



United States  
Department of  
Agriculture



Natural  
Resources  
Conservation  
Service

In cooperation with  
the Minnesota Agricultural  
Experiment Station

# Soil Survey of Meeker County, Minnesota

## Part II



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# How to Use This Soil Survey

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

On the **general soil map**, 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 unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** in Part I of this survey for a general description of the soils in your area.

The **detailed soil maps** 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 **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. See the **Contents** in Part I and Part II for other sections of this publication that may address your specific needs.

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

Major fieldwork for this soil survey was completed in 1992. Soil names and descriptions were approved in 1996. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service, the Minnesota Agricultural Experiment Station, the Agricultural Extension Service, the Minnesota Department of Natural Resources, and the Board of Water and Soil Resources. The survey is part of the technical assistance furnished to the Meeker County Soil and Water Conservation District. Partial funding was provided by the Legislative Commission on Minnesota Resources and by the Meeker County Board of Commissioners.

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

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**Cover: This nearly level to gently undulating landscape is in an area of Cosmos, Kandiyohi, Lura, and Strout soils in the southern part of Meeker 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").*

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W—Water

# Soil Survey of Meeker County, Minnesota

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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 bedrock, 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
Angus-----	Mollic Hapludalfs, fine-loamy, mixed, mesic
Arkton-----	Aquic Hapludolls, fine-loamy, mixed, mesic
Barry-----	Typic Argiaquolls, fine-loamy, mixed, mesic
Biscay-----	Typic Endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Blue Earth-----	Mollic Fluvaquents, fine-silty, mixed (calcareous), mesic
Bold-----	Typic Udorthents, coarse-silty, mixed (calcareous), mesic
Calco-----	Cumulic Haplaquolls, fine-silty, mixed (calcareous), mesic
Canisteco-----	Typic Endoaquolls, fine-loamy, mixed (calcareous), mesic
Chelsea-----	Argic Udipsamments, mixed, mesic
Clarion-----	Typic Hapludolls, fine-loamy, mixed, mesic
Cohoctah-----	Fluvaquentic Endoaquolls, coarse-loamy, mixed, mesic
Cokato-----	Typic Argiudolls, fine-loamy, mixed, mesic
Collinwood-----	Aquertic Hapludolls, fine, montmorillonitic, mesic
Cordova-----	Typic Argiaquolls, fine-loamy, mixed, mesic
Corvuso-----	Typic Calciaquolls, fine, mesic
Cosmos-----	Vertic Epiquolls, fine, montmorillonitic, mesic
Crowriver-----	Typic Calciaquolls, coarse-loamy, mesic
Cylinder-----	Aquic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Danielson-----	Cumulic Vertic Epiquolls, fine, montmorillonitic, mesic
Darfur-----	Typic Endoaquolls, coarse-loamy, mixed, mesic
Dassel-----	Typic Endoaquolls, coarse-loamy, mixed, mesic
Dickman-----	Typic Hapludolls, sandy, mixed, mesic
Estherville-----	Typic Hapludolls, sandy, mixed, mesic
Fieldon-----	Typic Endoaquolls, coarse-loamy, mixed (calcareous), mesic
Forestcity-----	Typic Argiaquolls, fine-loamy, mixed, mesic
Gardencity-----	Typic Hapludolls, coarse-loamy, mixed, mesic
Glencoe-----	Cumulic Endoaquolls, fine-loamy, mixed, mesic
Granby-----	Typic Endoaquolls, sandy, mixed, mesic
Grovecity-----	Aquic Hapludolls, coarse-loamy, mixed, mesic
Hamel-----	Typic Argiaquolls, fine-loamy, mixed, mesic
Harps-----	Typic Calciaquolls, fine-loamy, mesic
Havelock-----	Cumulic Endoaquolls, fine-loamy, mixed (calcareous), mesic
Hawick-----	Entic Hapludolls, sandy, mixed, mesic
Houghton-----	Typic Medisaprists, euic, mesic
Kanaranzi-----	Typic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Kandiyohi-----	Aquertic Hapludolls, fine, montmorillonitic, mesic
Kingston-----	Aquic Hapludolls, fine-silty, mixed, mesic
Klossner-----	Terric Medisaprists, loamy, mixed, euic, mesic
Koronis-----	Mollic Hapludalfs, fine-loamy, mixed, mesic
Lester-----	Mollic Hapludalfs, fine-loamy, mixed, mesic
Le Sueur-----	Aquic Argiudolls, fine-loamy, mixed, mesic
Litchfield-----	Aquic Hapludolls, sandy, mixed, mesic
Lundlake-----	Cumulic Endoaquolls, fine-loamy, mixed, mesic
Lura-----	Cumulic Vertic Epiquolls, fine, montmorillonitic, mesic
Madelia-----	Typic Endoaquolls, fine-silty, mixed, mesic
Marcellon-----	Aquic Argiudolls, fine-loamy, mixed, mesic
Mayer-----	Typic Endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic
Medo-----	Terric Medisaprists, loamy, mixed, euic, mesic
Minneopa-----	Aquic Hapludolls, sandy, mixed, mesic
Muskego-----	Limnic Medisaprists, coprogenous, euic, mesic
Newlondon-----	Aquic Eutrochrepts, fine-loamy, mixed, mesic
Nicollet-----	Aquic Hapludolls, fine-loamy, mixed, mesic
Okoboji-----	Cumulic Vertic Endoaquolls, fine, montmorillonitic, mesic
Omsrud-----	Typic Hapludolls, fine-loamy, mixed, mesic
Reedslake-----	Typic Argiudolls, fine-loamy, mixed, mesic
Rohrbeck-----	Arenic Hapludalfs, loamy, mixed, mesic
Rolfe-----	Typic Argialbolls, fine, montmorillonitic, mesic
Seaforth-----	Aquic Calciudolls, fine-loamy, mixed, mesic
Shorewood-----	Aquertic Argiudolls, fine, montmorillonitic, mesic
Sparta-----	Entic Hapludolls, sandy, mixed, mesic
Spicer-----	Typic Endoaquolls, fine-silty, mixed (calcareous), mesic
Storden-----	Typic Eutrochrepts, fine-loamy, mixed, mesic
Strout-----	Vertic Hapludolls, fine, montmorillonitic, mesic
Sunburg-----	Typic Udorthents, coarse-loamy, mixed (calcareous), mesic

Classification of the Soils--Continued

Soil name	Family or higher taxonomic class
Swanlake-----	Typic Calcudolls, fine-loamy, mixed, mesic
Swedegrove-----	Typic Endoaquolls, coarse-loamy, mixed (calcareous), mesic
Truman-----	Typic Hapludolls, fine-silty, mixed, mesic
Udipsamments-----	Udipsamments
Udorthents-----	Udorthents
Uniongrove-----	Typic Endoaquolls, coarse-loamy, mixed, mesic
Wadena-----	Typic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Wadenill-----	Typic Hapludolls, coarse-loamy, mixed, mesic
Waldorf-----	Vertic Epiaquolls, fine, montmorillonitic, mesic
Webster-----	Typic Endoaquolls, fine-loamy, mixed, mesic
Zook-----	Cumulic Vertic Endoaquolls, fine, montmorillonitic, mesic

## Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
8B	Sparta loamy sand, 1 to 6 percent slopes-----	3,361	0.8
8C	Sparta loamy sand, 6 to 12 percent slopes-----	992	0.2
8D	Sparta loamy sand, 12 to 25 percent slopes-----	547	0.1
35	Blue Earth mucky silt loam, 0 to 1 percent slopes-----	1,195	0.3
39A	Wadena loam, 0 to 2 percent slopes-----	1,234	0.3
41A	Estherville sandy loam, 0 to 2 percent slopes-----	5,820	1.4
85	Calco silty clay loam, 0 to 2 percent slopes, occasionally flooded-----	1,320	0.3
86	Canisteo clay loam, moderately fine substratum, 0 to 2 percent slopes-----	2,709	0.7
96B	Collinwood silty clay loam, 3 to 6 percent slopes-----	1,555	0.4
101B	Truman silt loam, 2 to 6 percent slopes-----	2,339	0.6
102B	Clarion loam, moderately fine substratum, 2 to 5 percent slopes-----	4,787	1.2
106C2	Lester loam, 6 to 12 percent slopes, eroded-----	1,737	0.4
112	Harps clay loam, 0 to 2 percent slopes-----	1,317	0.3
113	Webster clay loam, 0 to 2 percent slopes-----	4,327	1.0
114	Glencoe clay loam, depressional, 0 to 1 percent slopes-----	1,610	0.4
129	Cylinder loam, 0 to 1 percent slopes-----	1,088	0.3
130	Nicollet clay loam, 1 to 3 percent slopes-----	3,798	0.9
134	Okoboji silty clay loam, depressional, 0 to 1 percent slopes-----	3,246	0.8
136	Madelia silty clay loam, 0 to 2 percent slopes-----	2,750	0.7
140	Spicer silty clay loam, 0 to 2 percent slopes-----	2,800	0.7
143B	Chelsea loamy fine sand, 1 to 6 percent slopes-----	762	0.2
178	Granby fine sandy loam, 0 to 1 percent slopes-----	1,196	0.3
181	Litchfield loamy fine sand, 0 to 2 percent slopes-----	3,836	0.9
183	Dassel mucky fine sandy loam, depressional, 0 to 1 percent slopes-----	323	*
197	Kingston silty clay loam, 1 to 3 percent slopes-----	3,512	0.9
211	Lura silty clay, depressional, 0 to 1 percent slopes-----	2,933	0.7
229	Waldorf silty clay loam, 0 to 2 percent slopes-----	2,728	0.7
239	Le Sueur clay loam, 1 to 3 percent slopes-----	1,823	0.4
281	Darfur loam, 0 to 2 percent slopes-----	2,363	0.6
286B	Shorewood silty clay loam, 3 to 6 percent slopes-----	1,299	0.3
311C2	Shorewood silty clay, 6 to 12 percent slopes, eroded-----	827	0.2
327A	Dickman sandy loam, 0 to 2 percent slopes-----	3,671	0.9
327B	Dickman sandy loam, 2 to 6 percent slopes-----	1,599	0.4
399	Biscay loam, depressional, 0 to 1 percent slopes-----	442	0.1
415	Kanaranzi loam, 0 to 3 percent slopes-----	4,409	1.1
423	Seaforth loam, 1 to 3 percent slopes-----	1,909	0.5
461B	Koronis loam, 2 to 6 percent slopes-----	19,382	4.7
461C2	Koronis loam, 6 to 12 percent slopes, eroded-----	8,792	2.1
511	Marcellon loam, 0 to 3 percent slopes-----	7,567	1.8
523	Houghton muck, depressional, 0 to 1 percent slopes-----	441	0.1
525	Muskego muck, depressional, 0 to 1 percent slopes-----	1,047	0.3
539	Klossner muck, depressional, 0 to 1 percent slopes-----	3,920	0.9
548	Medo muck, depressional, 0 to 1 percent slopes-----	600	0.1
610	Calco silty clay loam, 0 to 1 percent slopes, frequently flooded-----	1,178	0.3
611D	Hawick gravelly sandy loam, 12 to 25 percent slopes-----	1,128	0.3
612B	Wadenill loam, 2 to 6 percent slopes-----	6,564	1.6
613	Grovecity loam, 1 to 3 percent slopes-----	5,545	1.3
664	Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded-----	586	0.1
740	Hamel-Glencoe, depressional, complex, 0 to 3 percent slopes-----	6,903	1.7
804B	Koronis-Sunburg-Hawick complex, 2 to 6 percent slopes-----	1,168	0.3
804C2	Koronis-Sunburg-Hawick complex, 6 to 12 percent slopes, eroded-----	1,997	0.5
804D2	Koronis-Sunburg-Hawick complex, 12 to 18 percent slopes, eroded-----	1,021	0.2
804E	Koronis-Sunburg-Hawick complex, 18 to 40 percent slopes-----	1,509	0.4
805C2	Sunburg-Wadenill complex, 6 to 12 percent slopes, eroded-----	4,222	1.0
805D2	Sunburg-Wadenill complex, 12 to 18 percent slopes, eroded-----	1,105	0.3
807D2	Koronis-Sunburg complex, 12 to 18 percent slopes, eroded-----	2,674	0.6
875B	Estherville-Hawick complex, 2 to 6 percent slopes-----	7,229	1.8
875C	Hawick-Estherville complex, 6 to 12 percent slopes-----	1,980	0.5
887B	Clarion-Swanlake complex, 2 to 6 percent slopes-----	7,263	1.8
899	Harps-Okoboji, depressional, complex, 0 to 2 percent slopes-----	4,467	1.1
909C2	Bold-Truman complex, 6 to 12 percent slopes, eroded-----	954	0.2
909D2	Bold-Truman complex, 12 to 18 percent slopes, eroded-----	325	*

See footnote at end of table.

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

Map symbol	Soil name	Acres	Percent
920B	Clarion-Storden-Hawick complex, 2 to 6 percent slopes-----	1,011	0.2
945D2	Lester-Storden complex, 12 to 18 percent slopes, eroded-----	1,003	0.2
945E	Lester-Storden complex, 18 to 40 percent slopes-----	1,595	0.4
956	Canisteeo-Glencoe, depressional, complex, 0 to 2 percent slopes-----	9,838	2.4
960C2	Storden-Omsrud complex, 6 to 12 percent slopes, eroded-----	9,805	2.4
960D2	Storden-Omsrud complex, 12 to 18 percent slopes, eroded-----	4,655	1.1
978	Cordova-Rolfe, depressional, complex, 0 to 2 percent slopes-----	683	0.2
1015	Udipsamments (cut and fill land)-----	558	0.1
1016	Udorthents, loamy (cut and fill land)-----	788	0.2
1030	Pits, gravel-Udipsamments complex-----	558	0.1
1080	Klossner, Okoboji, and Glencoe soils, ponded, 0 to 1 percent slopes-----	6,223	1.5
1096	Fieldon-Dassel, depressional, complex, 0 to 2 percent slopes-----	4,302	1.0
1097	Mayer-Biscay, depressional, complex, 0 to 2 percent slopes-----	5,668	1.4
1098	Biscay-Biscay, depressional, complex, 0 to 2 percent slopes-----	3,134	0.8
1099	Granby loamy fine sand, very wet, 0 to 1 percent slopes-----	621	0.2
1100	Nicollet silty clay loam, 1 to 3 percent slopes-----	4,560	1.1
1101	Webster silty clay loam, moderately fine substratum, 0 to 2 percent slopes-----	5,287	1.3
1159B	Strout-Arkton complex, 2 to 6 percent slopes-----	4,769	1.2
1161	Barry loam, 0 to 2 percent slopes-----	3,609	0.9
1162A	Kandiyohi clay, 0 to 2 percent slopes-----	4,506	1.1
1162B	Kandiyohi clay, 2 to 5 percent slopes-----	4,013	1.0
1163	Cohoctah loam, 0 to 2 percent slopes, frequently flooded-----	3,743	0.9
1165	Lundlake silty clay loam, depressional, 0 to 1 percent slopes-----	3,236	0.8
1168	Swedegrove-Lundlake, depressional, complex, 0 to 2 percent slopes-----	9,982	2.4
1169	Corvuso-Lura, depressional, complex, 0 to 2 percent slopes-----	3,724	0.9
1171C	Newlondon-Strout complex, 6 to 12 percent slopes, eroded-----	4,596	1.1
1171D	Newlondon-Strout complex, 12 to 18 percent slopes, eroded-----	1,074	0.3
1172C	Sparta-Gardencity complex, 6 to 12 percent slopes-----	445	0.1
1173	Muskego and Klossner soils, depressional, 0 to 1 percent slopes, frequently flooded--	3,398	0.8
1174	Danielson clay loam, 1 to 3 percent slopes-----	4,900	1.2
1175	Swedegrove loam, 0 to 2 percent slopes-----	4,889	1.2
1176	Litchfield sandy loam, 0 to 2 percent slopes-----	1,009	0.2
1177C	Gardencity-Bold complex, 6 to 12 percent slopes, eroded-----	501	0.1
1178	Uniongrove loam, 0 to 2 percent slopes-----	8,365	2.0
1183	Crowriver loam, 0 to 2 percent slopes-----	5,911	1.4
1184	Corvuso silty clay loam, 0 to 2 percent slopes-----	2,320	0.6
1185	Gardencity fine sandy loam, moderately wet, 0 to 2 percent slopes-----	729	0.2
1186	Forestcity-Lundlake, depressional, complex, 0 to 3 percent slopes-----	8,250	2.0
1192	Crowriver-Lundlake, depressional, complex, 0 to 2 percent slopes-----	1,714	0.4
1193	Cosmos silty clay, 0 to 2 percent slopes-----	7,598	1.8
1197	Cohoctah fine sandy loam, 0 to 2 percent slopes, occasionally flooded-----	598	0.1
1198B	Rohrbeck-Koronis complex, 1 to 6 percent slopes-----	1,355	0.3
1199	Klossner and Lundlake soils, ponded-----	5,478	1.3
1203	Muskego, Blue Earth, and Houghton soils, ponded-----	21,417	5.2
1204B	Reedslake loam, 2 to 5 percent slopes-----	10,856	2.6
1213C	Cokato-Storden complex, 6 to 12 percent slopes, eroded-----	4,298	1.0
1220C	Cokato-Storden-Hawick complex, 6 to 12 percent slopes, eroded-----	1,490	0.4
1356	Water, miscellaneous-----	85	*
1362B	Angus loam, 2 to 5 percent slopes-----	2,019	0.5
1383A	Shorewood silty clay loam, moderately wet, 0 to 3 percent slopes-----	817	0.2
1384	Minneopa loam, 0 to 2 percent slopes-----	2,575	0.6
1385	Havelock loam, 0 to 2 percent slopes, frequently flooded-----	31	*
1387A	Collinwood silty clay loam, moderately wet, 0 to 3 percent slopes-----	1,580	0.4
1391B	Wadenill-Sunburg complex, 2 to 6 percent slopes-----	4,971	1.2
1406	Medo, Dassel, and Biscay soils, ponded, 0 to 1 percent slopes-----	3,699	0.9
1801B	Gardencity very fine sandy loam, 2 to 6 percent slopes-----	1,971	0.5
W	Water-----	13,800	3.3
	Total-----	412,900	100.0

\* Less than 0.1 percent.

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# Agronomy

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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.

## Cropland Management Considerations

Dale A. Johnson, soil conservationist, Natural Resources Conservation Service, helped prepare this section.

According to the Minnesota Agricultural Statistics Service, approximately 250,000 acres in Meeker County was used for cropland in 1991. Of this acreage, about 115,500 acres was used for corn as grain and 8,400 acres for corn as silage; about 68,400 acres was used for soybeans; about 27,300 acres was used for oats and wheat; and about 22,500 acres was used for hay and alfalfa. About 7,000 acres was used for edible beans, peas, sugar beets, and sweet corn.

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 soil blowing and water erosion, and maintaining soil fertility. Other concerns include preventing surface compaction, controlling ponding or flooding, and improving internal drainage conditions.

About 7 percent of the soils used as cropland have very few limitations that affect this use. These soils are nearly level and are not significantly susceptible to erosion or wetness. Examples are Nicollet, Grovecity, and Kingston soils.

About 23 percent of the cropland soils have gentle slopes that are subject to water erosion and surface runoff. Water erosion and surface runoff are detrimental for two reasons. First, as topsoil is

removed by erosion, nutrients and organic matter are lost. Second, the sediment produced by erosion settles at the base of slopes or in nearby depressions or enters rivers and lakes. This sedimentation affects water quality. Clarion, Koronis, and Truman soils on B and C slopes are examples of soils subject to water erosion. Water erosion on these soils can be controlled by returning crop residue to the surface and by using conservation tillage practices, such as chisel plowing, ridge till, or no-till. The benefits of conservation tillage include erosion control, reduced fuel consumption, and a substantial savings of time.

Approximately 14 percent of the cropland is in sloping or moderately steep areas. Koronis, Sunburg, Truman, and Bold soils on C and D slopes are examples of steep soils that are highly susceptible to erosion. Conservation practices are needed to control erosion in these areas. These practices include terraces, diversions, waterways, stripcropping, conservation tillage, and contour farming. Planting trees and seeding the steeper areas to a permanent cover of grass or hay are additional conservation practices that can be used in these areas. Returning crop residue to the soil increases the rate of water infiltration, reduces the runoff rate, and helps to control erosion. In areas where water concentrates as it flows downslope, grassed waterways may be needed (fig. 1).

About 11 percent of the soils used for cropland are subject to soil blowing. Estherville, Hawick, and Sparta soils are examples. Properly placed field windbreaks and a system of conservation tillage that leaves the surface rough and maintains a cover of crop residue are the most effective erosion-control practices in areas of these soils.

About 9 percent of the county consists of droughty soils (fig. 2). Measures that conserve moisture are needed in areas of these soils. These measures include controlling soil blowing, controlling runoff, increasing the rate of water infiltration, and controlling weeds. Stripcropping, managing crop residue, and planting early maturing crops are practices that conserve moisture.

A small acreage in the county is irrigated. Wells are the main source of irrigation water. Management



**Figure 1.—A grassed waterway in an area of Forestcity-Lundlake, depressional, complex, 0 to 3 percent slopes.**

factors that should be considered when irrigation systems are planned include the type of soil, the amount and quality of water needed, the type of irrigation system needed, drainage, preparation, and the overall management of the land. Good irrigation management includes the proper amount and timing of water applications and the even distribution of irrigation water. Also, fertilizer is needed in most irrigated areas if the crops are to benefit fully from irrigation.

About 32 percent of the cropland in the county consists of poorly drained soils, such as Canisteo, Cosmos, and Webster soils. A proper drainage system is needed on these soils to produce adequate crop yields. The spacing of subsurface drainage lines is dependent upon the soil type and the depth at which the drains can be installed. Generally, the finer the soil texture, the closer the lines should be. Information and guidelines for draining wet soils are available in the local office of the Natural Resources Conservation Service. Nearly all areas of poorly drained soils have been drained by ditches and subsurface drains, but crop yields could be increased in most areas if additional drainage were provided.

About 20 percent of the poorly drained soils are

calcareous and have a fertility imbalance caused by high soil pH. Corvuso, Canisteo, Harps, Fieldon, and Spicer soils are examples. Proper crop and variety selection, a good fertility program, and an adequate drainage system are needed on these soils to overcome this imbalance.

About 12 percent of the cropland in the county consists of soils in depressions and soils on flood plains. These soils are capable of producing crops but are subject to ponding or flooding. Examples of these soils are Glencoe, Klossner, Lura, and Okoboji soils in depressions and Calco and Zook soils on flood plains. Open ditches drain much of the surface water and provide outlets for subsurface tile lines. In areas where outlets are not available, a pumping station may be required. Before drainage projects are implemented, Federal and State agencies should be consulted regarding drainage laws and regulations.

Surface compaction can be a problem on about 22 percent of the cropland in the county. Collinwood, Cosmos, Kandiyohi, Shorewood, and Waldorf soils have a high content of clay. If these soils are worked when they are too wet, the surface may become compacted. Tilling only at the proper moisture content helps to prevent the formation of clods. These soils are

often tilled in the fall, but fall tillage can increase the hazard of erosion. Returning crop residue to the soil, chisel plowing, and using a rotation that includes alfalfa-grass mixtures help to control erosion, improve soil tilth, and increase the rate of water infiltration.

Natural soil fertility is high in most soils in the county, including Nicollet and Truman soils. About 13 percent of the soils in the county, however, have low fertility. Among these soils are Bold, Storden, Sparta,

and Sunburg soils. On most of the soils, crops respond well to applications of fertilizer. Most of the soils in Meeker County are naturally low in phosphorus but generally have adequate amounts of potassium and lime. Soils that formed under woodland vegetation, such as Koronis and Lester soils, tend to be more acid than soils that formed under grass or other kinds of vegetation. These soils respond well to applications of lime in some places.



**Figure 2.—**The lighter colored, drought-stressed soybeans are on the Hawick soil in an area of Hawick-Esterville complex, 6 to 12 percent slopes. The Hawick soil has a low available water capacity.

The need for fertilizer depends on the soil type and on management history, the crops to be grown, and the projected yields. The results of soil tests should be used when decisions about the application of fertilizer are made.

Some of the considerations shown in the table "Cropland Management Considerations" 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 in areas of 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.

*Salt content.*—In areas where this is a limitation, only salt-tolerant crops should be grown.

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.

*Depth to rock.*—The depth to bedrock is less than 40 inches.

*Eroded.*—The word "eroded" is included in the map unit name.

*Excessive permeability.*—Permeability is 6 inches per hour or more within the soil profile.

*Flooding.*—Flooding is occasional or frequent.

*Gullied.*—The word "gullied" is included in the map unit name.

*High organic matter content.*—The surface layer has more than 20 percent organic matter.

*Lime content.*—The pH is 7.4 or more in the surface layer, or the wind erodibility group is 4L.

*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 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.

*Salt content.*—The electrical conductivity is 4 or more in the surface layer or 8 or more within a depth of 30 inches.

*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 each map unit 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 are also 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 each soil 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.”

About 29,000 acres, or about 7 percent of Meeker County, is used for grazing. The areas used for pasture are generally not conducive to cultivation, mainly because of the slope, the hazard of flooding, or wetness. Some pastures are full of brush or are in otherwise poor condition. Clearing brush and reseeding to more productive species, providing a proper supply of nutrients, and allowing plants to reach the proper height before grazing increase forage yields. Delaying grazing in the spring and during other wet periods, controlling weeds, and clipping mature plants also improve yields. Proper stocking rates and a system of pasture rotation promote the efficient utilization of forage and maintain the sod in good condition (fig. 3). Warm-season grasses can provide good summer pasture and thus enhance full-season grazing.

The soils that are suited to the widest range of pasture species are the well drained to somewhat poorly drained Arkton, Clarion, Collinwood, Cylinder, Gardencity, Kandiyohi, Kingston, Koronis, Lester, Le Sueur, Nicollet, Shorewood, Sunburg, Storden, Truman, Wadena, and Wadenill soils. Cool-season species include alfalfa, birdsfoot trefoil, red clover, smooth bromegrass, timothy, and Kentucky bluegrass. Warm-season grasses, such as big bluestem, indiagrass, and switchgrass, grow well during July and August. All of these species also grow well on the poorly drained Biscay, Corvuso, Calco, Canisteo, Cordova, Cosmos, Crowriver, Darfur, Fieldon, Forestcity, Granby, Hamel, Harps, Madelia, Mayer, Danielson, Spicer, Waldorf, and Webster soils.

The very poorly drained Dassel, Glencoe, Houghton, Klossner, Lura, Lundlake, Muskego, and Okoboji soils and the depressional Biscay soils are suited only to species that are adapted to wet conditions and tolerant of ponding. These species include reed canarygrass, alsike clover, Garrison creeping foxtail, and birdsfoot trefoil. Areas of very



**Figure 3.—Cattle grazing in an area of Koronis-Sunburg complex, 12 to 18 percent slopes, eroded. Proper pasture management helps to prevent overgrazing and control erosion.**

poorly drained soils can also be used as livestock-watering facilities (fig. 4).

Well drained to excessively drained soils, such as Chelsea, Dickman, Estherville, Hawick, Litchfield, Minneopa, and Sparta soils, generally provide forage during spring and early summer and again in the fall, when precipitation is adequate. During summer, droughty conditions limit forage production. Alfalfa, birdsfoot trefoil, red clover, smooth bromegrass, timothy, orchardgrass, and Kentucky bluegrass grow well when moisture supplies are adequate. Sideoats grama and warm-season grasses, such as big bluestem, little bluestem, indianguass, and switchgrass, grow well in summer. Current information on variety selection and species adaptation can be obtained from local offices of the Cooperative

Extension Service or the Natural Resources Conservation Service.

Good pasture management can include controlling weeds and applying fertilizer. Applications of fertilizer should be based on the results of soil tests. The timely clipping of weedy areas and the use of herbicides help to control weeds.

### **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 rangeland, 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 numerals 1 through 8. The numerals 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, 2*e*. 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



Figure 4.—A livestock-watering facility in a pastured area of Klossner soils. These very poorly drained soils have a seasonal high water table that is close to the surface.

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, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit 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 231,292 acres, or nearly 56 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." 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. 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 gulying, 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 numbers 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**

Since the days of the early settlers, windbreaks have been planted to protect farmsteads and livestock. In the 1930's, they were planted to control soil blowing. In recent years field windbreaks have been planted to

trap snow and thus increase the moisture supply. Maximum growth and survival rates can be obtained by controlling weeds around newly planted seedlings.

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. In areas where the hazard of water erosion is severe, site preparation should be limited to spot treatment extending 2 feet from where the plant is established. Specific information also can be obtained from the Meeker County Soil and Water Conservation District, the Natural Resources Conservation Service, or the Meeker County Extension Service.

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 explain 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 and very 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 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 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 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
8B: Sparta-----	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
8C: Sparta-----	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
8D: Sparta-----	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
35: Blue Earth-----	High organic matter content Lime content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
39A: Wadena-----	Excessive permeability Potential for ground-water contamination
41A: Estherville-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
85: Calco-----	Flooding Lime content Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table Wind erosion
86: Canisteo-----	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion

## Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
96B: Collinwood-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion
101B: Truman-----	Potential for surface-water contamination Water erosion
102B: Clarion-----	Potential for ground-water contamination Potential for surface-water contamination Water erosion
106C2: Lester-----	Potential for surface-water contamination Previously eroded Water erosion
112: Harps-----	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
113: Webster-----	Potential for ground-water contamination Water table
114: Glencoe-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
129: Cylinder-----	Excessive permeability Potential for ground-water contamination Water table
130: Nicollet-----	Potential for ground-water contamination Potential poor tilth and compaction Water table
134: Okoboji-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
136: Madelia-----	Potential for ground-water contamination Potential poor tilth and compaction Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
140: Spicer-----	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
143B: Chelsea-----	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
178: Granby-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Water table Wind erosion
181: Litchfield-----	Excessive permeability Potential for ground-water contamination Wind erosion
183: Dassel-----	Excessive permeability Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
197: Kingston-----	Potential for ground-water contamination Potential poor tilth and compaction
211: Lura-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
229: Waldorf-----	Potential for ground-water contamination Potential poor tilth and compaction Water table
239: Le Sueur-----	Potential for ground-water contamination Potential poor tilth and compaction
281: Darfur-----	Potential for ground-water contamination Water table
286B: Shorewood-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion

## Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
311C2: Shorewood-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
327A: Dickman-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
327B: Dickman-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Water erosion Wind erosion
399: Biscay-----	Excessive permeability Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
415: Karananzi-----	Excessive permeability Limited available water capacity Potential for ground-water contamination
423: Seaforth-----	Lime content Potential for ground-water contamination Wind erosion
461B: Koronis-----	Potential for surface-water contamination Water erosion
461C2: Koronis-----	Potential for surface-water contamination Previously eroded Water erosion
511: Marcellon-----	Potential for ground-water contamination Potential for surface-water contamination Water table
523: Houghton-----	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
525: Muskego-----	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
539: Klossner-----	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
548: Medo-----	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
610: Calco-----	Flooding Lime content Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table Wind erosion
611D: Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion
612B: Wadenill-----	Potential for surface-water contamination Water erosion
613: Grovecity-----	Potential for ground-water contamination
664: Zook-----	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
740: Hamel-----	Potential for ground-water contamination Potential for surface-water contamination Water table
Glencoe-----	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
804B:	
Koronis-----	Potential for surface-water contamination Water erosion
Sunburg-----	Potential for surface-water contamination Water erosion Wind erosion
Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination
804C2:	
Koronis-----	Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Sunburg-----	Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion
804D2:	
Koronis-----	Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
Sunburg-----	Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Previously eroded Slope Water erosion
804E:	
Koronis-----	Potential for surface-water contamination Slope Water erosion Wind erosion
Sunburg-----	Potential for surface-water contamination Slope Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
804E: Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion
805C2: Sunburg-----	Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Wadenill-----	Potential for surface-water contamination Previously eroded Water erosion
805D2: Sunburg-----	Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
Wadenill-----	Potential for surface-water contamination Previously eroded Slope Water erosion
807D2: Koronis-----	Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
Sunburg-----	Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
875B: Estherville-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Water erosion Wind erosion
875C: Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion

## Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
875C: Estherville-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
887B: Clarion-----	Potential for ground-water contamination Potential for surface-water contamination Water erosion
Swanlake-----	Lime content Potential for surface-water contamination Water erosion Wind erosion
899: Harps-----	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
Okoboji-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
909C2: Bold-----	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Truman-----	Potential for surface-water contamination Previously eroded Water erosion
909D2: Bold-----	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
Truman-----	Potential for surface-water contamination Previously eroded Slope Water erosion
920B: Clarion-----	Potential for ground-water contamination Potential for surface-water contamination Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
920B:	
Storden-----	Lime content Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion
Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Water erosion
945D2:	
Lester-----	Potential for surface-water contamination Previously eroded Slope Water erosion
Storden-----	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
945E:	
Lester-----	Potential for surface-water contamination Slope Water erosion
Storden-----	Lime content Limited organic matter content Potential for surface-water contamination Slope Water erosion Wind erosion
956:	
Canisteo-----	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
Glencoe-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
960C2:	
Storden-----	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Omsrud-----	Potential for surface-water contamination Previously eroded Water erosion

## Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
960D2: Storden-----	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
Omsrud-----	Potential for surface-water contamination Previously eroded Slope Water erosion
978: Cordova-----	Potential for ground-water contamination Potential poor tilth and compaction Water table
Rolfe-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1015: Udipsamments-----	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
1016: Udorthents-----	Nonsoil material
1030: Pits, gravel-----	Nonsoil material
Udipsamments-----	Nonsoil material
1080: Klossner-----	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Okoboji-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
Glencoe-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1096: Fieldon-----	Excessive permeability Lime content Potential for ground-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1096: Dassel-----	Excessive permeability Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1097: Mayer-----	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Water table Wind erosion
Biscay-----	Excessive permeability Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1098: Biscay-----	Excessive permeability Potential for ground-water contamination Water table
Biscay, depressional----	Excessive permeability Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1099: Granby-----	Excessive permeability Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1100: Nicollet-----	Potential for ground-water contamination Potential poor tilth and compaction Water table
1101: Webster-----	Potential for ground-water contamination Potential poor tilth and compaction Water table
1159B: Strout-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion
Arkton-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion

## Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1161: Barry-----	Potential for ground-water contamination Water table
1162A: Kandiyohi-----	Potential for ground-water contamination Potential poor tilth and compaction Water table
1162B: Kandiyohi-----	Potential for ground-water contamination Potential poor tilth and compaction Water erosion Water table
1163: Cohoctah-----	Flooding Potential for ground-water contamination Water table
1165: Lundlake-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1168: Swedegrove-----	Lime content Potential for ground-water contamination Water table Wind erosion
Lundlake-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1169: Corvuso-----	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
Lura-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1171C: Newlondon-----	Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Surface crusting Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1171C: Strout-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
1171D: Newlondon-----	Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Surface crusting Water erosion
Strout-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
1172C: Sparta-----	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Gardencity-----	Potential for surface-water contamination Water erosion Wind erosion
1173: Muskego-----	Flooding High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
Klossner-----	Flooding High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1174: Danielson-----	Potential for ground-water contamination Potential poor tilth and compaction Water table

## Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1175: Swedegrove-----	Lime content Potential for ground-water contamination Water table Wind erosion
1176: Litchfield-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
1177C: Gardencity-----	Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Bold-----	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
1178: Uniongrove-----	Potential for ground-water contamination Water table
1183: Crowriver-----	Lime content Potential for ground-water contamination Water table Wind erosion
1184: Corvuso-----	Lime content Limited organic matter content Potential for ground-water contamination Potential poor tilth and compaction Surface crusting Water table Wind erosion
1185: Gardencity-----	Potential for ground-water contamination Wind erosion
1186: Forestcity-----	Potential for ground-water contamination Water table Wind erosion
Lundlake-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1192: Crowriver-----	Lime content Potential for ground-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1192: Lundlake-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1193: Cosmos-----	Potential for ground-water contamination Potential poor tilth and compaction Water table
1197: Cohoctah-----	Flooding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1198B: Rohrbeck-----	Excessive permeability Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
Koronis-----	Potential for surface-water contamination Water erosion Wind erosion
1199: Klossner-----	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Lundlake-----	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1203: Muskego-----	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Blue Earth-----	High organic matter content Lime content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Houghton-----	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
1204B: Reedslake-----	Potential for ground-water contamination Potential for surface-water contamination Water erosion
1213C: Cokato-----	Potential for surface-water contamination Previously eroded Water erosion
Storden-----	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
1220C: Cokato-----	Potential for surface-water contamination Previously eroded Water erosion
Storden-----	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Hawick-----	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion
1356: Water, miscellaneous----	Nonsoil material
1362B: Angus-----	Potential for ground-water contamination Potential for surface-water contamination Water erosion
1383A: Shorewood-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1384: Minneopa-----	Excessive permeability Limited available water capacity Potential for ground-water contamination
1385: Havelock-----	Flooding Lime content Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1387A: Collinwood-----	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1391B: Wadenill-----	Potential for surface-water contamination Water erosion
Sunburg-----	Potential for surface-water contamination Water erosion Wind erosion
1406: Medo-----	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
Dassel-----	Excessive permeability Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
Biscay-----	Excessive permeability Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1801B: Gardencity-----	Potential for surface-water contamination Water erosion 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	Corn	Soybeans	Oats	Spring wheat	Bromegrass- alfalfa	Bromegrass- alfalfa hay
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>	<u>Tons</u>
8B----- Sparta	4s	69	23	65	39	3.0	2
8C----- Sparta	6s	58	20	52	31	2.3	2
8D----- Sparta	7s	55	18	49	29	2.2	2
35----- Blue Earth	3w	107	31	74	44	4.0	3
39A----- Wadena	2s	112	34	79	48	4.3	3
41A----- Estherville	3s	65	22	55	33	2.5	2
85----- Calco	2w	123	36	74	44	4.6	4
86----- Canisteo	2w	138	40	83	50	5.0	4
96B----- Collinwood	2e	140	50	86	51	5.3	4
101B----- Truman	2e	147	48	89	53	6.0	5
102B----- Clarion	2e	145	45	89	53	6.0	5
106C2----- Lester	3e	126	38	76	47	5.3	4
112----- Harps	2w	134	38	80	48	4.9	4
113----- Webster	2w	144	47	86	52	5.2	4
114----- Glencoe	3w	127	44	80	48	4.3	3
129----- Cylinder	2s	115	38	78	47	3.9	3
130----- Nicollet	1	150	50	88	52	5.7	4
134----- Okoboji	3w	133	41	80	48	4.3	3
136----- Madelia	2w	144	48	86	52	5.2	4

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Soybeans	Oats	Spring wheat	Bromegrass- alfalfa	Bromegrass- alfalfa hay
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>	<u>Tons</u>
140----- Spicer	2w	140	45	81	48	4.7	4
143B----- Chelsea	4s	81	25	68	41	3.3	2
178----- Granby	4w	97	30	74	44	3.4	3
181----- Litchfield	3s	104	32	79	47	4.2	3
183----- Dassel	3w	115	36	76	46	3.8	3
197----- Kingston	1	153	52	90	54	5.6	5
211----- Lura	3w	125	36	76	46	4.0	3
229----- Waldorf	2w	144	47	86	52	5.2	4
239----- Le Sueur	1	150	51	90	54	6.7	5
281----- Darfur	2w	135	42	84	51	4.9	4
286B----- Shorewood	2e	139	43	87	52	5.6	4
311C2----- Shorewood	3e	129	41	75	45	4.7	4
327A----- Dickman	3s	74	23	65	39	3.0	2
327B----- Dickman	3e	70	21	62	37	2.7	2
399----- Biscay	3w	84	26	64	38	2.7	2
415----- Kanaranzi	3s	74	23	65	39	3.5	2
423----- Seaforth	2s	145	46	86	50	5.2	4
461B----- Koronis	2e	130	40	79	47	5.2	4
461C2----- Koronis	3e	115	34	72	43	4.6	4
511----- Marcellon	1	133	41	86	52	5.1	4

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Soybeans	Oats	Spring wheat	Bromegrass- alfalfa	Bromegrass- alfalfa hay
		Bu	Bu	Bu	Bu	AUM*	Tons
523----- Houghton	3w	105	34	76	46	4.1	3
525----- Muskego	4w	105	34	76	46	4.2	3
539----- Klossner	3w	105	34	76	46	4.2	3
548----- Medo	3w	105	34	76	46	4.2	3
610----- Calco	5w	---	---	---	---	---	---
611D----- Hawick	7s	39	13	35	20	1.4	1
612B----- Wadenill	2e	135	42	83	49	5.5	4
613----- Grovecity	1	142	46	85	54	6.0	5
664----- Zook	2w	119	37	72	43	4.3	3
740----- Hamel----- Glencoe-----	2w 3w	138	44	82	50	5.1	4
804B----- Koronis----- Sunburg----- Hawick-----	2e 2e 4s	125	39	82	48	5.2	4
804C2----- Koronis----- Sunburg----- Hawick-----	3e 3e 4s	112	35	74	44	4.6	4
804D2----- Koronis----- Sunburg----- Hawick-----	4e 4e 6s	102	30	67	40	4.2	3
804E----- Koronis----- Sunburg----- Hawick-----	6e 7e 7s	---	---	---	---	3.6	3

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Soybeans	Oats	Spring wheat	Bromegrass- alfalfa	Bromegrass- alfalfa hay
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>	<u>Tons</u>
805C2----- Sunburg-Wadenill	3e	118	36	74	44	4.8	4
805D2----- Sunburg-Wadenill	4e	98	31	63	37	4.0	3
807D2----- Koronis-Sunburg	4e	108	31	57	34	4.2	3
875B----- Estherville-----	3s	60	17	50	30	2.1	2
Hawick-----	4s						
875C----- Hawick- Estherville	4s	49	15	47	28	2.0	2
887B----- Clarion-Swanlake	2e	144	43	88	53	6.0	5
899----- Harps-----	2w	133	39	80	48	4.8	4
Okoboji-----	3w						
909C2----- Bold-Truman	3e	127	41	74	44	4.9	4
909D2----- Bold-----	6e	108	35	58	37	4.2	3
Truman-----	4e						
920B----- Clarion-----	2e	130	40	80	48	5.2	4
Storden-----	2e						
Hawick-----	4s						
945D2----- Lester-Storden	4e	108	34	58	35	4.4	3
945E----- Lester-Storden	7e	---	---	---	---	4.0	3
956----- Canisteeo-----	2w	137	41	82	49	4.8	4
Glencoe-----	3w						
960C2----- Storden-Omsrud	3e	125	40	73	44	4.5	4
960D2----- Storden-Omsrud	4e	108	35	58	37	4.2	3

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Soybeans	Oats	Spring wheat	Bromegrass- alfalfa	Bromegrass- alfalfa hay
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>	<u>Tons</u>
978----- Cordova-----	2w	142	44	85	51	5.1	4
Rolfe-----	3w						
1015----- Udipsamments	8s	---	---	---	---	---	---
1016----- Udorthents	6s	---	---	---	---	---	---
1030: Pits, gravel.  Udipsamments----	8s	---	---	---	---	---	---
1080----- Klossner, Okoboji, and Glencoe	8w	---	---	---	---	---	---
1096----- Fieldon-----	2w	113	33	77	46	4.0	3
Dassel-----	3w						
1097----- Mayer-----	2w	97	29	73	44	3.5	3
Biscay-----	3w						
1098----- Biscay-----	2w	107	33	78	47	3.9	3
Biscay, depressional----	3w						
1099----- Granby	5w	---	---	---	---	---	---
1100----- Nicollet	1	148	46	89	53	5.9	4
1101----- Webster	2w	144	44	86	52	5.2	4
1159B----- Strout-Arkton	2e	140	41	82	49	5.2	4
1161----- Barry	2w	135	42	84	49	4.9	4
1162A----- Kandiyohi	2w	143	44	87	50	5.1	4
1162B----- Kandiyohi	2e	140	43	85	49	4.9	4
1163----- Cohoctah	5w	---	---	---	---	---	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Soybeans	Oats	Spring wheat	Bromegrass- alfalfa	Bromegrass- alfalfa hay
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>	<u>Tons</u>
1165----- Lundlake	3w	122	34	78	46	4.4	3
1168----- Swedegrove----- Lundlake-----	2w 3w	125	37	83	50	4.8	4
1169----- Corvuso----- Lura-----	2w 3w	130	37	78	46	4.7	4
1171C----- Newlondon-Strout	3e	118	36	77	46	4.8	4
1171D----- Newlondon-Strout	4e	102	31	58	35	4.2	3
1172C----- Sparta----- Gardencity-----	6s 3e	80	27	66	40	3.5	3
1173----- Muskego and Klossner	8w	---	---	---	---	---	---
1174----- Danielson	2w	142	45	85	50	5.2	4
1175----- Swedegrove	2w	128	38	82	49	4.7	4
1176----- Litchfield	2s	96	30	77	46	3.9	3
1177C----- Gardencity-Bold	3e	121	37	76	46	4.9	4
1178----- Uniongrove	2w	128	40	82	50	4.7	4
1183----- Crowriver	2w	124	36	80	48	4.7	4
1184----- Corvuso	2w	132	38	80	48	4.9	4
1185----- Gardencity	1	129	38	82	49	4.7	4
1186----- Forestcity----- Lundlake-----	2w 3w	134	40	80	48	5.1	4

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Soybeans	Oats	Spring wheat	Bromegrass- alfalfa	Bromegrass- alfalfa hay
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>	<u>Tons</u>
1192----- Crowriver-----	2w	123	35	80	47	4.7	4
Lundlake-----	3w						
1193----- Cosmos	2w	135	42	83	50	4.9	4
1197----- Cohoctah	2w	105	33	68	38	3.9	3
1198B----- Rohrbeck-----	3s	110	36	71	43	4.4	3
Koronis-----	2e						
1199----- Klossner and Lundlake	8w	---	---	---	---	---	---
1203----- Muskego, Blue Earth, and Houghton	8w	---	---	---	---	---	---
1204B----- Reedslake	2e	145	45	89	53	6.0	5
1213C----- Cokato-Storden	3e	129	40	77	46	5.2	4
1220C----- Cokato-----	3e	118	36	73	44	4.8	4
Storden-----	3e						
Hawick-----	4s						
1362B----- Angus	2e	141	44	89	53	6.0	5
1383A----- Shorewood	2w	145	47	88	53	5.6	4
1384----- Minneopa	3s	74	23	65	39	3.0	2
1385----- Havelock	5w	---	---	---	---	---	---
1387A----- Collinwood	2w	145	51	86	52	5.3	4
1391B----- Wadenill-Sunburg	2e	133	41	83	48	5.3	4
1406----- Medo, Dassel, and Biscay	6w	---	---	---	---	---	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Corn	Soybeans	Oats	Spring wheat	Bromegrass- alfalfa	Bromegrass- alfalfa hay
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>	<u>Tons</u>
1801B----- Gardencity	2e	137	42	88	53	5.6	4

\* 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

Map symbol	Soil name
39A	Wadena loam, 0 to 2 percent slopes
85	Calco silty clay loam, 0 to 2 percent slopes, occasionally flooded (where drained)
86	Canistee clay loam, moderately fine substratum, 0 to 2 percent slopes (where drained)
96B	Collinwood silty clay loam, 3 to 6 percent slopes
101B	Truman silt loam, 2 to 6 percent slopes
102B	Clarion loam, moderately fine substratum, 2 to 5 percent slopes
112	Harps clay loam, 0 to 2 percent slopes (where drained)
113	Webster clay loam, 0 to 2 percent slopes (where drained)
114	Glencoe clay loam, depressional, 0 to 1 percent slopes (where drained)
129	Cylinder loam, 0 to 1 percent slopes
130	Nicollet clay loam, 1 to 3 percent slopes
134	Okoboji silty clay loam, depressional, 0 to 1 percent slopes (where drained)
136	Madelia silty clay loam, 0 to 2 percent slopes (where drained)
140	Spicer silty clay loam, 0 to 2 percent slopes (where drained)
197	Kingston silty clay loam, 1 to 3 percent slopes
211	Lura silty clay, depressional, 0 to 1 percent slopes (where drained)
229	Waldorf silty clay loam, 0 to 2 percent slopes (where drained)
239	Le Sueur clay loam, 1 to 3 percent slopes
281	Darfur loam, 0 to 2 percent slopes (where drained)
286B	Shorewood silty clay loam, 3 to 6 percent slopes
423	Seaforth loam, 1 to 3 percent slopes
461B	Koronis loam, 2 to 6 percent slopes
511	Marcellon loam, 0 to 3 percent slopes
612B	Wadenill loam, 2 to 6 percent slopes
613	Grovecity loam, 1 to 3 percent slopes
664	Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded (where drained)
740	Hamel-Glencoe, depressional, complex, 0 to 3 percent slopes (where drained)
804B	Koronis-Sunburg-Hawick complex, 2 to 6 percent slopes
887B	Clarion-Swanlake complex, 2 to 6 percent slopes
899	Harps-Okoboji, depressional, complex, 0 to 2 percent slopes (where drained)
956	Canistee-Glencoe, depressional, complex, 0 to 2 percent slopes (where drained)
978	Cordova-Rolfe, depressional, complex, 0 to 2 percent slopes (where drained)
1100	Nicollet silty clay loam, 1 to 3 percent slopes
1101	Webster silty clay loam, moderately fine substratum, 0 to 2 percent slopes (where drained)
1159B	Strout-Arkton complex, 2 to 6 percent slopes
1161	Barry loam, 0 to 2 percent slopes (where drained)
1162A	Kandiyohi clay, 0 to 2 percent slopes (where drained)
1162B	Kandiyohi clay, 2 to 5 percent slopes
1165	Lundlake silty clay loam, depressional, 0 to 1 percent slopes (where drained)
1168	Swedegrove-Lundlake, depressional, complex, 0 to 2 percent slopes (where drained)
1169	Corvuso-Lura, depressional, complex, 0 to 2 percent slopes (where drained)
1174	Danielson clay loam, 1 to 3 percent slopes (where drained)
1175	Swedegrove loam, 0 to 2 percent slopes (where drained)
1178	Uniongrove loam, 0 to 2 percent slopes (where drained)
1183	Crowriver loam, 0 to 2 percent slopes (where drained)
1184	Corvuso silty clay loam, 0 to 2 percent slopes (where drained)
1185	Gardencity fine sandy loam, moderately wet, 0 to 2 percent slopes
1186	Forestcity-Lundlake, depressional, complex, 0 to 3 percent slopes (where drained)
1192	Crowriver-Lundlake, depressional, complex, 0 to 2 percent slopes (where drained)
1193	Cosmos silty clay, 0 to 2 percent slopes (where drained)
1204B	Reedslake loam, 2 to 5 percent slopes
1362B	Angus loam, 2 to 5 percent slopes
1383A	Shorewood silty clay loam, moderately wet, 0 to 3 percent slopes
1387A	Collinwood silty clay loam, moderately wet, 0 to 3 percent slopes
1391B	Wadenill-Sunburg complex, 2 to 6 percent slopes
1801B	Gardencity very fine sandy loam, 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
8B: Sparta-----	Siberian peashrub	Eastern redcedar, Black Hills spruce, blue spruce, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Silver maple, green ash, Norway spruce, white spruce, Austrian pine, red pine, Siberian elm.	Eastern white pine, Scotch pine, eastern cottonwood.	---
8C, 8D: Sparta-----	Siberian peashrub	Eastern redcedar, Black Hills spruce, blue spruce, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Silver maple, green ash, Norway spruce, white spruce, Austrian pine, red pine.	Eastern white pine, Scotch pine, eastern cottonwood.	---
35: Blue Earth-----	---	Redosier dogwood	Tall purple willow	White willow, golden willow.	Eastern cottonwood.
39A: Wadena-----	Siberian peashrub, lilac.	Hackberry, eastern redcedar, American plum, chokecherry, silver buffaloberry, northern whitecedar.	Norway spruce, white spruce, Black Hills spruce, blue spruce, eastern white pine, bur oak.	Silver maple, green ash.	Eastern cottonwood.
41A: Estherville-----	Siberian peashrub	Eastern redcedar, Black Hills spruce, blue spruce, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Silver maple, green ash, Norway spruce, white spruce, Austrian pine, red pine.	Eastern white pine, Scotch pine, eastern cottonwood.	---
85: Calco-----	---	American plum, lilac, northern whitecedar.	Hackberry, eastern redcedar, Black Hills spruce.	Green ash, golden willow.	Silver maple, eastern cottonwood.
86: Canisteo-----	Redosier dogwood	American plum, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Eastern redcedar, white spruce, Black Hills spruce, blue spruce.	Green ash, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.

## 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
96B: Collinwood-----	---	Siberian peashrub, cotoneaster, eastern redcedar, lilac, northern whitecedar.	Amur maple, hackberry, Norway spruce, Austrian pine, bur oak.	Green ash, eastern white pine.	---
101B: Truman-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, sugar maple, hackberry, eastern redcedar, Norway spruce, bur oak, northern whitecedar.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.
102B: Clarion-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, Black Hills spruce, bur oak.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.
106C2: Lester-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, Black Hills spruce, bur oak.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.
112: Harps-----	---	Lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, Black Hills spruce.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
113: Webster-----	---	Redosier dogwood, cotoneaster, eastern redcedar, chokecherry, silver buffaloberry.	Hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, American plum, tall purple willow, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.
114: Glencoe-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	Golden willow, black willow.	Eastern cottonwood.

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
129: Cylinder-----	---	Redosier dogwood, eastern redcedar, blue spruce, lilac.	Amur maple, white spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
130: Nicollet-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, black walnut, eastern redcedar, Norway spruce, jack pine, white spruce, Black Hills spruce.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple, eastern cottonwood, Siouxland cottonwood.
134: Okoboji-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	Golden willow, black willow.	Eastern cottonwood.
136: Madelia-----	---	Redosier dogwood, cotoneaster, eastern redcedar, chokecherry, silver buffaloberry.	Amur maple, hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, American plum, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.
140: Spicer-----	---	Lilac, northern whitecedar.	Hackberry, eastern redcedar, Norway spruce, Black Hills spruce, bur oak.	Green ash, honeylocust, golden willow.	Silver maple, eastern cottonwood.
143B: Chelsea-----	Siberian peashrub, lilac.	Eastern redcedar, Black Hills spruce.	Green ash, Norway spruce, Austrian pine, red pine.	Eastern white pine	---
178: Granby-----	---	American plum, northern whitecedar.	Eastern cottonwood	Silver maple, golden willow, black willow.	---
181: Litchfield-----	---	Redosier dogwood, American plum, lilac.	Amur maple, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
183: Dassel-----	---	Redosier dogwood, American plum.	Amur maple, hackberry, northern whitecedar.	Green ash, golden willow, black willow.	Silver maple, eastern cottonwood.

## 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
197: Kingston-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, black walnut, eastern redcedar, Norway spruce, jack pine, white spruce, Black Hills spruce.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple, eastern cottonwood, Siouxland cottonwood.
211: Lura-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	White willow, golden willow, black willow.	Eastern cottonwood.
229: Waldorf-----	---	Redosier dogwood, lilac.	Amur maple, hackberry, white spruce, American plum, northern whitecedar.	Green ash, golden willow, black willow.	Silver maple, eastern cottonwood.
239: Le Sueur-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, black walnut, eastern redcedar, Norway spruce, jack pine, white spruce, Black Hills spruce.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple, eastern cottonwood, Siouxland cottonwood.
281: Darfur-----	---	Redosier dogwood, cotoneaster, eastern redcedar, American plum, chokecherry, silver buffaloberry.	Amur maple, hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.
286B: Shorewood-----	---	Siberian peashrub, eastern redcedar, lilac.	Hackberry, Norway spruce, white spruce, Black Hills spruce, Austrian pine, bur oak.	Sugar maple, green ash, eastern white pine.	---
311C2: Shorewood-----	Siberian peashrub, cotoneaster, lilac.	Eastern redcedar	Hackberry, green ash, Norway spruce, Black Hills spruce, Austrian 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
327A: Dickman-----	Siberian peashrub	Black Hills spruce, blue spruce, chokecherry, silver buffaloberry, lilac.	Silver maple, green ash, eastern redcedar, Norway spruce, jack pine, white spruce, Austrian pine.	Red pine, eastern white pine, eastern cottonwood.	---
327B: Dickman-----	Siberian peashrub	Black Hills spruce, blue spruce, silver buffaloberry, lilac.	Silver maple, green ash, eastern redcedar, Norway spruce, jack pine, white spruce, Austrian pine.	Red pine, eastern white pine, eastern cottonwood.	---
399: Biscay-----	---	Redosier dogwood	Black ash, northern whitecedar.	Golden willow, black willow.	Eastern cottonwood.
415: Kanaranzi-----	Siberian peashrub, lilac.	Eastern redcedar, American plum, chokecherry, silver buffaloberry, northern whitecedar.	White spruce, Black Hills spruce, blue spruce, bur oak.	Silver maple, green ash.	Eastern cottonwood.
423: Seaforth-----	---	Siberian peashrub, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, black walnut, eastern redcedar, Norway spruce, Scotch pine, bur oak.	Green ash, black thornless honeylocust, golden willow.	Eastern cottonwood, Siouxlant cottonwood.
461B, 461C2: Koronis-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce, bur oak.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxlant cottonwood.
511: Marcellon-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, black walnut, eastern redcedar, Norway spruce, jack pine, white spruce, Black Hills spruce.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple, eastern cottonwood, Siouxlant cottonwood.

## 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
523: Houghton-----	---	Siberian peashrub, redosier dogwood.	Black ash, green ash, tamarack, tall purple willow.	Black willow-----	---
525: Muskego-----	---	Siberian peashrub, redosier dogwood.	Black ash, green ash, tamarack, tall purple willow.	Black willow-----	---
539: Klossner-----	---	Siberian peashrub, redosier dogwood.	Black ash, green ash, tamarack, tall purple willow.	Black willow-----	---
548: Medo-----	---	Siberian peashrub, redosier dogwood.	Black ash, green ash, tamarack, tall purple willow.	Black willow-----	---
610: Calco-----	---	Redosier dogwood, lilac, northern whitecedar.	Eastern redcedar	Green ash, honeylocust, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.
611D: Hawick-----	Siberian peashrub	Honeysuckle, blue spruce, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Silver maple, green ash, thornless honeylocust, eastern redcedar, Norway spruce, jack pine, Austrian pine.	Red pine, eastern white pine, Scotch pine, eastern cottonwood.	---
612B: Wadenill-----	---	Siberian peashrub, cotoneaster, blue spruce, chokecherry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce.	Silver maple, green ash, eastern white pine.	---
613: Grovecity-----	---	Siberian peashrub, redosier dogwood, cotoneaster, blue spruce, chokecherry, silver buffaloberry, lilac.	Amur maple, black walnut, eastern redcedar, Norway spruce, jack pine, white spruce.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple, eastern cottonwood, Siouxland cottonwood.

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
664: Zook-----	---	Redosier dogwood, cotoneaster, eastern redcedar, chokecherry, silver buffaloberry.	White spruce, Black Hills spruce, blue spruce, Scotch pine, American plum, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.
740: Hamel-----	---	Redosier dogwood, cotoneaster, eastern redcedar, American plum, chokecherry, silver buffaloberry.	Amur maple, hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow, black willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.
Glencoe-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	Golden willow, black willow.	Eastern cottonwood.
804B, 804C2: Koronis-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.
Sunburg-----	American plum, late lilac, lilac.	Siberian peashrub, hackberry, eastern redcedar, honeysuckle, Black Hills spruce.	Green ash, thornless honeylocust.	---	---
Hawick-----	Siberian peashrub	Honeysuckle, late lilac.	Green ash, eastern redcedar, Norway spruce, Austrian pine.	Red pine, eastern white pine.	---
804D2: Koronis-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce.	Green ash, black walnut, eastern white pine.	Silver maple, Siouxland cottonwood.
Sunburg-----	American plum, late lilac, lilac.	Siberian peashrub, hackberry, eastern redcedar, honeysuckle, Black Hills spruce.	Green ash, thornless honeylocust.	---	---

## 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
804D2: Hawick-----	Siberian peashrub	Honeysuckle, late lilac.	Green ash, thornless honeylocust, eastern redcedar, Norway spruce, Austrian pine.	Red pine, eastern white pine.	---
804E: Koronis-----	---	Siberian peashrub, blue spruce, American plum, chokecherry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, Black Hills spruce.	Green ash, eastern white pine.	---
Sunburg-----	American plum, late lilac, lilac.	Siberian peashrub, hackberry, eastern redcedar, honeysuckle, Black Hills spruce.	Green ash, thornless honeylocust.	---	---
Hawick-----	Siberian peashrub	Honeysuckle, late lilac.	Green ash, thornless honeylocust, eastern redcedar, Norway spruce, Austrian pine.	Red pine, eastern white pine.	---
805C2, 805D2: Sunburg-----	American plum, late lilac, lilac.	Siberian peashrub, hackberry, eastern redcedar, honeysuckle, Black Hills spruce.	Green ash, thornless honeylocust.	---	---
Wadenill-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce.	Green ash, black walnut, eastern white pine.	Silver maple, Siouxi cottonwood.
807D2: Koronis-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce.	Green ash, black walnut, eastern white pine.	Silver maple, Siouxi cottonwood.
Sunburg-----	American plum, late lilac, lilac.	Siberian peashrub, hackberry, eastern redcedar, honeysuckle, Black Hills spruce.	Green ash, thornless honeylocust.	---	---

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
875B: Estherville-----	Siberian peashrub	Eastern redcedar, Black Hills spruce, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Silver maple, green ash, honeylocust, Norway spruce, jack pine, white spruce, Austrian pine.	Eastern white pine, Scotch pine, eastern cottonwood, Siberian elm.	---
Hawick-----	Siberian peashrub	Honeysuckle, late lilac.	Green ash, thornless honeylocust, eastern redcedar, jack pine, Austrian pine.	Red pine, eastern white pine.	---
875C: Hawick-----	Siberian peashrub	Honeysuckle, chokecherry, silver buffaloberry, late lilac, northern whitecedar.	Silver maple, green ash, thornless honeylocust, eastern redcedar, Norway spruce, jack pine, white spruce, Austrian pine.	Red pine, eastern white pine, eastern cottonwood, Siberian elm.	---
Estherville-----	Siberian peashrub	Eastern redcedar, lilac.	Green ash, honeylocust, jack pine, Austrian pine, red pine.	Eastern white pine	---
887B: Clarion-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouland cottonwood.
Swanlake-----	American plum-----	Siberian peashrub, hackberry, cotoneaster, eastern redcedar.	Sugar maple, green ash, honeylocust.	---	---
899: Harps-----	Redosier dogwood	Chokecherry, silver buffaloberry, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, Black Hills spruce, blue spruce.	Green ash, honeylocust, golden willow, black willow.	Eastern cottonwood, Siouland cottonwood.
Okoboji-----	---	Redosier dogwood	Black ash, green ash, black spruce.	White willow, golden willow, black willow.	Eastern cottonwood.

## 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
909C2: Bold-----	American plum-----	Siberian peashrub, hackberry, cotoneaster, eastern redcedar.	Sugar maple, green ash, honeylocust.	---	---
Truman-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, Black Hills spruce, bur oak.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.
909D2: Bold-----	American plum-----	Siberian peashrub, hackberry, cotoneaster, eastern redcedar.	Sugar maple, green ash, honeylocust.	Jack pine-----	---
Truman-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce, bur oak.	Green ash, black walnut, eastern white pine.	Silver maple, Siouxland cottonwood.
920B: Clarion-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, bur oak.	Green ash, black walnut, eastern white pine.	Silver maple, Siouxland cottonwood.
Storden-----	American plum-----	Siberian peashrub, hackberry, cotoneaster, eastern redcedar.	Sugar maple, green ash, honeylocust.	---	---
Hawick-----	Siberian peashrub	Honeysuckle, late lilac.	Green ash, thornless honeylocust, eastern redcedar, jack pine, Austrian pine.	Red pine, eastern white pine.	---
945D2: Lester-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce, bur oak.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.

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
945D2: Storden-----	American plum-----	Siberian peashrub, hackberry, cotoneaster, eastern redcedar.	Sugar maple, green ash, honeylocust.	---	---
945E: Lester-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, Black Hills spruce.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple.
Storden-----	American plum-----	Siberian peashrub, hackberry, cotoneaster, eastern redcedar.	Sugar maple, green ash, honeylocust.	---	---
956: Canistee-----	Redosier dogwood	Chokecherry, silver buffaloberry, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, Black Hills spruce, blue spruce.	Green ash, honeylocust, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.
Glencoe-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	White willow, golden willow, black willow.	Silver maple, eastern cottonwood.
960C2, 960D2: Storden-----	American plum-----	Siberian peashrub, hackberry, cotoneaster, eastern redcedar.	Sugar maple, green ash, honeylocust.	---	---
Omsrud-----	---	Siberian peashrub, redosier dogwood, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.
978: Cordova-----	---	Redosier dogwood, cotoneaster, eastern redcedar, American plum, chokecherry, silver buffaloberry.	Amur maple, hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.
Rolfe-----	---	Redosier dogwood, American plum.	Hackberry, white spruce, northern whitecedar.	Green ash, golden willow, black willow.	Silver maple, eastern cottonwood.

## 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
1096: Fieldon-----	Redosier dogwood	American plum, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Eastern redcedar, white spruce.	Green ash, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.
Dassel-----	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, northern whitecedar.	Green ash, golden willow, black willow.	Silver maple, eastern cottonwood.
1097: Mayer-----	Redosier dogwood	American plum, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.
Biscay-----	---	Redosier dogwood	Black ash-----	White willow, golden willow, black willow.	Eastern cottonwood.
1098: Biscay-----	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Biscay, depressional---	---	Redosier dogwood	Black ash-----	White willow, golden willow, black willow.	Eastern cottonwood.
1100: Nicollet-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, black walnut, eastern redcedar, Norway spruce, jack pine, white spruce, Black Hills spruce.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple, eastern cottonwood, Siouxland cottonwood.
1101: Webster-----	---	Redosier dogwood, cotoneaster, eastern redcedar, American plum, chokecherry, silver buffaloberry.	Hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.

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
1159B: Strout-----	---	Siberian peashrub, redosier dogwood, cotoneaster, American plum, chokecherry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce.	Green ash, eastern white pine.	---
Arkton-----	---	Siberian peashrub, lilac.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, golden willow.	Honeylocust, eastern cottonwood.
1161: Barry-----	---	Redosier dogwood, cotoneaster, eastern redcedar, American plum, chokecherry, silver buffaloberry.	Amur maple, hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow.	Silver maple, eastern cottonwood.
1162A, 1162B: Kandiyohi-----	Lilac-----	Siberian peashrub, eastern redcedar.	Hackberry, green ash, honeylocust, Black Hills spruce, American plum.	---	---
1163: Cohoctah-----	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
1165: Lundlake-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	Eastern cottonwood, golden willow, black willow.	---
1168: Swedegrove-----	Redosier dogwood	American plum, chokecherry, silver buffaloberry, lilac.	Hackberry, eastern redcedar, white spruce, blue spruce.	Green ash, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.
Lundlake-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	Eastern cottonwood, golden willow, black willow.	---
1169: Corvuso-----	Redosier dogwood	Cotoneaster, chokecherry, silver buffaloberry, lilac.	Hackberry, American plum, northern whitecedar.	Green ash, golden willow, black willow.	Eastern cottonwood.

## 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
1169: Lura-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	White willow, golden willow, black willow.	Eastern cottonwood.
1171C, 1171D: Newlondon-----	---	Siberian peashrub, chokecherry, late lilac, lilac.	Hackberry, eastern redcedar, Black Hills spruce, bur oak.	Green ash, golden willow.	Honeylocust, eastern cottonwood.
Strout-----	---	Siberian peashrub, redosier dogwood, American plum, lilac.	Amur maple, sugar maple, hackberry, eastern redcedar, Norway spruce, blue spruce.	Green ash, eastern white pine.	---
1172C: Sparta-----	Siberian peashrub	Eastern redcedar, Black Hills spruce, blue spruce, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Silver maple, green ash, Norway spruce, white spruce, Austrian pine, red pine.	Eastern white pine, Scotch pine, eastern cottonwood.	---
Gardencity-----	---	Siberian peashrub, eastern redcedar, Siberian crabapple, common chokecherry, lilac.	Hackberry, Norway spruce, red pine.	Green ash, thornless honeylocust, eastern white pine.	---
1174: Danielson-----	---	Redosier dogwood, eastern redcedar, chokecherry.	Amur maple, white spruce, Black Hills spruce, blue spruce, Scotch pine, American plum, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow, black willow.	Silver maple, eastern cottonwood, Siouland cottonwood.
1175: Swedegrove-----	Redosier dogwood	American plum, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce.	Green ash, golden willow, black willow.	Eastern cottonwood, Siouland cottonwood.
1176: Litchfield-----	Siberian peashrub	Blue spruce, American plum, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Amur maple, silver maple, jack pine, white spruce.	Hackberry, green ash, Austrian pine, eastern white pine, Scotch 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
1177C: Gardencity-----	---	Siberian peashrub, eastern redcedar, Siberian crabapple, common chokecherry, lilac.	Hackberry, Norway spruce, red pine.	Green ash, thornless honeylocust, eastern white pine.	---
Bold-----	American plum-----	Siberian peashrub, hackberry, cotoneaster, eastern redcedar.	Amur maple, green ash.	Eastern white pine	---
1178: Uniongrove-----	---	Redosier dogwood, cotoneaster, eastern redcedar, chokecherry, silver buffaloberry.	Hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, American plum, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow, black willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.
1183: Crowriver-----	Redosier dogwood	American plum, silver buffaloberry, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce.	Green ash, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.
1184: Corvuso-----	Redosier dogwood	American plum, chokecherry, silver buffaloberry, lilac, northern whitecedar.	Eastern redcedar, blue spruce.	Green ash, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.
1185: Gardencity-----	---	Redosier dogwood, Black Hills spruce, blue spruce, American plum, silver buffaloberry, lilac.	Hackberry, green ash, white spruce, Austrian pine, red pine, eastern white pine, bur oak.	Norway spruce, jack pine.	Silver maple, Siouxland cottonwood.
1186: Forestcity-----	---	Redosier dogwood, cotoneaster, eastern redcedar, chokecherry, silver buffaloberry.	Amur maple, hackberry, white spruce, Black Hills spruce, blue spruce, Scotch pine, American plum, northern whitecedar.	Green ash, jack pine, eastern white pine, golden willow.	Silver maple, eastern cottonwood, Siouxland cottonwood.
Lundlake-----	---	Redosier dogwood	Black ash, green ash, black spruce, northern whitecedar.	Eastern cottonwood, golden willow, black willow.	Siouxland cottonwood.

## 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
1192: Crowriver-----	Redosier dogwood	American plum, silver buffaloberry, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce.	Green ash, golden willow, black willow.	Eastern cottonwood, Siouxland cottonwood.
Lundlake-----	---	Redosier dogwood	Black ash, northern whitecedar.	Eastern cottonwood, golden willow, black willow.	Siouxland cottonwood.
1193: Cosmos-----	---	Redosier dogwood, eastern redcedar, Black Hills spruce, chokecherry, silver buffaloberry.	Amur maple, hackberry, white spruce, blue spruce, Scotch pine, American plum, northern whitecedar.	Jack pine, eastern white pine, golden willow, black willow.	Silver maple, green ash, eastern cottonwood, Siouxland cottonwood.
1197: Cohoctah-----	---	Redosier dogwood, cotoneaster, eastern redcedar, silver buffaloberry.	Norway spruce, Austrian pine, northern whitecedar.	Green ash, eastern white pine.	Silver maple, eastern cottonwood, Siouxland cottonwood.
1198B: Rohrbeck-----	---	Amur maple, Siberian peashrub, gray dogwood, cotoneaster, eastern redcedar, lilac, American cranberrybush.	Hackberry, Norway spruce, bur oak.	Red pine, eastern white pine.	---
Koronis-----	---	Siberian peashrub, redosier dogwood, blue spruce, chokecherry, lilac.	Amur maple, hackberry, eastern redcedar, Black Hills spruce.	Green ash, eastern white pine.	---
1204B: Reedslake-----	---	Siberian peashrub, redosier dogwood, cotoneaster, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce, bur oak.	Green ash, black walnut, jack pine, eastern white pine, American basswood.	Silver maple, Siouxland cottonwood.

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
1213C: Cokato-----	---	Siberian peashrub, redosier dogwood, cotoneaster, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce, bur oak.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.
Storden-----	American plum-----	Siberian peashrub, hackberry, eastern redcedar.	Sugar maple, green ash, honeylocust.	Siberian elm-----	---
1220C: Cokato-----	---	Siberian peashrub, redosier dogwood, blue spruce, American plum, chokecherry, silver buffaloberry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce, white spruce, Black Hills spruce, bur oak.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.
Storden-----	American plum-----	Siberian peashrub, hackberry, eastern redcedar.	Green ash, honeylocust.	Siberian elm-----	---
Hawick-----	Siberian peashrub	Late lilac-----	Green ash, thornless honeylocust, eastern redcedar, Norway spruce, jack pine, Austrian pine.	Red pine, eastern white pine, Siberian elm.	---
1362B: Angus-----	---	Siberian peashrub, redosier dogwood, blue spruce, chokecherry, lilac.	Amur maple, sugar maple, hackberry, eastern redcedar, Norway spruce.	Green ash, eastern white pine.	---
1383A: Shorewood-----	---	Lilac, northern whitecedar.	Hackberry, white spruce, Black Hills spruce, Austrian pine.	Green ash, eastern white pine.	Silver maple, Siouxland cottonwood.
1384: Minneopa-----	---	Redosier dogwood, eastern redcedar, blue spruce, lilac.	Amur maple, white spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
1385: Havelock-----	---	Redosier dogwood, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce.	Green ash, golden willow, black willow.	Silver maple, eastern cottonwood.

## 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
1387A: Collinwood-----	---	Cotoneaster, lilac, northern whitecedar.	Hackberry, white spruce, Black Hills spruce, Austrian pine.	Green ash, eastern white pine.	Silver maple, Siouxland cottonwood.
1391B: Wadenill-----	---	Siberian peashrub, redosier dogwood, cotoneaster, blue spruce, chokecherry, lilac.	Amur maple, hackberry, eastern redcedar, Norway spruce.	Green ash, eastern white pine.	---
Sunburg-----	American plum, late lilac, lilac.	Siberian peashrub, hackberry, eastern redcedar, honeysuckle, Black Hills spruce.	Green ash, thornless honeylocust.	---	---
1406: Medo-----	---	Silky dogwood, honeysuckle.	Tall purple willow	Black willow-----	Imperial Carolina poplar.
1801B: Gardencity-----	---	Siberian peashrub, redosier dogwood, eastern redcedar, Black Hills spruce, American plum, common chokecherry, silver buffaloberry, lilac.	Hackberry, Norway spruce, red pine, bur oak.	Green ash, black walnut, jack pine, eastern white pine.	Silver maple, Siouxland cottonwood.

## Windbreak Suitability Groups

(See text for descriptions of the groups listed in this table)

Map symbol and soil name	Windbreak suitability group
8B, 8C, 8D: Sparta-----	7
35: Blue Earth-----	2, drained; 10, undrained
39A: Wadena-----	6G
41A: Estherville-----	7
85: Calco-----	2K
86: Canisteo-----	2K
96B: Collinwood-----	4
101B: Truman-----	3
102B: Clarion-----	3
106C2: Lester-----	3
112: Harps-----	2K
113: Webster-----	2
114: Glencoe-----	2, drained; 10, undrained
129: Cylinder-----	1
130: Nicollet-----	1
134: Okoboji-----	2
136: Madelia-----	2
140: Spicer-----	2K
143B: Chelsea-----	7
178: Granby-----	2, drained; 10, undrained

## Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
181: Litchfield-----	1
183: Dassel-----	2, drained; 10, undrained
197: Kingston-----	1
211: Lura-----	2
229: Waldorf-----	2
239: Le Sueur-----	1
281: Darfur-----	2
286B: Shorewood-----	4
311C2: Shorewood-----	4C
327A, 327B: Dickman-----	7
399: Biscay-----	2, drained; 10, undrained
415: Kanaranzi-----	6G
423: Seaforth-----	1K
461B, 461C2: Koronis-----	3
511: Marcellon-----	1
523: Houghton-----	2H
525: Muskego-----	2H, drained; 10, ponded
539: Klossner-----	2H
548: Medo-----	2H
610: Calco-----	2K
611D: Hawick-----	7

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
612B: Wadenill-----	3
613: Grovecity-----	1
664: Zook-----	2
740: Hamel-----	2
Glencoe-----	2, drained; 10, undrained
804B, 804C2, 804D2, 804E: Koronis-----	3
Sunburg-----	8
Hawick-----	7
805C2, 805D2: Sunburg-----	8
Wadenill-----	3
807D2: Koronis-----	3
Sunburg-----	8
875B: Estherville-----	7
Hawick-----	7
875C: Hawick-----	7
Estherville-----	7
887B: Clarion-----	3
Swanlake-----	8
899: Harps-----	2K
Okoboji-----	2
909C2, 909D2: Bold-----	8
Truman-----	3
920B: Clarion-----	3
Storden-----	8
Hawick-----	7

## Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
945D2, 945E: Lester-----	3
Storden-----	8
956: Canisteo-----	2K
Glencoe-----	2, drained; 10, undrained
960C2, 960D2: Storden-----	8
Omsrud-----	3
978: Cordova-----	2
Rolfe-----	2
1016: Udorthents-----	10
1080: Klossner-----	10
Okoboji-----	10
Glencoe-----	10
1096: Fieldon-----	2K
Dassel-----	2, drained; 10, undrained
1097: Mayer-----	2K
Biscay-----	2, drained; 10, undrained
1098: Biscay-----	2
Biscay, depressional-	2, drained; 10, undrained
1099: Granby-----	5, drained; 2, undrained
1100: Nicollet-----	1
1101: Webster-----	2
1159B: Strout-----	4C
Arkton-----	1K
1161: Barry-----	2

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
1162A, 1162B: Kandiyohi-----	4C
1163: Cohoctah-----	1, drained; 2, undrained
1165: Lundlake-----	2, drained; 10, undrained
1168: Swedegrove-----	2K
Lundlake-----	2, drained; 10, undrained
1169: Corvuso-----	2K
Lura-----	2
1171C, 1171D: Newlondon-----	1K
Strout-----	4
1172C: Sparta-----	7
Gardencity-----	5
1174: Danielson-----	2
1175: Swedegrove-----	2K
1177C: Gardencity-----	5
Bold-----	8
1178: Uniongrove-----	2
1183: Crowriver-----	2K
1184: Corvuso-----	2K
1185: Gardencity-----	5
1186: Forestcity-----	2
Lundlake-----	2, drained; 10, undrained
1192: Crowriver-----	2K
Lundlake-----	2, drained; 10, undrained

## Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
1193: Cosmos-----	2
1197: Cohoctah-----	1, drained; 2, undrained
1198B: Rohrbeck-----	3
Koronis-----	3
1199: Klossner-----	10
Lundlake-----	10
1203: Muskego-----	10
Blue Earth-----	10
Houghton-----	10
1204B: Reedslake-----	3
1213C: Cokato-----	3
Storden-----	8
1220C: Cokato-----	3
Storden-----	8
Hawick-----	7
1362B: Angus-----	3
1383A: Shorewood-----	4
1384: Minneopa-----	1
1385: Havelock-----	2L
1387A: Collinwood-----	4
1391B: Wadenill-----	3
Sunburg-----	8
1406: Medo-----	2H
Dassel-----	2, drained; 10, undrained
Biscay-----	2, drained; 10, undrained

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
1801B: Gardencity-----	5

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# Woodland Management and Productivity

The eastern part of Meeker County and a fringe of land bordering lakes and large marshes were wooded at the time of settlement. The woodland that remains forms part of the western edge of the northern deciduous forest region commonly referred to as the Big Woods. Native species included basswood, hard maple, bur oak, white oak, red oak, ash, birch, soft maple, wild cherry, cottonwood, and willow. A large prairie occupied the western and central parts of the county (see map, Original Vegetation). Small tracts of prairie also existed within the forested area.

There are several forest types in the county. These are the aspen-oak forest type, which is the largest in extent; the Big Woods; the brush-prairie type; the oak openings and barrens type, which makes up only a small acreage, mostly around lakes and large marshes in the western part of the county; and the river bottom forest type, which is the smallest in extent (Marschner, 1974).

Most of the woodland in the county is now in small woodlots or on steep slopes bordering lakes and major rivers and streams. About 4 percent of the county is woodlots. The present distribution of tree species is similar to that in the original forest types, but wood production is limited. Many wooded areas are a source of firewood and are used for recreation or for homesites. A few areas are grazed.

The table "Woodland Management and Productivity" can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the ordination symbol, a number, indicates the potential productivity of the soils for an indicator tree species. The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter R indicates steep

slopes; X, stoniness or rockiness; W, excess water in or on the soil; T, toxic substances in the soil; D, restricted rooting depth; C, clay in the upper part of the soil; S, sandy texture; F, a high content of rock fragments in the soil; and N, snowpack. The letter A indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and N.

In the table, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

*Erosion hazard* is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Woodlands that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of slight indicates that no particular prevention measures are needed under ordinary conditions. A rating of moderate indicates that erosion-control measures are needed in certain silvicultural activities. A rating of severe indicates that special precautions are needed to control erosion in most silvicultural activities.

*Equipment limitation* reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of slight indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of moderate indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of severe indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

*Seedling mortality* refers to the death of naturally occurring or planted tree seedlings, as influenced by

the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of slight indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of moderate indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of severe indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

*Windthrow hazard* is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of slight indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of moderate indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of severe indicates that many trees can be blown down during these periods.

*Plant competition* ratings indicate the degree to which undesirable species are expected to invade and

grow when openings are made in the tree canopy. The main factors that affect plant competition are the depth to the water table and the available water capacity. A rating of slight indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of moderate indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of severe indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The potential productivity of merchantable or *common trees* on a soil is expressed as a site index and as a productivity class.

The *site index* is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of wood fiber produced in a fully stocked, even-aged stand.

*Trees to plant* are those that are suitable for commercial wood production.

Woodland Management and Productivity

(Only the soils suitable for production of commercial trees are listed. See text for definitions of terms used in this table)

Map symbol and soil name	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
106C2: Lester-----	5A	Slight	Slight	Slight	Slight	Severe	Northern red oak----	65	5	Silver maple, black walnut, white oak, northern red oak.
							Eastern white pine--	65	10	
							Eastern cottonwood--	90	7	
							American basswood---	70	5	
							Black walnut-----	62	---	
							White oak-----	60	4	
143B: Chelsea-----	5S	Slight	Slight	Moderate	Slight	Moderate	White oak-----	70	5	Jack pine, red pine, eastern white pine.
							Quaking aspen-----	72	6	
							Jack pine-----	70	7	
							Red pine-----	72	9	
							Eastern white pine--	83	13	
239: Le Sueur-----	3A	Slight	Slight	Slight	Slight	Severe	Sugar maple-----	60	3	Black walnut, eastern cottonwood, American basswood.
							Bur oak-----	43	2	
							Black walnut-----	55	---	
							Eastern cottonwood--	85	6	
							American basswood---	70	5	
286B: Shorewood-----	3A	Slight	Slight	Slight	Slight	Severe	Sugar maple-----	60	3	Black walnut, eastern white pine, eastern cottonwood.
							American basswood---	70	5	
							Black walnut-----	60	3	
							Eastern cottonwood--	85	6	
311C2: Shorewood-----	3A	Slight	Slight	Slight	Slight	Severe	Sugar maple-----	60	3	Black walnut, eastern white pine, eastern cottonwood.
							American basswood---	70	5	
							Black walnut-----	60	3	
							Eastern cottonwood--	85	6	
461B, 461C2: Koronis-----	4A	Slight	Slight	Slight	Slight	Slight	Northern red oak----	69	4	Silver maple, black walnut, white spruce, eastern white pine, white oak, northern red oak, American basswood.
							Eastern redcedar----	39	3	
							Black walnut-----	62	---	
							Eastern white pine--	64	9	
							White oak-----	62	4	
							Sugar maple-----	64	3	
							American basswood---	69	4	

See footnote at end of table.

## Woodland Management and Productivity--Continued

Map symbol and soil name	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
523: Houghton-----	2W	Slight	Severe	Severe	Severe	Severe	Red maple----- Silver maple----- White ash----- Green ash----- Tamarack----- Quaking aspen----- Northern whitecedar-	56 82 56 --- 52 60 37	2 2 3 --- 3 4 4	---
525: Muskego-----	3W	Slight	Severe	Severe	Severe	Severe	Tamarack-----	50	3	---
740: Hamel-----	5W	Slight	Moderate	Moderate	Slight	Severe	American basswood--- Black ash----- Eastern cottonwood--	70 50 85	5 2 6	Silver maple, black ash, eastern cottonwood.
Glencoe. 804B, 804C2: Koronis-----	4A	Slight	Slight	Slight	Slight	Slight	Northern red oak---- Eastern redcedar---- Black walnut----- Eastern white pine-- White oak----- Sugar maple----- American basswood---	69 39 62 64 62 64 69	4 3 --- 9 4 3 4	Silver maple, black walnut, white spruce, eastern white pine, white oak, northern red oak, American basswood.
Sunburg. Hawick.										
804D2, 804E: Koronis-----	4R	Moderate	Moderate	Slight	Slight	Slight	Northern red oak---- Eastern redcedar---- Black walnut----- Eastern white pine-- White oak----- Sugar maple----- American basswood---	69 39 62 64 62 64 69	4 3 --- 9 4 3 4	Silver maple, black walnut, white spruce, eastern white pine, white oak, northern red oak, American basswood.
Sunburg. Hawick.										

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
807D2: Koronis-----	4R	Moderate	Moderate	Slight	Slight	Slight	Northern red oak----	69	4	Silver maple, black walnut, white spruce, eastern white pine, white oak, northern red oak, American basswood.
							Eastern redcedar----	39	3	
							Black walnut-----	62	---	
							Eastern white pine--	64	9	
							White oak-----	62	4	
							Sugar maple-----	64	3	
							American basswood---	69	4	
Sunburg.										
945D2, 945E: Lester-----	5R	Moderate	Moderate	Slight	Slight	Severe	Northern red oak----	70	5	Silver maple, black walnut, white oak, northern red oak.
							Eastern white pine--	65	10	
							Eastern cottonwood--	90	7	
							American basswood---	70	5	
							Black walnut-----	62	---	
							White oak-----	60	4	
Storden.										
978: Cordova-----	4W	Slight	Moderate	Moderate	Slight	Severe	American basswood---	60	4	Black ash, eastern cottonwood.
							Sugar maple-----	55	2	
							Green ash-----	52	3	
							Eastern cottonwood--	90	7	
Rolfe.										
1099: Granby-----	2W	Slight	Severe	Severe	Severe	Severe	Silver maple-----	82	2	White spruce, Austrian pine, eastern white pine, northern whitecedar.
							Red maple-----	68	3	
							White ash-----	---	---	
							Eastern cottonwood--	---	---	
							Quaking aspen-----	---	---	
							American basswood---	---	---	
1161: Barry-----	3W	Slight	Moderate	Moderate	Slight	Severe	American basswood---	55	3	Black ash, green ash, eastern cottonwood.
							Green ash-----	50	2	
							Eastern cottonwood--	85	6	
1163: Cohoctah-----	1W	Slight	Severe	Moderate	Moderate	Severe	Silver maple-----	60	1	Silver maple, green ash, white spruce, eastern cottonwood, American basswood.
							Green ash-----	60	1	
							Eastern cottonwood--	90	7	
							American basswood---	80	4	
1173: Muskego-----	3W	Slight	Severe	Severe	Severe	Severe	Tamarack-----	50	3	---
Klossner.										

See footnote at end of table.

## Woodland Management and Productivity--Continued

Map symbol and soil name	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
1186: Forestcity-----	5W	Slight	Moderate	Moderate	Slight	Severe	American basswood---	70	5	Silver maple, black ash, eastern cottonwood.
							Black ash-----	50	2	
							Eastern cottonwood--	85	6	
Lundlake.										
1198B: Rohrbeck-----	4A	Slight	Slight	Moderate	Slight	Moderate	Northern red oak----	65	4	Black walnut, eastern white pine, white oak, northern red oak.
							Sugar maple-----	55	2	
							Eastern cottonwood--	85	6	
							Bur oak-----	40	2	
							American basswood---	60	4	
							White oak-----	55	3	
Koronis-----	4A	Slight	Slight	Slight	Slight	Slight	Northern red oak----	69	4	Silver maple, black walnut, white spruce, eastern white pine, white oak, northern red oak, American basswood.
							Sugar maple-----	64	3	
							Eastern redcedar----	39	3	
							Black walnut-----	62	---	
							Eastern white pine--	64	9	
							White oak-----	62	4	
							American basswood---	69	4	
1204B: Reedslake-----	5A	Slight	Slight	Slight	Slight	Severe	Northern red oak----	70	5	Black walnut, white oak, northern red oak.
							Eastern cottonwood--	90	7	
							American basswood---	70	5	
							White oak-----	60	4	
1213C: Cokato-----	5A	Slight	Slight	Slight	Slight	Severe	Northern red oak----	70	5	Black walnut, white oak, northern red oak.
							Eastern cottonwood--	90	7	
							American basswood---	70	5	
							White oak-----	60	4	
Storden.										
1220C: Cokato-----	5A	Slight	Slight	Slight	Slight	Severe	Northern red oak----	70	5	Black walnut, white oak, northern red oak.
							Eastern cottonwood--	90	7	
							American basswood---	70	5	
							White oak-----	60	4	
Storden.										
Hawick.										
1362B: Angus-----	5A	Slight	Slight	Slight	Slight	Severe	Northern red oak----	70	5	Silver maple, black walnut, white oak, northern red oak.
							Eastern white pine--	65	10	
							Eastern cottonwood--	90	7	
							American basswood---	70	5	
							Black walnut-----	62	---	
							White oak-----	60	4	

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
1383A: Shorewood-----	3A	Slight	Slight	Slight	Slight	Severe	Sugar maple-----	60	3	Black walnut, eastern white pine, eastern cottonwood.
						American basswood---	70	5		
						Black walnut-----	60	3		
						Eastern cottonwood--	85	6		

\* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

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# Recreation

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Meeker County offers many opportunities for fishing, hunting, canoeing, hiking, camping, bird watching, and other outdoor activities. Many lakes, streams, and other areas provide ample opportunity for recreational development. The lakes in the county are used for boating, swimming, and fishing. Public access areas are provided on the larger lakes and on the North Fork of the Crow River. Many of the lakes have swimming beaches and picnic areas. Overnight camping is available on the east shore of Lake Ripley, and picnic sites are at several locations near the lake. Picnic areas are also available on the Crow River at Kingston and at Forest City. Association 4, which is described under the heading "General Soil Map Units" in Part I of this survey, is characterized by many marshes and lakes that are well suited to recreational development. The North Fork of the Crow River, which is within association 17, is part of a designated canoe route administered by the Minnesota Department of Natural Resources.

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, bedrock near the surface, 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
8B: Sparta-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
8C: Sparta-----	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
8D: Sparta-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: slope.
35: Blue Earth-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
39A: Wadena-----	Slight-----	Slight-----	Slight-----	Slight-----	Slight.
41A: Estherville-----	Slight-----	Slight-----	Moderate: small stones.	Slight-----	Moderate: droughty.
85: Calco-----	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
86: Canistee-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
96B: Collinwood-----	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight-----	Slight.
101B: Truman-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
102B: Clarion-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
106C2: Lester-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
112: Harps-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
113: Webster-----	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
114: Glencoe-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
129: Cylinder-----	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight-----	Slight.
130: Nicollet-----	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight-----	Slight.
134: Okoboji-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
136: Madelia-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
140: Spicer-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
143B: Chelsea-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
178: Granby-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
181: Litchfield-----	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
183: Dassel-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
197: Kingston-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
211: Lura-----	Severe: ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
229: Waldorf-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
239: Le Sueur-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
281: Darfur-----	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
286B: Shorewood-----	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight-----	Slight.
311C2: Shorewood-----	Severe: too clayey.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.	Severe: too clayey.
327A: Dickman-----	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
327B: Dickman-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: droughty.
399: Biscay-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
415: Kanananzi-----	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
423: Seaforth-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
461B: Koronis-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
461C2: Koronis-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
511: Marcellon-----	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
523: Houghton-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
525: Muskego-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
539: Klossner-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
548: Medo-----	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
610: Calco-----	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
611D: Hawick-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Slight-----	Severe: slope.
612B: Wadenill-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
613: Grovecity-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
664: Zook-----	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
740: Hamel-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Glencoe-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
804B: Koronis-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
Sunburg-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
Hawick-----	Slight-----	Slight-----	Severe: small stones.	Slight-----	Moderate: droughty.
804C2: Koronis-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Sunburg-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Hawick-----	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Severe: too sandy.	Severe: slope.
804D2: Koronis-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Sunburg-----	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
804D2: Hawick-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Slight-----	Severe: slope.
804E: Koronis-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sunburg-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hawick-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Slight-----	Severe: slope.
805C2: Sunburg-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Wadenill-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
805D2: Sunburg-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Wadenill-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
807D2: Koronis-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Sunburg-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
875B: Estherville----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Moderate: droughty.
Hawick-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Moderate: droughty.
875C: Hawick-----	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Slight-----	Moderate: droughty, slope.
Estherville----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: droughty, slope.
887B: Clarion-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Swanlake-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.

## Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
899: Harps-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Okoboji-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
909C2: Bold-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Truman-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
909D2: Bold-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Truman-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
920B: Clarion-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Storden-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Hawick-----	Slight-----	Slight-----	Severe: small stones.	Slight-----	Moderate: droughty.
945D2: Lester-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
945E: Lester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
956: Canistee-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Glencoe-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
960C2: Storden-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Omsrud-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
960D2: Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Omsrud-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
978: Cordova-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Rolfe-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1015: Udipsamments----	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
1016: Udorthents-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
1030: Pits, gravel.					
Udipsamments----	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
1080: Klossner-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Okoboji-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Glencoe-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1096: Fieldon-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Dassel-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1097: Mayer-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Biscay-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1098: Biscay-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Biscay, depressional---	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

## Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1099: Granby-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1100: Nicollet-----	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight-----	Slight.
1101: Webster-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1159B: Strout-----	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Arkton-----	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones.	Slight-----	Slight.
1161: Barry-----	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
1162A: Kandiyohi-----	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
1162B: Kandiyohi-----	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
1163: Cohoctah-----	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1168: Swedegrove-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1169: Corvuso-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lura-----	Severe: ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
1171C: Newlondon-----	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight-----	Moderate: slope.
Strout-----	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight-----	Moderate: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1171D: Newlondon-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Strout-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
1172C: Sparta-----	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
Gardencity-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
1173: Muskego-----	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: ponding, flooding, excess humus.
Klossner-----	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: ponding, flooding, excess humus.
1174: Danielson-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1175: Swedegrove-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1176: Litchfield-----	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
1177C: Gardencity-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Bold-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
1178: Uniongrove-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1183: Crowriver-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1184: Corvuso-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1185: Gardencity-----	Slight-----	Slight-----	Slight-----	Slight-----	Slight.

## Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1186: Forestcity-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1192: Crowriver-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1193: Cosmos-----	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
1197: Cohoctah-----	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1198B: Rohrbeck-----	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Slight.
Koronis-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
1199: Klossner-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1203: Muskego-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Blue Earth-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Houghton-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1204B: Reedslake-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
1213C: Cokato-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Storden-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1220C: Cokato-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Storden-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Hawick-----	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Slight-----	Moderate: droughty, slope.
1362B: Angus-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
1383A: Shorewood-----	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
1384: Minneopa-----	Slight-----	Slight-----	Moderate: small stones.	Slight-----	Moderate: droughty.
1385: Havelock-----	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
1387A: Collinwood-----	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
1391B: Wadenill-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
Sunburg-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
1406: Medo-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Dassel-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Biscay-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1801B: Gardencity-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.

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# Wildlife Habitat

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The soils of Meeker County have the potential to provide excellent habitat for various kinds of wildlife. Wildlife in the area include several species of migratory waterfowl. Canada geese are the most common. Mink, muskrat, beaver, and other small furbearers inhabit water areas. Pondered soils, such as Muskego, Blue Earth, and Houghton soils, are well suited to wetland wildlife habitat. Upland birds include pheasant, Hungarian partridge, and other species. Other animals in the survey area include rabbit, fox, squirrel, and other small mammals and deer. There are many small fishing lakes in the county. The main sport fish are walleye, northern pike, crappie, and sunfish. Some of the better fishing lakes are Big Swan, Koronis, Minnebelle, Jennie, and Stella. The Crow River provides good fishing for northern pike, walleye, and catfish.

Wildlife populations can be increased by using crop rotations, planting crops in strips, and seeding ditchbanks and field borders. These measures provide a variety of cover for wildlife.

Scattered throughout the county are tracts of land set aside to preserve the natural wetlands. These areas provide excellent habitat and are used by waterfowl and pheasants.

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.

## 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, indiagrass, 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 Hungarian partridge, ring-necked

pheasant, bobwhite quail, sharp-tailed grouse, 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 wild turkey, ruffed grouse, thrushes, woodpeckers, owls, tree squirrels, porcupine, raccoon, white-tailed 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.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. The wildlife attracted to rangeland include antelope, deer, sage grouse, and meadowlark.

Wildlife Habitat

(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	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	Range- land wild- life
8B: Sparta-----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
8C, 8D: Sparta-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
35: Blue Earth-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Poor	Good	Fair.
39A: Wadena-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
41A: Estherville-----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
85: Calco-----	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair	---
86: Canistee-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
96B: Collinwood-----	Good	Good	Good	Good	Good	Poor	Poor	Fair	Good	Poor	---
101B: Truman-----	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	---
102B: Clarion-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
106C2: Lester-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
112: Harps-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---
113: Webster-----	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good	---
114: Glencoe-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
129: Cylinder-----	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	---
130: Nicollet-----	Good	Good	Good	Good	Good	Poor	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	Range- land wild- life
134: Okoboji-----	Fair	Fair	Fair	Fair	Very poor.	Good	Good	Fair	Fair	Good	---
136: Madelia-----	Good	Good	Good	Good	Fair	Good	Good	Good	Fair	Good	---
140: Spicer-----	Good	Good	Fair	Fair	Poor	Good	Good	Good	Fair	Good	---
143B: Chelsea-----	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	---
178: Granby-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	---
181: Litchfield-----	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor	---
183: Dassel-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	---
197: Kingston-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	---
211: Lura-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	---
229: Waldorf-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
239: Le Sueur-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	---
281: Darfur-----	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	---
286B: Shorewood-----	Good	Good	Good	Good	Good	Poor	Poor	Fair	Good	Poor	---
311C2: Shorewood-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
327A, 327B: Dickman-----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
399: Biscay-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---
415: Kanananzi-----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
423: Seaforth-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	---
461B: Koronis-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	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	Range- land wild- life
461C2: Koronis-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
511: Marcellon-----	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	---
523: Houghton-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	---
525: Muskego-----	Good	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	---
539: Klossner-----	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	---
548: Medo-----	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	---
610: Calco-----	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair	---
611D: Hawick-----	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	---
612B: Wadenill-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
613: Grovecity-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	---
664: Zook-----	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good	---
740: Hamel-----	Good	Good	Fair	Good	Fair	Good	Good	Good	Fair	Good	---
Glencoe-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
804B: Koronis-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Sunburg-----	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.	---
Hawick-----	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	---
804C2: Koronis-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Sunburg-----	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Hawick-----	Poor	Poor	Fair	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	Range- land wild- life
804D2:											
Koronis-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Sunburg-----	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Hawick-----	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	---
804E:											
Koronis-----	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Sunburg-----	Poor	Poor	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Hawick-----	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	---
805C2:											
Sunburg-----	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Wadenill-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
805D2:											
Sunburg-----	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Wadenill-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
807D2:											
Koronis-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Sunburg-----	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
875B:											
Estherville----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Hawick-----	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	---
875C:											
Hawick-----	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	---
Estherville----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
887B:											
Clarion-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
Swanlake-----	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	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	Range- land wild- life
899:											
Harps-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---
Okoboji-----	Fair	Fair	Fair	Fair	Very poor.	Good	Good	Fair	Fair	Good	---
909C2:											
Bold-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Truman-----	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	---
909D2:											
Bold-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Truman-----	Fair	Good	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	---
920B:											
Clarion-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
Storden-----	Good	Good	Good	Fair	Poor	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.
Hawick-----	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	---
945D2:											
Lester-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Storden-----	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.
945E:											
Lester-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Storden-----	Poor	Fair	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.
956:											
Canistee-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
Glencoe-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
960C2:											
Storden-----	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.
Omsrud-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
960D2:											
Storden-----	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.
Omsrud-----	Poor	Fair	Good	Good	Good	Very 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	Range- land wild- life	
978:												
Cordova-----	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good	---	
Rolfe-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---	
1015:												
Udipsamments.												
1016:												
Udorthents-----	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Fair	Very poor.	Fair.	
1030:												
Pits, gravel.												
Udipsamments.												
1080:												
Klossner-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	---	
Okoboji-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	---	
Glencoe-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	---	
1096:												
Fieldon-----	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good	---	
Dassel-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	---	
1097:												
Mayer-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---	
Biscay-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---	
1098:												
Biscay-----	Good	Good	Good	Good	Fair	Good	Good	Good	Fair	Good	---	
Biscay, depressional---	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---	
1099:												
Granby-----	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good	---	
1100:												
Nicollet-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	---	
1101:												
Webster-----	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good	---	
1159B:												
Strout-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---	
Arkton-----	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---	
1161:												
Barry-----	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	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 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	Range- land wild- life
1162A, 1162B: Kandiyohi-----	Fair	Fair	Fair	Good	Good	Poor	Poor	Poor	Fair	Poor	---
1163: Cohoctah-----	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	---
1165: Lundlake-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
1168: Swedegrove-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
Lundlake-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
1169: Corvuso-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
Lura-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	---
1171C: Newlondon-----	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
Strout-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
1171D: Newlondon-----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Strout-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
1172C: Sparta-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	---
Gardencity-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
1173: Muskego-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Poor	Poor	Good	---
Klossner-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	---
1174: Danielson-----	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good	---
1175: Swedegrove-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---
1176: Litchfield-----	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	---
1177C: Gardencity-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Bold-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	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	Range- land wild- life	
1178: Uniongrove-----	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good	---	
1183: Crowriver-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---	
1184: Corvuso-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---	
1185: Gardencity-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---	
1186: Forestcity-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---	
Lundlake-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---	
1192: Crowriver-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---	
Lundlake-----	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good	---	
1193: Cosmos-----	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good	---	
1197: Cohoctah-----	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	---	
1198B: Rohrbeck-----	Fair	Good	Good	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---	
Koronis-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---	
1199: Klossner-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	---	
Lundlake-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	---	
1203: Muskego-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	---	
Blue Earth-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.	
Houghton-----	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	---	
1204B: Reedslake-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---	
1213C: Cokato-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	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	Range- land wild- life
1213C: Storden-----	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.
1220C: Cokato-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Storden-----	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.
Hawick-----	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	---
1362B: Angus-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
1383A: Shorewood-----	Good	Good	Good	Good	Good	Poor	Poor	Fair	Good	Poor	---
1384: Minneopa-----	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	---
1385: Havelock-----	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good	---
1387A: Collinwood-----	Good	Good	Good	Good	Good	Poor	Poor	Fair	Good	Poor	---
1391B: Wadenill-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
Sunburg-----	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.	---
1406: Medo-----	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	---
Dassel-----	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	---
Biscay-----	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	---
1801B: Gardencity-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---

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# Engineering

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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, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, 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 bedrock, 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, depth to bedrock, 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 bedrock or to a cemented pan, 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, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts 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 a 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, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock 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 or fractured bedrock is 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 “Sanitary Facilities” 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, depth to bedrock, 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 and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

*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.

*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 “Sanitary Facilities” are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts 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 soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or 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 "Construction Materials," 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 "Construction Materials," 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 as much as 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. Fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

*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, bedrock, 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 and the depth to fractured bedrock or other permeable material. 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 “Water Management,” 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. Depth to bedrock and the content of large stones affect 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 bedrock, or to other 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 depth to bedrock, 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 and depth to bedrock. 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, large stones, and depth to bedrock 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, slope, and depth to bedrock 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
8B: Sparta-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
8C: Sparta-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
8D: Sparta-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
35: Blue Earth-----	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.
39A: Wadena-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Slight.
41A: Estherville-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
85: Calco-----	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
86: Canistee-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
96B: Collinwood-----	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
101B: Truman-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Severe: low strength, frost action.	Slight.
102B: Clarion-----	Moderate: wetness.	Slight-----	Moderate: wetness.	Slight-----	Moderate: frost action.	Slight.
106C2: Lester-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	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
112: Harps-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
113: Webster-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
114: Glencoe-----	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.
129: Cylinder-----	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.	Slight.
130: Nicollet-----	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
134: Okoboji-----	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
136: Madelia-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
140: Spicer-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
143B: Chelsea-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
178: Granby-----	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
181: Litchfield-----	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Slight-----	Moderate: frost action.	Moderate: droughty.
183: Dassel-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

## 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
197: Kingston-----	Moderate: wetness.	Slight-----	Moderate: wetness.	Slight-----	Severe: low strength, frost action.	Slight.
211: Lura-----	Severe: excess humus, ponding.	Severe: ponding, shrink-swell, low strength.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell, low strength.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
229: Waldorf-----	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
239: Le Sueur-----	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
281: Darfur-----	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
286B: Shorewood-----	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
311C2: Shorewood-----	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, frost action.	Severe: too clayey.
327A: Dickman-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
327B: Dickman-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: droughty.
399: Biscay-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
415: Kananranzi-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Moderate: frost action.	Moderate: droughty.
423: Seaforth-----	Moderate: wetness.	Slight-----	Moderate: wetness.	Slight-----	Severe: frost action.	Slight.
461B: Koronis-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.

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
461C2: Koronis-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
511: Marcellon-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
523: Houghton-----	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
525: Muskego-----	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
539: Klossner-----	Severe: 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.
548: Medo-----	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.
610: Calco-----	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
611D: Hawick-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
612B: Wadenill-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
613: Grovecity-----	Moderate: wetness.	Slight-----	Moderate: wetness.	Slight-----	Severe: frost action.	Slight.
664: Zook-----	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, 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
740: Hamel-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
Glencoe-----	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.
804B: Koronis-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
Sunburg-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
Hawick-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: droughty.
804C2: Koronis-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Sunburg-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Hawick-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
804D2: Koronis-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sunburg-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hawick-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
804E: Koronis-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sunburg-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hawick-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
805C2: Sunburg-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Wadenill-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, 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
805D2:						
Sunburg-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wadenill-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
807D2:						
Koronis-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sunburg-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
875B:						
Estherville-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: droughty.
Hawick-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: droughty.
875C:						
Hawick-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Estherville-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
887B:						
Clarion-----	Moderate: wetness.	Slight-----	Moderate: wetness.	Slight-----	Moderate: frost action.	Slight.
Swanlake-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
899:						
Harps-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
Okoboji-----	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
909C2:						
Bold-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
Truman-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
909D2:						
Bold-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	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
909D2: Truman-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
920B: Clarion-----	Moderate: wetness.	Slight-----	Moderate: wetness.	Slight-----	Moderate: frost action.	Slight.
Storden-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
Hawick-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: droughty.
945D2: Lester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
945E: Lester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
956: Canisteco-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
Glencoe-----	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.
960C2: Storden-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
Omsrud-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
960D2: Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Omsrud-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, 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
978: Cordova-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
Rolfe-----	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
1015: Udipsamments----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty, too sandy.
1016: Udorthents-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
1030: Pits, gravel.						
Udipsamments----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1080: Klossner-----	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, low strength, ponding.	Severe: ponding, excess humus.
Okoboji-----	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
Glencoe-----	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.
1096: Fieldon-----	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Dassel-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
1097: Mayer-----	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Biscay-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.

## 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
1098: Biscay-----	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
Biscay, depressional---	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
1099: Granby-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1100: Nicollet-----	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
1101: Webster-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
1159B: Strout-----	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Arkton-----	Moderate: too clayey, wetness.	Severe: shrink-swell.	Moderate: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
1161: Barry-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
1162A, 1162B: Kandiyohi-----	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Severe: too clayey.
1163: Cohoctah-----	Severe: cutbank cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
1165: Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
1168: Swedegrove-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

## 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
1169: Corvuso-----	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Lura-----	Severe: excess humus, ponding.	Severe: ponding, shrink-swell, low strength.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell, low strength.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
1171C: Newlondon-----	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
Strout-----	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
1171D: Newlondon-----	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
Strout-----	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
1172C: Sparta-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Gardencity-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
1173: Muskego-----	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.
Klossner-----	Severe: excess humus, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, low strength, ponding.	Severe: ponding, flooding, excess humus.
1174: Danielson-----	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
1175: Swedegrove-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	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
1176: Litchfield-----	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Slight-----	Moderate: frost action.	Moderate: droughty.
1177C: Gardencity-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Bold-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
1178: Uniongrove-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
1183: Crowriver-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
1184: Corvuso-----	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
1185: Gardencity-----	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Slight-----	Severe: frost action.	Slight.
1186: Forestcity-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
1192: Crowriver-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
1193: Cosmos-----	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
1197: Cohoctah-----	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	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
1198B: Rohrbeck-----	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Slight-----	Slight-----	Slight.
Koronis-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
1199: Klossner-----	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, low strength, ponding.	Severe: ponding, excess humus.
Lundlake-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
1203: Muskego-----	Severe: 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.
Blue Earth-----	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.
Houghton-----	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.
1204B: Reedslake-----	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength.	Slight.
1213C: Cokato-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Storden-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
1220C: Cokato-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Storden-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
Hawick-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: 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
1362B: Angus-----	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
1383A: Shorewood-----	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
1384: Minneopa-----	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Slight-----	Moderate: frost action.	Moderate: droughty.
1385: Havelock-----	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, flooding.
1387A: Collinwood-----	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
1391B: Wadenill-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
Sunburg-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.
1406: Medo-----	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.
Dassel-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Biscay-----	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
1801B: Gardencity-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Slight.

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
8B: Sparta-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
8C: Sparta-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
8D: Sparta-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
35: Blue Earth-----	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
39A: Wadena-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
41A: Estherville-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
85: Calco-----	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
86: Canisteo-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
96B: Collinwood-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
101B: Truman-----	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
102B: Clarion-----	Slight-----	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.

## 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
106C2: Lester-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
112: Harps-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
113: Webster-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
114: Glencoe-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
129: Cylinder-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
130: Nicollet-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
134: Okoboji-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
136: Madelia-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
140: Spicer-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
143B: Chelsea-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
178: Granby-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
181: Litchfield-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: 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
183: Dassel-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
197: Kingston-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
211: Lura-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey, excess humus.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
229: Waldorf-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
239: Le Sueur-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
281: Darfur-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
286B: Shorewood-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
311C2: Shorewood-----	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
327A: Dickman-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
327B: Dickman-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
399: Biscay-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	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
415: Kananranzi-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
423: Seaforth-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
461B: Koronis-----	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
461C2: Koronis-----	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
511: Marcellon-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
523: Houghton-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
525: Muskego-----	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: hard to pack, ponding.
539: Klossner-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
548: Medo-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
610: Calco-----	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
611D: Hawick-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
612B: Wadenill-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: 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
613: Grovecity-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness.
664: Zook-----	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
740: Hamel-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Glencoe-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
804B: Koronis-----	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Sunburg-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
Hawick-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
804C2: Koronis-----	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Sunburg-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: small stones, slope.
Hawick-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
804D2: Koronis-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Sunburg-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Hawick-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	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
804E:					
Koronis-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Sunburg-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Hawick-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
805C2:					
Sunburg-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: small stones, slope.
Wadenill-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: small stones, slope.
805D2:					
Sunburg-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Wadenill-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
807D2:					
Koronis-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Sunburg-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
875B:					
Estherville----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Hawick-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
875C:					
Hawick-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Estherville----	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
<b>887B:</b>					
Clarion-----	Slight-----	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Swanlake-----	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
<b>899:</b>					
Harps-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Okoboji-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
<b>909C2:</b>					
Bold-----	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Truman-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
<b>909D2:</b>					
Bold-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Truman-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
<b>920B:</b>					
Clarion-----	Slight-----	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Storden-----	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
Hawick-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
<b>945D2:</b>					
Lester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
<b>945E:</b>					
Lester-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: 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
956: Canisteo-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Glencoe-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
960C2: Storden-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Omsrud-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
960D2: Storden-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Omsrud-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
978: Cordova-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Rolfe-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
1015: Udipsamments---	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
1016: Udorthents-----	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
1030: Pits, gravel. Udipsamments---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
1080: Klossner-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
Okoboji-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, 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
1080: Glencoe-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
1096: Fieldon-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
Dassel-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
1097: Mayer-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
Biscay-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
1098: Biscay-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
Biscay, depressional---	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
1099: Granby-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
1100: Nicollet-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
1101: Webster-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1159B: Strout-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Arkton-----	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: hard to pack.

## 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
1161: Barry-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
1162A: Kandiyohi-----	Severe: wetness, percs slowly.	Slight-----	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
1162B: Kandiyohi-----	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
1163: Cohoctah-----	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness, seepage.	Poor: wetness.
1165: Lundlake-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
1168: Swedegrove-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
Lundlake-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
1169: Corvuso-----	Severe: wetness, percs slowly.	Slight-----	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Lura-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey, excess humus.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
1171C: Newlondon-----	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
Strout-----	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
1171D: Newlondon-----	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, 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
1171D: Strout-----	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
1172C: Sparta-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Gardencity-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
1173: Muskego-----	Severe: subsides, flooding, ponding.	Severe: seepage, flooding, excess humus.	Severe: flooding, ponding, excess humus.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
Klossner-----	Severe: subsides, flooding, ponding.	Severe: seepage, flooding, excess humus.	Severe: flooding, ponding.	Severe: flooding, seepage, ponding.	Poor: hard to pack, ponding.
1174: Danielson-----	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
1175: Swedegrove-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
1176: Litchfield-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
1177C: Gardencity-----	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Bold-----	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
1178: Uniongrove-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
1183: Crowriver-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: 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
1184: Corvuso-----	Severe: wetness, percs slowly.	Slight-----	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
1185: Gardencity-----	Severe: wetness.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: too sandy.
1186: Forestcity-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
Lundlake-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
1192: Crowriver-----	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
Lundlake-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
1193: Cosmos-----	Severe: wetness, percs slowly.	Slight-----	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
1197: Cohoctah-----	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
1198B: Rohrbeck-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness.
Koronis-----	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
1199: Klossner-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
Lundlake-----	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: 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
1203: Muskego-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: hard to pack, ponding.
Blue Earth-----	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
Houghton-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
1204B: Reedslake-----	Severe: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Good.
1213C: Cokato-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Storden-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
1220C: Cokato-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Storden-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Hawick-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
1362B: Angus-----	Severe: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
1383A: Shorewood-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
1384: Minneopa-----	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	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
1385: Havelock-----	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
1387A: Collinwood-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
1391B: Wadenill-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
Sunburg-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
1406: Medo-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Dassel-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Biscay-----	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
1801B: Gardencity-----	Slight-----	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.

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
8B, 8C: Sparta-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
8D: Sparta-----	Fair: slope.	Probable-----	Improbable: too sandy.	Poor: too sandy, slope.
35: Blue Earth-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
39A: Wadena-----	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
41A: Estherville-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
85: Calco-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
86: Canisteo-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
96B: Collinwood-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
101B: Truman-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
102B: Clarion-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
106C2: Lester-----	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
112: Harps-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

## Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
113: Webster-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
114: Glencoe-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
129: Cylinder-----	Fair: wetness.	Probable-----	Probable-----	Poor: small stones.
130: Nicollet-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
134: Okoboji-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
136: Madelia-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
140: Spicer-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
143B: Chelsea-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
178: Granby-----	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy, wetness.
181: Litchfield-----	Fair: wetness.	Probable-----	Improbable: too sandy.	Fair: too sandy, thin layer.
183: Dassel-----	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: wetness.
197: Kingston-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
211: Lura-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
229: Waldorf-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
239: Le Sueur-----	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
281: Darfur-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
286B: Shorewood-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
311C2: Shorewood-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
327A: Dickman-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
327B: Dickman-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
399: Biscay-----	Poor: wetness.	Probable-----	Probable-----	Poor: area reclaim, wetness.
415: Kanaranzi-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
423: Seaforth-----	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
461B: Koronis-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
461C2: Koronis-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
511: Marcellon-----	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
523: Houghton-----	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.

## Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
525: Muskego-----	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
539: Klossner-----	Poor: thin layer, wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
548: Medo-----	Poor: wetness.	Probable-----	Probable-----	Poor: excess humus, wetness.
610: Calco-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
611D: Hawick-----	Fair: slope.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
612B: Wadenill-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
613: Grovecity-----	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
664: Zook-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
740: Hamel-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Glencoe-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
804B: Koronis-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Sunburg-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Hawick-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
804C2:				
Koronis-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Sunburg-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Hawick-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
804D2:				
Koronis-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sunburg-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Hawick-----	Fair: slope.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
804E:				
Koronis-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sunburg-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Hawick-----	Poor: slope.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
805C2:				
Sunburg-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Wadenill-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
805D2:				
Sunburg-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wadenill-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
807D2:				
Koronis-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sunburg-----	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

## Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
875B: Estherville-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
Hawick-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
875C: Hawick-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
Estherville-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
887B: Clarion-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Swanlake-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
899: Harms-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Okoboje-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
909C2: Bold-----	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Truman-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
909D2: Bold-----	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Truman-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
920B: Clarion-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Storden-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
920B: Hawick-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
945D2: Lester-----	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Storden-----	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
945E: Lester-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Storden-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
956: Canisteco-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Glencoe-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
960C2: Storden-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Omsrud-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
960D2: Storden-----	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Omsrud-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
978: Cordova-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Rolfe-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
1015: Udipsamments-----	Good-----	Probable-----	Probable-----	Poor: too sandy.

## Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1016: Udorthents-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
1030: Pits, gravel.				
Udipsamments-----	Fair: slope.	Probable-----	Probable-----	Poor: too sandy, slope.
1080: Klossner-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Okoboji-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Glencoe-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1096: Fieldon-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Dassel-----	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: wetness.
1097: Mayer-----	Poor: wetness.	Probable-----	Probable-----	Poor: small stones, area reclaim, wetness.
Biscay-----	Poor: wetness.	Probable-----	Probable-----	Poor: area reclaim, wetness.
1098: Biscay-----	Poor: wetness.	Probable-----	Probable-----	Poor: area reclaim, wetness.
Biscay, depressional---	Poor: wetness.	Probable-----	Probable-----	Poor: area reclaim, wetness.
1099: Granby-----	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: too sandy, wetness.
1100: Nicollet-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1101: Webster-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1159B: Strout-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Arkton-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
1161: Barry-----	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
1162A, 1162B: Kandiyohi-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
1163: Cohoctah-----	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: wetness.
1165: Lundlake-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1168: Swedegrove-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Lundlake-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1169: Corvuso-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Lura-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1171C: Newlondon-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Strout-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
1171D: Newlondon-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Strout-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.

## Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1172C: Sparta-----	Good-----	Probable-----	Improbable: too sandy.	Poor: too sandy.
Gardencity-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
1173: Muskego-----	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Klossner-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
1174: Danielson-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1175: Swedegrove-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1176: Litchfield-----	Fair: wetness.	Probable-----	Improbable: too sandy.	Fair: too sandy, thin layer.
1177C: Gardencity-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Bold-----	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
1178: Uniongrove-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1183: Crowriver-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1184: Corvuso-----	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1185: Gardencity-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
1186: Forestcity-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Lundlake-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1192: Crowriver-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Lundlake-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1193: Cosmos-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1197: Cohoctah-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1198B: Rohrbeck-----	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Koronis-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1199: Klossner-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Lundlake-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1203: Muskego-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Blue Earth-----	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Houghton-----	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
1204B: Reedslake-----	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
1213C: Cokato-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Storden-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
1220C: Cokato-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.

## Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1220C: Storden-----	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Hawick-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
1362B: Angus-----	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1383A: Shorewood-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
1384: Minneopa-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones.
1385: Havelock-----	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1387A: Collinwood-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
1391B: Wadenill-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Sunburg-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
1406: Medo-----	Poor: wetness.	Probable-----	Probable-----	Poor: excess humus, wetness.
Dassel-----	Poor: wetness.	Probable-----	Improbable: too sandy.	Poor: wetness.
Biscay-----	Poor: wetness.	Probable-----	Probable-----	Poor: area reclaim, wetness.
1801B: Gardencity-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.

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	
8B: Sparta-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.	
8C, 8D: Sparta-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.	
35: Blue Earth-----	Moderate: seepage.	Severe: piping, excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.	
39A: Wadena-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable-----	Too sandy-----	Favorable.	
41A: Esterville-----	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.	
85: Calco-----	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness-----	Wetness.	
86: Canisteo-----	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness-----	Wetness-----	Wetness.	
96B: Collinwood-----	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Slope, wetness.	Wetness, perc slowly.	Percs slowly.	
101B: Truman-----	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Erodes easily	Erodes easily.	

## 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
102B: Clarion-----	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Slope-----	Erodes easily	Erodes easily.
106C2: Lester-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
112: Harps-----	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness, rooting depth.	Wetness-----	Wetness, rooting depth.
113: Webster-----	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action---	Wetness-----	Wetness-----	Wetness.
114: Glencoe-----	Moderate: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.
129: Cylinder-----	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness-----	Wetness, too sandy.	Favorable.
130: Nicollet-----	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action---	Wetness-----	Wetness-----	Favorable.
134: Okoboji-----	Slight-----	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.
136: Madellia-----	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action---	Wetness-----	Erodes easily, wetness.	Wetness, erodes easily.
140: Spicer-----	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness-----	Erodes easily, wetness.	Wetness, erodes easily.

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
143B: Chelsea-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
178: Granby-----	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
181: Litchfield-----	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
183: Dassel-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding-----	Ponding, too sandy.	Wetness.
197: Kingston-----	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action---	Wetness-----	Erodes easily, wetness.	Erodes easily.
211: Lura-----	Slight-----	Severe: excess humus, hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
229: Waldorf-----	Slight-----	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
239: Le Sueur-----	Moderate: seepage.	Severe: thin layer.	Moderate: deep to water, slow refill.	Frost action---	Wetness-----	Wetness-----	Favorable.
281: Darfur-----	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness-----	Wetness, too sandy.	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
286B: Shorewood-----	Moderate: seepage, slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Erodes easily, percs slowly.
311C2: Shorewood-----	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, slow intake.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
327A: Dickman-----	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
327B: Dickman-----	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
399: Biscay-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding-----	Ponding, too sandy.	Wetness.
415: Kanaranzi-----	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty-----	Erodes easily, too sandy.	Erodes easily, droughty.
423: Seaforth-----	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action---	Wetness-----	Wetness-----	Favorable.
461B: Koronis-----	Severe: seepage.	Slight-----	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.
461C2: Koronis-----	Severe: seepage, slope.	Slight-----	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
511: Marcellon-----	Severe: seepage.	Severe: seepage, piping, wetness.	Moderate: slow refill.	Frost action---	Wetness-----	Wetness-----	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
523: Houghton-----	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
525: Muskego-----	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, percs slowly.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
539: Klossner-----	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily.
548: Medo-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
610: Calco-----	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness-----	Wetness.
611D: Hawick-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
612B: Wadenill-----	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.
613: Grovecity-----	Severe: seepage.	Severe: piping.	Moderate: deep to water.	Frost action---	Wetness-----	Wetness-----	Favorable.
664: Zook-----	Slight-----	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
740: Hamel-----	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action---	Wetness-----	Wetness-----	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
740: Glencoe-----	Moderate: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----		Wetness.
804B: Koronis-----	Severe: seepage.	Slight-----	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.
Sunburg-----	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.		Favorable.
Hawick-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy-----	Droughty.
804C2, 804D2, 804E: Koronis-----	Severe: seepage, slope.	Slight-----	Severe: no water.	Deep to water	Slope, soil blowing.		Slope.
Sunburg-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.		Slope.
Hawick-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
805C2, 805D2: Sunburg-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.		Slope.
Wadenill-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----		Slope.
807D2: Koronis-----	Severe: seepage, slope.	Slight-----	Severe: no water.	Deep to water	Slope, soil blowing.		Slope.
Sunburg-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.		Slope.

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	
875B: Esterville-----	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.	
Hawick-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.	
875C: Hawick-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.	
Esterville-----	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.	
887B: Clarion-----	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Slope-----	Erodes easily	Erodes easily.	
Swanlake-----	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope-----	Erodes easily	Erodes easily.	
899: Harps-----	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness, rooting depth.	Wetness-----	Wetness, rooting depth.	
Okoboji-----	Slight-----	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.	
909C2, 909D2: Bold-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.	
Truman-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.	
920B: Clarion-----	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Slope-----	Erodes easily	Erodes easily.	

## 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	
920B: Storden-----	Moderate: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope-----	Erodes easily	Erodes easily.	
Hawick-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy-----	Droughty.	
945D2, 945E: Lester-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.	
Storden-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.	
956: Canisteo-----	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness-----	Wetness-----	Wetness.	
Glencoe-----	Moderate: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.	
960C2, 960D2: Storden-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.	
Omsrud-----	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.	
978: Cordova-----	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action---	Wetness-----	Wetness-----	Wetness.	
Rolfe-----	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.	
1015: Udipsamments-----	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--				Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways	
1016: Udorthents-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, soil blowing.	Slope, droughty.	
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.	
1080: Klossner-----	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding-----	Ponding-----	Wetness.	
Okoboji-----	Slight-----	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Erodes easily, ponding.	Wetness, erodes easily.	
Glencoe-----	Moderate: seepage.	Severe: excess humus, hard to pack, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.	
1096: Fieldon-----	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness-----	Wetness, too sandy.	Wetness.	
Dassel-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding-----	Ponding, too sandy.	Wetness.	
1097: Mayer-----	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness-----	Wetness, too sandy.	Wetness.	
Biscay-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding-----	Ponding, too sandy.	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
1098: Biscay-----	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness-----	Wetness, too sandy.	Wetness.
Biscay, depressional----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding-----	Ponding, too sandy.	Wetness.
1099: Granby-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
1100: Nicollet-----	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action----	Wetness-----	Wetness-----	Favorable.
1101: Webster-----	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action----	Wetness-----	Wetness-----	Wetness.
1159B: Strout-----	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, slow intake.	Erodes easily, wetness.	Erodes easily, rooting depth.
Arkton-----	Moderate: slope.	Moderate: piping, hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Erodes easily, rooting depth.
1161: Barry-----	Severe: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action----	Wetness, rooting depth.	Wetness-----	Wetness, rooting depth.
1162A: Kandiyohi-----	Slight-----	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action.	Wetness, slow intake.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.

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	
1162B: Kandiyohti	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, slow intake.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.	
1163: Cohoctah	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.	
1165: Lundlake	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.	
1168: Swedegrove	Severe: seepage.	Severe: piping, wetness.	Slight	Frost action	Wetness	Wetness	Wetness.	
Lundlake	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.	
1169: Corvuso	Slight	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.	
Lura	Slight	Severe: excess humus, hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.	
1171C, 1171D: Newlondon	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.	
Strout	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.	

## 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
1172C: Sparta-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Gardencity-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, too sandy, soil blowing.	Slope.
1173: Muskego-----	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, flooding, subsides.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing.	Wetness.
Klossner-----	Severe: seepage.	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, flooding, subsides.	Ponding, soil blowing, flooding.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily.
1174: Danielson-----	Slight-----	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, rooting depth, percs slowly.
1175: Swedegrove-----	Severe: seepage.	Severe: piping, wetness.	Slight-----	Frost action---	Wetness-----	Wetness-----	Wetness.
1176: Litchfield-----	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Droughty.
1177C: Gardencity-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, too sandy, soil blowing.	Slope.
Bold-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
1178: Uniongrove-----	Severe: seepage.	Severe: piping, wetness.	Slight-----	Frost action---	Wetness-----	Wetness-----	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
1183: Crowriver-----	Severe: seepage.	Severe: piping, wetness.	Slight-----	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
1184: Corvuso-----	Slight-----	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
1185: Gardencity-----	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Soil blowing---	Too sandy, soil blowing.	Favorable.
1186: Forestcity-----	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
Lundlake-----	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.
1192: Crowriver-----	Severe: seepage.	Severe: piping, wetness.	Slight-----	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
Lundlake-----	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.
1193: Cosmos-----	Slight-----	Severe: wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, rooting depth, percs slowly.
1197: Cohoctah-----	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, flooding.	Wetness, soil blowing.	Wetness.
1198B: Rohrbeck-----	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Slope-----	Slope, wetness, fast intake.	Erodes easily, wetness, soil blowing.	Erodes easily.
Koronis-----	Severe: seepage.	Slight-----	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.

## 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
1199: Klossner-----	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding-----	Ponding-----	Wetness.
Lundlake-----	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.
1203: Muskego-----	Severe: seepage.	Severe: piping, excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding-----	Ponding-----	Wetness.
Blue Earth-----	Moderate: seepage.	Severe: piping, excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.
Houghton-----	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding-----	Ponding-----	Wetness.
1204B: Reedslake-----	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Slope-----	Erodes easily	Erodes easily.
1213C: Cokato-----	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.
Storden-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.
1220C: Cokato-----	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.
Storden-----	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.
Hawick-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.

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	
1362B: Angus-----	Moderate: seepage, slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Deep to water	Slope-----	Favorable-----	Favorable.	
1383A: Shorewood-----	Moderate: seepage.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.	
1384: Minneopa-----	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Deep to water	Droughty-----	Too sandy-----	Droughty.	
1385: Havelock-----	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness-----	Wetness.	
1387A: Collinwood-----	Slight-----	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.	
1391B: Wadenhill-----	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.	
Sunburg-----	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.	
1406: Medo-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.	
Dassel-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.	
Biscay-----	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding-----	Ponding, too sandy.	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
1801B: Cardencity-----	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.

# Soil Properties

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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, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

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 oven-dry 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 are generally 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.

*Moist bulk density* is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at  $\frac{1}{3}$ -bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In the table "Physical Properties of the Soils," 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*, more than 6 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 "Physical Properties of the Soils," 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 K<sub>f</sub>* 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 soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. 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 soil blowing 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 soil blowing 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 soil blowing 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 soil blowing 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 soil blowing 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 soil blowing 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 soil blowing are used.

8. Soils that are not subject to soil blowing 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. It is a measurement of the nutrient-holding capacity of the soil.

*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* is expressed as a weighted percentage of the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients, such as phosphorus, is affected by the amount of carbonates in the soil.

*Gypsum* is expressed as the percent, by weight, of hydrated calcium sulfates in the fraction of the soil less

than 20 millimeters in size. Soils high in gypsum, such as those more than 10 percent gypsum, may collapse if the gypsum is removed by percolating water. Gypsum is corrosive to concrete. Corrosion of concrete is most likely to occur in soils that are more than about 1 percent gypsum when wetting and drying occur.

## 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 clay pan 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 "Water Features" 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 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 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 "Water Features" 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 "Soil Features" 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

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
8B: Sparta-----	0-16	Loamy sand-----	SM	A-2, A-4	0	0	85-100	85-100	35-95	15-50	0-14	NP
	16-29	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	0	85-100	85-100	50-95	5-50	0-14	NP
	29-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	0	85-100	85-100	50-95	2-30	0-14	NP
8C: Sparta-----	0-7	Loamy sand-----	SM	A-2, A-4	0	0	85-100	85-100	35-95	15-50	0-14	NP
	7-13	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	0	85-100	85-100	50-95	5-50	0-14	NP
	13-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	0	85-100	85-100	50-95	2-30	0-14	NP
8D: Sparta-----	0-9	Loamy sand-----	SM	A-2, A-4	0	0	85-100	85-100	35-95	15-50	0-14	NP
	9-40	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	0	85-100	85-100	50-95	5-50	0-14	NP
	40-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	0	85-100	85-100	50-95	2-30	0-14	NP
35: Blue Earth-----	0-8	Mucky silt loam	OL, ML	A-5	0	0	95-100	95-100	85-95	80-95	41-50	2-8
	8-60	Mucky silty clay loam, clay loam, mucky silt loam.	OL, ML	A-5	0	0	95-100	80-100	80-95	80-95	41-50	2-8
39A: Wadena-----	0-13	Loam-----	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	13-29	Loam, sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	29-60	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-3	0-5	45-100	35-100	10-80	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
41A: Estherville-----	0-12 12-15	Sandy loam----- Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC A-2, A-4 SM, SC-SM, SC A-2, A-4, A-1		0 0	0-5 0-5	90-100 80-100 50-75 85-100 80-95 40-75	25-50 15-45	20-30 2-8			
85: Calco-----	15-60	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, A-1 SM, GP		0	0-10	55-90 50-85 10-40	2-25	0-14	NP		
86: Canisteo-----	0-22 22-60	Silty clay loam Silty clay loam	CH, CL CL, CH	A-7 A-7	0 0	0 0	100 100 95-100 85-100 100 100 95-100 85-100	40-60 40-60	15-30 15-30			
96B: Collinwood-----	0-18 18-26	Clay loam----- Clay loam, loam, silty clay loam.	OL, CL CL	A-7 A-6, A-7	0 0	0 0	95-100 95-100 85-100 60-100 98-100 90-100 85-100 65-95	40-50 38-50	15-20 25-35			
101B: Truman-----	26-33 33-60	Clay loam, loam, loam Clay loam, loam	CL, ML CL	A-6 A-6	0 0	0-5 0-5	90-100 80-95 60-95 50-85 95-100 90-98 80-95 50-75	30-40 30-40	5-15 12-20			
102B: Clarion-----	0-8 8-32	Silty clay loam Silty clay, clay, silty clay loam.	CL, CH, ML, MH MH, CH	A-7 A-7	0 0	0 0	100 100 95-100 90-95 100 100 95-100 90-95	40-55 50-65	15-25 20-35			
101B: Truman-----	32-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	0	100 100 95-100 90-95	40-60	15-30			
101B: Truman-----	0-14 14-40	Silt loam----- Silt loam, silty clay loam.	ML, CL-ML, CL A-4, A-6 ML, CL, CL-ML A-4, A-6, A-7	A-6 A-6, A-7	0 0	0 0	100 100 95-100 80-100 100 100 95-100 80-100	25-40 25-45	5-15 5-20			
102B: Clarion-----	40-60	Silt loam-----	CL, CL-ML, ML A-4, A-6	A-6	0	0	100 100 95-100 75-95	25-40	5-15			
102B: Clarion-----	0-12 12-27	Loam----- Loam, sandy loam.	CL, CL-ML CL, CL-ML	A-4, A-6 A-4, A-6	0 0	0-5 0-5	95-100 95-100 75-90 50-75 90-100 85-100 75-90 50-75	25-40 25-40	5-15 5-15			
102B: Clarion-----	27-60	Loam, clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100 85-98 70-85 50-75	25-40	5-15			

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
106C2: Lester	In 0-9 9-27 27-60	Loam Clay loam, loam Loam, clay loam	ML, CL, CL-ML A-6, A-4 A-6 A-6		0 0-1 0-1	0-5 0-5 0-5	95-100 95-100 95-100	90-100 90-100 90-100	80-95 80-95 75-90	50-85 55-75 50-70	30-40 35-40 32-39	11-15 15-20 13-18
112: Harps	0-19 19-25 25-60	Clay loam Loam, clay loam Loam, clay loam	CL, CH A-6, A-7 A-6, A-7 A-6		0 0 0	0-5 0-5 0-5	95-100 95-100 90-100	95-100 95-100 85-98	80-90 80-90 70-80	65-80 65-80 50-75	35-55 30-60 25-35	15-35 10-20 8-15
113: Webster	0-17 17-24 24-60	Clay loam Clay loam, silty clay loam, loam. Loam, clay loam	CL, CH CL A-7, A-6 A-6, A-7 CL, CL-ML, SC A-6, A-4		0 0 0	0-5 0-5 0-5	95-100 95-100 95-100	95-100 95-100 90-100	85-95 85-95 75-90	75-85 65-85 40-70	35-45 35-45 25-35	15-25 15-25 8-15
114: Glencoe	0-10 10-34 34-80	Clay loam Silty clay loam, clay loam, loam. Loam, clay loam, silty clay loam.	OL, ML, CL OL, ML, CL CL, ML A-6, A-7 A-6, A-7 A-6, A-7		0 0 0	0 0 0	95-100 95-100 95-100	90-100 90-100 90-100	75-100 75-100 75-100	60-90 60-90 60-90	35-45 30-45 30-45	15-20 10-20 10-20
129: Cylinder	0-15 15-31 31-60	Loam Loam, clay loam Gravelly coarse sand, loamy sand.	CL CL, SC SP-SM, SM A-1, A-2, A-3		0 0 0	0 0 0-10	100 95-100 65-95	90-100 80-100 65-95	80-100 80-95 20-55	50-75 45-70 5-25	30-40 30-40 0-14	10-20 10-20 NP
130: Nicollet	0-16 16-30 30-60	Clay loam Clay loam, loam, silty clay loam. Loam, clay loam	ML, CL CL A-6, A-7 A-6, A-7 A-6		0-1 0-1 0-1	0-5 0-5 0-5	95-100 95-100 95-100	90-100 90-100 90-100	85-100 80-95 75-90	55-85 55-80 50-75	35-50 35-50 30-40	10-25 15-25 15-25

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			
													Pct
134: Okoboji	In 0-8 8-28 28-60	Silty clay loam Silty clay loam, silty clay. Silty clay loam, silty clay.	CH CH, CL CH, CL	A-7 A-7 A-7	0 0 0	0 0 0	100 100 95-100	100 100 95-100	100 100 90-100	80-95 80-95 80-95	50-60 50-60 50-60	30-35 30-35 30-35	
136: Madelia	0-16 16-30 30-60	Silty clay loam Silty clay loam, silt loam. Silt loam, silty clay loam.	ML CL ML, CL	A-7 A-7, A-6 A-6, A-4, A-7	0 0 0	0 0 0	100 100 100	100 100 100	100 100 100	90-100 90-100 90-100	40-50 30-50 30-50	10-20 10-25 5-25	
140: Spicer	0-14 14-27 27-60	Silty clay loam Silt loam, silty clay loam. Silt loam, silty clay loam.	ML ML ML	A-7, A-6 A-7, A-6 A-4, A-6	0 0 0	0 0 0	100 100 100	100 100 100	100 100 100	95-100 90-100 85-100	35-50 35-50 30-40	10-20 10-20 5-12	
143B: Chelsea	0-6 6-60	Loamy fine sand Fine sand, sand, loamy sand.	SM, SP-SM SP, SM, SP-SM	A-2-4 A-3, A-2, A-4	0 0	0 0	100 100	100 100	100 100	65-80 65-80	10-35 3-15	0-14 0-14	NP NP
178: Granby	0-13 13-26 26-60	Fine sandy loam Sand, fine sand, loamy sand. Sand, fine sand, loamy fine sand.	SM, SC, SC-SM, ML SP-SM, SM SP-SM, SM	A-2, A-4 A-3, A-2, A-1 A-3, A-2, A-1	0 0 0	0 0 0	100 100 100	100 100 100	100 95-100 95-100	60-90 45-80 45-80	30-60 5-35 5-35	0-30 0-14 0-14	NP-10 NP NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth In	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid Plasticity index	
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
					Pct	Pct						Pct
181: Litchfield-----	0-20 20-40	Loamy fine sand Stratified fine sand to very fine sandy loam.	SM SM	A-2 A-2	0 0	0 0	100 100	100 100	80-95 80-95	15-35 20-35	15-20 15-20	NP-4 NP-4
183: Dassel-----	40-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	0	100	100	70-95	5-30	15-20	NP-4
	0-23	Mucky fine sandy loam.	OL, ML	A-4	0	0	100	95-100	70-85	50-65	15-30	NP-4
	23-31	Stratified loamy fine sand to fine sandy loam.	SM	A-4, A-2	0	0	100	95-100	55-80	25-50	15-30	NP-4
	31-60	Stratified loamy sand to coarse sand.	SM, SP-SM	A-2	0	0	100	80-100	45-90	10-55	---	NP
197: Kingston-----	0-16 16-25	Silty clay loam Silty clay loam, silt loam.	CL CL, ML	A-6 A-6, A-7, A-4	0 0	0 0	100 100	100 100	95-100 95-100	85-100 85-100	30-40 25-50	10-20 6-20
	25-60	Silt loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6, A-7	0	0	100	100	95-100	85-100	25-50	5-20
211: Lura-----	0-24 24-31	Silty clay----- Silty clay, clay.	CH, OH OH, CH	A-7 A-7	0 0	0 0	100 100	100 100	95-100 95-100	90-100 90-100	50-75 50-75	25-45 25-45
	31-60	Silty clay, silty clay loam, clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	40-75	15-45
229: Waldorf-----	0-8 8-35	Silty clay loam Silty clay, silty clay loam.	ML, MH MH	A-7 A-7	0 0	0 0	100 100	100 100	95-100 95-100	90-100 95-100	45-65 50-70	14-30 20-35
	35-60	Silty clay loam, silty clay, silt loam.	MH, CL, ML, CH	A-7, A-6	0	0	100	100	95-100	90-100	35-65	11-30

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		
239: Le Sueur-----	In 0-14 14-33	Clay loam----- Clay loam, loam, silty clay loam.	CL, ML CL	A-6, A-7 A-6, A-7	0 0	0 0	95-100 95-100	95-100 95-100	90-100 85-100	75-90 60-80	35-50 35-50	10-25 15-25
281: Darfur-----	33-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-1	0-5	95-100	90-100	80-95	55-75	20-40	5-20
286B: Shorewood-----	0-23 23-30	Loam----- Fine sandy loam, loam, loamy fine sand.	OL, ML SM	A-4 A-4	0 0	0 0	100 100	100 100	100 70-100	60-80 35-50	25-40 20-30	NP-10 NP-5
286B: Shorewood-----	30-60	Stratified fine sand to fine sandy loam.	SM	A-2, A-4	0	0	100	100	50-100	15-40	---	NP
311C2: Shorewood-----	0-12 12-38	Silty clay loam Silty clay, silty clay loam.	CL, ML MH, CH	A-6, A-7 A-7	0 0	0 0	100 100	100 100	90-100 90-100	85-100 85-100	35-50 55-75	12-20 20-40
311C2: Shorewood-----	38-60	Clay loam, silty clay loam, silty clay.	CL, ML, CH	A-6, A-7	0	0-5	95-100	90-100	75-100	60-95	35-50	10-20
311C2: Shorewood-----	0-6 6-20	Silty clay----- Silty clay, silty clay loam.	MH MH, CH	A-7 A-7	0 0	0 0	100 100	100 100	90-100 90-100	85-100 85-100	50-70 55-75	15-25 20-40
311C2: Shorewood-----	20-60	Clay loam, silty clay loam, silty clay.	CL, ML, CH	A-6, A-7	0	0-5	95-100	90-100	75-100	60-95	35-50	10-20

## 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												
327A: Dickman-----	0-12 12-18	Sandy loam----- Sandy loam, fine sandy loam, loamy sand.	SM, SC-SM, SC A-2, A-4 SM, SC-SM, SC A-2, A-4		0 0	0 0	0 0	95-100 95-100	95-100 85-100	55-95 55-95	25-40 25-45	20-30 15-25	2-8 2-8
	18-60	Fine sand, coarse sand, sand.	SP-SM A-3, A-2		0	0	0	95-100	75-100	50-80	5-10	0-14	NP
327B: Dickman-----	0-12 12-30	Sandy loam----- Sandy loam, fine sandy loam, loamy sand.	SM, SC-SM, SC A-2, A-4 SM, SC-SM, SC A-2, A-4		0 0	0 0	0 0	95-100 95-100	95-100 85-100	55-95 55-95	25-40 25-45	20-30 15-25	2-8 2-8
	30-60	Fine sand, coarse sand, sand.	SP-SM A-3, A-2		0	0	0	95-100	75-100	50-80	5-10	0-14	NP
399: Biscay-----	0-14 14-25	Loam----- Loam, clay loam, sandy clay loam.	CL, ML CL, ML	A-7, A-6 A-6, A-7	0 0	0 0	0 0	95-100 95-100	95-100 90-100	70-90 70-90	50-75 50-75	35-50 30-50	10-25 10-20
	25-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM A-1		0	0	0-5	45-95	35-95	20-45	2-10	---	NP
415: Kanaranzi-----	0-9 9-18	Loam----- Loam, clay loam, coarse sandy loam.	ML, CL, CL-ML CL, ML, CL-ML	A-4, A-6 A-4, A-6	0 0	0 0	0 0	95-100 95-100	90-100 90-100	80-95 80-95	60-85 60-85	20-40 20-40	3-15 3-15
	18-60	Gravelly coarse sand.	SP, SP-SM, GP, GP-GM A-1		0	0	0-5	50-90	40-85	20-50	0-15	0-25	NP-5
423: Seaforth-----	0-12 12-28 28-60	Loam----- Loam, clay loam Loam-----	ML, CL CL CL	A-6 A-6 A-6	0 0 0	0 0 0	0-5 0-5 0-5	95-100 90-100 90-100	90-97 90-97 90-95	80-95 80-95 80-90	60-80 55-80 55-80	30-38 30-39 30-36	11-18 11-18 11-15

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		
	<u>In</u>											
461B: Koronis-----	0-8	Loam-----	CL-ML, CL	A-4, A-6	0-1	0-5	85-100	80-95	75-90	50-70	25-35	5-14
	8-31	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-6	0-1	0-5	85-100	80-95	70-90	35-70	30-40	10-20
	31-60	Sandy loam, fine sandy loam, loam.	SC-SM, SC	A-4, A-2	0-2	0-5	85-100	80-95	50-85	25-50	20-30	5-10
461C2: Koronis-----	0-8	Loam-----	CL-ML, CL	A-4, A-6	0-1	0-5	85-100	80-95	75-90	50-70	25-35	5-14
	8-24	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-6	0-1	0-5	85-100	80-95	70-90	35-70	30-40	10-20
	24-60	Sandy loam, fine sandy loam, loam.	SC-SM, SC	A-4, A-2	0-2	0-5	85-100	80-95	50-85	25-50	20-30	5-10
511: Marcellon-----	0-13	Loam-----	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	85-100	75-100	55-95	45-80	20-30	6-11
	13-32	Loam, clay loam, sandy clay loam.	CL, SC	A-6, A-2	0	0-9	85-100	75-95	60-95	25-80	30-35	11-14
	32-60	Sandy loam, fine sandy loam, gravelly sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1-b	0	0	55-100	50-95	30-85	15-50	18-25	3-8
523: Houghton-----	0-7	Muck-----	PT	A-8	0	0	0	0	0	0	---	NP
	7-60	Muck-----	PT	A-8	0	0	0	0	0	0	---	NP
525: Muskego-----	0-10	Muck-----	PT	A-8	0	0	0	0	0	0	---	NP
	10-40	Muck-----	PT	A-8	0	0	0	0	0	0	---	NP
	40-60	Coprogenous earth.	OL	A-5	0	0	95-100	95-100	85-100	75-96	40-50	2-8

Engineering Index Properties--Continued

Map symbol and soil name	Depth In	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
539: Klossner-----	0-28 28-45	Muck----- Mucky silt loam, mucky silty clay loam, silt loam.	PT MH	A-8 A-7	0 0	0 0	0 100	0 95-100	0 90-100	0 90-100	0 85-95	NP 10-30
548: Medo-----	0-24 24-29	Muck----- Sandy clay loam, mucky loam, mucky silt loam.	PT CL-ML, CL, MH	A-8 A-7, A-6	0 0	0 0	0 85-100	0 75-100	0 55-95	0 45-85	0 35-65	NP 7-25
610: Calco-----	0-6 6-55 55-60	Silty clay loam Silty clay loam Silty clay loam, loam, clay loam.	CH, CL CL, CH CL	A-7 A-7 A-7, A-6	0 0 0	0 0 0	100 100 100	100 100 100	95-100 95-100 90-100	85-100 85-100 80-100	40-60 40-60 30-45	15-30 15-30 10-20
611D: Hawick-----	0-7 7-10	Gravelly sandy loam. Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM SP-SM, SM	A-1, A-2, A-3 A-1, A-2, A-3	0-2 0-2	0-5 0-5	75-95 75-95	60-95 60-95	35-70 35-70	5-35 5-25	0-14 0-14	NP-4 NP
10-60		Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth In	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
612B: Wadenhill-----	0-13 13-30 30-60	Loam----- Loam, sandy loam, fine sandy loam. Loam, sandy loam, fine sandy loam.	CL-ML, CL CL, ML, SM, SC CL, ML, SM, SC	A-4, A-6 A-4, A-6	0-1 0-1 0-2	0-5 0-5 0-5	95-100 95-100 95-100	75-95 75-95 75-95	50-70 35-60 35-60	20-35 20-35 20-35	4-15 2-12 2-12	
613: Grovecity-----	0-15 15-30 30-60	Loam----- Sandy loam, fine sandy loam, loam. Fine sandy loam, sandy loam, loam.	CL, ML, CL-ML SM, SC, CL, ML SM, SC, CL, ML	A-4, A-6 A-4, A-6	0-1 0-1 0-2	0-3 0-3 0-3	95-100 95-100 95-100	85-100 85-100 85-100	50-70 35-65 35-65	20-40 15-35 15-35	2-15 2-13 NP-15	
664: Zook-----	0-10 10-41 41-60	Silty clay loam Silty clay, silty clay loam. Silty clay loam, silty clay, silt loam.	CH, CL CH CH, CL, ML, MH	A-7 A-7 A-7, A-6	0 0 0	0 0 0	100 100 100	95-100 95-100 95-100	95-100 95-100 95-100	45-65 60-85 35-80	20-35 35-55 10-50	
740: Hamel-----	0-28 28-56 56-60	Loam----- Clay loam, loam, silty clay loam. Loam, clay loam	ML, CL CH, CL CL	A-6, A-4 A-7 A-6, A-7	0 0 0	0 0 0-5	100 95-100 95-100	85-100 85-95 80-95	60-85 65-80 60-80	25-40 40-55 30-45	8-16 25-35 10-25	
Glencoe-----	0-15 15-45 45-60	Loam----- Silty clay loam, clay loam, loam. Loam, clay loam, silty clay loam.	OL, ML, CL OL, ML, CL CL, ML	A-6 A-6, A-7 A-6, A-7	0 0 0	0 0 0	95-100 95-100 95-100	90-100 90-100 90-100	60-90 60-90 60-90	30-35 30-45 30-45	10-15 10-20 10-20	

Engineering Index Properties--Continued

Map symbol and soil name	Depth In	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
804B: Koronis-----	0-8	Loam-----	CL-ML, CL	A-4, A-6	0-1	0-5	85-100	80-95	75-90	50-70	25-35	5-14
	8-33	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-6	0-1	0-5	85-100	80-95	70-90	35-70	30-40	10-20
	33-60	Sandy loam, fine sandy loam, loam.	SC-SM, SC	A-4, A-2	0-2	0-5	85-100	80-95	50-85	25-50	20-30	5-10
Sunburg-----	0-9	Sandy loam-----	SC, SM, SC-SM	A-4, A-2	0-1	0-5	85-95	75-95	50-80	30-50	15-30	2-10
	9-60	Loam, fine sandy loam, sandy loam.	CL, ML, SC, SM	A-4, A-6, A-2	0-2	0-5	85-95	75-95	50-85	25-60	15-33	3-12
Hawick-----	0-9	Gravelly loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-35	0-14	NP-4
	9-49	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP
	49-60	Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	0-14	NP
804C2: Koronis-----	0-8	Sandy loam-----	SM, SC, SC-SM	A-4, A-2	0-1	0-5	85-100	80-95	50-80	30-50	20-30	3-10
	8-26	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-6	0-1	0-5	85-100	80-95	70-90	35-70	30-40	10-20
	26-60	Sandy loam, fine sandy loam, loam.	SC-SM, SC	A-4, A-2	0-2	0-5	85-100	80-95	50-85	25-50	20-30	5-10
Sunburg-----	0-10	Sandy loam-----	SC, SM, SC-SM	A-4, A-2	0-1	0-5	85-95	75-95	50-80	30-50	15-30	2-10
	10-60	Loam, fine sandy loam, sandy loam.	CL, ML, SC, SM	A-4, A-6, A-2	0-2	0-5	85-95	75-95	50-85	25-60	15-33	3-12
Hawick-----	0-9	Gravelly sand	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-35	0-14	NP-4
	9-60	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
804D2: Koronis-----	In 0-8 8-25	Sandy loam----- Sandy clay loam, loam, fine sandy loam.	SM, SC, SC-SM SC, CL A-4, A-2 A-6		0-1 0-1	0-5 0-5	85-100 85-100	80-95 80-95	50-80 70-90	30-50 35-70	20-30 30-40	3-10 10-20
	25-60	Sandy loam, fine sandy loam, loam.	SC-SM, SC A-4, A-2		0-2	0-5	85-100	80-95	50-85	25-50	20-30	5-10
Sunburg-----	0-7 7-60	Sandy loam----- Loam, fine sandy loam, sandy loam.	SC, SM, SC-SM CL, ML, SC, SM A-4, A-2 A-4, A-6, A-2		0-1 0-2	0-5 0-5	85-95 85-95	75-95 75-95	50-80 50-85	30-50 25-60	15-30 15-33	2-10 3-12
Hawick-----	0-7 7-20	Gravelly sandy loam. Gravelly loamy coarse sand, gravelly coarse sand, loamy sand. Gravelly coarse sand, coarse sand, sand.	SP-SM, SM SP-SM, SM A-1, A-2, A-3 A-1, A-2, A-3		0-2 0-2	0-5 0-5	75-95 75-95	60-95 60-95	35-70 35-70	5-35 5-25	0-14 0-14	NP-4 NP
804E: Koronis-----	0-5 5-21	Fine sandy loam Sandy clay loam, loam, fine sandy loam.	SM, SC, SC-SM SC, CL A-4, A-2 A-6		0-1 0-1	0-5 0-5	85-100 85-100	80-95 80-95	50-80 70-90	30-50 35-70	20-30 30-40	3-10 10-20
	21-60	Sandy loam, fine sandy loam, loam.	SC-SM, SC A-4, A-2		0-2	0-5	85-100	80-95	50-85	25-50	20-30	5-10
Sunburg-----	0-4 4-60	Fine sandy loam Loam, fine sandy loam, sandy loam.	SC, SM, SC-SM CL, ML, SC, SM A-4, A-2 A-4, A-6, A-2		0-1 0-2	0-5 0-5	85-95 85-95	75-95 75-95	50-80 50-85	30-50 25-60	15-30 15-33	2-10 3-12

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
804E: Hawick-----	In 0-14	Gravelly loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-35	0-14	NP-4
	14-60	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP
805C2: Sunburg-----	0-8	Sandy loam-----	SC, SM, SC-SM	A-4, A-2	0-1	0-5	85-95	75-95	50-80	30-50	15-30	2-10
	8-60	Loam, fine sandy loam, sandy loam.	CL, ML, SC, SM	A-4, A-6, A-2	0-2	0-5	85-95	75-95	50-85	25-60	15-33	3-12
Wadenill-----	0-7	Loam-----	CL-ML, CL	A-4, A-6	0-1	0-5	95-100	75-95	75-90	50-70	20-35	4-15
	7-20	Loam, sandy loam, fine sandy loam.	CL, ML, SM, SC	A-4, A-6	0-1	0-5	95-100	75-95	60-85	35-60	20-35	2-12
	20-60	Loam, sandy loam, fine sandy loam.	CL, ML, SM, SC	A-4, A-6	0-2	0-5	95-100	75-95	60-85	35-60	20-35	2-12
805D2: Sunburg-----	0-7	Sandy loam-----	SC, SM, SC-SM	A-4, A-2	0-1	0-5	85-95	75-95	50-80	30-50	15-30	2-10
	7-60	Loam, fine sandy loam, sandy loam.	CL, ML, SC, SM	A-4, A-6, A-2	0-2	0-5	85-95	75-95	50-85	25-60	15-33	3-12
Wadenill-----	0-7	Loam-----	CL-ML, CL	A-4, A-6	0-1	0-5	95-100	75-95	75-90	50-70	20-35	4-15
	7-18	Loam, sandy loam, fine sandy loam.	CL, ML, SM, SC	A-4, A-6	0-1	0-5	95-100	75-95	60-85	35-60	20-35	2-12
	18-60	Loam, sandy loam, fine sandy loam.	CL, ML, SM, SC	A-4, A-6	0-2	0-5	95-100	75-95	60-85	35-60	20-35	2-12

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
807D2: Koronis-----	0-9	Sandy loam-----	SM, SC, SC-SM	A-4, A-2	0-1	0-5	85-100	80-95	50-80	30-50	20-30	3-10
	9-25	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-6	0-1	0-5	85-100	80-95	70-90	35-70	30-40	10-20
	25-60	Sandy loam, fine sandy loam, loam.	SC-SM, SC	A-4, A-2	0-2	0-5	85-100	80-95	50-85	25-50	20-30	5-10
Sunburg-----	0-7	Sandy loam-----	SC, SM, SC-SM	A-4, A-2	0-1	0-5	85-95	75-95	50-80	30-50	15-30	2-10
	7-60	Loam, fine sandy loam, sandy loam, sandy loam.	CL, ML, SC, SM	A-4, A-6, A-2	0-2	0-5	85-95	75-95	50-85	25-60	15-33	3-12
875B: Estherville-----	0-9	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0	0-5	90-100	80-100	50-75	25-50	20-30	2-10
	9-14	Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1	0	0-5	85-100	80-95	40-75	15-45	20-30	2-8
	14-60	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, SM, GP	A-1	0	0-10	55-90	50-85	10-40	2-25	0-14	NP
Hawick-----	0-7	Sandy loam-----	SM	A-2	0-2	0-5	85-100	80-95	50-65	25-35	0-20	NP-4
	7-11	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP
	11-60	Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	0-14	NP
875C: Hawick-----	0-11	Gravelly sandy loam.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-35	0-14	NP-4
	11-60	Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	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	
<b>875C:</b>													
Estherville-----	0-8	Sandy loam-----	SM, SC-SM, SC	A-2, A-4		0	0-5	90-100	80-100	50-75	25-50	20-30	2-10
	8-13	Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1		0	0-5	85-100	80-95	40-75	15-45	20-30	2-8
	13-60	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, SM, GP	A-1		0	0-10	55-90	50-85	10-40	2-25	0-14	NP
<b>887B:</b>													
Clarion-----	0-11	Loam-----	CL, CL-ML	A-4, A-6		0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	11-30	Loam, sandy loam.	CL, CL-ML	A-4, A-6		0	0-5	90-100	85-100	75-90	50-75	25-40	5-15
	30-60	Loam, clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6		0	0-5	90-100	85-98	70-85	50-75	25-40	5-15
<b>Swanlake-----</b>													
	0-8	Loam-----	CL, ML	A-6		0	0-5	90-100	85-98	75-90	50-70	28-36	9-15
	8-12	Loam, clay loam	CL	A-6		0	0-5	90-100	85-98	70-90	50-70	28-39	9-18
	12-60	Loam, clay loam	CL	A-6		0	0-5	90-100	85-98	75-90	50-75	28-39	9-18
<b>899:</b>													
Harps-----	0-9	Clay loam-----	CL, CH	A-6, A-7		0	0-5	95-100	95-100	80-90	65-80	35-55	15-35
	9-28	Loam, clay loam	CL, CH	A-6, A-7		0	0-5	95-100	95-100	80-90	65-80	30-60	10-20
	28-60	Loam, clay loam	CL	A-6		0	0-5	90-100	85-98	70-80	50-75	25-35	8-15
<b>Okoboji-----</b>													
	0-17	Silty clay loam	CH	A-7		0	0	100	100	90-100	80-95	50-60	30-35
	17-47	Silty clay loam, silty clay.	CH, CL	A-7		0	0	100	100	90-100	80-95	50-60	30-35
	47-60	Silty clay loam, silty clay.	CH, CL	A-7		0	0	95-100	95-100	90-100	80-95	50-60	30-35
<b>909C2:</b>													
Boyd-----	0-7	Silt loam-----	ML, CL, CL-ML	A-4, A-6		0	0	100	100	100	90-100	20-35	3-15
	7-60	Silt loam-----	ML, CL, CL-ML	A-4, A-6		0	0	100	100	100	90-100	20-35	3-15
<b>Truman-----</b>													
	0-10	Silt loam-----	ML, CL-ML, CL	A-4, A-6		0	0	100	100	95-100	80-100	25-40	5-15
	10-31	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7		0	0	100	100	95-100	80-100	25-45	5-20
	31-60	Silt loam-----	CL, CL-ML, ML	A-4, A-6		0	0	100	100	95-100	75-95	25-40	5-15

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							
909D2: Bold													
	0-7	Silt loam	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	3-15	
	7-60	Silt loam	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	3-15	
	0-13	Silt loam	ML, CL-ML, CL	A-4, A-6	0	0	100	100	100	95-100	80-100	25-40	5-15
Truman	13-22	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	0	100	100	100	95-100	80-100	25-45	5-20
	22-60	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	100	95-100	75-95	25-40	5-15
920B: Clarion													
	0-12	Loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15	
	12-23	Loam, sandy loam.	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-90	50-75	25-40	5-15	
	23-60	Loam, clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-98	70-85	50-75	25-40	5-15	
Storden													
	0-7	Loam	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15	
	7-37	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18	
	37-60	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18	
Hawick	0-9	Gravelly sandy loam.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-35	0-14	NP-4	
	9-28	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP	
945D2: Lester													
	28-60	Gravelly coarse sand, coarse sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	0-14	NP	
	0-9	Loam	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15	
	9-26	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20	
Storden	26-60	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18	
	0-5	Loam	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15	
	5-28	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18	
	28-60	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18	
945E: Lester													
	0-7	Loam	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15	
	7-23	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20	
23-60	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18		

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	
945E: Storden	0-9	Loam	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15
	9-30	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
	30-60	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
956: Canisteeo	0-17	Clay loam	OL, CL	A-7	0	0	95-100	95-100	85-100	60-100	40-50	15-20
	17-23	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	0	98-100	90-100	85-100	65-95	38-50	25-35
Glencoe	23-41	Clay loam, loam	CL, ML	A-6	0	0-5	90-100	80-95	60-95	50-85	30-40	5-15
	41-60	Clay loam, loam	CL	A-6	0	0-5	95-100	90-98	80-95	50-75	30-40	12-20
Omsrud	0-7	Clay loam	OL, ML, CL	A-6, A-7	0	0	95-100	90-100	75-100	60-90	35-45	15-20
	7-36	Silty clay loam, clay loam, loam.	OL, ML, CL	A-6, A-7	0	0	95-100	90-100	75-100	60-90	30-45	10-20
960C2: Storden	36-60	Loam, clay loam, silty clay loam.	CL, ML	A-6, A-7	0	0	95-100	90-100	75-100	60-90	30-45	10-20
	0-8	Loam	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15
Omsrud	8-21	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
	21-60	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
960D2: Storden	0-9	Loam	CL, ML	A-6, A-2-6	0	0-5	95-100	90-98	85-95	55-75	30-35	11-15
	9-25	Loam, clay loam	CL, ML	A-6, A-2-6	0	0-5	90-100	85-98	75-95	55-80	32-39	13-18
Omsrud	25-60	Loam, clay loam	CL, ML	A-6, A-2-6	0	0-5	90-100	85-98	75-95	55-85	32-39	13-18
	0-7	Loam	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15
978: Cordova	7-23	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
	23-60	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
Omsrud	0-8	Loam	CL, ML	A-6, A-2-6	0	0-5	95-100	90-98	85-95	55-75	30-35	11-15
	8-22	Loam, clay loam	CL, ML	A-6, A-2-6	0	0-5	90-100	85-98	75-95	55-80	32-39	13-18
978: Cordova	22-60	Loam, clay loam	CL, ML	A-6, A-2-6	0	0-5	90-100	85-98	75-95	55-85	32-39	13-18
	0-15	Clay loam	CL, ML, MH, OH	A-6, A-7	0	0	95-100	95-100	90-100	70-85	38-60	12-25
Omsrud	15-39	Silty clay loam, clay loam.	CL	A-7	0	0	90-100	90-100	85-95	65-90	40-50	20-30
	39-60	Clay loam, loam	CL	A-6	0	0-5	90-100	90-100	80-95	55-70	30-40	12-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
978: Rolfe-----	In 0-28 28-40	Silt loam----- Clay, silty clay, clay loam.	OL, CL, ML CH	A-6, A-4 A-7	0 0	0 0	100 100	95-100 95-100	90-100 90-100	80-95 75-95	30-40 50-65	5-15 25-35
1015: Udipsammits-----	0-14 14-60 60-80	Sand----- Sand, fine sand Coarse sand, gravelly coarse sand.	SM, SP-SM SP-SM, SP SP, SP-SM, GP-GM	A-2 A-2, A-3 A-1, A-2	0 0 0	0 0 0	95-100 95-100 75-100	85-100 85-100 65-85	75-90 50-75 40-65	10-35 5-25 1-10	---	NP NP NP
1016: Udorthents-----	0-60 60-80	Loam----- Variable-----	ML, SM, SC-SM, CL-ML ---	A-4, A-6 ---	0 0	0-10 0	95-100 0	90-100 0	65-95 0	35-75 0	0-30 ---	NP-15 NP
1030: Pits, gravel.												
Udipsammits-----	0-14 14-60 60-80	Sand----- Sand, fine sand Coarse sand, gravelly coarse sand.	SM, SP-SM SP-SM, SP SP, SP-SM, GP-GM	A-2 A-2, A-3 A-1, A-2	0 0 0	0 0 0	95-100 95-100 75-100	85-100 85-100 65-85	75-90 50-75 40-65	10-35 5-25 1-10	---	NP NP NP
1080: Klossner-----	0-25 25-60	Muck----- Clay loam, loam, mucky silty clay loam.	PT CL-ML, CL	A-8 A-4, A-6, A-7	0 0	0 0	0 90-100	0 85-100	0 80-100	0 60-90	0-14 25-55	NP 10-30
Okoboji-----	0-10 10-42 42-60	Mucky silty clay loam. Silty clay loam, silty clay. Silty clay loam, silty clay.	MH CH CH CH	A-7 A-7 A-7 A-7	0 0 0 0	0 0 0 0	100 100 100 95-100	100 100 100 95-100	95-100 80-95 80-95 80-95	60-90 55-65 55-65 80-95	10-30 30-40 30-40 30-40	

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	
1080: Glencoe-----	0-42	Silty clay loam	OL, OH, MH, CL	A-6, A-7		0	0	95-100	90-100	75-100	60-90	30-55	10-25
	42-50	Loam, clay loam, silty clay loam.	MH, CL	A-6, A-7		0	0	95-100	90-100	75-100	60-90	30-50	10-25
	50-60	Loam, clay loam	CL, ML	A-6, A-7		0	0	90-100	85-100	60-95	55-75	30-50	10-20
1096: Fieldon-----	0-20	Loam-----	CL-ML, CL, ML	A-4		0	0	100	100	85-95	50-75	20-35	NP-10
	20-26	Fine sandy loam, very fine sandy loam, loam.	ML, SM	A-4		0	0	100	100	70-90	35-60	15-30	NP-5
	26-60	Stratified fine sand to fine sandy loam.	SM	A-2, A-4		0	0	100	100	60-100	15-40	---	NP
Dassel-----	0-21	Loam-----	OL, ML	A-4		0	0	100	95-100	70-85	50-65	15-30	NP-4
	21-32	Stratified loamy fine sand to fine sandy loam.	SM	A-4, A-2		0	0	100	95-100	55-80	25-50	15-30	NP-4
	32-60	Stratified loamy sand to coarse sand.	SM, SP-SM	A-2		0	0	100	80-100	45-90	10-55	---	NP
1097: Mayer-----	0-16	Loam-----	CL, ML	A-6, A-4		0	0-2	95-100	85-100	70-90	50-85	30-40	5-20
	16-25	Sandy clay loam, silt loam, clay loam.	CL, SC, ML, SM	A-6, A-4		0	0-10	65-95	45-85	20-45	2-10	30-40	5-15
	25-60	Gravelly coarse sand, sand, coarse sand.	SP, SW, SP-SM	A-1		0-1	0-10	65-95	45-85	20-45	2-10	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
1097: Biscay	0-20 20-25	Clay loam Loam, clay loam, sandy clay loam.	CL, ML CL, ML	A-7, A-6 A-6, A-7	0 0	0 0	95-100 95-100	95-100 90-100	70-90 70-90	50-75 50-75	35-50 30-50	10-25 10-20
	25-28	Gravelly loam, sandy loam, gravelly sandy loam.	SM, SC-SM, SC	A-4	0	0-5	95-100	70-95	50-80	35-50	15-30	2-10
	28-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	45-95	35-95	20-45	2-10	---	NP
1098: Biscay	0-20 20-25	Loam Loam, clay loam, sandy clay loam.	CL, ML CL, ML	A-7, A-6 A-6, A-7	0 0	0 0	95-100 95-100	95-100 90-100	70-95 70-90	50-80 50-75	35-50 30-50	10-25 10-20
	25-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	45-95	35-95	20-45	2-10	---	NP
Biscay, depressional	0-18 18-22	Clay loam Loam, clay loam, sandy clay loam.	CL, ML CL, ML	A-7, A-6 A-6, A-7	0 0	0 0	95-100 95-100	95-100 90-100	70-90 70-90	50-75 50-75	35-50 30-50	10-25 10-20
	22-26	Gravelly loam, sandy loam, gravelly sandy loam.	SM, SC-SM, SC	A-4	0	0-5	95-100	70-95	50-80	35-50	15-30	2-10
	26-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	45-95	35-95	20-45	2-10	---	NP
1099: Granby	0-12 12-24	Loamy fine sand Sand, fine sand, loamy sand.	SM SP-SM, SM	A-2 A-3, A-2, A-1	0 0	0 0	100 100	100 95-100	50-80 45-80	15-35 5-35	0-14 0-14	NP NP
	24-60	Coarse sand, fine sand, loamy sand.	SP-SM, SM	A-3, A-2, A-1	0	0	100	95-100	45-80	5-35	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
1100: Nicollet-----	0-13	Silty clay loam	ML, CL	A-6, A-7	0-1	0-5	95-100	90-100	85-100	55-85	35-50	10-25
	13-26	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-1	0-5	95-100	90-100	80-95	55-80	35-50	15-25
	26-60	Loam, clay loam	CL	A-6	0-1	0-5	95-100	90-100	75-90	50-75	30-40	15-25
1101: Webster-----	0-19	Silty clay loam	CL, CH	A-7, A-6	0	0-5	95-100	95-100	85-95	80-90	35-45	15-25
	19-24	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0	0-5	95-100	95-100	85-95	65-85	35-45	15-25
	24-60	Loam, clay loam	CL, CL-ML, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	40-70	25-35	8-15
1159B: Strout-----	0-10	Clay-----	CL, CH	A-7	0-1	0-2	98-100	95-100	90-100	75-95	45-60	20-35
	10-24	Clay loam, clay	CL, CH	A-7	0-2	0-2	95-100	95-100	90-100	75-95	45-60	20-30
	24-60	Clay loam, clay	CL, CH	A-7	0-2	0-4	95-100	95-100	90-100	70-95	40-55	20-30
Arkton-----	0-9	Clay loam-----	CL	A-7	0-1	0-3	95-100	85-100	75-100	65-95	40-50	15-25
	9-25	Clay, silty clay, clay loam.	CH, CL	A-7	0-1	0-3	95-100	85-100	75-100	70-95	40-60	15-35
	25-60	Clay loam, loam	CL, CH	A-6, A-7	0-1	0-3	95-100	85-100	70-100	55-90	35-60	11-30
1161: Barry-----	0-11	Loam-----	SC, CL	A-4, A-6	0	2-5	95-98	90-95	60-80	40-70	25-35	8-15
	11-33	Loam, sandy clay loam.	CL	A-6	0	5-7	90-95	85-95	60-80	50-75	28-35	10-15
	33-60	Sandy loam, fine sandy loam.	SC, SC-SM, CL-ML, CL	A-4	0	5-7	90-95	85-95	50-75	35-55	20-25	5-10
1162A: Kandiyohi-----	0-11	Clay-----	CH	A-7	0-1	1-2	95-100	95-98	95-98	85-95	55-65	25-40
	11-26	Silty clay, silty clay loam, clay.	CH	A-7	0-1	1-2	95-100	95-98	95-98	85-95	55-70	25-50
	26-33	Clay loam, silty clay, clay.	CH, CL	A-7	0-2	2-4	95-100	95-98	90-95	75-95	50-70	20-45
33-60	Clay loam, clay	CH, CL	A-7	0-2	2-5	95-100	95-98	80-95	70-95	45-70	20-45	

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index	
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200			
	In					Pct					Pct		
1162B: Kandiyohi-----	0-10	Clay-----	CH			0-1	1-2	95-100	95-98	95-98	85-95	55-65	25-40
	10-23	Silty clay, silty clay loam, clay.	CH			0-1	1-2	95-100	95-98	95-98	85-95	55-70	25-50
	23-29	Clay loam, silty clay, clay.	CH, CL			0-2	2-4	95-100	95-98	90-95	75-95	50-70	20-45
	29-60	Clay loam, clay	CH, CL			0-2	2-5	95-100	95-98	80-95	70-95	45-70	20-45
1163: Cohoctah-----	0-17	Loam-----	ML, CL, CL-ML	A-4		0	0	100	100	85-95	50-85	0-30	0-10
	17-22	Loam, fine sandy loam, sandy loam.	ML, SM, SC, CL	A-4, A-2		0	0	95-100	85-100	70-90	30-70	0-30	0-10
	22-60	Coarse sand, sand, loamy fine sand.	SP, SM, SW, SP-SM	A-3, A-2, A-1		0	0-2	90-100	85-100	40-80	2-30	0-25	NP
1165: Lundlake-----	0-14	Silty clay loam	OL, ML, CL	A-6, A-7		0-1	0-3	95-99	90-95	65-90	50-80	37-43	16-21
	14-35	Loam, clay loam, silty clay loam.	CL, ML, CL-ML	A-6		0-1	1-3	95-99	90-95	65-90	50-80	30-39	11-18
	35-47	Loam, sandy clay loam, sandy loam.	CL, SC	A-6, A-4		0-1	3-5	90-95	85-95	60-85	45-60	28-36	9-15
	47-60	Sandy loam, fine sandy loam, loam.	CL, SC, SM	A-4		0-2	3-7	85-95	75-95	60-80	35-55	21-26	4-8
1168: Swedegrove-----	0-15	Loam-----	CL, SC	A-6, A-4		0-1	1-3	90-98	85-95	70-85	45-75	30-35	10-15
	15-31	Loam, sandy clay loam, fine sandy loam.	CL, SC, SC-SM	A-6, A-4		0-1	3-5	85-95	85-95	60-85	45-65	30-35	5-10
	31-60	Sandy loam, fine sandy loam.	CL-ML, SC-SM, SC	A-4		0-2	3-7	85-95	85-95	60-75	35-55	20-25	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		
	<u>In</u>											
1168: Lundlake-----	0-12 12-28	Silty clay loam Loam, clay loam, silty clay loam.	OL, ML, CL CL, ML, CL-ML A-6, A-7 A-6		0-1 0-1	0-3 1-3	95-99 95-99	90-95 90-95	65-90 65-90	50-80 50-80	37-43 30-39	16-21 11-18
	28-36	Loam, sandy clay loam, sandy loam.	CL, SC A-6, A-4		0-1	3-5	90-95	85-95	60-85	45-60	28-36	9-15
	36-60	Sandy loam, fine sandy loam, loam.	CL, SC, SM A-4		0-2	3-7	85-95	75-95	60-80	35-55	21-26	4-8
1169: Corvuso-----	0-11 11-28	Clay loam----- Silty clay, clay, silty clay loam.	CH, MH CH, MH A-7 A-7		0-1 0-1	0-1 1-2	100 100	95-100 95-100	90-100 90-100	75-95 75-95	50-65 50-70	30-45 30-50
	28-60	Clay loam, clay, silty clay.	CH, CL A-7		0-2	2-4	95-100	95-98	80-95	70-95	45-70	25-45
Lura-----	0-26 26-60	Silty clay----- Silty clay, clay.	CH, OH OH, CH A-7 A-7		0 0	0 0	100 100	100 100	95-100 95-100	90-100 90-100	50-75 50-75	25-45 25-45
1171C: Newlondon-----	0-7 7-38	Clay loam----- Clay loam, clay, silty clay.	CL, CH CL, CH A-7 A-7		0-1 0-2	0-2 0-3	98-100 95-100	95-100 95-100	90-100 90-100	75-95 70-95	40-55 40-55	20-30 20-30
	38-60	Clay loam, loam	CL, CH A-6, A-7		0-1	0-3	95-100	85-100	70-100	55-90	35-55	11-30
Strout-----	0-9 9-23 23-60	Clay loam----- Clay loam, clay Clay loam, clay	CL, CH CL, CH A-7 A-7		0-1 0-2 0-2	0-2 0-2 0-4	98-100 95-100 95-100	95-100 95-100 95-100	90-100 90-100 90-100	75-95 75-95 70-95	45-60 45-60 40-55	20-35 20-30 20-30
1171D: Newlondon-----	0-7 7-38	Clay loam----- Clay loam, clay, silty clay.	CL, CH CL, CH A-7 A-7		0-1 0-2	0-2 0-3	98-100 95-100	95-100 90-100	90-100 90-100	75-95 70-95	40-55 40-55	20-30 20-30
	38-60	Clay loam, loam	CL, CH A-6, A-7		0-1	0-3	95-100	85-100	70-100	55-90	35-55	11-30

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
1171D: Strout	In											
	0-9	Clay loam	CL, CH	A-7	0-1	0-2	98-100	95-100	90-100	75-95	45-60	20-35
	9-19	Clay loam, clay	CL, CH	A-7	0-2	0-2	95-100	95-100	90-100	75-95	45-60	20-30
1172C: Sparta	19-60	Clay loam, clay	CL, CH	A-7	0-2	0-4	95-100	95-100	90-100	70-95	40-55	20-30
	0-18	Loamy sand	SM	A-2, A-4	0	0	85-100	85-100	35-95	15-50	0-14	NP
	18-55	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	0	85-100	85-100	50-95	5-50	0-14	NP
Gardencity	55-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	0	85-100	85-100	50-95	2-30	0-14	NP
	0-7	Fine sandy loam	SM	A-2, A-3	0	0	100	100	75-85	40-65	10-35	2-10
	7-24	Stratified fine sand to silt loam.	SM, ML, CL-ML	A-2, A-3, A-4	0	0	100	100	65-100	30-90	10-30	4-10
1173: Muskego	24-60	Stratified fine sand to silt loam.	SM, ML, CL-ML	A-2, A-3, A-4	0	0	100	100	65-100	30-90	10-35	4-10
	0-45	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	45-60	Coprogenous earth.	PT	A-5	0	0	100	100	95-100	95-100	40-50	2-4
Klossner	0-22	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	22-45	Mucky silt loam, mucky silty clay loam.	MH	A-7	0	0	100	95-100	90-100	85-95	60-90	35-65
	45-60	Silt loam, loam, silty clay loam.	CL, ML	A-7, A-6	0	0-5	90-100	85-100	60-100	55-90	35-65	10-25
1174: Danielson	0-9	Clay loam	CL, CH	A-7	0-1	0-1	95-100	95-100	80-90	75-90	40-60	20-30
	9-36	Silty clay loam, silty clay.	CH, MH	A-7	0-1	1-2	95-100	95-100	85-95	85-95	45-60	20-35
	36-51	Silty clay loam, silty clay, clay.	CH, MH	A-7	0-1	1-2	95-100	95-100	85-95	85-95	50-65	30-40
51-60	Silty clay loam, clay loam, clay.	CH, CL	A-7	0-1	2-4	90-95	90-95	70-95	70-95	40-60	20-40	

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct						Pct
1175: Swedegrove-----	0-14	Loam-----	CL, SC	A-6, A-4	0-1	1-3	90-98	85-95	70-85	45-75	30-35	10-15
	14-20	Loam, sandy clay loam, fine sandy loam.	CL, SC, SC-SM	A-6, A-4	0-1	3-5	85-95	85-95	60-85	45-65	30-35	5-10
	20-60	Sandy loam, fine sandy loam.	CL-ML, SC-SM, SC	A-4	0-2	3-7	85-95	85-95	60-75	35-55	20-25	5-10
1176: Litchfield-----	0-17	Sandy loam-----	SC-SM, SC	A-2, A-4	0	0	100	100	60-75	30-45	20-25	5-10
	17-33	Loamy sand, loamy fine sand.	SM, SC-SM	A-2	0	0	100	100	50-70	5-15	10-20	NP-5
	33-60	Sand, fine sand	SP-SM, SM	A-2, A-3	0	0	100	100	50-75	5-15	---	NP
1177C: Gardencity-----	0-13	Fine sandy loam	SM	A-2, A-3	0	0	100	100	75-85	40-65	10-35	2-10
	13-25	Stratified fine sand to silt loam.	SM, ML, CL-ML	A-2, A-3, A-4	0	0	100	100	65-100	30-90	10-30	4-10
	25-60	Stratified fine sand to silt loam.	SM, ML, CL-ML	A-2, A-3, A-4	0	0	100	100	65-100	30-90	10-35	4-10
Bold-----	0-7	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	3-15
	7-60	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	3-15
1178: Uniongrove-----	0-16	Loam-----	CL	A-6	0-1	1-4	90-98	85-95	70-85	50-75	30-35	10-15
	16-30	Loam, sandy clay loam, fine sandy loam.	CL	A-6, A-4	0-2	4-6	90-98	85-95	60-85	50-70	25-35	10-15
	30-60	Sandy loam, fine sandy loam.	SC, SC-SM, CL-ML	A-4	0-2	4-6	90-95	85-95	60-75	35-55	20-25	5-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
1183: Crowriver-----	In					Pct	Pct					
	0-15	Loam-----	SM, SC-SM, SC, CL	A-4, A-6	0-1	1-3	95-99	85-95	65-90	40-60	25-30	7-11
	15-22	Sandy clay loam, loam, fine sandy loam.	SC-SM, SC, CL	A-4, A-6	0-1	1-3	85-95	85-95	65-85	40-60	23-32	6-13
1184: Corvuso-----	22-60	Sandy loam, fine sandy loam.	SC, SC-SM, CL-ML	A-4	0-2	3-7	85-95	80-95	60-80	35-55	23-28	6-9
	0-19	Silty clay loam	CH, MH	A-7	0-1	0-1	100	95-100	90-100	75-95	50-70	30-50
	19-26	Silty clay, clay, silty clay loam.	CH, MH	A-7	0-1	1-2	100	95-100	90-100	75-95	50-70	30-50
1185: Gardencity-----	26-60	Clay loam, clay, silty clay.	CH, CL	A-7	0-2	2-4	95-100	95-98	80-95	70-95	45-70	25-45
	0-19	Fine sandy loam	SM	A-2, A-3	0	0	100	100	75-85	40-65	10-35	2-10
	19-24	Stratified fine sand to silt loam.	SM, ML, CL-ML	A-2, A-3, A-4	0	0	100	100	65-100	30-90	10-30	4-10
1186: Forestcity-----	24-60	Stratified fine sand to silt loam.	SM, ML, CL-ML	A-2, A-3, A-4	0	0	100	100	65-100	30-90	10-35	4-10
	0-22	Fine sandy loam	SC-SM, SC	A-4, A-2	0-1	0-2	98-100	90-98	55-75	25-50	20-30	4-9
	22-36	Loam, sandy clay loam, clay loam.	CL	A-6	0-4	2-5	95-98	90-95	75-90	50-75	30-40	10-15
1187: Forestcity-----	36-60	Loam, sandy clay loam, clay loam.	CL, CL-ML, SC	A-6, A-4	0-4	3-6	95-98	85-95	60-90	35-70	20-40	5-15
	60-65	Fine sandy loam, sandy loam.	SC-SM, SC, CL-ML	A-4	0-4	3-6	90-95	85-95	60-75	35-55	20-30	4-8

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		
1186: Lundlake-----	In					Pct	Pct					Pct
	0-20	Loam-----	OL, ML, CL, CL-ML	A-6	0-1	1-3	95-99	90-95	65-90	50-80	30-36	11-15
	20-28	Loam, clay loam, silty clay loam.	CL, ML, CL-ML	A-6	0-1	1-3	95-99	90-95	65-90	50-80	30-39	11-18
	28-46	Loam, sandy clay loam, sandy loam.	CL, SC	A-6, A-4	0-1	3-5	90-95	85-95	60-85	45-60	28-36	9-15
1192: Crowriver-----	46-60	Sandy loam, fine sandy loam, loam.	CL, SC, SM	A-4	0-2	3-7	85-95	75-95	60-80	35-55	21-26	4-8
	0-13	Fine sandy loam	SM, SC-SM, SC, CL	A-4, A-6	0-1	1-3	95-99	85-95	65-90	40-60	25-30	7-11
	13-17	Sandy clay loam, loam, fine sandy loam.	SC-SM, SC, CL	A-4, A-6	0-1	1-3	85-95	85-95	65-85	40-60	23-32	6-13
	17-60	Sandy loam, fine sandy loam.	SC, SC-SM, CL-ML	A-4	0-2	3-7	85-95	80-95	60-80	35-55	23-28	6-9
Lundlake-----	0-22	Loam-----	OL, ML, CL, CL-ML	A-6	0-1	1-3	95-99	90-95	65-90	50-80	30-36	11-15
	22-28	Loam, clay loam, silty clay loam.	CL, ML, CL-ML	A-6	0-1	1-3	95-99	90-95	65-90	50-80	30-39	11-18
	28-35	Loam, sandy clay loam, sandy loam.	CL, SC	A-6, A-4	0-1	3-5	90-95	85-95	60-85	45-60	28-36	9-15
	35-60	Sandy loam, fine sandy loam, loam.	CL, SC, SM	A-4	0-2	3-7	85-95	75-95	60-80	35-55	21-26	4-8
1193: Cosmos-----	0-15	Silty clay-----	CH, MH	A-7	0-1	0-1	98-100	98-100	95-100	85-95	50-65	30-40
	15-30	Silty clay, silty clay loam, clay.	CH, MH	A-7	0-1	0-2	98-100	98-100	95-100	85-95	50-75	30-50
	30-60	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	0-4	95-100	95-98	90-95	70-95	40-60	18-35

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
1197: Cohoctah-----	In 0-21	Fine sandy loam	ML, SM, SC, CL	A-4, A-2	0	0	100	100	60-95	30-65	0-30	NP-10
	21-36	Loam, fine sandy loam, sandy loam.	ML, SM, SC, CL	A-4, A-2	0	0	95-100	85-100	70-90	30-70	0-30	NP-10
	36-60	Loam, sandy loam, loamy fine sand.	ML, SM, SC, CL	A-4, A-2	0	0	95-100	85-100	65-90	20-70	0-30	NP-10
1198B: Rohrbeck-----	0-6	Loamy sand-----	SM	A-2	0	0-1	98-100	95-100	70-90	15-35	5-15	NP-2
	6-25	Sand, fine sand, loamy sand.	SM, SP-SM	A-2	0	0-1	98-100	95-100	65-90	10-25	5-15	NP-2
	25-41	Sandy loam, sandy clay loam, loam.	SC, CL, SC-SM	A-4, A-6	0-1	0-5	85-100	80-95	65-90	30-60	25-40	10-15
	41-60	Sandy loam, fine sandy loam.	SC, SC-SM, CL-ML	A-4	0-1	0-5	85-100	80-95	50-85	35-55	20-30	5-10
Koronis-----	0-9	Sandy loam-----	SM, SC, SC-SM	A-4, A-2	0-1	0-5	85-100	80-95	50-80	30-50	20-30	3-10
	9-28	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-6	0-1	0-5	85-100	80-95	70-90	35-70	30-40	10-20
	28-60	Sandy loam, fine sandy loam, loam.	SC-SM, SC	A-4, A-2	0-2	0-5	85-100	80-95	50-85	25-50	20-30	5-10
1199: Klossner-----	0-38	Muck-----	PT	A-8	0	0	0	0	0	0	0-14	NP
	38-60	Clay loam, loam, mucky silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	0	90-100	85-100	80-100	60-90	25-55	10-30
Lundlake-----	0-26	Mucky loam-----	OL, CL, ML	A-6	0-1	1-3	95-99	90-95	65-90	50-80	30-36	11-15
	26-56	Loam, clay loam, silty clay loam.	CL, ML	A-6	0-1	1-3	95-100	90-100	65-95	50-90	30-36	11-15
	56-60	Sandy loam, loam, fine sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-2-4	0-2	3-7	85-95	75-95	60-80	35-55	21-26	4-8

## 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		
1203:	In											
Muskego-----	0-10	Muck-----	PT	A-8	0	0	0	0	0	---	NP	
	10-29	Coprogenous earth.	OL, ML	A-5	0	0	95-100	95-100	85-100	75-96	41-50	2-8
	29-60	Loam, clay loam	CL, ML	A-6, A-7	0	0	94-100	88-100	60-95	55-75	30-50	10-20
Blue Earth-----	0-50	Mucky silt loam	OL, ML	A-5	0	0	95-100	95-100	85-95	80-95	41-50	2-8
	50-60	Mucky silty clay loam, clay loam, mucky silt loam.	OL, ML	A-5	0	0	95-100	80-100	80-95	80-95	41-50	2-8
Houghton-----	0-60	Muck-----	PT	A-8	0	0	0	0	0	---	NP	
1204B:												
Reedslake-----	0-12	Loam-----	CL, CL-ML	A-6	0	0-2	95-100	90-98	80-95	60-75	30-35	10-15
	12-26	Clay loam, loam	CL	A-6, A-7	0	0-5	95-100	90-98	80-95	60-80	32-45	12-25
	26-60	Loam-----	CL, CL-ML	A-6	0	0-5	95-100	90-98	80-95	55-75	30-36	11-15
1213C:												
Cokato-----	0-16	Loam-----	CL, CL-ML	A-6	0	0-2	95-100	90-98	80-95	60-70	32-36	13-15
	16-41	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	0-5	95-100	90-98	80-95	65-80	34-43	14-21
	41-60	Loam-----	CL, CL-ML	A-6	0	0-5	95-100	90-98	80-95	55-75	30-39	11-18
Storden-----	0-9	Loam-----	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15
	9-18	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
	18-60	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
1220C:												
Cokato-----	0-10	Loam-----	CL, CL-ML	A-6	0	0-2	95-100	90-98	80-95	60-70	32-36	13-15
	10-29	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	0-5	95-100	90-98	80-95	65-80	34-43	14-21
	29-60	Loam-----	CL, CL-ML	A-6	0	0-5	95-100	90-98	80-95	55-75	30-39	11-18
Storden-----	0-9	Loam-----	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15
	9-60	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquidity index	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
1220C: Hawick-----	In											
	0-8	Gravelly sandy loam.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-35	0-14	NP-4
	8-33	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP
	33-60	Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	0-14	NP
1362B: Angus-----	0-9	Loam-----	CL		0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	9-35	Clay loam, loam	CL		0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	35-60	Loam, clay loam	CL		0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
1383A: Shorewood-----	0-9	Silty clay loam	CL, ML	A-6, A-7	0	0	100	100	90-100	85-100	35-50	12-20
	9-46	Silty clay, silty clay loam.	MH, CH	A-7	0	0	100	100	90-100	85-100	55-75	20-40
	46-60	Clay loam, silty clay loam, silty clay.	CL, ML, CH	A-6, A-7	0	0-5	95-100	90-100	75-100	60-95	35-50	10-20
1384: Minneopa-----	0-7	Loam-----	CL, CL-ML	A-6	0	0	95-100	85-100	70-95	50-75	20-35	4-13
	7-15	Loam, sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	0	90-100	85-100	55-90	25-70	16-28	3-9
	15-25	Loamy sand, gravelly loamy sand, gravelly coarse sand.	SP, SP-SM, GP	A-1	0	0	70-100	50-90	10-55	2-10	---	NP
	25-60	Gravelly loamy sand, gravelly sand, gravelly coarse sand.	SP, SP-SM, SM, GP	A-1	0	0	70-100	50-90	10-40	0-10	---	NP
1385: Havelock-----	0-15	Loam-----	CL	A-6	0	0	100	95-100	85-95	60-75	30-40	10-20
	15-38	Clay loam, silty clay loam.	CL, CH	A-7	0	0	100	100	95-100	65-85	45-55	20-30
	38-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0	100	90-100	60-70	40-60	20-40	5-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	ASHFTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct						Pct
1387A: Collinwood-----	0-13	Silty clay loam	CL, CH, ML, MH	A-7	0	0	100	100	95-100	90-95	40-55	15-25
	13-32	Silty clay, clay, silty clay loam.	MH, CH	A-7	0	0	100	100	95-100	90-95	50-65	20-35
	32-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	0	100	100	95-100	90-95	40-60	15-30
1391B: Wadenhall-----	0-9	Loam-----	CL-ML, CL	A-4, A-6	0-1	0-5	95-100	75-95	75-90	50-70	20-35	4-15
	9-25	Loam, sandy loam, fine sandy loam.	CL, ML, SM, SC	A-4, A-6	0-1	0-5	95-100	75-95	60-85	35-60	20-35	2-12
	25-60	Loam, sandy loam, fine sandy loam.	CL, ML, SM, SC	A-4, A-6	0-2	0-5	95-100	75-95	60-85	35-60	20-35	2-12
	0-7	Fine sandy loam	SC, SM, SC-SM	A-4, A-2	0-1	0-5	85-95	75-95	50-80	30-50	15-30	2-10
1406: Medco-----	7-60	Loam, fine sandy loam, sandy loam.	CL, ML, SC, SM	A-4, A-6, A-2	0-2	0-5	85-95	75-95	50-85	25-60	15-33	3-12
	0-20	Muck-----	PT	A-8	0	0	0	0	0	0	---	NP
	20-28	Sandy clay loam, mucky loam, mucky silt loam.	CL-ML, CL, MH	A-7, A-6	0	0	85-100	75-100	55-95	45-85	35-65	7-25
Dassel-----	28-34	Silt loam, sandy loam, silty clay loam.	CL-ML, CL, ML	A-6	0	0	85-100	75-100	55-95	45-85	25-39	7-18
	34-60	Gravelly coarse sand, gravelly loamy coarse sand, fine sand.	SM, SP-SM, SP, GP	A-2, A-4, A-3, A-1	0-2	0-5	75-95	60-95	20-75	2-40	15-25	NP-7
Dassel-----	0-14	Fine sandy loam	SM, OL	A-4	0	0	100	95-100	70-85	40-50	15-30	NP-4
	14-31	Stratified loamy fine sand to fine sandy loam.	SM	A-4, A-2	0	0	100	95-100	55-80	25-50	15-30	NP-4
	31-60	Stratified loamy sand to coarse sand.	SM, SP-SM	A-2	0	0	100	80-100	45-90	10-55	---	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		
1406: Biscay-----	In											
	0-10	Mucky loam-----	CL, ML	A-7, A-6	0	0	95-100	95-100	70-90	50-75	35-50	10-25
	10-29	Loam, clay loam, sandy clay loam.	CL, ML	A-6, A-7	0	0	95-100	90-100	70-90	50-75	30-50	10-20
1801B: Gardencity-----	29-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	45-95	35-95	20-45	2-10	---	NP
	0-13	Very fine sandy loam.	SM	A-2, A-3	0	0	100	100	75-85	40-65	10-35	2-10
	13-34	Stratified fine sand to silt loam.	SM, ML	CL-ML, A-2, A-3, A-4	0	0	100	100	65-100	30-90	10-30	4-10
34-60	Stratified fine sand to silt loam.	SM, ML	CL-ML, A-2, A-3, A-4	0	0	100	100	65-100	30-90	10-35	4-10	

## 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	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
8B: Sparta-----	0-16	3-10	1.20-1.40	2.00-6.00	0.09-0.12	Low-----	1.0-2.0	0.17	0.17	5	2	134
	16-29	1-8	1.40-1.60	6.00-20.00	0.05-0.11	Low-----	0.1-1.0	0.15	0.15			
	29-60	0-5	1.50-1.70	6.00-20.00	0.04-0.07	Low-----	0.0-0.5	0.15	0.15			
8C: Sparta-----	0-7	3-10	1.20-1.40	2.00-6.00	0.09-0.12	Low-----	1.0-2.0	0.17	0.17	5	2	134
	7-13	1-8	1.40-1.60	6.00-20.00	0.05-0.11	Low-----	0.1-1.0	0.15	0.15			
	13-60	0-5	1.50-1.70	6.00-20.00	0.04-0.07	Low-----	0.0-0.5	0.15	0.15			
8D: Sparta-----	0-9	3-10	1.20-1.40	2.00-6.00	0.09-0.12	Low-----	1.0-2.0	0.17	0.17	5	2	134
	9-40	1-8	1.40-1.60	6.00-20.00	0.05-0.11	Low-----	0.1-1.0	0.15	0.15			
	40-60	0-5	1.50-1.70	6.00-20.00	0.04-0.07	Low-----	0.0-0.5	0.15	0.15			
35: Blue Earth-----	0-8	18-32	0.20-0.80	0.60-2.00	0.18-0.24	Moderate	10-25	0.28	0.28	5	6	48
	8-60	18-32	0.20-0.80	0.60-2.00	0.18-0.24	Low-----	10-25	0.28	0.28			
39A: Wadena-----	0-13	18-27	1.30-1.50	0.60-2.00	0.20-0.22	Low-----	3.0-6.0	0.24	0.24	4	6	48
	13-29	18-30	1.35-1.50	0.60-2.00	0.14-0.19	Low-----	0.5-1.0	0.32	0.32			
	29-60	1-5	1.55-1.65	20.0-63.0	0.02-0.04	Low-----	0.0-0.5	0.10	0.10			
41A: Estherville-----	0-12	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low-----	2.0-4.0	0.20	0.20	3	3	86
	12-15	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low-----	0.0-0.5	0.20	0.20			
	15-60	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low-----	0.0-0.5	0.10	0.10			
85: Calco-----	0-22	28-33	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	5.0-7.0	0.28	0.28	5	4L	86
	22-60	30-35	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	3.0-5.0	0.28	0.28			
86: Canisteo-----	0-18	27-35	1.25-1.35	0.60-2.00	0.18-0.22	Moderate	4.0-8.0	0.24	0.24	5	4L	86
	18-26	25-35	1.35-1.50	0.60-2.00	0.15-0.19	Moderate	2.0-4.0	0.32	0.32			
	26-33	25-35	1.30-1.50	0.60-2.00	0.12-0.18	Low-----	0.5-1.0	0.32	0.32			
	33-60	22-30	1.45-1.60	0.60-2.00	0.14-0.16	Low-----	0.0-0.5	0.32	0.32			
96B: Collinwood-----	0-8	35-40	1.20-1.30	0.20-0.60	0.14-0.17	Moderate	5.0-7.0	0.32	0.32	5	4	86
	8-32	35-60	1.25-1.35	0.06-0.60	0.13-0.16	High-----	1.0-3.0	0.32	0.32			
	32-60	35-45	1.25-1.40	0.06-0.60	0.11-0.15	High-----	0.0-2.0	0.32	0.32			
101B: Truman-----	0-14	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low-----	4.0-8.0	0.32	0.32	5	6	48
	14-40	18-32	1.30-1.45	0.60-2.00	0.18-0.21	Low-----	1.0-2.0	0.43	0.43			
	40-60	18-32	1.35-1.45	0.60-2.00	0.18-0.20	Low-----	0.0-1.0	0.43	0.43			
102B: Clarion-----	0-12	20-27	1.30-1.55	0.60-2.00	0.20-0.22	Low-----	3.0-6.0	0.24	0.24	5	6	48
	12-27	23-30	1.30-1.55	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.37	0.37			
	27-60	22-30	1.30-1.55	0.60-2.00	0.17-0.19	Moderate	0.0-0.5	0.37	0.37			
106C2: Lester-----	0-9	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-----	1.0-4.0	0.28	0.28	5	6	48
	9-27	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	27-60	22-30	1.55-1.75	0.60-2.00	0.14-0.19	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	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
112: Harps-----	0-19	27-35	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	3.0-5.0	0.24	0.24	5	4L	86
	19-25	24-35	1.40-1.50	0.60-2.00	0.17-0.19	Moderate	1.0-3.0	0.32	0.32			
	25-60	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-----	0.0-1.0	0.32	0.32			
113: Webster-----	0-17	26-35	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	4.0-7.0	0.24	0.24	5	6	48
	17-24	25-35	1.40-1.50	0.60-2.00	0.16-0.18	Moderate	2.0-4.0	0.32	0.32			
	24-60	22-30	1.35-1.55	0.60-2.00	0.14-0.19	Moderate	1.0-2.0	0.32	0.32			
114: Glencoe-----	0-10	27-35	1.35-1.45	0.20-2.00	0.18-0.22	Moderate	5.0-10	0.28	0.28	5	6	48
	10-34	25-35	1.35-1.45	0.20-2.00	0.18-0.22	Moderate	2.0-5.0	0.28	0.28			
	34-80	25-35	1.35-1.50	0.20-2.00	0.15-0.19	Moderate	1.0-4.0	0.28	0.28			
129: Cylinder-----	0-15	22-27	1.40-1.45	0.60-2.00	0.20-0.22	Moderate	4.0-5.0	0.24	0.24	4	6	48
	15-31	22-30	1.45-1.60	0.60-2.00	0.17-0.19	Moderate	2.0-3.0	0.32	0.32			
	31-60	2-12	1.60-1.70	20.0-63.0	0.02-0.04	Low-----	0.0-0.5	0.10	0.15			
130: Nicollet-----	0-16	27-35	1.15-1.25	0.60-2.00	0.17-0.22	Moderate	4.0-8.0	0.24	0.24	5	6	48
	16-30	25-35	1.25-1.35	0.60-2.00	0.15-0.19	Moderate	1.0-2.0	0.32	0.32			
	30-60	22-30	1.35-1.55	0.60-2.00	0.14-0.19	Low-----	0.0-1.0	0.32	0.32			
134: Okoboji-----	0-8	35-42	1.30-1.40	0.20-0.60	0.21-0.23	High-----	7.0-10	0.32	0.32	5	4	86
	8-28	35-45	1.30-1.40	0.20-0.60	0.18-0.20	High-----	7.0-10	0.32	0.32			
	28-60	25-35	1.35-1.40	0.20-0.60	0.18-0.20	High-----	3.0-4.0	0.32	0.32			
136: Madelia-----	0-16	27-35	1.20-1.30	0.60-2.00	0.18-0.24	Moderate	4.0-8.0	0.28	0.28	5	7	38
	16-30	18-35	1.25-1.35	0.60-2.00	0.16-0.22	Moderate	2.0-4.0	0.28	0.28			
	30-60	18-35	1.30-1.40	0.60-2.00	0.16-0.22	Low-----	1.0-2.0	0.37	0.37			
140: Spicer-----	0-14	29-35	1.20-1.30	0.60-2.00	0.18-0.24	Moderate	4.0-8.0	0.28	0.28	5	4L	86
	14-27	18-35	1.25-1.35	0.60-2.00	0.16-0.22	Moderate	3.0-5.0	0.37	0.37			
	27-60	18-35	1.25-1.35	0.60-2.00	0.16-0.22	Low-----	0.0-2.0	0.37	0.37			
143B: Chelsea-----	0-6	8-15	1.50-1.55	6.00-20.00	0.10-0.15	Low-----	0.5-1.0	0.17	0.17	5	2	134
	6-60	5-10	1.55-1.70	6.00-20.00	0.06-0.08	Low-----	0.0-0.5	0.17	0.17			
178: Granby-----	0-13	8-18	1.20-1.60	2.00-6.00	0.16-0.18	Low-----	4.0-6.0	0.20	0.20	3	3	86
	13-26	0-14	1.45-1.60	6.00-20.00	0.05-0.12	Low-----	0.0-0.5	0.17	0.17			
	26-60	0-10	1.45-1.60	6.00-20.00	0.05-0.09	Low-----	0.0-0.5	0.17	0.17			
181: Litchfield-----	0-20	5-10	1.30-1.50	6.00-20.00	0.10-0.12	Low-----	2.0-4.0	0.17	0.17	4	2	134
	20-40	5-10	1.40-1.65	2.00-6.00	0.07-0.16	Low-----	0.5-1.0	0.17	0.17			
	40-60	1-8	1.45-1.65	6.00-20.00	0.08-0.10	Low-----	0.0-0.5	0.17	0.17			
183: Dassel-----	0-23	10-24	1.00-1.40	2.00-6.00	0.18-0.24	Low-----	3.0-20	0.20	0.20	4	5	56
	23-31	2-6	1.40-1.60	2.00-6.00	0.12-0.17	Low-----	1.0-4.0	0.20	0.20			
	31-60	2-8	1.45-1.65	6.00-20.00	0.08-0.10	Low-----	0.0-1.0	0.20	0.20			
197: Kingston-----	0-16	27-32	1.20-1.30	0.60-2.00	0.18-0.24	Low-----	4.0-8.0	0.28	0.28	5	7	38
	16-25	18-32	1.25-1.35	0.60-2.00	0.16-0.20	Low-----	2.0-4.0	0.37	0.37			
	25-60	18-32	1.25-1.35	0.60-2.00	0.16-0.20	Low-----	0.0-1.0	0.37	0.37			

## Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
211: Lura-----	0-24	45-60	1.25-1.35	0.06-0.20	0.14-0.17	High-----	4.0-12	0.28	0.28	5	4	86
	24-31	45-60	1.25-1.35	0.06-0.20	0.14-0.17	High-----	1.0-4.0	0.32	0.32			
	31-60	28-60	1.30-1.45	0.06-0.60	0.11-0.19	High-----	0.0-1.0	0.32	0.32			
229: Waldorf-----	0-8	35-40	1.20-1.30	0.20-0.60	0.18-0.25	High-----	6.0-8.0	0.28	0.28	5	4	86
	8-35	40-55	1.25-1.35	0.06-0.60	0.13-0.16	High-----	0.5-1.0	0.32	0.32			
	35-60	24-45	1.25-1.45	0.06-0.60	0.20-0.22	Moderate	0.0-0.5	0.32	0.32			
239: Le Sueur-----	0-14	28-30	1.50-1.70	0.60-2.00	0.17-0.20	Moderate	3.0-7.0	0.24	0.24	5	6	48
	14-33	24-35	1.30-1.45	0.60-2.00	0.15-0.19	Moderate	0.5-2.0	0.32	0.32			
	33-60	20-30	1.45-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.32	0.32			
281: Darfur-----	0-23	18-25	1.20-1.35	0.60-2.00	0.20-0.22	Low-----	5.0-8.0	0.20	0.20	5	5	56
	23-30	13-18	1.35-1.50	2.00-6.00	0.15-0.17	Low-----	1.0-2.0	0.20	0.20			
	30-60	5-15	1.45-1.60	2.00-6.00	0.08-0.10	Low-----	0.0-0.5	0.20	0.20			
286B: Shorewood-----	0-12	30-40	1.20-1.40	0.20-0.60	0.18-0.22	Moderate	4.0-8.0	0.28	0.28	5	7	38
	12-38	36-55	1.20-1.35	0.06-0.60	0.13-0.16	High-----	1.0-4.0	0.32	0.32			
	38-60	24-45	1.25-1.55	0.20-2.00	0.14-0.16	Moderate	0.0-1.0	0.37	0.37			
311C2: Shorewood-----	0-6	40-45	1.20-1.40	0.20-0.60	0.14-0.17	High-----	4.0-8.0	0.28	0.28	5	4	86
	6-20	36-55	1.20-1.35	0.06-0.60	0.13-0.16	High-----	1.0-4.0	0.32	0.32			
	20-60	24-45	1.25-1.55	0.20-2.00	0.14-0.16	Moderate	0.0-1.0	0.37	0.37			
327A: Dickman-----	0-12	6-18	1.30-1.40	2.00-6.00	0.13-0.15	Low-----	2.0-4.0	0.20	0.20	3	3	86
	12-18	6-18	1.35-1.50	2.00-6.00	0.12-0.14	Low-----	0.0-1.0	0.20	0.20			
	18-60	1-10	1.50-1.60	6.00-20.00	0.02-0.07	Low-----	0.0-0.5	0.15	0.15			
327B: Dickman-----	0-12	6-18	1.30-1.40	2.00-6.00	0.13-0.15	Low-----	2.0-4.0	0.20	0.20	3	3	86
	12-30	6-18	1.35-1.50	2.00-6.00	0.12-0.14	Low-----	0.0-1.0	0.20	0.20			
	30-60	1-10	1.50-1.60	6.00-20.00	0.02-0.07	Low-----	0.0-0.5	0.15	0.15			
399: Biscay-----	0-14	18-27	1.20-1.30	0.60-2.00	0.20-0.22	Moderate	4.0-8.0	0.28	0.28	4	6	48
	14-25	18-30	1.25-1.35	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.28	0.28			
	25-60	1-6	1.55-1.65	6.00-63.00	0.02-0.04	Low-----	0.0-0.5	0.05	0.10			
415: Kanaranzi-----	0-9	18-27	1.30-1.45	0.60-2.00	0.17-0.21	Low-----	2.0-5.0	0.24	0.24	4	6	48
	9-18	18-32	1.35-1.50	0.60-2.00	0.15-0.19	Low-----	0.0-0.5	0.37	0.37			
	18-60	0-5	1.55-1.65	6.00-40.00	0.02-0.04	Low-----	---	0.10	0.15			
423: Seaforth-----	0-12	20-30	1.30-1.45	0.60-2.00	0.17-0.24	Moderate	3.0-6.0	0.24	0.24	5	4L	86
	12-28	20-30	1.30-1.50	0.60-2.00	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	28-60	20-27	1.35-1.60	0.60-2.00	0.17-0.19	Low-----	0.0-1.0	0.28	0.28			
461B: Koronis-----	0-8	10-20	1.20-1.40	2.00-6.00	0.20-0.22	Low-----	1.0-4.0	0.28	0.28	5	5	56
	8-31	18-24	1.30-1.50	0.60-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	31-60	12-20	1.35-1.60	2.00-6.00	0.11-0.16	Low-----	0.0-1.0	0.28	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
								In	Pct	g/cc		
<b>461C2:</b>												
<b>Koronis-----</b>	0-8	10-20	1.20-1.40	2.00-6.00	0.20-0.22	Low-----	1.0-4.0	0.28	0.28	5	5	56
	8-24	18-24	1.30-1.50	0.60-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	24-60	12-20	1.35-1.60	2.00-6.00	0.11-0.16	Low-----	0.0-1.0	0.28	0.28			
<b>511:</b>												
<b>Marcellon-----</b>	0-13	13-20	1.25-1.35	0.60-2.00	0.17-0.24	Low-----	3.0-7.0	0.24	0.24	5	5	56
	13-32	20-24	1.45-1.55	0.60-2.00	0.12-0.18	Moderate	0.0-1.0	0.32	0.32			
	32-60	8-17	1.55-1.65	2.00-6.00	0.07-0.14	Low-----	0.0-0.5	0.24	0.24			
<b>523:</b>												
<b>Houghton-----</b>	0-7	---	0.20-0.35	0.20-6.00	0.35-0.45	-----	70-99	---	---	3	2	134
	7-60	---	0.15-0.25	0.20-6.00	0.35-0.45	-----	70-99	---	---			
<b>525:</b>												
<b>Muskego-----</b>	0-10	---	0.10-0.21	0.60-6.00	0.35-0.45	-----	60-90	0.10	0.10	1	2	134
	10-40	---	0.10-0.21	0.60-6.00	0.35-0.45	-----	60-90	0.10	0.10			
	40-60	18-35	0.30-1.10	0.06-0.20	0.18-0.24	Moderate	6.0-20	0.28	0.28			
<b>539:</b>												
<b>Klossner-----</b>	0-28	---	0.25-0.55	0.20-6.00	0.35-0.48	-----	25-60	---	---	2	2	134
	28-45	22-35	1.10-1.25	0.60-2.00	0.22-0.26	Moderate	10-20	0.37	0.37			
	45-60	15-32	1.35-1.50	0.60-2.00	0.15-0.19	Moderate	0.0-5.0	0.28	0.28			
<b>548:</b>												
<b>Medo-----</b>	0-24	---	0.25-0.45	0.20-6.00	0.35-0.45	-----	20-50	---	---	2	2	134
	24-29	15-30	1.15-1.65	0.60-6.00	0.13-0.20	Moderate	5.0-20	0.24	0.24			
	29-56	15-30	1.35-1.65	0.60-6.00	0.13-0.20	Moderate	1.0-4.0	0.32	0.32			
	56-60	0-10	1.50-1.65	2.00-20.00	0.03-0.10	Low-----	0.5-2.0	0.10	0.10			
<b>610:</b>												
<b>Calco-----</b>	0-6	28-33	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	5.0-7.0	0.28	0.28	5	4L	86
	6-55	30-35	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	3.0-5.0	0.28	0.28			
	55-60	22-32	1.30-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-3.0	0.32	0.32			
<b>611D:</b>												
<b>Hawick-----</b>	0-7	2-10	1.50-1.65	2.00-20.00	0.03-0.13	Low-----	1.0-3.0	0.10	0.15	5	8	---
	7-10	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low-----	0.0-0.5	0.10	0.15			
	10-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low-----	0.0-0.5	0.10	0.15			
<b>612B:</b>												
<b>Wadenill-----</b>	0-13	12-22	1.30-1.50	0.60-2.00	0.20-0.22	Low-----	2.0-5.0	0.24	0.24	5	5	56
	13-30	8-18	1.30-1.55	2.00-6.00	0.12-0.19	Low-----	1.0-2.0	0.24	0.24			
	30-60	8-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.28	0.28			
<b>613:</b>												
<b>Grovecity-----</b>	0-15	12-22	1.30-1.50	2.00-6.00	0.20-0.22	Low-----	4.0-8.0	0.20	0.20	5	5	56
	15-30	10-18	1.30-1.55	2.00-6.00	0.12-0.19	Low-----	0.0-1.0	0.20	0.20			
	30-60	8-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-0.5	0.20	0.20			
<b>664:</b>												
<b>Zook-----</b>	0-10	35-40	1.30-1.35	0.20-0.60	0.21-0.23	High-----	5.0-7.0	0.37	0.37	5	7	38
	10-41	36-45	1.30-1.45	0.06-0.20	0.11-0.13	High-----	2.0-4.0	0.28	0.28			
	41-60	20-45	1.30-1.45	0.06-0.60	0.11-0.22	High-----	0.0-1.0	0.28	0.28			
<b>740:</b>												
<b>Hamel-----</b>	0-28	20-27	1.30-1.40	0.60-2.00	0.20-0.24	Low-----	5.0-7.0	0.28	0.28	5	6	48
	28-56	24-35	1.45-1.60	0.20-0.60	0.16-0.19	Moderate	2.0-5.0	0.28	0.28			
	56-60	20-30	1.55-1.75	0.60-2.00	0.14-0.18	Moderate	0.0-3.0	0.28	0.28			
<b>Glencoe-----</b>	0-15	25-27	1.35-1.45	0.60-2.00	0.18-0.22	Moderate	5.0-10	0.28	0.28	5	6	48
	15-45	25-35	1.35-1.45	0.20-2.00	0.18-0.22	Moderate	2.0-5.0	0.28	0.28			
	45-60	25-35	1.35-1.50	0.20-2.00	0.15-0.19	Moderate	1.0-4.0	0.28	0.28			

## Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
<b>804B:</b>												
Koronis-----	0-8	10-20	1.20-1.40	2.00-6.00	0.20-0.22	Low-----	1.0-4.0	0.28	0.28	5	5	56
	8-33	18-24	1.30-1.50	0.60-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	33-60	12-20	1.35-1.60	2.00-6.00	0.11-0.16	Low-----	0.0-1.0	0.28	0.28			
Sunburg-----	0-9	12-20	1.35-1.55	2.00-6.00	0.16-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	9-60	10-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.24	0.24			
Hawick-----	0-9	2-10	1.50-1.65	2.00-20.00	0.03-0.13	Low-----	1.0-3.0	0.10	0.15	5	8	---
	9-49	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low-----	0.0-0.5	0.10	0.15			
	49-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low-----	0.0-0.5	0.10	0.15			
<b>804C2:</b>												
Koronis-----	0-8	6-16	1.25-1.45	2.00-6.00	0.13-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	8-26	18-24	1.30-1.50	0.60-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	26-60	12-20	1.35-1.60	2.00-6.00	0.11-0.16	Low-----	0.0-1.0	0.28	0.28			
Sunburg-----	0-10	12-20	1.35-1.55	2.00-6.00	0.16-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	10-60	10-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.24	0.24			
Hawick-----	0-9	2-10	1.50-1.65	2.00-20.00	0.03-0.13	Low-----	1.0-3.0	0.10	0.15	5	8	---
	9-60	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low-----	0.0-0.5	0.10	0.15			
<b>804D2:</b>												
Koronis-----	0-8	6-16	1.25-1.45	2.00-6.00	0.13-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	8-25	18-24	1.30-1.50	0.60-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	25-60	12-20	1.35-1.60	2.00-6.00	0.11-0.16	Low-----	0.0-1.0	0.28	0.28			
Sunburg-----	0-7	12-20	1.35-1.55	2.00-6.00	0.16-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	7-60	10-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.24	0.24			
Hawick-----	0-7	2-10	1.50-1.65	2.00-20.00	0.03-0.13	Low-----	1.0-3.0	0.10	0.15	5	8	---
	7-20	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low-----	0.0-0.5	0.10	0.15			
	20-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low-----	0.0-0.5	0.10	0.15			
<b>804E:</b>												
Koronis-----	0-5	6-16	1.25-1.45	2.00-6.00	0.13-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	5-21	18-24	1.30-1.50	0.60-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	21-60	12-20	1.35-1.60	2.00-6.00	0.11-0.16	Low-----	0.0-1.0	0.28	0.28			
Sunburg-----	0-4	12-20	1.35-1.55	2.00-6.00	0.16-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	4-60	10-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.24	0.24			
Hawick-----	0-14	2-10	1.50-1.65	2.00-20.00	0.03-0.13	Low-----	1.0-3.0	0.10	0.15	5	8	---
	14-60	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low-----	0.0-0.5	0.10	0.15			
<b>805C2:</b>												
Sunburg-----	0-8	12-20	1.35-1.55	2.00-6.00	0.16-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	8-60	10-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.24	0.24			
Wadenill-----	0-7	12-22	1.30-1.50	0.60-2.00	0.20-0.22	Low-----	2.0-5.0	0.24	0.24	5	5	56
	7-20	8-18	1.30-1.55	2.00-6.00	0.12-0.19	Low-----	1.0-2.0	0.24	0.24			
	20-60	8-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.28	0.28			
<b>805D2:</b>												
Sunburg-----	0-7	12-20	1.35-1.55	2.00-6.00	0.16-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	7-60	10-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.24	0.24			
Wadenill-----	0-7	12-22	1.30-1.50	0.60-2.00	0.20-0.22	Low-----	2.0-5.0	0.24	0.24	5	5	56
	7-18	8-18	1.30-1.55	2.00-6.00	0.12-0.19	Low-----	1.0-2.0	0.24	0.24			
	18-60	8-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.28	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
<b>807D2:</b>												
Koronis-----	0-9	6-16	1.25-1.45	2.00-6.00	0.13-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	9-25	18-24	1.30-1.50	0.60-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	25-60	12-20	1.35-1.60	2.00-6.00	0.11-0.16	Low-----	0.0-1.0	0.28	0.28			
Sunburg-----	0-7	12-20	1.35-1.55	2.00-6.00	0.16-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	7-60	10-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.24	0.24			
<b>875B:</b>												
Estherville----	0-9	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low-----	2.0-4.0	0.20	0.20	3	3	86
	9-14	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low-----	0.0-0.5	0.20	0.20			
	14-60	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low-----	0.0-0.5	0.10	0.10			
Hawick-----	0-7	5-15	1.35-1.55	2.00-6.00	0.13-0.15	Low-----	1.0-4.0	0.17	0.17	3	3	86
	7-11	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low-----	0.0-0.5	0.10	0.15			
	11-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low-----	0.0-0.5	0.10	0.15			
<b>875C:</b>												
Hawick-----	0-11	2-10	1.50-1.65	2.00-20.00	0.03-0.13	Low-----	1.0-3.0	0.10	0.15	5	8	---
	11-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low-----	0.0-0.5	0.10	0.15			
Estherville----	0-8	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low-----	2.0-4.0	0.20	0.20	3	3	86
	8-13	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low-----	0.0-0.5	0.20	0.20			
	13-60	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low-----	0.0-0.5	0.10	0.10			
<b>887B:</b>												
Clarion-----	0-11	20-27	1.30-1.55	0.60-2.00	0.20-0.22	Low-----	3.0-6.0	0.24	0.24	5	6	48
	11-30	23-30	1.30-1.55	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.37	0.37			
	30-60	22-30	1.30-1.55	0.60-2.00	0.17-0.19	Moderate	0.0-0.5	0.37	0.37			
Swanlake-----	0-8	18-27	1.35-1.45	0.60-2.00	0.20-0.24	Low-----	2.0-4.0	0.28	0.28	5	4L	86
	8-12	18-30	1.30-1.50	0.60-2.00	0.17-0.19	Moderate	0.0-2.0	0.37	0.37			
	12-60	18-30	1.30-1.50	0.60-2.00	0.17-0.19	Moderate	0.0-1.0	0.37	0.37			
<b>899:</b>												
Harps-----	0-9	27-35	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	3.0-5.0	0.24	0.24	5	4L	86
	9-28	24-35	1.40-1.50	0.60-2.00	0.17-0.19	Moderate	1.0-3.0	0.32	0.32			
	28-60	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-----	0.0-1.0	0.32	0.32			
Okoboji-----	0-17	35-42	1.30-1.40	0.20-0.60	0.21-0.23	High-----	7.0-10	0.32	0.32	5	4	86
	17-47	35-45	1.30-1.40	0.20-0.60	0.18-0.20	High-----	7.0-10	0.32	0.32			
	47-60	25-35	1.35-1.40	0.20-0.60	0.18-0.20	High-----	3.0-4.0	0.32	0.32			
<b>909C2:</b>												
Bold-----	0-7	12-18	1.40-1.60	0.60-2.00	0.21-0.24	Low-----	0.5-2.0	0.43	0.43	5	4L	86
	7-60	12-18	1.10-1.30	0.60-2.00	0.20-0.24	Low-----	0.0-0.5	0.43	0.43			
Truman-----	0-10	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low-----	4.0-8.0	0.32	0.32	5	6	48
	10-31	18-32	1.30-1.45	0.60-2.00	0.18-0.21	Low-----	1.0-2.0	0.43	0.43			
	31-60	18-32	1.35-1.45	0.60-2.00	0.18-0.20	Low-----	0.0-1.0	0.43	0.43			
<b>909D2:</b>												
Bold-----	0-7	12-18	1.40-1.60	0.60-2.00	0.21-0.24	Low-----	0.5-2.0	0.43	0.43	5	4L	86
	7-60	12-18	1.10-1.30	0.60-2.00	0.20-0.24	Low-----	0.0-0.5	0.43	0.43			
Truman-----	0-13	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low-----	4.0-8.0	0.32	0.32	5	6	48
	13-22	18-32	1.30-1.45	0.60-2.00	0.18-0.21	Low-----	1.0-2.0	0.43	0.43			
	22-60	18-32	1.35-1.45	0.60-2.00	0.18-0.20	Low-----	0.0-1.0	0.43	0.43			
<b>920B:</b>												
Clarion-----	0-12	20-27	1.30-1.55	0.60-2.00	0.20-0.22	Low-----	3.0-6.0	0.24	0.24	5	6	48
	12-23	23-30	1.30-1.55	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.37	0.37			
	23-60	22-30	1.30-1.55	0.60-2.00	0.17-0.19	Moderate	0.0-0.5	0.37	0.37			

## Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
920B:												
Storden-----	0-7	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	1.0-2.0	0.28	0.28	5	4L	86
	7-37	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
	37-60	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
Hawick-----	0-9	2-10	1.50-1.65	2.00-20.00	0.03-0.13	Low-----	1.0-3.0	0.10	0.15	5	8	---
	9-28	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low-----	0.0-0.5	0.10	0.15			
	28-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low-----	0.0-0.5	0.10	0.15			
945D2:												
Lester-----	0-9	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-----	1.0-4.0	0.28	0.28	5	6	48
	9-26	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	26-60	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-----	0.0-0.5	0.37	0.37			
Storden-----	0-5	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	1.0-2.0	0.28	0.28	5	4L	86
	5-28	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
	28-60	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
945E:												
Lester-----	0-7	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-----	1.0-4.0	0.28	0.28	5	6	48
	7-23	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	23-60	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-----	0.0-0.5	0.37	0.37			
Storden-----	0-9	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	1.0-2.0	0.28	0.28	5	4L	86
	9-30	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
	30-60	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
956:												
Canisteco-----	0-17	27-35	1.25-1.35	0.60-2.00	0.18-0.22	Moderate	4.0-8.0	0.24	0.24	5	4L	86
	17-23	25-35	1.35-1.50	0.60-2.00	0.15-0.19	Moderate	2.0-4.0	0.32	0.32			
	23-41	25-35	1.30-1.50	0.60-2.00	0.12-0.18	Low-----	0.5-1.0	0.32	0.32			
	41-60	22-30	1.45-1.60	0.60-2.00	0.14-0.16	Low-----	0.0-0.5	0.32	0.32			
Glencoe-----	0-7	27-35	1.35-1.45	0.20-2.00	0.18-0.22	Moderate	5.0-10	0.28	0.28	5	6	48
	7-36	25-35	1.35-1.45	0.20-2.00	0.18-0.22	Moderate	2.0-5.0	0.28	0.28			
	36-60	25-35	1.35-1.50	0.20-2.00	0.15-0.19	Moderate	1.0-4.0	0.28	0.28			
960C2:												
Storden-----	0-8	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	1.0-2.0	0.28	0.28	5	4L	86
	8-21	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
	21-60	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
Omsrud-----	0-9	20-26	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	2.0-4.0	0.24	0.24	5	6	48
	9-25	22-30	1.35-1.50	0.60-2.00	0.17-0.19	Low-----	0.5-2.0	0.32	0.32			
	25-60	22-30	1.35-1.60	0.60-2.00	0.17-0.19	Low-----	0.0-1.0	0.37	0.37			
960D2:												
Storden-----	0-7	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	1.0-2.0	0.28	0.28	5	4L	86
	7-23	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
	23-60	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
Omsrud-----	0-8	20-26	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	2.0-4.0	0.24	0.24	5	6	48
	8-22	22-30	1.35-1.50	0.60-2.00	0.17-0.19	Low-----	0.5-2.0	0.32	0.32			
	22-60	22-30	1.35-1.60	0.60-2.00	0.17-0.19	Low-----	0.0-1.0	0.37	0.37			
978:												
Cordova-----	0-15	27-30	1.25-1.45	0.20-0.60	0.18-0.22	Moderate	4.0-7.0	0.28	0.28	5	6	48
	15-39	28-35	1.35-1.50	0.20-0.60	0.15-0.19	Moderate	1.0-4.0	0.28	0.28			
	39-60	18-30	1.45-1.70	0.60-2.00	0.14-0.16	Moderate	0.0-1.0	0.28	0.28			
Rolfe-----	0-28	22-27	1.35-1.40	0.60-2.00	0.22-0.24	Low-----	3.0-5.0	0.37	0.37	5	6	48
	28-40	38-45	1.40-1.50	0.06-0.20	0.11-0.13	High-----	1.0-2.0	0.28	0.28			
	40-60	24-35	1.50-1.60	0.20-2.00	0.14-0.16	Moderate	0.0-1.0	0.28	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
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	2-18	1.50-1.70	0.60-6.00	0.08-0.14	Low-----	0.5-1.0	0.24	0.28	5	3	86
	60-80	---	---	0.06-6.00	---	-----	---	---	---			
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			
1080: Klossner-----	0-25	---	0.25-0.45	0.20-6.00	0.35-0.45	-----	25-60	---	---	2	8	---
	25-60	20-35	1.45-1.70	0.20-2.00	0.14-0.22	Moderate	5.0-20	0.28	0.28			
Okoboji-----	0-10	30-40	1.20-1.25	0.60-2.00	0.22-0.25	Moderate	10-18	0.32	0.32	5	6	48
	10-42	35-45	1.35-1.40	0.20-0.60	0.18-0.20	High-----	---	0.37	0.37			
	42-60	35-45	1.35-1.40	0.20-0.60	0.18-0.20	High-----	---	0.37	0.37			
Glencoe-----	0-42	27-35	1.35-1.45	0.20-2.00	0.18-0.22	Moderate	5.0-10	0.28	0.28	5	8	---
	42-50	25-35	1.35-1.50	0.20-2.00	0.15-0.19	Moderate	2.0-6.0	0.28	0.28			
	50-60	22-32	1.35-1.50	0.60-2.00	0.15-0.19	Low-----	0.0-3.0	0.28	0.28			
1096: Fieldon-----	0-20	15-22	1.25-1.40	0.60-6.00	0.18-0.20	Low-----	5.0-8.0	0.28	0.28	4	4L	86
	20-26	10-18	1.35-1.55	0.60-6.00	0.15-0.17	Low-----	2.0-6.0	0.20	0.20			
	26-60	5-15	1.40-1.60	6.00-20.00	0.05-0.07	Low-----	0.0-0.5	0.20	0.20			
Dassel-----	0-21	10-24	1.00-1.40	2.00-6.00	0.18-0.24	Low-----	3.0-20	0.20	0.20	4	5	56
	21-32	2-6	1.40-1.60	2.00-6.00	0.12-0.17	Low-----	1.0-4.0	0.20	0.20			
	32-60	2-8	1.45-1.65	6.00-20.00	0.08-0.10	Low-----	0.0-1.0	0.20	0.20			
1097: Mayer-----	0-16	18-30	1.25-1.35	0.60-2.00	0.20-0.22	Low-----	4.0-8.0	0.24	0.24	4	4L	86
	16-25	18-30	1.25-1.35	0.60-2.00	0.16-0.19	Low-----	2.0-6.0	0.28	0.28			
	25-60	1-5	1.55-1.65	6.00-20.00	0.02-0.04	Low-----	1.0-4.0	0.15	0.15			
Biscay-----	0-20	27-30	1.20-1.30	0.60-2.00	0.20-0.22	Moderate	4.0-8.0	0.28	0.28	4	6	48
	20-25	18-30	1.25-1.35	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.28	0.28			
	25-28	10-28	1.35-1.55	2.00-6.00	0.11-0.17	Low-----	0.0-0.5	0.28	0.32			
	28-60	1-6	1.55-1.65	6.00-63.00	0.02-0.04	Low-----	0.0-0.5	0.05	0.10			
1098: Biscay-----	0-20	18-30	1.20-1.30	0.60-2.00	0.20-0.22	Moderate	4.0-8.0	0.28	0.28	4	6	48
	20-25	18-30	1.25-1.35	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.28	0.28			
	25-60	1-6	1.55-1.65	6.00-63.00	0.02-0.04	Low-----	0.0-0.5	0.05	0.10			
Biscay, depressional---	0-18	27-30	1.20-1.30	0.60-2.00	0.20-0.22	Moderate	4.0-8.0	0.28	0.28	4	6	48
	18-22	18-30	1.25-1.35	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.28	0.28			
	22-26	10-28	1.35-1.55	2.00-6.00	0.11-0.17	Low-----	0.0-0.5	0.28	0.32			
	26-60	1-6	1.55-1.65	6.00-63.00	0.02-0.04	Low-----	0.0-0.5	0.05	0.10			
1099: Granby-----	0-12	2-14	1.20-1.60	6.00-20.00	0.10-0.12	Low-----	4.0-10	0.17	0.17	5	2	134
	12-24	0-14	1.45-1.60	6.00-20.00	0.05-0.12	Low-----	---	0.17	0.17			
	24-60	0-10	1.45-1.60	6.00-20.00	0.05-0.09	Low-----	---	0.17	0.17			

## Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1100: Nicollet-----	0-13	27-35	1.15-1.25	0.60-2.00	0.17-0.22	Moderate	4.0-8.0	0.24	0.24	5	7	38
	13-26	25-35	1.25-1.35	0.60-2.00	0.15-0.19	Moderate	1.0-2.0	0.32	0.32			
	26-60	22-30	1.35-1.55	0.60-2.00	0.14-0.19	Low-----	0.0-1.0	0.32	0.32			
1101: Webster-----	0-19	27-35	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	4.0-7.0	0.28	0.28	5	7	38
	19-24	25-35	1.40-1.50	0.60-2.00	0.16-0.18	Moderate	2.0-4.0	0.32	0.32			
	24-60	22-30	1.35-1.55	0.60-2.00	0.14-0.19	Moderate	1.0-2.0	0.32	0.32			
1159B: Strout-----	0-10	35-45	1.30-1.50	0.20-0.60	0.14-0.19	High-----	3.0-6.0	0.28	0.28	5	4	86
	10-24	35-50	1.40-1.70	0.20-0.60	0.12-0.18	High-----	0.5-2.0	0.24	0.24			
	24-60	30-45	1.60-1.80	0.06-0.60	0.10-0.15	High-----	0.0-1.0	0.37	0.37			
Arkton-----	0-9	30-40	1.30-1.60	0.20-0.60	0.15-0.19	Moderate	2.0-5.0	0.24	0.24	5	6	48
	9-25	30-45	1.40-1.70	0.20-0.60	0.10-0.19	High-----	0.0-2.0	0.28	0.28			
	25-60	25-40	1.60-1.80	0.06-0.60	0.13-0.19	Moderate	0.0-1.0	0.37	0.37			
1161: Barry-----	0-11	16-23	1.55-1.70	2.00-6.00	0.17-0.19	Low-----	4.0-6.0	0.24	0.24	5	6	48
	11-33	18-25	1.60-1.80	0.60-2.00	0.15-0.18	Moderate	0.5-1.0	0.28	0.32			
	33-60	10-16	1.55-1.70	2.00-6.00	0.11-0.14	Low-----	0.0-0.5	0.24	0.28			
1162A: Kandiyohi-----	0-11	40-50	1.30-1.50	0.06-0.60	0.16-0.22	High-----	4.0-7.0	0.28	0.28	5	4	86
	11-26	35-60	1.40-1.60	0.06-0.60	0.14-0.19	High-----	0.5-2.0	0.32	0.32			
	26-33	30-55	1.50-1.70	0.06-0.20	0.13-0.19	High-----	0.0-1.0	0.37	0.37			
	33-60	30-55	1.60-1.80	0.06-0.20	0.11-0.15	High-----	0.0-1.0	0.37	0.37			
1162B: Kandiyohi-----	0-10	40-50	1.30-1.50	0.06-0.60	0.16-0.22	High-----	4.0-7.0	0.28	0.28	5	4	86
	10-23	35-60	1.40-1.60	0.06-0.60	0.14-0.19	High-----	0.5-2.0	0.32	0.32			
	23-29	30-55	1.50-1.70	0.06-0.20	0.13-0.19	High-----	0.0-1.0	0.37	0.37			
	29-60	30-55	1.60-1.80	0.06-0.20	0.11-0.15	High-----	0.0-1.0	0.37	0.37			
1163: Cohoctah-----	0-17	7-20	1.20-1.60	2.00-6.00	0.18-0.24	Low-----	3.0-6.0	.28	.28	4	5	56
	17-22	5-18	1.45-1.65	2.00-6.00	0.12-0.20	Low-----	0.5-1.0	.28	.28			
	22-60	2-5	1.55-1.65	6.00-63.00	0.06-0.09	Low-----	0.0-0.5	.10	.10			
Lundlake-----	0-14	28-35	1.20-1.45	0.20-2.00	0.17-0.22	Moderate	5.0-12	0.28	0.28	5	7	38
	14-35	20-30	1.20-1.45	0.20-2.00	0.17-0.22	Moderate	2.0-5.0	0.28	0.28			
	35-47	18-27	1.30-1.50	0.60-2.00	0.15-0.19	Low-----	1.0-2.0	0.28	0.28			
	47-60	10-18	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-1.0	0.28	0.28			
1168: Swedegrove-----	0-15	14-24	1.20-1.40	2.00-6.00	0.16-0.20	Low-----	5.0-7.0	0.24	0.24	5	4L	86
	15-31	16-22	1.30-1.50	2.00-6.00	0.14-0.18	Low-----	1.0-3.0	0.28	0.28			
	31-60	10-16	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-1.0	0.28	0.28			
Lundlake-----	0-12	28-35	1.20-1.45	0.20-2.00	0.17-0.22	Moderate	5.0-12	0.28	0.28	5	7	38
	12-28	20-30	1.20-1.45	0.20-2.00	0.17-0.22	Moderate	2.0-5.0	0.28	0.28			
	28-36	18-27	1.30-1.50	0.60-2.00	0.15-0.19	Low-----	1.0-2.0	0.28	0.28			
	36-60	10-18	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-1.0	0.28	0.28			
1169: Corvuso-----	0-11	35-55	1.30-1.45	0.06-0.60	0.14-0.22	High-----	4.0-7.0	0.24	0.24	5	4L	86
	11-28	35-60	1.40-1.60	0.06-0.60	0.13-0.19	High-----	0.0-1.0	0.32	0.32			
	28-60	30-55	1.60-1.80	0.06-0.20	0.11-0.15	High-----	0.0-0.5	0.37	0.37			
Lura-----	0-26	45-60	1.25-1.35	0.06-0.20	0.14-0.17	High-----	4.0-12	0.28	0.28	5	4	86
	26-60	45-60	1.25-1.35	0.06-0.20	0.14-0.17	High-----	1.0-4.0	0.32	0.32			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1171C: Newlondon-----	0-7	30-45	1.30-1.60	0.20-0.60	0.16-0.18	High-----	1.0-2.0	0.28	0.28	5	4	86
	7-38	35-45	1.40-1.60	0.20-0.60	0.14-0.18	High-----	0.0-1.0	0.28	0.28			
	38-60	25-40	1.60-1.80	0.06-0.60	0.13-0.19	Moderate	0.0-0.5	0.37	0.37			
Strout-----	0-9	35-45	1.30-1.50	0.20-0.60	0.14-0.19	High-----	3.0-6.0	0.28	0.28	5	4	86
	9-23	35-50	1.40-1.70	0.20-0.60	0.12-0.18	High-----	0.5-2.0	0.24	0.24			
	23-60	30-45	1.60-1.80	0.06-0.60	0.10-0.15	High-----	0.0-1.0	0.37	0.37			
1171D: Newlondon-----	0-7	30-45	1.30-1.60	0.20-0.60	0.16-0.18	High-----	1.0-2.0	0.28	0.28	5	4	86
	7-38	35-45	1.40-1.60	0.20-0.60	0.14-0.18	High-----	0.0-1.0	0.28	0.28			
	38-60	25-40	1.60-1.80	0.06-0.60	0.13-0.19	Moderate	0.0-0.5	0.37	0.37			
Strout-----	0-9	35-45	1.30-1.50	0.20-0.60	0.14-0.19	High-----	3.0-6.0	0.28	0.28	5	4	86
	9-19	35-50	1.40-1.70	0.20-0.60	0.12-0.18	High-----	0.5-2.0	0.24	0.24			
	19-60	30-45	1.60-1.80	0.06-0.60	0.10-0.15	High-----	0.0-1.0	0.37	0.37			
1172C: Sparta-----	0-18	3-10	1.20-1.40	2.00-6.00	0.09-0.12	Low-----	1.0-2.0	0.17	0.17	5	2	134
	18-55	1-8	1.40-1.60	6.00-20.00	0.05-0.11	Low-----	0.1-1.0	0.15	0.15			
	55-60	0-5	1.50-1.70	6.00-20.00	0.04-0.07	Low-----	0.0-0.5	0.15	0.15			
Gardencity-----	0-7	5-20	1.30-1.40	2.00-6.00	0.16-0.20	Low-----	2.0-4.0	0.20	0.20	5	3	86
	7-24	12-18	1.40-1.50	2.00-6.00	0.11-0.17	Low-----	0.5-2.0	0.20	0.20			
	24-60	10-20	1.40-1.50	2.00-6.00	0.10-0.17	Low-----	0.0-0.5	0.20	0.20			
1173: Muskego-----	0-45	---	0.10-0.21	0.60-6.00	0.35-0.45	Low-----	60-90	0.10	0.10	1	2	134
	45-60	18-35	0.30-1.10	0.06-0.20	0.20-0.25	Moderate	6.0-20	0.28	0.28			
Klossner-----	0-22	---	0.25-0.55	0.20-6.00	0.35-0.48	-----	25-60	---	---	2	2	134
	22-45	22-35	1.10-1.25	0.60-2.00	0.22-0.26	Moderate	10-20	0.37	0.37			
	45-60	15-32	1.30-1.40	0.20-2.00	0.18-0.22	Moderate	5.0-10	0.28	0.28			
1174: Danielson-----	0-9	35-40	1.20-1.40	0.06-0.60	0.15-0.22	High-----	5.0-10	0.28	0.28	5	4	86
	9-36	35-45	1.40-1.60	0.06-0.60	0.14-0.19	High-----	4.0-10	0.28	0.28			
	36-51	35-55	1.40-1.80	0.06-0.60	0.07-0.19	High-----	0.0-1.0	0.28	0.28			
	51-60	30-55	1.60-1.80	0.06-0.20	0.07-0.18	High-----	0.0-0.5	0.28	0.28			
1175: Swedegrove-----	0-14	14-24	1.20-1.40	2.00-6.00	0.16-0.20	Low-----	5.0-7.0	0.24	0.24	5	4L	86
	14-20	16-22	1.30-1.50	2.00-6.00	0.14-0.18	Low-----	1.0-3.0	0.28	0.28			
	20-60	10-16	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-1.0	0.28	0.28			
1176: Litchfield-----	0-17	10-16	1.30-1.40	2.00-6.00	0.13-0.15	Low-----	2.0-4.0	0.20	0.20	3	3	86
	17-33	5-12	1.35-1.50	6.00-20.00	0.09-0.11	Low-----	0.0-0.5	0.17	0.17			
	33-60	0-2	1.50-1.65	6.00-20.00	0.05-0.07	Low-----	0.0-0.5	0.15	0.15			
1177C: Gardencity-----	0-13	5-20	1.30-1.40	2.00-6.00	0.16-0.20	Low-----	2.0-4.0	0.20	0.20	5	3	86
	13-25	12-18	1.40-1.50	2.00-6.00	0.11-0.17	Low-----	0.5-2.0	0.20	0.20			
	25-60	10-20	1.40-1.50	2.00-6.00	0.10-0.17	Low-----	0.0-0.5	0.20	0.20			
Bold-----	0-7	12-18	1.40-1.60	0.60-2.00	0.21-0.24	Low-----	0.5-2.0	0.43	0.43	5	4L	86
	7-60	12-18	1.10-1.30	0.60-2.00	0.20-0.24	Low-----	0.0-0.5	0.43	0.43			
1178: Uniongrove-----	0-16	20-25	1.20-1.40	2.00-6.00	0.20-0.22	Low-----	5.0-7.0	0.24	0.24	5	6	48
	16-30	18-23	1.30-1.50	2.00-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	30-60	10-16	1.40-1.60	2.00-6.00	0.10-0.15	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	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
1183: Crowriver-----	0-15	14-20	1.20-1.50	2.00-6.00	0.14-0.20	Low-----	4.0-6.0	0.20	0.20	5	3	86
	15-22	12-22	1.30-1.50	2.00-6.00	0.12-0.18	Low-----	1.0-3.0	0.24	0.24			
	22-60	12-18	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-1.0	0.24	0.24			
1184: Corvuso-----	0-19	35-60	1.35-1.55	0.06-0.60	0.13-0.19	High-----	0.0-2.0	0.28	0.28	5	4L	86
	19-26	35-60	1.40-1.60	0.06-0.60	0.13-0.19	High-----	0.0-1.0	0.32	0.32			
	26-60	30-55	1.60-1.80	0.06-0.20	0.11-0.15	High-----	0.0-0.5	0.37	0.37			
1185: Gardencity-----	0-19	5-20	1.30-1.40	2.00-6.00	0.16-0.20	Low-----	3.0-5.0	0.20	0.20	5	3	86
	19-24	12-18	1.40-1.50	2.00-6.00	0.11-0.17	Low-----	0.5-2.0	0.20	0.20			
	24-60	10-20	1.40-1.50	2.00-6.00	0.10-0.17	Low-----	0.0-0.5	0.20	0.20			
1186: Forestcity-----	0-22	10-18	1.20-1.40	2.00-6.00	0.14-0.16	Low-----	4.0-8.0	0.20	0.20	5	3	86
	22-36	18-28	1.30-1.50	0.60-2.00	0.14-0.17	Moderate	2.0-5.0	0.32	0.32			
	36-60	12-28	1.30-1.50	0.60-6.00	0.11-0.17	Moderate	1.0-3.0	0.32	0.32			
	60-65	10-18	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-2.0	0.24	0.24			
Lundlake-----	0-20	20-27	1.20-1.45	0.20-2.00	0.17-0.22	Moderate	5.0-12	0.28	0.28	5	6	48
	20-28	20-30	1.20-1.45	0.20-2.00	0.17-0.22	Moderate	2.0-5.0	0.28	0.28			
	28-46	18-27	1.30-1.50	0.60-2.00	0.15-0.19	Low-----	1.0-2.0	0.28	0.28			
	46-60	10-18	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-1.0	0.28	0.28			
1192: Crowriver-----	0-13	14-20	1.20-1.50	2.00-6.00	0.14-0.20	Low-----	4.0-6.0	0.20	0.20	5	3	86
	13-17	12-22	1.30-1.50	2.00-6.00	0.12-0.18	Low-----	1.0-3.0	0.24	0.24			
	17-60	12-18	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-1.0	0.24	0.24			
Lundlake-----	0-22	20-27	1.20-1.45	0.20-2.00	0.17-0.22	Moderate	5.0-12	0.28	0.28	5	6	48
	22-28	20-30	1.20-1.45	0.20-2.00	0.17-0.22	Moderate	2.0-5.0	0.28	0.28			
	28-35	18-27	1.30-1.50	0.60-2.00	0.15-0.19	Low-----	1.0-2.0	0.28	0.28			
	35-60	10-18	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	0.0-1.0	0.28	0.28			
1193: Cosmos-----	0-15	35-50	1.40-1.50	0.06-0.20	0.16-0.22	High-----	4.0-8.0	0.28	0.28	5	4	86
	15-30	35-60	1.40-1.60	0.06-0.20	0.14-0.19	High-----	0.5-2.0	0.32	0.32			
	30-60	30-55	1.60-1.80	0.06-0.20	0.11-0.15	Moderate	0.0-0.5	0.32	0.32			
1197: Cohoctah-----	0-21	5-20	1.20-1.50	2.00-6.00	0.13-0.22	Low-----	3.0-15	0.24	0.24	5	3	86
	21-36	5-18	1.45-1.65	2.00-6.00	0.12-0.20	Low-----	0.5-1.0	0.28	0.28			
	36-60	2-18	1.45-1.65	2.00-6.00	0.08-0.20	Low-----	---	0.28	0.28			
1198B: Rohrbeck-----	0-6	3-6	1.50-1.55	6.00-20.00	0.08-0.12	Low-----	0.5-2.0	0.17	0.17	5	2	134
	6-25	2-6	1.50-1.55	6.00-20.00	0.07-0.11	Low-----	0.5-1.0	0.17	0.17			
	25-41	16-24	1.25-1.45	2.00-6.00	0.15-0.18	Moderate	0.5-1.0	0.37	0.37			
	41-60	12-18	1.35-1.60	2.00-6.00	0.15-0.18	Low-----	0.0-0.5	0.37	0.37			
Koronis-----	0-9	6-16	1.25-1.45	2.00-6.00	0.13-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	9-28	18-24	1.30-1.50	0.60-6.00	0.15-0.19	Low-----	0.0-2.0	0.28	0.28			
	28-60	12-20	1.35-1.60	2.00-6.00	0.11-0.16	Low-----	0.0-1.0	0.28	0.28			
1199: Klossner-----	0-38	---	0.25-0.45	0.20-6.00	0.35-0.45	-----	25-60	---	---	2	8	---
	38-60	20-35	1.45-1.70	0.20-2.00	0.14-0.22	Moderate	5.0-20	0.28	0.28			
Lundlake-----	0-26	20-27	1.20-1.40	0.20-2.00	0.17-0.22	Moderate	10-20	0.24	0.24	5	8	---
	26-56	20-27	1.20-1.40	0.20-2.00	0.17-0.22	Moderate	5.0-10	0.28	0.28			
	56-60	10-18	1.40-1.60	2.00-6.00	0.10-0.15	Low-----	1.0-4.0	0.28	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
<b>1203:</b>												
Muskego-----	0-10	2-4	0.10-0.21	0.20-6.00	0.35-0.45	-----	25-60	0.10	0.10	1	8	---
	10-29	18-35	0.30-1.10	0.60-2.00	0.18-0.24	Moderate	6.0-20	0.28	0.28			
	29-60	22-32	1.35-1.50	0.60-2.00	0.15-0.19	Low-----	0.5-2.0	0.32	0.32			
Blue Earth-----	0-50	18-32	0.20-0.80	0.60-2.00	0.18-0.24	Moderate	10-25	0.28	0.28	5	6	48
	50-60	18-32	0.20-0.80	0.60-2.00	0.18-0.24	Low-----	10-25	0.28	0.28			
Houghton-----	0-60	---	0.08-0.30	0.20-6.00	0.35-0.45	-----	70-99	---	---	3	8	---
<b>1204B:</b>												
Reedslake-----	0-12	20-26	1.30-1.40	0.60-2.00	0.20-0.22	Low-----	3.0-5.0	0.24	0.24	5	6	48
	12-26	22-32	1.40-1.50	0.60-2.00	0.15-0.19	Moderate	0.5-2.0	0.32	0.32			
	26-60	20-27	1.45-1.60	0.60-2.00	0.14-0.18	Low-----	0.0-1.0	0.37	0.37			
<b>1213C:</b>												
Cokato-----	0-16	22-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-----	3.0-5.0	0.28	0.28	5	6	48
	16-41	25-35	1.40-1.50	0.60-2.00	0.15-0.19	Moderate	1.0-2.0	0.37	0.37			
	41-60	20-30	1.45-1.60	0.60-2.00	0.14-0.18	Moderate	0.0-1.0	0.37	0.37			
Storden-----	0-9	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	1.0-2.0	0.28	0.28	5	4L	86
	9-18	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
	18-60	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
<b>1220C:</b>												
Cokato-----	0-10	22-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-----	3.0-5.0	0.28	0.28	5	6	48
	10-29	25-35	1.40-1.50	0.60-2.00	0.15-0.19	Moderate	1.0-2.0	0.37	0.37			
	29-60	20-30	1.45-1.60	0.60-2.00	0.14-0.18	Moderate	0.0-1.0	0.37	0.37			
Storden-----	0-9	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-----	1.0-2.0	0.28	0.28	5	4L	86
	9-60	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
Hawick-----	0-8	2-10	1.50-1.65	2.00-20.00	0.03-0.13	Low-----	1.0-3.0	0.10	0.15	5	8	---
	8-33	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low-----	0.0-0.5	0.10	0.15			
	33-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low-----	0.0-0.5	0.10	0.15			
<b>1362B:</b>												
Angus-----	0-9	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-----	1.0-4.0	0.28	0.28	5	6	48
	9-35	24-35	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	35-60	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-----	0.0-0.5	0.37	0.37			
<b>1383A:</b>												
Shorewood-----	0-9	30-40	1.20-1.40	0.20-0.60	0.18-0.22	Moderate	4.0-7.0	0.28	0.28	5	4	86
	9-46	36-55	1.20-1.35	0.06-0.60	0.13-0.16	High-----	1.0-3.0	0.32	0.32			
	46-60	24-45	1.25-1.55	0.20-2.00	0.14-0.16	Moderate	0.0-1.0	0.37	0.37			
<b>1384:</b>												
Minneopa-----	0-7	10-22	1.20-1.40	0.60-2.00	0.18-0.22	Low-----	2.0-4.0	0.24	0.24	3	5	56
	7-15	8-18	1.30-1.50	0.60-6.00	0.14-0.19	Low-----	0.5-1.0	0.24	0.24			
	15-25	2-6	1.45-1.70	6.00-63.00	0.03-0.08	Low-----	0.0-0.5	0.05	0.10			
	25-60	1-5	1.50-1.70	6.00-63.00	0.02-0.06	Low-----	0.0-0.5	0.05	0.10			
<b>1385:</b>												
Havelock-----	0-15	20-26	1.40-1.45	0.60-2.00	0.20-0.22	Moderate	5.0-7.0	0.24	0.24	5	4L	86
	15-38	27-35	1.40-1.50	0.60-2.00	0.20-0.22	High-----	1.0-2.0	0.28	0.28			
	38-60	12-26	1.50-1.65	2.00-6.00	0.13-0.17	Low-----	0.0-0.5	0.28	0.28			
<b>1387A:</b>												
Collinwood-----	0-13	35-40	1.20-1.30	0.20-0.60	0.14-0.17	Moderate	5.0-8.0	0.28	0.28	5	4	86
	13-32	35-60	1.25-1.35	0.06-0.60	0.13-0.16	High-----	1.0-4.0	0.32	0.32			
	32-60	35-45	1.25-1.40	0.06-0.60	0.11-0.15	High-----	0.0-2.0	0.32	0.32			

## Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
<b>1391B:</b>												
Wadenill-----	0-9	12-22	1.30-1.50	0.60-2.00	0.20-0.22	Low-----	2.0-5.0	0.24	0.24	5	5	56
	9-25	8-18	1.30-1.55	2.00-6.00	0.12-0.19	Low-----	1.0-2.0	0.24	0.24			
	25-60	8-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.28	0.28			
Sunburg-----	0-7	12-20	1.35-1.55	2.00-6.00	0.16-0.18	Low-----	1.0-4.0	0.24	0.24	5	3	86
	7-60	10-18	1.40-1.60	2.00-6.00	0.11-0.19	Low-----	0.0-1.0	0.24	0.24			
<b>1406:</b>												
Medo-----	0-20	---	0.25-0.45	0.20-6.00	0.35-0.45	-----	20-50	---	---	2	2	134
	20-28	15-30	1.15-1.65	0.60-6.00	0.13-0.20	Moderate	5.0-20	0.24	0.24			
	28-34	15-30	1.35-1.65	0.60-6.00	0.13-0.20	Moderate	1.0-4.0	0.32	0.32			
	34-60	0-10	1.50-1.65	2.00-20.00	0.03-0.10	Low-----	0.5-2.0	0.10	0.10			
Dassel-----	0-14	6-18	1.30-1.45	2.00-6.00	0.16-0.20	Low-----	3.0-15	0.20	0.20	4	3	86
	14-31	2-6	1.40-1.60	2.00-6.00	0.12-0.17	Low-----	1.0-4.0	0.20	0.20			
	31-60	2-8	1.45-1.65	6.00-20.00	0.08-0.10	Low-----	0.0-1.0	0.20	0.20			
Biscay-----	0-10	18-27	1.20-1.30	0.60-2.00	0.20-0.22	Moderate	4.0-8.0	0.28	0.28	4	6	48
	10-29	18-30	1.25-1.35	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.28	0.28			
	29-60	1-6	1.55-1.65	6.00-63.00	0.02-0.04	Low-----	0.0-0.5	0.05	0.10			
<b>1801B:</b>												
Gardencity-----	0-13	5-20	1.30-1.40	2.00-6.00	0.16-0.20	Low-----	2.0-4.0	0.20	0.20	5	3	86
	13-34	12-18	1.40-1.50	2.00-6.00	0.11-0.17	Low-----	0.5-2.0	0.20	0.20			
	34-60	10-20	1.40-1.50	2.00-6.00	0.10-0.17	Low-----	0.0-0.5	0.20	0.20			

Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth		Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
<b>8B:</b>							
Sparta-----	0-16	3-10		2.0-12.0	5.1-7.3	---	---
	16-29	1-8		1.0-6.0	5.1-7.3	---	---
	29-60	0-5		1.0-4.0	5.1-7.8	---	---
<b>8C:</b>							
Sparta-----	0-7	3-10		2.0-12.0	5.1-7.3	---	---
	7-13	1-8		1.0-6.0	5.1-7.3	---	---
	13-60	0-5		1.0-4.0	5.1-7.8	---	---
<b>8D:</b>							
Sparta-----	0-9	3-10		2.0-12.0	5.1-7.3	---	---
	9-40	1-8		1.0-6.0	5.1-7.3	---	---
	40-60	0-5		1.0-4.0	5.1-7.8	---	---
<b>35:</b>							
Blue Earth-----	0-8	18-32		30.0-70.0	7.4-8.4	5-20	---
	8-60	18-32		30.0-70.0	7.4-8.4	5-40	---
<b>39A:</b>							
Wadena-----	0-13	18-27		5.0-25.0	6.1-7.3	---	---
	13-29	18-30		5.0-20.0	5.6-7.3	---	---
	29-60	1-5		0.0-5.0	6.6-8.4	0-15	---
<b>41A:</b>							
Esterville-----	0-12	5-15		2.0-20.0	5.6-7.3	---	---
	12-15	10-18		4.0-20.0	5.6-7.3	---	---
	15-60	0-8		0.0-5.0	6.6-8.4	0-15	---
<b>85:</b>							
Calco-----	0-22	28-33		36.0-41.0	7.4-8.4	5-30	---
	22-60	30-35		36.0-41.0	7.4-8.4	5-30	---
<b>86:</b>							
Canisteo-----	0-18	27-35		19.0-37.0	7.4-8.4	5-15	---
	18-26	25-35		12.0-29.0	7.4-8.4	12-18	---
	26-33	25-35		6.0-23.0	7.4-8.4	10-15	---
	33-60	22-30		9.0-20.0	7.4-8.4	10-15	---
<b>96B:</b>							
Collinwood-----	0-8	35-40		35.0-42.0	5.6-7.3	---	---
	8-32	35-60		26.0-50.0	5.6-7.3	---	---
	32-60	35-45		25.0-35.0	7.4-8.4	5-15	---
<b>101B:</b>							
Truman-----	0-14	18-27		20.0-35.0	5.6-7.3	---	---
	14-40	18-32		15.0-25.0	5.6-7.8	0-15	---
	40-60	18-32		13.0-23.0	7.4-8.4	5-20	---
<b>102B:</b>							
Clarion-----	0-12	20-27		20.0-25.0	5.6-7.3	---	---
	12-27	23-30		20.0-25.0	5.6-7.8	0-15	---
	27-60	22-30		20.0-25.0	7.4-8.4	5-30	---
<b>106C2:</b>							
Lester-----	0-9	20-27		10.0-24.0	5.6-7.3	---	---
	9-27	24-32		10.0-23.0	5.1-7.3	---	---
	27-60	22-30		8.0-18.0	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	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
112: Harps-----	0-19	27-35	20.0-30.0	7.9-8.4	20-40	---	---
	19-25	24-35	15.0-25.0	7.9-8.4	20-30	---	---
	25-60	22-30	10.0-20.0	7.4-8.4	20-30	---	---
113: Webster-----	0-17	26-35	22.0-32.0	6.6-7.3	---	---	---
	17-24	25-35	15.0-25.0	6.6-7.8	0-10	---	---
	24-60	22-30	13.0-20.0	7.4-8.4	5-30	---	---
114: Glencoe-----	0-10	27-35	23.0-37.0	6.1-7.8	0-5	---	---
	10-34	25-35	16.0-27.0	6.1-7.8	0-5	---	---
	34-80	25-35	14.0-25.0	6.6-7.8	0-5	---	---
129: Cylinder-----	0-15	22-27	20.0-25.0	5.6-7.3	---	---	---
	15-31	22-30	20.0-25.0	6.1-7.3	---	---	---
	31-60	2-12	5.0-10.0	6.6-8.4	0-25	---	---
130: Nicollet-----	0-16	27-35	25.0-40.0	5.6-7.3	---	---	---
	16-30	25-35	15.0-25.0	5.6-7.8	0-15	---	---
	30-60	22-30	10.0-20.0	7.4-8.4	5-30	---	---
134: Okoboji-----	0-8	35-42	41.0-45.0	6.1-7.8	0-15	---	---
	8-28	35-45	41.0-45.0	6.6-7.8	0-15	---	---
	28-60	25-35	36.0-41.0	6.6-8.4	0-30	---	---
136: Madelia-----	0-16	27-35	27.0-40.0	6.1-7.3	---	---	---
	16-30	18-35	17.0-32.0	6.6-7.8	---	---	---
	30-60	18-35	15.0-28.0	7.4-8.4	5-20	---	---
140: Spicer-----	0-14	29-35	28.0-40.0	7.4-8.4	5-30	---	---
	14-27	18-35	20.0-35.0	7.4-8.4	5-30	---	---
	27-60	18-35	15.0-30.0	7.4-8.4	5-30	---	---
143B: Chelsea-----	0-6	8-15	5.0-10.0	5.6-7.3	---	---	---
	6-60	5-10	5.0-10.0	5.1-6.5	---	---	---
178: Granby-----	0-13	8-18	5.0-20.0	5.6-7.3	---	---	---
	13-26	0-14	1.0-10.0	5.6-7.8	---	---	---
	26-60	0-10	1.0-3.0	6.6-8.4	---	---	---
181: Litchfield-----	0-20	5-10	6.0-14.0	5.1-7.3	---	---	---
	20-40	5-10	3.0-8.0	5.1-7.3	---	---	---
	40-60	1-8	1.0-6.0	6.1-7.8	0-5	---	---
183: Dassel-----	0-23	10-24	10.0-50.0	5.6-7.3	---	---	---
	23-31	2-6	3.0-10.0	5.6-7.3	---	---	---
	31-60	2-8	1.0-5.0	6.1-7.8	0-5	---	---
197: Kingston-----	0-16	27-32	25.0-35.0	5.6-7.3	---	---	---
	16-25	18-32	15.0-30.0	5.6-7.8	0-5	---	---
	25-60	18-32	15.0-25.0	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	Gypsum
	In	Pct	meq/100g	pH	Pct	Pct
211:						
Lura-----	0-24	45-60	35.0-70.0	6.1-7.8	0-5	---
	24-31	45-60	29.0-54.0	6.1-7.3	---	---
	31-60	28-60	17.0-47.0	6.6-7.8	10-20	---
229:						
Waldorf-----	0-8	35-40	33.0-48.0	6.1-7.3	---	---
	8-35	40-55	25.0-46.0	6.6-7.8	0-15	---
	35-60	24-45	14.0-37.0	7.4-8.4	15-30	---
239:						
Le Sueur-----	0-14	28-30	15.0-26.0	5.6-7.3	---	---
	14-33	24-35	11.0-25.0	5.1-7.3	---	---
	33-60	20-30	8.0-18.0	7.4-8.4	5-30	---
281:						
Darfur-----	0-23	18-25	10.0-20.0	6.1-7.3	---	---
	23-30	13-18	5.0-15.0	6.6-7.8	---	---
	30-60	5-15	1.0-10.0	6.6-8.4	0-15	---
286B:						
Shorewood-----	0-12	30-40	30.0-45.0	5.6-7.3	---	---
	12-38	36-55	25.0-45.0	5.1-7.3	---	---
	38-60	24-45	12.0-35.0	6.6-7.8	0-15	---
311C2:						
Shorewood-----	0-6	40-45	35.0-47.0	5.6-7.3	---	---
	6-20	36-55	25.0-45.0	5.1-7.3	---	---
	20-60	24-45	12.0-35.0	6.6-7.8	0-15	---
327A:						
Dickman-----	0-12	6-18	5.0-15.0	5.6-6.5	---	---
	12-18	6-18	3.0-10.0	5.6-7.3	---	---
	18-60	1-10	0.0-5.0	5.6-7.8	0-5	---
327B:						
Dickman-----	0-12	6-18	5.0-15.0	5.6-6.5	---	---
	12-30	6-18	3.0-10.0	5.6-7.3	---	---
	30-60	1-10	0.0-5.0	5.6-7.8	0-5	---
399:						
Biscay-----	0-14	18-27	20.0-35.0	6.1-7.8	0-15	---
	14-25	18-30	12.0-25.0	6.6-7.8	0-15	---
	25-60	1-6	1.0-5.0	7.4-8.4	5-30	---
415:						
Kanaranzi-----	0-9	18-27	5.0-23.0	5.6-7.3	---	---
	9-18	18-32	5.0-20.0	5.6-7.8	0-10	---
	18-60	0-5	0.0-5.0	7.4-8.4	5-20	---
423:						
Seaforth-----	0-12	20-30	16.0-27.0	7.4-8.4	5-20	---
	12-28	20-30	10.0-19.0	7.4-8.4	18-30	---
	28-60	20-27	10.0-18.0	7.4-8.4	10-25	---
461B:						
Koronis-----	0-8	10-20	5.0-20.0	5.6-7.3	---	---
	8-31	18-24	10.0-20.0	5.6-7.3	---	---
	31-60	12-20	5.0-15.0	7.4-8.4	5-20	---

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth		Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
461C2:							
Koronis-----	0-8	10-20		5.0-20.0	5.6-7.3	---	---
	8-24	18-24		10.0-20.0	5.6-7.3	---	---
	24-60	12-20		5.0-15.0	7.4-8.4	5-20	---
511:							
Marcellon-----	0-13	13-20		8.0-30.0	5.6-7.3	---	---
	13-32	20-24		4.0-20.0	5.6-7.3	---	---
	32-60	8-17		2.0-15.0	7.4-8.4	10-25	---
523:							
Houghton-----	0-7	---		140-200	4.5-7.8	---	---
	7-60	---		100-200	4.5-7.8	---	---
525:							
Muskego-----	0-10	---		140-180	5.6-7.3	---	---
	10-40	---		150-190	5.6-7.3	---	---
	40-60	18-35		10.0-45.0	6.6-8.4	60-80	---
539:							
Klossner-----	0-28	---		50-150	5.6-7.8	0-5	---
	28-45	22-35		35.0-65.0	6.1-7.8	0-5	---
	45-60	15-32		5.0-25.0	6.1-8.4	0-20	---
548:							
Medo-----	0-24	---		40-100	6.1-7.8	0-10	---
	24-29	15-30		20.0-55.0	6.1-7.8	0-5	---
	29-56	15-30		10.0-25.0	6.1-7.8	0-5	---
	56-60	0-10		1.0-9.0	6.1-8.4	0-15	---
610:							
Calco-----	0-6	28-33		36.0-41.0	7.4-8.4	5-30	---
	6-55	30-35		36.0-41.0	7.4-8.4	5-30	---
	55-60	22-32		36.0-41.0	7.4-8.4	5-30	---
611D:							
Hawick-----	0-7	2-10		1.0-10.0	6.1-7.8	0-10	---
	7-10	1-10		1.0-5.0	6.1-7.8	0-10	---
	10-60	1-5		1.0-5.0	7.4-8.4	5-15	---
612B:							
Wadenill-----	0-13	12-22		15.0-25.0	5.6-7.3	---	---
	13-30	8-18		10.0-20.0	5.6-7.3	0-5	---
	30-60	8-18		5.0-15.0	7.4-8.4	10-20	---
613:							
Grovecity-----	0-15	12-22		15.0-25.0	6.1-7.3	---	---
	15-30	10-18		10.0-20.0	6.1-7.8	0-5	---
	30-60	8-18		5.0-15.0	7.4-8.4	10-20	---
664:							
Zook-----	0-10	35-40		36.0-41.0	5.6-7.3	---	---
	10-41	36-45		36.0-41.0	5.6-7.8	---	---
	41-60	20-45		30.0-36.0	5.6-7.8	---	---
740:							
Hamel-----	0-28	20-27		15.0-30.0	5.6-7.3	---	---
	28-56	24-35		15.0-30.0	5.6-7.3	---	---
	56-60	20-30		10.0-20.0	7.4-7.8	5-25	---
Glencoe-----	0-15	25-27		22.0-33.0	6.1-7.8	0-5	---
	15-45	25-35		16.0-27.0	6.1-7.8	0-5	---
	45-60	25-35		14.0-25.0	6.6-7.8	0-5	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth		Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
<b>804B:</b>							
Koronis-----	0-8	10-20		5.0-20.0	5.6-7.3	---	---
	8-33	18-24		10.0-20.0	5.6-7.3	---	---
	33-60	12-20		5.0-15.0	7.4-8.4	5-20	---
Sunburg-----	0-9	12-20		5.0-15.0	6.6-8.4	0-15	---
	9-60	10-18		5.0-11.0	7.4-8.4	10-30	---
Hawick-----	0-9	2-10		1.0-10.0	6.1-7.8	0-10	---
	9-49	1-10		1.0-5.0	6.1-7.8	0-10	---
	49-60	1-5		1.0-5.0	7.4-8.4	5-15	---
<b>804C2:</b>							
Koronis-----	0-8	6-16		5.0-15.0	5.6-7.3	---	---
	8-26	18-24		10.0-20.0	5.6-7.3	---	---
	26-60	12-20		5.0-15.0	7.4-8.4	5-20	---
Sunburg-----	0-10	12-20		5.0-15.0	6.6-8.4	0-15	---
	10-60	10-18		5.0-11.0	7.4-8.4	10-30	---
Hawick-----	0-9	2-10		1.0-10.0	6.1-7.8	0-10	---
	9-60	1-10		1.0-5.0	6.1-7.8	0-10	---
<b>804D2:</b>							
Koronis-----	0-8	6-16		5.0-15.0	5.6-7.3	---	---
	8-25	18-24		10.0-20.0	5.6-7.3	---	---
	25-60	12-20		5.0-15.0	7.4-8.4	5-20	---
Sunburg-----	0-7	12-20		5.0-15.0	6.6-8.4	0-15	---
	7-60	10-18		5.0-11.0	7.4-8.4	10-30	---
Hawick-----	0-7	2-10		1.0-10.0	6.1-7.8	0-10	---
	7-20	1-10		1.0-5.0	6.1-7.8	0-10	---
	20-60	1-5		1.0-5.0	7.4-8.4	5-15	---
<b>804E:</b>							
Koronis-----	0-5	6-16		5.0-15.0	5.6-7.3	---	---
	5-21	18-24		10.0-20.0	5.6-7.3	---	---
	21-60	12-20		5.0-15.0	7.4-8.4	5-20	---
Sunburg-----	0-4	12-20		5.0-15.0	6.6-8.4	0-15	---
	4-60	10-18		5.0-11.0	7.4-8.4	10-30	---
Hawick-----	0-14	2-10		1.0-10.0	6.1-7.8	0-10	---
	14-60	1-10		1.0-5.0	6.1-7.8	0-10	---
<b>805C2:</b>							
Sunburg-----	0-8	12-20		5.0-15.0	6.6-8.4	0-15	---
	8-60	10-18		5.0-11.0	7.4-8.4	10-30	---
Wadenill-----	0-7	12-22		15.0-25.0	5.6-7.3	---	---
	7-20	8-18		10.0-20.0	5.6-7.3	0-5	---
	20-60	8-18		5.0-15.0	7.4-8.4	10-20	---
<b>805D2:</b>							
Sunburg-----	0-7	12-20		5.0-15.0	6.6-8.4	0-15	---
	7-60	10-18		5.0-11.0	7.4-8.4	10-30	---
Wadenill-----	0-7	12-22		15.0-25.0	5.6-7.3	---	---
	7-18	8-18		10.0-20.0	5.6-7.3	0-5	---
	18-60	8-18		5.0-15.0	7.4-8.4	10-20	---

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth		Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
<b>807D2:</b>							
Koronis-----	0-9	6-16	5.0-15.0	5.6-7.3	---	---	
	9-25	18-24	10.0-20.0	5.6-7.3	---	---	
	25-60	12-20	5.0-15.0	7.4-8.4	5-20	---	
Sunburg-----	0-7	12-20	5.0-15.0	6.6-8.4	0-15	---	
	7-60	10-18	5.0-11.0	7.4-8.4	10-30	---	
<b>875B:</b>							
Estherville----	0-9	5-15	2.0-20.0	5.6-7.3	---	---	
	9-14	10-18	4.0-20.0	5.6-7.3	---	---	
	14-60	0-8	0.0-5.0	6.6-8.4	0-15	---	
Hawick-----	0-7	5-15	1.0-10.0	6.1-7.8	0-10	---	
	7-11	1-10	1.0-5.0	6.1-7.8	0-10	---	
	11-60	1-5	1.0-5.0	7.4-8.4	5-15	---	
<b>875C:</b>							
Hawick-----	0-11	2-10	1.0-10.0	6.1-7.8	0-10	---	
	11-60	1-5	1.0-5.0	7.4-8.4	5-15	---	
Estherville----	0-8	5-15	2.0-20.0	5.6-7.3	---	---	
	8-13	10-18	4.0-20.0	5.6-7.3	---	---	
	13-60	0-8	0.0-5.0	6.6-8.4	0-15	---	
<b>887B:</b>							
Clarion-----	0-11	20-27	20.0-25.0	5.6-7.3	---	---	
	11-30	23-30	20.0-25.0	5.6-7.8	0-15	---	
	30-60	22-30	20.0-25.0	7.4-8.4	5-30	---	
Swanlake-----	0-8	18-27	13.0-22.0	7.4-8.4	0-10	---	
	8-12	18-30	9.0-19.0	7.4-8.4	10-25	---	
	12-60	18-30	9.0-17.0	7.4-8.4	10-25	---	
<b>899:</b>							
Harps-----	0-9	27-35	20.0-30.0	7.9-8.4	20-40	---	
	9-28	24-35	15.0-25.0	7.9-8.4	20-30	---	
	28-60	22-30	10.0-20.0	7.4-8.4	20-30	---	
Okoboji-----	0-17	35-42	41.0-45.0	6.1-7.8	0-15	---	
	17-47	35-45	41.0-45.0	6.6-7.8	0-15	---	
	47-60	25-35	36.0-41.0	6.6-8.4	0-30	---	
<b>909C2:</b>							
Bold-----	0-7	12-18	6.0-15.0	7.4-8.4	10-40	---	
	7-60	12-18	5.0-12.0	7.4-8.4	10-50	---	
Truman-----	0-10	18-27	20.0-35.0	5.6-7.3	---	---	
	10-31	18-32	15.0-25.0	5.6-7.8	0-15	---	
	31-60	18-32	13.0-23.0	7.4-8.4	5-20	---	
<b>909D2:</b>							
Bold-----	0-7	12-18	6.0-15.0	7.4-8.4	10-40	---	
	7-60	12-18	5.0-12.0	7.4-8.4	10-50	---	
Truman-----	0-13	18-27	20.0-35.0	5.6-7.3	---	---	
	13-22	18-32	15.0-25.0	5.6-7.8	0-15	---	
	22-60	18-32	13.0-23.0	7.4-8.4	5-20	---	
<b>920B:</b>							
Clarion-----	0-12	20-27	20.0-25.0	5.6-7.3	---	---	
	12-23	23-30	20.0-25.0	5.6-7.8	0-15	---	
	23-60	22-30	20.0-25.0	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	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
<b>920B:</b>							
Storden-----	0-7	18-27	11.0-18.0	7.4-8.4	5-30	---	---
	7-37	18-30	9.0-18.0	7.4-8.4	15-30	---	---
	37-60	18-30	9.0-18.0	7.4-8.4	10-20	---	---
Hawick-----	0-9	2-10	1.0-10.0	6.1-7.8	0-10	---	---
	9-28	1-10	1.0-5.0	6.1-7.8	0-10	---	---
	28-60	1-5	1.0-5.0	7.4-8.4	5-15	---	---
<b>945D2:</b>							
Lester-----	0-9	20-27	10.0-24.0	5.6-7.3	---	---	---
	9-26	24-32	10.0-23.0	5.1-7.3	---	---	---
	26-60	22-30	8.0-18.0	7.4-8.4	5-30	---	---
Storden-----	0-5	18-27	11.0-18.0	7.4-8.4	5-30	---	---
	5-28	18-30	9.0-18.0	7.4-8.4	15-30	---	---
	28-60	18-30	9.0-18.0	7.4-8.4	10-20	---	---
<b>945E:</b>							
Lester-----	0-7	20-27	10.0-24.0	5.6-7.3	---	---	---
	7-23	24-32	10.0-23.0	5.1-7.3	---	---	---
	23-60	22-30	8.0-18.0	7.4-8.4	5-30	---	---
Storden-----	0-9	18-27	11.0-18.0	7.4-8.4	5-30	---	---
	9-30	18-30	9.0-18.0	7.4-8.4	15-30	---	---
	30-60	18-30	9.0-18.0	7.4-8.4	10-20	---	---
<b>956:</b>							
Canistee-----	0-17	27-35	19.0-37.0	7.4-8.4	5-15	---	---
	17-23	25-35	12.0-29.0	7.4-8.4	12-18	---	---
	23-41	25-35	6.0-23.0	7.4-8.4	10-15	---	---
	41-60	22-30	9.0-20.0	7.4-8.4	10-15	---	---
Glencoe-----	0-7	27-35	23.0-37.0	6.1-7.8	0-5	---	---
	7-36	25-35	16.0-27.0	6.1-7.8	0-5	---	---
	36-60	25-35	14.0-25.0	6.6-7.8	0-5	---	---
<b>960C2:</b>							
Storden-----	0-8	18-27	11.0-18.0	7.4-8.4	5-30	---	---
	8-21	18-30	9.0-18.0	7.4-8.4	15-30	---	---
	21-60	18-30	9.0-18.0	7.4-8.4	10-20	---	---
Omsrud-----	0-9	20-26	14.0-35.0	5.6-7.3	---	---	---
	9-25	22-30	9.0-22.0	5.6-7.3	---	---	---
	25-60	22-30	7.0-16.0	7.4-8.4	5-30	---	---
<b>960D2:</b>							
Storden-----	0-7	18-27	11.0-18.0	7.4-8.4	5-30	---	---
	7-23	18-30	9.0-18.0	7.4-8.4	15-30	---	---
	23-60	18-30	9.0-18.0	7.4-8.4	10-20	---	---
Omsrud-----	0-8	20-26	14.0-35.0	5.6-7.3	---	---	---
	8-22	22-30	9.0-22.0	5.6-7.3	---	---	---
	22-60	22-30	7.0-16.0	7.4-8.4	5-30	---	---
<b>978:</b>							
Cordova-----	0-15	27-30	20.0-30.0	6.1-7.3	---	---	---
	15-39	28-35	15.0-25.0	5.1-6.5	---	---	---
	39-60	18-30	10.0-17.0	7.4-8.4	5-20	---	---
Rolfe-----	0-28	22-27	20.0-25.0	5.1-7.3	---	---	---
	28-40	38-45	20.0-30.0	6.1-7.3	---	---	---
	40-60	24-35	20.0-25.0	6.1-8.4	0-25	---	---

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth		Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct		meq/100g	pH	Pct	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-----	0-60	2-18	1.0-15.0	6.6-9.0	---	---	
	60-80	---	---	---	---	---	
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	---	
1080:							
Klossner-----	0-25	---	50-150	5.1-7.8	0-5	---	
	25-60	20-35	20.0-60.0	6.1-8.4	0-20	---	
Okoboji-----	0-10	30-40	41.0-50.0	6.1-7.8	0-15	---	
	10-42	35-45	41.0-45.0	6.6-7.8	0-15	---	
	42-60	35-45	36.0-41.0	6.6-7.8	0-30	---	
Glencoe-----	0-42	27-35	20.0-40.0	6.1-7.8	0-5	---	
	42-50	25-35	15.0-30.0	6.6-7.8	0-5	---	
	50-60	22-32	10.0-20.0	7.4-7.8	5-20	---	
1096:							
Fieldon-----	0-20	15-22	15.0-30.0	7.4-8.4	5-30	---	
	20-26	10-18	10.0-20.0	7.4-8.4	5-30	---	
	26-60	5-15	1.0-10.0	7.4-8.4	5-30	---	
Dassel-----	0-21	10-24	10.0-50.0	5.6-7.3	---	---	
	21-32	2-6	3.0-10.0	5.6-7.3	---	---	
	32-60	2-8	1.0-5.0	6.1-7.8	0-5	---	
1097:							
Mayer-----	0-16	18-30	15.0-31.0	7.4-8.4	5-30	---	
	16-25	18-30	13.0-27.0	7.4-8.4	5-30	---	
	25-60	1-5	1.0-10.0	7.4-8.4	5-30	---	
Biscay-----	0-20	27-30	20.0-35.0	6.1-7.8	0-15	---	
	20-25	18-30	12.0-25.0	6.6-7.8	0-15	---	
	25-28	10-28	5.0-20.0	6.6-7.8	0-15	---	
	28-60	1-6	1.0-5.0	7.4-8.4	5-30	---	
1098:							
Biscay-----	0-20	18-30	20.0-35.0	6.1-7.8	0-15	---	
	20-25	18-30	12.0-25.0	6.6-7.8	0-15	---	
	25-60	1-6	1.0-5.0	7.4-8.4	5-30	---	
Biscay, depressional---	0-18	27-30	20.0-35.0	6.1-7.8	0-15	---	
	18-22	18-30	12.0-25.0	6.6-7.8	0-15	---	
	22-26	10-28	5.0-20.0	6.6-7.8	0-15	---	
	26-60	1-6	1.0-5.0	7.4-8.4	5-30	---	
1099:							
Granby-----	0-12	2-14	5.0-20.0	5.6-7.3	---	---	
	12-24	0-14	1.0-10.0	5.6-7.8	---	---	
	24-60	0-10	1.0-3.0	6.6-8.4	---	---	

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct	meq/100g	pH	Pct	Pct
1100: Nicollet-----	0-13	27-35	25.0-40.0	5.6-7.3	---	---
	13-26	25-35	15.0-25.0	5.6-7.8	0-15	---
	26-60	22-30	10.0-20.0	7.4-8.4	5-30	---
1101: Webster-----	0-19	27-35	22.0-32.0	6.6-7.3	---	---
	19-24	25-35	15.0-25.0	6.6-7.8	0-10	---
	24-60	22-30	13.0-20.0	7.4-8.4	5-30	---
1159B: Strout-----	0-10	35-45	25.0-45.0	6.1-7.3	---	---
	10-24	35-50	20.0-40.0	5.6-7.3	---	---
	24-60	30-45	15.0-35.0	7.4-8.4	5-30	---
Arkton-----	0-9	30-40	25.0-40.0	6.6-8.4	0-30	---
	9-25	30-45	20.0-35.0	7.4-8.4	15-30	---
	25-60	25-40	10.0-30.0	7.4-8.4	5-30	---
1161: Barry-----	0-11	16-23	15.0-26.0	6.1-7.3	---	---
	11-33	18-25	8.0-17.0	6.1-7.3	---	---
	33-60	10-16	4.0-11.0	7.4-7.8	10-20	---
1162A: Kandiyohi-----	0-11	40-50	35.0-50.0	6.1-7.3	---	---
	11-26	35-60	25.0-45.0	6.1-7.3	---	---
	26-33	30-55	20.0-40.0	7.4-8.4	15-30	0-1
	33-60	30-55	20.0-40.0	7.4-8.4	10-20	0-1
1162B: Kandiyohi-----	0-10	40-50	35.0-50.0	6.1-7.3	---	---
	10-23	35-60	25.0-45.0	6.1-7.3	---	---
	23-29	30-55	20.0-40.0	7.4-8.4	15-30	0-1
	29-60	30-55	20.0-40.0	7.4-8.4	10-20	0-1
1163: Cohoctah-----	0-17	7-20	10-20	6.1-7.8	---	---
	17-22	5-18	5-20	6.1-8.4	---	---
	22-60	2-5	1-5	6.1-8.4	---	---
1165: Lundlake-----	0-14	28-35	25.0-42.0	6.6-7.3	---	---
	14-35	20-30	14.0-25.0	6.6-7.3	---	---
	35-47	18-27	10.0-18.0	6.6-7.8	0-10	---
	47-60	10-18	5.0-10.0	7.4-7.8	10-20	---
1168: Swedegrove-----	0-15	14-24	17.0-26.0	7.4-8.4	5-20	---
	15-31	16-22	8.0-13.0	7.4-8.4	5-20	---
	31-60	10-16	5.0-9.0	7.4-8.4	10-25	---
Lundlake-----	0-12	28-35	25.0-42.0	6.6-7.3	---	---
	12-28	20-30	14.0-25.0	6.6-7.3	---	---
	28-36	18-27	10.0-18.0	6.6-7.8	0-10	---
	36-60	10-18	5.0-10.0	7.4-7.8	10-20	---
1169: Corvuso-----	0-11	35-55	25.0-40.0	7.4-8.4	3-20	---
	11-28	35-60	15.0-30.0	7.4-8.4	15-25	0-2
	28-60	30-55	15.0-30.0	7.4-8.4	10-20	---

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth		Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
1169:							
Lura-----	0-26	45-60	35.0-70.0	6.1-7.8	0-5	---	---
	26-60	45-60	29.0-54.0	6.1-7.3	---	---	---
1171C:							
Newlondon-----	0-7	30-45	30.0-45.0	6.6-7.8	0-20	---	---
	7-38	35-45	30.0-45.0	7.4-8.4	10-30	---	---
	38-60	25-40	10.0-30.0	7.4-8.4	5-25	---	---
Strout-----	0-9	35-45	25.0-45.0	6.1-7.3	---	---	---
	9-23	35-50	20.0-40.0	5.6-7.3	---	---	---
	23-60	30-45	15.0-35.0	7.4-8.4	5-30	---	---
1171D:							
Newlondon-----	0-7	30-45	30.0-45.0	6.6-7.8	0-20	---	---
	7-38	35-45	30.0-45.0	7.4-8.4	10-30	---	---
	38-60	25-40	10.0-30.0	7.4-8.4	5-25	---	---
Strout-----	0-9	35-45	25.0-45.0	6.1-7.3	---	---	---
	9-19	35-50	20.0-40.0	5.6-7.3	---	---	---
	19-60	30-45	15.0-35.0	7.4-8.4	5-30	---	---
1172C:							
Sparta-----	0-18	3-10	2.0-12.0	5.1-7.3	---	---	---
	18-55	1-8	1.0-6.0	5.1-7.3	---	---	---
	55-60	0-5	1.0-4.0	5.1-7.8	---	---	---
Gardencity-----	0-7	5-20	8.0-25.0	6.1-7.3	---	---	---
	7-24	12-18	3.0-25.0	5.6-7.3	---	---	---
	24-60	10-20	3.0-25.0	6.1-8.4	0-20	---	---
1173:							
Muskego-----	0-45	---	140-180	6.6-7.3	---	---	---
	45-60	18-35	25.0-45.0	7.4-7.8	2-10	---	---
Klossner-----	0-22	---	150-200	5.6-7.8	0-15	---	---
	22-45	22-35	150-200	6.1-7.8	0-15	---	---
	45-60	15-32	20.0-50.0	6.1-7.8	0-30	---	---
1174:							
Danielson-----	0-9	35-40	25.0-50.0	6.1-7.3	---	---	---
	9-36	35-45	30.0-45.0	6.1-7.3	---	---	---
	36-51	35-55	25.0-40.0	6.1-7.3	---	---	---
	51-60	30-55	15.0-40.0	6.6-8.4	0-20	---	---
1175:							
Swedegrove-----	0-14	14-24	17.0-26.0	7.4-8.4	5-20	---	---
	14-20	16-22	8.0-13.0	7.4-8.4	5-20	---	---
	20-60	10-16	5.0-9.0	7.4-8.4	10-25	---	---
1176:							
Litchfield-----	0-17	10-16	8.0-18.0	6.1-7.3	---	---	---
	17-33	5-12	2.0-8.0	6.6-7.3	---	---	---
	33-60	0-2	0.0-2.0	6.6-7.3	---	---	---
1177C:							
Gardencity-----	0-13	5-20	8.0-25.0	6.1-7.3	---	---	---
	13-25	12-18	3.0-25.0	5.6-7.3	---	---	---
	25-60	10-20	3.0-25.0	6.1-8.4	0-20	---	---
Bold-----	0-7	12-18	6.0-15.0	7.4-8.4	10-40	---	---
	7-60	12-18	5.0-12.0	7.4-8.4	10-50	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth		Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
1178: Uniongrove-----	0-16	20-25	18.0-27.0	6.1-7.3	---	---	
	16-30	18-23	8.0-15.0	6.1-7.3	---	---	
	30-60	10-16	4.0-10.0	7.4-7.8	10-25	---	
1183: Crowriver-----	0-15	14-20	15.0-22.0	7.4-8.4	20-30	---	
	15-22	12-22	8.0-17.0	7.4-8.4	20-30	---	
	22-60	12-18	7.0-11.0	7.4-7.8	10-20	---	
1184: Corvuso-----	0-19	35-60	15.0-35.0	7.4-8.4	15-25	0-2	
	19-26	35-60	15.0-30.0	7.4-8.4	15-25	0-2	
	26-60	30-55	15.0-30.0	7.4-8.4	10-20	---	
1185: Gardencity-----	0-19	5-20	15.0-24.0	6.6-7.3	---	---	
	19-24	12-18	5.0-20.0	6.1-7.3	---	---	
	24-60	10-20	5.0-12.0	6.6-8.4	0-15	---	
1186: Forestcity-----	0-22	10-18	10.0-25.0	6.1-7.3	---	---	
	22-36	18-28	15.0-25.0	6.1-7.3	---	---	
	36-60	12-28	8.0-20.0	5.6-7.3	---	---	
	60-65	10-18	5.0-12.0	7.4-7.8	10-20	0-1	
Lundlake-----	0-20	20-27	20.0-38.0	6.6-7.3	---	---	
	20-28	20-30	14.0-25.0	6.6-7.3	---	---	
	28-46	18-27	10.0-18.0	6.6-7.8	0-10	---	
	46-60	10-18	5.0-10.0	7.4-7.8	10-20	---	
1192: Crowriver-----	0-13	14-20	15.0-22.0	7.4-8.4	20-30	---	
	13-17	12-22	8.0-17.0	7.4-8.4	20-30	---	
	17-60	12-18	7.0-11.0	7.4-7.8	10-20	---	
Lundlake-----	0-22	20-27	20.0-38.0	6.6-7.3	---	---	
	22-28	20-30	14.0-25.0	6.6-7.3	---	---	
	28-35	18-27	10.0-18.0	6.6-7.8	0-10	---	
	35-60	10-18	5.0-10.0	7.4-7.8	10-20	---	
1193: Cosmos-----	0-15	35-50	30.0-50.0	6.1-7.3	---	---	
	15-30	35-60	25.0-45.0	6.1-7.3	---	0-2	
	30-60	30-55	15.0-30.0	7.4-8.4	10-20	0-2	
1197: Cohoctah-----	0-21	5-20	10.0-30.0	6.1-7.8	---	---	
	21-36	5-18	5.0-20.0	6.1-8.4	---	---	
	36-60	2-18	1.0-10.0	6.1-8.4	---	---	
1198B: Rohrbeck-----	0-6	3-6	3.0-8.0	6.1-7.3	---	---	
	6-25	2-6	2.0-6.0	5.6-6.5	---	---	
	25-41	16-24	8.0-17.0	5.6-7.3	---	---	
	41-60	12-18	5.0-12.0	7.4-7.8	10-20	---	
Koronis-----	0-9	6-16	5.0-15.0	5.6-7.3	---	---	
	9-28	18-24	10.0-20.0	5.6-7.3	---	---	
	28-60	12-20	5.0-15.0	7.4-8.4	5-20	---	

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct	meq/100g	pH	Pct	Pct
1199:						
Klossner-----	0-38	---	50-150	5.1-7.8	0-5	---
	38-60	20-35	20.0-60.0	6.1-8.4	0-20	---
Lundlake-----	0-26	20-27	30.0-55.0	6.6-7.3	---	---
	26-56	20-27	20.0-34.0	6.6-7.3	---	---
	56-60	10-18	7.0-16.0	6.6-7.8	0-5	---
1203:						
Muskego-----	0-10	2-4	140-180	5.6-7.3	---	---
	10-29	18-35	10.0-45.0	6.6-8.4	60-80	---
	29-60	22-32	5.0-45.0	7.4-8.4	5-35	---
Blue Earth-----	0-50	18-32	30.0-70.0	7.4-8.4	5-20	---
	50-60	18-32	30.0-70.0	7.4-8.4	5-40	---
Houghton-----	0-60	---	150-230	6.6-7.3	---	---
1204B:						
Reedslake-----	0-12	20-26	16.0-23.0	5.6-7.3	---	---
	12-26	22-32	13.0-21.0	5.6-7.3	---	---
	26-60	20-27	10.0-15.0	7.4-7.8	5-25	---
1213C:						
Cokato-----	0-16	22-27	15.0-25.0	5.6-7.3	---	---
	16-41	25-35	15.0-20.0	5.6-7.3	---	---
	41-60	20-30	10.0-15.0	7.4-8.4	10-20	---
Storden-----	0-9	18-27	11.0-18.0	7.4-8.4	5-30	---
	9-18	18-30	9.0-18.0	7.4-8.4	15-30	---
	18-60	18-30	9.0-18.0	7.4-8.4	10-20	---
1220C:						
Cokato-----	0-10	22-27	15.0-25.0	5.6-7.3	---	---
	10-29	25-35	15.0-20.0	5.6-7.3	---	---
	29-60	20-30	10.0-15.0	7.4-8.4	10-20	---
Storden-----	0-9	18-27	11.0-18.0	7.4-8.4	5-30	---
	9-60	18-30	9.0-18.0	7.4-8.4	15-30	---
Hawick-----	0-8	2-10	1.0-10.0	6.1-7.8	0-10	---
	8-33	1-10	1.0-5.0	6.1-7.8	0-10	---
	33-60	1-5	1.0-5.0	7.4-8.4	5-15	---
1362B:						
Angus-----	0-9	20-27	10.0-24.0	5.6-7.3	---	---
	9-35	24-35	10.0-23.0	5.1-7.3	---	---
	35-60	22-30	8.0-18.0	7.4-8.4	5-30	---
1383A:						
Shorewood-----	0-9	30-40	30.0-45.0	5.6-7.3	---	---
	9-46	36-55	25.0-45.0	5.1-7.3	---	---
	46-60	24-45	25.0-35.0	6.6-7.8	0-15	---
1384:						
Minneopa-----	0-7	10-22	10.0-20.0	6.1-7.3	---	---
	7-15	8-18	5.0-10.0	6.1-7.3	---	---
	15-25	2-6	1.0-4.0	6.1-7.3	---	---
	25-60	1-5	0.0-4.0	7.4-8.4	5-25	---

## Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth		Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	Pct		meq/100g	pH	Pct	Pct
<b>1385:</b>							
Havelock-----	0-15	20-26	30.0-36.0	30.0-36.0	7.4-8.4	5-30	---
	15-38	27-35	30.0-36.0	30.0-36.0	7.4-8.4	5-30	---
	38-60	12-26	10.0-20.0	10.0-20.0	7.4-8.4	5-30	---
<b>1387A:</b>							
Collinwood-----	0-13	35-40	35.0-44.0	35.0-44.0	5.6-7.3	---	---
	13-32	35-60	26.0-52.0	26.0-52.0	5.6-7.3	---	---
	32-60	35-45	25.0-35.0	25.0-35.0	7.4-8.4	5-15	---
<b>1391B:</b>							
Wadenill-----	0-9	12-22	15.0-25.0	15.0-25.0	5.6-7.3	---	---
	9-25	8-18	10.0-20.0	10.0-20.0	5.6-7.3	0-5	---
	25-60	8-18	5.0-15.0	5.0-15.0	7.4-8.4	10-20	---
<b>Sunburg-----</b>	0-7	12-20	5.0-15.0	5.0-15.0	6.6-8.4	0-15	---
	7-60	10-18	5.0-11.0	5.0-11.0	7.4-8.4	10-30	---
<b>1406:</b>							
Medo-----	0-20	---	40-100	40-100	6.1-7.8	0-10	---
	20-28	15-30	20.0-55.0	20.0-55.0	6.1-7.8	0-5	---
	28-34	15-30	10.0-25.0	10.0-25.0	6.1-7.8	0-5	---
	34-60	0-10	1.0-9.0	1.0-9.0	6.1-8.4	0-15	---
<b>Dassel-----</b>	0-14	6-18	10.0-40.0	10.0-40.0	5.6-7.3	---	---
	14-31	2-6	3.0-10.0	3.0-10.0	5.6-7.3	---	---
	31-60	2-8	1.0-5.0	1.0-5.0	6.1-7.8	0-5	---
<b>Biscay-----</b>	0-10	18-27	20.0-35.0	20.0-35.0	6.1-7.8	0-15	---
	10-29	18-30	12.0-25.0	12.0-25.0	6.6-7.8	0-15	---
	29-60	1-6	1.0-5.0	1.0-5.0	7.4-8.4	5-30	---
<b>1801B:</b>							
Gardencity-----	0-13	5-20	8.0-25.0	8.0-25.0	6.1-7.3	---	---
	13-34	12-18	3.0-25.0	3.0-25.0	5.6-7.3	---	---
	34-60	10-20	3.0-25.0	3.0-25.0	6.1-8.4	0-20	---

## 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	Hydro- logic 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
8B, 8C, 8D: Sparta-----	A	None-----	---	---	>6.0	---	---	---	---
35: Blue Earth-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Jan-Dec	Very long	1.0
39A: Wadena-----	B	None-----	---	---	>6.0	---	---	---	---
41A: Estherville-----	B	None-----	---	---	>6.0	---	---	---	---
85: Calco-----	B/D	Occasional	Brief-----	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
86: Canisteo-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Oct-Jul	---	---
96B: Collinwood-----	C	None-----	---	---	2.5-4.0	Apparent---	Nov-May	---	---
101B: Truman-----	B	None-----	---	---	>6.0	---	---	---	---
102B: Clarion-----	B	None-----	---	---	3.5-6.0	Apparent---	Nov-Jul	---	---
106C2: Lester-----	B	None-----	---	---	>6.0	---	---	---	---
112: Harps-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jul	---	---
113: Webster-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jul	---	---
114: Glencoe-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Oct-Jul	Very long	1.0
129: Cylinder-----	B	None-----	---	---	2.0-4.0	Apparent---	Nov-Jul	---	---
130: Nicollet-----	B	None-----	---	---	2.0-3.5	Apparent---	Mar-Jun	---	---
134: Okoboji-----	B/D	None-----	---	---	0.0-1.0	Apparent---	Nov-Jul	Very long	1.0
136: Madelia-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Nov-May	---	---
140: Spicer-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jun	---	---
143B: Chelsea-----	A	None-----	---	---	>6.0	---	---	---	---
178: Granby-----	A/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jun	---	---

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth  Ft	Kind of water table	Months	Ponding duration	Maximum ponding depth  Ft
181: Litchfield-----	B	None-----	---	---	2.5-4.0	Apparent---	Mar-Jun	---	---
183: Dassel-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Jan-Dec	Very long	1.0
197: Kingston-----	B	None-----	---	---	2.5-4.0	Apparent---	Apr-May	---	---
211: Lura-----	C/D	None-----	---	---	0.0-0.5	Apparent---	Nov-Jul	Very long	1.0
229: Waldorf-----	C/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jul	---	---
239: Le Sueur-----	B	None-----	---	---	2.5-4.0	Apparent---	Nov-May	---	---
281: Darfur-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Dec-May	---	---
286B: Shorewood-----	C	None-----	---	---	2.5-4.0	Perched---	Apr-Jun	---	---
311C2: Shorewood-----	C	None-----	---	---	2.5-4.0	Perched---	Apr-Jun	---	---
327A, 327B: Dickman-----	A	None-----	---	---	>6.0	---	---	---	---
399: Biscay-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Jan-Dec	Long-----	1.0
415: Kanaranzi-----	B	None-----	---	---	>6.0	---	---	---	---
423: Seaforth-----	B	None-----	---	---	2.5-4.0	Apparent---	Mar-Jun	---	---
461B, 461C2: Koronis-----	B	None-----	---	---	>6.0	---	---	---	---
511: Marcellon-----	C	None-----	---	---	1.0-2.5	Apparent---	Nov-May	---	---
523: Houghton-----	A/D	None-----	---	---	0.0-1.0	Apparent---	Sep-Jun	Very long	1.0
525: Muskego-----	A/D	None-----	---	---	0.0-1.0	Apparent---	Nov-Aug	Long-----	1.0
539: Klossner-----	A/D	None-----	---	---	0.0-0.5	Apparent---	Oct-Jul	Very long	1.0
548: Medo-----	A/D	None-----	---	---	0.0-0.5	Apparent---	Nov-May	Very long	1.0
610: Calco-----	B/D	Frequent---	Brief-----	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
611D: Hawick-----	A	None-----	---	---	>6.0	---	---	---	---

## Water Features--Continued

Map symbol and soil name	Hydro- logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					<u>Ft</u>				<u>Ft</u>
612B: Wadenill-----	B	None-----	---	---	>6.0	---	---	---	---
613: Grovecity-----	B	None-----	---	---	2.5-4.0	Apparent---	Mar-Jun	---	---
664: Zook-----	C/D	Occasional	Long-----	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
740: Hamel-----	C	None-----	---	---	0.5-1.5	Apparent---	Nov-Jun	---	---
Glencoe-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Oct-Jul	Very long	1.0
804B, 804C2, 804D2, 804E: Koronis-----	B	None-----	---	---	>6.0	---	---	---	---
Sunburg-----	B	None-----	---	---	>6.0	---	---	---	---
Hawick-----	A	None-----	---	---	>6.0	---	---	---	---
805C2, 805D2: Sunburg-----	B	None-----	---	---	>6.0	---	---	---	---
Wadenill-----	B	None-----	---	---	>6.0	---	---	---	---
807D2: Koronis-----	B	None-----	---	---	>6.0	---	---	---	---
Sunburg-----	B	None-----	---	---	>6.0	---	---	---	---
875B: Estherville-----	B	None-----	---	---	>6.0	---	---	---	---
Hawick-----	A	None-----	---	---	>6.0	---	---	---	---
875C: Hawick-----	A	None-----	---	---	>6.0	---	---	---	---
Estherville-----	B	None-----	---	---	>6.0	---	---	---	---
887B: Clarion-----	B	None-----	---	---	3.5-6.0	Apparent---	Nov-Jul	---	---
Swanlake-----	B	None-----	---	---	>6.0	---	---	---	---
899: Harps-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jul	---	---
Okoboji-----	B/D	None-----	---	---	0.0-1.0	Apparent---	Nov-Jul	Very long	1.0
909C2, 909D2: Bold-----	B	None-----	---	---	>6.0	---	---	---	---
Truman-----	B	None-----	---	---	>6.0	---	---	---	---
920B: Clarion-----	B	None-----	---	---	3.5-6.0	Apparent---	Nov-Jul	---	---
Storden-----	B	None-----	---	---	>6.0	---	---	---	---
Hawick-----	A	None-----	---	---	>6.0	---	---	---	---

Water Features--Continued

Map symbol and soil name	Hydro- logic 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
945D2, 945E: Lester-----	B	None-----	---	---	>6.0	---	---	---	---
Storden-----	B	None-----	---	---	>6.0	---	---	---	---
956: Canistee-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Oct-Jul	---	---
Glencoe-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Oct-Jul	Very long	1.0
960C2, 960D2: Storden-----	B	None-----	---	---	>6.0	---	---	---	---
Omsrud-----	B	None-----	---	---	>6.0	---	---	---	---
978: Cordova-----	C/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jun	---	---
Rolfe-----	C	None-----	---	---	0.0-1.0	Apparent---	Nov-Jul	Long-----	1.0
1015: Udipsamments---	A	None-----	---	---	>6.0	---	---	---	---
1016: Udorthents-----	B	None-----	---	---	>6.0	---	---	---	---
1030: Pits, gravel. Udipsamments---	A	None-----	---	---	>6.0	---	---	---	---
1080: Klossner-----	D	None-----	---	---	0.0-0.0	Apparent---	Jan-Dec	Very long	3.0
Okoboji-----	D	None-----	---	---	0.0-1.0	Apparent---	Jan-Dec	Very long	3.0
Glencoe-----	D	None-----	---	---	0.0-0.0	Apparent---	Jan-Dec	Very long	3.0
1096: Fieldon-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jun	---	---
Dassel-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Jan-Dec	Long-----	1.0
1097: Mayer-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Oct-Jun	---	---
Biscay-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Jan-Dec	Long-----	1.0
1098: Biscay-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jun	---	---
Biscay, depressional---	B/D	None-----	---	---	0.0-0.5	Apparent---	Jan-Dec	Long-----	1.0
1099: Granby-----	A/D	None-----	---	---	0.0-1.0	Apparent---	Nov-Jun	Long-----	1.0
1100: Nicollet-----	B	None-----	---	---	2.0-3.5	Apparent---	Mar-Jun	---	---
1101: Webster-----	B/D	None-----	---	---	0.5-1.5	Apparent---	Nov-Jul	---	---

## Water Features--Continued

Map symbol and soil name	Hydro- logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth <u>Ft</u>	Kind of water table	Months	Ponding duration	Maximum ponding depth <u>Ft</u>
1159B: Strout-----	C	None-----	---	---	2.5-4.0	Perched----	Nov-Jul	---	---
Arkton-----	C	None-----	---	---	2.5-4.0	Perched----	Nov-Jul	---	---
1161: Barry-----	B/D	None-----	---	---	1.0-2.5	Apparent----	Nov-Jul	---	---
1162A, 1162B: Kandiyohi-----	C/D	None-----	---	---	1.5-2.5	Perched----	Nov-Jul	---	---
1163: Cohoctah-----	B/D	Frequent----	Long-----	Nov-Apr	0.0-1.0	Apparent----	Sep-May	---	---
1165: Lundlake-----	B/D	None-----	---	---	0.0-0.5	Apparent----	Nov-Jul	Very long	1.0
1168: Swedegrove-----	B/D	None-----	---	---	0.5-1.5	Apparent----	Nov-Jul	---	---
Lundlake-----	B/D	None-----	---	---	0.0-0.5	Apparent----	Nov-Jul	Very long	1.0
1169: Corvuso-----	C/D	None-----	---	---	0.5-1.5	Perched----	Nov-Jul	---	---
Lura-----	C/D	None-----	---	---	0.0-0.5	Apparent----	Nov-Jul	Very long	1.0
1171C, 1171D: Newlondon-----	C	None-----	---	---	2.5-4.0	Perched----	Nov-Jul	---	---
Strout-----	C	None-----	---	---	2.5-4.0	Perched----	Nov-Jul	---	---
1172C: Sparta-----	A	None-----	---	---	>6.0	---	---	---	---
Gardencity-----	B	None-----	---	---	>6.0	---	---	---	---
1173: Muskego-----	A/D	Frequent----	Long-----	Apr-Jul	0.0-1.6	Apparent----	Nov-Aug	Long-----	3.0
Klossner-----	A/D	Frequent----	Brief-----	Apr-Nov	0.0-1.0	Apparent----	Oct-Jul	Very long	1.0
1174: Danielson-----	C/D	None-----	---	---	0.5-1.5	Perched----	Nov-Jul	---	---
1175: Swedegrove-----	B/D	None-----	---	---	0.5-1.5	Apparent----	Nov-Jul	---	---
1176: Litchfield-----	B	None-----	---	---	2.5-4.0	Apparent----	Mar-Jun	---	---
1177C: Gardencity-----	B	None-----	---	---	>6.0	---	---	---	---
Bold-----	B	None-----	---	---	>6.0	---	---	---	---
1178: Uniongrove-----	B/D	None-----	---	---	0.5-1.5	Apparent----	Nov-Jul	---	---
1183: Crowriver-----	B/D	None-----	---	---	0.5-1.5	Apparent----	Nov-Jul	---	---

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					<u>Ft</u>				<u>Ft</u>
1184: Corvuso-----	C/D	None-----	---	---	0.5-1.5	Perched----	Nov-Jul	---	---
1185: Gardencity-----	B	None-----	---	---	3.5-6.0	Apparent----	Nov-Jul	---	---
1186: Forestcity-----	B/D	None-----	---	---	0.5-1.5	Apparent----	Nov-Jul	---	---
Lundlake-----	B/D	None-----	---	---	0.0-0.5	Apparent----	Nov-Jul	Very long	1.0
1192: Crowriver-----	B/D	None-----	---	---	0.5-1.5	Apparent----	Nov-Jul	---	---
Lundlake-----	B/D	None-----	---	---	0.0-0.5	Apparent----	Nov-Jul	Very long	1.0
1193: Cosmos-----	C/D	None-----	---	---	0.5-1.5	Perched----	Nov-Jul	---	---
1197: Cohoctah-----	B/D	Occasional	Long-----	Nov-Apr	0.0-1.0	Apparent----	Sep-May	---	---
1198B: Rohrbeck-----	B	None-----	---	---	2.5-4.0	Apparent----	Apr-Jul	---	---
Koronis-----	B	None-----	---	---	>6.0	---	---	---	---
1199: Klossner-----	D	None-----	---	---	0.0-0.0	Apparent----	Jan-Dec	Very long	3.0
Lundlake-----	D	None-----	---	---	0.0-0.0	Apparent----	Jan-Dec	Very long	3.0
1203: Muskego-----	D	None-----	---	---	---	Apparent----	Jan-Dec	Long-----	3.0
Blue Earth-----	B/D	None-----	---	---	0.0-0.0	Apparent----	Jan-Dec	Very long	3.0
Houghton-----	D	None-----	---	---	0.0-0.5	Apparent----	Sep-Jun	Very long	2.0
1204B: Reedslake-----	B	None-----	---	---	3.5-6.0	Apparent----	Mar-Jun	---	---
1213C: Cokato-----	B	None-----	---	---	>6.0	---	---	---	---
Storden-----	B	None-----	---	---	>6.0	---	---	---	---
1220C: Cokato-----	B	None-----	---	---	>6.0	---	---	---	---
Storden-----	B	None-----	---	---	>6.0	---	---	---	---
Hawick-----	A	None-----	---	---	>6.0	---	---	---	---
1362B: Angus-----	B	None-----	---	---	3.5-6.0	Apparent----	Mar-Jun	---	---
1383A: Shorewood-----	C	None-----	---	---	1.5-2.5	Perched----	Apr-Jun	---	---
1384: Minneopa-----	B	None-----	---	---	3.0-5.0	Apparent----	Nov-Jun	---	---

## Water Features--Continued

Map symbol and soil name	Hydro- logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					<u>Ft</u>				<u>Ft</u>
1385: Havelock-----	B/D	Frequent---	Brief-----	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
1387A: Collinwood-----	C	None-----	---	---	1.5-2.5	Perched---	Apr-Jun	---	---
1391B: Wadenill-----	B	None-----	---	---	>6.0	---	---	---	---
Sunburg-----	B	None-----	---	---	>6.0	---	---	---	---
1406: Medo-----	A/D	None-----	---	---	0.0-0.5	Apparent---	Nov-May	Very long	1.0
Dassel-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Jan-Dec	Very long	1.0
Biscay-----	B/D	None-----	---	---	0.0-0.5	Apparent---	Jan-Dec	Long-----	1.0
1801B: Gardencity-----	B	None-----	---	---	>6.0	---	---	---	---

Soil Features

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
8B, 8C, 8D: Sparta-----	>60	---	---	---	Low-----	Low-----	Moderate.
35: Blue Earth-----	>60	---	---	---	High-----	High-----	Low.
39A: Wadena-----	>60	---	---	---	Low-----	Low-----	Low.
41A: Estherville-----	>60	---	---	---	Low-----	Low-----	Low.
85: Calco-----	>60	---	---	---	High-----	High-----	Low.
86: Canisteo-----	>60	---	---	---	High-----	High-----	Low.
96B: Collinwood-----	>60	---	---	---	High-----	High-----	Low.
101B: Truman-----	>60	---	---	---	High-----	Low-----	Low.
102B: Clarion-----	>60	---	---	---	Moderate---	Low-----	Low.
106C2: Lester-----	>60	---	---	---	Moderate---	Low-----	Moderate.
112: Harps-----	>60	---	---	---	High-----	High-----	Low.
113: Webster-----	>60	---	---	---	High-----	High-----	Low.
114: Glencoe-----	>60	---	---	---	High-----	High-----	Low.
129: Cylinder-----	>60	---	---	---	High-----	Moderate---	Low.
130: Niccollet-----	>60	---	---	---	High-----	High-----	Low.
134: Okoboji-----	>60	---	---	---	High-----	High-----	Low.
136: Madelia-----	>60	---	---	---	High-----	High-----	Low.
140: Spicer-----	>60	---	---	---	High-----	High-----	Low.
143B: Chelsea-----	>60	---	---	---	Low-----	Low-----	Low.
178: Granby-----	>60	---	---	---	Moderate---	High-----	Low.
181: Litchfield-----	>60	---	---	---	Moderate---	Low-----	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			
183: Dassel-----	>60	---	---	---	High-----	High-----	Low.
197: Kingston-----	>60	---	---	---	High-----	High-----	Low.
211: Lura-----	>60	---	---	---	High-----	High-----	Low.
229: Waldorf-----	>60	---	---	---	High-----	High-----	Low.
239: Le Sueur-----	>60	---	---	---	High-----	High-----	Low.
281: Darfur-----	>60	---	---	---	High-----	High-----	Low.
286B: Shorewood-----	>60	---	---	---	High-----	High-----	Moderate.
311C2: Shorewood-----	>60	---	---	---	High-----	High-----	Moderate.
327A, 327B: Dickman-----	>60	---	---	---	Low-----	Low-----	Moderate.
399: Biscay-----	>60	---	---	---	High-----	Moderate---	Low.
415: Kanaranzi-----	>60	---	---	---	Moderate---	Moderate---	Low.
423: Seaforth-----	>60	---	---	---	High-----	High-----	Low.
461B, 461C2: Koronis-----	>60	---	---	---	Moderate---	Low-----	Moderate.
511: Marcellon-----	>60	---	---	---	High-----	High-----	Moderate.
523: Houghton-----	>60	---	6-18	55-60	High-----	High-----	Moderate.
525: Muskego-----	>60	---	---	35-45	High-----	Moderate---	Moderate.
539: Klossner-----	>60	---	2-4	25-32	High-----	High-----	Moderate.
548: Medo-----	>60	---	2-4	25-32	High-----	High-----	Moderate.
610: Calco-----	>60	---	---	---	High-----	High-----	Low.
611D: Hawick-----	>60	---	---	---	Low-----	Low-----	Low.
612B: Wadenill-----	>60	---	---	---	Moderate---	Low-----	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			
613: Grovecity-----	>60	---	---	---	High-----	Moderate---	Low.
664: Zook-----	>60	---	---	---	High-----	High-----	Moderate.
740: Hamel-----	>60	---	---	---	High-----	High-----	Low.
Glencoe-----	>60	---	---	---	High-----	High-----	Low.
804B, 804C2, 804D2, 804E: Koronis-----	>60	---	---	---	Moderate---	Low-----	Moderate.
Sunburg-----	>60	---	---	---	Moderate---	Low-----	Low.
Hawick-----	>60	---	---	---	Low-----	Low-----	Low.
805C2, 805D2: Sunburg-----	>60	---	---	---	Moderate---	Low-----	Low.
Wadenill-----	>60	---	---	---	Moderate---	Low-----	Low.
807D2: Koronis-----	>60	---	---	---	Moderate---	Low-----	Moderate.
Sunburg-----	>60	---	---	---	Moderate---	Low-----	Low.
875B: Estherville----	>60	---	---	---	Low-----	Low-----	Low.
Hawick-----	>60	---	---	---	Low-----	Low-----	Low.
875C: Hawick-----	>60	---	---	---	Low-----	Low-----	Low.
Estherville----	>60	---	---	---	Low-----	Low-----	Low.
887B: Clarion-----	>60	---	---	---	Moderate---	Low-----	Low.
Swanlake-----	>60	---	---	---	Moderate---	Low-----	Low.
899: Harps-----	>60	---	---	---	High-----	High-----	Low.
Okoboji-----	>60	---	---	---	High-----	High-----	Low.
909C2, 909D2: Bold-----	>60	---	---	---	High-----	Low-----	Low.
Truman-----	>60	---	---	---	High-----	Low-----	Low.
920B: Clarion-----	>60	---	---	---	Moderate---	Low-----	Low.
Storden-----	>60	---	---	---	Moderate---	Low-----	Low.
Hawick-----	>60	---	---	---	Low-----	Low-----	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			
945D2, 945E:							
Lester-----	>60	---	---	---	Moderate---	Low-----	Moderate.
Storden-----	>60	---	---	---	Moderate---	Low-----	Low.
956:							
Canisteo-----	>60	---	---	---	High-----	High-----	Low.
Glencoe-----	>60	---	---	---	High-----	High-----	Low.
960C2, 960D2:							
Storden-----	>60	---	---	---	Moderate---	Low-----	Low.
Omsrud-----	>60	---	---	---	Moderate---	Low-----	Low.
978:							
Cordova-----	>80	---	---	---	High-----	High-----	Low.
Rolfe-----	>60	---	---	---	High-----	High-----	Moderate.
1015:							
Udipsamments---	>60	---	---	---	Low-----	Low-----	Low.
1016:							
Udorthents-----	>60	---	---	---	Moderate---	High-----	Moderate.
1030:							
Pits, gravel.							
Udipsamments---	>60	---	---	---	Low-----	Low-----	Low.
1080:							
Klossner-----	>60	---	2-4	25-32	High-----	High-----	Moderate.
Okoboji-----	>60	---	---	---	High-----	High-----	Low.
Glencoe-----	>60	---	---	---	High-----	High-----	Low.
1096:							
Fieldon-----	>60	---	---	---	High-----	High-----	Low.
Dassel-----	>60	---	---	---	High-----	High-----	Low.
1097:							
Mayer-----	>60	---	---	---	High-----	High-----	Low.
Biscay-----	>60	---	---	---	High-----	Moderate---	Low.
1098:							
Biscay-----	>60	---	---	---	High-----	Moderate---	Low.
Biscay, depressional---	>60	---	---	---	High-----	Moderate---	Low.
1099:							
Granby-----	>60	---	---	---	Moderate---	High-----	Low.
1100:							
Nicollet-----	>60	---	---	---	High-----	High-----	Low.
1101:							
Webster-----	>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			
1159B: Strout-----	>60	---	---	---	Moderate---	High-----	Low.
Arkton-----	>60	---	---	---	High-----	High-----	Low.
1161: Barry-----	>60	---	---	---	High-----	High-----	Low.
1162A, 1162B: Kandiyohi-----	>60	---	---	---	High-----	High-----	Low.
1163: Cohoctah-----	>60	---	---	---	High-----	High-----	Low.
1165: Lundlake-----	>80	---	---	---	High-----	High-----	Low.
1168: Swedegrove-----	>60	---	---	---	High-----	Moderate---	Low.
Lundlake-----	>80	---	---	---	High-----	High-----	Low.
1169: Corvuso-----	>60	---	---	---	High-----	High-----	Low.
Lura-----	>60	---	---	---	High-----	High-----	Low.
1171C, 1171D: Newlondon-----	>60	---	---	---	High-----	High-----	Low.
Strout-----	>60	---	---	---	Moderate---	High-----	Low.
1172C: Sparta-----	>60	---	---	---	Low-----	Low-----	Moderate.
Gardencity-----	>80	---	---	---	Moderate---	Low-----	Low.
1173: Muskego-----	>60	---	---	30-40	High-----	Moderate---	Moderate.
Klossner-----	>60	---	---	25-32	High-----	High-----	Moderate.
1174: Danielson-----	>80	---	---	---	High-----	High-----	Low.
1175: Swedegrove-----	>60	---	---	---	High-----	Moderate---	Low.
1176: Litchfield-----	>60	---	---	---	Moderate---	Low-----	Low.
1177C: Gardencity-----	>80	---	---	---	Moderate---	Low-----	Low.
Bold-----	>60	---	---	---	High-----	Low-----	Low.
1178: Uniongrove-----	>60	---	---	---	High-----	Moderate---	Low.
1183: Crowriver-----	>60	---	---	---	High-----	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			
1184: Corvuso-----	>60	---	---	---	High-----	High-----	Low.
1185: Gardencity-----	>60	---	---	---	High-----	Low-----	Low.
1186: Forestcity-----	>60	---	---	---	High-----	Moderate----	Low.
Lundlake-----	>80	---	---	---	High-----	High-----	Low.
1192: Crowriver-----	>60	---	---	---	High-----	Moderate----	Low.
Lundlake-----	>80	---	---	---	High-----	High-----	Low.
1193: Cosmos-----	>60	---	---	---	High-----	High-----	Low.
1197: Cohoctah-----	>60	---	---	---	High-----	High-----	Low.
1198B: Rohrbeck-----	>60	---	---	---	Low-----	Low-----	Moderate.
Koronis-----	>60	---	---	---	Moderate----	Low-----	Moderate.
1199: Klossner-----	>60	---	2-4	25-32	High-----	High-----	Moderate.
Lundlake-----	>80	---	---	---	High-----	High-----	Low.
1203: Muskego-----	>60	---	---	30-40	High-----	Moderate----	Moderate.
Blue Earth-----	>60	---	---	---	High-----	High-----	Low.
Houghton-----	>60	---	---	40-60	High-----	High-----	Low.
1204B: Reedslake-----	>60	---	---	---	Moderate----	Low-----	Low.
1213C: Cokato-----	>60	---	---	---	Moderate----	Low-----	Low.
Storden-----	>60	---	---	---	Moderate----	Low-----	Low.
1220C: Cokato-----	>60	---	---	---	Moderate----	Low-----	Low.
Storden-----	>60	---	---	---	Moderate----	Low-----	Low.
Hawick-----	>60	---	---	---	Low-----	Low-----	Low.
1362B: Angus-----	>80	---	---	---	Moderate----	Low-----	Moderate.
1383A: Shorewood-----	>60	---	---	---	High-----	High-----	Moderate.
1384: Minneopa-----	>60	---	---	---	Moderate----	Low-----	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			
1385: Havelock-----	>60	---	---	---	High-----	High-----	Low.
1387A: Collinwood-----	>60	---	---	---	High-----	High-----	Low.
1391B: Wadenill-----	>60	---	---	---	Moderate----	Low-----	Low.
Sunburg-----	>60	---	---	---	Moderate----	Low-----	Low.
1406: Medo-----	>60	---	2-4	25-32	High-----	High-----	Moderate.
Dassel-----	>60	---	---	---	High-----	High-----	Low.
Biscay-----	>60	---	---	---	High-----	Moderate----	Low.
1801B: Gardencity-----	>80	---	---	---	Moderate----	Low-----	Low.

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# Glossary

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**Ablation till.** Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

**Aeration, soil.** The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Aquic conditions.** Current soil wetness characterized by saturation, reduction, and redoximorphic features.

**Area reclaim** (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Aspect.** The direction in which a slope faces.

**Association, soil.** A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low .....	0 to 3
Low .....	3 to 6
Moderate .....	6 to 9
High .....	9 to 12
Very high .....	more than 12

**Backslope.** The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile are commonly steep and linear and descend to a

footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

**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 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.

**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.

**California bearing ratio (CBR).** The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

**Canopy.** The leafy crown of trees or shrubs. (See Crown.)

**Capillary water.** Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

**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 is, 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.

**Cobby soil material.** Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobby soil material is 35 to 60 percent of these rock fragments, and extremely cobby soil material is more than 60 percent.

**Colluvium.** Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

**Complex slope.** Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

**Complex, soil.** A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

**Compressible (in tables).** Excessive decrease in volume of soft soil under load.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

**Conservation cropping system.** Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops

of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

**Conservation tillage.** Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the surface after planting in order to reduce the hazard of water erosion; in areas where soil blowing is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its equivalent during the critical erosion period.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—Readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.

*Sticky.*—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard; little affected by moistening.

**Contour stripcropping (or contour farming).**

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

**Coprogenous earth (sedimentary peat).** Fecal material deposited in water by aquatic organisms.

**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.** 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.

**Depth to rock** (in tables). Bedrock is too near the surface for the specified use.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class (natural).** Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

*Excessively drained.*—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

*Somewhat excessively drained.*—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

*Well drained.*—These soils have an intermediate or high water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

*Moderately well drained.*—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of most field crops are affected. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the

profile, additions of water by seepage, or some combination of these.

*Somewhat poorly drained.*—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted under natural conditions.

Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

*Poorly drained.*—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poor drainage is caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

*Very poorly drained.*—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) under natural conditions.

**Drainage, surface.** Runoff, or surface flow of water, from an area.

**Drumlin.** A low, smooth, elongated oval hill, mound, or ridge of compact 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. The term is more often applied to cliffs resulting from differential erosion.

**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.

**Excess lime (in tables).** Excess carbonates in the soil that restrict the growth of some plants.

**Excess salts (in tables).** Excess water-soluble salts in the soil that restrict the growth of most plants.

**Excess sodium (in tables).** Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

**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, tillage, and other growth factors are favorable.

**Fibric soil material (peat).** The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

**Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field*

*capacity, normal moisture capacity, or capillary capacity.*

**Fine textured soil.** Sandy clay, silty clay, or clay.

**Firebreak.** An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of 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 is, 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 inundation under flood-stage conditions unless protected artificially. It is generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

**Footslope.** The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface is dominantly concave. In terms of gradational processes, a footslope is a transition zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

**Forb.** Any herbaceous plant not a grass or a sedge.

**Forest cover.** All trees and other woody plants (underbrush) covering the ground in a forest.

**Forest type.** A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

**Fragile** (in tables). A soil that is easily damaged by use or disturbance.

**Fragipan.** A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

**Frost action** (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

**Genesis, soil.** The mode of origin of the soil. Refers

especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

**Geomorphology.** The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms.

**Glacial drift.** Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

**Glacial outwash.** Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

**Glaciofluvial deposits.** Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

**Glaciolacustrine deposits.** Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

**Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

**Graded stripcropping.** Growing crops in strips that grade toward a protected waterway.

**Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

**Gravel.** Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

**Gravelly soil material.** Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

**Green manure crop** (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

**Ground water.** Water filling all the unblocked pores of underlying material below the water table.

**Gully.** A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to

be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

**Hard bedrock.** Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

**Hemic soil material (mucky peat).** Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

**High-chroma zones.** Zones having chroma of 3 or more. Typical color in areas of iron concentrations.

**High-residue crops.** Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

**Hill.** A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 6 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

*O horizon.*—An organic layer of fresh and decaying plant residue.

*A horizon.*—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

*E horizon.*—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

*B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

*C horizon.*—The mineral horizon or layer,

excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material.

The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

*Cr horizon.*—Soft, consolidated bedrock beneath the soil.

*R layer.*—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

**Humus.** The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

**Ice-walled lake plain.** A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted, the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

**Igneous rock.** Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

**Illuviation.** The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

**Impervious soil.** A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as

contrasted with percolation, which is movement of water through soil layers or material.

**Infiltration capacity.** The maximum rate at which water can infiltrate into a soil under a given set of conditions.

**Infiltration rate.** The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

**Intake rate.** The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2 .....	very low
0.2 to 0.4 .....	low
0.4 to 0.75 .....	moderately low
0.75 to 1.25 .....	moderate
1.25 to 1.75 .....	moderately high
1.75 to 2.5 .....	high
More than 2.5 .....	very high

**Intermittent stream.** A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

**Iron concentrations.** High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

**Iron depletions.** Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are:

*Basin.*—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

*Corrugation.*—Water is applied to small, closely

spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

*Drip (or trickle).*—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

*Furrow.*—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

*Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

*Subirrigation.*—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

*Wild flooding.*—Water, released at high points, is allowed to flow onto an area without controlled distribution.

**Kame.** 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.

**Lake bed.** The bottom of a lake; a lake basin.

**Lake plain.** A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

**Lakeshore.** A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

**Lake terrace.** A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

**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 the wind.

**Low-chroma zones.** Zones having chroma of 2 or less. Typical color in areas of iron depletions.

**Low-residue crops.** Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

**Low strength.** The soil is not strong enough to support loads.

**Marl.** An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

**Masses.** Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

**Mechanical treatment.** Use of mechanical equipment for seeding, brush management, and other management practices.

**Medium textured soil.** Very fine sandy loam, loam, silt loam, or silt.

**Metamorphic rock.** Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

**Mineral soil.** Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

**Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.

**Miscellaneous area.** An area that has little or no natural soil and supports little or no vegetation.

**Moderately coarse textured soil.** Coarse sandy loam, sandy loam, or fine sandy loam.

**Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.

**Mollic epipedon.** A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

**Moraine.** An accumulation of glacial drift in a topographic landform resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

**Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity,

consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

**Muck.** Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

**Mudstone.** Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

**Munsell notation.** A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

**Neutral soil.** A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

**Nodules.** Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

**Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

**Organic matter.** Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low .....	less than 0.5 percent
Low .....	0.5 to 1.0 percent
Moderately low .....	1.0 to 2.0 percent
Moderate .....	2.0 to 4.0 percent
High .....	4.0 to 8.0 percent
Very high .....	more than 8.0 percent

**Outwash plain.** An extensive area of glaciofluvial material that was deposited by meltwater streams.

**Parent material.** The unconsolidated organic and mineral material in which soil forms.

**Peat.** Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedisediment.** A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

**Pedon.** The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percolation.** The movement of water through the soil.

**Percs slowly** (in tables). The slow movement of water through the soil adversely affects the specified use.

**Permeability.** The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Extremely slow .....	less than 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 thickness.

**pH value.** A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

**Piping** (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit.** The moisture content at which a soil changes from semisolid to plastic.

**Plateau.** An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

**Plowpan.** A compacted layer formed in the soil directly below the plowed layer.

**Ponding.** Standing water on soils in closed

depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

**Poor filter** (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

**Poorly graded.** Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Poor outlets** (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

**Potential native plant community.** See Climax plant community.

**Potential rooting depth (effective rooting depth).** Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

**Prescribed burning.** 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:

Extremely acid .....	less than 4.5
Very strongly acid .....	4.5 to 5.0
Strongly acid .....	5.1 to 5.5
Moderately acid .....	5.6 to 6.0
Slightly acid .....	6.1 to 6.5
Neutral .....	6.6 to 7.3
Slightly alkaline .....	7.4 to 7.8
Moderately alkaline .....	7.9 to 8.4
Strongly alkaline .....	8.5 to 9.0
Very strongly alkaline .....	9.1 and higher

**Redoximorphic concentrations.** Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

**Redoximorphic depletions.** Low-chroma zones from

which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

- Redoximorphic features.** Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.
- Reduced matrix.** A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.
- Regolith.** The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.
- Relief.** The elevations or inequalities of a land surface, considered collectively.
- Residuum (residual soil material).** Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.
- Rill.** A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.
- Road cut.** A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.
- Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.
- Rooting depth** (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.
- Root zone.** The part of the soil that can be penetrated by plant roots.
- Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.
- Saline soil.** A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.
- Salty water** (in tables). Water that is too salty for consumption by livestock.
- Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in

diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

- Sandstone.** Sedimentary rock containing dominantly sand-sized particles.
- 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 hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone 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.

**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.

**Similar soils.** Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

**Sinkhole.** A depression in the landscape where limestone has been dissolved.

**Site index.** A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

**Slickensides.** Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

**Slippage** (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

**Slope.** The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

**Slope** (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

**Sloughed till.** Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

**Slow intake** (in tables). The slow movement of water into the soil.

**Slow refill** (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

**Small stones** (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

**Soft bedrock.** Bedrock that can be excavated with

trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

**Soil.** A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates.** Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand .....	2.0 to 1.0
Coarse sand .....	1.0 to 0.5
Medium sand .....	0.5 to 0.25
Fine sand .....	0.25 to 0.10
Very fine sand .....	0.10 to 0.05
Silt .....	0.05 to 0.002
Clay .....	less than 0.002

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

**Stone line.** A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

**Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

**Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

- Stubble mulch.** Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.
- Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.
- Subsoiling.** Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that restricts roots.
- Substratum.** The part of the soil below the solum.
- Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.
- Summit.** The topographically highest position of a hillslope profile and exhibiting a nearly level surface. A general term for the top, or highest level of a landform, such as a hill, mountain, or tableland. It usually refers to a high interfluvial area of gentler slope that is flanked by steeper hillslopes, for example, mountain fronts or tableland escarpments.
- 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.
- Swale.** A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine due to uneven glacial deposition.
- Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.
- Terminal moraine.** A belt of thick glacial drift that generally marks the termination of important glacial advances.
- Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.
- Terrace (geologic).** An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.
- Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."
- Thin layer (in tables).** Otherwise suitable soil material too thin for the specified use.
- Till.** Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.
- Till plain.** An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.
- Tilth, soil.** The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.
- Toeslope.** The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.
- Topsoil.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.
- Toxicity (in tables).** Excessive amount of toxic substances, such as salts, that severely hinder establishment of vegetation or severely restrict plant growth.
- Trace elements.** Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.
- Unstable fill (in tables).** Risk of caving or sloughing on banks of fill material.
- Upland (geology).** Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.
- Valley fill.** In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.
- Variation.** Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.
- Varve.** A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

**Water bars.** Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

**Weathering.** All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

**Well graded.** Refers to soil material consisting of

coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

**Wilting point (or permanent wilting point).** The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

**Windthrow.** The uprooting and tipping over of trees by the wind.



# Accessibility Statement

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