60 inches
Depth to dense till: 40 to 60 inches
Content of rock fragments: 2 to 15 percent
Other features: Most pedons have an EB, BE, or B/E horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam

E horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—sandy loam or fine sandy loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—sandy loam or sandy clay loam

Cd horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—sandy loam or loamy sand

1321—Paddock-Becida complex, 0 to 2 percent slopes, stony

Composition

Paddock and similar soils: About 45 percent
Becida and similar soils: About 35 percent
Inclusions: About 20 percent

Setting

Landform: Drumlins
Position on the landform: Footslopes and toeslopes
Slope range: 0 to 2 percent

Component Description

Paddock

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 1.0 to 2.5 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 5.7 inches (low)
Content of organic matter in the surface layer: About 4 percent (high)

Becida

Texture of the surface layer: Loam

Depth to bedrock: More than 80 inches
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Water table depth: At the surface to 1 foot below the surface
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 5.7 inches (low)
Content of organic matter in the surface layer: About 5 percent (high)

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

- Blowers and similar soils
- Runeberg and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1030—Pits, gravel-Udipsamments complex

Composition

Pits, gravel: About 50 percent
Udipsamments: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains, lake plains, and moraines
Slope range: 1 to 50 percent

Component Description

Pits, gravel

Dominant parent material: Outwash or beach deposits

Udipsamments

Texture of the surface layer: Sand
Depth to bedrock: More than 60 inches
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.0 inches (low)

Inclusions

- Poorly drained and moderately well drained areas

Potatolake Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderate; lower part—rapid or very rapid
Landform: Lake plains, outwash plains, and moraines
Parent material: Glaciolacustrine deposits over outwash
Slope range: 1 to 15 percent
Taxonomic classification: Fine-silty, mixed, superactive Aquic Eutroboralfs

Typical Pedon

Potatolake very fine sandy loam, 1 to 8 percent slopes, 2,200 feet south and 1,400 feet east of the northwest corner of sec. 8, T. 141 N., R. 35 W., Hubbard County; USGS Two Inlets quadrangle; lat. 47 degrees 2 minutes 47.5 seconds N. and long. 95 degrees 8 minutes 40.9 seconds W., NAD27:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many very fine and fine roots; slightly acid; abrupt smooth boundary.
E—9 to 15 inches; brown (10YR 5/3) very fine sandy loam, light gray (10YR 7/2) dry; weak thin platy structure parting to weak very fine subangular blocky; friable; many very fine and fine roots; slightly acid; clear smooth boundary.
Bt1—15 to 24 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; many faint dark brown (10YR 3/3) clay films on faces of peds and in pores; slightly acid; clear smooth boundary.
Bt2—24 to 30 inches; olive brown (2.5Y 4/4) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) iron depletions; moderate medium subangular blocky structure; firm; common faint olive brown (2.5Y 4/3) clay films on faces of peds and in pores; slightly acid; gradual smooth boundary.
2Bk—30 to 50 inches; light olive brown (2.5Y 5/4), stratified fine sandy loam, loamy very fine sand, and silt loam; many medium distinct grayish brown (2.5Y 5/2) iron depletions and common fine distinct light olive brown (2.5Y 5/6) iron

concentrations; massive; very friable; many light gray (2.5Y 7/2) carbonate coatings; strongly effervescent; slightly alkaline; gradual smooth boundary.
2C1—50 to 57 inches; light olive brown (2.5Y 5/4), stratified fine sand, sand, and very fine sand; common medium distinct grayish brown (2.5Y 5/2) iron depletions; single grain; loose; few light gray (2.5Y 7/2) carbonate coatings in strata; slightly effervescent; slightly alkaline; gradual wavy boundary.
2C2—57 to 80 inches; light yellowish brown (2.5Y 6/4) and light olive brown (2.5Y 5/6), stratified sand and coarse sand; few fine prominent yellowish brown (10YR 5/8) iron concentrations; single grain; loose; 7 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to more than 60 inches

A or Ap horizon:
Hue—10YR or neutral
Value—2 to 4
Chroma—0 to 3
Texture—very fine sandy loam
Content of rock fragments—0 to 5 percent

E horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam, fine sandy loam, or very fine sandy loam
Content of rock fragments—0 to 5 percent

Bt horizon:
Hue—10YR, 7.5YR, or 2.5Y
Value—4 to 6
Chroma—3 to 5
Texture—silt loam, silty clay loam, or very fine sandy loam
Content of rock fragments—0 to 5 percent

2Bk horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—stratified very fine sandy loam, fine sandy loam, silt loam, loamy very fine sand, very fine sand, fine sand, sand, or the gravelly analogs of these textures
Content of rock fragments—5 to 25 percent

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 8
Texture—stratified sand, coarse sand, fine sand, very fine sand, loamy sand, loamy coarse sand, loamy very fine sand, sandy loam, fine sandy loam, very fine sandy loam, silt loam, silt, or the gravelly analogs of these textures
Content of rock fragments—5 to 25 percent

820B—Potatolake very fine sandy loam, 1 to 8 percent slopes

Composition

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

Setting

Landform: Flats on moraines and outwash plains
Slope range: 1 to 8 percent

Component Description

Texture of the surface layer: Very fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits over outwash
Flooding: None
Depth to the water table: 2.0 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

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

- Willosippi and similar soils
- Debs and similar soils
- Steamboat and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

820C—Potatolake very fine sandy loam, 8 to 15 percent slopes

Composition

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

Setting

Landform: Outwash plains, lake plains, and moraines
Position on the landform: Backslopes and footslopes
Slope range: 8 to 15 percent

Component Description

Texture of the surface layer: Very fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits over outwash
Flooding: None
Depth to the water table: 2.0 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

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

- Willosippi and similar soils
- Debs and similar soils
- Steamboat and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Redeye Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—rapid; lower part—slow or very slow
Landform: Drumlins and moraines
Parent material: Outwash over till
Slope range: 1 to 15 percent
Taxonomic classification: Loamy, mixed, superactive Arenic Eutroboralfs

Typical Pedon

Redeye loamy sand, 6 to 12 percent slopes, 250 feet south and 25 feet east of the northwest corner of sec. 23, T. 138 N., R. 34 W., Wadena County; USGS Huntersville quadrangle; lat. 46 degrees 45 minutes 38 seconds N. and long. 94 degrees 57 minutes 15 seconds W., NAD27:

A—0 to 3 inches; very dark gray (10YR 3/1) loamy sand, grayish brown (10YR 5/2) dry; moderate medium granular structure; very friable; strongly acid; abrupt smooth boundary.
E—3 to 18 inches; brown (10YR 5/3) sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; 1 percent gravel; strongly acid; clear wavy boundary.
Bw—18 to 26 inches; yellowish brown (10YR 5/4) loamy sand; weak medium subangular blocky structure; very friable; 5 percent gravel; slightly acid; clear smooth boundary.
2Bt1—26 to 38 inches; yellowish brown (10YR 5/4) sandy loam; moderate coarse prismatic structure; friable; common pale yellow (10YR 6/3) clean sand coatings on faces of peds; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds and in pores; 3 percent gravel; moderately acid; clear wavy boundary.
2Bt2—38 to 52 inches; dark yellowish brown (10YR 4/4) sandy loam; weak thick platy structure parting to moderate coarse subangular blocky; firm; common faint dark brown (10YR 4/3) clay films on faces of peds and in pores; 3 percent gravel; slightly acid; clear wavy boundary.
2Cd—52 to 60 inches; light yellowish brown (10YR 6/4) sandy loam; massive breaking to moderate thick platy soil fragments; very firm; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 40 to more than 60 inches
Depth to dense till: 40 to 60 inches

A or Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 to 3

Texture—loamy sand
Content of rock fragments—0 to 15 percent

E horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 or 3
Texture—loamy sand, loamy fine sand, sand, or fine sand
Content of rock fragments—0 to 15 percent

Bw horizon:
Hue—10YR
Value—3 to 6
Chroma—3 to 6
Texture—sand or loamy sand
Content of rock fragments—0 to 15 percent

2Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—4 to 6
Texture—sandy loam or gravelly sandy loam
Content of rock fragments—2 to 20 percent

2Cd horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—4 or 5
Texture—sandy loam, loamy sand, or the gravelly analogs of these textures
Content of rock fragments—2 to 20 percent

82B—Redeye loamy sand, 1 to 6 percent slopes

Composition

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

Setting

Landform: Drumlins
Position on the landform: Summits and backslopes
Slope range: 1 to 6 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash over till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.4 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Huntersville and similar soils
- Staples and similar soils
- Graycalm and similar soils
- Rockwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

82C—Redeye loamy sand, 6 to 12 percent slopes

Composition

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

Setting

Landform: Drumlins
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash over till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.4 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Huntersville and similar soils
- Staples and similar soils
- Graycalm and similar soils
- Rockwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1440B—Redeye loamy sand, morainic, 3 to 8 percent slopes

Composition

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

Setting

Landform: Moraines
Position on the landform: Summits and backslopes
Slope range: 3 to 8 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash over till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.2 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Huntersville and similar soils
- Staples and similar soils
- Graycalm and similar soils
- Rockwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1440C—Redeye loamy sand, morainic, 8 to 15 percent slopes

Composition

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

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 8 to 15 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash over till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.2 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Huntersville and similar soils
- Staples and similar soils
- Graycalm and similar soils
- Rockwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Rifle Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderate or moderately rapid
Landform: Moraines, outwash plains, and lake plains
Parent material: Herbaceous organic materials
Slope range: 0 to 1 percent
Taxonomic classification: Euic Typic Borohemists

Typical Pedon

Rifle mucky peat, 2,100 feet north and 200 feet west of the southeast corner of sec. 31, T. 140 N., R. 40 W., Becker County; USGS Richwood quadrangle; lat. 46 degrees 53 minutes 47 seconds N. and long. 95 degrees 46 minutes 26 seconds W., NAD27:

Oe1—0 to 14 inches; mucky peat, dark reddish brown (5YR 2/2) broken face and rubbed; about 70 percent fiber, about 20 percent rubbed; massive; friable; primarily herbaceous fibers; moderately acid; clear smooth boundary.
Oe2—14 to 40 inches; mucky peat, dark reddish brown (5YR 3/2) broken face and rubbed; about 70 percent fiber, about 30 percent rubbed; massive; friable; primarily herbaceous fibers; moderately acid; clear smooth boundary.
Oe3—40 to 60 inches; mucky peat, dark reddish brown (5YR 3/2) broken face and rubbed; about 65 percent fiber, about 25 percent rubbed; massive; friable; primarily herbaceous fibers; moderately acid.

Range in Characteristics

Thickness of the organic material: Greater than 51 inches
Content of wood fragments: 0 to 10 percent

Oe horizon:
Hue—5YR to 10YR
Value—2 to 6
Chroma—1 to 4
Texture—mucky peat

541—Rifle mucky peat, depressional, MAP 22-30, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on lake plains, outwash plains, and moraines
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Mucky peat
Depth to bedrock: More than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Herbaceous organic material
Flooding: None
Water table: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 31.8 inches (high)
Content of organic matter in the surface layer: About 87 percent (very high)

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

- Cathro and similar soils
- Haslie and similar soils
- Markey and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

Rockwood Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—moderate; lower part—slow or very slow
Landform: Drumlins and moraines
Parent material: Till
Slope range: 2 to 30 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Mollic Eutroboralfs

Typical Pedon

Rockwood sandy loam, 2 to 6 percent slopes, stony,

50 feet south and 1,220 feet west of the northeast corner of sec. 18, T. 132 N., R. 34 W., Todd County; USGS Bertha quadrangle; lat. 46 degrees 15 minutes 7.5 seconds N. and long. 95 degrees 0 minutes 14.2 seconds W., NAD27:

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; 8 percent gravel; strongly acid; abrupt smooth boundary.

E—8 to 16 inches; dark brown (10YR 4/3) sandy loam; weak medium platy structure; friable; common fine roots; about 9 percent gravel; slightly acid; clear smooth boundary.

BE1—16 to 24 inches; dark yellowish brown (10YR 4/4) sandy loam (B); weak fine subangular blocky structure; friable; few fine roots; many light brownish gray (10YR 6/2) sand coatings on faces of peds (E); 13 percent gravel; slightly acid; clear wavy boundary.

BE2—24 to 37 inches; dark yellowish brown (10YR 4/4) sandy loam (B); weak medium subangular blocky structure; friable; few fine roots; many light brownish gray (10YR 6/2) sand coatings on faces of peds (E); common dark brown (10YR 3/3) clay films on faces of peds; 10 percent gravel; slightly acid; clear wavy boundary.

Bt—37 to 46 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate fine subangular blocky structure; firm; very few fine roots; common dark yellowish brown (10YR 3/4) clay films on faces of peds; common very dark grayish brown (10YR 3/2) clay films in channels and pores; 10 percent gravel; slightly acid; clear wavy boundary.

Cd—46 to 80 inches; yellowish brown (10YR 5/4) sandy loam; thin platy soil fragments; firm; common very pale brown (10YR 7/3) concretions; 10 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches
Depth to dense till: 40 to 60 inches
Content of rock fragments: 2 to 15 percent
Other features: Most pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—sandy loam or fine sandy loam

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 to 4
Texture—sandy loam or loamy sand

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—sandy loam

Cd horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—3 or 4
Texture—sandy loam or loamy sand

1319B—Rockwood sandy loam, 2 to 6 percent slopes, stony

Composition

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

Setting

Landform: Drumlins
Position on the landform: Backslopes and shoulders
Slope range: 2 to 6 percent

Component Description

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.4 inches (moderate)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Blowers and similar soils
- Redeye and similar soils
- Becida and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Cropland
- Hayland

- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1319C—Rockwood sandy loam, 6 to 12 percent slopes, stony

Composition

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

Setting

Landform: Drumlins
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.4 inches (moderate)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Blowers and similar soils
- Redeye and similar soils
- Becida and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1319D—Rockwood sandy loam, 12 to 20 percent slopes, stony

Composition

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

Setting

Landform: Drumlins
Position on the landform: Backslopes and shoulders
Slope range: 12 to 20 percent

Component Description

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.4 inches (moderate)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Blowers and similar soils
- Redeye and similar soils
- Becida and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1332B—Rockwood fine sandy loam, morainic, 3 to 8 percent slopes, stony

Composition

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

Setting

Landform: Moraines
Position on the landform: Summits and backslopes
Slope range: 3 to 8 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.1 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Blowers and similar soils
- Becida and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1332C—Rockwood fine sandy loam, morainic, 8 to 15 percent slopes, stony

Composition

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

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 8 to 15 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.1 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Blowers and similar soils
- Becida and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1332E—Rockwood fine sandy loam, morainic, 15 to 30 percent slopes, stony

Composition

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

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 15 to 30 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.1 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Blowers and similar soils
- Becida and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1421B—Rockwood-Two Inlets, morainic, complex, 3 to 8 percent slopes, stony

Composition

Rockwood and similar soils: About 55 percent
Two Inlets and similar soils: About 30 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Rockwood—summits and backslopes; Two Inlets—backslopes and shoulders
Slope range: 3 to 8 percent

Component Description

Rockwood

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.1 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

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

- Becida and similar soils
- Blowers and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1421C—Rockwood-Two Inlets, morainic, complex, 8 to 15 percent slopes, stony

Composition

Rockwood and similar soils: About 50 percent
Two Inlets and similar soils: About 35 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Rockwood—summits and backslopes; Two Inlets—backslopes and shoulders
Slope range: 8 to 15 percent

Component Description

Rockwood

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.1 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

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

- Becida and similar soils
- Blowers and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1421E—Rockwood-Two Inlets, morainic, complex, 15 to 30 percent slopes, stony

Composition

Rockwood and similar soils: About 50 percent
Two Inlets and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Rockwood—summits and backslopes; Two Inlets—backslopes and shoulders
Slope range: 15 to 30 percent

Component Description

Rockwood

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.1 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

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

- Graycalm and similar soils
- Blowers and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Rondeau Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—slow or very slow
Landform: Outwash plains and moraines
Parent material: Organic materials over marl
Slope range: 0 to 6 percent
Taxonomic classification: Marly, euic Limnic Borosaprists

Typical Pedon

Rondeau muck, depressional, 0 to 1 percent slopes,

2,200 feet south and 1,300 feet east of the northwest corner of sec. 30, T. 31 N., R. 22 W., Anoka County; USGS Circle Pines quadrangle; lat. 45 degrees 8 minutes 31 seconds N. and long. 93 degrees 7 minutes 54 seconds W., NAD27:

Oa—0 to 9 inches; muck, black (10YR 2/1) broken face and rubbed; about 10 percent fiber, trace rubbed; weak fine granular structure; very friable; herbaceous fiber; about 25 percent mineral material; neutral; clear smooth boundary.

Oe—9 to 16 inches; mucky peat, dark brown (10YR 3/2) broken face, very dark brown (10YR 2/2) rubbed; about 40 percent fiber, about 15 percent rubbed; weak medium platy structure; very friable; herbaceous fiber; about 15 percent mineral material; neutral; clear smooth boundary.

O´a1—16 to 37 inches; muck, black (10YR 2/1) broken face and rubbed; less than 5 percent fiber; massive; very friable; herbaceous fiber; about 35 percent mineral material; neutral; clear smooth boundary.

O´a2—37 to 42 inches; muck, black (10YR 2/1) broken face, black (10YR 2/1) rubbed; about 20 percent fiber, about 5 percent rubbed; massive; very friable; herbaceous fiber; about 25 percent mineral material; slightly acid; clear smooth boundary.

O´a3—42 to 44 inches; muck, black (10YR 2/1) broken face and rubbed; about 10 percent fiber, about 5 percent rubbed; weak medium subangular blocky structure; very friable; herbaceous fiber; about 40 percent mineral material; slightly acid; clear smooth boundary.

Cg1—44 to 49 inches; black (N 2/0) and very dark gray (N 3/0) coprogenous earth; trace of fiber; massive; friable; slightly sticky; about 5 percent shells and shell fragments 1 to 3 mm in size; about 70 percent mineral material; violently effervescent; slightly alkaline; clear smooth boundary.

Cg2—49 to 60 inches; gray (10YR 7/1) marl; few fine prominent light olive gray (2.5Y 5/4) iron concentrations; massive; friable; slightly sticky; about 5 percent plant detritus; violently effervescent; moderately alkaline.

Range in Characteristics

Thickness of the organic material: 16 to 51 inches

Oa horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—muck

Cg horizon:
Hue—10YR to 5Y
Value—4 to 7
Chroma—1 or 2
Texture—marl

545—Rondeau muck, depressional, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on moraines and outwash plains
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over marl
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 21.6 inches (high)
Content of organic matter in the surface layer: About 62 percent (very high)

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

- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

719B—Rondeau muck (seepland), 1 to 6 percent slopes

Composition

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

Setting

Landform: Flats and slight rises on outwash plains
Slope range: 1 to 6 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over marl
Flooding: None
Water table depth: At the surface to 2 feet below the surface
Kind of water table: Apparent
Ponding duration: Brief
Available water capacity to 60 inches or root-limiting layer: About 16.7 inches (high)
Content of organic matter in the surface layer: About 62 percent (very high)

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

- Isan and similar soils
- Spooner and similar soils
- Meehan and similar soils
- Nidaros and similar soils

Major Uses of the Unit

- Forest land

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

- "Forest Land" section

Roscommon Series

Depth class: Very deep
Drainage class: Poorly drained and very poorly drained
Permeability: Rapid
Landform: Outwash plains and lake plains
Parent material: Glaciofluvial deposits
Slope range: 0 to 2 percent
Taxonomic classification: Mixed, frigid Mollic Psammaquents

Typical Pedon

Roscommon loamy sand, 1,800 feet south and 1,300 feet west of the northeast corner of sec. 22, T. 150 N., R. 36 W., Clearwater County; USGS Bagley Lake quadrangle; lat. 47 degrees 47 minutes 57 seconds N. and long. 95 degrees 14 minutes 30 seconds W., NAD27:

A—0 to 6 inches; very dark gray (10YR 3/1) loamy sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; 1 percent gravel; slightly acid; abrupt smooth boundary.
Cg1—6 to 24 inches; pale brown (2.5Y 6/3) sand; common medium prominent strong brown (7.5YR 4/6) iron concentrations; single grain; loose; 1 percent gravel; slightly acid; clear wavy boundary.
Cg2—24 to 60 inches; light brownish gray (2.5Y 6/2) sand; many coarse prominent strong brown (7.5YR 4/6) iron concentrations; single grain; loose; 1 percent gravel; slightly acid.

Range in Characteristics

Content of rock fragments: 0 to 10 percent

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loamy sand or mucky loamy sand

Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 to 3
Texture—sand, coarse sand, loamy sand, or loamy coarse sand

1271—Roscommon mucky loamy sand, depressional, MAP 22-30, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on lake plains and outwash plains
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Mucky loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Glaciofluvial deposits
Flooding: None
Water table: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Long

Available water capacity to 60 inches or root-limiting layer: About 4.6 inches (low)
Content of organic matter in the surface layer: About 9.5 percent (very high)

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

- Markey and similar soils
- Meehan and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- "Wildlife Habitat" section

1943—Roscommon loamy sand, MAP 22-30, 0 to 2 percent slopes

Composition

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

Setting

Landform: Swales on outwash plains and lake plains
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Poorly drained
Dominant parent material: Glaciofluvial deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 4.1 inches (low)
Content of organic matter in the surface layer: About 6 percent (high)

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

- Markey and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Runeberg Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow or slow
Landform: Drumlins and moraines
Parent material: Till
Slope range: 0 to 1 percent
Taxonomic classification: Coarse-loamy, mixed, superactive, frigid Typic Endoaquolls

Typical Pedon

Runeberg mucky loam, depressional, 0 to 1 percent slopes, 2,500 feet south and 2,380 feet west of the northeast corner of sec. 13, T. 137 N., R. 36 W., Otter Tail County; USGS Sebeka NW quadrangle; lat. 46 degrees 40 minutes 53 seconds N. and long. 95 degrees 10 minutes 23 seconds W., NAD27:

A—0 to 10 inches; black (N 2/0) mucky loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.
Bg1—10 to 14 inches; dark gray (10YR 4/1) loam; few fine distinct yellowish brown (10YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; common fine roots; 1 percent gravel; neutral; clear smooth boundary.
Bg2—14 to 21 inches; grayish brown (2.5Y 5/2) sandy loam; common medium prominent brown (7.5YR 5/4) and strong brown (7.5YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; neutral; clear smooth boundary.
Bg3—21 to 36 inches; grayish brown (2.5Y 5/2) sandy loam; common coarse prominent strong brown (7.5YR 5/6) iron concentrations; weak medium subangular blocky structure; friable; 1 percent gravel; slightly alkaline; clear smooth boundary.
Cg1—36 to 48 inches; light brownish gray (2.5Y 6/2) sandy loam; few medium prominent strong brown (7.5YR 5/6) iron concentrations; massive; friable; few light gray (10YR 7/2) carbonate concentrations; 1 percent gravel; slightly

effervescent; slightly alkaline; clear smooth boundary.
Cg2—48 to 60 inches; light olive gray (5Y 6/2) sandy loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; firm; few light gray (10YR 7/2) carbonate concentrations; 2 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 24 to 36 inches
Thickness of the mollic epipedon: 8 to 20 inches
Content of rock fragments: 3 to 15 percent

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

Bg horizon:
Hue—10YR to 5Y
Value—4 or 5
Chroma—1 or 2
Texture—sandy loam or loam

Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 or 6
Chroma—1 to 3
Texture—sandy loam

701—Runeberg mucky loam, depressional, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on drumlins and moraines
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Mucky loam
Depth to bedrock: More than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Till
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 8.3 inches (moderate)
Content of organic matter in the surface layer: About 8 percent (very high)

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

- Blowers and similar soils
- Becida and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

Sanburn Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Upper part—moderately rapid; lower part—rapid or very rapid
Landform: Outwash plains and valley trains
Parent material: Outwash or beach deposits
Slope range: 0 to 30 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Typic Eutroboralfs

Typical Pedon

Sanburn loamy sand, 0 to 3 percent slopes, 100 feet east and 1,000 feet north of the southwest corner of sec. 26, T. 138 N., R. 30 W., Cass County; USGS Pine River quadrangle; lat. 46 degrees 44 minutes 9.2 seconds N. and long. 94 degrees 27 minutes 3.2 seconds W., NAD27:

A—0 to 2 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; many very fine roots; moderately acid; abrupt smooth boundary.
E1—2 to 6 inches; dark brown (10YR 4/3) loamy sand; weak fine subangular blocky structure; friable; many fine roots; moderately acid; clear smooth boundary.
E2—6 to 15 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine subangular blocky

structure; friable; common fine roots; 2 percent gravel; moderately acid; clear smooth boundary.
Bt—15 to 21 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common fine roots; few dark brown (7.5YR 4/4) clay films on faces of peds; 8 percent gravel; strongly acid; clear smooth boundary.
2BC—21 to 33 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few fine roots; 8 percent gravel; strongly acid; gradual smooth boundary.
2C1—33 to 40 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; 5 percent gravel; strongly acid; gradual smooth boundary.
2C2—40 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; 3 percent gravel; strongly acid.

Range in Characteristics

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand or very stony loamy sand
Content of rock fragments—0 to 10 percent

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 to 4
Texture—loamy sand, loamy coarse sand, fine sandy loam, or sandy loam
Content of rock fragments—0 to 10 percent

Bt horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—3 to 6
Texture—sandy loam, fine sandy loam, or coarse sandy loam
Content of rock fragments—0 to 10 percent

2BC horizon (if it occurs):
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—sand, coarse sand, gravelly sand, or gravelly coarse sand
Content of rock fragments—0 to 35 percent

2C horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—sand, coarse sand, gravelly sand, or gravelly coarse sand
Content of rock fragments—0 to 35 percent

731A—Sanburn loamy sand, 0 to 3 percent slopes

Composition

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

Setting

Landform: Flats on outwash plains
Slope range: 0 to 3 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.1 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils
- Graycalm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

844B—Sanburn-Graycalm complex, 3 to 8 percent slopes

Composition

Sanburn and similar soils: About 55 percent
Graycalm and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains

Position on the landform: Sanburn—summits and backslopes; Graycalm—backslopes and shoulders
Slope range: 3 to 8 percent

Component Description

Sanburn

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.1 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Graycalm

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1450B—Sanburn very stony loamy sand, 1 to 8 percent slopes, bouldery

Composition

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

Setting

Landform: Outwash plains and valley trains
Position on the landform: Summits and backslopes
Slope range: 1 to 8 percent

Component Description

Texture of the surface layer: Very stony loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Graycalm and similar soils
- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

1450C—Sanburn very stony loamy sand, 8 to 15 percent slopes, bouldery

Composition

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

Setting

Landform: Outwash plains and valley trains
Position on the landform: Summits and backslopes
Slope range: 8 to 15 percent

Component Description

Texture of the surface layer: Very stony loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Graycalm and similar soils
- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1450E—Sanburn very stony loamy sand, 15 to 30 percent slopes, bouldery

Composition

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

Setting

Landform: Outwash plains and valley trains
Position on the landform: Summits and backslopes
Slope range: 15 to 30 percent

Component Description

Texture of the surface layer: Very stony loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Graycalm and similar soils
- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Seelyeville Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately rapid to moderately slow
Landform: Outwash plains, flood plains, glacial lake plains, and moraines
Parent material: Herbaceous organic materials
Slope range: 0 to 1 percent
Taxonomic classification: Euic Typic Borosaprists

Typical Pedon

Seelyeville muck, 0 to 1 percent slopes, 1,300 feet south and 800 feet east of the northwest corner of sec. 34, T. 33 N., R. 26 W., Sherburne County; USGS Elk River quadrangle; lat. 45 degrees 18 minutes 37 seconds N. and long. 93 degrees 34 minutes 8 seconds W., NAD27:

Oa1—0 to 10 inches; muck, black (10YR 2/1) broken face; about 20 percent fiber, about 5 percent rubbed; weak fine and medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

Oa2—10 to 19 inches; muck, dark brown (7.5YR 3/2) broken face, black (10YR 2/1) rubbed; about 30 percent fiber, about 2 percent rubbed; weak

medium subangular blocky structure; very friable; slightly acid; gradual wavy boundary.
Oa3—19 to 35 inches; muck, very dark brown (10YR 2/2) broken face, black (10YR 2/1) rubbed; about 50 percent fiber, about 15 percent rubbed; massive; very friable; slightly acid; gradual wavy boundary.
Oa4—35 to 42 inches; muck, black (10YR 2/1) broken face and rubbed; about 6 percent fiber, about 1 percent rubbed; massive; friable; slightly acid; clear smooth boundary.
Oa5—42 to 80 inches; muck, dark brown (7.5YR 3/2) broken face, black (10YR 2/1) rubbed; about 15 percent fiber, about 2 percent rubbed; massive; friable; slightly acid.

Range in Characteristics

Thickness of the organic material: More than 51 inches
Content of wood fragments: 0 to 5 percent

Oa horizon:
Hue—7.5YR, 10YR, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—muck

540—Seelyeville muck, depressional, MAP 22-30, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on lake plains, outwash plains, and moraines
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Herbaceous organic material
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches (high)
Content of organic matter in the surface layer: About 62 percent (very high)

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

- Cathro and similar soils
- Haslie and similar soils
- Markey and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

799—Seelyeville and Bowstring soils, 0 to 1 percent slopes, frequently flooded

Composition

Seelyeville: Variable
Bowstring: Variable
Inclusions: About 15 percent

Setting

Landform: Flood plains
Slope range: 0 to 1 percent

Component Description

Seelyeville

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Herbaceous organic material
Flooding: Frequent
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches (high)
Content of organic matter in the surface layer: About 62 percent (very high)

Bowstring

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials stratified with thin layers of sandy or loamy materials

Flooding: Frequent
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 21.4 inches (high)
Content of organic matter in the surface layer: About 65 percent (very high)

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

- Cathro and similar soils
- Markey and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- "Wildlife Habitat" section

Snellman Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 2 to 8 percent
Taxonomic classification: Fine-loamy, mixed, superactive Typic Eutroboralfs

Typical Pedon

Snellman sandy loam, 2 to 8 percent slopes, 600 feet east and 1,300 feet north of the southwest corner of sec. 6, T. 139 N., R. 37 W., Becker County; USGS Ponsford quadrangle; lat. 46 degrees 52 minutes 45 seconds N. and long. 95 degrees 24 minutes 45 seconds W., NAD27:

A—0 to 2 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; 3 percent gravel; slightly acid; abrupt smooth boundary.
E1—2 to 8 inches; brown (10YR 5/3) loamy sand, light gray (10YR 7/2) dry; weak thin platy structure; very friable; 3 percent gravel; moderately acid; clear smooth boundary.
E2—8 to 16 inches; pale brown (10YR 6/3) loamy sand, white (10YR 8/1) dry; weak thin platy structure; very friable; 3 percent gravel; moderately acid; clear wavy boundary.
Bt1—16 to 18 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; many thin light yellowish brown (10YR 6/4) sand and silt coatings on faces of peds and in pores; 4 percent gravel; strongly acid; clear wavy boundary.
Bt2—18 to 31 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate coarse subangular blocky structure; friable; many thick distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 4 percent gravel; moderately acid; clear smooth boundary.
Bk—31 to 41 inches; light olive brown (2.5Y 5/4) sandy loam; moderate medium platy structure; friable; many light gray (10YR 7/2) filaments and threads of calcium carbonate; 7 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.
C—41 to 80 inches; light olive brown (2.5Y 5/4) sandy loam; massive; friable; few light gray (10YR 7/2) filaments and threads of calcium carbonate; 7 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Content of rock fragments: 2 to 15 percent
Other features: Some pedons have an EB, BE, or B/E horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 to 3
Texture—sandy loam

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 or 3
Texture—loamy sand, loamy fine sand, sandy loam, or fine sandy loam

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

C horizon:
Hue—10YR or 2.5Y

Value—5 or 6
Chroma—3 or 4
Texture—sandy loam, coarse sandy loam, fine sandy loam, or loam

267B—Snellman sandy loam, 2 to 8 percent slopes

Composition

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

Setting

Landform: Moraines
Position on the landform: Summits and backslopes
Slope range: 2 to 8 percent

Component Description

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.1 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Nary and similar soils
- Egglake and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Sol Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 2 to 30 percent
Taxonomic classification: Fine-loamy, mixed, superactive Glossic Eutroboralfs

Typical Pedon

Sol fine sandy loam, 2 to 6 percent slopes, 1,700 feet west and 500 feet north of the southeast corner of sec. 23, T. 148 N., R. 36 W., Clearwater County; USGS Solway quadrangle; lat. 47 degrees 37 minutes 1 second N. and long. 95 degrees 12 minutes 46 seconds W., NAD27:

A—0 to 3 inches; very dark gray (10YR 3/1) fine sandy loam, light gray (10YR 5/1) dry; weak fine granular structure; very friable; 3 percent gravel; 10 percent cobbles; moderately acid; clear smooth boundary.
E—3 to 14 inches; brown (10YR 5/2) fine sandy loam, very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; very friable; 3 percent gravel; 10 percent cobbles; moderately acid; gradual wavy boundary.
B/E—14 to 24 inches; about 70 percent dark yellowish brown (10YR 4/4) sandy clay loam (Bt); about 30 percent brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry (E); moderate medium subangular blocky structure; friable; few prominent very dark grayish brown (10YR 3/2) clay films on faces of peds; 4 percent gravel; moderately acid; clear wavy boundary.
Bt—24 to 38 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; common distinct dark brown (10YR 4/3) clay films on faces of peds and lining pores; 4 percent gravel; slightly acid; clear smooth boundary.
C—38 to 60 inches; light olive brown (2.5Y 5/4) fine sandy loam; massive; very friable; common medium irregularly shaped seams and soft masses of carbonates; 10 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches
Other features: Most pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 to 3
Texture—fine sandy loam, sandy loam
Content of rock fragments—2 to 15 percent gravel; 0 to 35 percent cobbles

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 or 3
Texture—loamy sand, loamy fine sand, fine sandy loam, sandy loam
Content of rock fragments—2 to 15 percent gravel; 0 to 35 percent cobbles

Bt horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—3 or 4
Texture—loam or sandy clay loam
Content of rock fragments—2 to 15 percent

C horizon:
Hue—2.5Y
Value—4 to 6
Chroma—4 to 6
Texture—sandy loam or fine sandy loam
Content of rock fragments—2 to 15 percent

1244B—Sol-Sugarbush complex, 2 to 8 percent slopes, very stony

Composition

Sol and similar soils: About 50 percent
Sugarbush and similar soils: About 25 percent
Inclusions: About 25 percent

Setting

Landform: Moraines
Position on the landform: Sol—summits and backslopes; Sugarbush—backslopes and shoulders
Slope range: 2 to 8 percent

Component Description

Sol

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.0 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

Sugarbush

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.5 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Cathro and similar soils
- Nary and similar soils
- Egglake and similar soils
- Debs and similar soils
- Water

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1244C—Sol-Sugarbush complex, 8 to 15 percent slopes, very stony

Composition

Sol and similar soils: About 50 percent
Sugarbush and similar soils: About 25 percent
Inclusions: About 25 percent

Setting

Landform: Moraines
Position on the landform: Sol—summits and backslopes; Sugarbush—backslopes and shoulders
Slope range: 8 to 15 percent

Component Description

Sol

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.0 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

Sugarbush

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.5 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Cathro and similar soils
- Nary and similar soils
- Egglake and similar soils
- Debs and similar soils
- Water

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1244E—Sol-Sugarbush complex, 15 to 30 percent slopes, very stony

Composition

Sol and similar soils: About 45 percent
Sugarbush and similar soils: About 35 percent
Inclusions: About 20 percent

Setting

Landform: Moraines
Position on the landform: Sol—summits and backslopes; Sugarbush—backslopes and shoulders
Slope range: 15 to 30 percent

Component Description

Sol

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.0 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

Sugarbush

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.5 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Cathro and similar soils
- Nary and similar soils
- Egglake and similar soils
- Debs and similar soils
- Water

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1272B—Sol fine sandy loam, 2 to 6 percent slopes

Composition

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

Setting

Landform: Moraines
Position on the landform: Summits and backslopes
Slope range: 2 to 6 percent

Component Description

Texture of the surface layer: Fine sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.0 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Nary and similar soils
- Egglake and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Spooner Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Lake plains
Parent material: Lacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Fine-silty, mixed, superactive, frigid Mollic Endoaqualfs

Typical Pedon

Spooner silt loam, 0 to 2 percent slopes, 1,500 feet north and 950 feet west of the southeast corner of sec. 34, T. 141 N., R. 32 W., Hubbard County; USGS Crystal Lake quadrangle; lat. 46 degrees 58 minutes 53 seconds N. and long. 94 degrees 42 minutes 33 seconds W., NAD27:

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; strong medium granular structure; friable; common very fine to coarse roots throughout; slightly acid; clear smooth boundary.

Eg—8 to 13 inches; grayish brown (2.5Y 5/2) silt loam, light gray (2.5Y 7/2) dry; common fine faint light brownish gray (2.5Y 6/2) iron depletions and many fine and medium distinct light olive brown (2.5Y 5/6) iron concentrations; weak thin platy structure parting to moderate very fine subangular blocky; friable; common fine and medium roots throughout; moderately acid; clear smooth boundary.

Btg—13 to 20 inches; grayish brown (2.5Y 5/2) silt loam; few fine faint light brownish gray (2.5Y 6/2) iron depletions and few fine distinct light olive brown (2.5Y 5/6) iron concentrations; moderate medium subangular blocky structure; firm; few fine and medium roots throughout; many distinct continuous dark grayish brown (2.5Y 4/2) clay films on faces of peds and in pores; slightly acid; clear smooth boundary.

Cg1—20 to 35 inches; light brownish gray (2.5Y 6/2) silt loam; many medium distinct light olive brown (2.5Y 5/6) iron concentrations and few fine distinct gray (5Y 6/1) iron depletions; weak thin platy structure parting to weak very fine subangular blocky; friable; many distinct continuous pale yellow (2.5Y 8/2) carbonate coatings on bottom of plates; many fine irregular dark brown (7.5YR 3/2) soft masses of iron-manganese between peds; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg2—35 to 65 inches; light olive brown (2.5Y 5/3) silt loam; many coarse faint light brownish gray (2.5Y 6/2) iron depletions and many coarse prominent strong brown (7.5YR 5/8) iron concentrations; weak thin platy structure parting to weak very fine subangular blocky; firm; many distinct continuous pale yellow (2.5Y 8/2) carbonate coatings on bottom of plates; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg3—65 to 80 inches; light olive brown (2.5Y 5/3) silt

loam; few fine faint light brownish gray (2.5Y 6/2) iron depletions and common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak thin platy structure parting to weak very fine subangular blocky; firm; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 15 to 40 inches

A or Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—silt loam

E horizon:
Hue—10YR to 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loamy very fine sand, very fine sandy loam, loam, or silt loam

Btg horizon:
Hue—10YR to 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loam, silt loam, clay loam, or silty clay loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—1 to 3
Texture—very fine sandy loam, sandy loam, loam, sandy clay loam, clay loam, silty clay loam, silt loam, or silt

147—Spooner silt loam, 0 to 2 percent slopes

Composition

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

Setting

Landform: Swales on lake plains
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Silt loam
Depth to bedrock: More than 80 inches
Drainage class: Poorly drained
Dominant parent material: Lacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.8 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Baudette and similar soils
- Roscommon and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Staples Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—rapid; lower part—very slow
Landform: Drumlins and moraines
Parent material: Outwash over till
Slope range: 0 to 2 percent
Taxonomic classification: Loamy, mixed, superactive, frigid Arenic Epiaqualfs

Typical Pedon

Staples loamy sand, 0 to 2 percent slopes, 550 feet south and 1,875 feet east of the northwest corner of sec. 18, T. 135 N., R. 33 W., Wadena County; USGS Nimrod SW quadrangle; lat. 46 degrees 30 minutes 45.1 seconds N. and long. 94 degrees 53 minutes 49.5 seconds W., NAD27:

A—0 to 7 inches; very dark gray (10YR 3/1) loamy sand, dark grayish brown (10YR 4/2) dry; many fine distinct dark brown (7.5YR 3/2) and common fine faint dark grayish brown (10YR 4/2) iron depletions; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.
Eg1—7 to 15 inches; dark grayish brown (10YR 4/2) sand; many medium distinct dark yellowish brown (10YR 4/4) iron concentrations and common

medium distinct grayish brown (2.5Y 5/2) iron depletions; weak fine subangular blocky structure; very friable; neutral; clear smooth boundary.

Eg2—15 to 32 inches; grayish brown (2.5Y 5/2) sand; common medium distinct very dark grayish brown (10YR 3/2) and few fine distinct dark brown (10YR 4/3) iron concentrations; single grain; loose; neutral; clear smooth boundary.

Eg3—32 to 36 inches; grayish brown (2.5Y 5/2) sand; common medium distinct dark grayish brown (10YR 4/2) and common dark brown (7.5YR 3/4) iron concentrations; single grain; loose; common black (N 2/0) and dark reddish brown (5YR 3/3) oxide concretions; neutral; clear smooth boundary.

2Btg—36 to 44 inches; olive gray (5Y 5/2) sandy loam; common medium distinct dark grayish brown (10YR 4/2) and common dark brown (7.5YR 3/4) iron concentrations; weak fine subangular blocky structure; firm; common distinct and faint dark brown (10YR 4/3) clay films on faces of peds and in pores; 10 percent gravel; neutral; abrupt smooth boundary.

2Cd1—44 to 56 inches; olive gray (5Y 5/2) sandy loam; many coarse distinct greenish gray (5GY 5/1) iron depletions and few fine prominent dark brown (7.5YR 4/4) iron concentrations; massive; firm; 5 percent gravel; slightly alkaline; clear smooth boundary.

2Cd2—56 to 60 inches; olive gray (5Y 4/2) sandy loam; common coarse faint greenish gray (5GY 5/1) iron depletions; massive; very firm; common black (2.5Y 2/0) oxide concretions; 5 percent gravel; slightly alkaline.

Range in Characteristics

Depth to carbonates: 40 to more than 72 inches
Depth to dense till: 40 to 60 inches
Content of rock fragments: 0 to 15 percent

A or Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loamy sand

Eg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—loamy sand, sand, loamy fine sand, or fine sand

2Btg horizon:
Hue—10YR to 5Y
Value—4 to 6
Chroma—1 to 3
Texture—sandy loam, sandy clay loam, loam, or clay loam

2Cd horizon:
Hue—10YR to 5Y
Value—5 to 7
Chroma—1 to 4
Texture—sandy loam or loamy sand

1956—Staples loamy sand, 0 to 2 percent slopes

Composition

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

Setting

Landform: Swales on drumlins and moraines
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Poorly drained
Dominant parent material: Outwash over till
Flooding: None
Water table depth: At the surface to 1 foot below the surface
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 4.0 inches (low)
Content of organic matter in the surface layer: About 5 percent (high)

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

- Cathro and similar soils
- Becida and similar soils
- Runeberg and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Steamboat Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate or moderately slow
Landform: Moraines
Parent material: Till
Slope range: 3 to 65 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Typic Paleboralfs

Typical Pedon

Steamboat sandy loam, in an area of Steamboat-Two Inlets-Seelyeville complex, pitted, 0 to 15 percent slopes, 800 feet north and 1,300 feet west of the southeast corner of sec. 18, T. 141 N., R. 33 W., Hubbard County; USGS Mantrap Lake quadrangle; lat. 47 degrees 1 minute 26.2 seconds N. and long. 94 degrees 54 minutes 6.3 seconds W., NAD27:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; 5 percent gravel; 5 percent cobbles; moderately acid; clear wavy boundary.

E—3 to 18 inches; dark yellowish brown (10YR 4/4) loamy sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; many fine roots; 5 percent gravel; 5 percent cobbles; moderately acid; gradual wavy boundary.

E/B—18 to 35 inches; about 80 percent brown (10YR 5/3) loamy sand, very pale brown (10YR 7/3) dry (E); about 20 percent yellowish brown (10YR 5/4) sandy loam (B); moderate medium subangular blocky structure; very friable; common fine roots; common faint dark yellowish brown (10YR 3/4) clay films in channels; 5 percent gravel; 5 percent cobbles; moderately acid; gradual wavy boundary.

Bt—35 to 46 inches; yellowish brown (10YR 5/4) sandy loam; strong medium subangular blocky structure; firm; few fine roots; many distinct dark yellowish brown (10YR 3/4) clay films on faces of peds and in pores; 3 percent gravel; 2 percent cobbles; slightly acid; gradual wavy boundary.

C1—46 to 62 inches; olive brown (2.5Y 4/4) fine sandy loam; moderate thick platy structure parting to weak fine subangular blocky; very friable; common light gray (2.5Y 7/2) soft accumulations of calcium carbonate in old root channels and in cracks; 5 percent gravel; 2 percent cobbles; strongly effervescent; slightly alkaline; diffuse wavy boundary.

C2—62 to 80 inches; light olive brown (2.5Y 5/4) fine sandy loam; common fine distinct light olive brown (2.5Y 5/6) and few fine prominent yellowish brown (10YR 5/6) iron concentrations; moderate thick platy structure parting to weak fine subangular blocky; very friable; common light gray (2.5Y 7/2) soft accumulations of calcium carbonate in old root channels and in cracks; 5 percent gravel; 2 percent cobbles; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to more than 60 inches
Content of rock fragments: 2 to 10 percent gravel; 1 to 35 percent cobbles, stones, and boulders
Other features: All pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—sandy loam

E horizon:
Hue—10YR
Value—4 to 7
Chroma—3 or 4
Texture—loamy sand, loamy fine sand, sandy loam, or fine sandy loam

Bt horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—4 or 5
Texture—sandy loam, fine sandy loam, or loam

C horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—3 to 5
Texture—sandy loam, fine sandy loam, loamy sand, or loamy fine sand

526C—Steamboat-Two Inlets-Seelyeville complex, pitted, 0 to 15 percent slopes

Composition

Steamboat and similar soils: About 40 percent
Two Inlets and similar soils: About 30 percent
Seelyeville and similar soils: About 20 percent
Inclusions: About 10 percent

Setting

Landform: Moraines

Position on the landform: Steamboat—summits and backslopes; Two Inlets—backslopes and shoulders; Seelyeville—depressions
Slope range: Steamboat—3 to 15 percent; Two Inlets—3 to 15 percent; Seelyeville—0 to 1 percent

Component Description

Steamboat

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.2 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

Seelyeville

Texture of the surface layer: Muck
Depth to bedrock: More than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Herbaceous organic material
Flooding: None
Water table depth: At the surface to 3 feet above the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches (high)
Content of organic matter in the surface layer: About 62 percent (very high)

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

- Potatolake and similar soils
- Egglake and similar soils
- Water

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

526E—Steamboat-Two Inlets-Seelyeville complex, pitted, 0 to 35 percent slopes

Composition

Steamboat and similar soils: About 45 percent
Two Inlets and similar soils: About 25 percent
Seelyeville and similar soils: About 20 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Steamboat—summits and backslopes; Two Inlets—backslopes and shoulders; Seelyeville—depressions
Slope range: Steamboat—15 to 35 percent; Two Inlets—15 to 35 percent; Seelyeville—0 to 1 percent

Component Description

Steamboat

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.2 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits

Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

Seelyeville

Texture of the surface layer: Muck
Depth to bedrock: More than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Herbaceous organic material
Flooding: None
Water table depth: At the surface to 3 feet above the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches (high)
Content of organic matter in the surface layer: About 62 percent (very high)

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

- Potatolake and similar soils
- Egglake and similar soils
- Water

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

574G—Steamboat-Two Inlets complex, pitted, 35 to 65 percent slopes

Composition

Steamboat and similar soils: About 45 percent
Two Inlets and similar soils: About 35 percent
Inclusions: About 20 percent

Setting

Landform: Moraines
Position on the landform: Steamboat—summits and backslopes; Two Inlets—backslopes and shoulders
Slope range: 35 to 65 percent

Component Description

Steamboat

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.2 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

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

- Seelyeville and similar soils
- Egglake and similar soils
- Potatolake and similar soils
- Water

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Sugarbush Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Upper part—moderately rapid; lower part—rapid or very rapid
Landform: Outwash plains, moraines, and valley trains

Parent material: Outwash or beach deposits
Slope range: 1 to 45 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Typic Eutroboralfs

Typical Pedon

Sugarbush sandy loam, in an area of Sugarbush-Two Inlets complex, 1 to 8 percent slopes, 1,300 feet south and 1,400 feet west of the northeast corner of sec. 15, T. 142 N., R. 40 W., Becker County; USGS Strawberry Lake quadrangle; lat. 47 degrees 7 minutes 5 seconds N. and long. 95 degrees 43 minutes 35 seconds W., NAD27:

A—0 to 3 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; 3 percent gravel; moderately acid; clear smooth boundary.
E—3 to 13 inches; brown (10YR 5/3) loamy sand, very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; very friable; 3 percent gravel; slightly acid; gradual smooth boundary.
Bt—13 to 25 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; many faint dark brown (7.5YR 4/4) clay films on faces of peds; 5 percent gravel; slightly acid; clear smooth boundary.
2C—25 to 80 inches; brown (10YR 5/3) gravelly coarse sand; single grain; loose; few coatings of carbonates on bottom side of pebbles; 20 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 15 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam
Content of rock fragments—0 to 15 percent

E horizon:
Hue—10YR
Value—4 to 6
Chroma—3 or 4
Texture—loamy sand or loamy coarse sand
Content of rock fragments—0 to 15 percent

Bt horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—3 to 6
Texture—sandy loam or coarse sandy loam
Content of rock fragments—0 to 15 percent

2Bt horizon (if it occurs):
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—2 to 4
Texture—gravelly loamy sand, gravelly loamy coarse sand, loamy sand, loamy coarse sand, sand, or coarse sand
Content of rock fragments—10 to 35 percent

2C horizon:
Hue—10YR or 7.5YR
Value—5 or 6
Chroma—3 to 6
Texture—gravelly sand, gravelly coarse sand, coarse sand, or sand
Content of rock fragments—10 to 35 percent

775B—Sugarbush-Two Inlets complex, 1 to 8 percent slopes

Composition

Sugarbush and similar soils: About 60 percent
Two Inlets and similar soils: About 30 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and valley trains
Position on the landform: Sugarbush—summits and backslopes; Two Inlets—shoulders and summits
Slope range: 1 to 8 percent

Component Description

Sugarbush

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.4 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.1 inches (low)

Content of organic matter in the surface layer: About 0.75 percent (low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

775C—Sugarbush-Two Inlets complex, 8 to 15 percent slopes

Composition

Sugarbush and similar soils: About 55 percent
Two Inlets and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and valley trains
Position on the landform: Sugarbush—summits and backslopes; Two Inlets—shoulders and summits
Slope range: 8 to 15 percent

Component Description

Sugarbush

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.4 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.1 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Talmoon Series

Depth class: Very deep
Drainage class: Poorly drained and very poorly drained
Permeability: Upper part—moderate; lower part—moderately slow
Landform: Moraines
Parent material: Glaciofluvial materials over till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, superactive, frigid Mollic Endoaqualfs

Typical Pedon

Talmoon loam, 0 to 2 percent slopes, 100 feet south and 2,600 feet west of the northeast corner of sec. 1, T. 144 N., R. 32 W., Hubbard County; USGS Steamboat Lake quadrangle; lat. 47 degrees 19 minutes 22 seconds N. and long. 94 degrees 40 minutes 29 seconds W., NAD27:

A—0 to 3 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky

structure; very friable; 5 percent gravel; moderately acid; clear wavy boundary.
Eg—3 to 14 inches; dark grayish brown (10YR 4/2) very fine sandy loam, light gray (10YR 7/2) dry; many fine and medium prominent light olive brown (2.5Y 5/4) iron concentrations; strong medium platy structure; very friable; 5 percent gravel; slightly acid; gradual wavy boundary.
Btg1—14 to 25 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium and coarse distinct olive gray (5Y 5/2) iron depletions and many medium and coarse prominent yellowish brown (10YR 5/8) iron concentrations; strong coarse subangular blocky structure; very firm; common distinct discontinuous very dark grayish brown (2.5Y 3/2) clay films on faces of peds and lining pores and many distinct continuous light olive brown (2.5Y 5/3) silt coatings on faces of peds; 10 percent gravel; slightly acid; gradual wavy boundary.
Btg2—25 to 55 inches; olive gray (5Y 4/2) clay loam; many medium and coarse faint olive gray (5Y 5/2) iron depletions and many medium and coarse prominent olive yellow (2.5Y 6/6) iron concentrations; strong coarse subangular blocky structure; very firm; common distinct discontinuous dark olive gray (5Y 3/2) clay films on faces of peds and lining pores; 10 percent gravel; neutral; gradual wavy boundary.
Cg—55 to 80 inches; light olive brown (2.5Y 5/3) clay loam; common medium distinct olive gray (5Y 5/2) iron depletions and common medium distinct light olive brown (2.5Y 5/6) iron concentrations; massive; firm; 12 percent gravel; neutral.

Range in Characteristics

Depth to carbonates: 18 to more than 80 inches
Content of rock fragments: 1 to 10 percent

Oa horizon (if it occurs):
Hue—10YR, 2.5Y, or neutral
Value—2
Chroma—0 or 1
Texture—muck

A or Ap horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loam

Eg horizon:
Hue—10YR to 5Y
Value—4 to 6
Chroma—1 or 2
Texture—fine sandy loam, sandy loam, very fine sandy loam, loam, or silt loam

Btg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—clay loam, sandy clay loam, or loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 to 7
Chroma—1 or 2
Texture—loam, sandy clay loam, clay loam, sandy loam, silty clay loam, or silt loam

346—Talmoon loam, 0 to 2 percent slopes

Composition

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

Setting

Landform: Swales on moraines
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Loam
Depth to bedrock: More than 80 inches
Drainage class: Poorly drained
Dominant parent material: Glaciofluvial materials over till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Cathro and similar soils
- Beltrami and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

628—Talmoon muck, depressional, 0 to 1 percent slopes

Composition

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

Setting

Landform: Depressions on moraines
Slope range: 0 to 1 percent

Component Description

Texture of the surface layer: Muck
Depth to bedrock: More than 80 inches
Drainage class: Very poorly drained
Dominant parent material: Glaciofluvial materials over till
Flooding: None
Water table depth: 1.0 foot above to 0.5 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Content of organic matter in the surface layer: About 32.5 percent (very high)

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

- Cathro and similar soils
- Beltrami and similar soils

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

Two Inlets Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid or very rapid
Landform: Outwash plains, valley trains, and moraines
Parent material: Outwash or beach deposits
Slope range: 1 to 65 percent
Taxonomic classification: Mixed Psammentic Eutroboralfs

Typical Pedon

Two Inlets loamy sand, in an area of Two Inlets-Sugarbush complex, 15 to 30 percent slopes, 2,600 feet west and 25 feet south of the northeast corner of sec. 2, T. 141 N., R. 39 W., Becker County; USGS Many Point Lake quadrangle; lat. 47 degrees 3 minutes 18 seconds N. and long. 95 degrees 34 minutes 58 seconds W., NAD27:

A—0 to 2 inches; very dark gray (10YR 3/1) loamy sand, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; 10 percent gravel; slightly acid; clear wavy boundary.
E—2 to 10 inches; dark brown (10YR 4/3) gravelly loamy coarse sand, brown (10YR 5/3) dry; single grain; loose; 20 percent gravel; slightly acid; gradual wavy boundary.
Bt—10 to 33 inches; dark brown (7.5YR 4/4) gravelly loamy coarse sand; weak fine granular structure; very friable; 25 percent gravel; common clay bridging between sand grains; slightly acid; clear smooth boundary.
C—33 to 60 inches; light yellowish brown (10YR 6/4) gravelly coarse sand; single grain; loose; 30 percent gravel; few carbonate coatings on underside of pebbles; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 18 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—5 to 35 percent

E horizon:
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—loamy sand, loamy coarse sand, coarse sandy loam, sand, coarse sand, or the gravelly analogs of these textures
Content of rock fragments—5 to 35 percent

Bt horizon:
Hue—7.5YR or 10YR
Value—3 or 4
Chroma—3 or 4

Texture—loamy sand, loamy coarse sand, loamy very coarse sand, sand, coarse sand, or the gravelly analogs of these textures
Content of rock fragments—5 to 35 percent

C horizon:
Hue—10YR
Value—4 to 6
Chroma—3 to 6
Texture—gravelly sand, gravelly coarse sand, or gravelly very coarse sand
Content of rock fragments—15 to 35 percent

675C—Two Inlets-Eagleview-Steamboat complex, pitted, 3 to 15 percent slopes

Composition

Two Inlets and similar soils: About 45 percent
Eagleview and similar soils: About 25 percent
Steamboat and similar soils: About 20 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Two Inlets—shoulders and summits; Eagleview—backslopes; Steamboat—backslopes and footslopes
Slope range: 3 to 15 percent

Component Description

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

Eagleview

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.9 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Steamboat

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.2 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Wurtsmith and similar soils
- Potatolake and similar soils
- Seelyeville and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

675E—Two Inlets-Eagleview-Steamboat complex, pitted, 15 to 35 percent slopes

Composition

Two Inlets and similar soils: About 45 percent
Eagleview and similar soils: About 25 percent
Steamboat and similar soils: About 20 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Two Inlets—shoulders and summits; Eagleview—backslopes; Steamboat—backslopes and footslopes
Slope range: 15 to 35 percent

Component Description

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches

Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

Eagleview

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.9 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Steamboat

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.2 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Wurtsmith and similar soils
- Potatolake and similar soils
- Seelyeville and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

675G—Two Inlets-Eagleview-Steamboat complex, pitted, 35 to 65 percent slopes

Composition

Two Inlets and similar soils: About 45 percent
Eagleview and similar soils: About 30 percent
Steamboat and similar soils: About 20 percent
Inclusions: About 5 percent

Setting

Landform: Moraines
Position on the landform: Two Inlets—shoulders and summits; Eagleview—backslopes; Steamboat—backslopes and footslopes
Slope range: 35 to 65 percent

Component Description

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

Eagleview

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.9 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

Steamboat

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 80 inches
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.2 inches (moderate)

Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Wurtsmith and similar soils
- Seelyeville and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1238E—Two Inlets-Sugarbush complex, 15 to 30 percent slopes

Composition

Two Inlets and similar soils: About 60 percent
Sugarbush and similar soils: About 35 percent
Inclusions: About 5 percent

Setting

Landform: Outwash plains and valley trains
Position on the landform: Two Inlets—shoulders and summits; Sugarbush—backslopes
Slope range: 15 to 30 percent

Component Description

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.1 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

Sugarbush

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.4 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1238F—Two Inlets-Sugarbush complex, 30 to 45 percent slopes

Composition

Two Inlets and similar soils: About 70 percent
Sugarbush and similar soils: About 25 percent
Inclusions: About 5 percent

Setting

Landform: Outwash plains and valley trains
Position on the landform: Two Inlets—shoulders and summits; Sugarbush—backslopes
Slope range: 30 to 45 percent

Component Description

Two Inlets

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.1 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

Sugarbush

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.4 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1015—Udipsamments (cut and fill land)

Composition

Udipsamments: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and valley trains
Slope range: 0 to 10 percent

Component Description

Texture of the surface layer: Sand
Depth to bedrock: More than 60 inches
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.0 inches (low)

Inclusions

- Poorly drained areas

Major Uses of the Unit

- Wildlife habitat

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

- "Wildlife Habitat" section

1016—Udorthents, loamy (cut and fill land)

Composition

Udorthents: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Lake plains and moraines
Slope range: 0 to 50 percent

Component Description

Texture of the surface layer: Variable
Depth to bedrock: More than 60 inches
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits or till
Flooding: None
Depth to the water table: More than 6.0 feet

Inclusions

- Poorly drained areas

Major Uses of the Unit

- Wildlife habitat

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

- "Wildlife Habitat" section

1027—Udorthents, wet substratum (fill land)

Composition

Udorthents: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains, lake plains, and moraines
Slope range: 0 to 5 percent

Component Description

Texture of the surface layer: Variable
Depth to bedrock: More than 60 inches

Dominant parent material: Earth fill over organic materials

Inclusions

- Moderately well drained and well drained areas

Major Uses of the Unit

- Wildlife habitat

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

- “Wildlife Habitat” section

Verndale Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Upper part—moderate or moderately rapid; lower part—rapid
Landform: Outwash plains
Parent material: Loamy mantle over sandy outwash or beach deposits
Slope range: 0 to 12 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Udic Argiborolls

Typical Pedon

Verndale sandy loam, 0 to 2 percent slopes, 2,390 feet north and 1,375 feet east of the southwest corner of sec. 26, T. 134 N., R. 33 W., Wadena County; USGS Staple NE quadrangle; lat. 46 degrees 23 minutes 21.6 seconds N. and long. 94 degrees 48 minutes 54.5 seconds W., NAD27:

Ap—0 to 9 inches; black (10YR 2/1) sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.
Bt1—9 to 13 inches; dark brown (10YR 3/3) sandy loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate medium subangular blocky structure; friable; many distinct very dark brown (10YR 2/2) clay films on faces of peds; common very fine and fine roots; slightly acid; clear smooth boundary.
Bt2—13 to 19 inches; brown (10YR 4/3) sandy loam; moderate medium subangular blocky structure; friable; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few very fine and fine roots; 2 percent fine gravel; slightly acid; clear smooth boundary.
2Bw1—19 to 28 inches; dark yellowish brown (10YR 4/4) coarse sand; single grain; loose; 3 percent fine gravel; neutral; clear smooth boundary.
2Bw2—28 to 49 inches; yellowish brown (10YR 5/4) sand; single grain; loose; 2 percent fine gravel; neutral; clear smooth boundary.
2C—49 to 60 inches; light yellowish brown (10YR 6/4) sand; few yellowish brown strata; single grain; loose; 5 percent fine gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 24 to more than 60 inches
Thickness of the mollic epipedon: 7 to 16 inches
Content of rock fragments: 0 to 15 percent

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

Bt horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—3 or 4
Texture—sandy loam, coarse sandy loam, or fine sandy loam

2Bw horizon (if it occurs):
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 to 6
Texture—loamy sand, loamy coarse sand, sand, or coarse sand

2C horizon:
Hue—10YR
Value—4 to 7
Chroma—2 to 4
Texture—sand or coarse sand with strata of fine sand

567A—Verndale sandy loam, 0 to 2 percent slopes

Composition

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

Setting

Landform: Flats on outwash plains
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained

Dominant parent material: Loamy mantle over sandy outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.5 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Duelm and similar soils
- Nymore and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

1126B—Verndale-Nymore complex, 1 to 6 percent slopes

Composition

Verndale and similar soils: About 60 percent
Nymore and similar soils: About 30 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains
Position on the landform: Verndale—backslopes; Nymore—shoulders and summits
Slope range: 1 to 6 percent

Component Description

Verndale

Texture of the surface layer: Sandy loam
Depth to bedrock: More than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy mantle over sandy outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.5 inches (low)
Content of organic matter in the surface layer: About 3 percent (moderate)

Nymore

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

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

- Duelm and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

W—Water

Composition

Water: 100 percent

Component Description

- Naturally occurring basins of surface water

1356—Water, miscellaneous

Composition

Water: 100 percent

Component Description

- Small manmade areas that are used for industrial,

sanitary, or mining applications and that contain water most of the year

Willosippi Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderate or moderately rapid; lower part—moderate or moderately slow
Landform: Moraines
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, superactive, frigid Mollic Endoaqualfs

Typical Pedon

Willosippi loam, 0 to 2 percent slopes, 1,900 feet west and 200 feet north of the southeast corner of sec. 21, T. 49 N., R. 25 W., Aitkin County; USGS Waukenabo quadrangle; lat. 46 degrees 42 minutes 39 seconds N. and long. 93 degrees 30 minutes 48 seconds W., NAD27:

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; weak fine granular structure; friable; many fine and very fine roots; moderately acid; abrupt smooth boundary.

Eg—7 to 12 inches; light brownish gray (2.5Y 6/2) fine sandy loam; few fine faint light olive brown (2.5Y 5/4) iron concentrations; weak medium platy structure; friable; few very fine and fine roots; moderately acid; abrupt wavy boundary.

Btg1—12 to 22 inches; grayish brown (2.5Y 5/2) clay loam; few fine prominent dark yellowish brown (10YR 4/4) iron concentrations; moderate medium angular blocky structure; firm; few very fine roots; many distinct dark grayish brown (2.5Y 4/2 and 10YR 4/2) clay films on faces of peds; moderately acid; clear wavy boundary.

Btg2—22 to 24 inches; grayish brown (2.5Y 5/2) loamy sand; common fine prominent dark yellowish brown (10YR 4/4) iron concentrations; weak fine subangular blocky structure; very friable; common distinct dark grayish brown (10YR 4/2) clay films bridging sand grains; moderately acid; clear wavy boundary.

Btg3—24 to 26 inches; olive gray (5Y 5/2) loam; few fine prominent strong brown (7.5YR 5/8) iron concentrations; moderate fine subangular blocky structure; friable; many distinct olive gray (5Y 4/2) clay films on faces of peds; slightly acid; clear wavy boundary.

Btg4—26 to 32 inches; dark grayish brown and dark brown (10YR 4/2 and 4/3) sandy loam; common medium distinct yellowish brown (10YR 5/6) iron concentrations; weak fine subangular blocky structure; very friable; many distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; neutral; clear wavy boundary.

BCg—32 to 42 inches; olive gray (5Y 5/2) silt loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak fine subangular blocky structure; friable; slightly effervescent; slightly alkaline; gradual wavy boundary.

Cg1—42 to 49 inches; grayish brown (2.5Y 5/2) silt loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; massive; friable; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg2—49 to 53 inches; grayish brown (2.5Y 5/2), stratified loamy sand and silt loam; massive; friable; common medium distinct light olive brown (2.5Y 5/6) iron concentrations; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg3—53 to 60 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2), stratified silt loam and sandy loam; common medium distinct light olive brown (2.5Y 5/6) and olive yellow (2.5Y 6/6) iron concentrations; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 24 to 50 inches

A or Ap horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loam

Eg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—very fine sandy loam, fine sandy loam, sandy loam, loam, or silt loam

Btg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2
Texture—stratified loam, clay loam, silty clay loam, or silt loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 to 7
Chroma—2
Texture—stratified sandy loam, loamy sand, loamy

fine sand, fine sandy loam, very fine sandy loam, loamy very fine sand, loam, clay loam, silty clay loam, or silt loam

672—Willosippi loam, 0 to 2 percent slopes

Composition

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

Setting

Landform: Swales on moraines
Slope range: 0 to 2 percent

Component Description

Texture of the surface layer: Loam
Depth to bedrock: 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
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Zerkel and similar soils
- Cathro and similar soils

Major Uses of the Unit

- Cropland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Wurtsmith Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Outwash plains and lake plains
Parent material: Outwash or beach deposits
Slope range: 0 to 3 percent
Taxonomic classification: Mixed, frigid Oxyaquic Udipsamments

Typical Pedon

Wurtsmith loamy sand, MAP 22-30, 0 to 3 percent slopes, 1,550 feet south and 1,000 feet west of the northeast corner of sec. 27, T. 143 N., R. 32 W., Hubbard County; USGS Benedict quadrangle; lat. 47 degrees 10 minutes 31.2 seconds N. and long. 94 degrees 42 minutes 36.9 seconds W., NAD27:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak very fine granular structure; very friable; many medium roots; about 1 percent gravel; strongly acid; clear smooth boundary.
Bw1—6 to 10 inches; dark yellowish brown (10YR 4/4) sand; weak fine subangular blocky structure parting to single grain; very friable; few medium roots; about 1 percent gravel; strongly acid; clear smooth boundary.
Bw2—10 to 20 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 1 percent gravel; strongly acid; gradual smooth boundary.
BC—20 to 34 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 1 percent gravel; moderately acid; gradual smooth boundary.
C—34 to 56 inches; brownish yellow (10YR 6/6) sand; common fine prominent reddish yellow (7.5YR 6/8) iron concentrations and few fine distinct grayish brown (10YR 5/2) iron depletions; single grain; loose; about 1 percent gravel; slightly acid; gradual smooth boundary.
Cg—56 to 80 inches; grayish brown (10YR 5/2) sand; common large prominent reddish yellow (7.5YR 6/8) iron concentrations; single grain; loose; about 1 percent gravel; slightly acid.

Range in Characteristics

Content of rock fragments: 0 to 15 percent

A or Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loamy sand

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—4 to 8
Texture—loamy sand, sand, loamy coarse sand, or coarse sand

BC horizon (if it occurs):
Hue—10YR
Value—5 or 6
Chroma—4 to 6
Texture—sand or coarse sand

C horizon:
Hue—10YR
Value—5 or 6
Chroma—2 to 4
Texture—sand or coarse sand

1444—Wurtsmith loamy sand, MAP 22-30, 0 to 3 percent slopes

Composition

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

Setting

Landform: Flats and rises on lake plains and outwash plains
Slope range: 0 to 3 percent

Component Description

Texture of the surface layer: Loamy sand
Depth to bedrock: More than 80 inches
Drainage class: Moderately well drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: 2.0 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 4.3 inches (low)
Content of organic matter in the surface layer: About 1.25 percent (moderately low)

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

- Graycalm and similar soils
- Meehan and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- "Agronomy" section
- "Forest Land" section

Zerkel Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately slow or moderate; lower part—moderate or moderately rapid
Landform: Moraines
Parent material: Glaciolacustrine deposits
Slope range: 1 to 3 percent
Taxonomic classification: Fine-loamy, mixed, superactive Glossic Oxyaquic Eutroboralfs

Typical Pedon

Zerkel loam, 1 to 3 percent slopes, 1,100 feet east and 300 feet south of the northwest corner of sec. 27, T. 146 N., R. 38 W., Clearwater County; USGS Zerkel NW quadrangle; lat. 47 degrees 26 minutes 24 seconds N. and long. 95 degrees 28 minutes 58 seconds W., NAD27:

A—0 to 4 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; 1 percent gravel; slightly acid; abrupt smooth boundary.
E—4 to 10 inches; light brownish gray (10YR 6/2) very fine sandy loam, light gray (10YR 7/2) dry; weak thin platy structure; very friable; 1 percent gravel; slightly acid; clear wavy boundary.
B/E—10 to 15 inches; about 90 percent dark brown (10YR 3/3) loam (B), about 10 percent light brownish gray (10YR 6/2) very fine sandy loam (E); moderate medium subangular blocky structure; friable; 2 percent gravel; slightly acid; clear wavy boundary.
Bt1—15 to 21 inches; dark brown (10YR 3/3) loam; common fine distinct yellowish brown (10YR 5/6) iron concentrations; moderate medium subangular blocky structure; friable; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and lining pores; 2 percent gravel; neutral; clear wavy boundary.
Bt2—21 to 29 inches; dark brown (10YR 3/3) clay loam; common medium distinct yellowish brown (10YR 5/6) iron concentrations and light brownish gray (10YR 6/2) iron depletions; strong medium subangular blocky structure; firm; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and lining pores; 2 percent gravel; neutral; clear wavy boundary.

Bk—29 to 37 inches; light yellowish brown (2.5Y 6/4), stratified very fine sandy loam, loamy very fine sand, and silt loam; common medium distinct olive yellow (2.5Y 6/8) iron concentrations and light brownish gray (2.5Y 6/2) iron depletions; weak medium subangular blocky structure; very friable; common medium irregularly shaped filaments and soft masses of calcium carbonate; strongly effervescent; moderately alkaline; clear wavy boundary.

C—37 to 80 inches; light yellowish brown (2.5Y 6/4) and light olive brown (2.5Y 5/4), stratified very fine sandy loam, loamy very fine sand, and silt loam; common medium distinct olive yellow (2.5Y 6/8) iron concentrations and light brownish gray (2.5Y 6/2) iron depletions; massive; very friable; common medium irregularly shaped filaments and soft masses of calcium carbonate; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Content of rock fragments: 0 to 4 percent
Other features: Some pedons have an E/B, EB, B/E, or BE horizon, which has colors and textures similar to those of the E and B horizons.

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

E horizon:
Hue—10YR
Value—5 or 6
Chroma—2 or 3
Texture—fine sandy loam, very fine sandy loam, sandy loam, or loamy fine sand

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

Bk and C horizons:
Hue—10YR or 2.5Y
Value—5 to 7
Chroma—2 to 4
Texture—stratified with silt loam, loamy very fine sand, loamy fine sand, fine sand, very fine sandy loam, fine sandy loam, or loam

1164—Zerkel loam, 1 to 3 percent slopes

Composition

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

Setting

Landform: Flats and rises on moraines
Slope range: 1 to 3 percent

Component Description

Texture of the surface layer: Loam
Depth to bedrock: More than 80 inches
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

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

- Lengby and similar soils
- Willosippi and similar soils
- Nary and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

Zimmerman Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid
Landform: Outwash plains and valley trains
Parent material: Outwash or beach deposits
Slope range: 1 to 12 percent

Taxonomic classification: Mixed, frigid Argic Udipsamments

Typical Pedon

Zimmerman loamy fine sand, 1 to 6 percent slopes, 1,000 feet south and 500 feet east of the northwest corner of sec. 20, T. 150 N., R. 32 W., Beltrami County; USGS Nebish quadrangle; lat. 47 degrees 48 minutes 1 second N. and long. 94 degrees 46 minutes 55 seconds W., NAD27:

A—0 to 3 inches; very dark gray (10YR 3/1) loamy fine sand, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; moderately acid; abrupt wavy boundary.

E—3 to 16 inches; brown (10YR 5/3) fine sand, light brownish gray (10YR 6/2) dry; single grain; loose; moderately acid; clear wavy boundary.

Bw—16 to 35 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; slightly acid; clear wavy boundary.

E´—35 to 40 inches; pale brown (10YR 6/3) fine sand; single grain; loose; slightly acid; clear wavy boundary.

E&Bt—40 to 60 inches; very pale brown (10YR 7/3) fine sand (E); single grain; loose; several lamellae of dark yellowish brown (10YR 4/4) fine sandy loam 1/4 inch to 1 1/2 inches thick (Bt); common clay bridging between sand grains; moderately acid.

Range in Characteristics

Content of rock fragments: 0 to 5 percent

A horizon:
- Hue—10YR or neutral
- Value—2 or 3
- Chroma—0 to 2
- Texture—loamy fine sand

E and E´ horizons:
- Hue—10YR, 7.5YR, or neutral
- Value—4 to 7
- Chroma—1 to 4
- Texture—fine sand or loamy fine sand

Bw horizon:
- Hue—10YR or 7.5YR
- Value—4 to 7
- Chroma—3 to 8
- Texture—fine sand or loamy fine sand

E part of E&Bt horizon:
- Colors—similar to those of the E horizon
- Textures—similar to those of the E horizon

Bt part of E&Bt horizon:
- Special feature—layers 1/16 inch to 2 inches thick with cumulative thickness of less than 6 inches within a depth of 80 inches
- Hue—5YR to 10YR
- Value—3 to 6
- Chroma—2 to 7
- Texture—fine sand, loamy fine sand, very fine sand, loamy very fine sand, or fine sandy loam

C horizon (if it occurs):
- Hue—7.5YR to 2.5Y
- Value—5 to 7
- Chroma—2 to 6
- Texture—fine sand or sand

158B—Zimmerman loamy fine sand, 1 to 6 percent slopes

Composition

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

Setting

Landform: Outwash plains and valley trains
Position on the landform: Summits and backslopes
Slope range: 1 to 6 percent

Component Description

Texture of the surface layer: Loamy fine sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.3 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

158C—Zimmerman loamy fine sand, 6 to 12 percent slopes

Composition

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

Setting

Landform: Outwash plains and valley trains
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Texture of the surface layer: Loamy fine sand
Depth to bedrock: More than 60 inches
Drainage class: Excessively drained
Dominant parent material: Outwash or beach deposits
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.3 inches (low)
Content of organic matter in the surface layer: About 0.75 percent (low)

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

- Wurtsmith and similar soils
- Roscommon and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

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

- “Agronomy” section
- “Forest Land” section

References

American Association of State Highway and Transportation Officials (AASHTO). 1998. Standard specifications for transportation materials and methods of sampling and testing. 19th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1998. Standard classification of soils for engineering purposes. ASTM Standard D 2487.

Hobbs, Howard C., and Joseph E. Goebel. 1982. Geologic map of Minnesota Quaternary geology. Minnesota Geological Survey, University of Minnesota. Wall map.

Jenny, Hans. 1941. Factors of soil formation.

Marshner, Francis J. 1974. The original vegetation of Minnesota. North-Central Forest Experiment Station. Wall map.

McMiller, P.R., and others. 1935. Soil survey of Hubbard County, Minnesota. U.S. Department of Agriculture, Bureau of Chemistry and Soils, in cooperation with the University of Minnesota Agricultural Experiment Station.

Norton, Arthur R. Quaternary geology of the Itasca-St. Croix Moraine interlobate area, north-central Minnesota. (Unpublished M.S. thesis, University of Minnesota, 1982)

Sackreiter, Donald Keith. Quaternary geology of the southern part of the Grand Forks and Bemidji Quadrangles. (Unpublished Ph.D. dissertation, University of North Dakota, Grand Forks, 1975)

United States Department of Agriculture. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

United States Department of Agriculture. 1993. Soil survey manual. Soil Conservation Service, Soil Survey Division Staff. U.S. Department of Agriculture Handbook 18.

United States Department of Agriculture. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, Soil Survey Staff. U.S. Department of Agriculture Handbook 436.

Wright, H.E., Jr. 1962. Role of the Wadena Lobe in the Wisconsin glaciation of Minnesota. Geological Society of America Bulletin 73: 73-100.

Wright, H.E., Jr. 1972. Quaternary history of Minnesota. *In* Geology of Minnesota: A Centennial Volume. Minnesota Geological Survey.

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.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

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	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, 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.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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 material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) 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 shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay 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 stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse 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 has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

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.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Disintegration moraine. A drift topography characterized by chaotic mounds and pits, generally randomly oriented, developed in supraglacial drift by collapse and flow as the underlying stagnant ice melted. Slopes may be steep and unstable. Abrupt changes between materials of differing lithology are common.

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 wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A 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. Synonym: scarp.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

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.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

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 firefighters 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 has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has 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 flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

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.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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 has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Head slope. A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

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 15 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. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the

material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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

Interfluve. An elevated area between two drainageways that sheds water to those drainageways.

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 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. An irregular, short ridge or hill of stratified glacial drift.

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.

Lamella. A thin (commonly less than 1 cm thick), discontinuous or continuous, generally horizontal layer of fine material (especially clay and iron oxides) pedogenically concentrated (illuviated) within a coarser textured (sandy) eluvial layer.

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.

MAP. Mean annual precipitation, expressed in inches.

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 earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

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.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an

adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

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.

Nose slope. A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent.

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. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

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 or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

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.

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. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

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 generally is 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.

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.

Shoulder. The position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

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.

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 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 material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one

fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 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 erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

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.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

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. 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 ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

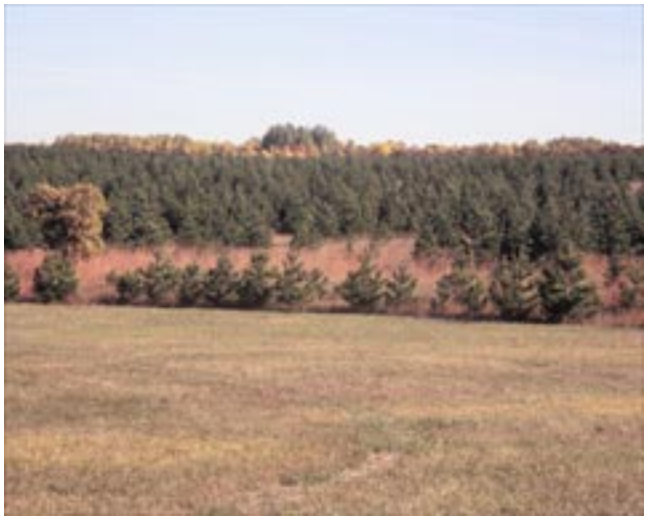
United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Minnesota Agricultural Experiment Station

Soil Survey of Hubbard County, Minnesota

Part II



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

On the **general soil map**, the survey area is divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map units in the area on the color-coded map legend, then refer to the section **General Soil Map Units** in Part I of this survey for a general description of the soils in your area.

The **detailed soil maps** 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**. 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 **Contents** in Part I of this survey, which lists the map units and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. Also, see the **Contents** in Part I and Part II for other 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 1994. Soil names and descriptions were approved in 1998. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1994. This survey was made cooperatively by the Natural Resources Conservation Service and the Minnesota Agricultural Experiment Station. It is part of the technical assistance furnished to the Hubbard County Soil and Water Conservation District. Other assistance was provided by the Agricultural Extension Service, the Minnesota Department of Natural Resources, and the Board of Water and Soil Resources. The survey was partially funded by the Legislative Commission for Minnesota Resources and by Hubbard County.

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.

Cover: *Top left*—Natural and scenic areas draw many visitors to the Hubbard County area. *Top right*—Red pine plantations are common in areas of soils that formed in sandy and gravelly outwash. *Bottom left*—Irrigated cropland is a major land use on outwash soils in southern Hubbard County. *Bottom right*—Forest products management is an important industry throughout most of Hubbard County.

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

Contents

Soil Survey of
Hubbard County, Minnesota

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

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.

Classification of the Soils

Soil name	Family or higher taxonomic class
Akeley	Arenic Eutroboralfs, loamy, mixed, superactive
Baudette	Aquic Eutroboralfs, fine-silty, mixed, superactive
Becida	Mollic Glossaqualfs, coarse-loamy, mixed, superactive, frigid
Beltrami	Aquic Eutroboralfs, fine-loamy, mixed, superactive
Blomford	Arenic Epiaqualfs, loamy, mixed, superactive, frigid
Blowers	Glossaquic Eutroboralfs, coarse-loamy, mixed, superactive
Bootlake	Typic Eutroboralfs, coarse-loamy, mixed, superactive
Bowstring	Fluvaquentic Borosaprists, euic
Braham	Arenic Eutroboralfs, loamy, mixed, superactive
Cathro	Terric Borosaprists, loamy, mixed, euic
Corliss	Typic Udipsamments, mixed, frigid
Dalbo	Aquertic Eutroboralfs, fine, smectitic
Debs	Typic Eutroboralfs, fine-silty, mixed, superactive
Dorset	Udic Argiborolls, coarse-loamy, mixed, superactive
Duelm	Aquic Haploborolls, sandy, mixed
Eagleview	Argic Udipsamments, mixed, frigid
Egglake	Mollic Endoaqualfs, fine-loamy, mixed, superactive, frigid
Evart	Fluvaquentic Endoaquolls, sandy, mixed, frigid
Graycalm	Argic Udipsamments, mixed, frigid
Haslie	Limnic Borosaprists, coprogenous, euic
Huntersville	Aquic Arenic Eutroboralfs, loamy, mixed, superactive
Isan	Typic Endoaquolls, sandy, mixed, frigid
Lengby	Typic Eutroboralfs, fine-loamy, mixed, superactive
Lupton	Typic Borosaprists, euic
Markey	Terric Borosaprists, sandy or sandy-skeletal, mixed, euic
Meehan	Aquic Udipsamments, mixed, frigid
Menahga	Typic Udipsamments, mixed, frigid
Mooselake	Typic Borohemists, euic
Nary	Glossaquic Eutroboralfs, fine-loamy, mixed, superactive
Nebish	Typic Eutroboralfs, fine-loamy, mixed, superactive
Nidaros	Terric Borosaprists, loamy, mixed, euic
Nymore	Typic Udipsamments, mixed, frigid
Paddock	Udollic Epiaqualfs, coarse-loamy, mixed, superactive, frigid
Potatolake	Aquic Eutroboralfs, fine-silty, mixed, superactive
Redeye	Arenic Eutroboralfs, loamy, mixed, superactive
Rifle	Typic Borohemists, euic
Rockwood	Mollic Eutroboralfs, coarse-loamy, mixed, superactive
Rondeau	Limnic Borosaprists, marly, euic
Roscommon	Mollic Psammaquents, mixed, frigid
Runeberg	Typic Endoaquolls, coarse-loamy, mixed, superactive, frigid
Sanburn	Typic Eutroboralfs, coarse-loamy, mixed, superactive
Seelyeville	Typic Borosaprists, euic
Snellman	Typic Eutroboralfs, fine-loamy, mixed, superactive
Sol	Glossic Eutroboralfs, fine-loamy, mixed, superactive
Spooner	Mollic Endoaqualfs, fine-silty, mixed, superactive, frigid
Staples	Arenic Epiaqualfs, loamy, mixed, superactive, frigid
Steamboat	Typic Paleboralfs, coarse-loamy, mixed, superactive
Sugarbush	Typic Eutroboralfs, coarse-loamy, mixed, superactive
Talmoon	Mollic Endoaqualfs, fine-loamy, mixed, superactive, frigid
Two Inlets	Psammentic Eutroboralfs, mixed
Udipsamments	Udipsamments
Udorthents	Udorthents
Verndale	Udic Argiborolls, coarse-loamy, mixed, superactive
Willosippi	Mollic Endoaqualfs, fine-loamy, mixed, superactive, frigid
Wurtsmith	Oxyaquic Udipsamments, mixed, frigid
Zerkel	Glossic Oxyaquic Eutroboralfs, fine-loamy, mixed, superactive
Zimmerman	Argic Udipsamments, mixed, frigid

Acreage and Proportionate Extent of the Soils

(The abbreviation "MAP" stands for mean annual precipitation; the numbers that follow the abbreviation refer to a range in inches)

Map symbol	Soil name	Acres	Percent
82B	Redeye loamy sand, 1 to 6 percent slopes	642	0.1
82C	Redeye loamy sand, 6 to 12 percent slopes	39	*
133B	Dalbo silt loam, 2 to 8 percent slopes	17	*
133C	Dalbo silt loam, 8 to 15 percent slopes	3	*
139B	Huntersville loamy fine sand, 1 to 6 percent slopes	760	0.1
147	Spooner silt loam, 0 to 2 percent slopes	140	*
158B	Zimmerman loamy fine sand, 1 to 6 percent slopes	1,657	0.3
158C	Zimmerman loamy fine sand, 6 to 12 percent slopes	60	*
167A	Baudette silt loam, 1 to 3 percent slopes	295	*
170	Blomford loamy fine sand, 0 to 2 percent slopes	740	0.1
202	Meehan loamy sand, MAP 22-30, 0 to 3 percent slopes	2,898	0.5
207B	Nymore loamy sand, 2 to 6 percent slopes	580	*
207C	Nymore loamy sand, 6 to 12 percent slopes	81	*
207D	Nymore loamy sand, 12 to 20 percent slopes	53	*
260	Duelm loamy sand, 0 to 2 percent slopes	459	*
261	Isan loamy sand, depressional, 0 to 1 percent slopes	466	*
267B	Snellman sandy loam, 2 to 8 percent slopes	563	*
346	Talmoon loam, 0 to 2 percent slopes	491	*
406A	Dorset sandy loam, 0 to 2 percent slopes	207	*
488	Becida fine sandy loam, morainic, 0 to 2 percent slopes, stony	4,766	0.7
526C	Steamboat-Two Inlets-Seelyeville complex, pitted, 0 to 15 percent slopes	65,187	10.2
526E	Steamboat-Two Inlets-Seelyeville complex, pitted, 0 to 35 percent slopes	38,306	6.0
540	Seelyeville muck, depressional, MAP 22-30, 0 to 1 percent slopes	10,127	1.6
541	Rifle mucky peat, depressional, MAP 22-30, 0 to 1 percent slopes	41	*
545	Rondeau muck, depressional, 0 to 1 percent slopes	433	*
567A	Verndale sandy loam, 0 to 2 percent slopes	10,532	1.6
574G	Steamboat-Two Inlets complex, pitted, 35 to 65 percent slopes	3,486	0.5
628	Talmoon muck, depressional, 0 to 1 percent slopes	126	*
672	Willosippi loam, 0 to 2 percent slopes	1,635	0.3
675C	Two Inlets-Eagleview-Steamboat complex, pitted, 3 to 15 percent slopes	23,233	3.6
675E	Two Inlets-Eagleview-Steamboat complex, pitted, 15 to 35 percent slopes	15,750	2.5
675G	Two Inlets-Eagleview-Steamboat complex, pitted, 35 to 65 percent slopes	2,827	0.4
701	Runeberg mucky loam, depressional, 0 to 1 percent slopes	728	0.1
709B	Lengby fine sandy loam, 2 to 8 percent slopes	744	0.1
709C	Lengby fine sandy loam, 8 to 15 percent slopes	94	*
719B	Rondeau muck (seepland), 1 to 6 percent slopes	277	*
731A	Sanburn loamy sand, 0 to 3 percent slopes	8,156	1.3
744B	Debs-Akeley complex, 1 to 8 percent slopes	2,424	0.4
746	Haslie muck, depressional, 0 to 1 percent slopes	122	*
775B	Sugarbush-Two Inlets complex, 1 to 8 percent slopes	14,068	2.2
775C	Sugarbush-Two Inlets complex, 8 to 15 percent slopes	11,030	1.7
778B	Dorset-Corliss complex, 1 to 6 percent slopes	8,251	1.3
778C	Dorset-Corliss complex, 6 to 12 percent slopes	2,276	0.4
797	Mooselake and Lupton soils, 0 to 1 percent slopes	28,717	4.5
799	Seelyeville and Bowstring soils, 0 to 1 percent slopes, frequently flooded	1,357	0.2
820B	Potatolake very fine sandy loam, 1 to 8 percent slopes	3,925	0.6
820C	Potatolake very fine sandy loam, 8 to 15 percent slopes	796	0.1
831C	Akeley-Debs complex, 8 to 15 percent slopes	1,263	0.2
831E	Akeley-Debs complex, 15 to 35 percent slopes	866	0.1
844B	Sanburn-Graycalm complex, 3 to 8 percent slopes	22,150	3.5
867B	Graycalm-Menahga complex, 1 to 8 percent slopes	26,445	4.1
867C	Graycalm-Menahga complex, 8 to 15 percent slopes	4,969	0.8
867E	Graycalm-Menahga complex, 15 to 30 percent slopes	5,527	0.9
867F	Graycalm-Menahga complex, 30 to 45 percent slopes	143	*
1015	Udipsamments (cut and fill land)	371	*
1016	Udorthents, loamy (cut and fill land)	147	*
1021C	Graycalm-Sanburn complex, 8 to 15 percent slopes	6,569	1.0

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
1027	Udorthents, wet substratum (fill land)	171	*
1030	Pits, gravel-Udipsamments complex	706	0.1
1111	Nidaros muck, 0 to 1 percent slopes, frequently flooded	11,207	1.8
1113	Haslie, Seelyeville, and Cathro soils, ponded, 0 to 1 percent slopes	10,408	1.6
1126B	Verndale-Nymore complex, 1 to 6 percent slopes	26,821	4.2
1127A	Bootlake-Graycalm complex, 0 to 2 percent slopes	239	*
1127B	Bootlake-Graycalm complex, 2 to 8 percent slopes	19,992	3.1
1136	Nidaros muck, depressional, 0 to 1 percent slopes	2,311	0.4
1164	Zerkel loam, 1 to 3 percent slopes	703	0.1
1200	Egglake loam, 0 to 2 percent slopes	174	*
1230	Haslie and Nidaros soils, ponded, 0 to 1 percent slopes	5,175	0.8
1238E	Two Inlets-Sugarbush complex, 15 to 30 percent slopes	5,933	0.9
1238F	Two Inlets-Sugarbush complex, 30 to 45 percent slopes	585	*
1244B	Sol-Sugarbush complex, 2 to 8 percent slopes, very stony	2,532	0.4
1244C	Sol-Sugarbush complex, 8 to 15 percent slopes, very stony	2,068	0.3
1244E	Sol-Sugarbush complex, 15 to 30 percent slopes, very stony	1,337	0.2
1247D	Corliss-Dorset complex, 12 to 20 percent slopes	224	*
1248C	Nymore-Verndale complex, 6 to 12 percent slopes	1,836	0.3
1249C	Graycalm-Bootlake complex, 8 to 15 percent slopes	8,133	1.3
1271	Roscommon mucky loamy sand, depressional, MAP 22-30, 0 to 1 percent slopes	1,811	0.3
1272B	Sol fine sandy loam, 2 to 6 percent slopes	780	0.1
1294	Nary fine sandy loam, 1 to 3 percent slopes	347	*
1319B	Rockwood sandy loam, 2 to 6 percent slopes, stony	3,146	0.5
1319C	Rockwood sandy loam, 6 to 12 percent slopes, stony	277	*
1319D	Rockwood sandy loam, 12 to 20 percent slopes, stony	250	*
1320B	Blowers sandy loam, 1 to 5 percent slopes, stony	1,326	0.2
1321	Paddock-Becida complex, 0 to 2 percent slopes, stony	154	*
1332B	Rockwood fine sandy loam, morainic, 3 to 8 percent slopes, stony	41,382	6.5
1332C	Rockwood fine sandy loam, morainic, 8 to 15 percent slopes, stony	5,781	0.9
1332E	Rockwood fine sandy loam, morainic, 15 to 30 percent slopes, stony	1,271	0.2
1334	Huntersville loamy sand, 1 to 3 percent slopes	4,452	0.7
1336	Blowers fine sandy loam, morainic, 1 to 3 percent slopes, stony	28,854	4.5
1356	Water, miscellaneous	135	*
1421B	Rockwood-Two Inlets, morainic, complex, 3 to 8 percent slopes, stony	15,347	2.4
1421C	Rockwood-Two Inlets, morainic, complex, 8 to 15 percent slopes, stony	9,805	1.5
1421E	Rockwood-Two Inlets, morainic, complex, 15 to 30 percent slopes, stony	4,952	0.8
1438B	Braham loamy fine sand, moderately wet, 2 to 6 percent slopes	1,327	0.2
1439	Cathro muck, depressional, MAP 22-30, 0 to 1 percent slopes	497	*
1440B	Redeye loamy sand, morainic, 3 to 8 percent slopes	5,637	0.9
1440C	Redeye loamy sand, morainic, 8 to 15 percent slopes	1,317	0.2
1444	Wurtsmith loamy sand, MAP 22-30, 0 to 3 percent slopes	6,076	0.9
1445	Markey muck, depressional, MAP 22-30, 0 to 1 percent slopes	284	*
1447	Beltrami very fine sandy loam, 1 to 3 percent slopes	3,423	0.5
1450B	Sanburn very stony loamy sand, 1 to 8 percent slopes, bouldery	882	0.1
1450C	Sanburn very stony loamy sand, 8 to 15 percent slopes, bouldery	368	*
1450E	Sanburn very stony loamy sand, 15 to 30 percent slopes, bouldery	229	*
1460B	Nebish very fine sandy loam, moderately wet, 2 to 6 percent slopes	6,780	1.1
1460C	Nebish very fine sandy loam, 6 to 12 percent slopes	494	*
1943	Roscommon loamy sand, MAP 22-30, 0 to 2 percent slopes	2,594	0.4
1956	Staples loamy sand, 0 to 2 percent slopes	1,663	0.3
1968	Evart loam, 0 to 1 percent slopes, occasionally flooded	9	*
1969	Evart-Isan complex, channeled, 0 to 1 percent slopes, frequently flooded	953	0.1
W	Water	48,827	7.6
	Total	640,000	100.0

* Less than 0.05 percent. The combined extent of the soils assigned an asterisk in the "Percent" column is about 1.6 percent of the survey area.

Agronomy

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider obtaining specific information from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Crops and Pasture

Russell D. Johnsrud, district conservationist, Natural Resources Conservation Service, helped prepare this section.

With proper management, a wide variety of crop and pasture species can be grown in Hubbard County. The dominant crops are corn, potatoes, dry edible beans, and hay (fig. 11). Oats, barley, and wheat also are grown. Small acreages are used for fruits and vegetables.

The main agricultural areas in the county can be divided into two distinct regions. The northern third of the county, consisting primarily of associations 3 and 4 (described under the heading “General Soil Map Units” in Part I of this survey), is interspersed forested and agricultural areas and has the highest percentage of dairy, beef, and sheep operations. Soils in this region are used primarily for the production of alfalfa, small grain, and corn. The southern third of the county consists primarily of associations 9, 10, and 11 and is characterized by nearly level to rolling landscapes and moderate relief. Soils in this region are used primarily for the production of potatoes, edible beans, and corn. The central part of the county consists mostly of a rolling to very steep landscape that is dominantly forested and has only a few isolated agricultural areas.

Major agricultural management concerns in Hubbard County are low available water capacity, water erosion, wind erosion, soil wetness, and maintenance of soil tilth and fertility levels. The potential for ground-water contamination also is a concern in some areas.

Low available water capacity is the major management concern in the southern third of the county. Crops grown on the coarse textured, rapidly permeable soils in this area need more water than is normally received from natural precipitation. The development of irrigation systems has helped to make these soils agriculturally productive. The leaching of plant nutrients and pesticides into ground-water resources is a concern in this area. Proper management of irrigation water and careful management of soil amendments help to prevent the contamination of ground-water resources.

Wind erosion and water erosion are the major management concerns on most soils in the county. Soils that have a surface layer of loamy fine sand, loamy sand, fine sandy loam, or sandy loam and large areas of soils that are not protected by vegetative cover are susceptible to the effects of wind erosion. Most wind erosion occurs in areas that have been plowed in the fall and left bare over winter. Soils in the more sloping areas are susceptible to water erosion. Control of sheet and rill erosion is especially important on the steeper slopes.

Failure to control erosion results in excessive soil loss, reduced productivity, and pollution of nearby lakes and streams. Conserving the topsoil is important because topsoil acts as a reservoir for nutrients and water to be used by plants. Using a system of conservation tillage, such as reduced tillage or no-till, planting on the contour, planting field windbreaks or shelterbelts, and managing crop residue can help to control water erosion and wind erosion. On the steeper slopes, constructing grassed waterways can also reduce the hazard of erosion. Also, a cropping sequence that includes a grass and legume forage crop for 3 to 5 years in an 8-year rotation is effective in keeping soil losses within tolerable limits.

Soil wetness is the main management concern in the northern and southeastern parts of the county. Soil wetness can delay planting and harvesting activities. Management activities in areas of poorly drained soils, such as Becida, Egglake, Spooner, and Willosippi soils, may be delayed in the spring and during periods of excessive precipitation. If these soils are tilled when too wet, severe compaction and clodding of the

Figure 11.—Bromegrass-alfalfa hay is a major crop in Hubbard County.

surface layer are likely. Some drainage systems have been installed in these areas, but many of them are not adequate or have not been maintained. Additional or future drainage of any soils is presently restricted by State and Federal regulations.

Maintaining soil tilth is a concern on silty soils, such as Baudette and Dalbo soils. If these soils are tilled when too wet, severe compaction and clodding of the surface layer are likely. Using reduced tillage, managing crop residue, and properly timing management activities can help to maintain soil tilth.

Many of the soils in Hubbard County have a moderate to low content of organic matter. Measures that maintain the content of organic matter and the fertility of the soils are needed. Such measures include nutrient management and crop residue management through the application of a conservation cropping system.

The application of fertilizers, pesticides, and herbicides can help to maintain or improve crop yields in Hubbard County. The amount of fertilizer needed should be based on soil fertility tests, soil type, past management, and the nutrient demands of the crop to be grown. Applying manure can be effective in adding organic matter and supplemental nitrogen to the soil. Many soils in the county already have a high content of inherent phosphorus. Adding phosphorus at rates present in some commercial fertilizers may not be necessary and could result in runoff of the unused nutrient. The application of agricultural chemicals should be undertaken with extreme care so that the risk of contamination of ground water and surface water can be minimized. Sandy, highly permeable soils are susceptible to ground-water contamination because they have a high leaching potential. Soils in the steeper areas have a greater runoff potential than those in the less sloping areas. Improper management of amendments can result in the contamination of surface water.

Moderately well drained, loamy soils in nearly level areas have few limitations affecting cropland management. Examples are Baudette, Nary, and Zerkel soils.

Many areas in the county are used for pasture.

Pastures can be improved with proper management. Pasture management includes a planned grazing system, a fertilization program, brush and weed control, and provision for a full-season grazing system.

In some areas forest land and cutover forest land are managed for pasture. Land managers should decide whether to manage these areas as pasture or for wood products. Intensive grazing of forest land can impair woodland productivity. The quality and quantity of forage in forest land varies depending upon the kind of soil, the age and species of the trees in the canopy, the density of the canopy, and the depth and composition of the litter. Cutover areas can also be managed for native or naturalized forest plants or can be managed for pasture.

Adjusting stocking rates, using rotation grazing, deferring grazing, and discouraging selective grazing are parts of a planned grazing system. Overgrazing reduces the quality of forage and the ability of the plants to recover after grazing. The use of wet pastures should be deferred until the sod is firm, the forage has reached a minimum height, and the plants are growing vigorously.

The species selected for hay and pasture should be based on the soil type, drainage class, and soil acidity. Well drained and moderately well drained soils are suited to the widest range of species, including alfalfa, red clover, birdsfoot trefoil, smooth bromegrass, timothy, orchardgrass, reed canarygrass, and Kentucky bluegrass.

Brush and weed control improves the quality of the pasture. Mechanical removal of undesirable species is labor intensive. When chemicals are selected and applied for brush and weed control, measures that prevent harm to livestock and contamination of local water resources are needed.

Full-season grazing systems may combine cool-season grasses for spring and fall and warm-season grasses for grazing during the warmer, drier summer months. Planting the cool- and warm-season grasses in different pastures and using a rotation grazing system result in maximum utilization of the forage produced. The most recent information about suitable species and varieties of grasses can be obtained from local offices of the Minnesota Cooperative Extension Service and the Natural Resources Conservation Service.

Applying fertilizers in pastures in a timely manner promotes vigorous growth during the period when the grasses are utilized for grazing.

Irrigation

Hubbard County has approximately 18,500 acres under irrigation. Approximately 155 irrigation systems are operating in the county. The majority of the irrigation systems are center-pivot systems. The major crops grown under irrigation are potatoes, corn, edible beans, and alfalfa hay. Currently, yields of irrigated corn are about 150 to 160 bushels per acre on a variety of soil types.

Most of the irrigated acreage is in association 11, which is described under the heading “General Soil Map Units” in Part I of this survey. Some areas in associations 9 and 10 also are used for irrigated crops.

Irrigation water is available in most areas. Most of the irrigation systems are using water drawn from ground-water aquifers with surficial deposits of sand and gravel. A few systems are using water from wastewater treatment lagoons, from wetlands, or from rivers.

Important soil properties and site features that should be considered when decisions regarding irrigation systems are made include available water capacity, rate of water intake, and slope.

Available water capacity is the amount of water stored in the soil that is available for plant growth. This amount of water is the difference between the amount of soil water at field capacity and the amount of soil water at wilting point. This value is commonly expressed as inches of water per inch of soil. Soil texture and bulk density within a depth of 60 inches are the primary factors that affect the water-holding capacity.

The water intake rate is a measure of the soil’s capacity to absorb water and the time water takes to move through the soil profile. Intake rates are dependent on infiltration rates and percolation rates. Infiltration is the rate at which water penetrates the surface of the soil. Percolation is the movement of water through the soil. The water intake rate is expressed as inches of soil per hour. The higher the rate, the faster water moves through the soil.

The degree of slope affects erosion rates. High yields cannot be maintained on eroding land. Erosion-control measures should be considered when irrigation is planned in sloping areas.

Proper management of irrigation water includes consideration of the demand for water at specific development stages of the plants and the amount of water currently stored in the rooting zone. Some

managers use computer programs together with field sampling of soil moisture to schedule irrigation. Producers are encouraged to conduct uniformity tests to ensure even distribution of irrigation water. Proper scheduling of irrigation and proper application of fertilizers and chemicals can reduce the potential for leaching and for ground-water contamination.

The production of irrigated crops also requires selecting crops and varieties that are drought tolerant, using reduced tillage, and managing crop residue. These practices conserve moisture.

Cropland Management Considerations

The management concerns affecting the use of the detailed soil map units in the survey area for crops are shown in the table "Cropland Management Considerations." The main concerns in managing nonirrigated cropland are conserving moisture, controlling wind erosion and water erosion, and maintaining soil fertility.

Conserving moisture consists primarily of reducing the evaporation and runoff rates and increasing the water infiltration rate. Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, and leaving crop residue on the surface conserve moisture.

Generally, a combination of several practices is needed to control *wind erosion* and *water erosion*. Conservation tillage, stripcropping, field windbreaks, contour farming, conservation cropping systems, crop residue management, terraces, diversions, and grassed waterways help to prevent excessive soil loss.

Measures that are effective in maintaining *soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients and thus helps to maintain productivity, although the level of fertility can be reduced even in areas where erosion is controlled. All soils used for nonirrigated crops respond well to applications of fertilizer.

Some of the considerations shown in the table cannot be easily overcome. These are *channels, flooding, gullies,* and *ponding.*

Additional considerations are as follows:

Lime content, limited available water capacity, potential poor tilth and compaction, and *restricted permeability*.—These limitations can be minimized by incorporating green manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. Also, crops may respond well to additions of phosphate fertilizer to soils that have a high content of lime.

Potential for ground-water contamination.—The proper use of nutrients and pesticides can reduce the risk of ground-water contamination.

Potential for surface-water contamination.—The risk of surface-water contamination can be reduced by the proper use of nutrients and pesticides and by conservation farming practices that reduce the runoff rate.

Surface crusting.—This limitation retards seedling development after periods of heavy rainfall.

Surface rock fragments.—This limitation causes rapid wear of tillage equipment. It cannot be easily overcome.

Surface stones.—Stones or boulders on or near the surface can hinder normal tillage unless they are removed (fig. 12).

On irrigated soils the main management concerns are *efficient water use, nutrient management, control of erosion, pest and weed control,* and *timely planting and harvesting* for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Also, it can create drainage problems, raise the water table, and increase soil salinity.

Explanation of Criteria

Acid soil.—The pH is less than 6.1.

Channeled.—The word "channeled" is included in the map unit name.

Dense layer.—The bulk density is 1.80 g/cc or greater within the soil profile.

Excessive permeability.—Permeability is 6 inches per hour or more within the soil profile.

Flooding.—Flooding is occasional or frequent.

High organic matter content.—The surface layer has more than 20 percent organic matter.

Limited available water capacity.—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 6 inches or less.

Limited organic matter content.—The content of organic matter is 2 percent or less in the surface layer.

Ponding.—Ponding duration is assigned to the map unit component. The water table is above the surface.

Potential poor tilth and compaction.—The content of clay is 27 percent or more in the surface layer.

Potential for ground-water contamination (by nutrients or pesticides).—Depth to the water table is 4 feet or less, the permeability of any layer is more than

Figure 12.—Stones along a field boundary in an area of Rockwood fine sandy loam, morainic, 3 to 8 percent slopes, stony. Surface stoniness varies in northern Hubbard County. The stones in some areas are so numerous that tillage for crop production is not feasible.

6.0 inches per hour, or the depth to bedrock is less than 60 inches.

Potential for surface-water contamination (by nutrients or pesticides).—The map unit component is occasionally flooded or frequently flooded, is subject to ponding, is assigned to hydrologic group C or D and has a slope of more than 2 percent, is assigned to hydrologic group A and has a slope of more than 6 percent, or is assigned to hydrologic group B, has a slope of 3 percent or more, and has a K factor of more than 0.17.

Restricted permeability.—Permeability is less than 0.06 inch per hour within the soil profile.

Slope (equipment limitation).—The slope is more than 15 percent.

Surface crusting.—The content of clay is 27 percent or more and the content of organic matter is 2 percent or less in the surface layer.

Surface rock fragments (equipment limitation).—The terms describing the texture of the surface layer include any rock fragment modifier, except for gravelly,

channery, stony, very stony, extremely stony, bouldery, very bouldery, and extremely bouldery.

Surface stones (equipment limitation).—The word "stony" or "bouldery" is included in the map unit name or in the description of the surface layer.

Water erosion.—Either the slope is 6 percent or more, or the slope is more than 3 percent and less than 6 percent and the surface layer is not sandy.

Water table.—A water table is within 2.5 feet of the surface.

Wind erosion.—The wind erodibility group is 1, 2, 3, or 4L.

Crop Yield Estimates

The average yields per acre that can be expected of the principal crops under a high level of management are shown in the table "Land Capability and Yields per Acre of Crops and Pasture." In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of the map units in the survey area also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in the table are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Pasture and Hayland Interpretations

Under good management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season. Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

Yield estimates are often provided in animal unit months (AUM), or the amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about forage yields other than those shown in the table "Land Capability and Yields per Acre of Crops and Pasture."

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils generally are grouped at three levels—capability class, subclass, and unit (USDA, 1961). These categories indicate the degree and kinds of limitations affecting mechanized farming systems that produce the more commonly grown field crops, such as corn, small grain, cotton, hay, and field-grown vegetables. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and woodland. The degree of the soil limitations affecting the production of cultivated crops increases

progressively from class 1 to class 4. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7.

Areas in class 8 are generally not suitable for crops, pasture, or woodland without a level of management that is impractical. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

Capability subclasses identify the dominant kind of limitation in the class. They are designated by adding a small letter, *e, w, s,* or *c*, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, woodland, wildlife habitat, or recreation.

The capability classification of the soils in the survey area is given in the table “Land Capability and Yields per Acre of Crops and Pasture” at the end of this section.

Prime Farmland

Prime farmland is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, State, and Federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in National forests, National parks, military reservations, and State parks.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity and the content of salts and sodium are acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and they are not frequently flooded during the growing season or are protected from flooding. Slopes range mainly from 0 to 6 percent.

Soils that have a high water table or are subject to flooding may qualify as prime farmland where these limitations are overcome by drainage measures or flood control. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information about the criteria for prime farmland can be obtained at the local office of the Natural Resources Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 24,640 acres, or nearly 4 percent of the survey area, meets the requirements for prime farmland.

The map units in the survey area that meet the requirements for prime farmland are listed in the table “Prime Farmland.” On some soils included in the table, measures that overcome limitations are needed. The need for these measures is indicated in parentheses after the map unit name. The location of each map unit is shown on the detailed soil maps. The soil qualities

that affect use and management are described in the section “Soil Series and Detailed Soil Map Units” in Part I of this publication. This list does not constitute a recommendation for a particular land use.

Erosion Factors

Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices. The erosion factors for the soils in the survey area are listed in the table “Physical Properties of the Soils.”

Soil Erodibility (K) Factor

The soil erodibility (K) factor indicates the susceptibility of a soil to sheet and rill erosion by water. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand, the content of sand coarser than very fine sand, the content of organic matter, soil structure, and permeability.

Fragment-Free Soil Erodibility (Kf) Factor

This is one of the factors used in the Revised Universal Soil Loss Equation (RUSLE). It shows the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Soil-Loss Tolerance (T) Factor

The soil-loss tolerance (T) factor is an estimate of the maximum annual rate of soil erosion that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used, depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

Wind Erodibility Groups

Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index (I) factor is determined. This factor is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEG) having similar percentages of dry soil aggregates larger than 0.84 millimeter. The wind erodibility groups and wind erodibility index are listed in the table “Physical Properties of the Soils.”

Additional information about wind erodibility groups and K, Kf, T, and I factors can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of trees that have been planted and have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or grow poorly, depending on the characteristics of the soil. Each tree or shrub has definable potential heights in a given physiographic

area and under a given climate. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The table “Windbreaks and Environmental Plantings” shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in this table are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a nursery.

Windbreak Suitability Groups

Windbreak suitability groups consist of soils in which the kinds and degrees of the hazards and limitations that affect the survival and growth of trees and shrubs in windbreaks are about the same. The windbreak suitability group for each soil in the survey area is listed in the table “Windbreak Suitability Groups” at the end of this section. The following paragraphs describe the characteristics of the soils in each group.

Group 1 consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and do not have free carbonates in the upper 20 inches.

Group 1K consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and have free carbonates within 20 inches of the surface. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2 consists of poorly drained soils that have been artificially drained and do not have free carbonates in the upper 20 inches. Permeability varies.

Group 2K consists of poorly drained or very poorly drained soils that have been artificially drained and have free carbonates within 20 inches of the surface. Permeability varies. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2H consists of very poorly drained soils that have been artificially drained and have more than 16 inches of organic material. Permeability varies.

Group 2W consists of very poorly drained soils that are subject to ponding and have been artificially drained. It includes soils that have an organic surface layer up to 16 inches thick. Permeability varies.

Group 3 consists of soils that are well drained or moderately well drained and are loamy or silty throughout. Permeability is moderate or moderately slow. These soils do not have free carbonates in the upper 20 inches.

Group 4 consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a silty or loamy surface layer and a clayey subsoil. Permeability is slow or very slow.

Group 4C consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a clayey surface layer and subsoil. Permeability is slow or very slow.

Group 4F consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a substratum of dense till. Permeability is slow or very slow.

Group 5 consists of soils that are excessively drained to moderately well drained and have a moderate available water capacity. These soils are dominantly fine sandy loam or sandy loam, but some are sandy in the upper part and loamy in the lower part.

Group 6G consists of excessively drained to moderately well drained soils that are loamy in the upper part and have sand or sand and gravel at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 6D consists of excessively drained to moderately well drained, loamy soils that have bedrock at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 7 consists of excessively drained to well drained soils that are dominantly loamy fine sand or coarser textured and are shallow to sand or to sand and gravel. These soils have a low available water capacity.

Group 8 consists of excessively drained to well drained, loamy soils that have free carbonates within 20 inches of the surface.

Group 9W consists of soils that are somewhat poorly drained, poorly drained, or very poorly drained and are moderately saline (the electrical conductivity is 8 to 16).

Group 10 consists of soils or miscellaneous land types that generally are not suitable for windbreaks. One or more characteristics, such as soil depth, texture, wetness, available water capacity, or slope, limit the planting, survival, or growth of trees and shrubs.

Cropland Management Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Cropland management considerations
82B:	
Redeye	Dense layer Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Wind erosion
82C:	
Redeye	Dense layer Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water erosion Wind erosion
133B, 133C:	
Dalbo	Potential for ground-water contamination Potential for surface-water contamination Water erosion
139B:	
Huntersville	Dense layer Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Wind erosion
147:	
Spooner	Potential for ground-water contamination Water table
158B:	
Zimmerman	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
158C:	
Zimmerman	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
167A:	
Baudette	Potential for ground-water contamination

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
170:	
Blomford	Excessive permeability Potential for ground-water contamination Water table Wind erosion
202:	
Meehan	Excessive permeability Limited available water capacity Potential for ground-water contamination Water table Wind erosion
207B:	
Nymore	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
207C:	
Nymore	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
207D:	
Nymore	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
260:	
Duelm	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
261:	
Isan	Excessive permeability Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
267B:	
Snellman	Potential for surface-water contamination Water erosion Wind erosion
346:	
Talmoon	Potential for ground-water contamination Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
406A:	
Dorset	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
488:	
Becida	Dense layer Limited available water capacity Potential for ground-water contamination Restricted permeability Surface stones Water table Wind erosion
526C:	
Steamboat	Potential for surface-water contamination Water erosion
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination
Seelyeville	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
526E:	
Steamboat	Potential for surface-water contamination Slope Water erosion
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion
Seelyeville	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
540:	
Seelyeville	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
541:	
Rifle	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
545:	
Rondeau	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water table Wind erosion
567A:	
Verndale	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
574G:	
Steamboat	Potential for surface-water contamination Slope Water erosion
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion
628:	
Talmoon	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
672:	
Willosippi	Potential for ground-water contamination Water table
675C:	
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination
Eagleview	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
Steamboat	Potential for surface-water contamination Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
675E:	
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion
Eagleview	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
Steamboat	Potential for surface-water contamination Slope Water erosion
675G:	
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion
Eagleview	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
Steamboat	Potential for surface-water contamination Slope Water erosion
701:	
Runeberg	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
709B, 709C:	
Lengby	Excessive permeability Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
719B:	
Rondeau	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water erosion Water table Wind erosion
731A:	
Sanburn	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
744B:	
Debs	Potential for surface-water contamination Water erosion
Akeley	Excessive permeability Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
746:	
Haslie	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
775B:	
Sugarbush	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
775C:	
Sugarbush	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
775C:	
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
778B:	
Dorset	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Corliss	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
778C:	
Dorset	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Corliss	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
797:	
Mooselake	High organic matter content Potential for ground-water contamination Water table
Lupton	High organic matter content Potential for ground-water contamination Water table Wind erosion
799:	
Seelyeville	Flooding High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
Bowstring	Flooding High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
820B, 820C:	
Potatolake	Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
831C:	
Akeley	Excessive permeability Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Debs	Potential for surface-water contamination Water erosion
831E:	
Akeley	Excessive permeability Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
Debs	Potential for surface-water contamination Slope Water erosion
844B:	
Sanburn	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
Graycalm	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
867B:	
Graycalm	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
Menahga	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
867C:	
Graycalm	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Menahga	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
867E, 867F:	
Graycalm	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
Menahga	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
1015:	
Udipsamments.	
1016:	
Udorthents.	
1021C:	
Graycalm	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Sanburn	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1027:	
Udorthents.	

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1030:	
Pits, gravel.	
Udipsamments.	
1111:	
Nidaros	Excessive permeability Flooding High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1113:	
Haslie	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Seelyeville	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Cathro	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1126B:	
Verndale	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Nymore	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
1127A:	
Bootlake	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
Graycalm	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1127B:	
Bootlake	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Graycalm	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
1136:	
Nidaros	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1164:	
Zerkel	Potential for ground-water contamination
1200:	
Egglake	Potential for ground-water contamination Water table
1230:	
Haslie	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Nidaros	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1238E:	
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
Sugarbush	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1238F:	
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
Sugarbush	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
1244B:	
Sol	Potential for surface-water contamination Surface stones Water erosion
Sugarbush	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Surface stones Water erosion Wind erosion
1244C:	
Sol	Potential for surface-water contamination Surface stones Water erosion
Sugarbush	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Surface stones Water erosion Wind erosion
1244E:	
Sol	Potential for surface-water contamination Slope Surface stones Water erosion
Sugarbush	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Surface stones Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1247D:	
Corliss	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
Dorset	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
1248C:	
Nymore	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Verndale	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1249C:	
Graycalm	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Bootlake	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1271:	
Roscommon	Excessive permeability Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1272B:	
Sol	Potential for surface-water contamination Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1294:	
Nary	Acid soil Potential for ground-water contamination
1319B:	
Rockwood	Dense layer Potential for surface-water contamination Restricted permeability Surface stones Water erosion Wind erosion
1319C:	
Rockwood	Dense layer Potential for surface-water contamination Restricted permeability Surface stones Water erosion Wind erosion
1319D:	
Rockwood	Dense layer Potential for surface-water contamination Restricted permeability Slope Surface stones Water erosion Wind erosion
1320B:	
Blowers	Dense layer Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Surface stones Water erosion Wind erosion
1321:	
Paddock	Dense layer Potential for ground-water contamination Restricted permeability Surface stones Water table Wind erosion
Becida	Dense layer Limited available water capacity Potential for ground-water contamination Restricted permeability Surface stones Water table
1332B, 1332C:	
Rockwood	Dense layer Limited available water capacity Potential for surface-water contamination Restricted permeability Surface stones Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1332E:	
Rockwood	Dense layer Limited available water capacity Potential for surface-water contamination Restricted permeability Slope Surface stones Water erosion Wind erosion
1334:	
Huntersville	Dense layer Excessive permeability Limited available water capacity Potential for ground-water contamination Restricted permeability Wind erosion
1336:	
Blowers	Dense layer Potential for ground-water contamination Restricted permeability Surface stones Wind erosion
1356:	
Water.	
1421B:	
Rockwood	Dense layer Limited available water capacity Potential for surface-water contamination Restricted permeability Water erosion Wind erosion
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination
1421C:	
Rockwood	Dense layer Limited available water capacity Potential for surface-water contamination Restricted permeability Surface stones Water erosion Wind erosion
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Surface stones Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1421E:	
Rockwood	Dense layer Limited available water capacity Potential for surface-water contamination Restricted permeability Slope Surface stones Water erosion Wind erosion
Two Inlets	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Surface stones Water erosion
1438B:	
Braham	Excessive permeability Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
1439:	
Cathro	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1440B:	
Redeye	Dense layer Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Wind erosion
1440C:	
Redeye	Dense layer Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water erosion Wind erosion
1444:	
Wurtsmith	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1445:	
Markey	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1447:	
Beltrami	Potential for ground-water contamination Water table Wind erosion
1450B:	
Sanburn	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Surface stones
1450C:	
Sanburn	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Surface stones Water erosion
1450E:	
Sanburn	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Surface stones Water erosion
1460B:	
Nebish	Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1460C:	
Nebish	Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion
1943:	
Roscommon	Excessive permeability Limited available water capacity Potential for ground-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1956:	
Staples	Dense layer Excessive permeability Limited available water capacity Potential for ground-water contamination Restricted permeability Water table Wind erosion
1968:	
Evart	Excessive permeability Flooding Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1969:	
Evart	Channeled Excessive permeability Flooding Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Isan	Channeled Excessive permeability Flooding Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion

Land Capability and Yields per Acre of Crops and Pasture

(Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Barley	Bromegrass-alfalfa hay	Corn	Corn silage	Kentucky bluegrass	Oats
		Bu	Tons	Bu	Tons	AUM*	Bu
82B—Redeye	3s	50	2.3	65	6.5	3.3	60
82C—Redeye	3e	40	1.9	55	5.5	2.8	50
133B—Dalbo	2e	65	5.0	85	8.5	3.8	80
133C—Dalbo	3e	50	4.2	70	7.0	3.2	65
139B—Huntersville	3s	50	2.3	65	6.5	3.5	60
147—Spooner	4w	50	---	70	7.0	3.3	65
158B—Zimmerman	4s	25	2.2	40	4.0	2.5	35
158C—Zimmerman	6s	20	1.9	30	3.0	2.2	25
167A—Baudette	1	75	4.8	100	10.0	3.2	95
170—Blomford	3w	35	---	50	5.0	3.6	45
202—Meehan	4w	35	---	50	5.0	3.6	45
207B—Nymore	4s	30	2.0	45	4.5	2.0	40
207C—Nymore	6s	25	1.7	40	4.0	1.7	35
207D—Nymore	6s	---	1.4	---	---	1.6	---
260—Duelm	4s	40	2.3	55	5.5	3.5	50
261—Isan	5w	---	---	---	---	---	---
267B—Snellman	2e	60	4.2	85	8.5	3.2	80
346—Talmoon	2w	50	---	70	7.0	3.3	65
406A—Dorset	3s	40	2.4	55	5.5	2.2	50

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Barley	Bromegrass-alfalfa hay	Corn	Corn silage	Kentucky bluegrass	Oats
		Bu	Tons	Bu	Tons	AUM*	Bu
488--Becida	3w	---	---	---	---	3.1	---
526C--Steamboat	4e	---	---	---	---	3.4	---
Two Inlets	4s						
Seelyeville	8w						
526E--Steamboat	6e	---	---	---	---	2.1	---
Two Inlets	6s						
Seelyeville	8w						
540--Seelyeville	6w	---	---	---	---	---	---
541--Rifle	6w	---	---	---	---	---	---
545--Rondeau	6w	---	---	---	---	---	---
567A--Verndale	3s	45	2.5	60	6.0	2.3	55
574G--Steamboat	7e	---	---	---	---	1.9	---
Two Inlets	7s						
628--Talmoon	6w	---	---	---	---	---	---
672--Willosippi	4w	50	---	70	7.0	3.3	65
675C--Two Inlets	4s	---	---	---	---	2.1	---
Eagleview	4s						
Steamboat	4e						
675E--Two Inlets	6s	---	---	---	---	1.6	---
Eagleview	6s						
Steamboat	6e						
675G--Two Inlets	7s	---	---	---	---	1.4	---
Eagleview	6s						
Steamboat	7e						

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Barley	Bromegrass-alfalfa hay	Corn	Corn silage	Kentucky bluegrass	Oats
		Bu	Tons	Bu	Tons	AUM*	Bu
701--Runeberg	6w	---	---	---	---	---	---
709B--Lengby	2e	65	5.0	85	8.5	3.8	80
709C--Lengby	3e	55	4.2	75	7.5	3.2	70
719B--Rondeau	6w	---	---	---	---	---	---
731A--Sanburn	3s	35	2.1	50	5.5	3.3	45
744B--Debs	2e	60	5.0	85	8.5	3.8	80
Akeley	4s						
746--Haslie	6w	---	---	---	---	---	---
775B--Sugarbush	3s	35	2.2	50	5.0	3.3	45
Two Inlets	4s						
775C--Sugarbush	4e	25	1.9	40	4.0	2.8	35
Two Inlets	4s						
778B--Dorset	3s	35	2.4	50	5.0	2.1	45
Corliss	4s						
778C--Dorset	4e	30	2.0	45	4.5	1.8	40
Corliss	4s						
797--Mooselake	6w	---	---	---	---	---	---
Lupton	7w						
799--Seelyeville	6w	---	---	---	---	---	---
Bowstring	6w						
820B--Potatolake	2e	75	5.0	95	9.5	3.8	90
820C--Potatolake	3e	65	4.2	85	8.5	3.2	80

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Barley	Bromegrass-alfalfa hay	Corn	Corn silage	Kentucky bluegrass	Oats
		Bu	Tons	Bu	Tons	AUM*	Bu
831C		30	2.0	45	4.5	2.8	40
Akeley	4s						
Debs	3e						
831E		---	---	---	---	1.3	---
Akeley	6s						
Debs	6e						
844B		30	2.1	45	4.5	3.1	40
Sanburn	3s						
Graycalm	4s						
867B		25	2.1	40	4.0	2.5	35
Graycalm	4s						
Menahga	4s						
867C		20	1.9	30	3.0	2.2	25
Graycalm	6s						
Menahga	4s						
867E		---	---	---	---	1.3	---
Graycalm	6s						
Menahga	7s						
867F		---	---	---	---	1.0	---
Graycalm	7s						
Menahga	7s						
1015	8s	---	---	---	---	---	---
Udipsamments							
1016	6s	---	---	---	---	---	---
Udorthents							
1021C		20	1.9	30	3.0	2.2	25
Graycalm	6s						
Sanburn	4e						
1027.							
Udorthents							
1030:							
Pits, gravel.							
Udipsamments.							
1111	6w	---	---	---	---	---	---
Nidaros							

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Barley	Bromegrass-alfalfa hay	Corn	Corn silage	Kentucky bluegrass	Oats
		Bu	Tons	Bu	Tons	AUM*	Bu
1113		---	---	---	---	---	---
Haslie	8w						
Seelyeville	8w						
Cathro	8w						
1126B		40	2.5	55	5.5	2.2	50
Verndale	3s						
Nymore	4s						
1127A		40	2.2	55	5.5	3.4	50
Bootlake	3s						
Graycalm	4s						
1127B		40	2.2	55	5.5	3.2	50
Bootlake	3s						
Graycalm	4s						
1136	6w	---	---	---	---	---	---
Nidaros							
1164	1	75	4.8	95	9.5	3.2	90
Zerkel							
1200	2w	50	---	70	7.0	3.3	65
Egglake							
1230		---	---	---	---	---	---
Haslie	8w						
Nidaros	8w						
1238E		---	---	---	---	1.3	---
Two Inlets	6s						
Sugarbush	6e						
1238F		---	---	---	---	1.0	---
Two Inlets	7s						
Sugarbush	6e						
1244B		---	---	---	---	4.0	---
Sol	6s						
Sugarbush	6s						
1244C		---	---	---	---	3.4	---
Sol	6s						
Sugarbush	6s						
1244E		---	---	---	---	3.2	---
Sol	7s						
Sugarbush	6s						

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Barley	Bromegrass-alfalfa hay	Corn	Corn silage	Kentucky bluegrass	Oats
		Bu	Tons	Bu	Tons	AUM*	Bu
1247D---------- Corliss---------	6e	---	1.4	---	---	1.5	---
Dorset----------	6e						
1248C---------- Nymore----------	6s	25	1.7	40	4.0	1.7	35
Verndale--------	4e						
1249C---------- Graycalm--------	6s	20	1.9	30	3.0	2.2	25
Bootlake--------	4e						
1271---------- Roscommon	6w	---	---	---	---	---	---
1272B---------- Sol	2e	65	4.2	85	8.5	3.2	80
1294---------- Nary	2s	65	4.2	85	8.5	3.2	80
1319B---------- Rockwood	2e	60	4.0	80	8.0	4.0	75
1319C---------- Rockwood	3e	50	3.4	70	7.0	3.4	65
1319D---------- Rockwood	4e	---	---	---	---	3.0	---
1320B---------- Blowers	2e	60	3.8	80	8.0	4.0	75
1321---------- Paddock---------	2w	50	---	65	6.5	3.6	60
Becida----------	2w						
1332B---------- Rockwood	3s	---	---	---	---	3.4	---
1332C---------- Rockwood	4e	---	---	---	---	2.9	---
1332E---------- Rockwood	6s	---	---	---	---	2.2	---
1334---------- Huntersville	3s	40	2.0	55	5.5	3.0	50
1336---------- Blowers	3s	---	---	---	---	3.4	---
1421B---------- Rockwood--------	3s	---	---	---	---	3.4	---
Two Inlets------	4s						

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Barley	Bromegrass-alfalfa hay	Corn	Corn silage	Kentucky bluegrass	Oats
		Bu	Tons	Bu	Tons	AUM*	Bu
1421C---------- Rockwood--------	4e	---	---	---	---	2.9	---
Two Inlets------	4s						
1421E---------- Rockwood--------	6s	---	---	---	---	2.2	---
Two Inlets------	6s						
1438B---------- Braham	3s	65	4.2	85	8.5	3.2	80
1439---------- Cathro	6w	---	---	---	---	---	---
1440B---------- Redeye	3s	35	2.0	50	5.0	2.8	45
1440C---------- Redeye	3e	30	1.7	45	4.5	2.4	40
1444---------- Wurtsmith	4s	40	2.2	55	5.5	3.5	50
1445---------- Markey	6w	---	---	---	---	---	---
1447---------- Beltrami	1	75	5.0	95	9.5	3.8	90
1450B---------- Sanburn	6s	---	---	---	---	3.0	---
1450C---------- Sanburn	6s	---	---	---	---	2.6	---
1450E---------- Sanburn	6s	---	---	---	---	1.9	---
1460B---------- Nebish	2e	75	4.8	95	9.5	3.2	90
1460C---------- Nebish	3e	80	4.1	85	8.5	2.7	80
1943---------- Roscommon	4w	30	---	45	4.5	3.6	40
1956---------- Staples	3w	35	---	50	5.0	3.6	45
1968---------- Evart	4w	---	---	---	---	---	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Barley	Bromegrass-alfalfa hay	Corn	Corn silage	Kentucky bluegrass	Oats
		Bu	Tons	Bu	Tons	AUM*	Bu
1969		---	---	---	---	---	---
Evart	8w						
Isan	7w						

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
133B	Dalbo silt loam, 2 to 8 percent slopes
147	Spooner silt loam, 0 to 2 percent slopes (where drained)
167A	Baudette silt loam, 1 to 3 percent slopes
267B	Snellman sandy loam, 2 to 8 percent slopes
346	Talmoon loam, 0 to 2 percent slopes (where drained)
672	Willosippi loam, 0 to 2 percent slopes (where drained)
709B	Lengby fine sandy loam, 2 to 8 percent slopes
820B	Potatolake very fine sandy loam, 1 to 8 percent slopes
1164	Zerkel loam, 1 to 3 percent slopes
1200	Egglake loam, 0 to 2 percent slopes (where drained)
1272B	Sol fine sandy loam, 2 to 6 percent slopes
1294	Nary fine sandy loam, 1 to 3 percent slopes
1319B	Rockwood sandy loam, 2 to 6 percent slopes, stony
1320B	Blowers sandy loam, 1 to 5 percent slopes, stony
1321	Paddock-Becida complex, 0 to 2 percent slopes, stony (where drained)
1447	Beltrami very fine sandy loam, 1 to 3 percent slopes
1460B	Nebish very fine sandy loam, moderately wet, 2 to 6 percent slopes

Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
82B:					
Redeye	Honeysuckle	Amur maple, Siberian peashrub, lilac.	Manchurian crabapple, white spruce, blue spruce, red pine, eastern white pine.	Green ash, jack pine.	---
82C:					
Redeye	Honeysuckle	Amur maple, Siberian peashrub, lilac.	Manchurian crabapple, white spruce, blue spruce, red pine, eastern white pine.	Green ash, jack pine.	---
133B:					
Dalbo	---	Amur maple, Siberian peashrub, Tatarian honeysuckle, lilac, northern whitecedar, American cranberrybush.	Manchurian crabapple, white spruce, common chokecherry.	Green ash, jack pine, eastern white pine.	---
133C:					
Dalbo	---	Amur maple, Siberian peashrub, Tatarian honeysuckle, lilac, northern whitecedar, American cranberrybush.	Manchurian crabapple, white spruce, common chokecherry.	Green ash, jack pine, eastern white pine.	---
139B:					
Huntersville	Honeysuckle	Amur maple, Siberian peashrub, lilac.	Manchurian crabapple, white spruce, blue spruce.	Green ash, jack pine, red pine, eastern white pine.	---
147:					
Spooner	---	Siberian peashrub, redosier dogwood, lilac, American cranberrybush.	White spruce, blue spruce, Scotch pine, northern whitecedar.	Green ash, eastern white pine, American basswood, Siberian elm.	Carolina poplar.
158B:					
Zimmerman	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
158C:					
Zimmerman	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
167A:					
Baudette	---	Amur maple, Siberian peashrub, redosier dogwood, lilac.	Manchurian crabapple, white spruce, blue spruce, common chokecherry, northern whitecedar.	Green ash, red pine, eastern white pine.	---
170:					
Blomford	---	Peking cotoneaster, redosier dogwood, honeysuckle, northern whitecedar, American cranberrybush.	Balsam fir, white spruce.	Silver maple, green ash, Siberian elm.	---
202:					
Meehan	---	Siberian peashrub, redosier dogwood, American plum, lilac.	White spruce, blue spruce, northern whitecedar.	Green ash, jack pine, red pine, eastern white pine.	---
207B:					
Nymore	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
207C:					
Nymore	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
207D:					
Nymore	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
260:					
Duelm	---	Siberian peashrub, redosier dogwood, lilac, American cranberrybush.	White spruce, blue spruce.	Green ash, jack pine, red pine, eastern white pine.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
267B:					
Snellman	---	Amur maple, American plum, lilac, American cranberrybush.	Hackberry, Manchurian crabapple, blue spruce, bur oak, northern whitecedar.	Green ash, eastern white pine, Siberian elm.	---
346:					
Talmoon	---	Siberian peashrub, redosier dogwood, common chokecherry, American cranberrybush.	Amur maple, Manchurian crabapple, white spruce, Scotch pine, northern whitecedar.	Green ash, eastern white pine, American basswood.	Silver maple.
406A:					
Dorset	Siberian peashrub, Peking cotoneaster, lilac.	Redosier dogwood, Manchurian crabapple, common chokecherry.	Green ash, jack pine, red pine, eastern white pine.	---	---
488:					
Becida	Peking cotoneaster	Redosier dogwood, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	White spruce, blue spruce.	Green ash, jack pine, eastern white pine.	---
526C:					
Steamboat	Peking cotoneaster	Amur maple, Siberian peashrub, American plum, common chokecherry, lilac, American cranberrybush.	Hackberry, Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine, Siberian elm.	---
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Manchurian crabapple, red pine.	Jack pine	---
526E:					
Steamboat	Peking cotoneaster	Amur maple, Siberian peashrub, American plum, common chokecherry, lilac, American cranberrybush.	Hackberry, Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine, Siberian elm.	---
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Manchurian crabapple, red pine.	Jack pine	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
567A:					
Verndale	---	Siberian peashrub, hackberry, redosier dogwood, lilac.	Green ash, Manchurian crabapple, white spruce, blue spruce, red pine, eastern white pine.	---	Carolina poplar.
574G:					
Steamboat	Peking cotoneaster	Amur maple, Siberian peashrub, American plum, common chokecherry, lilac, American cranberrybush.	Hackberry, Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine, Siberian elm.	---
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Manchurian crabapple, red pine.	Jack pine	---
672:					
Willosippi	---	Siberian peashrub, redosier dogwood, common chokecherry, American cranberrybush.	Amur maple, Manchurian crabapple, white spruce, northern whitecedar.	Green ash, eastern white pine, American basswood.	Silver maple.
675C:					
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Manchurian crabapple, red pine.	Jack pine	---
Eagleview	---	Siberian peashrub, redosier dogwood, blue spruce, lilac, northern whitecedar.	Silver maple, green ash, Manchurian crabapple, white spruce, red pine, Scotch pine.	Jack pine, American basswood.	---
Steamboat	Peking cotoneaster	Amur maple, Siberian peashrub, American plum, common chokecherry, lilac, American cranberrybush.	Hackberry, Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine, Siberian elm.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
675E:					
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Manchurian crabapple, red pine.	Jack pine	---
Eagleview	---	Siberian peashrub, redosier dogwood, blue spruce, lilac.	Silver maple, green ash, Manchurian crabapple, white spruce, red pine, Scotch pine.	Jack pine	---
Steamboat	Peking cotoneaster	Amur maple, Siberian peashrub, American plum, lilac, American cranberrybush.	Hackberry, Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine, Siberian elm.	---
675G:					
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Manchurian crabapple, red pine.	Jack pine	---
Eagleview	---	Siberian peashrub, redosier dogwood, lilac, northern whitecedar.	Silver maple, green ash, Manchurian crabapple, white spruce, red pine, Scotch pine.	Jack pine, American basswood.	---
Steamboat	Peking cotoneaster	Amur maple, Siberian peashrub, American plum, lilac, American cranberrybush.	Hackberry, Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine, Siberian elm.	---
709B:					
Lengby	Peking cotoneaster	Siberian peashrub, Manchurian crabapple, lilac, American cranberrybush.	White spruce, blue spruce, bur oak, northern whitecedar.	Green ash, jack pine, Siberian elm.	---
709C:					
Lengby	Peking cotoneaster	Siberian peashrub, Manchurian crabapple, lilac, American cranberrybush.	White spruce, blue spruce, bur oak, northern whitecedar.	Green ash, jack pine, Siberian elm.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
731A:					
Sanburn	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, bur oak, lilac, northern whitecedar.	Hackberry, green ash, jack pine, blue spruce, red pine.	Eastern white pine	---
744B:					
Debs	---	Amur maple, Siberian peashrub, redosier dogwood, lilac.	Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine.	---
Akeley	Honeysuckle	Amur maple, Siberian peashrub, lilac.	Hackberry, green ash, Manchurian crabapple, white spruce, blue spruce, red pine, eastern white pine.	Jack pine	---
775B:					
Sugarbush	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	Carolina poplar.
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Red pine	Jack pine	---
775C:					
Sugarbush	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	Carolina poplar.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
775C:					
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Red pine	Jack pine	---
778B:					
Dorset	Siberian peashrub, Peking cotoneaster, lilac.	Amur maple, Manchurian crabapple, common chokecherry.	Green ash, jack pine, red pine, eastern white pine, bur oak.	---	---
Corliss	---	Siberian peashrub, redosier dogwood, common chokecherry, lilac, American cranberrybush.	Silver maple, green ash, white spruce, blue spruce, red pine, Scotch pine, bur oak.	Carolina poplar.	---
778C:					
Dorset	Siberian peashrub, Peking cotoneaster, lilac.	Amur maple, Manchurian crabapple, common chokecherry.	Green ash, jack pine, red pine, eastern white pine, bur oak.	---	---
Corliss	---	Siberian peashrub, redosier dogwood, common chokecherry, lilac, American cranberrybush.	Silver maple, green ash, white spruce, blue spruce, red pine, Scotch pine, bur oak.	Carolina poplar---	---
820B:					
Potatolake	---	Amur maple, Siberian peashrub, redosier dogwood, lilac.	Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine.	---
820C:					
Potatolake	---	Amur maple, Siberian peashrub, redosier dogwood, lilac.	Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine.	---
831C:					
Akeley	Honeysuckle	Amur maple, Siberian peashrub, lilac.	Hackberry, green ash, white spruce, blue spruce, red pine, eastern white pine.	Jack pine	---
Debs	---	Amur maple, Siberian peashrub, redosier dogwood, lilac.	Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
831E:					
Akeley	Honeysuckle	Amur maple, Siberian peashrub, lilac.	Hackberry, green ash, white spruce, blue spruce, red pine, eastern white pine.	Jack pine	---
Debs	---	Amur maple, Siberian peashrub, redosier dogwood, lilac.	Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, red pine, eastern white pine.	---
844B:					
Sanburn	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, bur oak, lilac, northern whitecedar.	Hackberry, green ash, jack pine, blue spruce, red pine.	Eastern white pine	---
Graycalm	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
867B:					
Graycalm	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
Menahga	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
867C:					
Graycalm	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
Menahga	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
867E:					
Graycalm	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
Menahga	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
867F:					
Graycalm	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
Menahga	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
1021C:					
Graycalm	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
Sanburn	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, bur oak, lilac, northern whitecedar.	Hackberry, green ash, jack pine, blue spruce, red pine.	Eastern white pine	---
1126B:					
Verndale	---	Siberian peashrub, hackberry, common chokecherry, lilac.	Green ash, Manchurian crabapple, white spruce, blue spruce, red pine, eastern white pine.	---	Carolina poplar.
Nymore	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, common chokecherry, lilac.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1127A:					
Bootlake	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	---
Graycalm	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, common chokecherry, lilac.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
1127B:					
Bootlake	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	---
Graycalm	---	Siberian peashrub, Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
1164:					
Zerkel	---	Siberian peashrub, redosier dogwood, American plum, common chokecherry, lilac, northern whitecedar.	Amur maple, Manchurian crabapple, white spruce, blue spruce, Scotch pine.	Green ash, red pine, northern red oak, American basswood.	Carolina poplar.
1200:					
Egglake	---	Peking cotoneaster, redosier dogwood, northern whitecedar, arrowwood.	White spruce, blue spruce.	Green ash, eastern white pine, Siberian elm.	Silver maple, Carolina poplar.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1238E:					
Two Inlets	---	Siberian peashrub, redosier dogwood, honeysuckle, bur oak, lilac.	Manchurian crabapple, red pine.	Jack pine	---
Sugarbush	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	Carolina poplar.
1238F:					
Two Inlets	---	Siberian peashrub, redosier dogwood, honeysuckle, bur oak, lilac.	Manchurian crabapple, red pine.	Jack pine	---
Sugarbush	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	Carolina poplar.
1244B:					
Sol	---	Amur maple, American plum, lilac, American cranberrybush.	Hackberry, redosier dogwood, Manchurian crabapple, blue spruce, bur oak.	Green ash, eastern white pine, Siberian elm.	---
Sugarbush	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	Carolina poplar.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1244C:					
Sol	---	Amur maple, American plum, lilac, American cranberrybush.	Hackberry, redosier dogwood, Manchurian crabapple, blue spruce, bur oak.	Green ash, eastern white pine, Siberian elm.	---
Sugarbush	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	Carolina poplar.
1244E:					
Sol	---	Amur maple, American plum, lilac, American cranberrybush.	Hackberry, redosier dogwood, Manchurian crabapple, blue spruce, bur oak.	Green ash, eastern white pine, Siberian elm.	---
Sugarbush	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	Carolina poplar.
1247D:					
Corliss	---	Amur maple, Siberian peashrub, redosier dogwood, common chokecherry, lilac.	Silver maple, green ash, white spruce, blue spruce, Scotch pine, bur oak.	Carolina poplar	---
Dorset	Siberian peashrub, Peking cotoneaster, lilac.	Redosier dogwood, Manchurian crabapple, common chokecherry.	Green ash, jack pine, red pine, eastern white pine, bur oak.	---	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1248C:					
Nymore	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, common chokecherry, lilac.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
Verndale	---	Siberian peashrub, hackberry, redosier dogwood, lilac.	Green ash, Manchurian crabapple, white spruce, blue spruce, red pine, eastern white pine.	---	Carolina poplar.
1249C:					
Graycalm	---	Siberian peashrub, redosier dogwood, Manchurian crabapple, common chokecherry, lilac.	Green ash, jack pine, red pine, bur oak.	Eastern white pine, Siberian elm.	---
Bootlake	Honeysuckle	Amur maple, Siberian peashrub, hackberry, redosier dogwood, Manchurian crabapple, American plum, common chokecherry, bur oak, northern whitecedar, American cranberrybush.	---	---	---
1272B:					
Sol	---	Amur maple, American plum, lilac, American cranberrybush.	Hackberry, Manchurian crabapple, white spruce, blue spruce, bur oak.	Green ash, eastern white pine, Siberian elm.	---
1294:					
Nary	---	Siberian peashrub, redosier dogwood, blue spruce, lilac, American cranberrybush.	White spruce, northern whitecedar.	Green ash, jack pine, red pine, eastern white pine.	---
1319B:					
Rockwood	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1319C:					
Rockwood--------	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---
1319D:					
Rockwood--------	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---
1320B:					
Blowers---------	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, bur oak.	Silver maple, green ash, red pine, eastern white pine.	---
1321:					
Paddock---------	---	Siberian peashrub, redosier dogwood, blue spruce, lilac, American cranberrybush.	White spruce, northern whitecedar.	Green ash, jack pine, red pine, eastern white pine, American basswood.	---
Becida----------	Peking cotoneaster	Manchurian crabapple, common chokecherry, lilac, American cranberrybush.	Blue spruce-------	Green ash, jack pine, white spruce, eastern white pine.	---
1332B:					
Rockwood--------	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---
1332C:					
Rockwood--------	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---
1332E:					
Rockwood--------	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---
1334:					
Huntersville----	Honeysuckle-------	Amur maple, Siberian peashrub, lilac.	Manchurian crabapple, white spruce, blue spruce.	Green ash, jack pine, red pine, eastern white pine.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1336:					
Blowers	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, bur oak.	Silver maple, green ash, red pine, eastern white pine.	---
1421B:					
Rockwood	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Red pine	Jack pine	---
1421C:					
Rockwood	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Red pine	Jack pine	---
1421E:					
Rockwood	---	Amur maple, Siberian peashrub, lilac, northern whitecedar.	Manchurian crabapple, white spruce, blue spruce.	Green ash, red pine, eastern white pine.	---
Two Inlets	---	Siberian peashrub, honeysuckle, bur oak, lilac, American cranberrybush.	Red pine	Jack pine	---
1438B:					
Braham	---	Amur maple, Siberian peashrub, lilac, American cranberrybush.	White spruce, blue spruce, red pine, common chokecherry.	Green ash, jack pine, eastern white pine.	---
1440B:					
Redeye	Honeysuckle	Amur maple, Siberian peashrub, lilac.	Manchurian crabapple, white spruce, blue spruce, red pine, eastern white pine.	Green ash, jack pine.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1440C: Redeye	Honeysuckle	Amur maple, Siberian peashrub, lilac.	Manchurian crabapple, white spruce, blue spruce, red pine, eastern white pine.	Green ash, jack pine.	---
1444: Wurtsmith	Peking cotoneaster	Amur maple, Siberian peashrub, common chokecherry, lilac.	Jack pine, red pine.	Eastern white pine	---
1447: Beltrami	---	Siberian peashrub, redosier dogwood, lilac, American cranberrybush.	White spruce, blue spruce, common chokecherry.	Green ash, jack pine, red pine, eastern white pine.	---
1460B: Nebish	---	Amur maple, Siberian peashrub, redosier dogwood, lilac.	Manchurian crabapple, white spruce, blue spruce, common chokecherry, northern whitecedar.	Green ash, red pine, eastern white pine.	---
1460C: Nebish	---	Amur maple, Siberian peashrub, redosier dogwood, lilac.	Manchurian crabapple, white spruce, blue spruce, common chokecherry, northern whitecedar.	Green ash, red pine, eastern white pine.	---
1943: Roscommon	---	Siberian peashrub, redosier dogwood, common ninebark, common chokecherry, lilac.	Amur maple, white spruce.	Green ash, eastern white pine.	Silver maple.
1956: Staples	---	Siberian peashrub, redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Green ash, Siberian elm.	Silver maple.

Windbreak Suitability Groups

(See text for descriptions of the groups listed in this table)

Map symbol and soil name	Windbreak suitability group
82B, 82C:	
Redeye	5
133B, 133C:	
Dalbo	4
139B:	
Huntersville	5
147:	
Spooner	2
158B, 158C:	
Zimmerman	7
167A:	
Baudette	3
170:	
Blomford	2
202:	
Meehan	1
207B, 207C, 207D:	
Nymore	7
260:	
Duelm	1
261:	
Isan	10
267B:	
Snellman	3
346:	
Talmoon	2
406A:	
Dorset	6G
488:	
Becida	2
526C, 526E:	
Steamboat	3
Two Inlets	7
Seelyeville	10
540:	
Seelyeville	10
541:	
Rifle	10

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
545:	
Rondeau	10
567A:	
Verndale	7
574G:	
Steamboat	3
Two Inlets	7
628:	
Talmoon	10
672:	
Willosippi	2
675C, 675E, 675G:	
Two Inlets	7
Eagleview	7
Steamboat	3
701:	
Runeberg	10
709B, 709C:	
Lengby	5
719B:	
Rondeau	10
731A:	
Sanburn	5
744B:	
Debs	3
Akeley	7
746:	
Haslie	10
775B, 775C:	
Sugarbush	6G
Two Inlets	7
778B, 778C:	
Dorset	6G
Corliss	7
797:	
Mooselake	10
Lupton	10
799:	
Seelyeville	10
Bowstring	10

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
820B, 820C:	
Potatolake	3
831C, 831E:	
Akeley	7
Debs	3
844B:	
Sanburn	5
Graycalm	7
867B, 867C, 867E, 867F:	
Graycalm	7
Menahga	7
1015:	
Udipsamments	10
1016:	
Udorthents	10
1021C:	
Graycalm	7
Sanburn	5
1027:	
Udorthents	10
1030:	
Pits, gravel	10
Udipsamments	10
1111:	
Nidaros	10
1113:	
Haslie	10
Cathro	10
Seelyeville	10
1126B:	
Verndale	7
Nymore	7
1127A, 1127B:	
Bootlake	6G
Graycalm	7
1136:	
Nidaros	10
1164:	
Zerkel	1

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
1200:	
Egglake	2
1230:	
Haslie	10
Nidaros	10
1238E, 1238F:	
Two Inlets	7
Sugarbush	6G
1244B, 1244C, 1244E:	
Sol	3
Sugarbush	6G
1247D:	
Corliss	7
Dorset	6G
1248C:	
Nymore	7
Verndale	7
1249C:	
Graycalm	7
Bootlake	6G
1271:	
Roscommon	2
1272B:	
Sol	3
1294:	
Nary	1
1319B, 1319C, 1319D:	
Rockwood	4F
1320B:	
Blowers	4F
1321:	
Paddock	1
Becida	2
1332B, 1332C, 1332E:	
Rockwood	4F
1334:	
Huntersville	5
1336:	
Blowers	4F

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
1421B, 1421C, 1421E:	
Rockwood	4F
Two Inlets	7
1438B:	
Braham	5
1439:	
Cathro	10
1440B, 1440C:	
Redeye	5
1444:	
Wurtsmith	7
1445:	
Markey	10
1447:	
Beltrami	1
1450B, 1450C, 1450E:	
Sanburn	5
1460B, 1460C:	
Nebish	3
1943:	
Roscommon	2
1956:	
Staples	2
1968:	
Evart	10
1969:	
Evart	10
Isan	2

Forest Land

Forest land management should be based on the types of wood products desired and the suitability of the soils for producing the type and volume of timber needed. The proper management of the forest resource in the county is important to the local economy and provides the necessary balance between timber harvesting and forest regeneration (fig. 13). Approximately 80,000 to 100,000 cords of timber is harvested from Hubbard County each year to help meet the demands of the forest products industry, and those demands are likely to increase in the future. Sound forest management is needed by county, State, Federal, and private agencies to ensure the quality and quantity of the timber resource in Hubbard County for many years to come and to meet the demands of multiple uses. More information on private forest management is available from the Minnesota Department of Natural Resources, local offices of the Natural Resources Conservation Service, or private forestry managers.

Information about the hazards and limitations that should be considered in areas used as forest land are given in the tables "Forest Land Harvest Equipment Considerations," "Forest Haul Road Considerations," "Forest Log Landing Considerations," and "Forest Land Site Preparation and Planting Considerations."

Forest Land Harvest Equipment Considerations

For most soils spring is the most limiting season. Alternate thawing and freezing during snowmelt cause saturation and low strength of the surface soil layers. When thawing is complete, saturation continues for short periods in well drained soils to nearly all year in very poorly drained depressional soils. Degrees of wetness are generally proportionate to water table height and duration. The water table generally is lower in the summer during the heavy use of moisture by vegetation and is nearer the surface during periods when absorbed precipitation is greater than the vegetation requires. Harvesting during periods of saturation usually results in severe soil damage, except when the soil is frozen. The preferred season for timber harvest on many soils is winter, when wetness and low soil strength can be overcome by freezing.

Considerations shown in the table are as follows:

Slope.—The upper slope limit is more than 15 percent.

Flooding.—The map unit component is frequently flooded.

Wetness.—The map unit component is somewhat poorly drained, poorly drained, or very poorly drained or has a perched water table (any drainage class).

Surface stones.—The words "extremely stony" are in the map unit name.

Surface boulders.—The word "bouldery" is in the map unit name.

Susceptible to rutting and wheel slippage (low strength).—The AASHTO classification is A-6, A-7, or A-8 in any layer at a depth of 20 inches or less.

Poor traction (loose sandy material).—The USDA texture includes sands or loamy sands in any layer at a depth of 10 inches or less.

Forest Haul Road Considerations

Haul roads serve as transportation routes from log landings to primary roads. Generally, haul roads are unpaved, but some are graveled.

Considerations shown in the table are as follows:

Slope.—The slope is 8 percent or more.

Flooding.—The map unit component is frequently flooded.

Wetness.—The map unit component is somewhat poorly drained, poorly drained, or very poorly drained or has a perched water table (any drainage class).

Surface boulders.—The word "bouldery" is in the map unit name.

Low bearing strength.—The AASHTO classification is A-6, A-7, or A-8 in any layer at a depth of 20 inches or less.

Forest Log Landing Considerations

Log landings are areas where logs are assembled for transportation. Areas that require little or no cutting, filling, or surface preparation are desired (fig. 14).

Considerations shown in the table are as follows:

Slope.—The slope is more than 3 percent.

Flooding.—The map unit component is occasionally flooded or frequently flooded.

Wetness.—The map unit component is somewhat poorly drained, poorly drained, or very poorly drained or has a perched water table (any drainage class).

Surface boulders.—The word “bouldery” is in the map unit name.

Susceptible to rutting and wheel slippage (low strength).—The AASHTO classification is A-6, A-7, or A-8 in any layer at a depth of 20 inches or less.

Forest Land Site Preparation and Planting Considerations

Considerations shown in this table are as follows:

Slope.—The upper slope limit is more than 15 percent.

Flooding.—The map unit component is frequently flooded.

Wetness.—The map unit component is somewhat poorly drained, poorly drained, or very poorly drained or has a perched water table (any drainage class).

Surface stones.—The word “stony” is in the map unit name.

Surface boulders.—The word “bouldery” is in the map unit name.

Water erosion.—The slope is 8 percent or more.

Potential poor tilth and compaction.—The AASHTO classification is A-6 or A-7 in the upper 10 inches.

Cobbly surface.—The word “cobbly” is in the map unit name.

Figure 13.—A wooded area of Graycalm-Menahga complex, 1 to 8 percent slopes. Red pine, shown in the foreground, is commonly planted in harvested areas to meet future demands for forest products.

Figure 14.—A log landing in an area of Steamboat-Two Inlets-Seelyeville complex, pitted, 0 to 15 percent slopes. Forest products management and wildlife management are the major land uses in the Itasca Moraine region.

Forest Land Harvest Equipment Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Forest land harvest equipment considerations
82B, 82C:	
Redeye	Poor traction (loose sandy material)
133B, 133C:	
Dalbo	Susceptible to rutting and wheel slippage
139B:	
Huntersville	Poor traction (loose sandy material) Wetness
147:	
Spooner	Susceptible to rutting and wheel slippage Wetness
158B, 158C:	
Zimmerman	Poor traction (loose sandy material)
167A:	
Baudette	Susceptible to rutting and wheel slippage
170:	
Blomford	Poor traction (loose sandy material) Wetness
202:	
Meehan	Poor traction (loose sandy material) Wetness
207B, 207C:	
Nymore	Poor traction (loose sandy material)
207D:	
Nymore	Poor traction (loose sandy material) Slope
260:	
Duelm	Poor traction (loose sandy material)
267B:	
Snellman	Susceptible to rutting and wheel slippage
346:	
Talmoon	Susceptible to rutting and wheel slippage Wetness
406A:	
Dorset	Susceptible to rutting and wheel slippage
488:	
Becida	Poor traction (loose sandy material) Wetness
526C:	
Steamboat	No major considerations or hazards
Two Inlets	Poor traction (loose sandy material)
Seelyeville	Susceptible to rutting and wheel slippage Wetness

Forest Land Harvest Equipment Considerations--Continued

Map symbol and soil name	Forest land harvest equipment considerations
526E:	
Steamboat	Slope
Two Inlets	Poor traction (loose sandy material) Slope
Seelyeville	Susceptible to rutting and wheel slippage Wetness
541:	
Rifle	Susceptible to rutting and wheel slippage Wetness
567A:	
Verndale	No major considerations or hazards
574G:	
Steamboat	Slope
Two Inlets	Poor traction (loose sandy material) Slope
628:	
Talmoon	Susceptible to rutting and wheel slippage Wetness
672:	
Willosippi	Susceptible to rutting and wheel slippage Wetness
675C:	
Two Inlets	Poor traction (loose sandy material)
Eagleview	Poor traction (loose sandy material)
Steamboat	No major considerations or hazards
675E, 675G:	
Two Inlets	Poor traction (loose sandy material) Slope
Eagleview	Poor traction (loose sandy material) Slope
Steamboat	Slope
701:	
Runeberg	Susceptible to rutting and wheel slippage Wetness
709B, 709C:	
Lengby	Susceptible to rutting and wheel slippage
731A:	
Sanburn	Susceptible to rutting and wheel slippage
744B:	
Debs	Susceptible to rutting and wheel slippage
Akeley	Poor traction (loose sandy material)

Forest Land Harvest Equipment Considerations--Continued

Map symbol and soil name	Forest land harvest equipment considerations
775B, 775C:	
Sugarbush	Poor traction (loose sandy material)
Two Inlets	Poor traction (loose sandy material)
778B, 778C:	
Dorset	Susceptible to rutting and wheel slippage
Corliss	Poor traction (loose sandy material)
797:	
Mooselake	Susceptible to rutting and wheel slippage Wetness
Lupton	Susceptible to rutting and wheel slippage Wetness
820B, 820C:	
Potatolake	Susceptible to rutting and wheel slippage
831C:	
Akeley	Poor traction (loose sandy material)
Debs	Susceptible to rutting and wheel slippage
831E:	
Akeley	Poor traction (loose sandy material) Slope
Debs	Slope Susceptible to rutting and wheel slippage
844B:	
Sanburn	Susceptible to rutting and wheel slippage
Graycalm	Poor traction (loose sandy material)
867B, 867C:	
Graycalm	Poor traction (loose sandy material)
Menahga	Poor traction (loose sandy material)
867E, 867F:	
Graycalm	Poor traction (loose sandy material) Slope
Menahga	Poor traction (loose sandy material) Slope
1021C:	
Graycalm	Poor traction (loose sandy material)
Sanburn	Susceptible to rutting and wheel slippage
1111:	
Nidaros	Flooding Susceptible to rutting and wheel slippage Wetness
1126B:	
Verndale	No major considerations or hazards
Nymore	Poor traction (loose sandy material)

Forest Land Harvest Equipment Considerations--Continued

Map symbol and soil name	Forest land harvest equipment considerations
1127A, 1127B:	
Bootlake	Poor traction (loose sandy material)
Graycalm	Poor traction (loose sandy material)
1136:	
Nidaros	Susceptible to rutting and wheel slippage Wetness
1164:	
Zerkel	Susceptible to rutting and wheel slippage
1200:	
Egglake	Susceptible to rutting and wheel slippage Wetness
1238E, 1238F:	
Two Inlets	Poor traction (loose sandy material) Slope
Sugarbush	Poor traction (loose sandy material) Slope
1244B, 1244C:	
Sol	Susceptible to rutting and wheel slippage
Sugarbush	Poor traction (loose sandy material)
1244E:	
Sol	Slope Susceptible to rutting and wheel slippage
Sugarbush	Poor traction (loose sandy material) Slope
1247D:	
Corliss	Poor traction (loose sandy material) Slope
Dorset	Slope Susceptible to rutting and wheel slippage
1248C:	
Nymore	Poor traction (loose sandy material)
Verndale	No major considerations or hazards
1249C:	
Graycalm	Poor traction (loose sandy material)
Bootlake	Poor traction (loose sandy material)
1271:	
Roscommon	Poor traction (loose sandy material) Wetness
1272B:	
Sol	Susceptible to rutting and wheel slippage
1294:	
Nary	Susceptible to rutting and wheel slippage

Forest Land Harvest Equipment Considerations--Continued

Map symbol and soil name	Forest land harvest equipment considerations
1319B, 1319C:	
Rockwood	Poor traction (loose sandy material)
1319D:	
Rockwood	Poor traction (loose sandy material) Slope
1320B:	
Blowers	Wetness
1321:	
Paddock	Wetness
Becida	Susceptible to rutting and wheel slippage Wetness
1332B, 1332C:	
Rockwood	Poor traction (loose sandy material)
1332E:	
Rockwood	Poor traction (loose sandy material) Slope
1334:	
Huntersville	Poor traction (loose sandy material) Wetness
1336:	
Blowers	Poor traction (loose sandy material) Wetness
1421B, 1421C:	
Rockwood	Poor traction (loose sandy material)
Two Inlets	Poor traction (loose sandy material)
1421E:	
Rockwood	Poor traction (loose sandy material) Slope
Two Inlets	Poor traction (loose sandy material) Slope
1438B:	
Braham	Poor traction (loose sandy material)
1440B, 1440C:	
Redeye	Poor traction (loose sandy material)
1444:	
Wurtsmith	Poor traction (loose sandy material)
1447:	
Beltrami	Susceptible to rutting and wheel slippage Wetness
1450B, 1450C:	
Sanburn	Surface boulders Susceptible to rutting and wheel slippage

Forest Land Harvest Equipment Considerations--Continued

Map symbol and soil name	Forest land harvest equipment considerations
1450E:	
Sanburn	Slope Surface boulders Susceptible to rutting and wheel slippage
1460B, 1460C:	
Nebish	Susceptible to rutting and wheel slippage
1943:	
Roscommon	Poor traction (loose sandy material) Wetness
1956:	
Staples	Poor traction (loose sandy material) Wetness
1968:	
Evart	Susceptible to rutting and wheel slippage Wetness
1969:	
Evart	Flooding Susceptible to rutting and wheel slippage Wetness
Isan	Flooding Poor traction (loose sandy material) Wetness

Forest Haul Road Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Forest haul road considerations
82B:	
Redeye	No major considerations or hazards
82C:	
Redeye	Slope
133B, 133C:	
Dalbo	Low bearing strength Slope
139B:	
Huntersville	Wetness
147:	
Spooner	Low bearing strength Wetness
158B:	
Zimmerman	No major considerations or hazards
158C:	
Zimmerman	Slope
167A:	
Baudette	Low bearing strength
170:	
Blomford	Wetness
202:	
Meehan	Wetness
207B:	
Nymore	No major considerations or hazards
207C, 207D:	
Nymore	Slope
260:	
Duelm	No major considerations or hazards
267B:	
Snellman	Low bearing strength Slope
346:	
Talmoon	Low bearing strength Wetness
406A:	
Dorset	Low bearing strength
488:	
Becida	Wetness

Forest Haul Road Considerations--Continued

Map symbol and soil name	Forest haul road considerations
526C, 526E:	
Steamboat	Slope
Two Inlets	Slope
Seelyeville	Low bearing strength Wetness
541:	
Rifle	Low bearing strength Wetness
567A:	
Verndale	No major considerations or hazards
574G:	
Steamboat	Slope
Two Inlets	Slope
628:	
Talmoon	Low bearing strength Wetness
672:	
Willosippi	Low bearing strength Wetness
675C, 675E, 675G:	
Two Inlets	Slope
Eagleview	Slope
Steamboat	Slope
701:	
Runeberg	Low bearing strength Wetness
709B, 709C:	
Lengby	Low bearing strength Slope
731A:	
Sanburn	Low bearing strength
744B:	
Debs	Low bearing strength Slope
Akeley	Slope
775B, 775C:	
Sugarbush	Slope
Two Inlets	Slope
778B:	
Dorset	Low bearing strength
Corliss	No major considerations or hazards

Forest Haul Road Considerations--Continued

Map symbol and soil name	Forest haul road considerations
778C:	
Dorset	Low bearing strength Slope
Corliss	Slope
797:	
Mooselake	Low bearing strength Wetness
Lupton	Low bearing strength Wetness
820B, 820C:	
Potatolake	Low bearing strength Slope
831C, 831E:	
Akeley	Slope
Debs	Low bearing strength Slope
844B:	
Sanburn	Low bearing strength Slope
Graycalm	Slope
867B, 867C, 867E, 867F:	
Graycalm	Slope
Menahga	Slope
1021C:	
Graycalm	Slope
Sanburn	Low bearing strength Slope
1111:	
Nidaros	Flooding Low bearing strength Wetness
1126B:	
Verndale	No major considerations or hazards
Nymore	No major considerations or hazards
1127A:	
Bootlake	No major considerations or hazards
Graycalm	No major considerations or hazards
1127B:	
Bootlake	Slope
Graycalm	Slope
1136:	
Nidaros	Low bearing strength Wetness

Forest Haul Road Considerations--Continued

Map symbol and soil name	Forest haul road considerations
1164:	
Zerkel	Low bearing strength
1200:	
Egglake	Low bearing strength Wetness
1238E, 1238F:	
Two Inlets	Slope
Sugarbush	Slope
1244B, 1244C, 1244E:	
Sol	Low bearing strength Slope
Sugarbush	Slope
1247D:	
Corliss	Slope
Dorset	Low bearing strength Slope
1248C:	
Nymore	Slope
Verndale	Slope
1249C:	
Graycalm	Slope
Bootlake	Slope
1271:	
Roscommon	Wetness
1272B:	
Sol	Low bearing strength
1294:	
Nary	Low bearing strength
1319B:	
Rockwood	No major considerations or hazards
1319C, 1319D:	
Rockwood	Slope
1320B:	
Blowers	Wetness
1321:	
Paddock	Wetness
Becida	Low bearing strength Wetness
1332B, 1332C, 1332E:	
Rockwood	Slope
1334:	
Huntersville	Wetness

Forest Haul Road Considerations--Continued

Map symbol and soil name	Forest haul road considerations
1336:	
Blowers	Wetness
1421B, 1421C, 1421E:	
Rockwood	Slope
Two Inlets	Slope
1438B:	
Braham	No major considerations or hazards
1440B, 1440C:	
Redeye	Slope
1444:	
Wurtsmith	No major considerations or hazards
1447:	
Beltrami	Low bearing strength Wetness
1450B, 1450C, 1450E:	
Sanburn	Low bearing strength Slope Surface boulders
1460B:	
Nebish	Low bearing strength
1460C:	
Nebish	Low bearing strength Slope
1943:	
Roscommon	Wetness
1956:	
Staples	Wetness
1968:	
Evart	Low bearing strength Wetness
1969:	
Evart	Flooding Low bearing strength Wetness
Isan	Flooding Wetness

Forest Log Landing Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Forest log landing considerations
82B, 82C:	
Redeye	Slope
133B, 133C:	
Dalbo	Slope
	Susceptible to rutting and wheel slippage
139B:	
Huntersville	Slope
	Wetness
147:	
Spooner	Susceptible to rutting and wheel slippage
	Wetness
158B, 158C:	
Zimmerman	Slope
167A:	
Baudette	Susceptible to rutting and wheel slippage
170:	
Blomford	Wetness
202:	
Meehan	Wetness
207B, 207C, 207D:	
Nymore	Slope
260:	
Duelm	No major considerations or hazards
267B:	
Snellman	Slope
	Susceptible to rutting and wheel slippage
346:	
Talmoon	Susceptible to rutting and wheel slippage
	Wetness
406A:	
Dorset	Susceptible to rutting and wheel slippage
488:	
Becida	Wetness
526C, 526E:	
Steamboat	Slope
Two Inlets	Slope
Seelyeville	Susceptible to rutting and wheel slippage
	Wetness
541:	
Rifle	Susceptible to rutting and wheel slippage
	Wetness

Forest Log Landing Considerations--Continued

Map symbol and soil name	Forest log landing considerations
567A:	
Verndale	No major considerations or hazards
574G:	
Steamboat	Slope
Two Inlets	Slope
628:	
Talmoon	Susceptible to rutting and wheel slippage Wetness
672:	
Willosippi	Susceptible to rutting and wheel slippage Wetness
675C, 675E, 675G:	
Two Inlets	Slope
Eagleview	Slope
Steamboat	Slope
701:	
Runeberg	Susceptible to rutting and wheel slippage Wetness
709B, 709C:	
Lengby	Slope Susceptible to rutting and wheel slippage
731A:	
Sanburn	Susceptible to rutting and wheel slippage
744B:	
Debs	Slope Susceptible to rutting and wheel slippage
Akeley	Slope
775B, 775C:	
Sugarbush	Slope
Two Inlets	Slope
778B, 778C:	
Dorset	Slope Susceptible to rutting and wheel slippage
Corliss	Slope
797:	
Mooselake	Susceptible to rutting and wheel slippage Wetness
Lupton	Susceptible to rutting and wheel slippage Wetness
820B, 820C:	
Potatolake	Slope Susceptible to rutting and wheel slippage

Forest Log Landing Considerations--Continued

Map symbol and soil name	Forest log landing considerations
831C, 831E:	
Akeley	Slope
Debs	Slope Susceptible to rutting and wheel slippage
844B:	
Sanburn	Slope Susceptible to rutting and wheel slippage
Graycalm	Slope
867B, 867C, 867E, 867F:	
Graycalm	Slope
Menahga	Slope
1021C:	
Graycalm	Slope
Sanburn	Slope Susceptible to rutting and wheel slippage
1111:	
Nidaros	Flooding Susceptible to rutting and wheel slippage Wetness
1126B:	
Verndale	Slope
Nymore	Slope
1127A:	
Bootlake	No major considerations or hazards
Graycalm	No major considerations or hazards
1127B:	
Bootlake	Slope
Graycalm	Slope
1136:	
Nidaros	Susceptible to rutting and wheel slippage Wetness
1164:	
Zerkel	Susceptible to rutting and wheel slippage
1200:	
Egglake	Susceptible to rutting and wheel slippage Wetness
1238E, 1238F:	
Two Inlets	Slope
Sugarbush	Slope

Forest Log Landing Considerations--Continued

Map symbol and soil name	Forest log landing considerations
1244B, 1244C, 1244E:	
Sol	Slope
	Susceptible to rutting and wheel slippage
Sugarbush	Slope
1247D:	
Corliss	Slope
Dorset	Slope
	Susceptible to rutting and wheel slippage
1248C:	
Nymore	Slope
Verndale	Slope
1249C:	
Graycalm	Slope
Bootlake	Slope
1271:	
Roscommon	Wetness
1272B:	
Sol	Slope
	Susceptible to rutting and wheel slippage
1294:	
Nary	Susceptible to rutting and wheel slippage
1319B, 1319C, 1319D:	
Rockwood	Slope
1320B:	
Blowers	Slope
	Wetness
1321:	
Paddock	Wetness
Becida	Susceptible to rutting and wheel slippage
	Wetness
1332B, 1332C, 1332E:	
Rockwood	Slope
1334:	
Huntersville	Wetness
1336:	
Blowers	Wetness
1421B, 1421C, 1421E:	
Rockwood	Slope
Two Inlets	Slope
1438B:	
Braham	Slope

Forest Log Landing Considerations--Continued

Map symbol and soil name	Forest log landing considerations
1440B, 1440C:	
Redeye	Slope
1444:	
Wurtsmith	No major considerations or hazards
1447:	
Beltrami	Susceptible to rutting and wheel slippage Wetness
1450B, 1450C, 1450E:	
Sanburn	Slope Surface boulders Susceptible to rutting and wheel slippage
1460B, 1460C:	
Nebish	Slope Susceptible to rutting and wheel slippage
1943:	
Roscommon	Wetness
1956:	
Staples	Wetness
1968:	
Evart	Flooding Susceptible to rutting and wheel slippage Wetness
1969:	
Evart	Flooding Susceptible to rutting and wheel slippage Wetness
Isan	Flooding Wetness

Forest Land Site Preparation and Planting Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Site preparation and planting considerations
82B:	
Redeye	No major considerations or hazards
82C:	
Redeye	Water erosion
133B, 133C:	
Dalbo	Water erosion
139B:	
Huntersville	Wetness
147:	
Spooner	Potential poor tilth and compaction Wetness
158B:	
Zimmerman	No major considerations or hazards
158C:	
Zimmerman	Water erosion
167A:	
Baudette	No major considerations or hazards
170:	
Blomford	Wetness
202:	
Meehan	Wetness
207B:	
Nymore	No major considerations or hazards
207C:	
Nymore	Water erosion
207D:	
Nymore	Slope Water erosion
260:	
Duelm	No major considerations or hazards
267B:	
Snellman	Water erosion
346:	
Talmoon	Wetness
406A:	
Dorset	No major considerations or hazards
488:	
Becida	Surface stones Wetness

Forest Land Site Preparation and Planting Considerations--Continued

Map symbol and soil name	Site preparation and planting considerations
526C:	
Steamboat	Water erosion
Two Inlets	Water erosion
Seelyeville	Wetness
526E:	
Steamboat	Slope Water erosion
Two Inlets	Slope Water erosion
Seelyeville	Wetness
541:	
Rifle	Wetness
567A:	
Verndale	No major considerations or hazards
574G:	
Steamboat	Slope Water erosion
Two Inlets	Slope Water erosion
628:	
Talmoon	Wetness
672:	
Willosippi	Potential poor tilth and compaction Wetness
675C:	
Two Inlets	Water erosion
Eagleview	Water erosion
Steamboat	Water erosion
675E, 675G:	
Two Inlets	Slope Water erosion
Eagleview	Slope Water erosion
Steamboat	Slope Water erosion
701:	
Runeberg	Potential poor tilth and compaction Wetness
709B, 709C:	
Lengby	Water erosion
731A:	
Sanburn	No major considerations or hazards

Forest Land Site Preparation and Planting Considerations--Continued

Map symbol and soil name	Site preparation and planting considerations
744B:	
Debs	Water erosion
Akeley	Water erosion
775B, 775C:	
Sugarbush	Water erosion
Two Inlets	Water erosion
778B:	
Dorset	No major considerations or hazards
Corliss	No major considerations or hazards
778C:	
Dorset	Water erosion
Corliss	Water erosion
797:	
Mooselake	Wetness
Lupton	Wetness
820B, 820C:	
Potatolake	Potential poor tilth and compaction Water erosion
831C:	
Akeley	Water erosion
Debs	Water erosion
831E:	
Akeley	Slope Water erosion
Debs	Slope Water erosion
844B:	
Sanburn	Water erosion
Graycalm	Water erosion
867B, 867C:	
Graycalm	Water erosion
Menahga	Water erosion
867E, 867F:	
Graycalm	Slope Water erosion
Menahga	Slope Water erosion
1021C:	
Graycalm	Water erosion
Sanburn	Water erosion

Forest Land Site Preparation and Planting Considerations--Continued

Map symbol and soil name	Site preparation and planting considerations
1111:	
Nidaros	Flooding Wetness
1126B:	
Verndale	No major considerations or hazards
Nymore	No major considerations or hazards
1127A:	
Bootlake	No major considerations or hazards
Graycalm	No major considerations or hazards
1127B:	
Bootlake	Water erosion
Graycalm	Water erosion
1136:	
Nidaros	Wetness
1164:	
Zerkel	No major considerations or hazards
1200:	
Egglake	Wetness
1238E, 1238F:	
Two Inlets	Slope Water erosion
Sugarbush	Slope Water erosion
1244B, 1244C:	
Sol	Surface stones Water erosion
Sugarbush	Surface stones Water erosion
1244E:	
Sol	Slope Surface stones Water erosion
Sugarbush	Slope Surface stones Water erosion
1247D:	
Corliss	Slope Water erosion
Dorset	Slope Water erosion
1248C:	
Nymore	Water erosion
Verndale	Water erosion

Forest Land Site Preparation and Planting Considerations--Continued

Map symbol and soil name	Site preparation and planting considerations
1249C:	
Graycalm	Water erosion
Bootlake	Water erosion
1271:	
Roscommon	Wetness
1272B:	
Sol	No major considerations or hazards
1294:	
Nary	No major considerations or hazards
1319B:	
Rockwood	Surface stones
1319C:	
Rockwood	Surface stones Water erosion
1319D:	
Rockwood	Slope Surface stones Water erosion
1320B:	
Blowers	Surface stones Wetness
1321:	
Paddock	Surface stones Wetness
Becida	Potential poor tilth and compaction Surface stones Wetness
1332B, 1332C:	
Rockwood	Surface stones Water erosion
1332E:	
Rockwood	Slope Surface stones Water erosion
1334:	
Huntersville	Wetness
1336:	
Blowers	Surface stones Wetness
1421B:	
Rockwood	Water erosion
Two Inlets	Water erosion
1421C:	
Rockwood	Surface stones Water erosion

Forest Land Site Preparation and Planting Considerations--Continued

Map symbol and soil name	Site preparation and planting considerations
1421C:	
Two Inlets	Surface stones Water erosion
1421E:	
Rockwood	Slope Surface stones Water erosion
Two Inlets	Slope Surface stones Water erosion
1438B:	
Braham	No major considerations or hazards
1440B, 1440C:	
Redeye	Water erosion
1444:	
Wurtsmith	No major considerations or hazards
1447:	
Beltrami	Wetness
1450B, 1450C:	
Sanburn	Surface boulders Surface stones Water erosion
1450E:	
Sanburn	Slope Surface boulders Surface stones Water erosion
1460B:	
Nebish	No major considerations or hazards
1460C:	
Nebish	Water erosion
1943:	
Roscommon	Wetness
1956:	
Staples	Wetness
1968:	
Evart	Wetness
1969:	
Evart	Flooding Wetness
Isan	Flooding Wetness

Recreation

Hubbard County is noted for its year-round recreational opportunities. Annual tourist expenditures in the area total millions of dollars. Because the region has more than 150 lakes, there are many opportunities for water-related recreation. Many lakes have resorts and campgrounds along their shores.

The soil and water resources of the county provide a variety of habitat for many wildlife species. Waterfowl nest in the county and migrate through the area. Many of the visitors to the area are hunters. Ruffed grouse, rabbits, and squirrels are the most common upland small game. Whitetail deer and black bear are the most common big game species. Many acres of public land, including the Mississippi Headwaters State Forest, Badoura State Forest, Paul Bunyan State Forest, and the Schoolcraft Game Refuge, offer a variety of wildlife-related recreational opportunities.

Part of Itasca State Park is in Hubbard County. Itasca State Park encompasses the headwaters of the Mississippi River and provides many recreational and educational activities. The park has miles of trails for hiking, biking, snowmobiling, and cross-country skiing.

The Heartland Trail, between Park Rapids and Walker, is a hard-surfaced biking and snowmobile trail and is well used during all seasons.

More information regarding recreational opportunities can be obtained from the County Chamber of Commerce, County Land Department, Parks and Recreation Department, or the local office of the Department of Natural Resources or the Soil and Water Conservation District.

The soils of the survey area are rated in the table "Recreational Development" according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The soils are rated on the basis of soil properties that influence the ease of developing camp areas and performance of the areas after development. Also considered are the soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land that are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and that can withstand heavy foot traffic and maintain an adequate cover of vegetation. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. The areas should require little or no cutting and filling during site preparation. The soils are rated on the basis of soil properties that influence trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

The interpretive ratings in this table help engineers, planners, and others to understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as slight, moderate, or severe.

Slight means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means that soil properties are moderately favorable for the rated use. The limitations can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance may be less desirable than that of soils rated *slight*.

Severe means that soil properties are unfavorable for the rated use. Examples of limitations are slope, flooding, and a seasonal high water table. These limitations generally require major soil reclamation, special design, or intensive maintenance. Overcoming the limitations generally is difficult and costly.

The information in the table “Recreational Development” can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in the table “Building Site Development” and interpretations for septic tank absorption fields in the table “Sanitary Facilities.”

Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
82B:					
Redeye	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
82C:					
Redeye	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
133B:					
Dalbo	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
133C:					
Dalbo	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
139B:					
Huntersville	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
147:					
Spooner	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
158B:					
Zimmerman	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
158C:					
Zimmerman	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
167A:					
Baudette	Slight	Slight	Moderate: slope.	Slight	Slight.
170:					
Blomford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
202:					
Meehan	Severe: wetness, too acid.	Severe: too acid.	Severe: wetness, too acid.	Moderate: wetness, too sandy.	Severe: too acid.
207B:					
Nymore	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Severe: droughty.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
207C:					
Nymore	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Severe: droughty.
207D:					
Nymore	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: droughty, slope.
260:					
Duelm	Slight	Slight	Moderate: small stones, wetness.	Slight	Moderate: droughty.
261:					
Isan	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
267B:					
Snellman	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
346:					
Talmoon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
406A:					
Dorset	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
488:					
Becida	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
526C:					
Steamboat	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty.
Two Inlets	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Slight	Moderate: small stones, droughty, slope.
Seelyeville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
526E:					
Steamboat	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Two Inlets	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Seelyeville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
540:					
Seelyeville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
541:					
Rifle	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
545:					
Rondeau	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
567A:					
Verndale	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
574G:					
Steamboat	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Two Inlets	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
628:					
Talmoon	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
672:					
Willosippi	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
675C:					
Two Inlets	Severe: small stones.	Severe: small stones.	Severe: large stones, slope, small stones.	Moderate: large stones.	Severe: small stones.
Eagleview	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
Steamboat	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty.
675E:					
Two Inlets	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Eagleview	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Steamboat	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
675G:					
Two Inlets	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Eagleview	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Steamboat	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
701:					
Runeberg	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
709B:					
Lengby	Slight	Slight	Moderate: slope.	Slight	Slight.
709C:					
Lengby	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
719B:					
Rondeau	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
731A:					
Sanburn	Slight	Slight	Moderate: small stones.	Slight	Severe: droughty.
744B:					
Debs	Slight	Slight	Moderate: slope.	Slight	Slight.
Akeley	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
746:					
Haslie	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
775B:					
Sugarbush	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones, droughty.
Two Inlets	Moderate: small stones.	Slight	Severe: small stones.	Slight	Moderate: small stones.
775C:					
Sugarbush	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
Two Inlets	Moderate: slope, small stones.	Moderate: slope.	Severe: slope, small stones.	Slight	Moderate: small stones.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
778B:					
Dorset	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
Corliss	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Severe: droughty.
778C:					
Dorset	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Corliss	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Severe: droughty.
797:					
Mooselake	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness.	Severe: wetness, excess humus.	Severe: wetness, excess humus.
Lupton	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness.	Severe: wetness, excess humus.	Severe: wetness, excess humus.
799:					
Seelyeville	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: ponding, flooding, excess humus.
Bowstring	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: ponding, flooding, excess humus.
820B:					
Potatolake	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Severe: erodes easily.	Slight.
820C:					
Potatolake	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
831C:					
Akeley	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
Debs	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
831E:					
Akeley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Debs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
844B:					
Sanburn	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
Graycalm	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid, droughty.
867B:					
Graycalm	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid, droughty.
Menahga	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
867C:					
Graycalm	Severe: too acid.	Severe: too acid.	Severe: slope, too acid.	Moderate: too sandy.	Severe: too acid, droughty.
Menahga	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
867E:					
Graycalm	Severe: slope, too acid.	Severe: slope, too acid.	Severe: slope, too acid.	Moderate: too sandy, slope.	Severe: too acid, droughty, slope.
Menahga	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: slope.
867F:					
Graycalm	Severe: slope, too acid.	Severe: slope, too acid.	Severe: slope, too acid.	Severe: slope.	Severe: too acid, droughty, slope.
Menahga	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1015:					
Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
1016:					
Udorthents	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1021C:					
Graycalm	Severe: too acid.	Severe: too acid.	Severe: slope, too acid.	Moderate: too sandy.	Severe: too acid, droughty.
Sanburn	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Severe: droughty.
1027:					
Udorthents.					

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1030: Pits, gravel.					
Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.	Severe: slope.
1111: Nidaros	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: ponding, flooding, excess humus.
1113: Haslie	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Seelyeville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1126B: Verndale	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
Nymore	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Severe: droughty.
1127A: Bootlake	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
Graycalm	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid, droughty.
1127B: Bootlake	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
Graycalm	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid, droughty.
1136: Nidaros	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1164: Zerkel	Slight	Slight	Moderate: slope.	Slight	Slight.
1200: Egglake	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1230:					
Haslie	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Nidaros	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1238E:					
Two Inlets	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
Sugarbush	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
1238F:					
Two Inlets	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Sugarbush	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1244B:					
Sol	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
Sugarbush	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones, droughty.
1244C:					
Sol	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
Sugarbush	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
1244E:					
Sol	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Sugarbush	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
1247D:					
Corliss	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: droughty, slope.
Dorset	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1248C:					
Nymore	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Severe: droughty.
Verndale	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
1249C:					
Graycalm	Severe: too acid.	Severe: too acid.	Severe: slope, too acid.	Moderate: too sandy.	Severe: too acid, droughty.
Bootlake	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
1271:					
Roscommon	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1272B:					
Sol	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
1294:					
Nary	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
1319B:					
Rockwood	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
1319C:					
Rockwood	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
1319D:					
Rockwood	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
1320B:					
Blowers	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
1321:					
Paddock	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
Becida	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1332B:					
Rockwood	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1332C:					
Rockwood	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
1332E:					
Rockwood	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
1334:					
Huntersville	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
1336:					
Blowers	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones, wetness.	Slight	Moderate: large stones.
1421B:					
Rockwood	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
Two Inlets	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
1421C:					
Rockwood	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
Two Inlets	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Slight	Moderate: small stones, droughty, slope.
1421E:					
Rockwood	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Two Inlets	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
1438B:					
Braham	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Slight.
1439:					
Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1440B:					
Redeye	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1440C:					
Redeye	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
1444:					
Wurtsmith	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid.
1445:					
Markey	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1447:					
Beltrami	Slight	Slight	Moderate: small stones.	Slight	Slight.
1450B:					
Sanburn	Moderate: large stones.	Moderate: large stones.	Severe: large stones.	Moderate: large stones.	Severe: droughty.
1450C:					
Sanburn	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: large stones, slope.	Moderate: large stones.	Severe: droughty.
1450E:					
Sanburn	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: large stones, slope.	Severe: droughty, slope.
1460B:					
Nebish	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
1460C:					
Nebish	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
1943:					
Roscommon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1956:					
Staples	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1968:					
Evart	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1969:					
Evart	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Isan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Wildlife Habitat

The soil, water, and forest resources provide a variety of excellent habitat for fish and wildlife species throughout Hubbard County. The county has three major geological areas, which provide distinct types of habitat for wildlife species. The central part of the county is nearly all forested. This area has rugged hills, kettle lakes, and pothole marshes. The northern part of the county is a mixture of forested areas and open land used for pasture or hayland. In this area, low hills, swales, and streams dissect the landscape. The southern part of the county is mainly agricultural and has scattered forested tracts and pine plantations.

The central forested area of Hubbard County offers habitat for whitetail deer, black bear, ruffed grouse, American woodcock, rabbit, and squirrel. Nongame species in this area include timber wolf, coyote, raccoon, porcupine, and beaver. Timber management is important in this area, and the emphasis is on aspen regeneration and small wildlife openings.

The northern and southern parts of Hubbard County provide transitional areas for wildlife. These areas can be maintained by keeping forested tracts for habitat cover and providing wildlife food plots. These areas also have the greatest amount of open water in the county. Migratory waterfowl, such as geese, various duck species, trumpeter swans, sandhill cranes, and blue herons, frequent the marshes and lakes and the surrounding nesting areas.

The southeastern part of the county is mainly marshes and a few upland areas. This area provides habitat for prairie chickens and other migratory birds.

Lakes and streams in Hubbard County are open to public fishing. The major fish species are walleye, northern pike, panfish, largemouth bass, and smallmouth bass. Muskellunge also are in a few of the lakes. A number of streams in the northern part of the county and the Straight River south of Park Rapids offer trout fishing.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. If food, cover, or water is missing, inadequate, or inaccessible, wildlife will be scarce or will not inhabit the area.

If the soils have potential for habitat development, wildlife habitat can be created or improved by planting appropriate vegetation, properly managing the existing plant cover, and fostering the natural establishment of desirable plants.

The potential of the soils in Hubbard County for providing important habitat elements and various kinds of wildlife habitat is given in the table “Wildlife Habitat” at the end of this section.

Elements of Wildlife Habitat

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples are corn, soybeans, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples are bromegrass, timothy, orchardgrass, clover, alfalfa, wheatgrass, and birdsfoot trefoil.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestems, indiangrass, blueberry, goldenrod, lambsquarters, dandelions, blackberry, ragweed, wheatgrass, and nightshade.

The major soil properties affecting the growth of grain and forage crops and wild herbaceous plants are depth of the root zone, texture of the surface layer, the amount of water available to plants, wetness, salinity, and flooding. The length of the growing season also is important.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage that wildlife eat. Examples are oak, poplar, box elder, birch, maple, green ash, willow, and American elm. Examples of fruit-producing shrubs that are suitable for planting on soils that have good potential for these plants are hawthorn, honeysuckle, American plum, redosier dogwood, chokecherry, highbush cranberry, elderberry, gooseberry, serviceberry, silver buffaloberry, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, and ground cover that provide habitat or supply food in

the form of browse, seed, or fruit-like cones. Examples are pine, spruce, cedar, and tamarack.

The major soil properties affecting the growth of hardwood and coniferous trees and shrubs are depth of the root zone, the amount of water available to plants, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of these plants are smartweeds, wild millet, rushes, sedges, bulrushes, wild rice, arrowhead, waterplantain, cattail, prairie cordgrass, bluejoint grass, asters, and beggarticks.

The major soil properties affecting wetland plants are texture of the surface layer, wetness, acidity or alkalinity, and slope.

Shallow water areas have an average depth of less than 5 feet. They are useful as habitat for some wildlife species. They are naturally wet areas or are created by dams, levees, or water-control measures in marshes or streams. Examples are waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds.

The major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability.

Kinds of Wildlife Habitat

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include ring-necked pheasant, meadowlark, field sparrow, killdeer, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of hardwoods or conifers or a mixture of these and associated grasses, legumes, and wild herbaceous plants. The wildlife attracted to this habitat include ruffed grouse, thrushes, woodpeckers, owls, tree squirrels, porcupine, raccoon, whitetail deer, black bear, and moose.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas, bogs, or flood plains that support water-tolerant plants. The wildlife attracted to this habitat include ducks, geese, herons, bitterns, rails, kingfishers, muskrat, otter, mink, and beaver.

Wildlife Habitat

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
82B: Redeye	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
82C: Redeye	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
133B: Dalbo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
133C: Dalbo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
139B: Huntersville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
147: Spooner	Poor	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
158B: Zimmerman	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
158C: Zimmerman	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
167A: Baudette	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.
170: Blomford	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
202: Meehan	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
207B: Nymore	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
207C: Nymore	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
207D: Nymore	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.
260: Duelm	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
261: Isan	Very poor.	Poor	Good	Poor	Poor	Good	Good	Fair	Poor	Good.
267B: Snellman	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
346:										
Talmoon	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
406A:										
Dorset	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
488:										
Becida	Fair	Fair	Good	Good	Good	Good	Good	Fair	Good	Good.
526C:										
Steamboat	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Seelyeville	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
526E:										
Steamboat	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Seelyeville	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
540:										
Seelyeville	Very poor.	Poor	Good	Poor	Poor	Good	Good	Fair	Poor	Good.
541:										
Rifle	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
545:										
Rondeau	Poor	Poor	Poor	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Good.
567A:										
Verndale	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
574G:										
Steamboat	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
628:										
Talmoon	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
672:										
Willosippi	Fair	Good	Good	Good	Good	Good	Good	Fair	Good	Good.
675C:										
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Eagleview	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
675C:										
Steamboat	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
675E:										
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Eagleview	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Steamboat	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
675G:										
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Eagleview	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Steamboat	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
701:										
Runeberg	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
709B:										
Lengby	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.
709C:										
Lengby	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.
719B:										
Rondeau	Poor	Poor	Poor	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Good.
731A:										
Sanburn	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
744B:										
Debs	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Akeley	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.
746:										
Haslie	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
775B:										
Sugarbush	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Two Inlets	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
775C:										
Sugarbush	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
778B:										
Dorset	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Corliss	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
778C:										
Dorset	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Corliss	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
797:										
Mooselake	Very poor.	Poor	Poor	Poor	Fair	Good	Good	Poor	Poor	Good.
Lupton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
799:										
Seelyeville	Very poor.	Poor	Good	Poor	Poor	Good	Good	Good	Fair	Good.
Bowstring	Very poor.	Poor	Good	Poor	Poor	Good	Good	Poor	Poor	Good.
820B:										
Potatolake	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.
820C:										
Potatolake	Fair	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.
831C:										
Akeley	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Debs	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
831E:										
Akeley	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Debs	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
844B:										
Sanburn	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
867B:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Menahga	Poor	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
867C:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Menahga	Poor	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
867E:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Menahga	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
867F:										
Graycalm	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
Menahga	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
1015:										
Udipsamments.										
1016:										
Udorthents	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Fair	Very poor.
1021C:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Sanburn	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1027:										
Udorthents.										
1030:										
Pits, gravel.										
Udipsamments.										
1111:										
Nidaros	Very poor.	Very poor.	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
1113:										
Haslie	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Good.
Seelyeville	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Cathro	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1126B:										
Verndale	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Nymore	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
1127A:										
Bootlake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
1127B:										
Bootlake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
1136:										
Nidaros	Very poor.	Very poor.	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
1164:										
Zerkel	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1200:										
Egglake	Good	Good	Good	Good	Good	Good	Good	Fair	Fair	Good.
1230:										
Haslie	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Good.
Nidaros	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
1238E:										
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Sugarbush	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1238F:										
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Sugarbush	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1244B:										
Sol	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Sugarbush	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
1244C:										
Sol	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Sugarbush	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1244E:										
Sol	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Sugarbush	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
1247D:										
Corliss	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Dorset	Poor	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
1248C:										
Nymore	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Verndale	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1249C:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Bootlake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1271:										
Roscommon	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
1272B:										
Sol	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1294:										
Nary	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
1319B:										
Rockwood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1319C:										
Rockwood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1319D:										
Rockwood	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1320B:										
Blowers	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1321:										
Paddock	Fair	Good	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Becida	Fair	Fair	Good	Good	Good	Good	Good	Fair	Good	Good.
1332B:										
Rockwood	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
1332C:										
Rockwood	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1332E:										
Rockwood	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1334:										
Huntersville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1336:										
Blowers	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
1421B:										
Rockwood	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Two Inlets	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
1421C:										
Rockwood	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
1421E:										
Rockwood	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Two Inlets	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
1438B:										
Braham	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1439:										
Cathro	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.
1440B:										
Redeye	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1440C:										
Redeye	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1444:										
Wurtsmith	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
1445:										
Markey	Very poor.	Very poor.	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
1447:										
Beltrami	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
1450B:										
Sanburn	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
1450C:										
Sanburn	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
1450E:										
Sanburn	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
1460B:										
Nebish	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1460C:										
Nebish	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1943:										
Roscommon	Poor	Poor	Good	Good	Poor	Good	Good	Poor	Good	Good.
1956:										
Staples	Poor	Fair	Fair	Good	Fair	Good	Good	Fair	Good	Good.
1968:										
Evart	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
1969:										
Evart	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Isan	Poor	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

The table "Building Site Development" shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of

digging, filling, and compacting is affected by the depth to a cemented pan or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

The table “Sanitary Facilities” shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. It also shows the suitability of the soils for use as daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of *slight, moderate,* or *severe* are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of *good, fair,* and *poor* are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel are less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious soil material. Aerobic lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Relatively impervious soil material for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

The table gives ratings for the natural soil that

makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

A *trench sanitary landfill* is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

An *area sanitary landfill* is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2 feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. The ratings in the table are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

Soil texture, wetness, rock fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Waste Management

Soil properties are important when organic waste is applied as fertilizer and wastewater is applied in irrigated areas. They also are important when the soil is used as a medium for the treatment and disposal of the organic waste and wastewater. Unfavorable soil properties can result in environmental damage.

The use of organic waste and wastewater as production resources results in energy and resource conservation and minimizes the problems associated with waste disposal. If disposal is the goal, applying a maximum amount of the organic waste or the wastewater to a minimal area holds costs to a minimum and environmental damage is the main hazard. If reuse is the goal, a minimum amount should be applied to a maximum area and environmental damage is unlikely.

Interpretations developed for waste management may include ratings for manure- and food-processing waste, municipal sewage sludge, use of wastewater for irrigation, and treatment of wastewater by slow rate, overland flow, and rapid infiltration processes.

Specific information regarding waste management is available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Construction Materials

The table “Construction Materials” gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a

source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In the table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table, only the probability of finding material in suitable quantity in or below the soil is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

The table “Water Management” gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments,

dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In the table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones. The performance of a system is affected by the depth of the root zone, the amount of salts, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff.

Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
82B:						
Redeye	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
82C:						
Redeye	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
133B:						
Dalbo	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
133C:						
Dalbo	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
139B:						
Huntersville	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Moderate: droughty.
147:						
Spooner	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
158B:						
Zimmerman	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
158C:						
Zimmerman	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
167A:						
Baudette	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
170:						
Blomford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
202:						
Meehan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Severe: too acid.
207B:						
Nymore	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
207C:						
Nymore	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
207D:						
Nymore	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
260:						
Duelm	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Moderate: droughty.
261:						
Isan	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
267B:						
Snellman	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.	Moderate: large stones.
346:						
Talmoon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
406A:						
Dorset	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
488:						
Becida	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
526C:						
Steamboat	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty.
Two Inlets	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Seelyeville	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
526E:						
Steamboat	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Two Inlets	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Seelyeville	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
540:						
Seelyeville	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
541:						
Rifle	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, excess humus.
545:						
Rondeau	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: ponding, excess humus.
567A:						
Verndale	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
574G:						
Steamboat	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Two Inlets	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
628:						
Talmoon	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding, excess humus.
672:						
Willosippi	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
675C:						
Two Inlets	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: small stones.
Eagleview	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Steamboat	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty.
675E:						
Two Inlets	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Eagleview	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Steamboat	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
675G:						
Two Inlets	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Eagleview	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Steamboat	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
701:						
Runeberg	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
709B:						
Lengby	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
709C:						
Lengby	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
719B:						
Rondeau	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: ponding, excess humus.
731A:						
Sanburn	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
744B:						
Debs	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Severe: frost action.	Slight.
Akeley	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
746:						
Haslie	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
775B:						
Sugarbush	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones, droughty.
Two Inlets	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: small stones.
775C:						
Sugarbush	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
775C:						
Two Inlets	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones.
778B:						
Dorset	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Corliss	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
778C:						
Dorset	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Corliss	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
797:						
Mooselake	Severe: excess humus, wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, frost action.	Severe: wetness, excess humus.
Lupton	Severe: excess humus, wetness.	Severe: subsides, wetness, low strength.	Severe: subsides, wetness, low strength.	Severe: subsides, wetness, low strength.	Severe: subsides, wetness, frost action.	Severe: wetness, excess humus.
799:						
Seelyeville	Severe: excess humus, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, ponding, flooding.	Severe: ponding, flooding, excess humus.
Bowstring	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, ponding, flooding.	Severe: ponding, flooding, excess humus.
820B:						
Potatolake	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
820C:						
Potatolake	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
831C:						
Akeley	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Debs	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
831E:						
Akeley	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Debs	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
844B:						
Sanburn	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
Graycalm	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: too acid, droughty.
867B:						
Graycalm	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: too acid, droughty.
Menahga	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
867C:						
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too acid, droughty.
Menahga	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
867E:						
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: too acid, droughty, slope.
Menahga	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
867F:						
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: too acid, droughty, slope.
Menahga	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1015:						
Udipsamments	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty, too sandy.
1016:						
Udorthents	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1021C:						
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too acid, droughty.
Sanburn	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
1027:						
Udorthents.						
1030:						
Pits, gravel.						
Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1111:						
Nidaros	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, ponding, flooding.	Severe: ponding, flooding, excess humus.
1113:						
Haslie	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Seelyeville	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
Cathro	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
1126B:						
Verndale	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Nymore	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
1127A:						
Bootlake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Graycalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: too acid, droughty.
1127B:						
Bootlake	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Graycalm	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: too acid, droughty.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1136:						
Nidaros	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
1164:						
Zerkel	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength.	Slight.
1200:						
Egglake	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
1230:						
Haslie	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Nidaros	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
1238E:						
Two Inlets	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sugarbush	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1238F:						
Two Inlets	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sugarbush	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1244B:						
Sol	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.	Moderate: large stones.
Sugarbush	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones, droughty.
1244C:						
Sol	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: large stones, slope.
Sugarbush	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1244E:						
Sol	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sugarbush	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1247D:						
Corliss	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Dorset	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1248C:						
Nymore	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Verndale	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
1249C:						
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too acid, droughty.
Bootlake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
1271:						
Roscommon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1272B:						
Sol	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.	Moderate: large stones.
1294:						
Nary	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.	Moderate: large stones.
1319B:						
Rockwood	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
1319C:						
Rockwood	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
1319D:						
Rockwood	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1320B:						
Blowers	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Moderate: large stones.
1321:						
Paddock	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
Becida	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
1332B:						
Rockwood	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
1332C:						
Rockwood	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
1332E:						
Rockwood	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1334:						
Huntersville	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Moderate: droughty.
1336:						
Blowers	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Moderate: large stones.
1421B:						
Rockwood	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
Two Inlets	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: small stones.
1421C:						
Rockwood	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
Two Inlets	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
1421E:						
Rockwood	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Two Inlets	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1438B:						
Braham	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
1439:						
Cathro	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
1440B:						
Redeye	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
1440C:						
Redeye	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
1444:						
Wurtsmith	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: too acid.
1445:						
Markey	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
1447:						
Beltrami	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
1450B:						
Sanburn	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
1450C:						
Sanburn	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
1450E:						
Sanburn	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
1460B:						
Nebish	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength.	Slight.
1460C:						
Nebish	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
1943:						
Roscommon	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1956:						
Staples	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
1968:						
Evart	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness.
1969:						
Evart	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
Isan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
82B:					
Redeye	Severe: percs slowly, poor filter.	Severe: seepage.	Slight	Severe: seepage.	Fair: small stones.
82C:					
Redeye	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Moderate: slope.	Severe: seepage.	Fair: small stones, slope.
133B:					
Dalbo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
133C:					
Dalbo	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
139B:					
Huntersville	Severe: wetness, percs slowly.	Severe: seepage.	Moderate: wetness, too sandy.	Severe: seepage.	Fair: too sandy, small stones, wetness.
147:					
Spooner	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
158B:					
Zimmerman	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
158C:					
Zimmerman	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
167A:					
Baudette	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
170:					
Blomford	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
202:					
Meehan	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
207B:					
Nymore	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
207C:					
Nymore	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
207D:					
Nymore	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
260:					
Duelm	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
261:					
Isan	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
267B:					
Snellman	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.
346:					
Talmoon	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
406A:					
Dorset	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
488:					
Becida	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
526C:					
Steamboat	Severe: percs slowly.	Severe: slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: too sandy, large stones, slope.
Two Inlets	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Seelyeville	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
526E:					
Steamboat	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Two Inlets	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Seelyeville	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
540:					
Seelyeville	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
541:					
Rifle	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
545:					
Rondeau	Severe: subsides, ponding.	Severe: seepage, excess humus.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
567A:					
Verndale	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
574G:					
Steamboat	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Two Inlets	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
628:					
Talmoon	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
672:					
Willosippi	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
675C:					
Two Inlets	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
675C:					
Eagleview	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Steamboat	Severe: percs slowly.	Severe: slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: too sandy, large stones, slope.
675E:					
Two Inlets	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Eagleview	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Steamboat	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
675G:					
Two Inlets	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Eagleview	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Steamboat	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
701:					
Runeberg	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
709B:					
Lengby	Moderate: percs slowly.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
709C:					
Lengby	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
719B:					
Rondeau	Severe: subsides, ponding.	Severe: seepage, excess humus.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
731A:					
Sanburn	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
744B:					
Debs	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too sandy.	Slight	Good.
Akeley	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
746:					
Haslie	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: hard to pack, ponding.
775B:					
Sugarbush	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Two Inlets	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
775C:					
Sugarbush	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Two Inlets	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
778B:					
Dorset	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Corliss	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
778C:					
Dorset	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Corliss	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
797:					
Mooselake	Severe: wetness.	Severe: seepage, excess humus, wetness.	Severe: seepage, wetness, excess humus.	Severe: seepage, wetness.	Poor: wetness, excess humus.
Lupton	Severe: subsides, wetness, percs slowly.	Severe: seepage, excess humus, wetness.	Severe: seepage, wetness, excess humus.	Severe: seepage, wetness.	Poor: wetness, excess humus.
799:					
Seelyeville	Severe: subsides, flooding, ponding.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
Bowstring	Severe: flooding, ponding, percs slowly.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
820B:					
Potatolake	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
820C:					
Potatolake	Severe: wetness, poor filter.	Severe: seepage, slope, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
831C:					
Akeley	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Debs	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: slope.
831E:					
Akeley	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Debs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
844B:					
Sanburn	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
867B:					
Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Menahga	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
867C:					
Graycalm	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Menahga	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
867E:					
Graycalm	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Menahga	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
867F:					
Graycalm	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Menahga	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
1015:					
Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
1016:					
Udorthents	Slight	Slight	Severe: slope.	Severe: slope.	Poor: slope, thin layer.
1021C:					
Graycalm	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Sanburn	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
1027:					
Udorthents.					

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1030: Pits, gravel.					
Udipsamments	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
1111: Nidaros	Severe: subsides, flooding, ponding.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
1113: Haslie	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, too clayey, excess humus.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
Seelyeville	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Cathro	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
1126B: Verndale	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Nymore	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
1127A: Bootlake	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
1127B: Bootlake	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
1136: Nidaros	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1164:					
Zerkel	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
1200:					
Egglake	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1230:					
Haslie	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, too clayey, excess humus.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
Nidaros	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
1238E:					
Two Inlets	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Sugarbush	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
1238F:					
Two Inlets	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Sugarbush	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
1244B:					
Sol	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Fair: small stones.
Sugarbush	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
1244C:					
Sol	Moderate: percs slowly, slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Sugarbush	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1244E:					
Sol	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sugarbush	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
1247D:					
Corliss	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Dorset	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
1248C:					
Nymore	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Verndale	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
1249C:					
Graycalm	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Bootlake	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
1271:					
Roscommon	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
1272B:					
Sol	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Fair: small stones.
1294:					
Nary	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
1319B:					
Rockwood	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
1319C:					
Rockwood	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1319D:					
Rockwood	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
1320B:					
Blowers	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Moderate: wetness, too sandy.	Moderate: wetness.	Fair: too sandy, small stones, wetness.
1321:					
Paddock	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Becida	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1332B:					
Rockwood	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
1332C:					
Rockwood	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
1332E:					
Rockwood	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
1334:					
Huntersville	Severe: wetness, percs slowly.	Severe: seepage.	Moderate: wetness, too sandy.	Severe: seepage.	Fair: too sandy, small stones, wetness.
1336:					
Blowers	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
1421B:					
Rockwood	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Two Inlets	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
1421C:					
Rockwood	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Two Inlets	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1421E:					
Rockwood	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Two Inlets	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
1438B:					
Braham	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Fair: too clayey.
1439:					
Cathro	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
1440B:					
Redeye	Severe: percs slowly, poor filter.	Severe: seepage.	Slight	Severe: seepage.	Fair: small stones.
1440C:					
Redeye	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Moderate: slope.	Severe: seepage.	Fair: small stones, slope.
1444:					
Wurtsmith	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, too acid.
1445:					
Markey	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
1447:					
Beltrami	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
1450B:					
Sanburn	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
1450C:					
Sanburn	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1450E:					
Sanburn	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
1460B:					
Nebish	Severe: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
1460C:					
Nebish	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
1943:					
Roscommon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
1956:					
Staples	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
1968:					
Evart	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
1969:					
Evart	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Isan	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
82B: Redeye	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
82C: Redeye	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
133B: Dalbo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
133C: Dalbo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
139B: Huntersville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
147: Spooner	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
158B: Zimmerman	Good	Probable	Improbable: too sandy.	Poor: too sandy.
158C: Zimmerman	Good	Probable	Improbable: too sandy.	Poor: too sandy.
167A: Baudette	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
170: Blomford	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
202: Meehan	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, too acid.
207B: Nymore	Good	Probable	Improbable: too sandy.	Poor: too sandy.
207C: Nymore	Good	Probable	Improbable: too sandy.	Poor: too sandy.
207D: Nymore	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
260:				
Duelm	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
261:				
Isan	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
267B:				
Snellman	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
346:				
Talmoon	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
406A:				
Dorset	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
488:				
Becida	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
526C:				
Steamboat	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Two Inlets	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Seelyeville	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
526E:				
Steamboat	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Two Inlets	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Seelyeville	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
540:				
Seelyeville	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
541:				
Rifle	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
545:				
Rondeau	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
567A:				
Verndale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
574G:				
Steamboat	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Two Inlets	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
628:				
Talmoon	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
672:				
Willosippi	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
675C:				
Two Inlets	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Eagleview	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Steamboat	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
675E:				
Two Inlets	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Eagleview	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Steamboat	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
675G:				
Two Inlets	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Eagleview	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
675G:				
Steamboat	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
701:				
Runeberg	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
709B:				
Lengby	Good	Probable	Improbable: too sandy.	Poor: too sandy.
709C:				
Lengby	Good	Probable	Improbable: too sandy.	Poor: too sandy.
719B:				
Rondeau	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
731A:				
Sanburn	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
744B:				
Debs	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Akeley	Good	Probable	Improbable: too sandy.	Poor: too sandy.
746:				
Haslie	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
775B:				
Sugarbush	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Two Inlets	Good	Probable	Probable	Poor: small stones, area reclaim.
775C:				
Sugarbush	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Two Inlets	Good	Probable	Probable	Poor: small stones, area reclaim.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
778B:				
Dorset	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Corliss	Good	Probable	Improbable: thin layer.	Poor: too sandy, small stones, area reclaim.
778C:				
Dorset	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Corliss	Good	Probable	Improbable: thin layer.	Poor: too sandy, small stones, area reclaim.
797:				
Mooselake	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Lupton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
799:				
Seelyeville	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Bowstring	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
820B:				
Potatolake	Fair: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim.
820C:				
Potatolake	Fair: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim.
831C:				
Akeley	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Debs	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
831E:				
Akeley	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Debs	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
844B:				
Sanburn	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.
867B:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.
Menahga	Good	Probable	Improbable: too sandy.	Poor: too sandy.
867C:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.
Menahga	Good	Probable	Improbable: too sandy.	Poor: too sandy.
867E:				
Graycalm	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.
Menahga	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
867F:				
Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.
Menahga	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
1015:				
Udipsamments	Good	Probable	Probable	Poor: too sandy.
1016:				
Udorthents	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
1021C:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1021C:				
Sanburn	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1027:				
Udorthents.				
1030:				
Pits, gravel.				
Udipsamments	Poor: slope.	Probable	Probable	Poor: too sandy, slope.
1111:				
Nidaros	Poor: wetness.	Probable	Probable	Poor: excess humus, wetness.
1113:				
Haslie	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Seelyeville	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
1126B:				
Verndale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Nymore	Good	Probable	Improbable: too sandy.	Poor: too sandy.
1127A:				
Bootlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.
1127B:				
Bootlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.
1136:				
Nidaros	Poor: wetness.	Probable	Probable	Poor: excess humus, wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1164:				
Zerkel	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too clayey, thin layer.
1200:				
Egglake	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1230:				
Haslie	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Nidaros	Poor: wetness.	Probable	Probable	Poor: excess humus, wetness.
1238E:				
Two Inlets	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Sugarbush	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1238F:				
Two Inlets	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Sugarbush	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1244B:				
Sol	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Sugarbush	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1244C:				
Sol	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Sugarbush	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1244E:				
Sol	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1244E:				
Sugarbush	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1247D:				
Corliss	Fair: slope.	Probable	Improbable: thin layer.	Poor: too sandy, small stones, area reclaim.
Dorset	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1248C:				
Nymore	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Verndale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
1249C:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, too acid.
Bootlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
1271:				
Roscommon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
1272B:				
Sol	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
1294:				
Nary	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1319B:				
Rockwood	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
1319C:				
Rockwood	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
1319D:				
Rockwood	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1320B:				
Blowers	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
1321:				
Paddock	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Becida	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
1332B:				
Rockwood	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
1332C:				
Rockwood	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
1332E:				
Rockwood	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
1334:				
Huntersville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
1336:				
Blowers	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, area reclaim.
1421B:				
Rockwood	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Two Inlets	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1421C:				
Rockwood	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
Two Inlets	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1421E:				
Rockwood	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Two Inlets	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1438B:				
Braham	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
1439:				
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
1440B:				
Redeye	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
1440C:				
Redeye	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
1444:				
Wurtsmith	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, too acid.
1445:				
Markey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
1447:				
Beltrami	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1450B:				
Sanburn	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1450C:				
Sanburn	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1450E:				
Sanburn	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1460B:				
Nebish	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1460C:				
Nebish	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
1943:				
Roscommon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
1956:				
Staples	Poor: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones, wetness.
1968:				
Evart	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, wetness.
1969:				
Evart	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, wetness.
Isan	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
82B: Redeye	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing	Droughty, rooting depth.
82C: Redeye	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing.	Slope, droughty, rooting depth.
133B: Dalbo	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Erodes easily, percs slowly.
133C: Dalbo	Severe: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
139B: Huntersville	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Frost action, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
147: Spooner	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
158B: Zimmerman	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
158C: Zimmerman	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
167A: Baudette	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Erodes easily, wetness.	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
170: Blomford	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Favorable	Wetness, droughty.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, droughty.
202: Meehan	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, too acid.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
207B: Nymore	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
207C: Nymore	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
207D: Nymore	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
260: Duelm	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
261: Isan	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
267B: Snellman	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope, soil blowing, rooting depth.	Soil blowing	Rooting depth.
346: Talmoon	Slight	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
406A:							
Dorset	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty	Too sandy, soil blowing.	Droughty.
488:							
Becida	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, cutbanks cave.	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Wetness, droughty, rooting depth.
526C:							
Steamboat	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, rooting depth.	Slope, too sandy.	Slope, droughty, rooting depth.
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope	Slope, too sandy.	Slope, droughty.
Seelyeville	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
526E:							
Steamboat	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, rooting depth.	Slope, too sandy.	Slope, droughty, rooting depth.
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope	Slope, too sandy.	Slope, droughty.
Seelyeville	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
540:							
Seelyeville	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
541:							
Rifle	Severe: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
545:							
Rondeau	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing.	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
567A:							
Verndale	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
574G:							
Steamboat	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, rooting depth.	Slope, too sandy.	Slope, droughty, rooting depth.
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope	Slope, too sandy.	Slope, droughty.
628:							
Talmoon	Slight	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding, soil blowing.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily.
672:							
Willosippi	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
675C:							
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
Eagleview	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Steamboat	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, rooting depth.	Slope, too sandy.	Slope, droughty, rooting depth.
675E:							
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope	Slope, too sandy.	Slope, droughty.
Eagleview	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Steamboat	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, rooting depth.	Slope, too sandy.	Slope, droughty, rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
675G:							
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope	Slope, too sandy.	Slope, droughty.
Eagleview	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Steamboat	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, rooting depth.	Slope, too sandy.	Slope, droughty, rooting depth.
701:							
Runeberg	Slight	Severe: piping, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, rooting depth, percs slowly.
709B:							
Lengby	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Erodes easily, too sandy.	Erodes easily.
709C:							
Lengby	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, erodes easily, too sandy.	Slope, erodes easily.
719B:							
Rondeau	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing.	Wetness.
731A:							
Sanburn	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
744B:							
Debs	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
Akeley	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
746:							
Haslie	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, percs slowly, subsides.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
775B:							
Sugarbush	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty, rooting depth.
Two Inlets	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
775C:							
Sugarbush	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
778B:							
Dorset	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.
Corliss	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
778C:							
Dorset	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.
Corliss	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
797:							
Mooselake	Severe: seepage.	Severe: excess humus, wetness.	Moderate: slow refill.	Subsides, frost action.	Wetness	Wetness	Wetness.
Lupton	Severe: seepage.	Severe: excess humus, wetness.	Severe: slow refill.	Subsides, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
799:							
Seelyeville	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, flooding, subsides.	Ponding, soil blowing, flooding.	Ponding, soil blowing.	Wetness.
Bowstring	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill, cutbanks cave.	Ponding, flooding, subsides.	Ponding, flooding.	Ponding	Wetness.
820B:							
Potatolake	Severe: seepage.	Severe: seepage, piping.	Moderate: deep to water, slow refill, cutbanks cave.	Frost action, slope, cutbanks cave.	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
820C:							
Potatolake	Severe: seepage, slope.	Severe: seepage, piping.	Moderate: deep to water, slow refill, cutbanks cave.	Frost action, slope, cutbanks cave.	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.
831C:							
Akeley	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Debs	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
831E:							
Akeley	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Debs	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
844B:							
Sanburn	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Graycalm	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
867B:							
Graycalm	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Menahga	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
867C:							
Graycalm	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Menahga	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
867E:							
Graycalm	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Menahga	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
867F:							
Graycalm	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Menahga	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
1015:							
Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
1016:							
Udorthents	Slight	Slight	Severe: no water.	Deep to water	Slope	Slope	Slope.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1021C:							
Graycalm	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Sanburn	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
1027:							
Udorthents.							
1030:							
Pits, gravel.							
Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
1111:							
Nidaros	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill, cutbanks cave.	Ponding, flooding, subsides.	Ponding, soil blowing, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
1113:							
Haslie	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, percs slowly, subsides.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Seelyeville	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
Cathro	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
1126B:							
Verndale	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Nymore	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1127A:							
Bootlake	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty	Too sandy, soil blowing.	Droughty.
Graycalm	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
1127B:							
Bootlake	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.
Graycalm	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
1136:							
Nidaros	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Ponding, too sandy, soil blowing.	Wetness, rooting depth.
1164:							
Zerkel	Severe: seepage.	Severe: seepage, piping.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness	Wetness, too sandy.	Favorable.
1200:							
Egglake	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness, rooting depth.	Wetness	Wetness, rooting depth.
1230:							
Haslie	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, percs slowly, subsides.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Nidaros	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, rooting depth.	Ponding	Wetness, rooting depth.
1238E:							
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1238E:							
Sugarbush	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
1238F:							
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
Sugarbush	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
1244B:							
Sol	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, rooting depth.	Favorable	Rooting depth.
Sugarbush	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty, rooting depth.
1244C:							
Sol	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
Sugarbush	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
1244E:							
Sol	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
Sugarbush	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
1247D:							
Corliss	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Dorset	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1248C:							
Nymore	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Verndale	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
1249C:							
Graycalm	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Bootlake	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.
1271:							
Roscommon	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
1272B:							
Sol	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, rooting depth.	Favorable	Rooting depth.
1294:							
Nary	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Severe: slow refill, cutbanks cave.	Favorable	Wetness, rooting depth.	Wetness	Rooting depth.
1319B:							
Rockwood	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Soil blowing	Rooting depth.
1319C:							
Rockwood	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, soil blowing.	Slope, rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1319D:							
Rockwood	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, soil blowing.	Slope, rooting depth.
1320B:							
Blowers	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Frost action, slope, cutbanks cave.	Slope, wetness, soil blowing.	Wetness, too sandy, soil blowing.	Rooting depth.
1321:							
Paddock	Moderate: seepage.	Severe: piping.	Severe: no water.	Frost action	Wetness, soil blowing, percs slowly.	Wetness, soil blowing.	Wetness, rooting depth.
Becida	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness, rooting depth.
1332B:							
Rockwood	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Soil blowing	Rooting depth.
1332C:							
Rockwood	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, soil blowing.	Slope, rooting depth.
1332E:							
Rockwood	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, soil blowing.	Slope, rooting depth.
1334:							
Huntersville	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
1336:							
Blowers	Moderate: seepage.	Severe: piping.	Severe: no water.	Frost action	Wetness, soil blowing, percs slowly.	Wetness, soil blowing.	Rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1421B:							
Rockwood	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Soil blowing	Rooting depth.
Two Inlets	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy	Droughty.
1421C:							
Rockwood	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, soil blowing.	Slope, rooting depth.
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
1421E:							
Rockwood	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, soil blowing.	Slope, rooting depth.
Two Inlets	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope	Slope, too sandy.	Slope, droughty.
1438B:							
Braham	Severe: seepage.	Moderate: piping, wetness.	Severe: slow refill, cutbanks cave.	Deep to water	Slope, fast intake, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
1439:							
Cathro	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
1440B:							
Redeye	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing	Droughty, rooting depth.
1440C:							
Redeye	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing.	Slope, droughty, rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1444:							
Wurtsmith	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave, too acid.	Wetness, droughty.	Wetness, too sandy.	Droughty.
1445:							
Markey	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
1447:							
Beltrami	Moderate: seepage.	Severe: piping.	Severe: slow refill, cutbanks cave.	Frost action	Wetness, soil blowing.	Wetness, soil blowing.	Favorable.
1450B:							
Sanburn	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy	Droughty.
1450C:							
Sanburn	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy.	Slope, droughty.
1450E:							
Sanburn	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy.	Slope, droughty.
1460B:							
Nebish	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Slope, soil blowing.	Soil blowing	Favorable.
1460C:							
Nebish	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
1943:							
Roscommon	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty, rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1956:							
Staples	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: no water.	Frost action, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty, rooting depth.
1968:							
Evart	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
1969:							
Evart	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
Isan	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

The table “Engineering Index Properties” gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1998) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1998).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3

inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index generally are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

The tables "Physical Properties of the Soils" and "Chemical Properties of the Soils" show estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

In the table "Physical Properties of the Soils," *moist bulk density* is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In the table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, 6 to 9 percent. *Very high*, more than 9 percent, is sometimes used.

Organic matter is the plant and animal residue in

the soil at various stages of decomposition. In the table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams that have more than 5 percent finely divided calcium carbonate. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if measures to control wind erosion are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if ordinary measures to control wind erosion are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils have less than 5 percent finely divided calcium carbonate. They are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

The *wind erodibility index* is a number that is determined based on the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. It is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles.

In the table “Chemical Properties of the Soils,” *cation-exchange capacity* is 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. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. Soils having a high cation-exchange capacity can retain cations. The ability to retain cations helps to prevent the pollution of ground water.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less

than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Water Features

The table “Water Features” gives estimates of several important water features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. The soil properties that affect the runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include the depth to a seasonal high water table, the infiltration rate, permeability after prolonged wetting, and the depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of very deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have a moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils that have a moderately fine or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clayey soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in the table, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered to be ponding.

The table gives the frequency and duration of flooding and the time of year when flooding is most likely to occur. Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means that flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year that flooding is most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is a zone of saturation at the highest average depth during the wettest season. It is at least 6 inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Indicated in the table are the depth to the seasonal high water table, the kind of water table, and the months of the year when the water table usually is highest.

An *apparent* water table is indicated by the level at which water stands in a freshly dug, unlined borehole

after adequate time for adjustments in the surrounding soil.

A *perched* water table is one that is above an unsaturated zone in the soil. The basis for determining that a water table is perched may be general knowledge of the area. The water table is proven to be perched if the water level in a borehole is observed to fall when the borehole is extended.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. “More than 6.0” indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The maximum depth refers to the depth of the water above the surface of the soil.

Soil Features

The table “Soil Features” gives estimates of several important soil features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Depth to bedrock is given if bedrock is within a depth of 60 inches. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

A *low* potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a *moderate* potential indicates that the soil is susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a *high* potential indicates that the soil is highly susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate content, texture, moisture content, and acidity of the soil.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Properties

(Absence of an entry indicates that the data were not estimated)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
82B:												
Redeye	0-3	Loamy sand	SM, SP-SM	A-2-4	0-1	0-5	90-100	80-95	65-80	10-30	15-20	NP-4
	3-18	Loamy sand, loamy fine sand, sand.	SM	A-2-4	0-1	0-5	90-100	80-95	65-80	15-30	15-20	NP-4
	18-26	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2-4, A-3, A-1-b	0-1	0-10	75-95	70-90	30-65	5-15	15-20	NP-4
	26-52	Sandy loam, gravelly sandy loam.	SM, SC, SC-SM	A-2-4, A-2-6, A-1-b	0	0-10	85-100	70-95	45-70	15-35	15-25	NP-12
	52-60	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC, SC-SM	A-2-4, A-1-b	0	0-10	85-100	70-95	45-70	15-35	15-25	NP-9
82C:												
Redeye	0-3	Loamy sand	SM, SP-SM	A-2-4	0-1	0-5	90-100	80-95	65-80	10-30	15-20	NP-4
	3-18	Loamy sand, loamy fine sand, sand.	SM	A-2-4	0-1	0-5	90-100	80-95	65-80	15-30	15-20	NP-4
	18-26	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2-4, A-3, A-1-b	0-1	0-10	75-95	70-90	30-65	5-15	15-20	NP-4
	26-52	Sandy loam, gravelly sandy loam.	SM, SC, SC-SM	A-2-4, A-2-6, A-1-b	0	0-10	85-100	70-95	45-70	15-35	15-25	NP-12
	52-60	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC, SC-SM	A-2-4, A-1-b	0	0-10	85-100	70-95	45-70	15-35	15-25	NP-9
133B:												
Dalbo	0-6	Silt loam	CL, ML, CL-ML	A-4	0	0	100	100	95-100	60-100	20-35	2-10
	6-41	Silty clay, silty clay loam.	CL, CH	A-7	0	0	100	95-100	95-100	85-100	40-65	20-40
	41-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	95-100	95-100	85-100	30-60	10-35

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
133C:												
Dalbo	0-6	Silt loam	CL, ML, CL-ML	A-4	0	0	100	100	95-100	60-100	20-35	2-10
	6-41	Silty clay, silty clay loam.	CL, CH	A-7	0	0	100	95-100	95-100	85-100	40-65	20-40
	41-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	95-100	95-100	85-100	30-60	10-35
139B:												
Huntersville	0-12	Loamy fine sand	SM, SP-SM	A-2-4	0-1	0-5	90-100	80-95	65-80	10-30	15-20	NP
	12-24	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2-4, A-1-b, A-3	0-1	0-10	85-95	70-95	45-50	20-35	15-20	NP
	24-40	Sandy loam, gravelly sandy loam, clay loam.	SM, SC-SM, SC, CL-ML	A-2-4, A-1-b, A-6	0-10	0-10	85-100	70-95	45-50	20-35	15-25	NP-9
	40-80	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC-SM, SC	A-2-4, A-1-b	0-10	0-10	85-100	70-95	45-60	15-35	15-25	NP-9
147:												
Spooner	0-8	Silt loam	ML	A-4, A-6	0	0	100	100	90-100	50-80	25-40	1-14
	8-13	Loamy very fine sand, very fine sandy loam, loam.	SM, ML, SC, CL	A-4, A-6	0	0	100	100	90-100	35-60	10-40	1-15
	13-20	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	60-85	20-40	5-15
	20-80	Very fine sandy loam, silt loam, sandy loam.	ML, CL, SM, SC	A-4, A-6	0	0	100	100	90-100	35-95	16-40	NP-15
158B:												
Zimmerman	0-16	Loamy fine sand	SM	A-2	0	0	100	95-100	95-100	15-30	15-20	NP
	16-60	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	0	100	95-100	95-100	5-20	15-20	NP
158C:												
Zimmerman	0-16	Loamy fine sand	SM	A-2	0	0	100	95-100	95-100	15-30	15-20	NP
	16-80	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	0	100	95-100	95-100	5-20	15-20	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
167A:												
Baudette	0-4	Silt loam	ML	A-4	0	0	100	100	95-100	60-90	20-40	1-10
	4-8	Very fine sandy loam, fine sandy loam, silt loam.	SM, ML	A-4	0	0	100	100	75-100	40-90	15-40	NP-10
	8-35	Clay loam, silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	0	100	100	95-100	80-100	20-50	5-20
	35-60	Silt loam, very fine sandy loam, loamy very fine sand.	ML	A-4	0	0	100	100	95-100	70-100	20-40	1-10
170:												
Blomford	0-5	Loamy fine sand	SM	A-2	0	0	100	100	70-80	20-35	0-20	NP
	5-23	Loamy fine sand, loamy sand, fine sand.	SM, SP-SM	A-2, A-3	0	0	100	100	65-80	5-20	0-20	NP
	23-55	Sandy clay loam, clay loam, loam.	ML, CL, CL-ML	A-6, A-4, A-7	0-1	0-8	95-100	85-100	80-95	50-85	30-45	6-20
	55-80	Loam, sandy clay loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-1	0-5	95-100	85-100	80-100	50-90	25-40	3-15
202:												
Meehan	0-6	Loamy sand	SM	A-2, A-1	0	0	90-100	75-100	40-90	15-30	0-14	NP
	6-38	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-1, A-2, A-3	0	0	90-100	75-100	40-90	3-30	0-14	NP
	38-80	Sand, coarse sand.	SP, SP-SM	A-1, A-3, A-2	0	0	90-100	75-100	40-90	0-5	0-14	NP
207B:												
Nymore	0-8	Loamy sand	SM, SP-SM	A-2, A-3	0	0	95-100	90-100	50-75	5-30	15-20	NP
	8-33	Sand, coarse sand, loamy coarse sand.	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	85-100	45-75	2-15	15-20	NP
	33-60	Sand, coarse sand.	SP, SP-SM, SM	A-1, A-3, A-2	0	0	95-100	85-100	45-75	2-15	15-20	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
207C:												
Nymore	0-8	Loamy sand	SM, SP-SM	A-2, A-3	0	0	95-100	90-100	50-75	5-30	15-20	NP
	8-33	Sand, coarse sand, loamy coarse sand.	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	85-100	45-75	2-15	15-20	NP
	33-60	Sand, coarse sand.	SP, SP-SM, SM	A-1, A-3, A-2	0	0	95-100	85-100	45-75	2-15	15-20	NP
207D:												
Nymore	0-8	Loamy sand	SM, SP-SM	A-2, A-3	0	0	95-100	90-100	50-75	5-30	15-20	NP
	8-33	Sand, coarse sand, loamy coarse sand.	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	85-100	45-75	2-15	15-20	NP
	33-60	Sand, coarse sand.	SP, SP-SM, SM	A-1, A-3, A-2	0	0	95-100	85-100	45-75	2-15	15-20	NP
260:												
Duelm	0-16	Loamy sand	SM, SP-SM	A-2, A-1	0	0	90-100	85-100	35-75	10-25	15-20	NP
	16-30	Loamy sand, sand, coarse sand.	SM, SP-SM	A-2, A-3, A-1	0	0	90-100	85-100	35-75	5-25	15-20	NP
	30-80	Coarse sand, sand.	SP, SM, SP-SM	A-2, A-3, A-1	0	0	85-100	75-100	35-75	3-15	15-20	NP
261:												
Isan	0-11	Loamy sand	SM	A-2	0	0	95-100	92-100	50-75	12-30	15-20	NP
	11-15	Sand, loamy sand.	SM, SP-SM	A-2	0	0	95-100	92-100	50-75	10-30	15-20	NP
	15-80	Sand, coarse sand.	SM, SP	A-1, A-2, A-3	0	0	85-100	85-100	35-70	2-15	15-20	NP
267B:												
Snellman	0-2	Sandy loam	SM, SC-SM	A-4	0	0-10	90-100	80-95	65-80	40-50	25-30	2-5
	2-16	Loamy sand, sandy loam, fine sandy loam.	SM, SC-SM	A-4, A-2	0	0-10	88-100	80-95	65-80	30-50	15-20	NP-5
	16-31	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-6	0	0-10	90-100	80-95	70-80	35-50	25-40	10-20
	31-41	Sandy loam, fine sandy loam.	SC-SM, SC	A-4	0	0-10	85-95	80-95	65-80	35-50	15-25	5-10
	41-80	Sandy loam, fine sandy loam.	SC-SM, SC	A-4	0	0-10	85-95	80-95	65-80	35-50	15-25	5-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
346:												
Talmoon	0-3	Loam	ML, CL, CL-ML	A-4	0	0-2	95-100	85-100	70-100	60-90	20-32	3-10
	3-14	Very fine sandy loam, sandy loam, loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0-2	95-100	85-100	60-95	35-75	23-35	6-15
	14-55	Clay loam, silty clay loam, loam.	CL, ML	A-6, A-7, A-4	0	0-2	95-100	85-100	70-100	50-95	30-50	9-20
	55-80	Loam, sandy clay loam, clay loam.	CL, CL-ML, SC, SC-SM	A-6, A-4, A-7	0	0-2	95-100	85-100	75-100	45-80	25-45	6-18
406A:												
Dorset	0-11	Sandy loam	SM, SC-SM	A-4, A-2	0	0	90-100	85-100	50-70	25-50	0-25	NP-5
	11-20	Loam, sandy loam, coarse sandy loam.	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0	90-100	85-100	50-90	35-75	15-30	4-14
	20-38	Gravelly loamy sand, gravelly coarse sand, coarse sand.	SP-SM, SM, SC-SM, GM	A-1, A-2	0	0-5	50-90	50-75	20-50	10-25	0-20	NP-7
	38-80	Gravelly coarse sand, gravelly sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	50-90	50-75	15-40	0-10	0-20	NP
488:												
Becida	0-5	Fine sandy loam	SM, SC-SM	A-2, A-4	0-1	5-15	85-100	80-95	60-80	25-40	15-25	2-7
	5-12	Sandy loam, fine sandy loam, loamy sand.	SM, SC-SM	A-2, A-4	0-1	5-15	85-95	75-95	60-75	25-40	0-20	NP-5
	12-29	Sandy loam, fine sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0-1	5-10	85-95	75-95	60-75	25-45	15-25	2-10
	29-65	Sandy loam, fine sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0-1	0-5	85-95	75-95	60-75	25-40	15-25	2-10
	65-80	Sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4	0-1	0-5	85-95	75-95	60-75	25-40	15-25	2-8

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
526C:												
Steamboat-------	0-3	Sandy loam-----	SM, SC-SM	A-4	0-5	2-15	90-100	85-100	60-80	30-40	25-30	2-5
	3-35	Loamy sand, loamy fine sand, sandy loam.	SM, SC-SM	A-4, A-2	0-1	2-15	85-100	85-100	65-85	30-40	15-20	NP-5
	35-46	Sandy loam, fine sandy loam, loam.	SM, SC-SM, ML	A-4	0-1	0-10	90-100	85-100	65-80	25-40	15-25	2-10
	46-80	Sandy loam, fine sandy loam, loamy sand.	SC-SM, SC	A-4, A-2	0-1	0-10	85-95	85-95	65-80	25-40	15-25	2-10
Two Inlets------	0-2	Loamy sand-----	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP
Seelyeville-----	0-18	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	18-60	Mucky peat, muck.	PT	A-8	0	0	0	0	0	0	---	NP
526E:												
Steamboat-------	0-3	Sandy loam-----	SM, SC-SM	A-4	0-5	2-15	90-100	85-100	60-80	30-40	25-30	2-5
	3-35	Loamy sand, loamy fine sand, sandy loam.	SM, SC-SM	A-4, A-2	0-1	2-15	85-100	85-100	65-85	30-40	15-20	NP-5
	35-46	Sandy loam, fine sandy loam, loam.	SM, SC-SM, ML	A-4	0-1	0-10	90-100	85-100	65-80	25-40	15-25	2-10
	46-80	Sandy loam, fine sandy loam, loamy sand.	SC-SM, SC	A-4, A-2	0-1	0-10	85-95	85-95	65-80	25-40	15-25	2-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
526E:												
Two Inlets	0-2	Loamy sand	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP
Seelyeville	0-18	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	18-60	Mucky peat, muck.	PT	A-8	0	0	0	0	0	0	---	NP
540:												
Seelyeville	0-10	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	10-80	Muck, mucky peat.	PT	A-8	0	0	0	0	0	0	---	NP
541:												
Rifle	0-14	Mucky peat	PT	A-8	0	0	0	0	0	0	---	NP
	14-60	Mucky peat	PT	A-8	0	0	0	0	0	0	---	NP
545:												
Rondeau	0-44	Muck	PT	A-8	0	0	0	0	0	0	0-14	NP
	44-60	Marl	OH, MH	A-8, A-5, A-7	0	0	100	95-100	80-90	60-80	50-90	NP-20
567A:												
Verndale	0-9	Sandy loam	SM, SC-SM	A-4, A-2-4	0	0	100	85-100	60-85	25-45	15-20	3-6
	9-19	Sandy loam, fine sandy loam, loam.	SC, SC-SM	A-4, A-2-4	0	0	98-100	85-100	60-85	25-45	20-26	5-10
	19-49	Sand, coarse sand, loamy coarse sand.	SM, SP-SM	A-3, A-2-4	0	0	98-100	85-100	50-65	5-20	---	NP-2
	49-60	Sand, coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	0	96-100	75-100	45-60	3-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
574G:												
Steamboat	0-3	Sandy loam	SM, SC-SM	A-4	0-5	2-15	90-100	85-100	60-80	30-40	25-30	2-5
	3-35	Loamy sand, loamy fine sand, sandy loam.	SM, SC-SM	A-4, A-2	0-1	2-15	85-100	85-100	65-85	30-40	15-20	NP-5
	35-46	Sandy loam, fine sandy loam, loam.	SM, SC-SM, ML	A-4	0-1	0-10	90-100	85-100	65-80	25-40	15-25	2-10
	46-80	Sandy loam, fine sandy loam, loamy sand.	SC-SM, SC	A-4, A-2	0-1	0-10	85-95	85-95	65-80	25-40	15-25	2-10
Two Inlets	0-2	Loamy sand	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP
628:												
Talmoon	0-10	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	10-15	Very fine sandy loam, sandy loam, loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0-2	95-100	85-100	60-95	35-75	23-35	6-15
	15-55	Clay loam, silty clay loam, loam.	CL, ML	A-6, A-7, A-4	0	0-2	95-100	85-100	70-100	50-95	30-50	9-20
	55-80	Loam, sandy clay loam, clay loam.	CL, CL-ML, SC, SC-SM	A-6, A-4, A-7	0	0-2	95-100	85-100	75-100	45-80	25-45	6-18

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
672:												
Willosippi------	0-7	Loam----------	ML, CL, CL-ML	A-4, A-6	0	0	100	100	90-100	60-90	15-35	4-15
	7-12	Fine sandy loam, loam, silt loam.	SM, ML, CL-ML, SC-SM	A-4, A-6	0	0	100	100	70-95	40-90	15-35	NP-15
	12-32	Stratified silty clay loam to loamy sand.	ML, CL	A-6	0	0	100	100	50-90	20-90	25-40	10-20
	32-60	Stratified silty clay loam to loamy sand.	ML, CL, CL-ML, SC-SM	A-4, A-6	0	0	100	100	50-90	20-90	15-40	4-15
675C:												
Two Inlets------	0-2	Loamy sand-----	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP
Eagleview------	0-4	Loamy sand-----	SP-SM, SM	A-2, A-1	0	0	100	85-100	60-80	10-25	---	NP
	4-28	Loamy sand, loamy coarse sand, sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0	100	85-100	50-75	2-15	---	NP
	28-45	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-3, A-2, A-1	0	0	100	85-100	50-75	2-15	---	NP
	45-80	Sand, coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	85-100	40-75	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
675C:												
Steamboat-------	0-3	Fine sandy loam	SM, SC-SM	A-4	0-5	2-15	90-100	85-100	60-80	30-40	25-30	2-5
	3-35	Loamy sand, loamy fine sand, sandy loam.	SM, SC-SM	A-4, A-2	0-1	2-15	85-100	85-100	65-85	30-40	15-20	NP-5
	35-46	Sandy loam, fine sandy loam, loam.	SM, SC-SM, ML	A-4	0-1	0-10	90-100	85-100	65-80	25-40	15-25	2-10
	46-80	Sandy loam, fine sandy loam, loamy sand.	SC-SM, SC	A-4, A-2	0-1	0-10	85-95	85-95	65-80	25-40	15-25	2-10
675E:												
Two Inlets------	0-2	Loamy sand-----	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP
Eagleview-------	0-4	Loamy sand-----	SP-SM, SM	A-2, A-1	0	0	100	85-100	60-80	10-25	---	NP
	4-28	Loamy sand, loamy coarse sand, sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0	100	85-100	50-75	2-15	---	NP
	28-45	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-3, A-2, A-1	0	0	100	85-100	50-75	2-15	---	NP
	45-80	Sand, coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	85-100	40-75	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
675E:												
Steamboat-------	0-3	Sandy loam-----	SM, SC-SM	A-4	0-5	2-15	90-100	85-100	60-80	30-40	25-30	2-5
	3-35	Loamy sand, loamy fine sand, sandy loam.	SM, SC-SM	A-4, A-2	0-1	2-15	85-100	85-100	65-85	30-40	15-20	NP-5
	35-46	Sandy loam, fine sandy loam, loam.	SM, SC-SM, ML	A-4	0-1	0-10	90-100	85-100	65-80	25-40	15-25	2-10
	46-80	Sandy loam, fine sandy loam, loamy sand.	SC-SM, SC	A-4, A-2	0-1	0-10	85-95	85-95	65-80	25-40	15-25	2-10
675G:												
Two Inlets------	0-2	Loamy sand-----	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP
Eagleview-------	0-4	Loamy sand-----	SP-SM, SM	A-2, A-1	0	0	100	85-100	60-80	10-25	---	NP
	4-28	Loamy sand, loamy coarse sand, sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0	100	85-100	50-75	2-15	---	NP
	28-45	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-3, A-2, A-1	0	0	100	85-100	50-75	2-15	---	NP
	45-80	Sand, coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	85-100	40-75	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
675G:												
Steamboat	0-3	Sandy loam	SM, SC-SM	A-4	0-5	2-15	90-100	85-100	60-80	30-40	25-30	2-5
	3-35	Loamy sand, loamy fine sand, sandy loam.	SM, SC-SM	A-4, A-2	0-1	2-15	85-100	85-100	65-85	30-40	15-20	NP-5
	35-46	Sandy loam, fine sandy loam, loam.	SM, SC-SM, ML	A-4	0-1	0-10	90-100	85-100	65-80	25-40	15-25	2-10
	46-80	Sandy loam, fine sandy loam, loamy sand.	SC-SM, SC	A-4, A-2	0-1	0-10	85-95	85-95	65-80	25-40	15-25	2-10
701:												
Runeberg	0-10	Mucky loam	ML, CL	A-4, A-6	0-1	2-5	95-100	90-95	80-90	50-80	30-40	5-15
	10-36	Sandy loam	SM, SC, SC-SM	A-2, A-4	0-1	5-10	85-95	80-95	60-75	30-45	15-25	3-10
	36-60	Sandy loam	SM, SC-SM, SC	A-2, A-4	0-1	5-10	85-95	80-95	60-75	30-45	15-25	3-8
709B:												
Lengby	0-3	Fine sandy loam	SM, SC-SM	A-4	0	0	100	95-100	70-85	35-50	15-20	NP-5
	3-11	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2-4, A-3	0	0	100	95-100	65-80	5-30	---	NP
	11-26	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	60-85	25-40	5-20
	26-48	Stratified silt loam to coarse sand.	SM, SC-SM	A-2-4, A-4	0	0-5	90-100	85-100	50-80	20-50	15-25	NP-5
	48-60	Stratified sand to loamy very fine sand.	SM, SP-SM	A-2-4, A-1-b	0	0-3	90-100	85-100	35-75	10-35	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
709C:												
Lengby	0-3	Fine sandy loam	SM, SC-SM	A-4	0	0	100	95-100	70-85	35-50	15-20	NP-5
	3-11	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2-4, A-3	0	0	100	95-100	65-80	5-30	---	NP
	11-26	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	60-85	25-40	5-20
	26-48	Stratified silt loam to coarse sand.	SM, SC-SM	A-2-4, A-4	0	0-5	90-100	85-100	50-80	20-50	15-25	NP-5
	48-60	Stratified sand to loamy very fine sand.	SM, SP-SM	A-2-4, A-1-b	0	0-3	90-100	85-100	35-75	10-35	---	NP
719B:												
Rondeau	0-20	Muck	PT	A-8	0	0	0	0	0	0	0-14	NP
	20-80	Marl	OH, MH	A-8, A-5, A-7	0	0	100	95-100	80-90	60-80	50-90	NP-20
731A:												
Sanburn	0-6	Loamy sand	SM, SP-SM	A-2-4	0	0-5	80-100	80-100	50-75	10-20	---	NP
	6-15	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SC-SM	A-4, A-2-4	0-1	0-5	80-100	80-100	55-85	15-40	10-25	NP-10
	15-21	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-30	5-15
	21-60	Sand, coarse sand, gravelly sand.	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
744B:												
Debs	0-2	Silt loam	ML, CL-ML	A-4	0	0	100	100	95-100	60-90	20-30	NP-7
	2-12	Fine sandy loam, very fine sandy loam, silt loam.	ML, SM	A-4	0	0	100	100	85-100	40-70	15-20	NP-4
	12-32	Silt loam, silty clay loam, clay loam.	ML, CL	A-4, A-6	0	0	100	100	95-100	75-95	20-40	8-20
	32-60	Silt loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	0	100	100	95-100	40-75	15-20	NP-4
Akeley	0-3	Loamy sand	SM, SP-SM	A-2-4	0	0-1	90-100	80-95	65-80	10-30	0-14	NP
	3-49	Loamy sand, sand, coarse sand.	SM, SP-SM	A-2-4, A-3	0	0-3	85-100	80-95	50-75	5-30	0-14	NP
	49-56	Silt loam, clay loam, sandy clay loam.	ML, CL, CL-ML	A-4, A-6	0	0	95-100	95-100	95-100	75-95	20-40	8-20
	56-80	Stratified fine sand to silt loam.	SM, SC-SM, ML, CL-ML	A-2, A-4	0	0	95-100	95-100	65-90	30-80	15-20	NP-5
746:												
Haslie	0-12	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	12-30	Sapric material, muck.	PT	A-8	0	0	0	0	0	0	---	NP
	30-80	Coprogenous earth, mucky silt loam.	OL	A-5	0	0	100	95-100	85-100	75-96	41-50	2-10
775B:												
Sugarbush	0-3	Sandy loam	SM	A-2-4	0-1	0-10	95-100	90-100	55-70	25-35	15-20	NP-4
	3-13	Loamy sand, loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0-1	0-10	95-100	90-100	40-70	10-25	---	NP
	13-25	Sandy loam, coarse sandy loam.	SM	A-2-4	0-1	0-10	95-100	90-100	50-70	25-35	15-20	NP-4
	25-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1-b, A-2-4, A-3	0-1	0-10	55-85	50-75	30-55	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
775B:												
Two Inlets	0-2	Loamy sand	SM	A-2-4	0	0-2	80-100	50-90	35-70	15-30	---	NP
	2-10	Loamy coarse sand, gravelly loamy coarse sand, coarse sandy loam.	SM	A-2-4	0	0-2	80-100	50-90	30-65	15-30	15-21	NP-4
	10-33	Loamy coarse sand, gravelly loamy coarse sand, loamy sand.	SM	A-2-4, A-2, A-3	0	0-5	80-100	50-90	30-65	5-30	15-25	NP-7
	33-60	Gravelly coarse sand, gravelly sand, sand.	SP, SP-SM	A-1, A-3	0	0-5	60-95	50-75	30-55	2-10	---	NP
775C:												
Sugarbush	0-3	Sandy loam	SM	A-2-4	0-1	0-10	95-100	90-100	55-70	25-35	15-20	NP-4
	3-13	Loamy sand, loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0-1	0-10	95-100	90-100	40-70	10-25	---	NP
	13-25	Sandy loam, coarse sandy loam.	SM	A-2-4	0-1	0-10	95-100	90-100	50-70	25-35	15-20	NP-4
	25-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1-b, A-2-4, A-3	0-1	0-10	55-85	50-75	30-55	2-10	---	NP
Two Inlets	0-2	Loamy sand	SM	A-2-4	0	0-2	80-100	50-90	35-70	15-30	---	NP
	2-10	Loamy coarse sand, gravelly loamy coarse sand, coarse sandy loam.	SM	A-2-4	0	0-2	80-100	50-90	30-65	15-30	15-21	NP-4
	10-33	Loamy coarse sand, gravelly loamy coarse sand, loamy sand.	SM	A-2-4, A-2, A-3	0	0-5	80-100	50-90	30-65	5-30	15-25	NP-7
	33-60	Gravelly coarse sand, gravelly sand, sand.	SP, SP-SM	A-1, A-3	0	0-5	60-95	50-75	30-55	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
778B:												
Dorset	0-11	Sandy loam	SM, SC-SM	A-4, A-2	0	0	90-100	85-100	50-70	25-50	0-25	NP-5
	11-20	Loam, sandy loam, coarse sandy loam.	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0	90-100	85-100	50-90	35-75	15-30	4-14
	20-38	Gravelly loamy sand, gravelly coarse sand, coarse sand.	SP-SM, SM, SC-SM, GM	A-1, A-2	0	0-5	50-90	50-75	20-50	10-25	0-20	NP-7
	38-80	Gravelly coarse sand, gravelly sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	50-90	50-75	15-40	0-10	0-20	NP
Corliss	0-7	Loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0	0-5	85-100	80-100	40-70	10-25	15-21	NP-4
	7-11	Loamy sand, gravelly sand, coarse sand.	SP-SM, SM, SP	A-1-b, A-2-4, A-3	0	0-5	75-95	50-85	35-70	2-25	15-21	NP-4
	11-60	Coarse sand, sand, gravelly coarse sand.	SP, SP-SM	A-1-b, A-3	0	0-5	60-95	50-85	30-65	2-10	---	NP
778C:												
Dorset	0-11	Sandy loam	SM, SC-SM	A-4, A-2	0	0	90-100	85-100	50-70	25-50	0-25	NP-5
	11-20	Loam, sandy loam, coarse sandy loam.	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0	90-100	85-100	50-90	35-75	15-30	4-14
	20-38	Gravelly loamy sand, gravelly coarse sand, coarse sand.	SP-SM, SM, SC-SM, GM	A-1, A-2	0	0-5	50-90	50-75	20-50	10-25	0-20	NP-7
	38-80	Gravelly coarse sand, gravelly sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	50-90	50-75	15-40	0-10	0-20	NP
Corliss	0-7	Loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0	0-5	85-100	80-100	40-70	10-25	15-21	NP-4
	7-11	Loamy sand, gravelly sand, coarse sand.	SP-SM, SM, SP	A-1-b, A-2-4, A-3	0	0-5	75-95	50-85	35-70	2-25	15-21	NP-4
	11-60	Coarse sand, sand, gravelly coarse sand.	SP, SP-SM	A-1-b, A-3	0	0-5	60-95	50-85	30-65	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
797:												
Mooselake	0-10	Mucky peat	PT	A-8	0	0	0	0	0	0	---	NP
	10-80	Mucky peat	PT	A-8	0	0	0	0	0	0	---	NP
Lupton	0-10	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	10-80	Sapric material	PT	A-8	0	0	0	0	0	0	---	NP
799:												
Seelyeville	0-12	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	12-80	Muck, sapric material.	PT	A-8	0	0	0	0	0	0	---	NP
Bowstring	0-38	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	38-47	Stratified sand to fine sandy loam.	SP-SM, SM, SC-SM	A-2	0	0	100	100	50-85	10-35	15-20	NP-5
	47-80	Muck	PT	A-8	0	0	0	0	0	0	---	NP
820B:												
Potatolake	0-9	Very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	60-90	20-40	5-15
	9-15	Very fine sandy loam, silt loam, fine sandy loam.	ML, SM	A-4, A-6	0	0	100	95-100	75-100	40-90	15-40	NP-15
	15-30	Silty clay loam, silt loam, very fine sandy loam.	CL, ML, CL-ML	A-4, A-6, A-7-6	0	0	100	95-100	85-100	80-100	30-50	10-25
	30-80	Stratified silt loam to gravelly coarse sand.	SP-SM, SP, SM	A-1, A-2, A-3, A-4	0	0-5	75-100	50-100	40-70	10-50	0-20	NP-5

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
820C:												
Potatolake	0-9	Very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	60-90	20-40	5-15
	9-15	Very fine sandy loam, silt loam, fine sandy loam.	ML, SM	A-4, A-6	0	0	100	95-100	75-100	40-90	15-40	NP-15
	15-30	Silty clay loam, silt loam, very fine sandy loam.	CL, ML, CL-ML	A-4, A-6, A-7-6	0	0	100	95-100	85-100	80-100	30-50	10-25
	30-80	Stratified silt loam to gravelly coarse sand.	SP-SM, SP, SM	A-1, A-2, A-3, A-4	0	0-5	75-100	50-100	40-70	10-50	0-20	NP-5
831C:												
Akeley	0-3	Loamy sand	SM, SP-SM	A-2-4	0	0-1	90-100	80-95	65-80	10-30	0-14	NP
	3-49	Loamy sand, sand, coarse sand.	SM, SP-SM	A-2-4, A-3	0	0-3	85-100	80-95	50-75	5-30	0-14	NP
	49-56	Silt loam, clay loam, sandy clay loam.	ML, CL, CL-ML	A-4, A-6	0	0	95-100	95-100	95-100	75-95	20-40	8-20
	56-80	Stratified fine sand to silt loam.	SM, SC-SM, ML, CL-ML	A-2, A-4	0	0	95-100	95-100	65-90	30-80	15-20	NP-5
Debs	0-2	Silt loam	ML, CL-ML	A-4	0	0	100	100	95-100	60-90	20-30	NP-7
	2-12	Fine sandy loam, very fine sandy loam, silt loam.	ML, SM	A-4	0	0	100	100	85-100	40-70	15-20	NP-4
	12-32	Silt loam, silty clay loam, clay loam.	ML, CL	A-4, A-6	0	0	100	100	95-100	75-95	20-40	8-20
	32-60	Silt loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	0	100	100	95-100	40-75	15-20	NP-4

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
831E:												
Akeley	0-3	Loamy sand	SM, SP-SM	A-2-4	0	0-1	90-100	80-95	65-80	10-30	0-14	NP
	3-49	Loamy sand, sand, coarse sand.	SM, SP-SM	A-2-4, A-3	0	0-3	85-100	80-95	50-75	5-30	0-14	NP
	49-56	Silt loam, clay loam, sandy clay loam.	ML, CL, CL-ML	A-4, A-6	0	0	95-100	95-100	95-100	75-95	20-40	8-20
	56-80	Stratified fine sand to silt loam.	SM, SC-SM, ML, CL-ML	A-2, A-4	0	0	95-100	95-100	65-90	30-80	15-20	NP-5
Debs	0-2	Silt loam	ML, CL-ML	A-4	0	0	100	100	95-100	60-90	20-30	NP-7
	2-12	Fine sandy loam, very fine sandy loam, silt loam.	ML, SM	A-4	0	0	100	100	85-100	40-70	15-20	NP-4
	12-32	Silt loam, silty clay loam, clay loam.	ML, CL	A-4, A-6	0	0	100	100	95-100	75-95	20-40	8-20
	32-60	Silt loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	0	100	100	95-100	40-75	15-20	NP-4
844B:												
Sanburn	0-6	Loamy sand	SM, SP-SM	A-2-4	0	0-5	80-100	80-100	50-75	10-20	---	NP
	6-15	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SC-SM	A-4, A-2-4	0-1	0-5	80-100	80-100	55-85	15-40	10-25	NP-10
	15-21	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-30	5-15
	21-60	Sand, coarse sand, gravelly sand.	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
844B:												
Graycalm	0-3	Loamy sand	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP
867B:												
Graycalm	0-3	Loamy sand	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP
Menahga	0-3	Loamy sand	SM, SP-SM	A-2	0	0	100	85-100	60-80	10-30	---	NP
	3-17	Coarse sand, sand, loamy coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
	17-80	Coarse sand, sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
867C:												
Graycalm	0-3	Loamy sand	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP
Menahga	0-3	Loamy sand	SM, SP-SM	A-2	0	0	100	85-100	60-80	10-30	---	NP
	3-17	Coarse sand, sand, loamy coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
	17-80	Coarse sand, sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
867E:												
Graycalm	0-3	Loamy sand	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP
Menahga	0-3	Loamy sand	SM, SP-SM	A-2	0	0	100	85-100	60-80	10-30	---	NP
	3-17	Coarse sand, sand, loamy coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
	17-80	Coarse sand, sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
867F:												
Graycalm	0-3	Loamy sand	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP
Menahga	0-3	Loamy sand	SM, SP-SM	A-2	0	0	100	85-100	60-80	10-30	---	NP
	3-17	Coarse sand, sand, loamy coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
	17-80	Coarse sand, sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
1015:												
Udipsamments	0-14	Sand	SM, SP-SM	A-2	0	0	95-100	85-100	75-90	10-35	---	NP
	14-60	Sand, fine sand	SP-SM, SP	A-2, A-3	0	0	95-100	85-100	50-75	5-25	---	NP
	60-80	Coarse sand, gravelly coarse sand.	SP, SP-SM, GP-GM	A-1, A-2	0	0	75-100	65-85	40-65	1-10	---	NP
1016:												
Udorthents	0-60	Variable	---	---	---	---	---	---	---	---	---	---
	60-80	Variable	---	---	0	0	0	0	0	0	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1021C:												
Graycalm	0-3	Loamy sand	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP
Sanburn	0-6	Loamy sand	SM, SP-SM	A-2-4	0	0-5	80-100	80-100	50-75	10-20	---	NP
	6-15	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SC-SM	A-4, A-2-4	0-1	0-5	80-100	80-100	55-85	15-40	10-25	NP-10
	15-21	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-30	5-15
	21-60	Sand, coarse sand, gravelly sand.	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP
1027:												
Udorthents.												
1030:												
Pits, gravel.												
Udipsamments	0-14	Sand	SM, SP-SM	A-2	0	0	95-100	85-100	75-90	10-35	---	NP
	14-60	Sand, fine sand	SP-SM, SP	A-2, A-3	0	0	95-100	85-100	50-75	5-25	---	NP
	60-80	Coarse sand, gravelly coarse sand.	SP, SP-SM, GP-GM	A-1, A-2	0	0	75-100	65-85	40-65	1-10	---	NP
1111:												
Nidaros	0-32	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	32-38	Sandy clay loam, sandy loam, loam.	SC, CL, CL-ML, SC-SM	A-6, A-2-6, A-4	0	0	95-100	85-100	50-95	30-75	21-40	NP-20
	38-60	Coarse sand, loamy sand, gravelly sand.	SP, SM, SP-SM, SW	A-1-b, A-3, A-2-4	0	0	60-100	50-100	30-70	3-30	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1113:												
Haslie	0-20	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	20-60	Coprogenous earth, mucky silty clay.	OL	A-5	0	0	100	95-100	85-100	75-96	41-50	2-10
Seelyeville	0-18	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	18-60	Mucky peat, muck.	PT	A-8	0	0	0	0	0	0	---	NP
Cathro	0-23	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	23-60	Sandy loam, silt loam, clay loam.	SC-SM, CL-ML, SC, CL	A-4, A-6	0	0-5	80-100	65-100	60-100	35-90	20-40	4-20
1126B:												
Verndale	0-9	Sandy loam	SM, SC-SM	A-4, A-2-4	0	0	100	85-100	60-85	25-45	15-20	3-6
	9-19	Sandy loam, fine sandy loam, loam.	SC, SC-SM	A-4, A-2-4	0	0	98-100	85-100	60-85	25-45	20-26	5-10
	19-49	Sand, coarse sand, loamy coarse sand.	SM, SP-SM	A-3, A-2-4	0	0	98-100	85-100	50-65	5-20	---	NP-2
	49-60	Sand, coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	0	96-100	75-100	45-60	3-10	---	NP
Nymore	0-8	Loamy sand	SM, SP-SM	A-2, A-3	0	0	95-100	90-100	50-75	5-30	15-20	NP
	8-33	Sand, coarse sand, loamy coarse sand.	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	85-100	45-75	2-15	15-20	NP
	33-60	Sand, coarse sand.	SP, SP-SM, SM	A-1, A-3, A-2	0	0	95-100	85-100	45-75	2-15	15-20	NP
1127A:												
Bootlake	0-3	Sandy loam	SM	A-2-4	0	0	95-100	85-100	55-70	25-35	15-20	NP-4
	3-7	Coarse sand, loamy coarse sand, loamy sand.	SM, SP-SM	A-2-4, A-1-b	0	0	95-100	85-100	40-70	10-25	---	NP
	7-13	Sandy loam, coarse sandy loam.	SM	A-2-4	0	0	95-100	85-100	50-65	25-35	15-20	NP-4
	13-47	Sand, coarse sand.	SP, SP-SM	A-3, A-2-4	0	0	95-100	85-100	50-80	2-10	---	NP
	47-80	Sand, coarse sand.	SP, SP-SM	A-3, A-2-4	0	0	95-100	85-100	50-80	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1127A:												
Graycalm	0-3	Loamy sand	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP
1127B:												
Bootlake	0-3	Sandy loam	SM	A-2-4	0	0	95-100	85-100	55-70	25-35	15-20	NP-4
	3-7	Coarse sand, loamy coarse sand, loamy sand.	SM, SP-SM	A-2-4, A-1-b	0	0	95-100	85-100	40-70	10-25	---	NP
	7-13	Sandy loam, coarse sandy loam.	SM	A-2-4	0	0	95-100	85-100	50-65	25-35	15-20	NP-4
	13-47	Sand, coarse sand.	SP, SP-SM	A-3, A-2-4	0	0	95-100	85-100	50-80	2-10	---	NP
	47-80	Sand, coarse sand.	SP, SP-SM	A-3, A-2-4	0	0	95-100	85-100	50-80	2-10	---	NP
Graycalm	0-3	Loamy sand	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP
1136:												
Nidaros	0-27	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	27-38	Sandy clay loam, sandy loam, loam.	SC, CL, CL-ML, SC-SM	A-6, A-2-6, A-4	0	0	95-100	85-100	50-95	30-75	21-40	NP-20
	38-80	Coarse sand, loamy sand, gravelly sand.	SP, SM, SP-SM, SW	A-1-b, A-3, A-2-4	0	0	60-100	50-100	30-70	3-30	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1164:												
Zerkel	0-4	Loam	ML, CL, CL-ML	A-4	0	0	100	95-100	85-100	50-80	15-30	NP-10
	4-10	Very fine sandy loam, fine sandy loam, loamy fine sand.	SM, SC-SM, ML	A-2, A-4	0	0	100	95-100	60-90	30-55	15-20	NP-5
	10-29	Loam, clay loam, silt loam.	CL, ML	A-4, A-6, A-7	0	0	100	95-100	85-95	60-85	30-45	10-30
	29-37	Stratified fine sand to silt loam.	ML, CL-ML, SM, SP-SM	A-2-4, A-4, A-3	0	0	100	95-100	60-85	10-60	15-20	NP-10
	37-80	Stratified fine sand to silt loam.	ML, CL-ML, SM, SP-SM	A-2-4, A-4, A-3	0	0	100	95-100	60-85	10-60	15-20	NP-10
1200:												
Egglake	0-4	Loam	ML, CL-ML	A-4	0-1	0-5	95-100	85-98	50-97	50-90	15-25	3-7
	4-9	Fine sandy loam, sandy loam, loam.	SM	A-2-4	0-1	0-5	95-100	85-98	40-50	25-35	15-21	2-4
	9-25	Sandy clay loam, sandy loam, loam.	SC, CL	A-6, A-4	0-1	0-5	95-100	85-98	55-75	40-60	28-36	9-15
	25-80	Sandy loam, coarse sandy loam, fine sandy loam.	SC-SM, SC, CL-ML, CL	A-4	0-1	0-5	95-100	85-98	50-70	35-55	21-28	4-9
1230:												
Haslie	0-44	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	44-60	Coprogenous earth, mucky silty clay.	OL	A-5	0	0	100	95-100	85-100	75-96	41-50	2-10
Nidaros	0-38	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	38-54	Coarse sandy loam, sandy clay loam, loam.	SC-SM, SC, CL, CL-ML	A-6, A-2-6, A-4	0	0	95-100	85-100	45-95	25-70	21-40	NP-20
	54-60	Coarse sand, sand, gravelly coarse sand.	SP, SM, SP-SM, SW	A-1-b, A-3, A-2-4	0	0	60-100	50-100	30-70	3-15	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1238E:												
Two Inlets	0-2	Loamy sand	SM	A-2-4	0	0-2	80-100	50-90	35-70	15-30	---	NP
	2-10	Loamy coarse sand, gravelly loamy coarse sand, coarse sandy loam.	SM	A-2-4	0	0-2	80-100	50-90	30-65	15-30	15-21	NP-4
	10-33	Loamy coarse sand, gravelly loamy coarse sand, loamy sand.	SM	A-2-4, A-2, A-3	0	0-5	80-100	50-90	30-65	5-30	15-25	NP-7
	33-60	Gravelly coarse sand, gravelly sand, sand.	SP, SP-SM	A-1, A-3	0	0-5	60-95	50-75	30-55	2-10	---	NP
Sugarbush	0-3	Sandy loam	SM	A-2-4	0-1	0-10	95-100	90-100	55-70	25-35	15-20	NP-4
	3-13	Loamy sand, loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0-1	0-10	95-100	90-100	40-70	10-25	---	NP
	13-25	Sandy loam, coarse sandy loam.	SM	A-2-4	0-1	0-10	95-100	90-100	50-70	25-35	15-20	NP-4
	25-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1-b, A-2-4, A-3	0-1	0-10	55-85	50-75	30-55	2-10	---	NP
1238F:												
Two Inlets	0-2	Loamy sand	SM	A-2-4	0	0-2	80-100	50-90	35-70	15-30	---	NP
	2-10	Loamy coarse sand, gravelly loamy coarse sand, coarse sandy loam.	SM	A-2-4	0	0-2	80-100	50-90	30-65	15-30	15-21	NP-4
	10-33	Loamy coarse sand, gravelly loamy coarse sand, loamy sand.	SM	A-2-4, A-2, A-3	0	0-5	80-100	50-90	30-65	5-30	15-25	NP-7
	33-60	Gravelly coarse sand, gravelly sand, sand.	SP, SP-SM	A-1, A-3	0	0-5	60-95	50-75	30-55	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1238F:												
Sugarbush-------	0-3	Sandy loam-----	SM	A-2-4	0-1	0-10	95-100	90-100	55-70	25-35	15-20	NP-4
	3-13	Loamy sand, loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0-1	0-10	95-100	90-100	40-70	10-25	---	NP
	13-25	Sandy loam, coarse sandy loam.	SM	A-2-4	0-1	0-10	95-100	90-100	50-70	25-35	15-20	NP-4
	25-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1-b, A-2-4, A-3	0-1	0-10	55-85	50-75	30-55	2-10	---	NP
1244B:												
Sol-------------	0-4	Sandy loam-----	SM, SC, SC-SM	A-2-4, A-4	0	0-15	95-100	75-95	50-80	25-40	15-25	2-8
	4-17	Loamy sand, loamy fine sand, fine sandy loam.	SM, SC-SM	A-2-4, A-4	0	0-15	95-100	75-95	45-80	20-40	15-20	NP-7
	17-43	Loam, sandy clay loam.	SC, CL	A-4, A-6	0	0-1	95-100	75-95	70-90	40-70	25-40	8-18
	43-80	Fine sandy loam, sandy loam.	SM, SC, CL, ML	A-2-4, A-4	0	0-1	95-100	75-95	60-85	35-55	15-25	2-10
Sugarbush-------	0-3	Sandy loam-----	SM	A-2-4	0-1	0-10	95-100	90-100	55-70	25-35	15-20	NP-4
	3-12	Loamy sand, loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0-1	0-10	95-100	90-100	40-70	10-25	---	NP
	12-25	Sandy loam, coarse sandy loam.	SM	A-2-4	0-1	0-10	95-100	90-100	50-70	25-35	15-20	NP-4
	25-60	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1-b, A-2-4, A-3	0-1	0-10	55-85	50-75	30-55	2-10	---	NP
1244C:												
Sol-------------	0-4	Sandy loam-----	SM, SC, SC-SM	A-2-4, A-4	0	0-15	95-100	75-95	50-80	25-40	15-25	2-8
	4-17	Loamy sand, loamy fine sand, fine sandy loam.	SM, SC-SM	A-2-4, A-4	0	0-15	95-100	75-95	45-80	20-40	15-20	NP-7
	17-43	Loam, sandy clay loam.	SC, CL	A-4, A-6	0	0-1	95-100	75-95	70-90	40-70	25-40	8-18
	43-80	Fine sandy loam, sandy loam.	SM, SC, CL, ML	A-2-4, A-4	0	0-1	95-100	75-95	60-85	35-55	15-25	2-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1244C:												
Sugarbush	0-3	Sandy loam	SM	A-2-4	0-1	0-10	95-100	90-100	55-70	25-35	15-20	NP-4
	3-12	Loamy sand, loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0-1	0-10	95-100	90-100	40-70	10-25	---	NP
	12-25	Sandy loam, coarse sandy loam.	SM	A-2-4	0-1	0-10	95-100	90-100	50-70	25-35	15-20	NP-4
	25-60	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1-b, A-2-4, A-3	0-1	0-10	55-85	50-75	30-55	2-10	---	NP
1244E:												
Sol	0-4	Sandy loam	SM, SC, SC-SM	A-2-4, A-4	0	0-15	95-100	75-95	50-80	25-40	15-25	2-8
	4-17	Loamy sand, loamy fine sand, fine sandy loam.	SM, SC-SM	A-2-4, A-4	0	0-15	95-100	75-95	45-80	20-40	15-20	NP-7
	17-43	Loam, sandy clay loam.	SC, CL	A-4, A-6	0	0-1	95-100	75-95	70-90	40-70	25-40	8-18
	43-80	Fine sandy loam, sandy loam.	SM, SC, CL, ML	A-2-4, A-4	0	0-1	95-100	75-95	60-85	35-55	15-25	2-10
Sugarbush	0-3	Sandy loam	SM	A-2-4	0-1	0-10	95-100	90-100	55-70	25-35	15-20	NP-4
	3-12	Loamy sand, loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0-1	0-10	95-100	90-100	40-70	10-25	---	NP
	12-25	Sandy loam, coarse sandy loam.	SM	A-2-4	0-1	0-10	95-100	90-100	50-70	25-35	15-20	NP-4
	25-60	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1-b, A-2-4, A-3	0-1	0-10	55-85	50-75	30-55	2-10	---	NP
1247D:												
Corliss	0-7	Loamy coarse sand.	SM, SP-SM	A-1-b, A-2-4	0	0-5	85-100	80-100	40-70	10-25	15-21	NP-4
	7-11	Loamy sand, gravelly sand, coarse sand.	SP-SM, SM, SP	A-1-b, A-2-4, A-3	0	0-5	75-95	50-85	35-70	2-25	15-21	NP-4
	11-60	Coarse sand, sand, gravelly coarse sand.	SP, SP-SM	A-1-b, A-3	0	0-5	60-95	50-85	30-65	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1247D:												
Dorset----------	0-11	Sandy loam-----	SM, SC-SM	A-4, A-2	0	0	90-100	85-100	50-70	25-50	0-25	NP-5
	11-20	Loam, sandy loam, coarse sandy loam.	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0	90-100	85-100	50-90	35-75	15-30	4-14
	20-38	Gravelly loamy sand, gravelly coarse sand, coarse sand.	SP-SM, SM, SC-SM, GM	A-1, A-2	0	0-5	50-90	50-75	20-50	10-25	0-20	NP-7
	38-80	Gravelly coarse sand, gravelly sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	50-90	50-75	15-40	0-10	0-20	NP
1248C:												
Nymore----------	0-8	Loamy sand-----	SM, SP-SM	A-2, A-3	0	0	95-100	90-100	50-75	5-30	15-20	NP
	8-33	Sand, coarse sand, loamy coarse sand.	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	85-100	45-75	2-15	15-20	NP
	33-60	Sand, coarse sand.	SP, SP-SM, SM	A-1, A-3, A-2	0	0	95-100	85-100	45-75	2-15	15-20	NP
Verndale--------	0-9	Sandy loam-----	SM, SC-SM	A-4, A-2-4	0	0	100	85-100	60-85	25-45	15-20	3-6
	9-19	Sandy loam, fine sandy loam, loam.	SC, SC-SM	A-4, A-2-4	0	0	98-100	85-100	60-85	25-45	20-26	5-10
	19-49	Sand, coarse sand, loamy coarse sand.	SM, SP-SM	A-3, A-2-4	0	0	98-100	85-100	50-65	5-20	---	NP-2
	49-60	Sand, coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	0	96-100	75-100	45-60	3-10	---	NP
1249C:												
Graycalm--------	0-3	Loamy sand-----	SP-SM, SM	A-2, A-1	0	0-5	95-100	75-100	35-75	10-30	0-14	NP
	3-20	Sand, loamy sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	20-39	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-2, A-1, A-3	0	0-5	95-100	75-100	30-75	0-30	0-14	NP
	39-80	Sand, coarse sand.	SP, SP-SM, SM	A-2, A-1, A-3	0	0-5	95-100	75-100	35-55	0-15	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1249C:												
Bootlake	0-3	Sandy loam	SM	A-2-4	0	0	95-100	85-100	55-70	25-35	15-20	NP-4
	3-7	Coarse sand, loamy coarse sand, loamy sand.	SM, SP-SM	A-2-4, A-1-b	0	0	95-100	85-100	40-70	10-25	---	NP
	7-13	Sandy loam, coarse sandy loam.	SM	A-2-4	0	0	95-100	85-100	50-65	25-35	15-20	NP-4
	13-47	Sand, coarse sand.	SP, SP-SM	A-3, A-2-4	0	0	95-100	85-100	50-80	2-10	---	NP
	47-80	Sand, coarse sand.	SP, SP-SM	A-3, A-2-4	0	0	95-100	85-100	50-80	2-10	---	NP
1271:												
Roscommon	0-6	Mucky loamy sand.	SM, SP-SM, SC-SM	A-2, A-1-b	0	0	95-100	85-100	40-85	10-35	15-23	NP-6
	6-80	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	0	95-100	85-100	40-75	0-30	15-20	NP-4
1272B:												
Sol	0-3	Fine sandy loam	SM, SC, SC-SM	A-2-4, A-4	0	0-15	95-100	75-95	50-80	25-40	15-25	2-8
	3-14	Loamy sand, loamy fine sand, fine sandy loam.	SM, SC-SM	A-2-4, A-4	0	0-15	95-100	75-95	45-80	20-40	15-20	NP-7
	14-38	Loam, sandy clay loam.	SC, CL	A-4, A-6	0	0-1	95-100	75-95	70-90	40-70	25-40	8-18
	38-60	Fine sandy loam, sandy loam.	SM, SC, CL, ML	A-2-4, A-4	0	0-1	95-100	75-95	60-85	35-55	15-25	2-10
1294:												
Nary	0-3	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0	1-15	90-100	80-95	45-75	25-40	15-25	2-6
	3-15	Loamy sand, fine sandy loam, sandy loam.	SM, SC-SM	A-2-4	0	1-15	90-100	80-95	35-80	20-35	15-25	NP-6
	15-36	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-4, A-6	0	0-1	95-100	90-95	70-90	40-70	25-40	8-16
	36-60	Fine sandy loam, sandy loam.	SM, SC-SM, ML, CL-ML	A-4	0	0-1	95-100	90-95	60-85	35-55	20-30	2-7

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1319B:												
Rockwood	0-8	Sandy loam	SM	A-2, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	NP-4
	8-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-8
	16-37	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-46	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	46-60	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	80-90	60-75	25-40	15-25	2-10
1319C:												
Rockwood	0-8	Sandy loam	SM	A-2, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	NP-4
	8-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-8
	16-37	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-46	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	46-60	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	80-90	60-75	25-40	15-25	2-10
1319D:												
Rockwood	0-8	Sandy loam	SM	A-2, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	NP-4
	8-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-8
	16-37	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-46	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	46-60	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	5-10	85-95	80-90	60-75	25-40	15-25	2-10
1320B:												
Blowers	0-6	Sandy loam	SM, SC-SM	A-2, A-4	0-1	0-10	85-100	85-100	60-80	30-40	20-30	1-7
	6-17	Sandy loam	SM, SC-SM	A-2, A-4	0-1	0-10	85-95	85-90	60-75	30-40	15-20	1-5
	17-27	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	0-10	85-95	85-95	60-75	30-40	15-25	2-10
	27-40	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	0-10	85-95	80-95	60-75	30-40	15-25	2-10
	40-60	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	0-10	85-95	80-90	60-75	25-40	15-25	2-10
1321:												
Paddock	0-8	Fine sandy loam	SM, SC-SM	A-2, A-4	0	2-10	85-100	80-100	60-80	25-40	15-25	3-7
	8-15	Sandy loam, fine sandy loam.	SM, SC-SM	A-2, A-4	0	0-10	85-95	85-90	60-75	25-40	0-20	NP-5
	15-40	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	0-10	85-95	80-95	60-75	25-45	15-30	3-10
	40-60	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	0-10	85-90	80-90	60-75	25-40	15-25	NP-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1321:												
Becida	0-8	Loam	ML, CL	A-4, A-6	0-1	0-10	95-100	90-95	80-90	55-80	30-40	7-15
	8-13	Sandy loam, fine sandy loam, loamy sand.	SM, SC-SM	A-2, A-4	0-1	0-10	85-95	75-95	60-75	25-40	0-20	NP-5
	13-27	Sandy loam, fine sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0-1	0-5	85-95	75-95	60-75	25-45	15-25	2-10
	27-58	Sandy loam, fine sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0-1	0-5	85-95	75-95	60-75	25-40	15-25	2-10
	58-80	Sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4	0-1	0-5	85-95	75-95	60-75	25-40	15-25	2-8
1332B:												
Rockwood	0-7	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	3-7
	7-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-6
	16-37	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-80	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	80-90	60-75	25-40	15-25	2-10
1332C:												
Rockwood	0-7	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	3-7
	7-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-6
	16-37	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-80	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	80-90	60-75	25-40	15-25	2-10
1332E:												
Rockwood	0-7	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	3-7
	7-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-6
	16-37	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-80	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	80-90	60-75	25-40	15-25	2-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1334:												
Huntersville----	0-8	Loamy sand-----	SM, SP-SM	A-2-4	0-1	0-5	90-100	80-95	65-80	10-30	15-20	NP
	8-38	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2-4, A-1-b, A-3	0-1	0-10	85-95	70-95	45-50	20-35	15-20	NP
	38-65	Sandy loam, gravelly sandy loam, clay loam.	SM, SC-SM, SC, CL-ML	A-2-4, A-1-b, A-6	0-10	0-10	85-100	70-95	45-50	20-35	15-25	NP-9
	65-80	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC-SM, SC	A-2-4, A-1-b	0-10	0-10	85-100	70-95	45-60	15-35	15-25	NP-9
1336:												
Blowers---------	0-5	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0-1	5-10	90-100	85-100	60-80	30-40	20-30	1-7
	5-23	Sandy loam, loamy sand.	SM, SC-SM	A-2-4, A-4	0-1	5-10	85-95	85-90	45-75	15-40	15-20	1-6
	23-47	Sandy loam-----	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	47-80	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	80-90	60-75	25-40	15-25	2-10
1421B:												
Rockwood--------	0-7	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	3-7
	7-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-6
	16-37	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-80	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	80-90	60-75	25-40	15-25	2-10
Two Inlets------	0-2	Loamy sand-----	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1421C:												
Rockwood--------	0-7	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	3-7
	7-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-6
	16-37	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-80	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	80-90	60-75	25-40	15-25	2-10
Two Inlets------	0-2	Loamy sand-----	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP
1421E:												
Rockwood--------	0-7	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0-1	5-10	85-100	85-100	60-80	30-40	15-25	3-7
	7-16	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-90	60-75	30-40	15-20	1-6
	16-37	Fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	85-95	60-75	30-40	15-25	2-10
	37-80	Sandy loam, loamy sand.	SM, SC-SM, SC	A-2-4, A-4	0-1	5-10	85-95	80-90	60-75	25-40	15-25	2-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1421E:												
Two Inlets	0-2	Loamy sand	SM	A-2-4	0-5	0-5	60-90	60-75	25-40	10-20	0-23	NP-4
	2-9	Loamy coarse sand, gravelly loamy sand, cobbly loamy coarse sand.	SM, GM	A-1, A-2	0-5	0-25	60-90	60-75	25-40	10-20	0-21	NP-4
	9-19	Gravelly loamy coarse sand, gravelly loamy sand, loamy coarse sand.	SM	A-2	0-1	1-10	80-98	65-95	30-70	10-25	0-21	NP-4
	19-80	Gravelly coarse sand, gravelly sand.	SP, SP-SM	A-1, A-3	0-1	0-10	70-93	50-85	20-50	0-10	---	NP
1438B:												
Braham	0-8	Loamy fine sand	SM	A-2	0	0	100	90-100	55-70	20-35	15-20	NP
	8-24	Loamy fine sand, loamy sand, fine sand.	SP-SM, SM	A-2	0	0	100	90-100	65-90	10-20	15-20	NP
	24-42	Sandy clay loam, fine sandy loam, clay loam.	CL, ML, SC	A-4, A-6, A-7	0-1	0-3	95-100	85-95	80-95	45-70	28-43	10-21
	42-60	Sandy clay loam, loam, clay loam.	CL, ML, SC	A-4, A-6, A-7	0-1	0-3	95-100	85-95	80-95	45-70	28-43	10-21
1439:												
Cathro	0-12	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	12-43	Sapric material	PT	A-8	0	0	0	0	0	0	---	NP
	43-80	Sandy loam, loam, clay loam.	CL-ML, SC-SM, SC, CL	A-4, A-6	0	0-5	85-100	75-100	60-100	35-90	20-40	5-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1440B:												
Redeye	0-5	Loamy sand	SM, SP-SM	A-2-4	0-1	0-5	90-100	80-95	65-80	10-30	15-20	NP-4
	5-31	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2-4, A-3, A-1-b	0-1	0-10	75-95	70-90	30-65	5-15	15-20	NP-4
	31-43	Sandy loam, gravelly sandy loam.	SM, SC, SC-SM	A-2-4, A-2-6, A-1-b	0	0-10	85-100	70-95	45-70	15-35	15-25	NP-12
	43-80	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC, SC-SM	A-2-4, A-1-b	0	0-10	85-100	70-95	45-70	15-35	15-25	NP-9
1440C:												
Redeye	0-5	Loamy sand	SM, SP-SM	A-2-4	0-1	0-5	90-100	80-95	65-80	10-30	15-20	NP-4
	5-31	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2-4, A-3, A-1-b	0-1	0-10	75-95	70-90	30-65	5-15	15-20	NP-4
	31-43	Sandy loam, gravelly sandy loam.	SM, SC, SC-SM	A-2-4, A-2-6, A-1-b	0	0-10	85-100	70-95	45-70	15-35	15-25	NP-12
	43-80	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC, SC-SM	A-2-4, A-1-b	0	0-10	85-100	70-95	45-70	15-35	15-25	NP-9
1444:												
Wurtsmith	0-6	Loamy sand	SM, SP-SM	A-2-4	0	0	95-100	90-100	45-75	12-30	0-20	NP-10
	6-20	Sand	SP-SM, SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-30	0-20	NP-10
	20-80	Sand	SP-SM, SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-15	0-14	NP
1445:												
Markey	0-26	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	26-80	Fine sand, loamy sand, coarse sand.	SP, SM, SP-SM	A-2, A-3	0	0	100	75-100	60-75	0-20	---	NP
1447:												
Beltrami	0-6	Very fine sandy loam.	SM, SC-SM, ML	A-4	0-1	0-3	95-100	85-100	55-95	30-65	15-35	5-15
	6-12	Fine sandy loam, loam, loamy sand.	SM, SC-SM, ML, CL-ML	A-4, A-2	0-1	0-3	95-100	85-95	60-90	25-60	15-30	5-10
	12-39	Loam, sandy clay loam, clay loam.	CL	A-6, A-7	0-1	0-3	95-100	85-98	75-95	50-85	35-50	15-30
	39-80	Loam, clay loam	CL-ML, CL	A-4, A-6	0-1	1-3	95-100	85-95	70-95	50-80	35-45	15-25

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1450B:												
Sanburn---------	0-4	Very stony loamy sand.	SM, SP-SM	A-2-4	25-50	15-50	80-100	80-100	45-70	15-30	0-25	NP-10
	4-17	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SC-SM	A-4, A-2-4	0-1	0-5	80-100	80-100	55-85	15-40	10-25	NP-10
	17-24	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-30	5-15
	24-80	Sand, coarse sand, gravelly sand.	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP
1450C:												
Sanburn---------	0-4	Very stony loamy sand.	SM, SP-SM	A-2-4	25-50	15-50	80-100	80-100	45-70	15-30	0-25	NP-10
	4-17	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SC-SM	A-4, A-2-4	0-1	0-5	80-100	80-100	55-85	15-40	10-25	NP-10
	17-24	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-30	5-15
	24-80	Sand, coarse sand, gravelly sand.	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP
1450E:												
Sanburn---------	0-4	Very stony loamy sand.	SM, SP-SM	A-2-4	25-50	15-50	80-100	80-100	45-70	15-30	0-25	NP-10
	4-17	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SC-SM	A-4, A-2-4	0-1	0-5	80-100	80-100	55-85	15-40	10-25	NP-10
	17-24	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-30	5-15
	24-80	Sand, coarse sand, gravelly sand.	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1460B:												
Nebish	0-6	Very fine sandy loam.	SM, SC-SM	A-4, A-2-4	0	0-3	95-100	85-100	55-95	35-65	20-35	NP-7
	6-12	Loamy fine sand, fine sandy loam, sandy loam.	SM, SC-SM	A-4, A-2-4	0	0-3	95-100	85-100	50-85	30-50	15-25	NP-6
	12-32	Loam, clay loam	CL, ML	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	32-80	Loam, clay loam, sandy clay loam.	CL, ML, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20
1460C:												
Nebish	0-5	Very fine sandy loam.	SM, SC-SM	A-4, A-2-4	0	0-3	95-100	85-100	55-95	35-65	20-35	NP-7
	5-14	Loamy fine sand, fine sandy loam, sandy loam.	SM, SC-SM	A-4, A-2-4	0	0-3	95-100	85-100	50-85	30-50	15-25	NP-6
	14-39	Loam, clay loam	CL, ML	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	39-80	Loam, clay loam, sandy clay loam.	CL, ML, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20
1943:												
Roscommon	0-6	Loamy sand	SM, SP-SM	A-2, A-3, A-4	0	0	100	95-100	50-75	5-40	---	NP
	6-60	Sand, loamy sand, coarse sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	0	95-100	85-100	40-70	0-15	---	NP
1956:												
Staples	0-7	Loamy sand	SM, SP-SM	A-2-4	0	0	90-100	80-95	65-80	10-30	0-20	NP-4
	7-36	Loamy sand, sand, loamy fine sand.	SM, SP-SM	A-3, A-2-4, A-1-b	0	0-10	75-95	75-95	30-65	5-15	0-20	NP-4
	36-44	Sandy loam, gravelly sandy loam, clay loam.	SM, SC, SC-SM, CL-ML	A-2-4, A-1-b, A-6	0	0-10	85-95	70-95	45-67	20-35	0-25	NP-9
	44-60	Sandy loam, loamy sand, gravelly sandy loam.	SM, SC-SM, SC	A-2-4, A-1-b	0	0-10	85-95	70-95	45-67	20-35	0-25	NP-9

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1968:												
Evart	0-11	Loam	ML, CL, CL-ML	A-4, A-6	0	0-5	95-100	90-100	75-95	55-85	0-30	NP-11
	11-60	Fine sand, loamy sand, gravelly coarse sand.	SM, SP-SM, SC-SM, SP	A-1, A-3, A-2	0	0-5	95-100	60-100	30-75	0-20	0-25	NP-7
1969:												
Evart	0-11	Loam	ML, CL, CL-ML	A-4, A-6	0	0-5	95-100	90-100	75-95	55-85	0-30	NP-11
	11-60	Fine sand, loamy sand, gravelly coarse sand.	SM, SP-SM, SC-SM, SP	A-1, A-3, A-2	0	0-5	95-100	60-100	30-75	0-20	0-25	NP-7
Isan	0-13	Loamy sand	SM	A-2	0	0	95-100	92-100	50-75	12-30	15-20	NP
	13-30	Sand, loamy sand.	SM, SP-SM	A-2	0	0	95-100	92-100	50-75	10-30	15-20	NP
	30-60	Sand, coarse sand.	SM, SP	A-1, A-2, A-3	0	0	85-100	85-100	35-70	2-15	15-20	NP

Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
82B:												
Redeye	0-3	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	4	2	134
	3-18	2-6	1.45-1.60	6.00-20.00	0.07-0.10	Low	1.0-3.0	0.15	0.15			
	18-26	2-6	1.45-1.65	6.00-20.00	0.07-0.10	Low	0.5-2.0	0.15	0.15			
	26-52	6-18	1.65-1.80	0.20-0.60	0.11-0.13	Low	0.5-2.0	0.28	0.28			
	52-60	5-14	1.80-2.00	0.00-0.20	0.00-0.04	Low	0.0-0.5	0.28	0.28			
82C:												
Redeye	0-3	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	4	2	134
	3-18	2-6	1.45-1.60	6.00-20.00	0.07-0.10	Low	1.0-3.0	0.15	0.15			
	18-26	2-6	1.45-1.65	6.00-20.00	0.07-0.10	Low	0.5-2.0	0.15	0.15			
	26-52	6-18	1.65-1.80	0.20-0.60	0.11-0.13	Low	0.5-2.0	0.28	0.28			
	52-60	5-14	1.80-2.00	0.00-0.20	0.00-0.04	Low	0.0-0.5	0.28	0.28			
133B:												
Dalbo	0-6	20-27	1.25-1.45	0.60-2.00	0.22-0.24	Low	2.0-4.0	0.43	---	5	6	48
	6-41	35-60	1.25-1.45	0.06-0.60	0.10-0.18	High	0.5-2.0	0.32	---			
	41-60	24-35	1.30-1.60	0.20-2.00	0.20-0.22	Moderate	0.0-0.5	0.32	---			
133C:												
Dalbo	0-6	20-27	1.25-1.45	0.60-2.00	0.22-0.24	Low	2.0-4.0	0.43	---	5	6	48
	6-41	35-60	1.25-1.45	0.06-0.60	0.10-0.18	High	0.5-2.0	0.32	---			
	41-60	24-35	1.30-1.60	0.20-2.00	0.20-0.22	Moderate	0.0-0.5	0.32	---			
139B:												
Huntersville	0-12	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	4	2	134
	12-24	2-6	1.45-1.60	6.00-20.00	0.04-0.10	Low	0.0-1.0	0.15	0.15			
	24-40	6-35	1.65-1.80	0.20-0.60	0.11-0.13	Low	0.0-0.5	0.20	0.20			
	40-80	6-15	1.80-2.00	0.00-0.20	0.00-0.04	Low	0.0-0.5	0.20	0.20			
147:												
Spooner	0-8	10-24	1.25-1.40	0.60-2.00	0.20-0.24	Low	2.0-4.0	0.37	0.37	5	5	56
	8-13	3-18	1.35-1.55	0.60-6.00	0.17-0.19	Low	0.5-1.0	0.37	0.37			
	13-20	18-35	1.30-1.50	0.60-2.00	0.17-0.22	Low	0.0-0.5	0.37	0.37			
	20-80	5-32	1.40-1.60	0.60-2.00	0.17-0.22	Low	0.0-0.5	0.37	0.37			
158B:												
Zimmerman	0-16	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.17	0.17	5	2	134
	16-60	2-10	1.50-1.70	6.00-20.00	0.06-0.10	Low	0.0-0.5	0.17	0.17			
158C:												
Zimmerman	0-16	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.17	0.17	5	2	134
	16-80	2-10	1.50-1.70	6.00-20.00	0.06-0.10	Low	0.0-0.5	0.17	0.17			
167A:												
Baudette	0-4	10-27	1.20-1.40	0.60-2.00	0.20-0.22	Low	1.0-4.0	0.37	0.37	5	6	48
	4-8	5-27	1.30-1.50	0.60-2.00	0.14-0.20	Low	0.5-1.0	0.37	0.37			
	8-35	18-35	1.25-1.45	0.60-2.00	0.17-0.24	Moderate	0.5-1.0	0.37	0.37			
	35-60	5-27	1.30-1.60	0.60-2.00	0.17-0.22	Low	0.0-0.5	0.37	0.37			
170:												
Blomford	0-5	2-10	1.40-1.60	6.00-20.00	0.08-0.12	Low	1.0-4.0	0.17	0.17	5	2	134
	5-23	2-10	1.40-1.70	6.00-20.00	0.05-0.08	Low	0.5-1.0	0.17	0.17			
	23-55	18-30	1.65-1.75	0.60-2.00	0.13-0.17	Moderate	0.0-0.5	0.37	0.37			
	55-80	18-30	1.65-1.75	0.60-2.00	0.10-0.15	Low	0.0-0.5	0.37	0.37			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
202:												
Meehan	0-6	4-10	1.35-1.65	2.00-6.00	0.10-0.12	Low	0.5-3.0	0.17	0.17	5	2	134
	6-38	4-9	1.60-1.70	6.00-20.00	0.06-0.11	Low	0.0-0.5	0.15	0.15			
	38-80	1-4	1.60-1.70	6.00-20.00	0.02-0.07	Low	0.0-0.5	0.15	0.15			
207B:												
Nymore	0-8	2-12	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	5	2	134
	8-33	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
	33-60	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
207C:												
Nymore	0-8	2-12	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	5	2	134
	8-33	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
	33-60	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
207D:												
Nymore	0-8	2-12	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	5	2	134
	8-33	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
	33-60	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
260:												
Duelm	0-16	2-10	1.40-1.60	6.00-20.00	0.08-0.12	Low	2.0-6.0	0.17	0.17	5	2	134
	16-30	1-8	1.55-1.65	6.00-20.00	0.06-0.11	Low	0.0-0.5	0.15	0.15			
	30-80	0-6	1.55-1.65	6.00-20.00	0.02-0.07	Low	0.0-0.5	0.15	0.15			
261:												
Isan	0-11	2-8	1.30-1.60	6.00-20.00	0.08-0.12	Low	3.0-8.0	0.17	0.17	5	2	134
	11-15	2-8	1.50-1.65	6.00-20.00	0.06-0.10	Low	0.5-3.0	0.17	0.17			
	15-80	1-5	1.55-1.70	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.15	0.15			
267B:												
Snellman	0-2	5-18	1.35-1.60	0.60-6.00	0.13-0.18	Low	1.0-3.0	0.20	0.20	5	3	86
	2-16	5-15	1.50-1.70	0.60-2.00	0.09-0.14	Low	0.5-2.0	0.28	0.28			
	16-31	18-30	1.50-1.70	0.60-2.00	0.12-0.18	Moderate	0.0-0.5	0.28	0.28			
	31-41	7-18	1.60-1.80	0.60-2.00	0.11-0.16	Low	0.0-0.5	0.28	0.28			
	41-80	7-18	1.60-1.80	0.60-2.00	0.11-0.16	Low	0.0-0.5	0.28	0.28			
346:												
Talmoon	0-3	8-20	1.10-1.35	0.60-2.00	0.20-0.22	Low	2.0-4.0	0.28	0.28	5	5	56
	3-14	15-27	1.20-1.40	0.60-2.00	0.13-0.22	Low	0.5-1.0	0.37	0.37			
	14-55	22-35	1.40-1.60	0.20-0.60	0.16-0.19	Moderate	0.0-0.5	0.37	0.37			
	55-80	18-30	1.40-1.60	0.20-0.60	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
406A:												
Dorset	0-11	4-18	1.40-1.55	2.00-6.00	0.13-0.15	Low	3.0-5.0	0.20	0.20	4	3	86
	11-20	10-18	1.45-1.65	2.00-6.00	0.12-0.19	Low	1.0-2.0	0.28	0.28			
	20-38	5-10	1.55-1.65	6.00-20.00	0.06-0.10	Low	0.0-0.5	0.10	0.17			
	38-80	0-5	1.55-1.65	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
488:												
Becida	0-5	8-15	1.45-1.75	0.60-2.00	0.13-0.18	Low	2.0-6.0	0.24	0.24	4	3	86
	5-12	3-10	1.50-1.75	0.60-2.00	0.12-0.16	Low	1.0-3.0	0.24	0.28			
	12-29	8-18	1.60-1.80	0.60-2.00	0.12-0.16	Low	0.5-1.0	0.24	0.28			
	29-65	8-18	1.70-1.90	0.06-0.20	0.02-0.06	Low	0.0-0.5	0.24	0.28			
	65-80	6-15	1.80-2.00	0.00-0.20	0.00-0.04	Low	0.0-0.5	0.24	0.28			
526C:												
Steamboat	0-3	5-18	1.35-1.60	0.60-6.00	0.13-0.18	Low	1.0-3.0	0.24	0.24	5	8	86
	3-35	5-15	1.50-1.70	0.60-2.00	0.09-0.17	Low	0.0-0.5	0.28	0.28			
	35-46	10-18	1.55-1.75	0.20-0.60	0.12-0.19	Low	0.0-0.5	0.28	0.28			
	46-80	5-18	1.55-1.75	0.60-2.00	0.10-0.16	Low	0.0-0.5	0.24	0.24			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
526C:												
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
Seelyeville	0-18	---	0.10-0.25	0.20-6.00	0.35-0.45	---	25-99	---	---	3	8	---
	18-60	---	0.10-0.25	0.20-6.00	0.35-0.45	---	25-99	---	---			
526E:												
Steamboat	0-3	5-18	1.35-1.60	0.60-6.00	0.13-0.18	Low	1.0-3.0	0.24	0.24	5	8	86
	3-35	5-15	1.50-1.70	0.60-2.00	0.09-0.17	Low	0.0-0.5	0.28	0.28			
	35-46	10-18	1.55-1.75	0.20-0.60	0.12-0.19	Low	0.0-0.5	0.28	0.28			
	46-80	5-18	1.55-1.75	0.60-2.00	0.10-0.16	Low	0.0-0.5	0.24	0.24			
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
Seelyeville	0-18	---	0.10-0.25	0.20-6.00	0.35-0.45	---	25-99	---	---	3	8	---
	18-60	---	0.10-0.25	0.20-6.00	0.35-0.45	---	25-99	---	---			
540:												
Seelyeville	0-10	---	0.10-0.25	0.20-6.00	0.35-0.45	---	25-99	---	---	3	2	134
	10-80	---	0.10-0.25	0.20-6.00	0.35-0.45	---	25-99	---	---			
541:												
Rifle	0-14	---	0.20-0.35	0.60-6.00	0.48-0.58	---	75-99	---	---	5	5	56
	14-60	---	0.08-0.20	0.60-6.00	0.48-0.58	---	25-99	---	---			
545:												
Rondeau	0-44	0-10	0.10-0.25	0.20-6.00	0.35-0.48	Low	25-99	---	---	1	2	134
	44-60	5-15	0.05-0.20	0.00-0.20	0.20-0.22	Low	---	---	---			
567A:												
Verndale	0-9	7-12	1.50-1.70	2.00-6.00	0.13-0.17	Low	2.0-4.0	0.20	0.20	3	3	86
	9-19	7-18	1.60-1.70	0.60-2.00	0.14-0.18	Low	0.5-1.0	0.24	0.24			
	19-49	2-6	1.45-1.60	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.10	0.10			
	49-60	0-4	1.45-1.60	6.00-20.00	0.02-0.06	Low	0.0-0.5	0.10	0.10			
574G:												
Steamboat	0-3	5-18	1.35-1.60	0.60-6.00	0.13-0.18	Low	1.0-3.0	0.24	0.24	5	8	86
	3-35	5-15	1.50-1.70	0.60-2.00	0.09-0.17	Low	0.0-0.5	0.28	0.28			
	35-46	10-18	1.55-1.75	0.20-0.60	0.12-0.19	Low	0.0-0.5	0.28	0.28			
	46-80	5-18	1.55-1.75	0.60-2.00	0.10-0.16	Low	0.0-0.5	0.24	0.24			
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
628:												
Talmoon	0-10	---	0.13-0.42	2.00-6.00	0.25-0.40	---	15-50	---	---	5	2	134
	10-15	15-27	1.20-1.40	0.60-2.00	0.13-0.22	Moderate	0.5-1.0	0.28	0.28			
	15-55	18-35	1.40-1.60	0.20-0.60	0.16-0.19	Moderate	0.0-0.5	0.37	0.37			
	55-80	15-35	1.40-1.60	0.20-0.60	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
672:												
Willosippi	0-7	8-26	1.20-1.40	0.60-2.00	0.20-0.24	Low	2.0-4.0	0.32	0.32	5	5	56
	7-12	4-25	1.35-1.50	0.60-6.00	0.15-0.22	Low	0.5-1.0	0.28	0.28			
	12-32	10-30	1.35-1.50	0.20-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	32-60	8-30	1.35-1.50	0.20-2.00	0.12-0.19	Low	0.0-0.5	0.28	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
675C:												
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
Eagleview	0-4	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.17	0.17	5	2	134
	4-28	2-10	1.50-1.65	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	28-45	2-10	1.50-1.65	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.15	0.15			
	45-80	2-10	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.15	0.15			
Steamboat	0-3	5-18	1.35-1.60	0.60-6.00	0.13-0.18	Low	1.0-3.0	0.24	0.24	5	8	86
	3-35	5-15	1.50-1.70	0.60-2.00	0.09-0.17	Low	0.0-0.5	0.28	0.28			
	35-46	10-18	1.55-1.75	0.20-0.60	0.12-0.19	Low	0.0-0.5	0.28	0.28			
	46-80	5-18	1.55-1.75	0.60-2.00	0.10-0.16	Low	0.0-0.5	0.24	0.24			
675E:												
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
Eagleview	0-4	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.17	0.17	5	2	134
	4-28	2-10	1.50-1.65	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	28-45	2-10	1.50-1.65	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.15	0.15			
	45-80	2-10	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.15	0.15			
Steamboat	0-3	5-18	1.35-1.60	0.60-6.00	0.13-0.18	Low	1.0-3.0	0.24	0.24	5	8	86
	3-35	5-15	1.50-1.70	0.60-2.00	0.09-0.17	Low	0.0-0.5	0.28	0.28			
	35-46	10-18	1.55-1.75	0.20-0.60	0.12-0.19	Low	0.0-0.5	0.28	0.28			
	46-80	5-18	1.55-1.75	0.60-2.00	0.10-0.16	Low	0.0-0.5	0.24	0.24			
675G:												
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
Eagleview	0-4	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.17	0.17	5	2	134
	4-28	2-10	1.50-1.65	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	28-45	2-10	1.50-1.65	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.15	0.15			
	45-80	2-10	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.15	0.15			
Steamboat	0-3	5-18	1.35-1.60	0.60-6.00	0.13-0.18	Low	1.0-3.0	0.24	0.24	5	8	86
	3-35	5-15	1.50-1.70	0.60-2.00	0.09-0.17	Low	0.0-0.5	0.28	0.28			
	35-46	10-18	1.55-1.75	0.20-0.60	0.12-0.19	Low	0.0-0.5	0.28	0.28			
	46-80	5-18	1.55-1.75	0.60-2.00	0.10-0.16	Low	0.0-0.5	0.24	0.24			
701:												
Runeberg	0-10	10-25	1.40-1.55	0.60-2.00	0.18-0.25	Low	4.0-12	0.24	0.24	5	5	56
	10-36	10-18	1.60-1.75	0.20-0.60	0.12-0.18	Low	0.5-2.0	0.24	0.24			
	36-60	6-15	1.65-1.75	0.06-0.60	0.06-0.13	Low	0.0-0.5	0.24	0.24			
709B:												
Lengby	0-3	5-12	1.25-1.40	2.00-6.00	0.12-0.18	Low	1.0-2.0	0.24	0.24	4	3	86
	3-11	3-10	1.40-1.65	6.00-20.00	0.08-0.12	Low	0.5-1.0	0.17	0.17			
	11-26	18-35	1.30-1.55	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
	26-48	2-18	1.40-1.70	2.00-6.00	0.08-0.16	Low	0.0-0.5	0.28	0.28			
	48-60	2-8	1.60-1.75	6.00-20.00	0.06-0.12	Low	0.0-0.5	0.17	0.17			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
709C:												
Lengby	0-3	5-12	1.25-1.40	2.00-6.00	0.12-0.18	Low	1.0-2.0	0.24	0.24	4	3	86
	3-11	3-10	1.40-1.65	6.00-20.00	0.08-0.12	Low	0.5-1.0	0.17	0.17			
	11-26	18-35	1.30-1.55	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
	26-48	2-18	1.40-1.70	2.00-6.00	0.08-0.16	Low	0.0-0.5	0.28	0.28			
	48-60	2-8	1.60-1.75	6.00-20.00	0.06-0.12	Low	0.0-0.5	0.17	0.17			
719B:												
Rondeau	0-20	0-10	0.10-0.25	0.20-6.00	0.35-0.48	Low	25-99	---	---	1	2	134
	20-80	5-15	0.05-0.20	0.00-0.20	0.20-0.22	Low	---	---	---			
731A:												
Sanburn	0-6	2-4	1.45-1.60	2.00-6.00	0.09-0.11	Low	0.5-2.0	0.17	0.17	4	2	134
	6-15	4-12	1.45-1.60	2.00-6.00	0.07-0.09	Low	0.5-1.0	0.20	0.20			
	15-21	6-15	1.45-1.65	2.00-6.00	0.07-0.12	Low	0.5-1.0	0.17	0.24			
	21-60	1-4	1.50-1.60	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
744B:												
Debs	0-2	8-16	1.20-1.40	0.60-2.00	0.18-0.24	Low	4.0-7.0	0.32	0.32	5	5	56
	2-12	3-12	1.20-1.50	2.00-6.00	0.15-0.20	Low	0.5-1.0	0.43	0.43			
	12-32	18-30	1.25-1.50	0.60-2.00	0.16-0.22	Moderate	0.5-1.0	0.43	0.43			
	32-60	5-12	1.30-1.60	0.60-2.00	0.14-0.22	Low	0.0-0.5	0.43	0.43			
Akeley	0-3	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.17	0.17	5	2	134
	3-49	2-6	1.45-1.65	6.00-20.00	0.07-0.10	Low	0.0-0.5	0.15	0.15			
	49-56	18-35	1.25-1.50	0.60-2.00	0.16-0.22	Moderate	0.0-0.5	0.43	0.43			
	56-80	2-18	1.30-1.65	0.60-2.00	0.10-0.22	Low	0.0-0.5	0.28	0.28			
746:												
Haslie	0-12	---	0.10-0.30	0.60-6.00	0.35-0.48		60-90	---	---	1	2	134
	12-30	---	0.10-0.30	0.60-6.00	0.35-0.48		60-90	---	---			
	30-80	18-35	0.10-0.50	0.06-0.60	0.18-0.24	Moderate	6.0-20	0.28	0.28			
775B:												
Sugarbush	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	4	3	86
	3-13	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	13-25	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	25-80	1-5	1.60-1.80	20.00-40.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	2	134
	2-10	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	10-33	5-15	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	33-60	0-3	1.60-1.80	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
775C:												
Sugarbush	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	4	3	86
	3-13	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	13-25	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	25-80	1-5	1.60-1.80	20.00-40.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	2	134
	2-10	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	10-33	5-15	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	33-60	0-3	1.60-1.80	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
778B:												
Dorset	0-11	4-18	1.40-1.55	2.00-6.00	0.13-0.15	Low	3.0-5.0	0.20	0.20	4	3	86
	11-20	10-18	1.45-1.65	2.00-6.00	0.12-0.19	Low	1.0-2.0	0.28	0.28			
	20-38	5-10	1.55-1.65	6.00-20.00	0.06-0.10	Low	0.0-0.5	0.10	0.17			
	38-80	0-5	1.55-1.65	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
778B:												
Corliss	0-7	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.15	0.15	5	2	134
	7-11	0-10	1.50-1.65	6.00-20.00	0.03-0.10	Low	0.0-0.5	0.10	0.15			
	11-60	0-5	1.50-1.65	6.00-20.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
778C:												
Dorset	0-11	4-18	1.40-1.55	2.00-6.00	0.13-0.15	Low	3.0-5.0	0.20	0.20	4	3	86
	11-20	10-18	1.45-1.65	2.00-6.00	0.12-0.19	Low	1.0-2.0	0.28	0.28			
	20-38	5-10	1.55-1.65	6.00-20.00	0.06-0.10	Low	0.0-0.5	0.10	0.17			
	38-80	0-5	1.55-1.65	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
Corliss	0-7	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.15	0.15	5	2	134
	7-11	0-10	1.50-1.65	6.00-20.00	0.03-0.10	Low	0.0-0.5	0.10	0.15			
	11-60	0-5	1.50-1.65	6.00-20.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
797:												
Mooselake	0-10	---	0.05-0.30	0.60-6.00	0.35-0.55		25-99	---	---	3	5	56
	10-80	---	0.10-0.20	0.60-6.00	0.40-0.50		25-99	---	---			
Lupton	0-10	---	0.10-0.35	0.20-6.00	0.35-0.45		70-90	---	---	5	2	134
	10-80	---	0.10-0.35	0.20-6.00	0.35-0.45		---	---	---			
799:												
Seelyeville	0-12	---	0.10-0.25	0.20-6.00	0.35-0.45		25-99	---	---	3	2	134
	12-80	---	0.10-0.25	0.20-6.00	0.35-0.45		25-99	---	---			
Bowstring	0-38	0-5	0.15-0.30	0.20-6.00	0.35-0.45	Low	40-90	---	---	3	8	---
	38-47	1-12	1.40-1.60	0.60-20.00	0.08-0.14	Low	2.0-10	---	---			
	47-80	0-5	0.15-0.30	0.20-6.00	0.35-0.45	Low	40-90	---	---			
820B:												
Potatolake	0-9	10-27	1.20-1.40	0.60-2.00	0.20-0.22	Low	1.0-4.0	0.37	0.37	4	6	48
	9-15	5-27	1.30-1.50	0.60-2.00	0.15-0.22	Low	0.0-0.5	0.37	0.37			
	15-30	18-40	1.25-1.45	0.60-2.00	0.17-0.24	Moderate	0.0-0.5	0.37	0.37			
	30-80	2-15	1.35-1.65	6.00-20.00	0.06-0.16	Low	0.0-0.5	0.28	0.28			
820C:												
Potatolake	0-9	10-27	1.20-1.40	0.60-2.00	0.20-0.22	Low	1.0-4.0	0.37	0.37	4	6	48
	9-15	5-27	1.30-1.50	0.60-2.00	0.15-0.22	Low	0.0-0.5	0.37	0.37			
	15-30	18-40	1.25-1.45	0.60-2.00	0.17-0.24	Moderate	0.0-0.5	0.37	0.37			
	30-80	2-15	1.35-1.65	6.00-20.00	0.06-0.16	Low	0.0-0.5	0.28	0.28			
831C:												
Akeley	0-3	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.17	0.17	5	2	134
	3-49	2-6	1.45-1.65	6.00-20.00	0.07-0.10	Low	0.0-0.5	0.15	0.15			
	49-56	18-35	1.25-1.50	0.60-2.00	0.16-0.22	Moderate	0.0-0.5	0.43	0.43			
	56-80	2-18	1.30-1.65	0.60-2.00	0.10-0.22	Low	0.0-0.5	0.28	0.28			
Debs	0-2	8-16	1.20-1.40	0.60-2.00	0.18-0.24	Low	4.0-7.0	0.32	0.32	5	5	56
	2-12	3-12	1.20-1.50	2.00-6.00	0.15-0.20	Low	0.5-1.0	0.43	0.43			
	12-32	18-30	1.25-1.50	0.60-2.00	0.16-0.22	Moderate	0.5-1.0	0.43	0.43			
	32-60	5-12	1.30-1.60	0.60-2.00	0.14-0.22	Low	0.0-0.5	0.43	0.43			
831E:												
Akeley	0-3	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.17	0.17	5	2	134
	3-49	2-6	1.45-1.65	6.00-20.00	0.07-0.10	Low	0.0-0.5	0.15	0.15			
	49-56	18-35	1.25-1.50	0.60-2.00	0.16-0.22	Moderate	0.0-0.5	0.43	0.43			
	56-80	2-18	1.30-1.65	0.60-2.00	0.10-0.22	Low	0.0-0.5	0.28	0.28			
Debs	0-2	8-16	1.20-1.40	0.60-2.00	0.18-0.24	Low	4.0-7.0	0.32	0.32	5	5	56
	2-12	3-12	1.20-1.50	2.00-6.00	0.15-0.20	Low	0.5-1.0	0.43	0.43			
	12-32	18-30	1.25-1.50	0.60-2.00	0.16-0.22	Moderate	0.5-1.0	0.43	0.43			
	32-60	5-12	1.30-1.60	0.60-2.00	0.14-0.22	Low	0.0-0.5	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
844B:												
Sanburn	0-6	2-4	1.45-1.60	2.00-6.00	0.09-0.11	Low	0.5-2.0	0.17	0.17	4	2	134
	6-15	4-12	1.45-1.60	2.00-6.00	0.07-0.09	Low	0.5-1.0	0.20	0.20			
	15-21	6-15	1.45-1.65	2.00-6.00	0.07-0.12	Low	0.5-1.0	0.17	0.24			
	21-60	1-4	1.50-1.60	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			
867B:												
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			
Menahga	0-3	2-10	1.20-1.50	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.15	0.15	5	2	134
	3-17	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.5-1.0	0.15	0.15			
	17-80	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.15	0.15			
867C:												
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			
Menahga	0-3	2-10	1.20-1.50	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.15	0.15	5	2	134
	3-17	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.5-1.0	0.15	0.15			
	17-80	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.15	0.15			
867E:												
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			
Menahga	0-3	2-10	1.20-1.50	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.15	0.15	5	2	134
	3-17	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.5-1.0	0.15	0.15			
	17-80	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.15	0.15			
867F:												
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			
Menahga	0-3	2-10	1.20-1.50	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.15	0.15	5	2	134
	3-17	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.5-1.0	0.15	0.15			
	17-80	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.15	0.15			
1015:												
Udipsamments	0-14	1-15	1.50-1.70	2.00-20.00	0.05-0.10	Low	0.0-0.5	0.15	0.15	5	2	220
	14-60	1-10	1.50-1.70	6.00-20.00	0.05-0.08	Low	---	0.10	0.10			
	60-80	1-10	1.50-1.70	>20.00	0.03-0.05	Low	---	0.05	0.10			
1016:												
Udorthents	0-60	---	---	---	---	---	---	---	---	---	---	---
	60-80	---	---	0.06-6.00	---	---	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1021C:												
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			
Sanburn	0-6	2-4	1.45-1.60	2.00-6.00	0.09-0.11	Low	0.5-2.0	0.17	0.17	4	2	134
	6-15	4-12	1.45-1.60	2.00-6.00	0.07-0.09	Low	0.5-1.0	0.20	0.20			
	15-21	6-15	1.45-1.65	2.00-6.00	0.07-0.12	Low	0.5-1.0	0.17	0.24			
	21-60	1-4	1.50-1.60	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
1027:												
Udorthents.												
1030:												
Pits, gravel.												
Udipsamments	0-14	1-15	1.50-1.70	2.00-20.00	0.05-0.10	Low	0.0-0.5	0.15	0.15	5	2	220
	14-60	1-10	1.50-1.70	6.00-20.00	0.05-0.08	Low	---	0.10	0.10			
	60-80	1-10	1.50-1.70	>20.00	0.03-0.05	Low	---	0.05	0.10			
1111:												
Nidaros	0-32	---	0.15-0.45	0.20-6.00	0.35-0.45		55-85	---	---	2	2	134
	32-38	8-35	1.50-1.80	0.60-2.00	0.13-0.22	Low	5.0-15	0.20	0.24			
	38-60	0-4	1.40-1.65	6.00-20.00	0.03-0.08	Low	0.0-0.5	0.10	0.15			
1113:												
Haslie	0-20	---	0.10-0.30	0.60-6.00	0.35-0.48		60-90	---	---	1	8	---
	20-60	18-35	0.10-0.50	0.06-0.60	0.18-0.24	Moderate	6.0-20	0.28	0.28			
Seelyeville	0-18	---	0.10-0.25	0.20-6.00	0.35-0.45		25-99	---	---	3	8	---
	18-60	---	0.10-0.25	0.20-6.00	0.35-0.45		25-99	---	---			
Cathro	0-23	---	0.28-0.45	0.20-6.00	0.45-0.55		60-85	---	---	2	8	---
	23-60	10-30	1.50-1.70	0.20-2.00	0.11-0.22	Low	1.0-5.0	---	---			
1126B:												
Verndale	0-9	7-12	1.50-1.70	2.00-6.00	0.13-0.17	Low	2.0-4.0	0.20	0.20	3	3	86
	9-19	7-18	1.60-1.70	0.60-2.00	0.14-0.18	Low	0.5-1.0	0.24	0.24			
	19-49	2-6	1.45-1.60	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.10	0.10			
	49-60	0-4	1.45-1.60	6.00-20.00	0.02-0.06	Low	0.0-0.5	0.10	0.10			
Nymore	0-8	2-12	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	5	2	134
	8-33	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
	33-60	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
1127A:												
Bootlake	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	5	3	86
	3-7	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.17	0.17			
	7-13	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	13-47	1-5	1.50-1.65	6.00-20.00	0.02-0.07	Low	0.0-0.5	0.15	0.15			
	47-80	1-5	1.50-1.65	6.00-20.00	0.02-0.07	Low	0.0-0.5	0.15	0.15			
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1127B:												
Bootlake	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	5	3	86
	3-7	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.17	0.17			
	7-13	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	13-47	1-5	1.50-1.65	6.00-20.00	0.02-0.07	Low	0.0-0.5	0.15	0.15			
	47-80	1-5	1.50-1.65	6.00-20.00	0.02-0.07	Low	0.0-0.5	0.15	0.15			
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			
1136:												
Nidaros	0-27	---	0.15-0.45	0.20-6.00	0.35-0.45		55-85	---	---	2	2	134
	27-38	8-35	1.50-1.80	0.60-2.00	0.13-0.22	Low	5.0-15	0.24	0.24			
	38-80	0-4	1.40-1.65	6.00-20.00	0.03-0.08	Low	0.0-0.5	0.10	0.15			
1164:												
Zerkel	0-4	8-20	1.20-1.40	0.60-2.00	0.20-0.24	Low	2.0-4.0	0.32	0.32	5	5	56
	4-10	4-12	1.45-1.65	2.00-20.00	0.10-0.22	Low	0.5-1.0	0.24	0.24			
	10-29	20-35	1.40-1.60	0.20-2.00	0.15-0.19	Moderate	0.1-0.5	0.32	0.32			
	29-37	5-20	1.40-1.65	0.60-6.00	0.05-0.22	Low	0.1-0.5	0.24	0.24			
	37-80	2-18	1.45-1.70	0.60-6.00	0.05-0.22	Low	0.1-0.5	0.24	0.24			
1200:												
Egglake	0-4	8-15	1.35-1.60	0.60-6.00	0.10-0.21	Low	2.0-4.0	0.28	0.28	5	5	56
	4-9	3-10	1.50-1.70	0.60-6.00	0.12-0.14	Low	0.5-2.0	0.24	0.24			
	9-25	18-30	1.50-1.70	0.60-2.00	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	25-80	10-18	1.60-1.80	0.60-2.00	0.11-0.13	Low	0.0-0.5	0.24	0.24			
1230:												
Haslie	0-44	---	0.10-0.30	0.60-6.00	0.35-0.48		60-90	---	---	1	8	---
	44-60	18-35	0.10-0.50	0.06-0.60	0.18-0.24	Moderate	6.0-20	0.28	0.28			
Nidaros	0-38	---	0.15-0.45	0.20-6.00	0.35-0.45		55-85	---	---	2	8	---
	38-54	8-35	1.50-1.80	0.60-2.00	0.13-0.22	Low	5.0-15	0.20	0.24			
	54-60	0-4	1.40-1.65	6.00-20.00	0.03-0.08	Low	0.0-0.5	0.10	0.15			
1238E:												
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	2	134
	2-10	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	10-33	5-15	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	33-60	0-3	1.60-1.80	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
Sugarbush	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	4	3	86
	3-13	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	13-25	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	25-80	1-5	1.60-1.80	20.00-40.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
1238F:												
Two Inlets	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-1.0	0.10	0.15	5	2	134
	2-10	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	10-33	5-15	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.10	0.15			
	33-60	0-3	1.60-1.80	20.00-40.00	0.02-0.04	Low	0.0-0.5	0.05	0.10			
Sugarbush	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	4	3	86
	3-13	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	13-25	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	25-80	1-5	1.60-1.80	20.00-40.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1244B:												
Sol	0-4	4-16	1.50-1.65	0.60-2.00	0.12-0.20	Low	1.0-3.0	0.24	0.24	5	8	86
	4-17	2-12	1.40-1.55	2.00-6.00	0.09-0.13	Low	0.0-0.5	0.17	0.17			
	17-43	18-27	1.55-1.75	0.60-2.00	0.16-0.20	Moderate	0.0-0.5	0.32	0.32			
	43-80	8-18	1.55-1.75	0.60-2.00	0.11-0.16	Low	0.0-0.5	0.28	0.28			
Sugarbush	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	4	3	86
	3-12	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	12-25	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	25-60	1-5	1.60-1.80	20.00-40.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
1244C:												
Sol	0-4	4-16	1.50-1.65	0.60-2.00	0.12-0.20	Low	1.0-3.0	0.24	0.24	5	8	86
	4-17	2-12	1.40-1.55	2.00-6.00	0.09-0.13	Low	0.0-0.5	0.17	0.17			
	17-43	18-27	1.55-1.75	0.60-2.00	0.16-0.20	Moderate	0.0-0.5	0.32	0.32			
	43-80	8-18	1.55-1.75	0.60-2.00	0.11-0.16	Low	0.0-0.5	0.28	0.28			
Sugarbush	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	4	3	86
	3-12	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	12-25	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	25-60	1-5	1.60-1.80	20.00-40.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
1244E:												
Sol	0-4	4-16	1.50-1.65	0.60-2.00	0.12-0.20	Low	1.0-3.0	0.24	0.24	5	8	86
	4-17	2-12	1.40-1.55	2.00-6.00	0.09-0.13	Low	0.0-0.5	0.17	0.17			
	17-43	18-27	1.55-1.75	0.60-2.00	0.16-0.20	Moderate	0.0-0.5	0.32	0.32			
	43-80	8-18	1.55-1.75	0.60-2.00	0.11-0.16	Low	0.0-0.5	0.28	0.28			
Sugarbush	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	4	3	86
	3-12	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.5-1.0	0.17	0.17			
	12-25	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	25-60	1-5	1.60-1.80	20.00-40.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
1247D:												
Corliss	0-7	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.15	0.15	5	2	134
	7-11	0-10	1.50-1.65	6.00-20.00	0.03-0.10	Low	0.0-0.5	0.10	0.15			
	11-60	0-5	1.50-1.65	6.00-20.00	0.02-0.06	Low	0.0-0.5	0.10	0.15			
Dorset	0-11	4-18	1.40-1.55	2.00-6.00	0.13-0.15	Low	3.0-5.0	0.20	0.20	4	3	86
	11-20	10-18	1.45-1.65	2.00-6.00	0.12-0.19	Low	1.0-2.0	0.28	0.28			
	20-38	5-10	1.55-1.65	6.00-20.00	0.06-0.10	Low	0.0-0.5	0.10	0.17			
	38-80	0-5	1.55-1.65	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
1248C:												
Nymore	0-8	2-12	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	5	2	134
	8-33	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
	33-60	0-5	1.55-1.65	6.00-20.00	0.02-0.08	Low	0.0-0.5	0.17	0.17			
Verndale	0-9	7-12	1.50-1.70	2.00-6.00	0.13-0.17	Low	2.0-4.0	0.20	0.20	3	3	86
	9-19	7-18	1.60-1.70	0.60-2.00	0.14-0.18	Low	0.5-1.0	0.24	0.24			
	19-49	2-6	1.45-1.60	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.10	0.10			
	49-60	0-4	1.45-1.60	6.00-20.00	0.02-0.06	Low	0.0-0.5	0.10	0.10			
1249C:												
Graycalm	0-3	0-10	1.30-1.55	6.00-20.00	0.06-0.12	Low	0.5-2.0	0.15	0.17	5	2	134
	3-20	0-15	1.25-1.60	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.10	0.15			
	20-39	0-10	1.50-1.65	6.00-20.00	0.04-0.09	Low	0.0-0.5	0.10	0.15			
	39-80	0-10	1.50-1.65	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.10	0.15			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1249C:												
Bootlake	0-3	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-2.0	0.20	0.20	5	3	86
	3-7	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low	0.0-0.5	0.17	0.17			
	7-13	10-18	1.40-1.60	2.00-6.00	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	13-47	1-5	1.50-1.65	6.00-20.00	0.02-0.07	Low	0.0-0.5	0.15	0.15			
	47-80	1-5	1.50-1.65	6.00-20.00	0.02-0.07	Low	0.0-0.5	0.15	0.15			
1271:												
Roscommon	0-6	0-12	0.90-1.60	6.00-20.00	0.08-0.20	Low	4.0-15	0.17	0.17	5	2	134
	6-80	0-10	1.45-1.70	6.00-20.00	0.05-0.09	Low	0.0-1.0	0.17	0.17			
1272B:												
Sol	0-3	4-16	1.50-1.65	0.60-2.00	0.12-0.20	Low	1.0-3.0	0.24	0.24	5	8	86
	3-14	2-12	1.40-1.55	2.00-6.00	0.09-0.13	Low	0.0-0.5	0.17	0.17			
	14-38	18-27	1.55-1.75	0.60-2.00	0.16-0.20	Moderate	0.0-0.5	0.32	0.32			
	38-60	8-18	1.55-1.75	0.60-2.00	0.11-0.16	Low	0.0-0.5	0.28	0.28			
1294:												
Nary	0-3	4-15	1.50-1.65	0.60-2.00	0.12-0.20	Low	1.0-3.0	0.20	0.20	5	8	---
	3-15	2-12	1.40-1.55	2.00-6.00	0.09-0.13	Low	---	0.24	0.24			
	15-36	18-27	1.55-1.75	0.20-0.60	0.16-0.20	Moderate	---	0.32	0.32			
	36-60	5-18	1.55-1.80	0.60-2.00	0.11-0.16	Low	---	0.28	0.28			
1319B:												
Rockwood	0-8	5-15	1.55-1.75	0.60-2.00	0.13-0.18	Low	2.0-4.0	0.24	0.24	4	3	86
	8-16	5-10	1.60-1.75	0.60-2.00	0.12-0.15	Low	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low	0.5-1.0	0.28	0.28			
	37-46	8-18	1.65-1.80	0.20-0.60	0.12-0.15	Low	0.0-0.5	0.28	0.28			
	46-60	7-15	1.80-2.00	0.00-0.06	0.00-0.04	Low	0.0-0.5	0.24	0.24			
1319C:												
Rockwood	0-8	5-15	1.55-1.75	0.60-2.00	0.13-0.18	Low	2.0-4.0	0.24	0.24	4	3	86
	8-16	5-10	1.60-1.75	0.60-2.00	0.12-0.15	Low	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low	0.5-1.0	0.28	0.28			
	37-46	8-18	1.65-1.80	0.20-0.60	0.12-0.15	Low	0.0-0.5	0.28	0.28			
	46-60	7-15	1.80-2.00	0.00-0.06	0.00-0.04	Low	0.0-0.5	0.24	0.24			
1319D:												
Rockwood	0-8	5-15	1.55-1.75	0.60-2.00	0.13-0.18	Low	2.0-4.0	0.24	0.24	4	3	86
	8-16	5-10	1.60-1.75	0.60-2.00	0.12-0.15	Low	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low	0.5-1.0	0.28	0.28			
	37-46	8-18	1.65-1.80	0.20-0.60	0.12-0.15	Low	0.0-0.5	0.28	0.28			
	46-60	7-15	1.80-2.00	0.00-0.06	0.00-0.04	Low	0.0-0.5	0.24	0.24			
1320B:												
Blowers	0-6	5-15	1.55-1.80	0.60-2.00	0.13-0.18	Low	2.0-6.0	0.24	0.24	4	3	86
	6-17	5-10	1.60-1.80	0.60-2.00	0.12-0.15	Low	1.0-2.0	0.28	0.28			
	17-27	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low	0.5-1.0	0.24	0.24			
	27-40	8-18	1.65-1.80	0.20-0.60	0.12-0.15	Low	0.0-0.5	0.24	0.24			
	40-60	7-15	1.80-2.00	0.00-0.06	0.00-0.04	Low	0.0-0.5	0.24	0.24			
1321:												
Paddock	0-8	8-15	1.45-1.75	0.60-2.00	0.13-0.18	Low	2.0-6.0	0.24	0.24	4	3	86
	8-15	3-10	1.50-1.75	0.60-2.00	0.12-0.16	Low	0.5-2.0	0.24	0.24			
	15-40	8-18	1.60-1.80	0.20-0.60	0.12-0.16	Low	0.0-0.5	0.24	0.24			
	40-60	6-15	1.80-2.00	0.00-0.06	0.00-0.04	Low	0.0-0.5	0.24	0.24			
Becida	0-8	10-20	1.40-1.60	0.60-2.00	0.20-0.22	Low	3.0-7.0	0.32	0.32	4	5	56
	8-13	3-10	1.50-1.75	0.60-2.00	0.12-0.16	Low	1.0-3.0	0.24	0.28			
	13-27	8-18	1.60-1.80	0.60-2.00	0.12-0.16	Low	0.5-1.0	0.24	0.28			
	27-58	8-18	1.70-1.90	0.06-0.20	0.02-0.06	Low	0.0-0.5	0.24	0.28			
	58-80	6-15	1.80-2.00	0.01-0.06	0.02-0.06	Low	0.0-0.5	0.24	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1332B:												
Rockwood--------	0-7	8-15	1.55-1.75	0.60-2.00	0.13-0.18	Low------	2.0-4.0	0.24	0.24	4	3	86
	7-16	5-12	1.60-1.75	0.60-2.00	0.12-0.15	Low------	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low------	0.0-0.5	0.28	0.28			
	37-80	7-15	1.80-2.00	0.00-0.20	0.00-0.04	Low------	0.0-0.5	0.24	0.24			
1332C:												
Rockwood--------	0-7	8-15	1.55-1.75	0.60-2.00	0.13-0.18	Low------	2.0-4.0	0.24	0.24	4	3	86
	7-16	5-12	1.60-1.75	0.60-2.00	0.12-0.15	Low------	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low------	0.0-0.5	0.28	0.28			
	37-80	7-15	1.80-2.00	0.00-0.20	0.00-0.04	Low------	0.0-0.5	0.24	0.24			
1332E:												
Rockwood--------	0-7	8-15	1.55-1.75	0.60-2.00	0.13-0.18	Low------	2.0-4.0	0.24	0.24	4	3	86
	7-16	5-12	1.60-1.75	0.60-2.00	0.12-0.15	Low------	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low------	0.0-0.5	0.28	0.28			
	37-80	7-15	1.80-2.00	0.00-0.20	0.00-0.04	Low------	0.0-0.5	0.24	0.24			
1334:												
Huntersville----	0-8	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low------	1.0-3.0	0.17	0.17	4	2	134
	8-38	2-6	1.45-1.60	6.00-20.00	0.04-0.10	Low------	0.0-1.0	0.15	0.15			
	38-65	6-35	1.65-1.80	0.20-0.60	0.11-0.13	Low------	0.0-0.5	0.20	0.20			
	65-80	6-15	1.80-2.00	0.00-0.20	0.00-0.04	Low------	0.0-0.5	0.20	0.20			
1336:												
Blowers---------	0-5	8-15	1.55-1.80	0.60-2.00	0.13-0.18	Low------	2.0-6.0	0.24	0.24	4	3	86
	5-23	5-12	1.60-1.80	0.60-2.00	0.12-0.15	Low------	1.0-2.0	0.28	0.28			
	23-47	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low------	0.0-0.5	0.24	0.24			
	47-80	7-15	1.80-2.00	0.00-0.20	0.00-0.04	Low------	0.0-0.5	0.24	0.24			
1421B:												
Rockwood--------	0-7	8-15	1.55-1.75	0.60-2.00	0.13-0.18	Low------	2.0-4.0	0.24	0.24	4	3	86
	7-16	5-12	1.60-1.75	0.60-2.00	0.12-0.15	Low------	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low------	0.0-0.5	0.28	0.28			
	37-80	7-15	1.80-2.00	0.00-0.20	0.00-0.04	Low------	0.0-0.5	0.24	0.24			
Two Inlets------	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low------	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low------	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low------	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low------	0.0-0.5	0.05	0.10			
1421C:												
Rockwood--------	0-7	8-15	1.55-1.75	0.60-2.00	0.13-0.18	Low------	2.0-4.0	0.24	0.24	4	3	86
	7-16	5-12	1.60-1.75	0.60-2.00	0.12-0.15	Low------	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low------	0.0-0.5	0.28	0.28			
	37-80	7-15	1.80-2.00	0.00-0.20	0.00-0.04	Low------	0.0-0.5	0.24	0.24			
Two Inlets------	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low------	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low------	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low------	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low------	0.0-0.5	0.05	0.10			
1421E:												
Rockwood--------	0-7	8-15	1.55-1.75	0.60-2.00	0.13-0.18	Low------	2.0-4.0	0.24	0.24	4	3	86
	7-16	5-12	1.60-1.75	0.60-2.00	0.12-0.15	Low------	1.0-2.0	0.28	0.28			
	16-37	8-18	1.60-1.75	0.60-2.00	0.12-0.15	Low------	0.0-0.5	0.28	0.28			
	37-80	7-15	1.80-2.00	0.00-0.20	0.00-0.04	Low------	0.0-0.5	0.24	0.24			
Two Inlets------	0-2	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low------	0.5-1.0	0.10	0.15	5	8	134
	2-9	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low------	0.0-0.5	0.10	0.15			
	9-19	2-10	1.40-1.60	6.00-20.00	0.09-0.11	Low------	0.0-0.5	0.10	0.10			
	19-80	0-3	1.40-1.60	20.00-40.00	0.02-0.04	Low------	0.0-0.5	0.05	0.10			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1438B:												
Braham	0-8	2-8	1.40-1.60	6.00-20.00	0.10-0.12	Low	0.5-2.0	0.17	0.17	5	2	134
	8-24	2-8	1.45-1.60	6.00-20.00	0.08-0.10	Low	0.0-0.5	0.17	0.17			
	24-42	18-35	1.50-1.70	0.20-2.00	0.15-0.18	Moderate	0.0-0.5	0.37	0.37			
	42-60	18-35	1.55-1.75	0.20-2.00	0.15-0.18	Moderate	0.0-0.5	0.37	0.37			
1439:												
Cathro	0-12	---	0.28-0.45	0.20-6.00	0.45-0.55	---	60-85	---	---	5	2	134
	12-43	---	0.15-0.30	0.20-6.00	0.35-0.45	---	60-85	---	---			
	43-80	10-30	1.50-1.70	0.20-2.00	0.11-0.19	Low	1.0-5.0	0.20	0.24			
1440B:												
Redeye	0-5	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	4	2	134
	5-31	2-6	1.45-1.65	6.00-20.00	0.07-0.10	Low	0.5-2.0	0.15	0.15			
	31-43	6-18	1.65-1.80	0.20-0.60	0.11-0.13	Low	0.5-2.0	0.28	0.28			
	43-80	5-14	1.80-2.00	0.00-0.20	0.00-0.04	Low	0.0-0.5	0.28	0.28			
1440C:												
Redeye	0-5	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.17	0.17	4	2	134
	5-31	2-6	1.45-1.65	6.00-20.00	0.07-0.10	Low	0.5-2.0	0.15	0.15			
	31-43	6-18	1.65-1.80	0.20-0.60	0.11-0.13	Low	0.5-2.0	0.28	0.28			
	43-80	5-14	1.80-2.00	0.00-0.20	0.00-0.04	Low	0.0-0.5	0.28	0.28			
1444:												
Wurtsmith	0-6	3-8	1.50-1.65	6.00-20.00	0.08-0.12	Low	0.5-2.0	0.17	0.17	5	2	134
	6-20	0-8	1.40-1.60	6.00-20.00	0.06-0.12	Low	0.0-0.5	0.15	0.15			
	20-80	0-5	1.50-1.65	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.15	0.15			
1445:												
Markey	0-26	---	0.15-0.45	0.20-6.00	0.35-0.45	---	55-85	---	---	4	2	134
	26-80	0-10	1.40-1.65	6.00-20.00	0.03-0.08	Low	0.0-0.5	0.15	0.15			
1447:												
Beltrami	0-6	5-18	1.35-1.50	2.00-6.00	0.13-0.20	Low	2.0-4.0	0.24	0.24	5	3	86
	6-12	5-15	1.40-1.65	0.60-6.00	0.11-0.19	Low	1.0-3.0	0.32	0.32			
	12-39	18-35	1.50-1.65	0.20-2.00	0.15-0.19	Moderate	0.5-1.0	0.32	0.32			
	39-80	18-30	1.50-1.70	0.60-2.00	0.15-0.19	Low	0.0-0.5	0.32	0.32			
1450B:												
Sanburn	0-4	3-10	1.45-1.60	2.00-6.00	0.03-0.06	Low	0.5-2.0	0.10	0.17	4	5	56
	4-17	4-12	1.45-1.60	2.00-6.00	0.07-0.09	Low	0.5-1.0	0.20	0.20			
	17-24	6-15	1.45-1.65	2.00-6.00	0.07-0.12	Low	0.5-1.0	0.17	0.24			
	24-80	1-4	1.50-1.60	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
1450C:												
Sanburn	0-4	3-10	1.45-1.60	2.00-6.00	0.03-0.06	Low	0.5-2.0	0.10	0.17	4	5	56
	4-17	4-12	1.45-1.60	2.00-6.00	0.07-0.09	Low	0.5-1.0	0.20	0.20			
	17-24	6-15	1.45-1.65	2.00-6.00	0.07-0.12	Low	0.5-1.0	0.17	0.24			
	24-80	1-4	1.50-1.60	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
1450E:												
Sanburn	0-4	3-10	1.45-1.60	2.00-6.00	0.03-0.06	Low	0.5-2.0	0.10	0.17	4	5	56
	4-17	4-12	1.45-1.60	2.00-6.00	0.07-0.09	Low	0.5-1.0	0.20	0.20			
	17-24	6-15	1.45-1.65	2.00-6.00	0.07-0.12	Low	0.5-1.0	0.17	0.24			
	24-80	1-4	1.50-1.60	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.15			
1460B:												
Nebish	0-6	5-18	1.35-1.50	2.00-6.00	0.13-0.18	Low	1.0-2.0	0.24	0.24	5	3	86
	6-12	5-12	1.40-1.65	2.00-6.00	0.11-0.19	Low	0.5-1.0	0.24	0.24			
	12-32	22-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.32	0.32			
	32-80	18-30	1.50-1.70	0.60-2.00	0.11-0.19	Low	0.0-0.5	0.32	0.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1460C:												
Nebish	0-5	5-18	1.35-1.50	2.00-6.00	0.13-0.18	Low	1.0-2.0	0.24	0.24	5	3	86
	5-14	5-12	1.40-1.65	2.00-6.00	0.11-0.19	Low	0.5-1.0	0.24	0.24			
	14-39	22-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.32	0.32			
	39-80	18-30	1.50-1.70	0.60-2.00	0.11-0.19	Low	0.0-0.5	0.32	0.32			
1943:												
Roscommon	0-6	2-12	0.90-1.60	6.00-20.00	0.07-0.20	Low	4.0-8.0	0.17	0.17	5	2	134
	6-60	0-10	1.45-1.75	6.00-20.00	0.05-0.07	Low	0.0-1.0	0.17	0.17			
1956:												
Staples	0-7	2-6	1.45-1.60	6.00-20.00	0.10-0.12	Low	2.0-8.0	0.17	0.17	4	2	134
	7-36	2-6	1.45-1.60	6.00-20.00	0.07-0.10	Low	1.0-3.0	0.15	0.15			
	36-44	8-35	1.65-1.80	0.20-0.60	0.06-0.13	Low	0.0-0.5	0.28	0.28			
	44-60	6-15	1.80-2.00	0.00-0.20	0.00-0.04	Low	0.0-0.5	0.28	0.28			
1968:												
Evart	0-11	8-20	1.35-1.50	0.60-2.00	0.19-0.22	Low	1.0-6.0	0.28	0.28	3	5	56
	11-60	0-15	1.40-1.65	6.00-20.00	0.05-0.10	Low	---	0.15	0.20			
1969:												
Evart	0-11	8-20	1.35-1.50	0.60-2.00	0.19-0.22	Low	1.0-6.0	0.28	0.28	3	5	56
	11-60	0-15	1.40-1.65	6.00-20.00	0.05-0.10	Low	---	0.15	0.20			
Isan	0-13	2-8	1.30-1.60	6.00-20.00	0.08-0.12	Low	3.0-8.0	0.17	0.17	5	2	134
	13-30	2-8	1.50-1.65	6.00-20.00	0.06-0.10	Low	0.5-3.0	0.17	0.17			
	30-60	1-5	1.55-1.70	6.00-20.00	0.04-0.06	Low	0.0-0.5	0.15	0.15			

Chemical Properties of the Soils

(Absence of an entry indicates that the data were not estimated)

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
82B:					
Redeye	0-3	2-6	3.0-9.0	5.1-7.3	---
	3-18	2-6	3.0-9.0	5.1-6.5	---
	18-26	2-6	2.0-7.0	5.6-6.5	---
	26-52	6-18	4.0-13.0	5.1-7.3	---
	52-60	5-14	2.0-8.0	6.6-8.4	0-20
82C:					
Redeye	0-3	2-6	3.0-9.0	5.1-7.3	---
	3-18	2-6	3.0-9.0	5.1-6.5	---
	18-26	2-6	2.0-7.0	5.6-6.5	---
	26-52	6-18	4.0-13.0	5.1-7.3	---
	52-60	5-14	2.0-8.0	6.6-8.4	0-20
133B:					
Dalbo	0-6	20-27	8.0-25.0	5.6-7.3	---
	6-41	35-60	14.0-40.0	5.1-7.3	---
	41-60	24-35	10.0-22.0	7.4-8.4	5-30
133C:					
Dalbo	0-6	20-27	8.0-25.0	5.6-7.3	---
	6-41	35-60	14.0-40.0	5.1-7.3	---
	41-60	24-35	10.0-22.0	7.4-8.4	5-30
139B:					
Huntersville	0-12	2-6	3.0-9.0	6.1-7.3	---
	12-24	2-6	1.0-5.0	6.1-7.3	---
	24-40	6-35	3.0-20.0	6.1-7.3	---
	40-80	6-15	2.0-10.0	6.6-7.8	0-15
147:					
Spooner	0-8	10-24	6.0-22.0	5.6-7.8	0-15
	8-13	3-18	1.0-11.0	5.6-7.8	0-15
	13-20	18-35	11.0-21.0	6.1-7.8	0-15
	20-80	5-32	2.0-20.0	7.4-8.4	10-40
158B:					
Zimmerman	0-16	2-10	2.0-8.0	5.1-6.5	---
	16-60	2-10	1.0-6.0	5.1-7.3	---
158C:					
Zimmerman	0-16	2-10	2.0-8.0	5.1-6.5	---
	16-80	2-10	1.0-6.0	5.1-7.3	---
167A:					
Baudette	0-4	10-27	8.0-30.0	5.6-7.3	---
	4-8	5-27	4.0-24.0	5.6-7.3	---
	8-35	18-35	12.0-30.0	5.6-7.8	0-5
	35-60	5-27	3.0-23.0	7.4-8.4	10-20
170:					
Blomford	0-5	2-10	3.0-15.0	5.1-7.3	---
	5-23	2-10	1.0-10.0	5.1-7.3	---
	23-55	18-30	7.0-20.0	5.1-7.3	---
	55-80	18-30	7.0-20.0	6.1-8.4	0-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
202:					
Meehan	0-6	4-10	2.0-15.0	3.5-7.3	---
	6-38	4-9	1.0-8.0	3.5-6.5	---
	38-80	1-4	0.0-4.0	3.5-7.3	---
207B:					
Nymore	0-8	2-12	3.0-13.0	5.1-6.5	---
	8-33	0-5	0.0-5.0	5.1-7.3	---
	33-60	0-5	0.0-1.0	5.1-7.8	---
207C:					
Nymore	0-8	2-12	3.0-13.0	5.1-6.5	---
	8-33	0-5	0.0-5.0	5.1-7.3	---
	33-60	0-5	0.0-1.0	5.1-7.8	---
207D:					
Nymore	0-8	2-12	3.0-13.0	5.1-6.5	---
	8-33	0-5	0.0-5.0	5.1-7.3	---
	33-60	0-5	0.0-1.0	5.1-7.8	---
260:					
Duelm	0-16	2-10	5.0-18.0	5.6-7.3	---
	16-30	1-8	0.0-4.0	5.1-7.3	---
	30-80	0-6	0.0-5.0	5.6-7.8	0-5
261:					
Isan	0-11	2-8	10.0-20.0	5.6-7.3	---
	11-15	2-8	2.0-10.0	5.1-6.5	---
	15-80	1-5	1.0-5.0	5.6-7.3	---
267B:					
Snellman	0-2	5-18	4.0-16.0	5.1-6.5	---
	2-16	5-15	3.0-14.0	5.1-6.5	---
	16-31	18-30	8.0-16.0	5.6-7.3	---
	31-41	7-18	3.0-10.0	7.4-8.4	15-25
	41-80	7-18	3.0-10.0	7.4-8.4	5-15
346:					
Talmoon	0-3	8-20	7.0-20.0	5.1-7.3	---
	3-14	15-27	7.0-18.0	5.1-7.3	---
	14-55	22-35	8.0-20.0	5.6-7.3	---
	55-80	18-30	7.0-18.0	7.4-8.4	5-30
406A:					
Dorset	0-11	4-18	10.0-23.0	5.6-7.3	---
	11-20	10-18	7.0-17.0	5.6-7.3	---
	20-38	5-10	3.0-8.0	7.4-8.4	10-25
	38-80	0-5	0.0-5.0	7.4-8.4	5-15
488:					
Becida	0-5	8-15	8.0-19.0	5.6-7.3	---
	5-12	3-10	3.0-11.0	5.6-6.5	---
	12-29	8-18	9.0-11.0	5.1-6.5	---
	29-65	8-18	3.0-9.0	5.1-6.5	---
	65-80	6-15	3.0-9.0	6.6-7.8	---
526C:					
Steamboat	0-3	5-18	4.0-14.0	5.1-6.5	---
	3-35	5-15	1.0-6.0	5.1-6.5	---
	35-46	10-18	4.0-10.0	5.3-7.3	---
	46-80	5-18	2.0-10.0	7.4-7.8	5-20

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
526C:					
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10
Seelyeville	0-18	---	140-200	4.5-7.3	---
	18-60	---	140-200	4.5-7.3	---
526E:					
Steamboat	0-3	5-18	4.0-14.0	5.1-6.5	---
	3-35	5-15	1.0-6.0	5.1-6.5	---
	35-46	10-18	4.0-10.0	5.3-7.3	---
	46-80	5-18	2.0-10.0	7.4-7.8	5-20
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10
Seelyeville	0-18	---	140-200	4.5-7.3	---
	18-60	---	140-200	4.5-7.3	---
540:					
Seelyeville	0-10	---	140-200	4.5-7.3	---
	10-80	---	140-200	4.5-7.3	---
541:					
Rifle	0-14	---	150-180	4.5-7.3	---
	14-60	---	50-150	4.5-7.3	---
545:					
Rondeau	0-44	0-10	140-200	5.1-7.8	---
	44-60	5-15	10.0-45.0	7.4-8.4	50-90
567A:					
Verndale	0-9	7-12	7.0-15.0	5.6-7.3	---
	9-19	7-18	3.0-12.0	5.6-7.3	---
	19-49	2-6	2.0-4.0	5.6-7.3	---
	49-60	0-4	0.0-3.0	6.1-8.4	0-30
574G:					
Steamboat	0-3	5-18	4.0-14.0	5.1-6.5	---
	3-35	5-15	1.0-6.0	5.1-6.5	---
	35-46	10-18	4.0-10.0	5.3-7.3	---
	46-80	5-18	2.0-10.0	7.4-7.8	5-20
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10
628:					
Talmoon	0-10	---	30-100	5.1-7.3	---
	10-15	15-27	7.0-18.0	5.1-7.3	---
	15-55	18-35	8.0-20.0	5.6-7.3	---
	55-80	15-35	7.0-18.0	7.4-8.4	5-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
672:					
Willosippi	0-7	8-26	9.0-29.0	5.1-7.3	---
	7-12	4-25	7.0-29.0	5.1-7.3	---
	12-32	10-30	12.0-31.0	5.6-7.8	0-5
	32-60	8-30	6.0-25.0	6.6-8.4	5-15
675C:					
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10
Eagleview	0-4	2-10	10.0-15.0	5.6-7.3	---
	4-28	2-10	10.0-15.0	5.6-7.3	---
	28-45	2-10	5.0-10.0	6.1-7.3	---
	45-80	2-10	0.0-5.0	6.1-8.4	0-10
Steamboat	0-3	5-18	4.0-14.0	5.1-6.5	---
	3-35	5-15	1.0-6.0	5.1-6.5	---
	35-46	10-18	4.0-10.0	5.3-7.3	---
	46-80	5-18	2.0-10.0	7.4-7.8	5-20
675E:					
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10
Eagleview	0-4	2-10	10.0-15.0	5.6-7.3	---
	4-28	2-10	10.0-15.0	5.6-7.3	---
	28-45	2-10	5.0-10.0	6.1-7.3	---
	45-80	2-10	0.0-5.0	6.1-8.4	0-10
Steamboat	0-3	5-18	4.0-14.0	5.1-6.5	---
	3-35	5-15	1.0-6.0	5.1-6.5	---
	35-46	10-18	4.0-10.0	5.3-7.3	---
	46-80	5-18	2.0-10.0	7.4-7.8	5-20
675G:					
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10
Eagleview	0-4	2-10	10.0-15.0	5.6-7.3	---
	4-28	2-10	10.0-15.0	5.6-7.3	---
	28-45	2-10	5.0-10.0	6.1-7.3	---
	45-80	2-10	0.0-5.0	6.1-8.4	0-10
Steamboat	0-3	5-18	4.0-14.0	5.1-6.5	---
	3-35	5-15	1.0-6.0	5.1-6.5	---
	35-46	10-18	4.0-10.0	5.3-7.3	---
	46-80	5-18	2.0-10.0	7.4-7.8	5-20
701:					
Runeberg	0-10	10-25	12.0-40.0	6.1-7.3	---
	10-36	10-18	4.0-14.0	6.1-7.3	---
	36-60	6-15	2.0-9.0	7.4-8.4	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
709B:					
Lengby	0-3	5-12	4.0-10.0	6.1-7.3	---
	3-11	3-10	2.0-8.0	5.6-7.3	---
	11-26	18-35	9.0-18.0	6.1-7.3	---
	26-48	2-18	1.0-10.0	7.4-8.4	5-20
	48-60	2-8	1.0-6.0	7.4-8.4	5-20
709C:					
Lengby	0-3	5-12	4.0-10.0	6.1-7.3	---
	3-11	3-10	2.0-8.0	5.6-7.3	---
	11-26	18-35	9.0-18.0	6.1-7.3	---
	26-48	2-18	1.0-10.0	7.4-8.4	5-20
	48-60	2-8	1.0-6.0	7.4-8.4	5-20
719B:					
Rondeau	0-20	0-10	140-200	5.1-7.8	---
	20-80	5-15	10.0-45.0	7.4-8.4	50-90
731A:					
Sanburn	0-6	2-4	2.0-7.0	5.1-6.5	---
	6-15	4-12	3.0-9.0	5.1-6.5	---
	15-21	6-15	4.0-11.0	5.1-6.5	---
	21-60	1-4	1.0-4.0	5.1-6.5	---
744B:					
Debs	0-2	8-16	14.0-25.0	6.1-7.3	---
	2-12	3-12	3.0-10.0	6.1-7.3	---
	12-32	18-30	14.0-23.0	6.1-7.3	---
	32-60	5-12	4.0-9.0	7.4-8.4	5-15
Akeley	0-3	2-6	1.0-8.0	5.1-7.3	---
	3-49	2-6	1.0-5.0	5.1-6.5	---
	49-56	18-35	10.0-20.0	5.1-7.3	---
	56-80	2-18	1.0-8.0	5.1-7.8	5-20
746:					
Haslie	0-12	---	140-180	5.6-7.8	---
	12-30	---	140-190	5.6-7.8	---
	30-80	18-35	10.0-45.0	7.4-8.4	20-80
775B:					
Sugarbush	0-3	5-15	4.0-12.0	5.6-7.3	---
	3-13	2-10	2.0-8.0	5.6-7.3	---
	13-25	10-18	5.0-10.0	5.6-7.3	---
	25-80	1-5	1.0-5.0	5.6-8.4	0-15
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-10	2-10	1.0-6.0	5.6-7.3	---
	10-33	5-15	2.0-9.0	6.1-7.3	---
	33-60	0-3	0.0-2.0	7.4-8.4	5-30
775C:					
Sugarbush	0-3	5-15	4.0-12.0	5.6-7.3	---
	3-13	2-10	2.0-8.0	5.6-7.3	---
	13-25	10-18	5.0-10.0	5.6-7.3	---
	25-80	1-5	1.0-5.0	5.6-8.4	0-15
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-10	2-10	1.0-6.0	5.6-7.3	---
	10-33	5-15	2.0-9.0	6.1-7.3	---
	33-60	0-3	0.0-2.0	7.4-8.4	5-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
778B:					
Dorset	0-11	4-18	10.0-23.0	5.6-7.3	---
	11-20	10-18	7.0-17.0	5.6-7.3	---
	20-38	5-10	3.0-8.0	7.4-8.4	10-25
	38-80	0-5	0.0-5.0	7.4-8.4	5-15
Corliss	0-7	2-10	3.0-12.0	6.1-7.8	0-15
	7-11	0-10	1.0-6.0	6.1-7.8	0-15
	11-60	0-5	0.0-3.0	7.4-8.4	5-30
778C:					
Dorset	0-11	4-18	10.0-23.0	5.6-7.3	---
	11-20	10-18	7.0-17.0	5.6-7.3	---
	20-38	5-10	3.0-8.0	7.4-8.4	10-25
	38-80	0-5	0.0-5.0	7.4-8.4	5-15
Corliss	0-7	2-10	3.0-12.0	6.1-7.8	0-15
	7-11	0-10	1.0-6.0	6.1-7.8	0-15
	11-60	0-5	0.0-3.0	7.4-8.4	5-30
797:					
Mooselake	0-10	---	140-180	4.5-7.3	---
	10-80	---	140-180	4.5-7.3	---
Lupton	0-10	---	100-200	4.5-7.8	---
	10-80	---	100-200	4.5-7.8	---
799:					
Seelyeville	0-12	---	140-200	4.5-7.3	---
	12-80	---	140-200	4.5-7.3	---
Bowstring	0-38	0-5	80-190	5.6-8.4	0-25
	38-47	1-12	10.0-40.0	5.6-8.4	0-25
	47-80	0-5	80-190	5.6-8.4	0-25
820B:					
Potatolake	0-9	10-27	8.0-32.0	5.6-7.3	---
	9-15	5-27	4.0-24.0	5.6-7.3	---
	15-30	18-40	12.0-30.0	5.6-7.8	---
	30-80	2-15	1.0-10.0	6.6-8.4	5-20
820C:					
Potatolake	0-9	10-27	8.0-32.0	5.6-7.3	---
	9-15	5-27	4.0-24.0	5.6-7.3	---
	15-30	18-40	12.0-30.0	5.6-7.8	---
	30-80	2-15	1.0-10.0	6.6-8.4	5-20
831C:					
Akeley	0-3	2-6	1.0-8.0	5.1-7.3	---
	3-49	2-6	1.0-5.0	5.1-6.5	---
	49-56	18-35	10.0-20.0	5.1-7.3	---
	56-80	2-18	1.0-8.0	5.1-7.8	5-20
Debs	0-2	8-16	14.0-25.0	6.1-7.3	---
	2-12	3-12	3.0-10.0	6.1-7.3	---
	12-32	18-30	14.0-23.0	6.1-7.3	---
	32-60	5-12	4.0-9.0	7.4-8.4	5-15

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
831E:					
Akeley	0-3	2-6	1.0-8.0	5.1-7.3	---
	3-49	2-6	1.0-5.0	5.1-6.5	---
	49-56	18-35	10.0-20.0	5.1-7.3	---
	56-80	2-18	1.0-8.0	5.1-7.8	5-20
Debs	0-2	8-16	14.0-25.0	6.1-7.3	---
	2-12	3-12	3.0-10.0	6.1-7.3	---
	12-32	18-30	14.0-23.0	6.1-7.3	---
	32-60	5-12	4.0-9.0	7.4-8.4	5-15
844B:					
Sanburn	0-6	2-4	2.0-7.0	5.1-6.5	---
	6-15	4-12	3.0-9.0	5.1-6.5	---
	15-21	6-15	4.0-11.0	5.1-6.5	---
	21-60	1-4	1.0-4.0	5.1-6.5	---
Graycalm	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
867B:					
Graycalm	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
Menahga	0-3	2-10	2.0-10.0	4.5-6.5	---
	3-17	0-5	1.0-4.0	4.5-6.5	---
	17-80	0-5	1.0-4.0	5.6-7.8	---
867C:					
Graycalm	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
Menahga	0-3	2-10	2.0-10.0	4.5-6.5	---
	3-17	0-5	1.0-4.0	4.5-6.5	---
	17-80	0-5	1.0-4.0	5.6-7.8	---
867E:					
Graycalm	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
Menahga	0-3	2-10	2.0-10.0	4.5-6.5	---
	3-17	0-5	1.0-4.0	4.5-6.5	---
	17-80	0-5	1.0-4.0	5.6-7.8	---
867F:					
Graycalm	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
Menahga	0-3	2-10	2.0-10.0	4.5-6.5	---
	3-17	0-5	1.0-4.0	4.5-6.5	---
	17-80	0-5	1.0-4.0	5.6-7.8	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1015:					
Udipsamments----	0-14	1-15	1.0-5.0	6.6-7.3	---
	14-60	1-10	1.0-3.0	6.6-7.3	---
	60-80	1-10	1.0-3.0	7.4-8.4	0-5
1016:					
Udorthents.					
1021C:					
Graycalm--------	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
Sanburn---------	0-6	2-4	2.0-7.0	5.1-6.5	---
	6-15	4-12	3.0-9.0	5.1-6.5	---
	15-21	6-15	4.0-11.0	5.1-6.5	---
	21-60	1-4	1.0-4.0	5.1-6.5	---
1027:					
Udorthents.					
1030:					
Pits, gravel.					
Udipsamments----	0-14	1-15	1.0-5.0	6.6-7.3	---
	14-60	1-10	1.0-3.0	6.6-7.3	---
	60-80	1-10	1.0-3.0	7.4-8.4	0-5
1111:					
Nidaros---------	0-32	---	110-170	4.5-7.8	---
	32-38	8-35	13.0-51.0	5.6-8.4	---
	38-60	0-4	1.0-3.0	5.6-8.4	0-5
1113:					
Haslie----------	0-20	---	140-180	5.6-7.8	---
	20-60	18-35	10.0-45.0	7.4-8.4	60-80
Seelyeville-----	0-18	---	140-200	4.5-7.3	---
	18-60	---	140-200	4.5-7.3	---
Cathro----------	0-23	---	150-230	4.5-7.8	---
	23-60	10-30	2.0-20.0	5.6-8.4	5-25
1126B:					
Verndale--------	0-9	7-12	7.0-15.0	5.6-7.3	---
	9-19	7-18	3.0-12.0	5.6-7.3	---
	19-49	2-6	2.0-4.0	5.6-7.3	---
	49-60	0-4	0.0-3.0	6.1-8.4	0-30
Nymore----------	0-8	2-12	3.0-13.0	5.1-6.5	---
	8-33	0-5	0.0-5.0	5.1-7.3	---
	33-60	0-5	0.0-1.0	5.1-7.8	---
1127A:					
Bootlake--------	0-3	5-15	4.0-15.0	5.6-7.3	---
	3-7	2-10	1.0-10.0	5.6-7.3	---
	7-13	10-18	5.0-12.0	5.6-7.3	---
	13-47	1-5	1.0-5.0	6.1-7.3	---
	47-80	1-5	1.0-5.0	7.4-8.4	5-15

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1127A:					
Graycalm	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
1127B:					
Bootlake	0-3	5-15	4.0-15.0	5.6-7.3	---
	3-7	2-10	1.0-10.0	5.6-7.3	---
	7-13	10-18	5.0-12.0	5.6-7.3	---
	13-47	1-5	1.0-5.0	6.1-7.3	---
	47-80	1-5	1.0-5.0	7.4-8.4	5-15
Graycalm	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
1136:					
Nidaros	0-27	---	110-170	4.5-7.8	---
	27-38	8-35	13.0-51.0	5.6-8.4	---
	38-80	0-4	1.0-3.0	5.6-8.4	0-5
1164:					
Zerkel	0-4	8-20	7.0-18.0	5.6-7.3	---
	4-10	4-12	2.0-8.0	5.6-7.3	---
	10-29	20-35	10.0-20.0	5.6-7.3	---
	29-37	5-20	2.0-10.0	7.4-8.4	15-30
	37-80	2-18	1.0-8.0	7.4-8.4	10-20
1200:					
Egglake	0-4	8-15	7.0-17.0	5.6-7.3	---
	4-9	3-10	2.0-10.0	5.6-7.3	---
	9-25	18-30	7.0-18.0	5.6-7.3	---
	25-80	10-18	4.0-11.0	7.4-8.4	10-20
1230:					
Haslie	0-44	---	140-180	5.6-7.8	---
	44-60	18-35	10.0-45.0	7.4-8.4	60-80
Nidaros	0-38	---	110-170	4.5-7.8	---
	38-54	8-35	13.0-51.0	5.6-8.4	---
	54-60	0-4	1.0-3.0	5.6-8.4	0-5
1238E:					
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-10	2-10	1.0-6.0	5.6-7.3	---
	10-33	5-15	2.0-9.0	6.1-7.3	---
	33-60	0-3	0.0-2.0	7.4-8.4	5-30
Sugarbush	0-3	5-15	4.0-12.0	5.6-7.3	---
	3-13	2-10	2.0-8.0	5.6-7.3	---
	13-25	10-18	5.0-10.0	5.6-7.3	---
	25-80	1-5	1.0-5.0	5.6-8.4	0-15
1238F:					
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-10	2-10	1.0-6.0	5.6-7.3	---
	10-33	5-15	2.0-9.0	6.1-7.3	---
	33-60	0-3	0.0-2.0	7.4-8.4	5-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1238F:					
Sugarbush-------	0-3	5-15	4.0-12.0	5.6-7.3	---
	3-13	2-10	2.0-8.0	5.6-7.3	---
	13-25	10-18	5.0-10.0	5.6-7.3	---
	25-80	1-5	1.0-5.0	5.6-8.4	0-15
1244B:					
Sol----------	0-4	4-16	4.0-14.0	5.1-6.5	---
	4-17	2-12	1.0-6.0	5.1-6.5	---
	17-43	18-27	9.0-14.0	5.6-7.3	---
	43-80	8-18	2.0-9.0	7.4-7.8	10-20
Sugarbush-------	0-3	5-15	4.0-12.0	5.6-7.3	---
	3-12	2-10	2.0-8.0	5.6-7.3	---
	12-25	10-18	5.0-10.0	5.6-7.3	---
	25-60	1-5	1.0-5.0	5.6-8.4	0-15
1244C:					
Sol----------	0-4	4-16	4.0-14.0	5.1-6.5	---
	4-17	2-12	1.0-6.0	5.1-6.5	---
	17-43	18-27	9.0-14.0	5.6-7.3	---
	43-80	8-18	2.0-9.0	7.4-7.8	10-20
Sugarbush-------	0-3	5-15	4.0-12.0	5.6-7.3	---
	3-12	2-10	2.0-8.0	5.6-7.3	---
	12-25	10-18	5.0-10.0	5.6-7.3	---
	25-60	1-5	1.0-5.0	5.6-8.4	0-15
1244E:					
Sol----------	0-4	4-16	4.0-14.0	5.1-6.5	---
	4-17	2-12	1.0-6.0	5.1-6.5	---
	17-43	18-27	9.0-14.0	5.6-7.3	---
	43-80	8-18	2.0-9.0	7.4-7.8	10-20
Sugarbush-------	0-3	5-15	4.0-12.0	5.6-7.3	---
	3-12	2-10	2.0-8.0	5.6-7.3	---
	12-25	10-18	5.0-10.0	5.6-7.3	---
	25-60	1-5	1.0-5.0	5.6-8.4	0-15
1247D:					
Corliss---------	0-7	2-10	3.0-12.0	6.1-7.8	0-15
	7-11	0-10	1.0-6.0	6.1-7.8	0-15
	11-60	0-5	0.0-3.0	7.4-8.4	5-30
Dorset----------	0-11	4-18	10.0-23.0	5.6-7.3	---
	11-20	10-18	7.0-17.0	5.6-7.3	---
	20-38	5-10	3.0-8.0	7.4-8.4	10-25
	38-80	0-5	0.0-5.0	7.4-8.4	5-15
1248C:					
Nymore----------	0-8	2-12	3.0-13.0	5.1-6.5	---
	8-33	0-5	0.0-5.0	5.1-7.3	---
	33-60	0-5	0.0-1.0	5.1-7.8	---
Verndale--------	0-9	7-12	7.0-15.0	5.6-7.3	---
	9-19	7-18	3.0-12.0	5.6-7.3	---
	19-49	2-6	2.0-4.0	5.6-7.3	---
	49-60	0-4	0.0-3.0	6.1-8.4	0-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1249C:					
Graycalm	0-3	0-10	4.0-12.0	3.5-6.5	---
	3-20	0-15	2.0-4.0	3.5-7.3	---
	20-39	0-10	1.0-5.0	3.5-7.3	---
	39-80	0-10	0.0-2.0	3.5-8.4	---
Bootlake	0-3	5-15	4.0-15.0	5.6-7.3	---
	3-7	2-10	1.0-10.0	5.6-7.3	---
	7-13	10-18	5.0-12.0	5.6-7.3	---
	13-47	1-5	1.0-5.0	6.1-7.3	---
	47-80	1-5	1.0-5.0	7.4-8.4	5-15
1271:					
Roscommon	0-6	0-12	8.0-40.0	5.6-7.8	---
	6-80	0-10	1.0-4.0	5.6-8.4	0-10
1272B:					
Sol	0-3	4-16	4.0-14.0	5.1-6.5	---
	3-14	2-12	1.0-6.0	5.1-6.5	---
	14-38	18-27	9.0-14.0	5.6-7.3	---
	38-60	8-18	2.0-9.0	7.4-7.8	10-20
1294:					
Nary	0-3	4-15	---	5.1-6.0	---
	3-15	2-12	---	5.1-6.0	---
	15-36	18-27	---	5.6-6.5	---
	36-60	5-18	---	7.4-7.8	---
1319B:					
Rockwood	0-8	5-15	6.0-20.0	5.1-6.5	---
	8-16	5-10	4.0-9.0	5.1-6.5	---
	16-37	8-18	5.0-11.0	5.6-7.3	---
	37-46	8-18	4.0-10.0	5.6-7.3	---
	46-60	7-15	4.0-9.0	6.1-8.4	0-15
1319C:					
Rockwood	0-8	5-15	6.0-20.0	5.1-6.5	---
	8-16	5-10	4.0-9.0	5.1-6.5	---
	16-37	8-18	5.0-11.0	5.6-7.3	---
	37-46	8-18	4.0-10.0	5.6-7.3	---
	46-60	7-15	4.0-9.0	6.1-8.4	0-15
1319D:					
Rockwood	0-8	5-15	6.0-20.0	5.1-6.5	---
	8-16	5-10	4.0-9.0	5.1-6.5	---
	16-37	8-18	5.0-11.0	5.6-7.3	---
	37-46	8-18	4.0-10.0	5.6-7.3	---
	46-60	7-15	4.0-9.0	6.1-8.4	0-15
1320B:					
Blowers	0-6	5-15	6.0-20.0	5.1-7.3	---
	6-17	5-10	4.0-9.0	5.1-6.5	---
	17-27	8-18	5.0-11.0	5.6-7.3	---
	27-40	8-18	4.0-10.0	5.6-7.3	0-15
	40-60	7-15	4.0-9.0	6.6-8.4	0-15
1321:					
Paddock	0-8	8-15	8.0-20.0	5.6-7.3	---
	8-15	3-10	3.0-9.0	5.6-6.5	---
	15-40	8-18	4.0-10.0	6.6-7.3	---
	40-60	6-15	3.0-9.0	6.6-8.4	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1321:					
Becida	0-8	10-20	11.0-24.0	5.6-7.3	---
	8-13	3-10	3.0-11.0	5.6-6.5	---
	13-27	8-18	9.0-11.0	5.1-6.5	---
	27-58	8-18	3.0-9.0	5.1-6.5	---
	58-80	6-15	3.0-9.0	6.6-8.4	---
1332B:					
Rockwood	0-7	8-15	6.0-16.0	5.1-6.5	---
	7-16	5-12	4.0-9.0	5.1-6.5	---
	16-37	8-18	4.0-10.0	5.6-7.3	---
	37-80	7-15	2.0-10.0	6.6-7.8	0-15
1332C:					
Rockwood	0-7	8-15	6.0-16.0	5.1-6.5	---
	7-16	5-12	4.0-9.0	5.1-6.5	---
	16-37	8-18	4.0-10.0	5.6-7.3	---
	37-80	7-15	2.0-10.0	6.6-7.8	0-15
1332E:					
Rockwood	0-7	8-15	6.0-16.0	5.1-6.5	---
	7-16	5-12	4.0-9.0	5.1-6.5	---
	16-37	8-18	4.0-10.0	5.6-7.3	---
	37-80	7-15	2.0-10.0	6.6-7.8	0-15
1334:					
Huntersville	0-8	2-6	3.0-9.0	6.1-7.3	---
	8-38	2-6	1.0-5.0	6.1-7.3	---
	38-65	6-35	3.0-20.0	6.1-7.3	---
	65-80	6-15	2.0-10.0	6.6-7.8	0-15
1336:					
Blowers	0-5	8-15	6.0-20.0	5.1-7.3	---
	5-23	5-12	4.0-9.0	5.1-6.5	---
	23-47	8-18	4.0-10.0	5.6-7.3	---
	47-80	7-15	2.0-10.0	6.6-7.8	0-15
1421B:					
Rockwood	0-7	8-15	6.0-16.0	5.1-6.5	---
	7-16	5-12	4.0-9.0	5.1-6.5	---
	16-37	8-18	4.0-10.0	5.6-7.3	---
	37-80	7-15	2.0-10.0	6.6-7.8	0-15
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10
1421C:					
Rockwood	0-7	8-15	6.0-16.0	5.1-6.5	---
	7-16	5-12	4.0-9.0	5.1-6.5	---
	16-37	8-18	4.0-10.0	5.6-7.3	---
	37-80	7-15	2.0-10.0	6.6-7.8	0-15
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1421E:					
Rockwood	0-7	8-15	6.0-16.0	5.1-6.5	---
	7-16	5-12	4.0-9.0	5.1-6.5	---
	16-37	8-18	4.0-10.0	5.6-7.3	---
	37-80	7-15	2.0-10.0	6.6-7.8	0-15
Two Inlets	0-2	2-10	2.0-8.0	5.6-7.3	---
	2-9	2-10	1.0-6.0	5.6-7.3	---
	9-19	2-10	2.0-9.0	5.6-7.3	---
	19-80	0-3	0.0-2.0	6.6-7.8	0-10
1438B:					
Braham	0-8	2-8	2.0-9.0	5.6-7.3	---
	8-24	2-8	1.0-5.0	5.6-7.3	---
	24-42	18-35	7.0-21.0	5.1-7.3	---
	42-60	18-35	7.0-21.0	7.4-8.4	5-25
1439:					
Cathro	0-12	---	120-170	4.5-7.8	---
	12-43	---	120-170	4.5-7.8	---
	43-80	10-30	5.0-25.0	6.6-8.4	5-25
1440B:					
Redeye	0-5	2-6	3.0-9.0	5.1-7.3	---
	5-31	2-6	2.0-7.0	5.6-6.5	---
	31-43	6-18	4.0-13.0	5.1-7.3	---
	43-80	5-14	2.0-8.0	6.6-8.4	0-20
1440C:					
Redeye	0-5	2-6	3.0-9.0	5.1-7.3	---
	5-31	2-6	2.0-7.0	5.6-6.5	---
	31-43	6-18	4.0-13.0	5.1-7.3	---
	43-80	5-14	2.0-8.0	6.6-8.4	0-20
1444:					
Wurtsmith	0-6	3-8	2.0-10.0	4.5-7.3	---
	6-20	0-8	0.0-5.0	3.5-6.5	---
	20-80	0-5	0.0-3.0	3.5-7.3	---
1445:					
Markey	0-26	---	110-170	4.5-7.8	0-5
	26-80	0-10	1.0-3.0	5.6-8.4	0-5
1447:					
Beltrami	0-6	5-18	4.0-14.0	5.6-7.3	---
	6-12	5-15	4.0-14.0	5.6-7.3	---
	12-39	18-35	9.0-19.0	5.6-7.8	---
	39-80	18-30	8.0-16.0	7.4-8.4	12-30
1450B:					
Sanburn	0-4	3-10	2.0-9.0	5.1-6.5	---
	4-17	4-12	3.0-9.0	5.1-6.5	---
	17-24	6-15	4.0-11.0	5.1-6.5	---
	24-80	1-4	1.0-4.0	5.1-6.5	---
1450C:					
Sanburn	0-4	3-10	2.0-9.0	5.1-6.5	---
	4-17	4-12	3.0-9.0	5.1-6.5	---
	17-24	6-15	4.0-11.0	5.1-6.5	---
	24-80	1-4	1.0-4.0	5.1-6.5	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1450E:					
Sanburn	0-4	3-10	2.0-9.0	5.1-6.5	---
	4-17	4-12	3.0-9.0	5.1-6.5	---
	17-24	6-15	4.0-11.0	5.1-6.5	---
	24-80	1-4	1.0-4.0	5.1-6.5	---
1460B:					
Nebish	0-6	5-18	4.0-14.0	5.6-7.3	---
	6-12	5-12	3.0-8.0	5.6-7.3	---
	12-32	22-35	10.0-18.0	5.6-7.8	---
	32-80	18-30	9.0-16.0	7.4-8.4	5-15
1460C:					
Nebish	0-5	5-18	4.0-14.0	5.6-7.3	---
	5-14	5-12	3.0-8.0	5.6-7.3	---
	14-39	22-35	10.0-18.0	5.6-7.8	---
	39-80	18-30	9.0-16.0	7.4-8.4	5-15
1943:					
Roscommon	0-6	2-12	9.0-23.0	5.6-7.8	---
	6-60	0-10	1.0-4.0	5.6-8.4	0-10
1956:					
Staples	0-7	2-6	5.0-20.0	5.1-7.3	---
	7-36	2-6	1.0-5.0	5.1-7.3	---
	36-44	8-35	3.0-20.0	5.1-7.3	---
	44-60	6-15	2.0-10.0	6.6-7.8	0-15
1968:					
Evart	0-11	8-20	5.0-20.0	6.1-7.8	---
	11-60	0-15	1.0-3.0	6.1-8.4	0-10
1969:					
Evart	0-11	8-20	5.0-20.0	6.1-7.8	---
	11-60	0-15	1.0-3.0	6.1-8.4	0-10
Isan	0-13	2-8	10.0-25.0	5.6-7.3	---
	13-30	2-8	2.0-10.0	5.1-6.5	---
	30-60	1-5	1.0-5.0	5.6-7.3	---

Water Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Hydrologic group	Flooding			High water table and ponding				Maximum ponding depth
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	
					Ft				Ft
82B, 82C:									
Redeye	B	None	---	---	>6.0	---	---	---	---
133B, 133C:									
Dalbo	B	None	---	---	2.5-3.5	Apparent	Nov-May	---	---
139B:									
Huntersville	B	None	---	---	2.5-3.5	Perched	Nov-Jul	---	---
147:									
Spooner	C/D	None	---	---	0.5-1.5	Apparent	Nov-Jul	---	---
158B, 158C:									
Zimmerman	A	None	---	---	>6.0	---	---	---	---
167A:									
Baudette	B	None	---	---	2.5-3.5	Apparent	Apr-Jun	---	---
170:									
Blomford	B/D	None	---	---	0.5-1.5	Apparent	Apr-Jun	---	---
202:									
Meehan	B	None	---	---	1.0-2.5	Apparent	Oct-Jun	---	---
207B, 207C, 207D:									
Nymore	A	None	---	---	>6.0	---	---	---	---
260:									
Duelm	A	None	---	---	2.5-3.5	Apparent	Mar-Jun	---	---
261:									
Isan	A/D	None	---	---	0.0-0.5	Apparent	Oct-Aug	Long	1.0
267B:									
Snellman	B	None	---	---	>6.0	---	---	---	---
346:									
Talmoon	C	None	---	---	0.5-1.5	Apparent	Nov-Jun	---	---
406A:									
Dorset	B	None	---	---	>6.0	---	---	---	---
488:									
Becida	C/D	None	---	---	0.0-1.0	Perched	Oct-Jul	---	---
526C, 526E:									
Steamboat	B	None	---	---	>6.0	---	---	---	---
Two Inlets	A	None	---	---	>6.0	---	---	---	---
Seelyeville	D	None	---	---	0.0-0.0	Apparent	Jan-Dec	Very long	3.0
540:									
Seelyeville	A/D	None	---	---	0.0-0.5	Apparent	Oct-Jun	Very long	1.0
541:									
Rifle	A/D	None	---	---	0.0-0.5	Apparent	Nov-Jun	Very long	1.0

Water Features--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table and ponding				Maximum ponding depth
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	
					Ft				Ft
545:									
Rondeau	A/D	None	---	---	0.0-0.5	Apparent	Jan-Dec	Very long	1.0
567A:									
Verndale	B	None	---	---	>6.0	---	---	---	---
574G:									
Steamboat	B	None	---	---	>6.0	---	---	---	---
Two Inlets	A	None	---	---	>6.0	---	---	---	---
628:									
Talmoon	D	None	---	---	0.0-0.5	Apparent	Nov-Jun	Very long	1.0
672:									
Willosippi	C	None	---	---	0.5-1.5	Apparent	Oct-Jun	---	---
675C, 675E, 675G:									
Two Inlets	A	None	---	---	>6.0	---	---	---	---
Eagleview	A	None	---	---	>6.0	---	---	---	---
Steamboat	B	None	---	---	>6.0	---	---	---	---
701:									
Runeberg	C/D	None	---	---	0.0-0.5	Apparent	Jan-Dec	Long	1.0
709B, 709C:									
Lengby	B	None	---	---	>6.0	---	---	---	---
719B:									
Rondeau	A/D	None	---	---	0.0-2.0	Apparent	Jan-Dec	---	---
731A:									
Sanburn	B	None	---	---	>6.0	---	---	---	---
744B:									
Debs	B	None	---	---	>6.0	---	---	---	---
Akeley	A	None	---	---	>6.0	---	---	---	---
746:									
Haslie	A/D	None	---	---	0.0-0.5	Apparent	Nov-Jul	Very long	1.0
775B, 775C:									
Sugarbush	B	None	---	---	>6.0	---	---	---	---
Two Inlets	A	None	---	---	>6.0	---	---	---	---
778B, 778C:									
Dorset	B	None	---	---	>6.0	---	---	---	---
Corliss	A	None	---	---	>6.0	---	---	---	---
797:									
Mooselake	A/D	None	---	---	0.0-1.0	Apparent	Jan-Dec	---	---
Lupton	A/D	None	---	---	0.0-1.0	Apparent	Sep-May	---	---
799:									
Seelyeville	A/D	Frequent	Long	Nov-May	0.0-0.5	Apparent	Oct-Jun	Very long	1.0
Bowstring	A/D	Frequent	Long	Mar-Jun	0.0-0.5	Apparent	Oct-Jun	Very long	1.0

Water Features--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
820B, 820C:									
Potatolake	B	None	---	---	2.0-3.5	Apparent	Mar-Jun	---	---
831C, 831E:									
Akeley	A	None	---	---	>6.0	---	---	---	---
Debs	B	None	---	---	>6.0	---	---	---	---
844B:									
Sanburn	B	None	---	---	>6.0	---	---	---	---
Graycalm	A	None	---	---	>6.0	---	---	---	---
867B, 867C, 867E, 867F:									
Graycalm	A	None	---	---	>6.0	---	---	---	---
Menahga	A	None	---	---	>6.0	---	---	---	---
1015:									
Udipsamments	A	None	---	---	>6.0	---	---	---	---
1016:									
Udorthents	B	None	---	---	>6.0	---	---	---	---
1021C:									
Graycalm	A	None	---	---	>6.0	---	---	---	---
Sanburn	B	None	---	---	>6.0	---	---	---	---
1027:									
Udorthents.									
1030:									
Pits, gravel.									
Udipsamments	A	None	---	---	>6.0	---	---	---	---
1111:									
Nidaros	A/D	Frequent	Long	Mar-Nov	0.0-0.5	Apparent	Oct-Jun	Very long	1.0
1113:									
Haslie	D	None	---	---	0.0-0.0	Apparent	Jan-Dec	Very long	3.0
Seelyeville	D	None	---	---	0.0-0.0	Apparent	Jan-Dec	Very long	3.0
Cathro	D	None	---	---	0.0-0.0	Apparent	Jan-Dec	Very long	3.0
1126B:									
Verndale	B	None	---	---	>6.0	---	---	---	---
Nymore	A	None	---	---	>6.0	---	---	---	---
1127A, 1127B:									
Bootlake	B	None	---	---	>6.0	---	---	---	---
Graycalm	A	None	---	---	>6.0	---	---	---	---
1136:									
Nidaros	A/D	None	---	---	0.0-0.5	Apparent	Oct-Jun	Very long	1.0
1164:									
Zerkel	B	None	---	---	2.5-3.5	Apparent	Apr-Jun	---	---

Water Features--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table and ponding				Maximum ponding depth
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	
					Ft				Ft
1200:									
Egglake	B	None	---	---	0.5-1.5	Apparent	Oct-Jul	---	---
1230:									
Haslie	D	None	---	---	0.0-0.0	Apparent	Jan-Dec	Very long	3.0
Nidaros	D	None	---	---	0.0-0.0	Apparent	Jan-Dec	Very long	3.0
1238E, 1238F:									
Two Inlets	A	None	---	---	>6.0	---	---	---	---
Sugarbush	B	None	---	---	>6.0	---	---	---	---
1244B, 1244C, 1244E:									
Sol	B	None	---	---	>6.0	---	---	---	---
Sugarbush	B	None	---	---	>6.0	---	---	---	---
1247D:									
Corliss	A	None	---	---	>6.0	---	---	---	---
Dorset	B	None	---	---	>6.0	---	---	---	---
1248C:									
Nymore	A	None	---	---	>6.0	---	---	---	---
Verndale	B	None	---	---	>6.0	---	---	---	---
1249C:									
Graycalm	A	None	---	---	>6.0	---	---	---	---
Bootlake	B	None	---	---	>6.0	---	---	---	---
1271:									
Roscommon	A/D	None	---	---	0.0-0.5	Apparent	Sep-Jun	Long	1.0
1272B:									
Sol	B	None	---	---	>6.0	---	---	---	---
1294:									
Nary	B	None	---	---	2.5-3.5	Apparent	Apr-Jun	---	---
1319B, 1319C, 1319D:									
Rockwood	C	None	---	---	>6.0	---	---	---	---
1320B:									
Blowers	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
1321:									
Paddock	C/D	None	---	---	1.0-2.5	Perched	Nov-Jun	---	---
Becida	C/D	None	---	---	0.0-1.0	Perched	Oct-Jul	---	---
1332B, 1332C, 1332E:									
Rockwood	C	None	---	---	>6.0	---	---	---	---
1334:									
Huntersville	B	None	---	---	2.5-3.5	Perched	Nov-Jul	---	---

Water Features--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
1336:									
Blowers	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
1421B, 1421C, 1421E:									
Rockwood	C	None	---	---	>6.0	---	---	---	---
Two Inlets	A	None	---	---	>6.0	---	---	---	---
1438B:									
Braham	B	None	---	---	3.5-6.0	Apparent	Apr-May	---	---
1439:									
Cathro	A/D	None	---	---	0.0-0.5	Apparent	Oct-Jun	Very long	1.0
1440B, 1440C:									
Redeye	B	None	---	---	>6.0	---	---	---	---
1444:									
Wurtsmith	A	None	---	---	2.0-3.5	Apparent	Nov-May	---	---
1445:									
Markey	A/D	None	---	---	0.0-0.5	Apparent	Nov-Jun	Very long	1.0
1447:									
Beltrami	B	None	---	---	1.5-2.5	Apparent	Nov-Jun	---	---
1450B, 1450C, 1450E:									
Sanburn	B	None	---	---	>6.0	---	---	---	---
1460B:									
Nebish	B	None	---	---	3.5-6.0	Apparent	Apr-Jun	---	---
1460C:									
Nebish	B	None	---	---	>6.0	---	---	---	---
1943:									
Roscommon	A/D	None	---	---	0.5-1.5	Apparent	Sep-Jun	---	---
1956:									
Staples	B/D	None	---	---	0.0-1.0	Perched	Nov-Jul	---	---
1968:									
Evart	D	Occasional	Long	Nov-Jun	0.0-1.0	Apparent	Jan-Dec	---	---
1969:									
Evart	D	Frequent	Long	Nov-Jun	0.0-0.5	Apparent	Jan-Dec	Long	1.0
Isan	A/D	Frequent	Long	Nov-Jun	0.5-1.5	Apparent	Oct-Jun	---	---

Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
82B, 82C:							
Redeye	>60	---	---	---	Moderate	Moderate	Moderate.
133B, 133C:							
Dalbo	>60	---	---	---	High	High	Moderate.
139B:							
Huntersville	>60	---	---	---	High	Moderate	Moderate.
147:							
Spooner	>60	---	---	---	High	High	Low.
158B, 158C:							
Zimmerman	>60	---	---	---	Low	Low	High.
167A:							
Baudette	>60	---	---	---	High	Moderate	Low.
170:							
Blomford	>60	---	---	---	Moderate	High	Moderate.
202:							
Meehan	>60	---	---	---	Moderate	Low	Moderate.
207B, 207C, 207D:							
Nymore	>60	---	---	---	Low	Low	Moderate.
260:							
Duelm	>60	---	---	---	Moderate	Low	Moderate.
261:							
Isan	>60	---	---	---	Moderate	High	Moderate.
267B:							
Snellman	>60	---	---	---	Moderate	Low	Moderate.
346:							
Talmoon	>60	---	---	---	High	High	Moderate.
406A:							
Dorset	>60	---	---	---	Low	Low	Moderate.
488:							
Becida	>80	---	---	---	High	High	Moderate.
526C, 526E:							
Steamboat	>80	---	---	---	Moderate	Low	Moderate.
Two Inlets	>80	---	---	---	Low	Low	Low.
Seelyeville	>60	---	---	---	High	High	Moderate.
540:							
Seelyeville	>60	---	---	50-55	High	High	Moderate.
541:							
Rifle	>60	---	---	---	High	High	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
545:							
Rondeau	>60	---	---	35	High	High	Low.
567A:							
Verndale	>60	---	---	---	Low	Low	Low.
574G:							
Steamboat	>80	---	---	---	Moderate	Low	Moderate.
Two Inlets	>80	---	---	---	Low	Low	Low.
628:							
Talmoon	>60	---	---	---	High	High	Moderate.
672:							
Willosippi	>60	---	---	---	High	High	Moderate.
675C, 675E, 675G:							
Two Inlets	>80	---	---	---	Low	Low	Low.
Eagleview	>80	---	---	---	Low	Low	Low.
Steamboat	>80	---	---	---	Moderate	Low	Moderate.
701:							
Runeberg	>60	---	---	---	High	High	Low.
709B, 709C:							
Lengby	>60	---	---	---	Moderate	Moderate	Moderate.
719B:							
Rondeau	>60	---	---	35	High	High	Low.
731A:							
Sanburn	>60	---	---	---	Low	Low	Moderate.
744B:							
Debs	>60	---	---	---	High	Moderate	Low.
Akeley	>80	---	---	---	Low	Low	Moderate.
746:							
Haslie	>60	---	---	---	High	High	Moderate.
775B, 775C:							
Sugarbush	>60	---	---	---	Low	Low	Low.
Two Inlets	>80	---	---	---	Low	Low	Low.
778B, 778C:							
Dorset	>60	---	---	---	Low	Low	Moderate.
Corliss	>80	---	---	---	Low	Low	Low.
797:							
Mooselake	>60	---	0-12	6-12	High	High	High.
Lupton	>60	---	6-18	50-55	High	High	Low.
799:							
Seelyeville	>60	---	---	50-55	High	High	Moderate.
Bowstring	>60	---	---	20-30	High	High	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
820B, 820C:							
Potatolake	>80	---	---	---	High	Moderate	Low.
831C, 831E:							
Akeley	>80	---	---	---	Low	Low	Moderate.
Debs	>60	---	---	---	High	Moderate	Low.
844B:							
Sanburn	>60	---	---	---	Low	Low	Moderate.
Graycalm	>60	---	---	---	Low	Low	Moderate.
867B, 867C, 867E, 867F:							
Graycalm	>60	---	---	---	Low	Low	Moderate.
Menahga	>60	---	---	---	Low	Low	Moderate.
1015:							
Udipsamments	>60	---	---	---	Low	Low	Low.
1016:							
Udorthents	>60	---	---	---	Moderate	High	Moderate.
1021C:							
Graycalm	>60	---	---	---	Low	Low	Moderate.
Sanburn	>60	---	---	---	Low	Low	Moderate.
1027:							
Udorthents.							
1030:							
Pits, gravel.							
Udipsamments	>60	---	---	---	Low	Low	Low.
1111:							
Nidaros	>60	---	---	25-30	High	High	Low.
1113:							
Haslie	>60	---	---	30-45	High	High	Moderate.
Seelyeville	>60	---	---	---	High	High	Moderate.
Cathro	>60	---	---	---	High	High	Low.
1126B:							
Verndale	>60	---	---	---	Low	Low	Low.
Nymore	>60	---	---	---	Low	Low	Moderate.
1127A, 1127B:							
Bootlake	>60	---	---	---	Low	Low	Low.
Graycalm	>60	---	---	---	Low	Low	Moderate.
1136:							
Nidaros	>60	---	---	25-30	High	High	Low.
1164:							
Zerkel	>60	---	---	---	Moderate	Moderate	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
1200:							
Egglake	>60	---	---	---	High	High	Low.
1230:							
Haslie	>60	---	---	30-45	High	High	Moderate.
Nidaros	>60	---	---	25-30	High	High	Low.
1238E, 1238F:							
Two Inlets	>80	---	---	---	Low	Low	Low.
Sugarbush	>60	---	---	---	Low	Low	Low.
1244B, 1244C, 1244E:							
Sol	>60	---	---	---	Moderate	High	High.
Sugarbush	>60	---	---	---	Low	Low	Low.
1247D:							
Corliss	>80	---	---	---	Low	Low	Low.
Dorset	>60	---	---	---	Low	Low	Moderate.
1248C:							
Nymore	>60	---	---	---	Low	Low	Moderate.
Verndale	>60	---	---	---	Low	Low	Low.
1249C:							
Graycalm	>60	---	---	---	Low	Low	Moderate.
Bootlake	>60	---	---	---	Low	Low	Low.
1271:							
Roscommon	>60	---	---	---	Moderate	High	Low.
1272B:							
Sol	>60	---	---	---	Moderate	High	High.
1294:							
Nary	>60	---	---	---	Moderate	High	Moderate.
1319B, 1319C, 1319D:							
Rockwood	>60	---	---	---	Moderate	Low	Moderate.
1320B:							
Blowers	>60	---	---	---	High	Moderate	Moderate.
1321:							
Paddock	>60	---	---	---	High	High	Moderate.
Becida	>60	---	---	---	High	High	Moderate.
1332B, 1332C, 1332E:							
Rockwood	>80	---	---	---	Moderate	Low	Moderate.
1334:							
Huntersville	>60	---	---	---	High	Moderate	Moderate.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
1336:							
Blowers	>80	---	---	---	High	Moderate	Moderate.
1421B, 1421C, 1421E:							
Rockwood	>80	---	---	---	Moderate	Low	Moderate.
Two Inlets	>80	---	---	---	Low	Low	Low.
1438B:							
Braham	>60	---	---	---	Low	Low	Moderate.
1439:							
Cathro	>80	---	---	19-22	High	High	Low.
1440B, 1440C:							
Redeye	>60	---	---	---	Moderate	Moderate	Moderate.
1444:							
Wurtsmith	>60	---	---	---	Low	Low	Moderate.
1445:							
Markey	>60	---	---	25-30	High	High	Low.
1447:							
Beltrami	>60	---	---	---	High	Moderate	Low.
1450B, 1450C, 1450E:							
Sanburn	>60	---	---	---	Low	Low	Moderate.
1460B, 1460C:							
Nebish	>60	---	---	---	Moderate	Moderate	Low.
1943:							
Roscommon	>60	---	---	---	Moderate	High	Low.
1956:							
Staples	>60	---	---	---	High	High	Moderate.
1968:							
Evart	>60	---	---	---	Moderate	High	Low.
1969:							
Evart	>60	---	---	---	Moderate	High	Low.
Isan	>60	---	---	---	Moderate	High	Moderate.

References

American Association of State Highway and Transportation Officials (AASHTO). 1998. Standard specifications for transportation materials and methods of sampling and testing. 19th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1998. Standard classification of soils for engineering purposes. ASTM Standard D 2487.

Hobbs, Howard C., and Joseph E. Goebel. 1982. Geologic map of Minnesota Quaternary geology. Minnesota Geological Survey, University of Minnesota. Wall map.

Jenny, Hans. 1941. Factors of soil formation.

Marshner, Francis J. 1974. The original vegetation of Minnesota. North-Central Forest Experiment Station. Wall map.

McMiller, P.R., and others. 1935. Soil survey of Hubbard County, Minnesota. U.S. Department of Agriculture, Bureau of Chemistry and Soils, in cooperation with the University of Minnesota Agricultural Experiment Station.

Norton, Arthur R. Quaternary geology of the Itasca-St. Croix Moraine interlobate area, north-central Minnesota. (Unpublished M.S. thesis, University of Minnesota, 1982)

Sackreiter, Donald Keith. Quaternary geology of the southern part of the Grand Forks and Bemidji Quadrangles. (Unpublished Ph.D. dissertation, University of North Dakota, Grand Forks, 1975)

United States Department of Agriculture. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

United States Department of Agriculture. 1993. Soil survey manual. Soil Conservation Service, Soil Survey Division Staff. U.S. Department of Agriculture Handbook 18.

United States Department of Agriculture. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, Soil Survey Staff. U.S. Department of Agriculture Handbook 436.

Wright, H.E., Jr. 1962. Role of the Wadena Lobe in the Wisconsin glaciation of Minnesota. Geological Society of America Bulletin 73: 73-100.

Wright, H.E., Jr. 1972. Quaternary history of Minnesota. *In* Geology of Minnesota: A Centennial Volume. Minnesota Geological Survey.

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.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

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	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, 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.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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 material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) 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 shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay 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 stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse 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 has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

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.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Disintegration moraine. A drift topography characterized by chaotic mounds and pits, generally randomly oriented, developed in supraglacial drift by collapse and flow as the underlying stagnant ice melted. Slopes may be steep and unstable. Abrupt changes between materials of differing lithology are common.

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 wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A 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. Synonym: scarp.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

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.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

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 firefighters 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 has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has 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 flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

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.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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 has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Head slope. A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

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 15 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. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the

material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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

Interfluve. An elevated area between two drainageways that sheds water to those drainageways.

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 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. An irregular, short ridge or hill of stratified glacial drift.

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.

Lamella. A thin (commonly less than 1 cm thick), discontinuous or continuous, generally horizontal layer of fine material (especially clay and iron oxides) pedogenically concentrated (illuviated) within a coarser textured (sandy) eluvial layer.

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.

MAP. Mean annual precipitation, expressed in inches.

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 earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

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.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an

adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

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.

Nose slope. A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent.

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. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

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 or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

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.

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. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

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 generally is 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.

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.

Shoulder. The position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

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.

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 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 material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one

fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 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 erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

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.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

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. 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 ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.