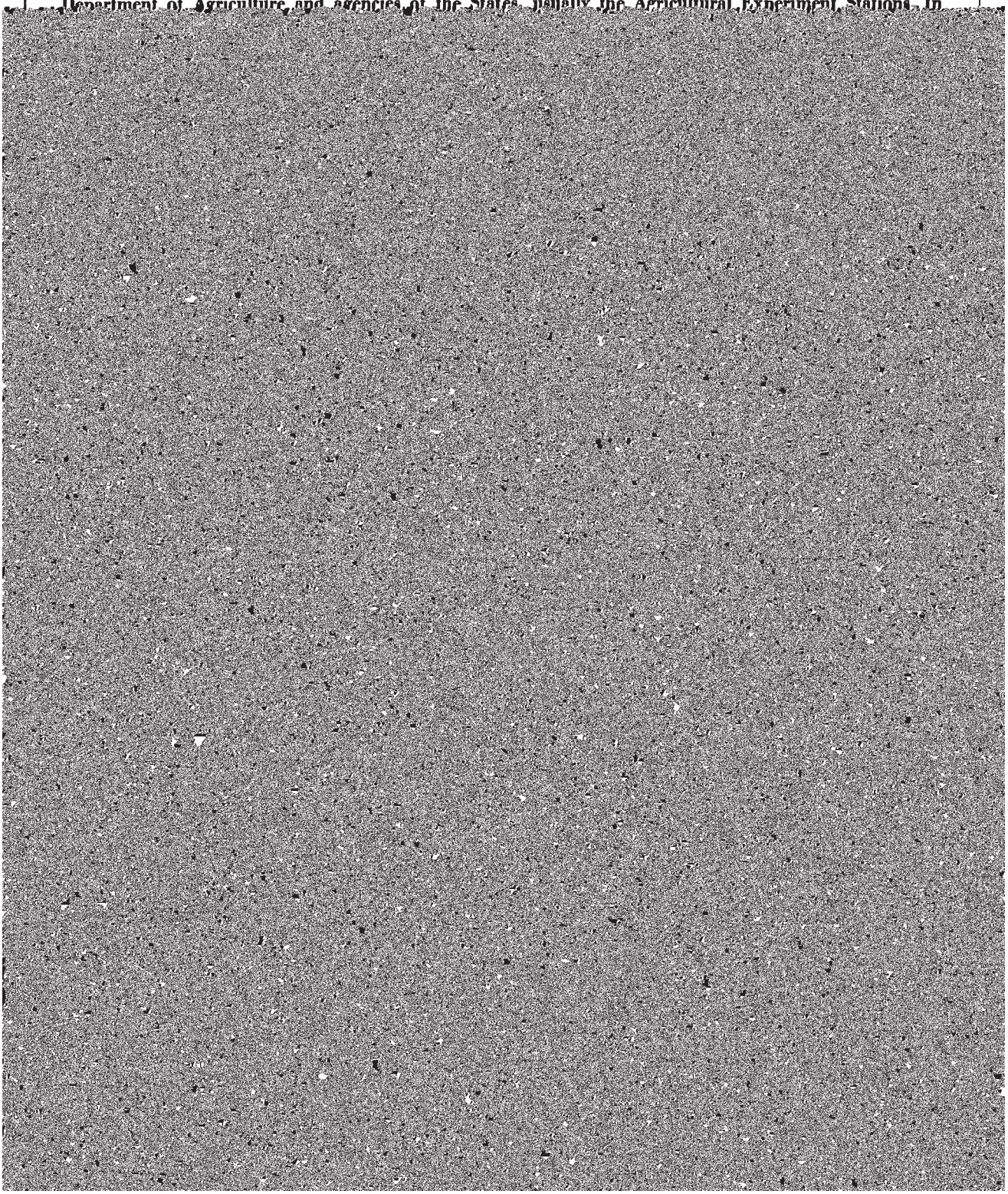
SOIL SURVEY OF

Door County, Wisconsin

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Research Division of the
College of Agricultural and
Life Sciences
University of Wisconsin

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In



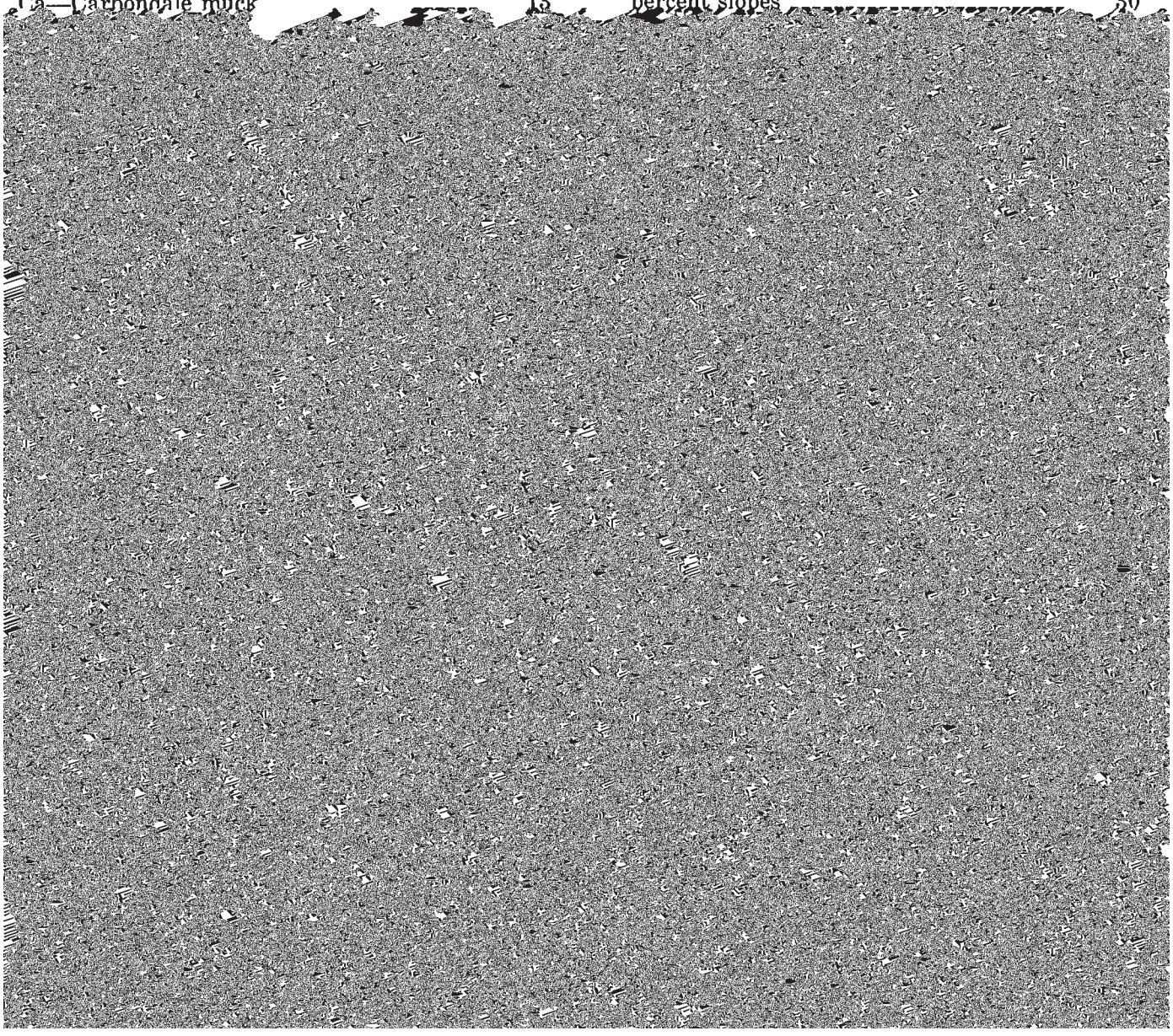
Contents

	Page
Index to mapping units	ii
Summary of tables	iii
How this survey was made	1
General soil map	2
1. Summerville-Longrie-Omena association	3
2. Emmet-Solona-Angelica association	3
3. Rousseau-Kiva-Markey association	3
4. Kewaunee-Kolberg-Manawa association	4
5. Deford-Yahara variant-Carbondale association	5
6. Carbondale-Cathro association	5
Descriptions of the soils	5
Allendale series	6
Alpena series	8
Angelica series	8
Beaches	9
Bonduel series	9
Bonduel shallow variant	10
Bonduel wet variant	10
Boyer series	11
Carbondale series	12
Casco series	13
Cathro series	14
Chippeny series	15
Deford series	15
Duel series	16
Duel variant	17
Emmet series	17
Fabius series	19
Fluvaquents	20
Gravel pits	20
Kewaunee series	20
Kiva series	22
Kolberg series	23
Kolberg variant	24
Longrie series	25
Manawa series	26
Manistee series	27
Markey series	27
Namur series	28
Namur variant	29
Omena series	29
Omena variant	31
Omro series	31
Pinconning series	32
Poygan series	33
Rock outcrop	34
Rondeau series	34
Rousseau series	35
Saprists	36
Shawano series	36
Sisson series	38
Solona series	39
Suamico series	39
Summerville series	40
Udipsamments	42
Udorthents	42
Wainola series	42
Yahara series	43
Yahara variant	44
Planning the use and management of the soils	44
Crops and pasture	45
Basic practices of management	45
Capability grouping	47
Management by capability units	47
Yields per acre	55
Woodland management and productivity	55
Windbreaks and environmental plantings	56
Recreation	59
Wildlife habitat	61
Engineering	76
Building site development	80
Sanitary facilities	80
Construction materials	90
Water management	90
Soil properties	97
Engineering properties	97
Physical and chemical properties	106
Soil and water features	107
Engineering test data	114
Formation of the soils	114
Climate	115
Plants and animals	115
Relief	120
Parent material	120
Time	121
Classification of the soils	121
Factors affecting soil use	122
Relief and drainage	123
Geology	124
Climate	125
Water supply	126
Natural vegetation	126
History	126
Transportation	126
Schools	126
Industry	127
Land use trends	127
Literature cited	128
Glossary	128
Guide to mapping units	Following 132

Issued December 1978

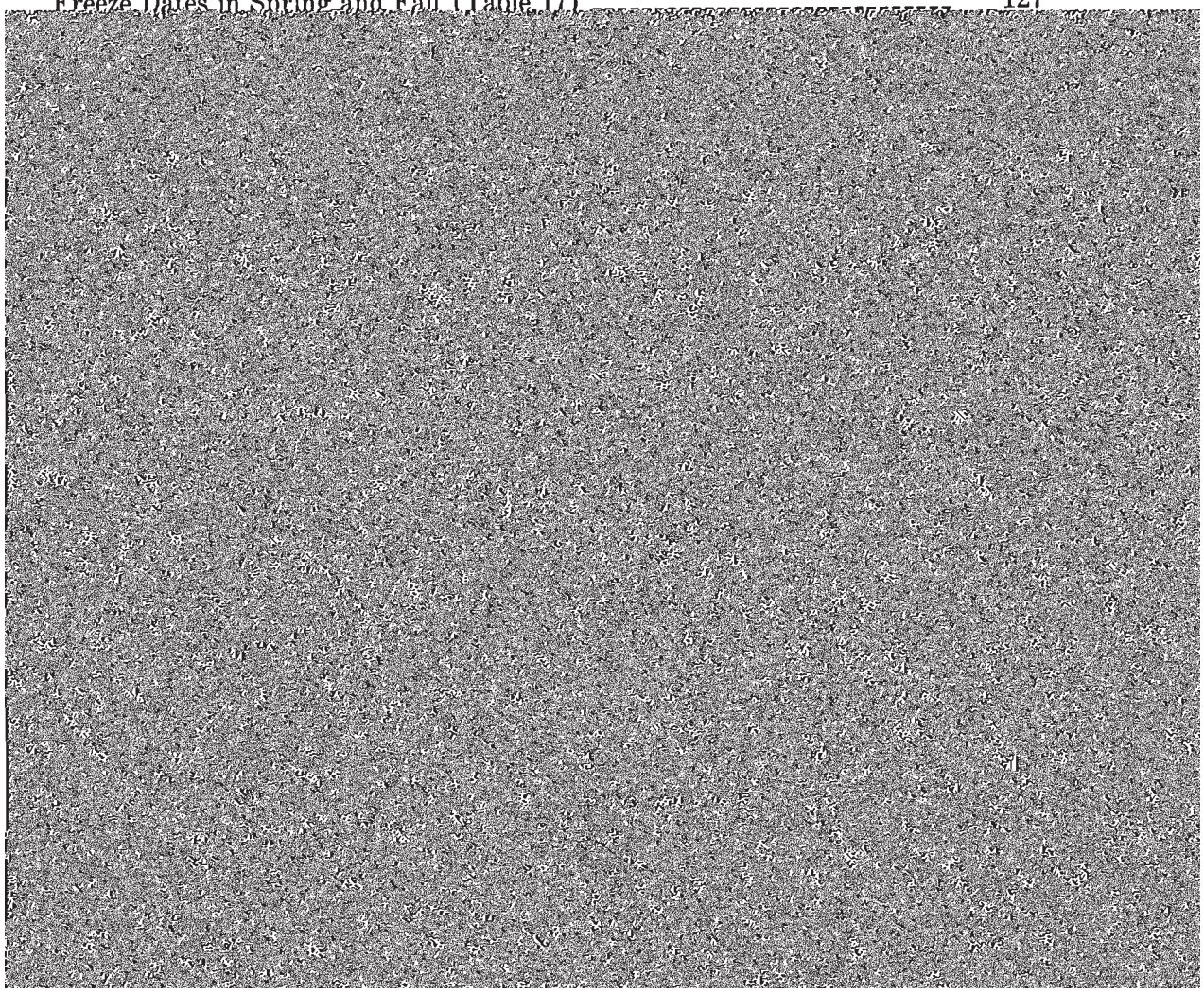
Index to Mapping Units

	Page
AdA—Allendale loamy sand, 0 to 3 percent slopes	6
ApC—Alpena gravelly sandy loam, 0 to 12 percent slopes	8
Ax—Angelica loam	9
Be—Beaches	9
Bn—Bonduel loam	10
Bo—Bonduel Shallow Variant fine sandy loam	10
Bp—Bonduel Wet Variant loam	11
BrB—Boyer loamy sand, 2 to 6 percent slopes	12
BrC—Boyer loamy sand, 6 to 12 percent slopes	12
BrD—Boyer loamy sand, 12 to 20 percent slopes	12
Ca—Carbondale muck	13
KvC2—Kolberg Variant loam, 6 to 12 percent slopes, eroded	24
LoA—Longrie loam, 0 to 2 percent slopes	25
LoB—Longrie loam, 2 to 6 percent slopes	25
LoC—Longrie loam, 6 to 12 percent slopes	26
McA—Manawa silt loam, 0 to 3 percent slopes	26
MeB—Manistee loamy sand, 2 to 6 percent slopes	27
Mk—Markey muck	28
NaB—Namur loam, 0 to 6 percent slopes	28
NaC—Namur loam, 6 to 12 percent slopes	28
Nv—Namur Variant loam	29
OmB—Omena sandy loam, 2 to 6 percent slopes	30
OmC—Omena sandy loam, 6 to 12 percent slopes	30



Summary of Tables

	Page
Acreage and Proportionate Extent of the Soils (Table 1) *Acres. Percent.*	7
Building Site Development (Table 7) *Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets.*	81
Classification of the Soils (Table 15) *Soil name. Family or higher taxonomic class.*	125
Construction Materials (Table 9) *Roadfill. Sand. Gravel. Topsoil.*	91
Engineering Properties and Classifications (Table 11) *Depth. USDA texture. Classification—Unified, AASHTO. Fragments > 3 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.*	98
Engineering Test Data (Table 14) *Name and location. Parent material. Report number. Depth. Moisture density—Maximum, Optimum. Percentage passing sieve—number—10, 40, 200. Percentage smaller than—0.05mm, 0.02mm, 0.005mm, 0.002mm. Liquid limit. Plasticity index. Classification—AASHTO, Unified.*	122
Freeze Dates in Spring and Fall (Table 17)	127



SOIL SURVEY OF DOOR COUNTY, WISCONSIN

BY ERNEST G. LINK, STEVEN L. ELMER, AND SIDNEY A. VANDERVEEN, SOIL CONSERVATION SERVICE

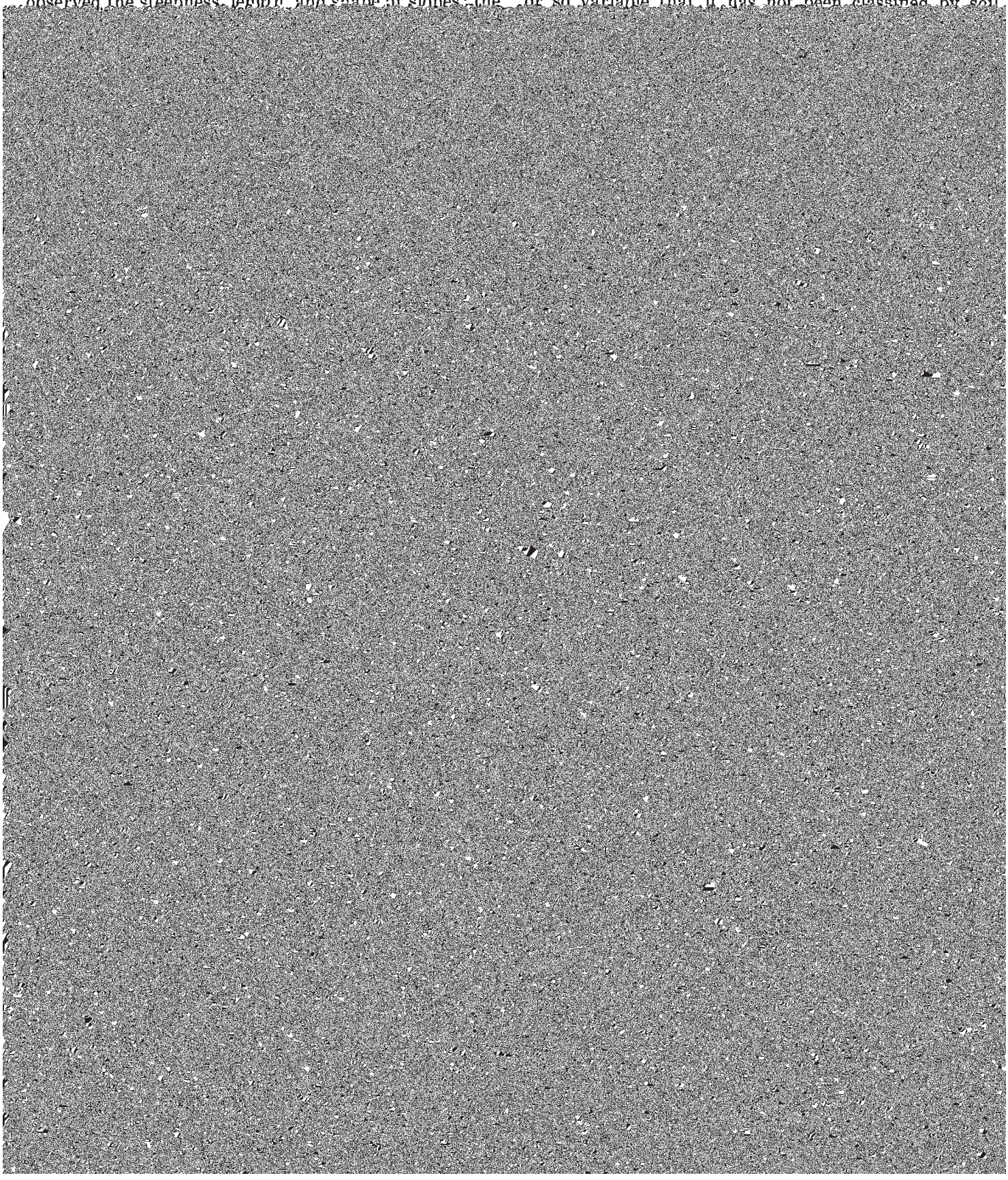
FIELDWORK BY WAYNE D. BARNDT, BUREL S. BUTMAN, STEVEN L. ELMER, ERNEST G. LINK, CHARLES F. LEONARD, HOWARD E. LORENZ, AND SIDNEY A. VANDERVEEN, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE RESEARCH DIVISION OF THE COLLEGE OF AGRICULTURAL AND LIFE SCIENCES, UNIVERSITY OF WISCONSIN

DOOR COUNTY is in the eastern part of Wisconsin, occupying most of the peninsula that separates Green Bay from Lake Michigan (fig. 1). Washington Island is separated from the tip of the peninsula by [illegible] which is about 4 miles across.

Sturgeon Bay, the county seat, with a population of 7,200 in 1970, is the largest city in Door County. It is the center of the agricultural area and serves as a distribution center for most of the county. Shipbuilding is the leading industry.

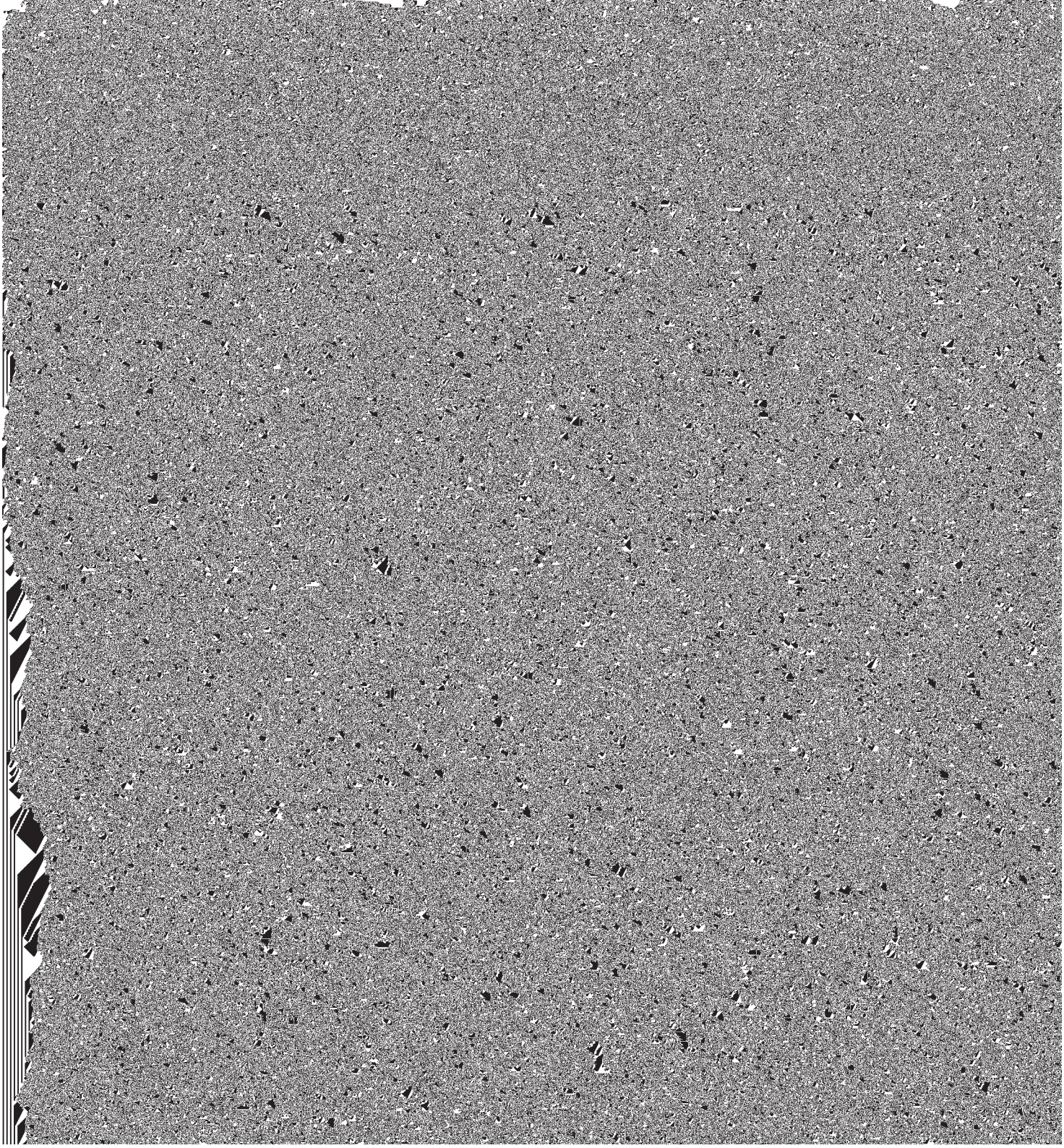
had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil



The six soil associations in Door County are discussed in the following pages. Soil associations and delineations on the general soil map do not fully agree with those of the general soil maps of adjacent counties published at a different date. Differences in the maps are the result of improvement in the classifica-

The gently sloping, moderately deep and deep soils are suited or moderately well suited to crops. The shallow and steeper soils are moderately well suited to generally unsuited to crops.

Controlling erosion and maintaining organic-matter content, tilth, and fertility are the main concerns of



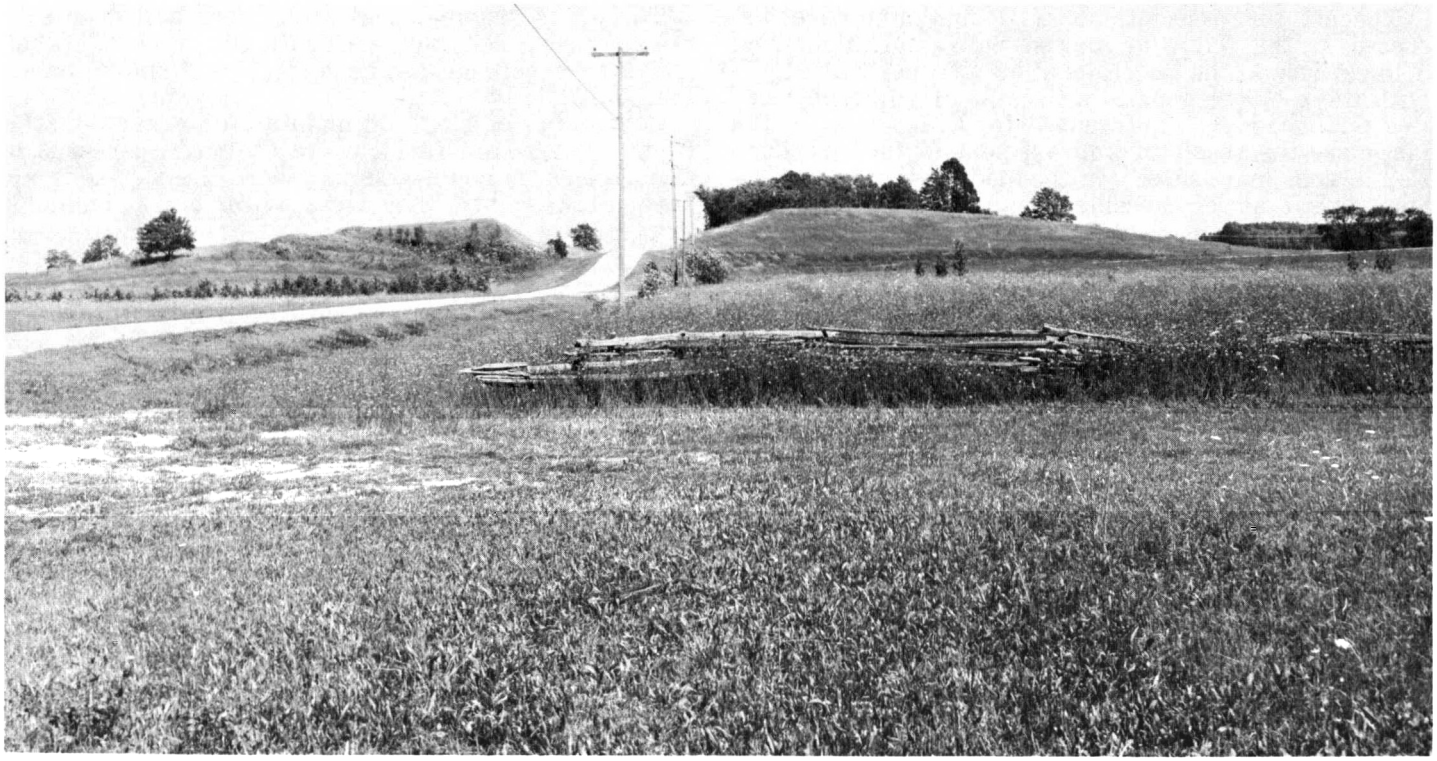


Figure 2.—Omena soils occupy much of the drumlin landscape in Liberty Grove Township.

and silty clay in the lower part. The substratum, at a depth of about 28 inches, is silty clay glacial till.

The Kolberg soils are well drained and are nearly level to sloping. They are on glacial till upland plains and broad ridges. These soils are underlain by dolomite bedrock at a depth of 20 to 40 inches. Typically, the surface layer is silt loam. The subsoil is clay loam in the upper part, silty clay in the middle part, and silty clay loam in the lower part. The substratum is heavy loam. Dolomite bedrock is at a depth of about 38 inches.

The Manawa soils are somewhat poorly drained and are nearly level. They are in drainageways and small depressions on glacial till upland plains. Typically, the surface layer is silt loam, and the subsoil silty clay. The substratum, at a depth of about 28 inches, is silty clay glacial till.

Minor soils in this association are Manistee, Namur, Poygan, Suamico, and Kolberg Variant soils. The Manistee soils are on broad ridge crests intermingled with the Kewaunee soils. The Namur and Kolberg Variant soils are along escarpments where the glacial till is thin over the underlying dolomite bedrock. The Poygan soils

material in these soils is derived mainly from herbaceous plants.

Minor soils in this association are mainly Markey, Rousseau, Deford, Wainola, and Yahara soils. The Markey soils are in small depressions and along the edges of large depressions. The Wainola and Yahara soils are on benches or terraces in areas adjacent to Deford and Yahara Variant soils. The Rousseau and Deford soils are on low ridges and in swales that were formed by the high lake elevation of the post-glacial period. They are in low–lying areas along Lake Michigan.

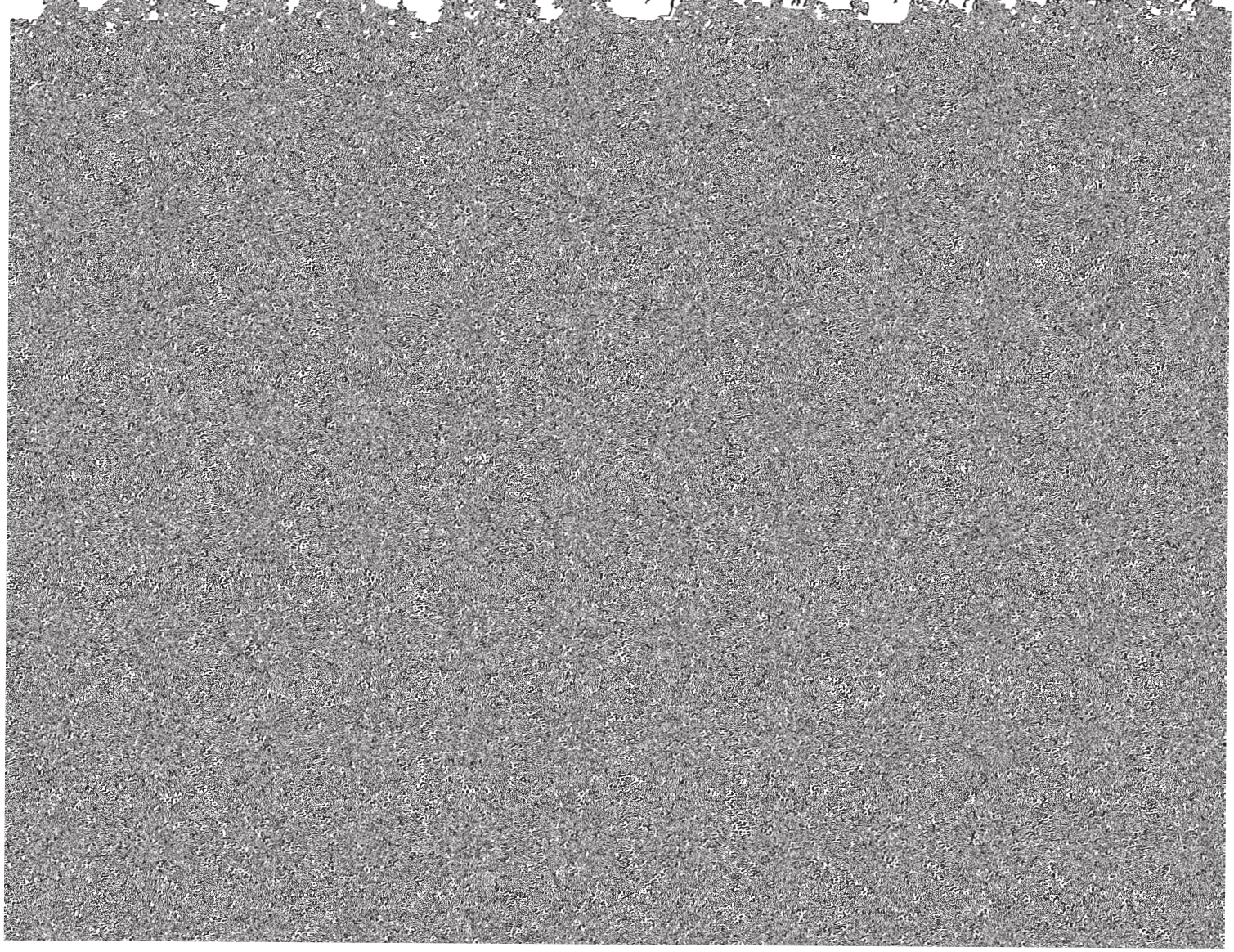
This association is used mostly for pasture, woodland, and wildlife habitat.

These soils are moderately well suited or poorly suited to crops.

6. Carbondale-Cathro association

Very poorly drained, nearly level organic soils

This association consists of nearly level organic soils in glacial lake basins and depressions. It occupies about 7 percent of the county. The Carbondale



tive of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are apparent in the name of the mapping unit.

As mentioned in the section "How this survey was made," not all mapping units are members of a soil series. Beaches, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order

B2ir—20 to 24 inches; brown (7.5YR 5/4) sand; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; single grained; loose; mildly alkaline; clear irregular boundary.

A'2—24 to 26 inches; brown (10YR 5/3) sand; single grained; loose; neutral; contains about 15 percent gravel, by volume; mildly alkaline; abrupt irregular bound-

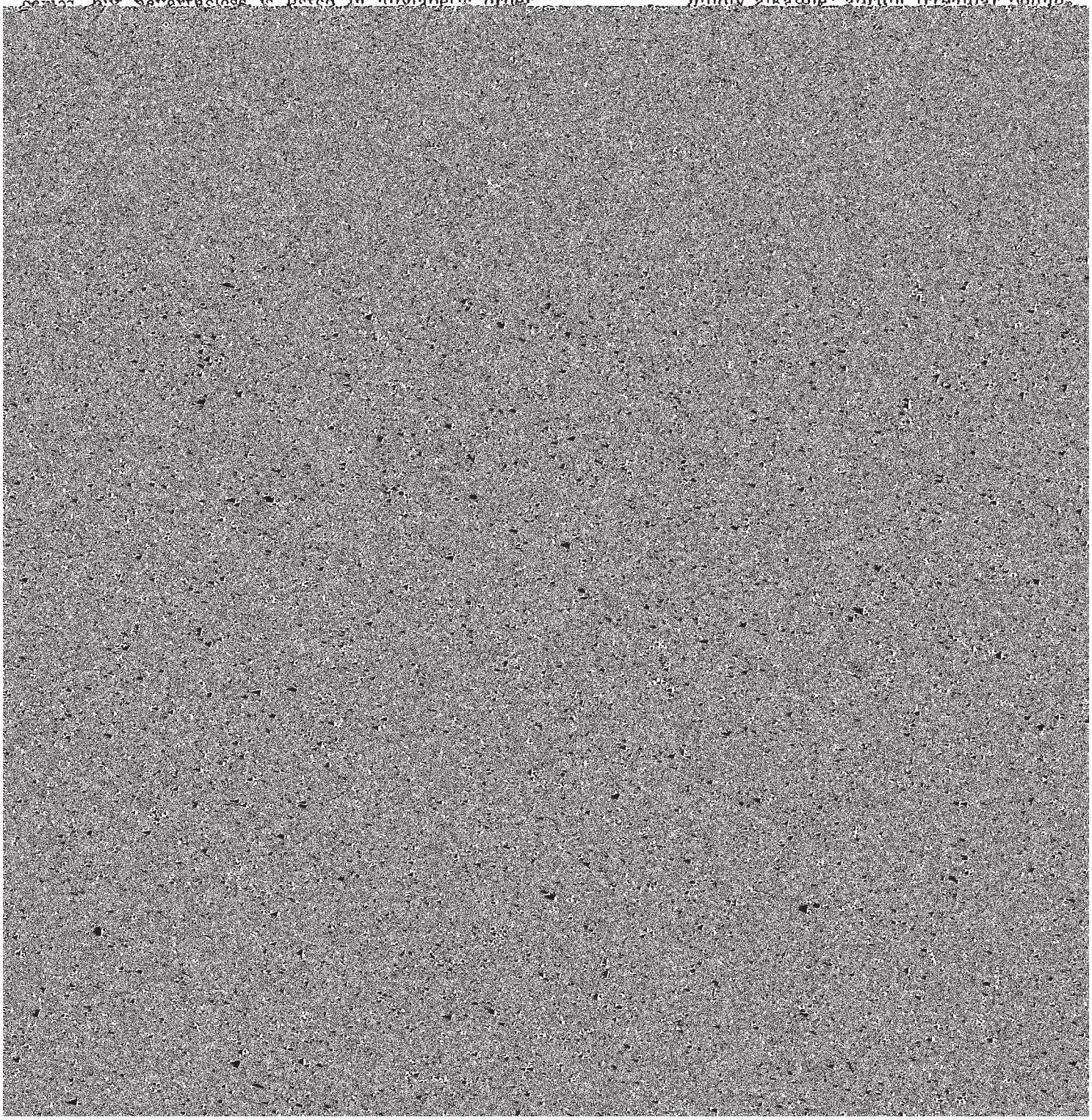
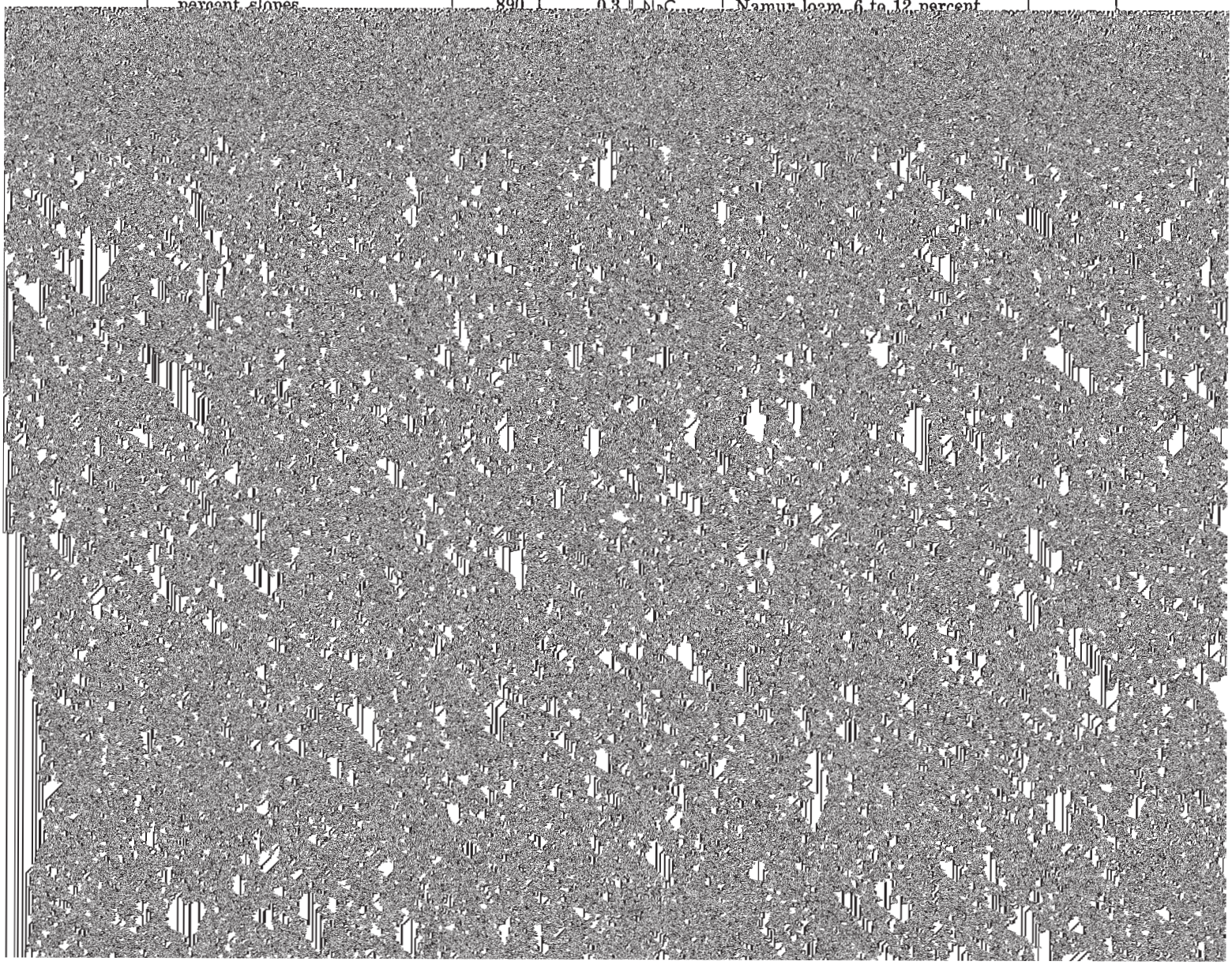


TABLE 1.—*Acreage and proportionate extent of the soils*

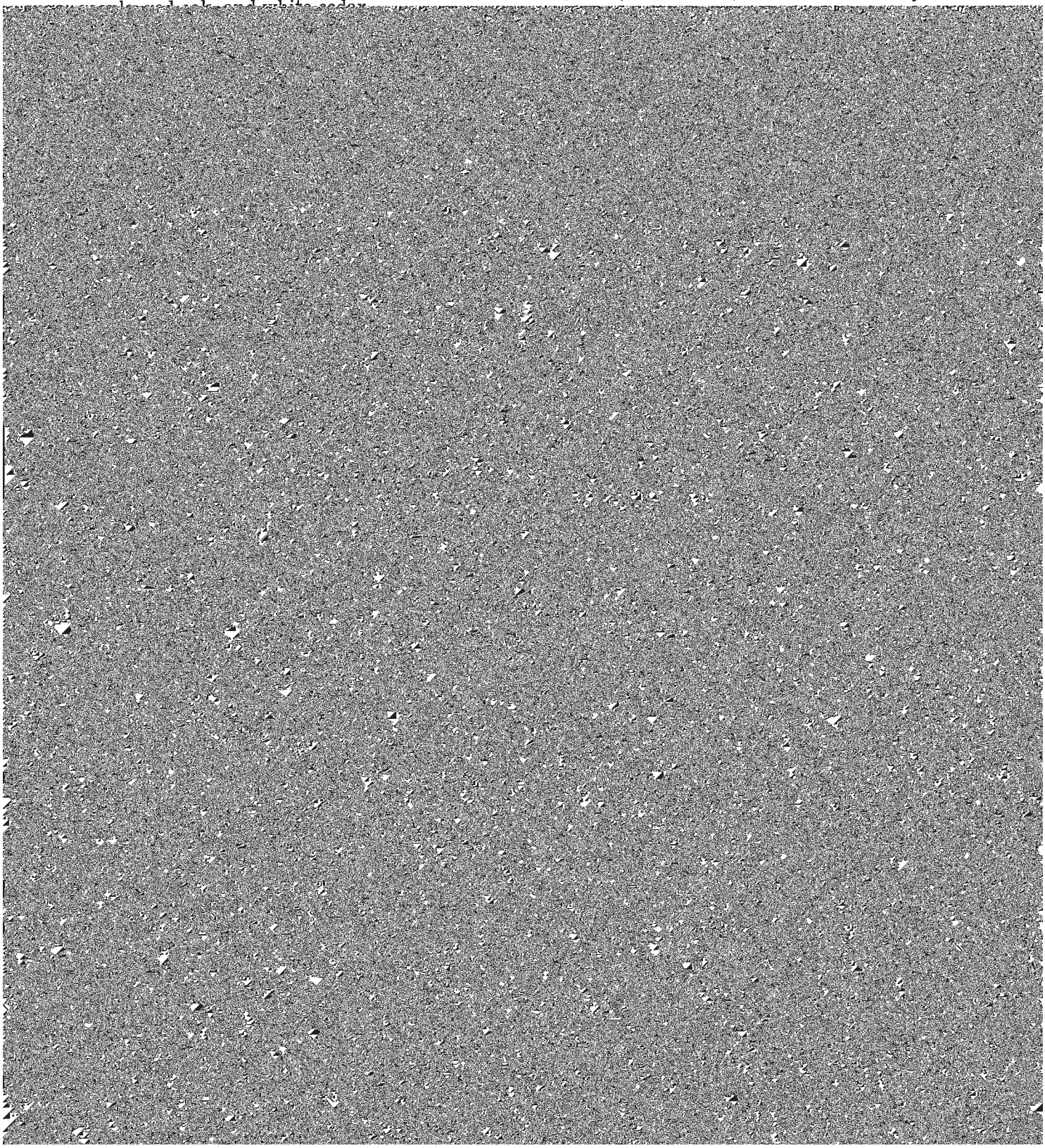
Map symbol	Soil name	Acres	Percent	Map symbol	Soil name	Acres	Percent
AdA	Allendale loamy sand, 0 to 3 percent slopes	510	0.2	LoB	Longrie loam, 2 to 6 percent slopes	26,750	8.5
ApC	Alpena gravelly sandy loam, 0 to 12 percent slopes	3,150	1.0	LoC	Longrie loam, 6 to 12 percent slopes	1,450	0.5
Ax	Angelica loam	8,900	2.8	McA	Manawa silt loam, 0 to 3 percent slopes	5,700	1.8
Be	Beaches	450	0.1	MeB	Manistee loamy sand, 2 to 6 percent slopes	630	0.2
Bn	Bonduel loam	7,400	2.4	Mk	Markey muck	5,500	1.7
Bo	Bonduel Shallow Variant fine sandy loam	2,550	0.8	NaB	Namur loam, 0 to 6 percent slopes	19,350	6.1
Bp	Bonduel Wet Variant loam	2,800	0.9				
BrB	Boyer loamy sand, 2 to 6 percent slopes	890	0.3	NaC	Namur loam, 6 to 12 percent		



Alpena series

The Alpena series consists of well drained to excessively drained, nearly level to sloping soils on eskers and old glacial lake beach ridges. The native vegetation is

Most areas of this soil are used for permanent pasture, woodland, or wildlife habitat. Because of the very low available water capacity, this soil is generally unsuited to crops. Gravel pits are common in some areas. Capability unit VIs–5; woodland suitability subclass 4f.



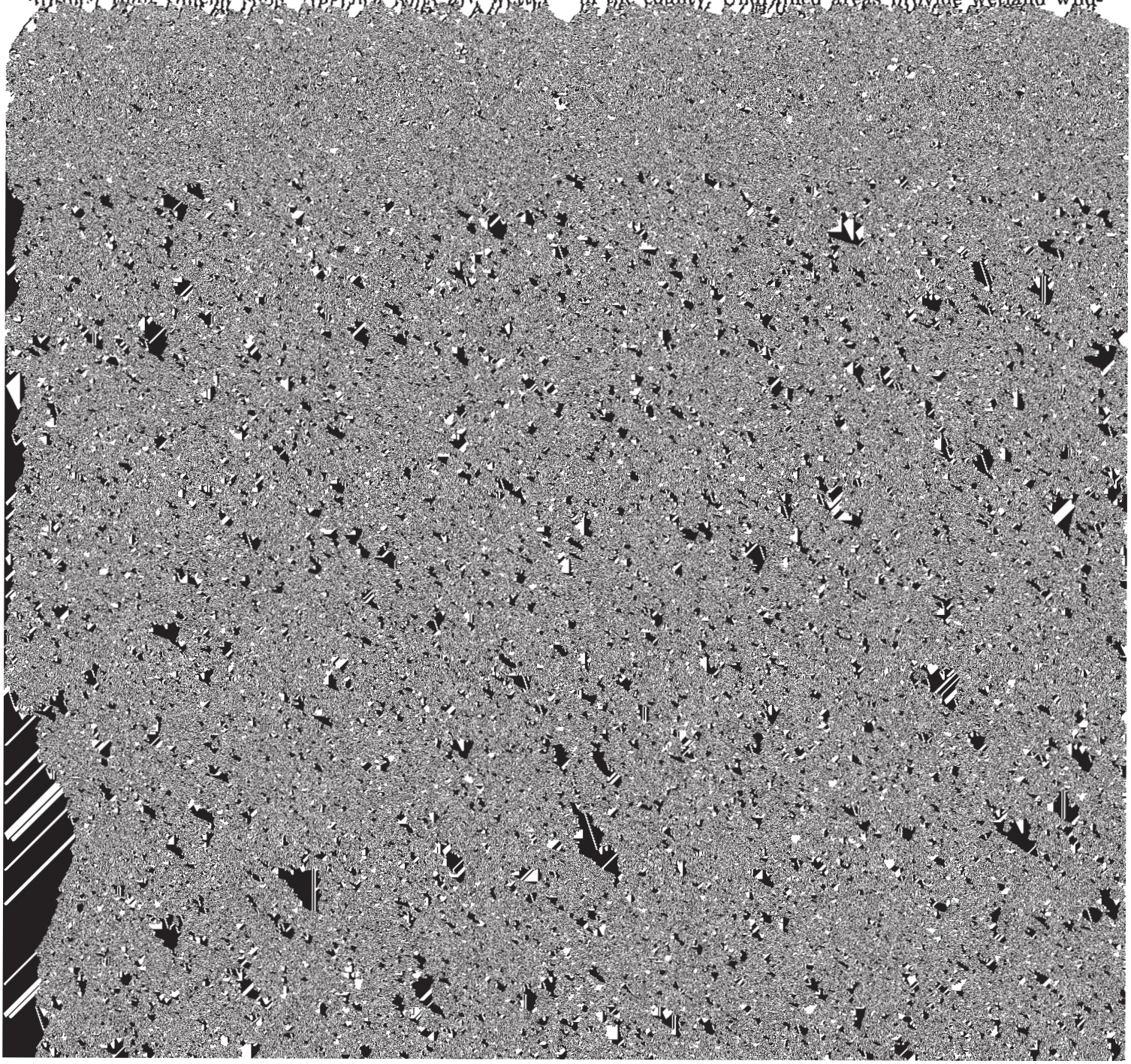
pedons. In cultivated areas is a very dark brown Ap horizon as much as 8 inches thick. The B21 horizon ranges from dark gray to light brownish gray, and the B22 horizon ranges from dark grayish brown to light brown. The B21g and B22 horizons are commonly loam but range to sandy clay loam or clay loam in some pedons. The C horizon ranges from brown to pink. It is commonly loam but ranges to sandy loam or silt loam. Content of coarse fragments ranges from 10 to 20 percent, by volume.

Angelica soils are near Emmet, Omena, and Solona soils. They have finer texture and are more poorly drained than Omena soils. Angelica soils are wetter

loam in the middle part; and mottled, brown, friable heavy loam and loam in the lower part. Below the subsoil is dolomite bedrock at a depth of about 28 inches.

The available water capacity is low, and permeability is moderate. These soils are seasonally saturated at a depth of 1 to 3 feet unless they are drained. If the soils are not drained, the depth of the root zone is limited by the water table. Natural fertility is medium, and the organic-matter content of the surface layer is moderate.

Where drained, most areas of these soils are used for pasture or for general farm crops commonly grown in the county. Undrained areas provide wetland wild-



Bn—Bonduel loam. This nearly level soil is on glacial till plains that are underlain by dolomite bedrock. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 3 to 20 acres in size.

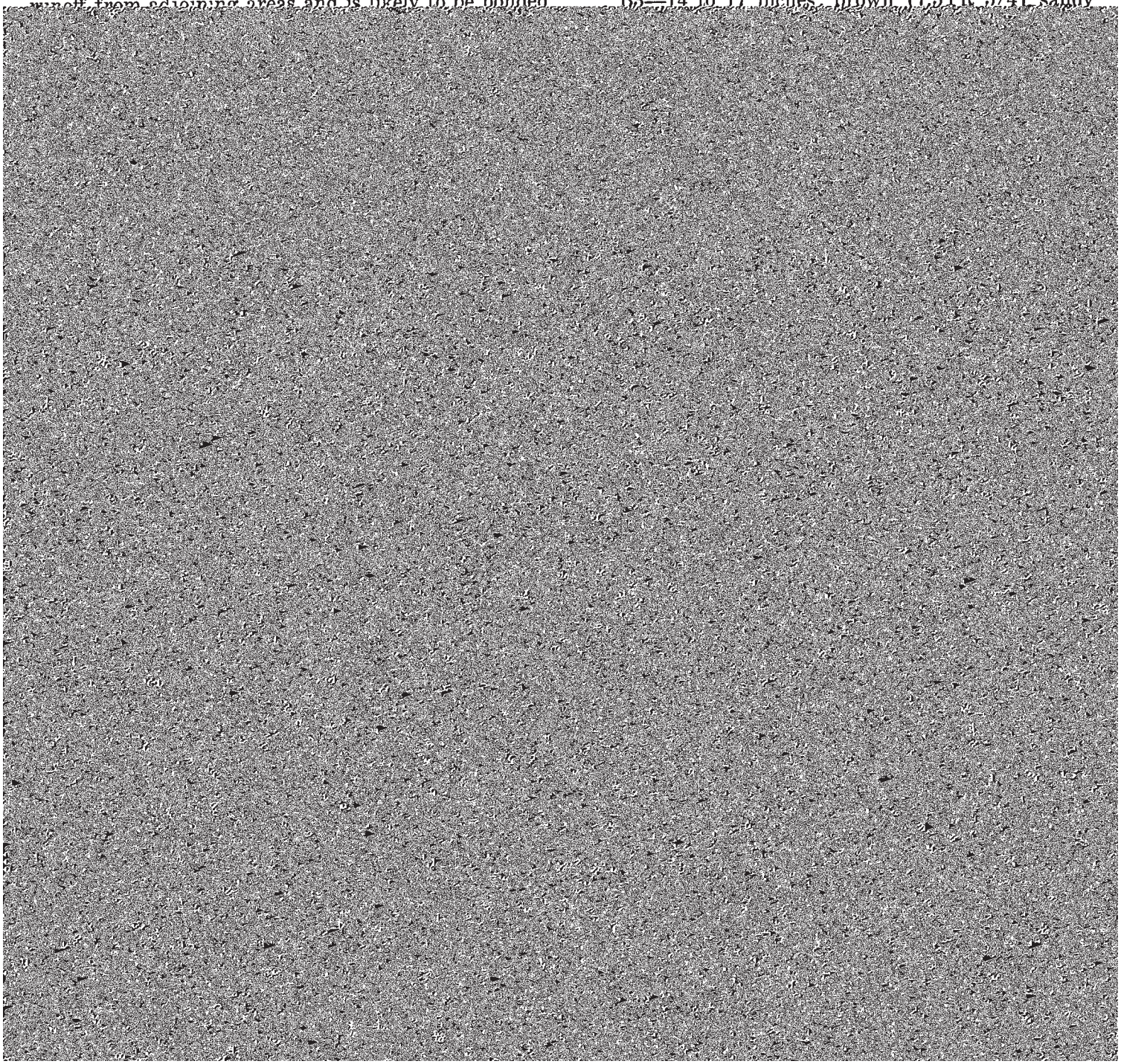
Included with this soil in mapping are small areas of Bonduel Wet Variant and Longrie soils. Also included are small areas of soils that have a fine sandy loam surface layer, small areas of soils that have a heavy clay loam subsoil, and areas of soils that are underlain by dolomite bedrock at a depth of 40 to 60 inches.

Runoff is slow. The hazard of erosion is slight. Wetness is the main limitation of this soil. This soil receives runoff from adjoining areas and is likely to be ponded

structure; friable; many roots; some dolomite fragments; many worm casts; mildly alkaline; clear wavy boundary.

B2—10 to 14 inches; dark brown (7.5YR 4/4) loam; common fine distinct light brownish gray (10YR 6/2) and many fine prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; dolomite fragments present; many roots; clay bridging of sand grains; mildly alkaline; clear wavy boundary.

B3—14 to 17 inches; brown (7.5YR 5/4) sandy

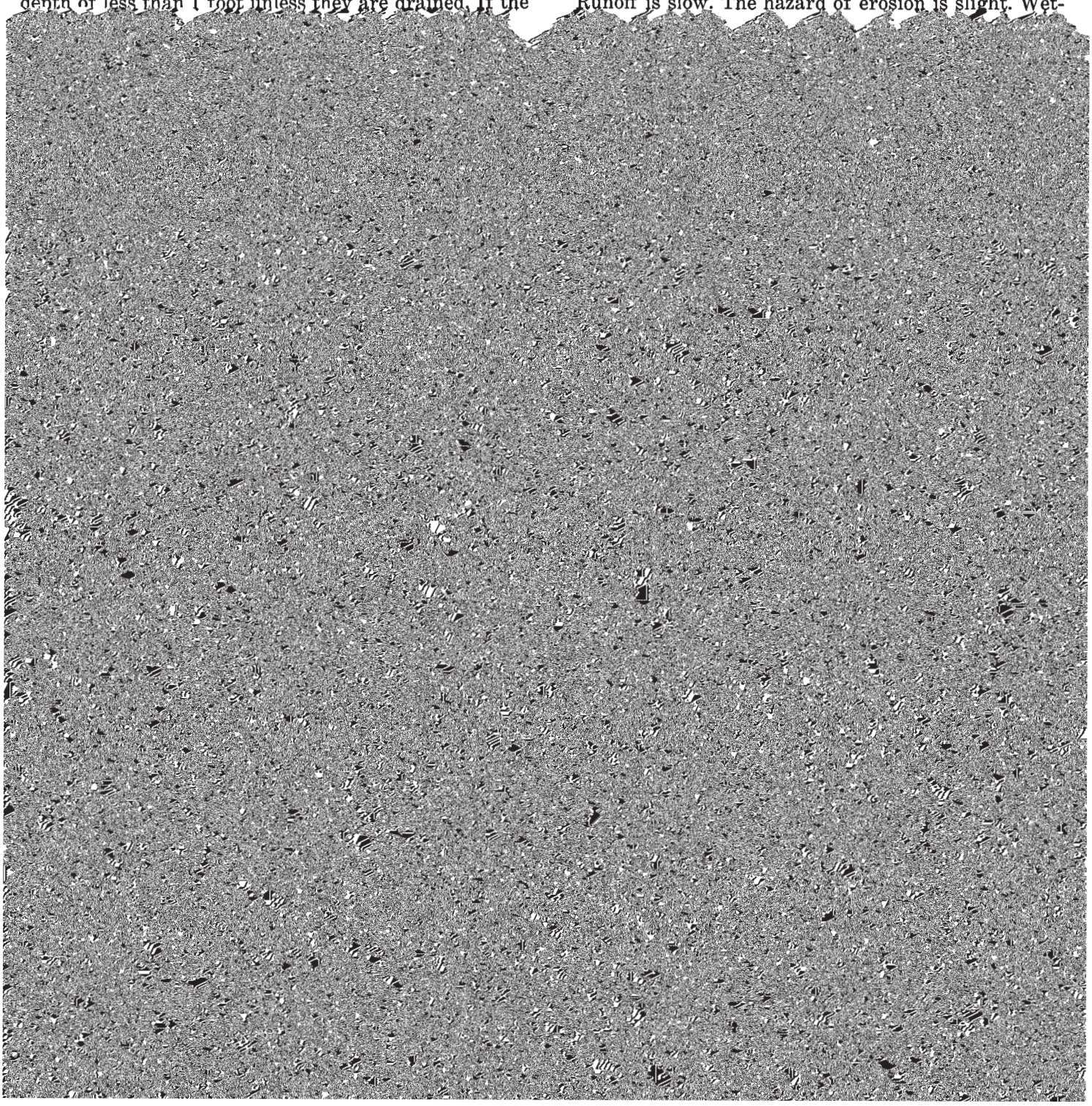


In a representative profile the surface layer is about 3 inches of black muck over about 3 inches of very dark grayish brown loam. The subsoil is grayish brown friable loam about 18 inches thick and is mottled in the lower part. The substratum is mottled, grayish brown, friable loam. It is underlain by dolomite bedrock at a depth of about 32 inches.

The available water capacity is low, and permeability is moderate. These soils are seasonally saturated at a depth of less than 1 foot unless they are drained. If the soil is in depressions on glacial till plains where dolomite bedrock is at a depth of 20 to 40 inches. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 20 acres in size.

Included with this soil in mapping are small areas of Bonduel and Namur Variant soils. Also included are small areas of soils that have a silt loam surface layer and areas of soils in which dolomite bedrock is at a depth of less than 20 inches or more than 40 inches.

Runoff is slow. The hazard of erosion is slight. Wet-



blocky structure; friable; clay bridging of sand grains; few fine roots; less than 10 percent gravel; neutral; clear wavy boundary.

B22t—23 to 33 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; thin clay films in pores; few fine roots; less than 10 percent gravel; mildly alkaline; abrupt wavy boundary.

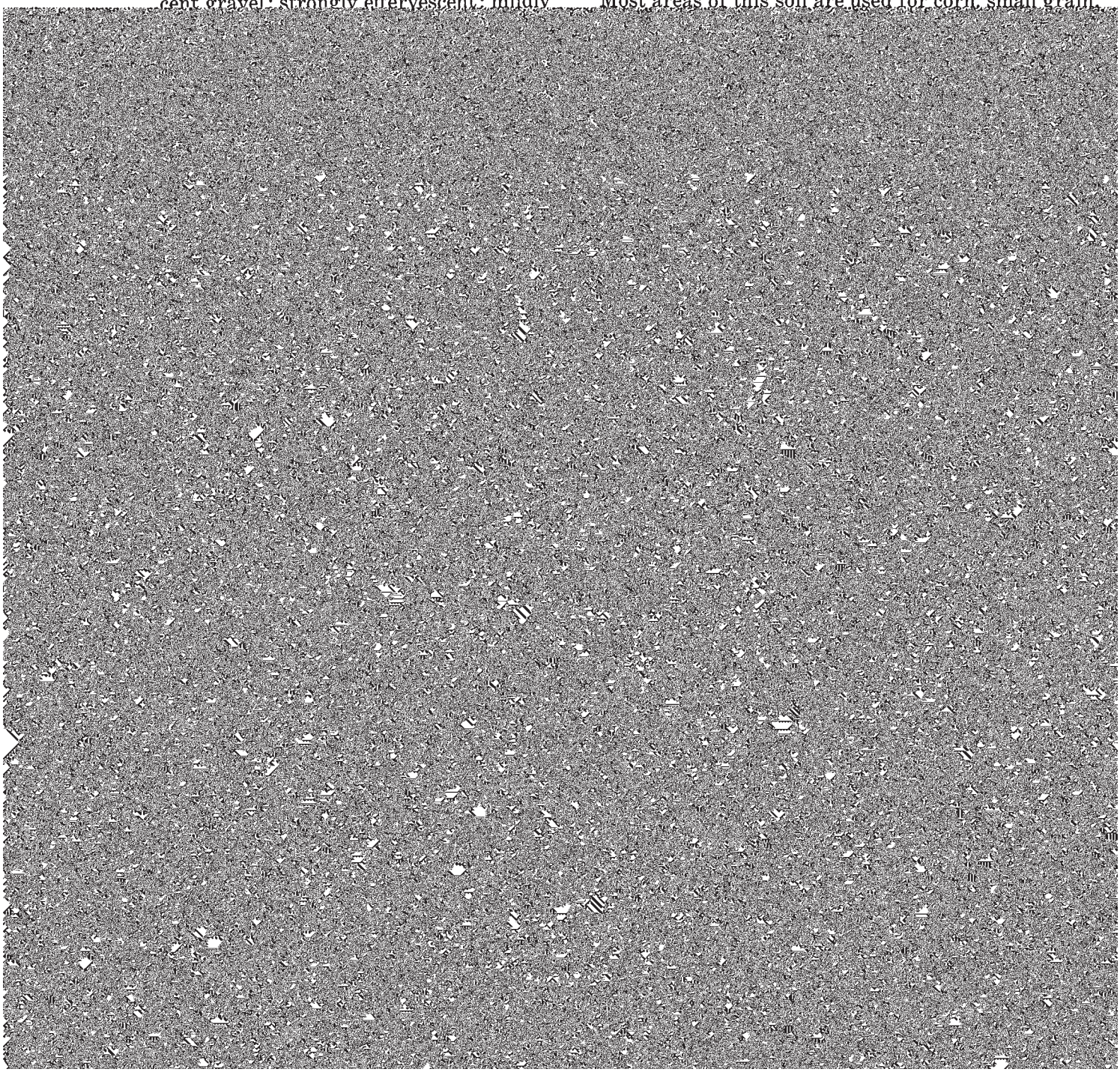
IIC1—33 to 38 inches; brown (10YR 5/3) sand and gravel; single grained; loose; 40 percent gravel; strongly effervescent; mildly

This soil has a profile similar to the one described as representative of the series, but it has a thinner surface layer and subsoil. This soil also is more susceptible to erosion, more droughty, and generally produces lower yields than the representative soil.

Included with this soil in mapping are small areas of Manistee, Rousseau, and Sisson soils. Also included are small areas of gently sloping and moderately steep Boyer loamy sand. In a few places the subsoil extends below a depth of 40 inches.

Runoff is medium. The hazard of erosion is moderate, and it is the main limitation of this soil.

Most areas of this soil are used for corn, small grain,



permeability is moderately rapid. Unless they are drained, these soils are saturated at a depth of less than 1 foot. If the soils are not drained, the depth of the root zone is limited by the water table. Natural fertility is low, and the organic-matter content of the surface layer is very high. Because of restricted air drainage, these soils have a severe frost hazard.

If drained, areas of these soils are used for most general farm crops commonly grown in the county. Undrained areas provide good wetland wildlife habitat. A few areas are used for unimproved pasture.

Representative profile of Carbondale muck in a wooded area, 100 feet east and 100 feet north of the southwest corner of sec. 36, T. 26 N., R. 24 E.:

Oa1—0 to 8 inches; black (10YR 2/1) broken face and rubbed sapric material; less than 10 percent fibers, less than 5 percent rubbed; moderate fine and medium subangular blocky structure; very friable; brown (10YR 5/3) with sodium pyrophosphate; primarily herbaceous fibers; neutral; clear smooth boundary.

Oe1—8 to 24 inches; black (10YR 2/1) broken face and rubbed hemic material; about 35 to 40 percent fibers, about 10 to 15 percent rubbed; massive; friable; very pale brown (10YR 7/3) with sodium pyrophosphate; 65 percent herbaceous fibers; neutral; abrupt smooth boundary.

Oa2—24 to 48 inches; black (10YR 2/1) broken face and rubbed sapric material; about 20 percent fibers, less than 10 percent rubbed; moderate medium granular

Runoff is very slow. The hazard of erosion is slight; however, large drained areas are susceptible to subsidence and soil blowing. Wetness is the main limitation of this soil. This soil is likely to be ponded during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Both deep ditches and subsurface drainage remove internal water if outlets are available.

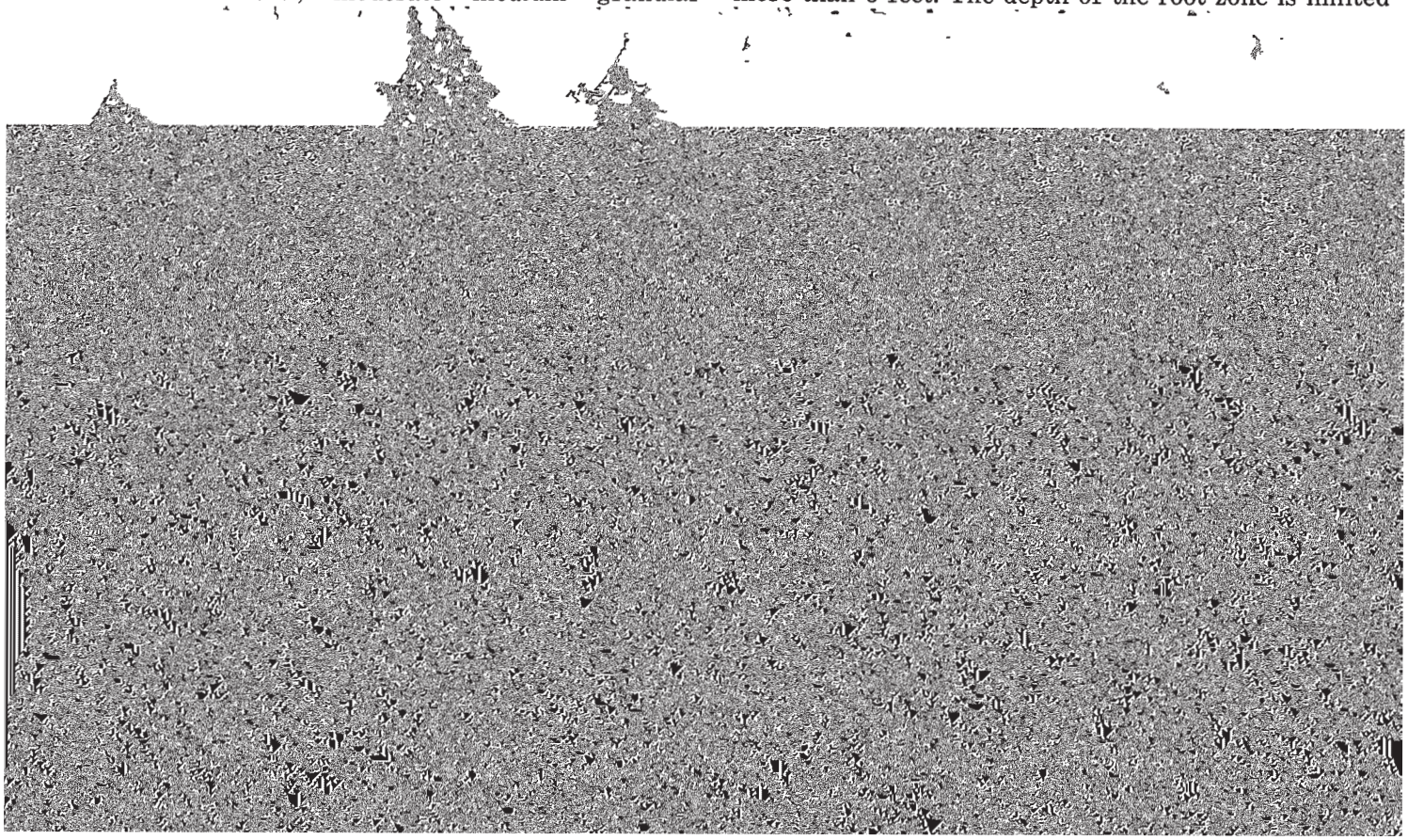
Even if drained, this soil is poorly suited to crops commonly grown in the county because of the frost hazard. Undrained areas are used for unimproved pasture, but are better suited to wetland wildlife habitat than to most other uses. Capability unit IVw–9; woodland suitability subclass 3w.

Casco series

The Casco series consists of well drained, gently sloping and sloping soils on outwash plains and morainic ridges. The native vegetation is sugar maple and red oak.

In a representative profile the surface layer is very dark grayish brown sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 5 inches thick. The subsoil is about 9 inches thick; it is dark brown, firm sandy clay loam in the upper part; and brown, very friable gravelly loam in the lower part. The substratum is yellowish brown, loose gravelly sand to a depth of about 60 inches.

The available water capacity is low. Permeability is moderate in the subsoil and very rapid in the substratum. These soils are seasonally saturated at a depth of more than 6 feet. The depth of the root zone is limited



more than 35 percent coarse fragments; strongly effervescent; mildly alkaline.

The solum is 10 to 24 inches thick and is commonly neutral or mildly alkaline. The C horizon is mildly alkaline or moderately alkaline. In undisturbed areas are a thin, dark colored A1 horizon and a dark grayish brown or brown A2 horizon. The Ap horizon, in cultivated areas, is dark grayish brown or dark brown sandy loam. The B2t horizon is dark brown, brown, or reddish brown. It is sandy clay loam, clay loam, or heavy loam. The C horizon has strata of poorly sorted to well sorted calcareous sand and gravel. Coarse fragments make up more than 35 percent, by volume.

In Door County, annual temperature of these soils is a few degrees cooler than the defined range for the series, but this difference does not alter their usefulness and behavior.

Casco soils are near Alpena, Boyer, and Kiva soils. They have a higher clay content in the B horizon than those soils. The C horizon of Casco soils is mainly sand and gravel, whereas the C horizon of the Boyer soils is mainly sand.

CcB—Casco sandy loam, 2 to 6 percent slopes. This gently sloping soil is on outwash plains and low morainic ridges. Most areas are elongated and are 10 to 60 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Boyer soils. Also included are small areas of nearly Sand and gravel pits are common on this soil. Capability unit IVe–3; woodland suitability subclass 3d.

Cathro series

The Cathro series consists of very poorly drained, nearly level, organic soils in old glacial lake basins and depressions. The native vegetation is northern white–cedar, white ash, white birch, tag alder, and redosier dogwood.

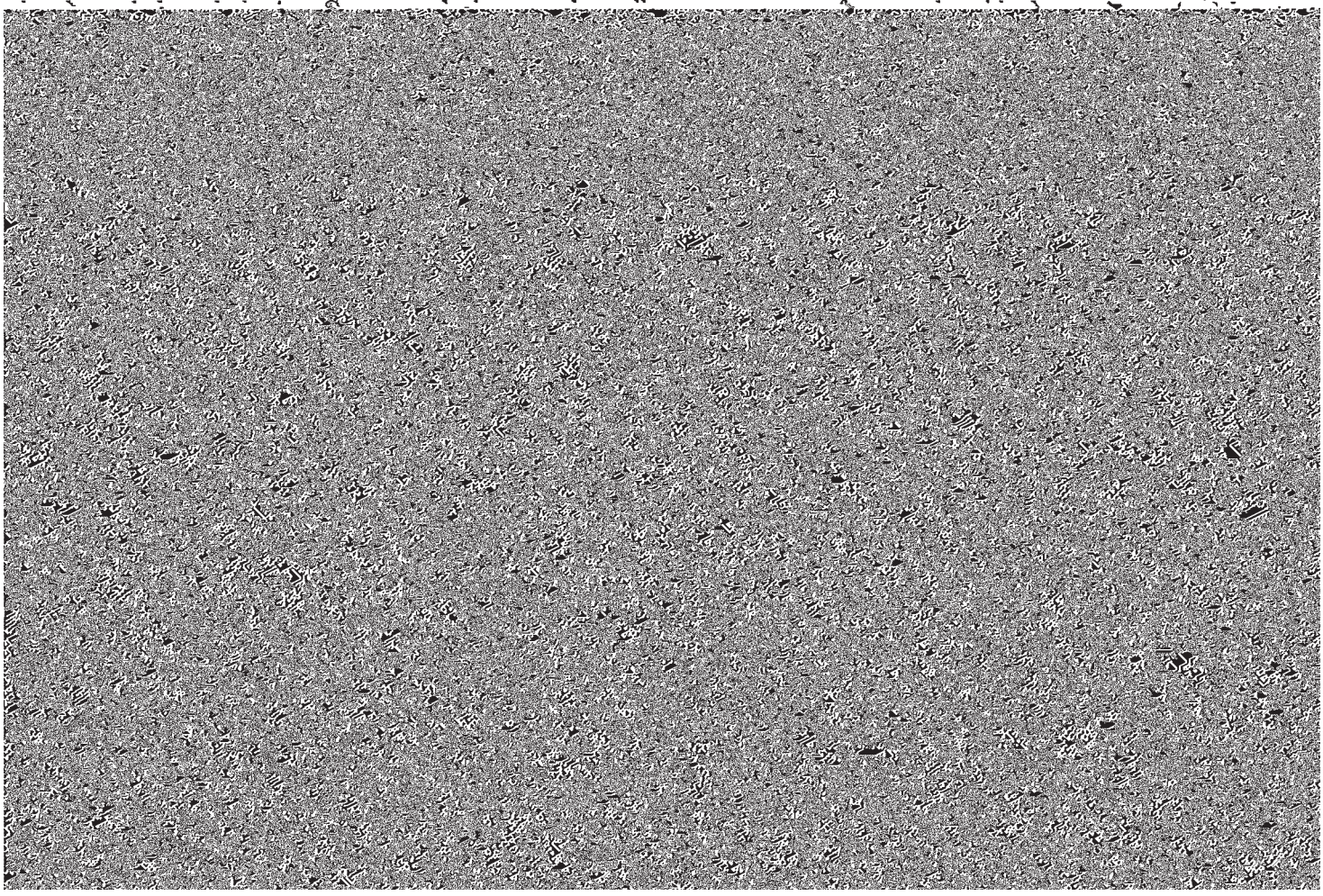
In a representative profile the upper 30 inches is black muck that contains 20 to 30 percent recognizable plant fibers if undisturbed. The upper 3 inches of the substratum is gray, very firm clay loam. The lower part of the substratum is brown, firm loam to a depth of about 60 inches. There are mottles in the substratum.

The available water capacity is very high. Permeability is moderately rapid in the organic layers and moderate in the substratum. These soils are saturated at a depth of less than 1 foot unless they are drained. If undrained, the depth of the root zone is limited by the water table. Natural fertility is low, and the organic-matter content of the surface layer is very high.

If drained, areas of these soils are used for improved pasture.

Representative profile of Cathro muck in a wooded area, 800 feet north and 440 feet east of the southwest corner of sec. 35, T. 26 N., R. 25 E.:

Oa1—0 to 15 inches; black (10YR 2/1) broken



neutral to moderately alkaline. It is mainly loam, silt loam, or sandy loam, but in places it includes thin layers of fine sand, silty clay loam, or clay loam.

Cathro soils are near Carbondale and Suamico soils. They have a thinner organic layer than Carbondale soils and they do not have the clayey C horizon that Suamico soils have.

Cm—Cathro muck. This nearly level soil is in old glacial lake basins and depressions. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 100 acres in size.

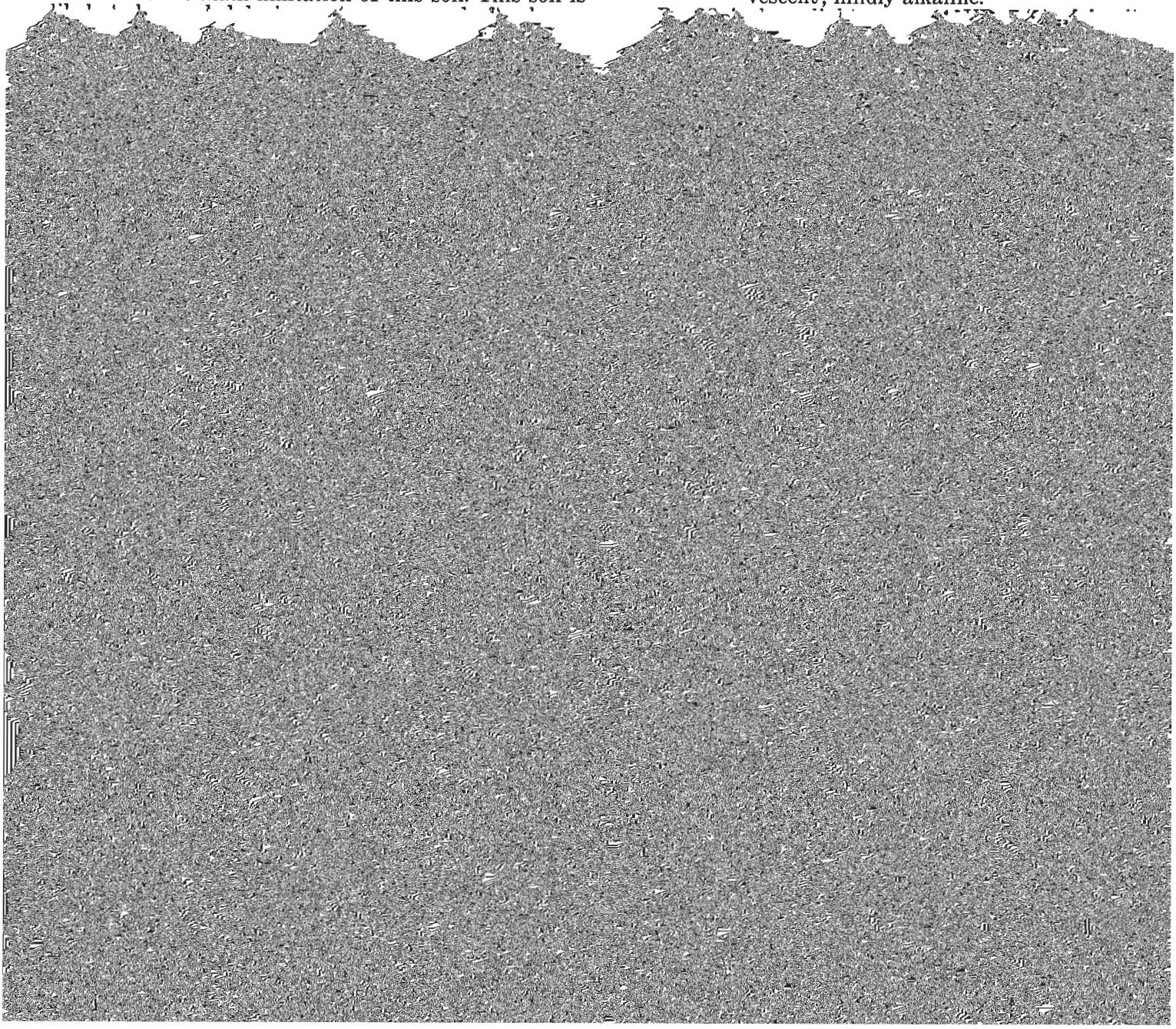
Included with this soil in mapping are small areas of Carbondale and Suamico soils. Also included are small seep areas of gently sloping soils.

Runoff is very slow. The hazard of erosion is slight. Wetness is the main limitation of this soil. This soil is

30 percent fibers, less than 10 percent rubbed; weak medium subangular blocky structure parting to weak fine granular; very friable; mixed herbaceous and woody fibers; mildly alkaline; clear wavy boundary.

IIC1—27 to 33 inches; light yellowish brown (10YR 6/4) dolomite gravel and stones, ½ to 10 inches in diameter; some coatings from the overlying organic horizons; abrupt smooth boundary.

IIC2—33 to 38 inches; pale brown (10YR 6/3) loamy fine sand; massive; nonsticky; some dolomite fragments and small snail shell fragments present; strongly effervescent; mildly alkaline.



Natural fertility is low, and the organic-matter content of the surface layer is high.

If drained, these soils are used for most general farm crops commonly grown in the county. Undrained areas provide good wetland wildlife habitat. A few areas are used for unimproved pasture.

Representative profile of Deford loamy fine sand in a wooded area, 760 feet east and 600 feet north of the southwest corner of the SE¼ sec. 17, T. 30 N., R. 28 E.:

A1—0 to 4 inches; black (10YR 2/1) loamy fine sand; very weak fine granular structure; very friable; slightly acid; abrupt wavy boundary.

C1—4 to 21 inches; pinkish gray (7.5YR 6/2) fine sand; single grained; loose; neutral; clear wavy boundary.

C2—21 to 60 inches; light brownish gray (10YR 6/2) fine sand; single grained; loose; neutral.

The reaction is commonly slightly acid to mildly alkaline to a depth of 60 inches but ranges from medium acid to moderately alkaline in some pedons. The A horizon is 4 to 8 inches thick. The C horizon is light brownish gray, gray, or pinkish gray. It is commonly fine sand but ranges to very fine sand or loamy fine sand. The content of coarse fragments is less than 5 percent, by volume.

Deford soils are near Markey, Rousseau, and Wainola soils. They are not so poorly drained as Markey soils, and they do not have the thick organic layer of those soils. Deford soils are more poorly drained than Rousseau and Wainola soils.

De—Deford loamy fine sand. This nearly level soil is in depressions of sandy glacial outwash and on lake plains. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 150 acres in size.

Included with this soil in mapping are small areas of Markey and Wainola soils. Also included are small areas of soils that have a fine sandy loam or muck surface layer.

Runoff is very slow. The hazard of erosion is slight. Wetness is the main limitation of this soil. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface layer is grayish brown sand about 1 inch thick. The subsoil is about 13 inches thick; it is reddish brown, very friable sand in the upper part and dark reddish brown, very friable sand in the lower part. The substratum is brown, very friable loamy sand about 12 inches thick. The dolomite bedrock is at a depth of about 28 inches.

The available water capacity is very low, and permeability is rapid. These soils are saturated at a depth of more than 6 feet. The depth of the root zone is limited by the dolomite bedrock. Natural fertility and the organic-matter content of the surface layer are low.

Most areas of these soils are used for farm crops commonly grown in the county. Some areas remain in native woodland.

Representative profile of Duel loamy sand, 1 to 6 percent slopes, in a wooded area, 940 feet south and 200 feet west of the northeast corner of the SE¼ sec. 15, T. 29 N., R. 27 E.:

A1—0 to 2 inches; black (N 2/0) loamy sand; moderate fine and very fine subangular blocky structure; very friable; many roots; slightly acid; clear smooth boundary.

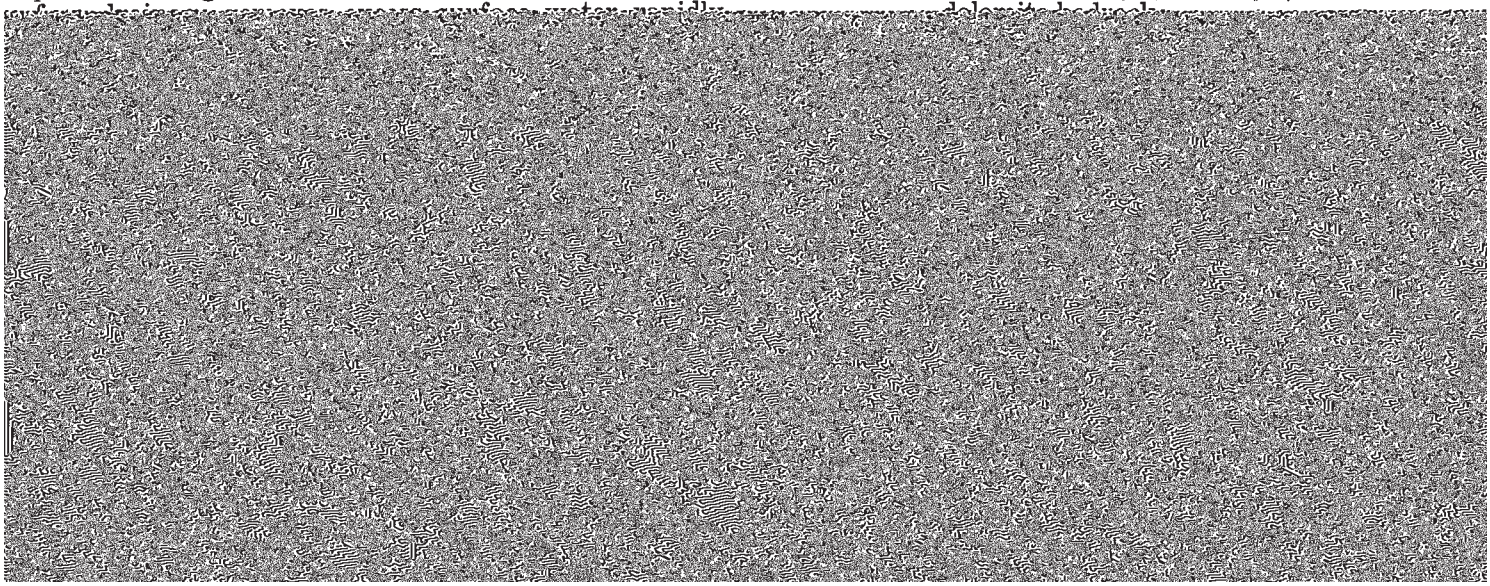
A2—2 to 3 inches; grayish brown (10YR 5/2) sand; weak fine and very fine subangular blocky structure; loose; many roots; slightly acid; clear wavy boundary.

B21ir—3 to 10 inches; reddish brown (5YR 4/4) sand; weak medium subangular blocky structure; very friable; many roots; slightly acid; clear wavy boundary.

B22ir—10 to 16 inches; dark reddish brown (5YR 3/4) sand; weak medium subangular blocky structure; very friable; many roots; few dolomite fragments; neutral; clear smooth boundary.

C—16 to 28 inches; brown (10YR 4/3) loamy sand; weak medium subangular blocky structure; very friable; many roots to 20 inches; ½- to 2-inch diameter dolomite fragments make up 20 percent of the horizon; slightly effervescent; mildly alkaline; abrupt smooth boundary.

R—28 inches; light gray (10YR 7/2) consolidated

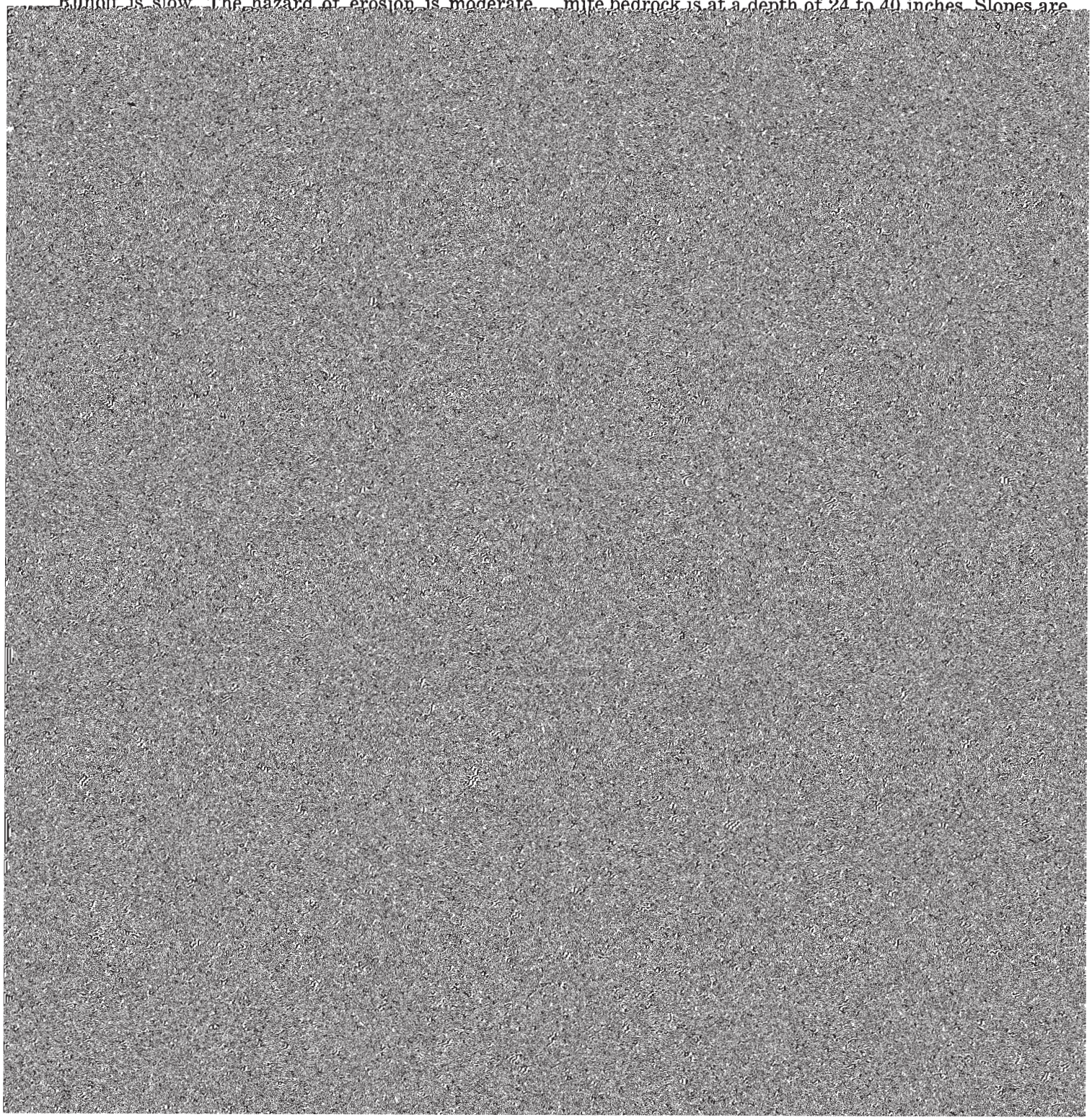


Included with this soil in mapping are small areas of Duel Variant and Rousseau soils. Also included are small areas of a sloping Duel loamy sand and small areas of soils that have a sandy loam surface layer. In places where this soil is adjacent to Rousseau soils, small areas are underlain by dolomite at a depth of 40 to 60 inches. The lower part of the subsoil and the substratum are mottled in some places.

Runoff is slow. The hazard of erosion is moderate.

Duel Variant soils are near Bonduel Wet Variant, Duel, and Summerville soils. They have more sand throughout the profile than Bonduel Wet Variant soils. Duel Variant soils are wetter and are underlain by bedrock at a greater depth than the well drained Summerville soils. They are also wetter than Duel soils.

Dv—Duel Variant sandy loam. This nearly level soil is in depressions on glacial outwash plains where dolomite bedrock is at a depth of 24 to 40 inches. Slopes are



sand; weak fine subangular blocky structure; very friable; slightly acid; gradual wavy boundary.

A2—18 to 24 inches; brown (10YR 5/3) sandy loam; weak medium subangular blocky

Runoff is slow. The hazard of erosion is moderate, and it is the main limitation of this soil (fig. 3).

Most areas of this soil are used for corn, small grain, legumes, and pasture. Truck crops and fruit trees are also grown. Management practices such as protective

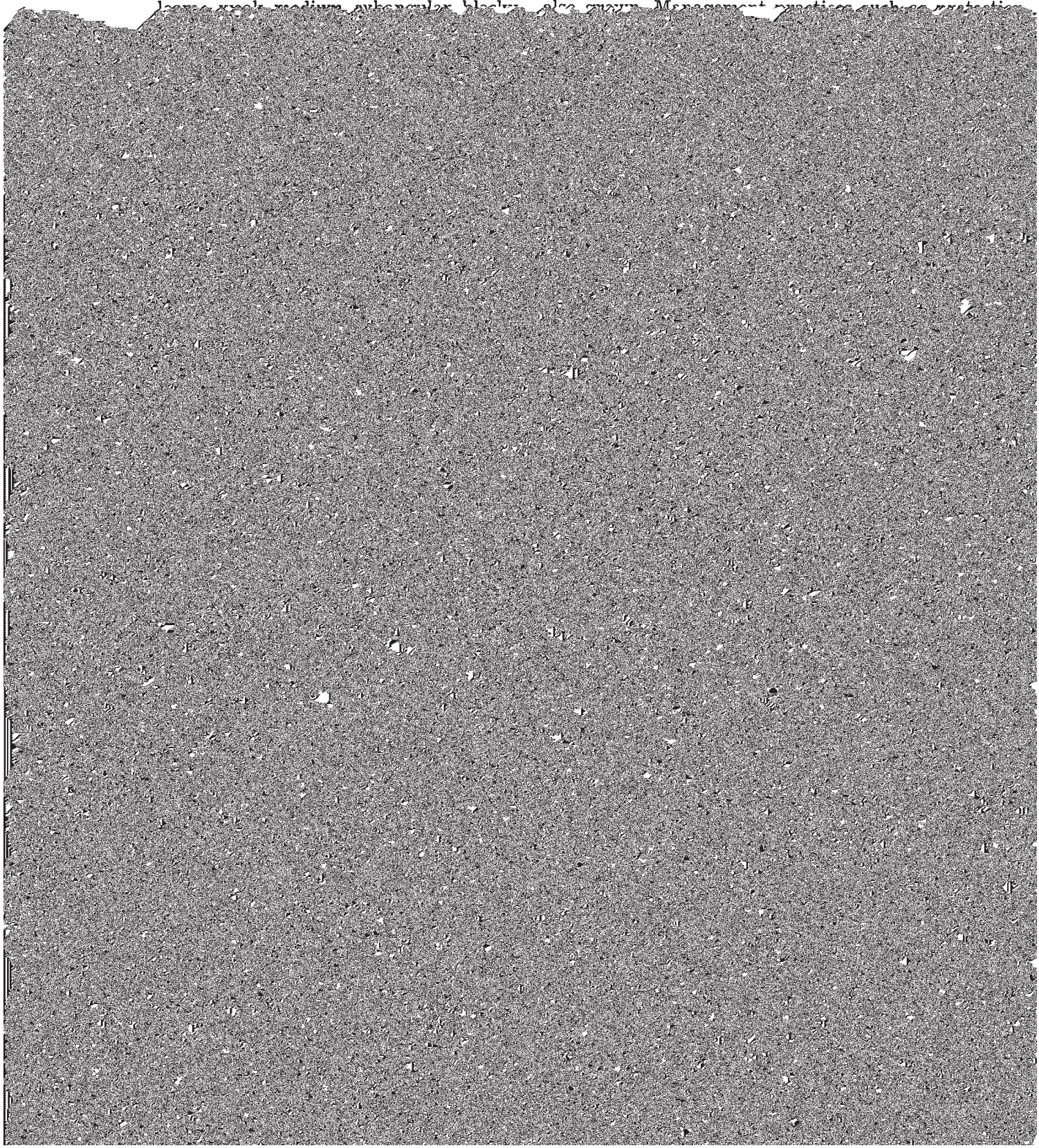


Figure 3.—**Typical area of Emmet soils. In the background, contour strips have been established to control erosion.**

This soil has a profile similar to the one described as representative of the series, but it has a thinner surface layer. This soil is more susceptible to erosion and is more droughty than gently sloping, sloping, and moderately steep Emmet sandy loams. This soil is too steep for use of tractor-drawn implements.

Included with this soil in mapping are small areas of Omena soils. Also included are small areas of soils that have a loamy surface layer and some areas of soils that have slopes of more than 35 percent.

Runoff is rapid. The hazard of erosion is very severe. is dark yellowish brown, friable sandy clay loam in the upper part and dark brown, friable heavy sandy loam in the lower part. The substratum, to a depth of about 60 inches, is brown gravelly sand.

The available water capacity is low. Permeability is moderate in the subsoil and rapid in the substratum. These soils are seasonally saturated at a depth of 1.5 to 2.0 feet unless they are drained. If the soils are not drained, the depth of the root zone is limited by the water table. Natural fertility is medium, and the organic-matter content of the surface layer is moderate.

B21t—7 to 15 inches; dark yellowish brown (10YR 3/4) sandy clay loam; common fine distinct yellowish brown (10YR 5/6) and many medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; many roots to 9 inches; few thin clay films on ped faces and in pores; neutral; clear irregular boundary.

B22t—15 to 19 inches; dark brown (10YR 3/3) heavy sandy loam; many medium prominent yellowish brown (10YR 5/6) and many medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; brownish yellow (10YR 6/6) weathered dolomite fragments present; few thin clay films on ped faces and in pores; mildly alkaline; clear wavy boundary.

IIC—19 to 60 inches; brown (7.5YR 5/4) gravelly sand; variegated colors throughout; single grained; loose; strongly effervescent; moderately alkaline.

The solum is 10 to 24 inches thick. It is commonly neutral but ranges from medium acid to mildly alkaline in some pedons. The depth to mottling is 5 to 12 inches. In cultivated areas, the Ap horizon is very dark grayish brown, very dark gray, or very dark brown and is 7 or more inches thick. The B horizon is sandy loam or sandy clay loam. The C horizon consists of strata of poorly sorted to well sorted, calcareous sand and gravel. It has more than 35 percent coarse fragments, by volume.

In Door County these soils have colors that are lower in value in the B horizon and are a few degrees cooler than the defined range for the series. These differences do not alter their usefulness and behavior.

Fabius soils are near the well drained Kiva soils. They have more clay in the B horizon than Kiva soils.

Fa—Fabius silt loam. This nearly level soil is on outwash plains. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 50 acres in size.

Included with this soil in mapping are small areas of Casco and Kiva soils. Also included are a few small areas of Fabius soils that have a loam or gravelly loam surface layer.

Runoff is slow. The hazard of erosion is slight. Wetness is the main limitation of this soil. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface sition of fresh sediment when floodwaters recede. The sediment is stratified in most places and ranges from gravelly sand to clay loam.

These soils are generally poorly drained, but in some places are small areas of well drained to somewhat poorly drained soils. Some small areas at slightly higher elevations are subject to periodic flooding.

Fluvaquents are better suited to woodland, wildlife habitat, and limited pasture than to most other uses. Because of the flooding hazard, they are poorly suited to crops. Capability unit Vw–14; woodland suitability subclass 4w.

Gravel pits

Gp—Gravel pits. Gravel pits are those areas where sand and gravel have been removed to a depth of several feet for use in highway construction and other engineering projects. Areas are 2 to 80 acres in size and are within or near areas of Alpena, Casco, and Kiva soils.

Gravel pits are scattered throughout the county, and many are still in use. They are better suited to recreational uses or to wildlife habitat than to most other uses. Not placed in a capability unit or a woodland suitability subclass.

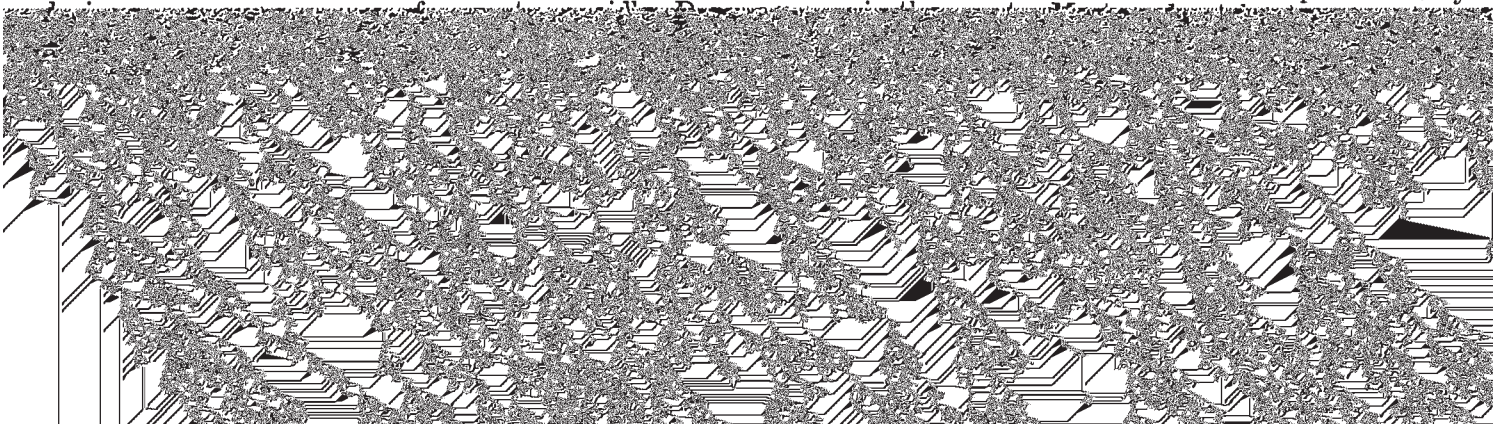
Kewaunee series

The Kewaunee series consists of well drained and moderately well drained, nearly level to moderately steep soils on glacial till plains. The native vegetation is mostly red oak and sugar maple.

In a representative profile the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 16 inches thick; it is reddish brown and yellowish brown, firm heavy clay loam in the upper part and reddish brown, very firm silty clay in the lower part. The substratum is reddish brown, very firm silty clay to a depth of about 60 inches.

The available water capacity is moderate, and permeability is moderately slow. Some areas of these soils are seasonally ponded for short periods. The depth of the root zone is more than 6 feet. Natural fertility is high, and the organic-matter content of the surface layer is moderate.

Most nearly level, gently sloping, and sloping areas of these soils are used for all farm crops commonly



B1—12 to 16 inches; reddish brown (5YR 4/4) and yellowish brown (7.5YR 5/4) heavy clay loam; moderate medium subangular blocky structure; firm; clean sand grains on ped faces; common roots; slightly acid; clear irregular boundary.

B2t—16 to 25 inches; reddish brown (5YR 4/4) silty clay; moderate medium angular and subangular blocky structure; very firm; thin patchy clay films on ped faces; common roots; slightly acid; clear wavy boundary.

B3—25 to 28 inches; reddish brown (2.5YR 4/4) silty clay; moderate medium subangular blocky structure; very firm; common roots; neutral; clear wavy boundary.

C—28 to 60 inches; reddish brown (5YR 4/4) silty clay; moderate medium subangular blocky structure; very firm; strongly effervescent; mildly alkaline.

The solum is commonly slightly acid to neutral but ranges from medium acid to mildly alkaline in some pedons. The C horizon is commonly mildly alkaline but ranges to moderately alkaline in some places. The Ap horizon is very dark grayish brown, dark grayish brown, dark yellowish brown, or brown. The A2 horizon is dark grayish brown, brown, or yellowish brown. The B horizon is reddish brown, yellowish red, or red. It is commonly clay or silty clay but ranges to heavy clay loam or silty clay loam in some pedons. The C horizon is similar in color to the B horizon. It is commonly silty clay or clay but ranges to silty clay loam. Content of coarse fragments is less than 10 percent, by volume.

In Door County, the annual temperature of these soils is a few degrees cooler than the defined range for the series, but this difference does not alter their usefulness and behavior.

Kewaunee soils are near Kolberg, Manawa, Manistee, and Poygan soils. They are better drained than the somewhat poorly drained Manawa soils and the poorly drained Poygan soils. Kewaunee soils do not have the dolomite bedrock that underlies Kolberg soils at a depth of 20 to 40 inches, and they do not have the sandy A and B horizons of Manistee soils.

KhA—Kewaunee silt loam, 0 to 2 percent slopes. This nearly level soil is on glacial till plains. Most areas are irregular in shape and are 10 to 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Kolberg, Manawa, and Omro soils. Also included are areas of nearly level and sloping Kewaunee silt loams; small areas of soils in which dolomite bedrock or loamy material are at a depth of 40 to 60 inches; and areas of gently sloping, eroded Kewaunee silt loam that has a reddish surface layer when plowed.

Runoff is slow. The hazard of erosion is slight. Surface or subsurface drainage is used to remove excess water rapidly.

Most areas of this soil are used for corn, small grain, legumes, and pasture. Truck crops are also grown. Management practices such as the use of green manure crops and barnyard manure are necessary for sustained crop yields. If properly managed, this soil is well suited to all crops commonly grown in the county. Capability unit IIs–8; woodland suitability subclass 2c.

KhB—Kewaunee silt loam, 2 to 6 percent slopes. This gently sloping soil is on glacial till plains. Most areas are irregular in shape and are 10 to 200 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Kolberg, Manawa, and Omro soils. Also included are areas of nearly level and sloping Kewaunee silt loams; small areas of soils in which dolomite bedrock or loamy material are at a depth of 40 to 60 inches; and areas of gently sloping, eroded Kewaunee silt loam that has a reddish surface layer when plowed.

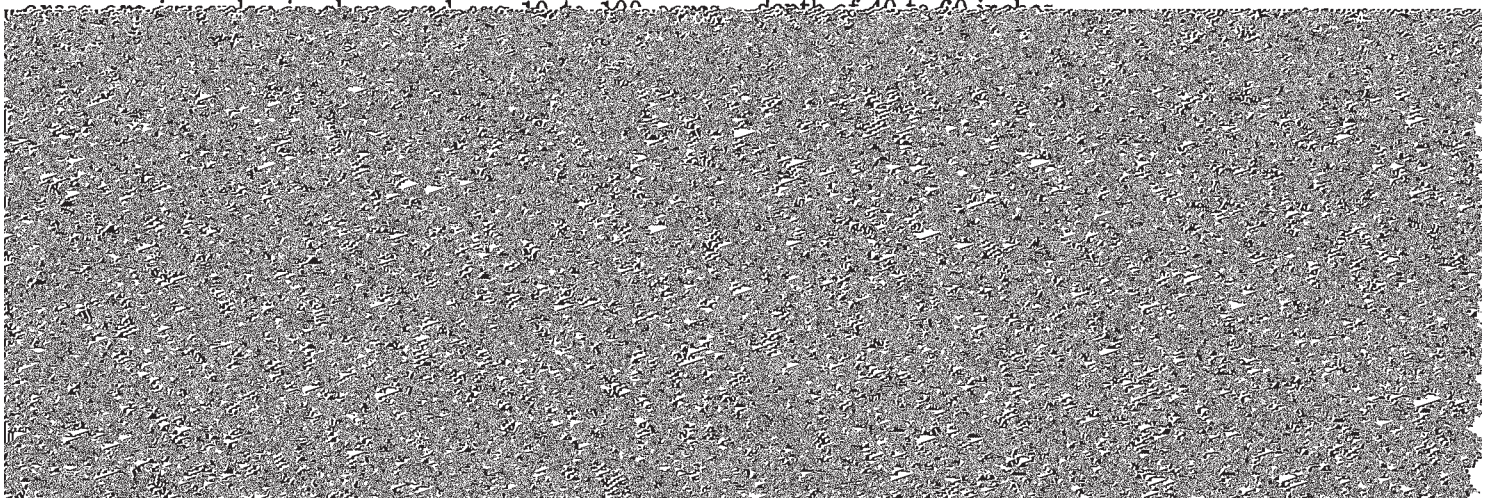
Runoff is medium. The hazard of erosion is moderate, and it is the main limitation of this soil. Good tilth is more difficult to maintain on eroded areas.

Most areas of this soil are used for corn, small grain, legumes, and pasture. Truck crops are also grown. Management practices such as erosion control and the use of green manure crops and barnyard manure are necessary for sustained crop yields. If properly managed, this soil is well suited to all crops commonly grown in the county. Capability unit IIe–6; woodland suitability subclass 2c.

KhC2—Kewaunee silt loam, 6 to 12 percent slopes, eroded. This sloping soil is on glacial till plains. Most areas are irregular in shape and are 5 to 100 acres in size.

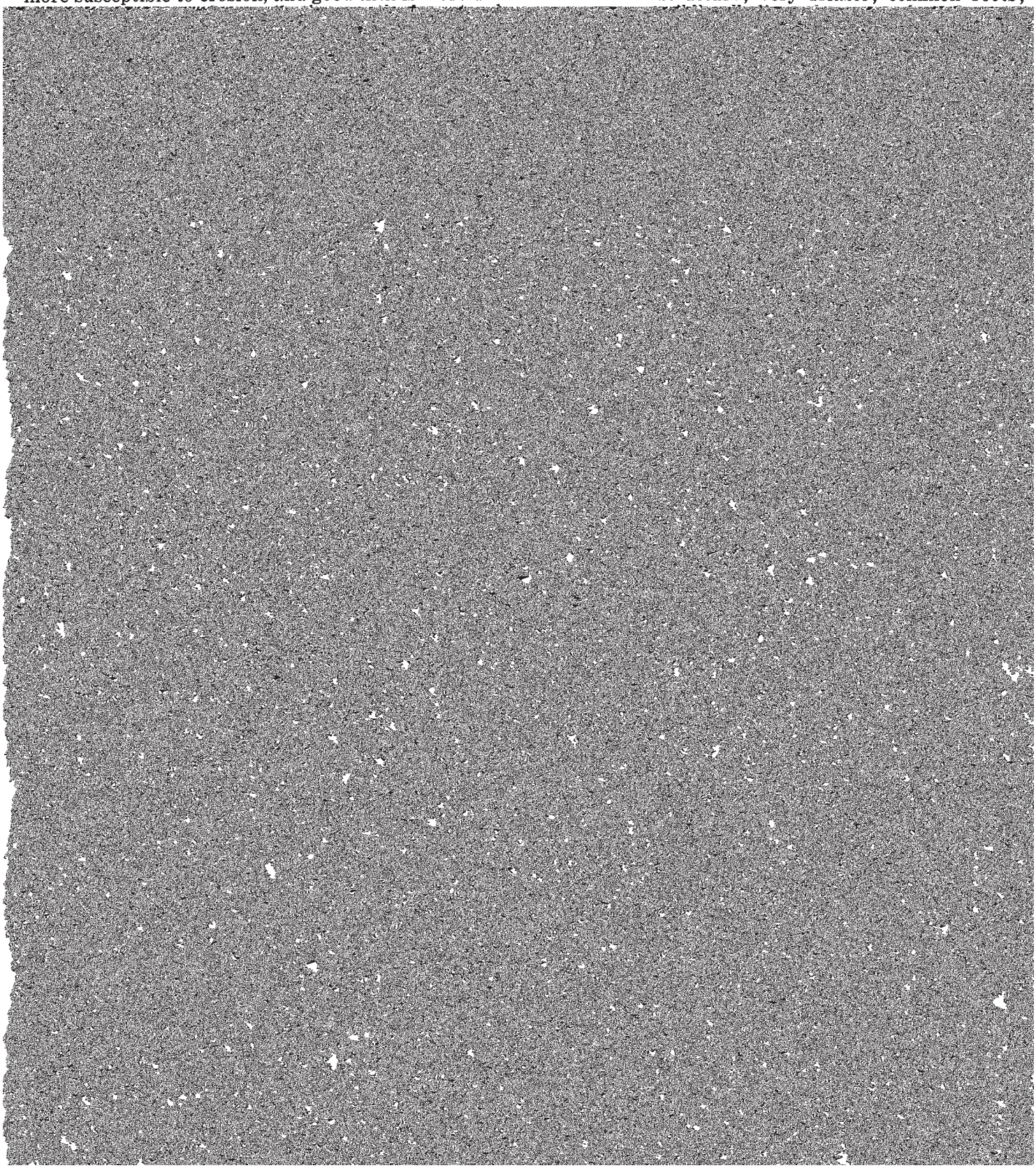
This soil has a profile similar to the one described as representative of the series, but it has a thinner, browner, less friable surface layer and a thinner subsoil. This soil is more susceptible to erosion, and good tilth is more difficult to maintain on this soil. Crop yields generally are lower than on the nearly level and gently sloping Kewaunee silt loams.

Included with this soil in mapping are small areas of Kolberg soils. Also included are small areas of gently sloping Kewaunee silt loam and small areas of soils that have a loamy substratum or dolomite bedrock at a depth of 40 to 60 inches.



surface layer and subsoil are thinner. These soils are more susceptible to erosion, and good tilth is more diffi-

sandy loam; weak fine subangular blocky structure; very friable; common roots;



Kolberg series

The Kolberg series consists of well drained, nearly level to sloping soils on glacial till plains with underlying dolomite bedrock at a depth of 20 to 40 inches. The native vegetation is mostly red oak and sugar maple.

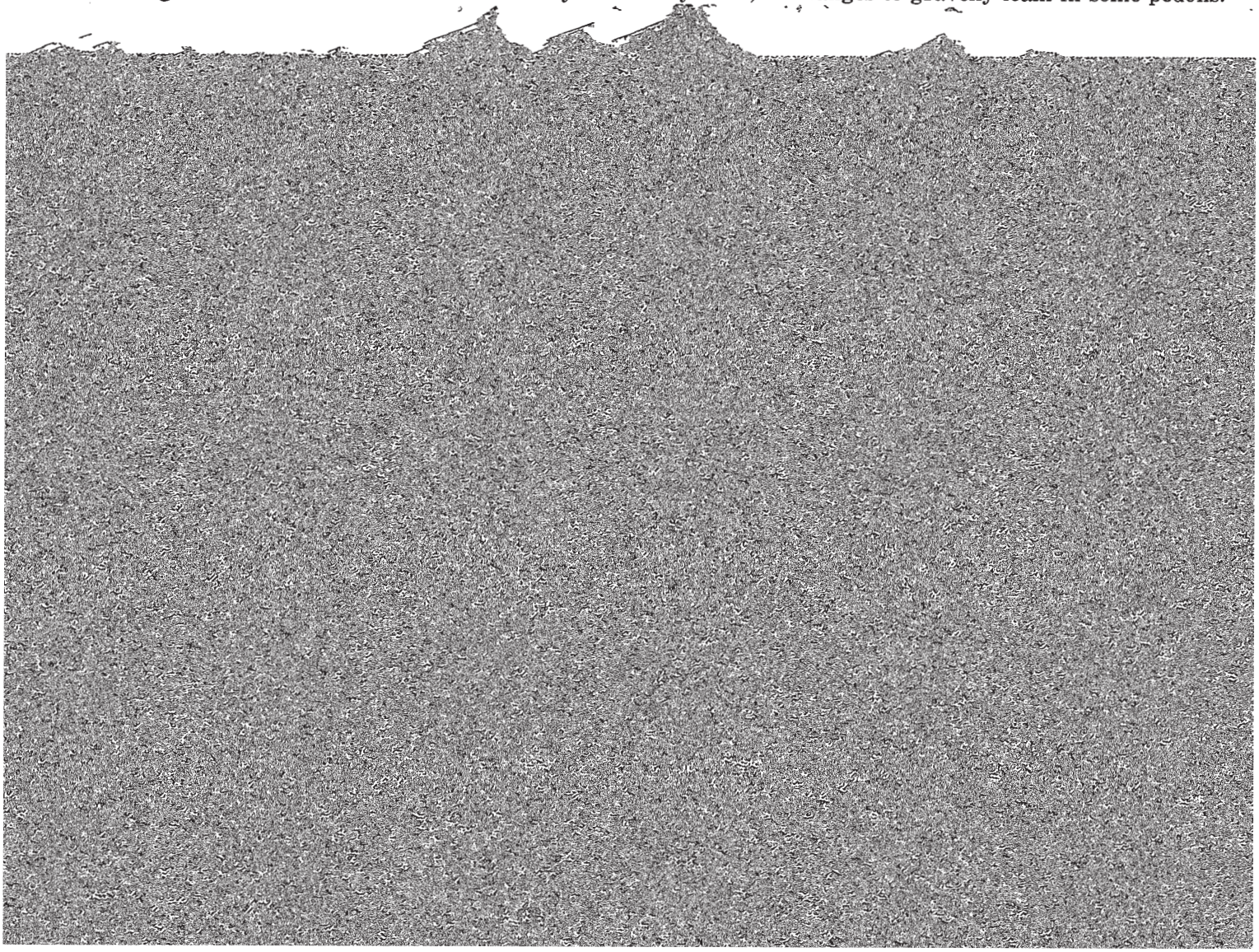
In a representative profile the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer, about 2 inches thick, is a mixture of brown silt loam and reddish brown clay loam. The subsoil is about 24 inches thick; the upper part is a mixture of reddish brown, firm clay loam and brown silt loam; the middle part is reddish brown, firm silty clay; and the lower part is reddish brown, firm silty clay loam. The substratum, extending to the underlying dolomite bedrock, is reddish brown, firm heavy loam. Dolomite bedrock is at a depth of about 38 inches.

The available water capacity is moderate. Permeability is moderately slow in the subsoil and moderate in the substratum. Some areas of these soils are seasonally ponded for short periods. Natural fertility is high, and the organic-matter content of the surface layer is

IIC—33 to 38 inches; reddish brown (5YR 5/4) heavy loam; massive, some weak medium subangular blocky structure; firm; slightly effervescent; mildly alkaline; abrupt smooth boundary.

IIR—38 inches; light gray (10YR 7/2) consolidated dolomite bedrock; shattered in the upper few inches and fissured to a depth of 10 feet or more.

Thickness of the solum and depth to underlying dolomite are 20 to 40 inches. The solum is commonly neutral to mildly alkaline. Reaction of the A1 or Ap horizon ranges to medium acid in some pedons. There are tongues of A2 horizon material surrounding columnlike peds of the B horizon or completely surrounding small, isolated remnants of the B horizon. The Bt horizon ranges from dark reddish brown to red. It is dominantly clay or silty clay, but it ranges to silty clay loam or has transitional heavy clay loam horizons in some places. The C horizon is loamy residuum from limestone 2 to 10 inches thick. It is commonly loam or clay loam, but ranges to gravelly loam in some pedons.



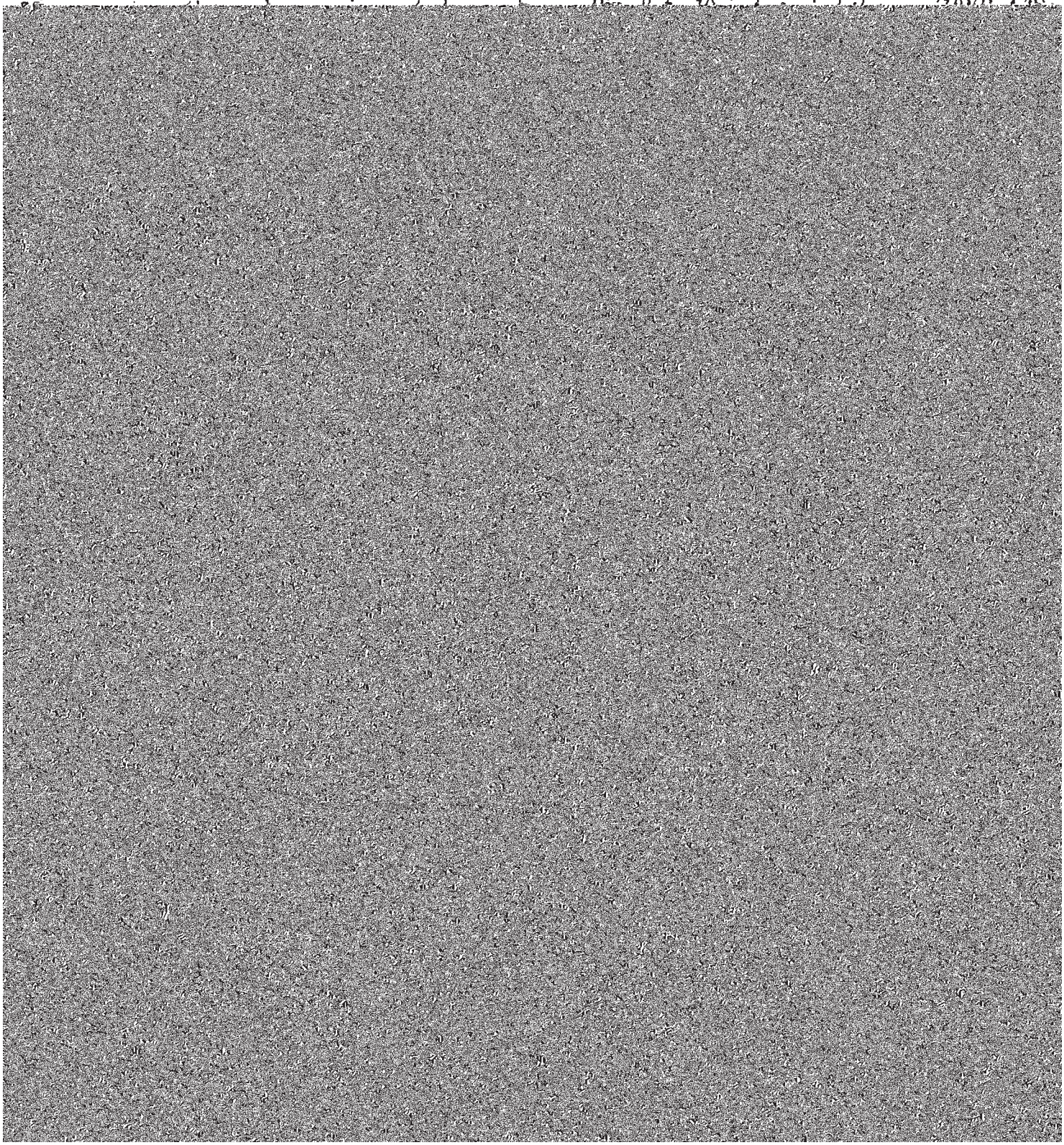
loam and areas of soils in which dolomite bedrock is at a depth of 40 to 60 inches.

Runoff is medium. The hazard of erosion is moderate, and it is the main limitation of this soil.

Most areas of this soil are used for corn, small grain, legumes, and pasture. Truck crops are also grown.

and 30 feet east of the northwest corner of sec. 29, T. 26 N., R. 24 E.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam; weak medium subangular blocky structure; friable; many roots; neutral; abrupt smooth boundary.



of the subsoil has been incorporated into the plow layer by tillage.

Included with this soil in mapping are small areas of Kolberg, Namur, and Summerville soils. Also included are small areas of gently sloping Kolberg Variant loam.

Runoff is medium. The hazard of erosion is moderate, and it is the main limitation of this soil.

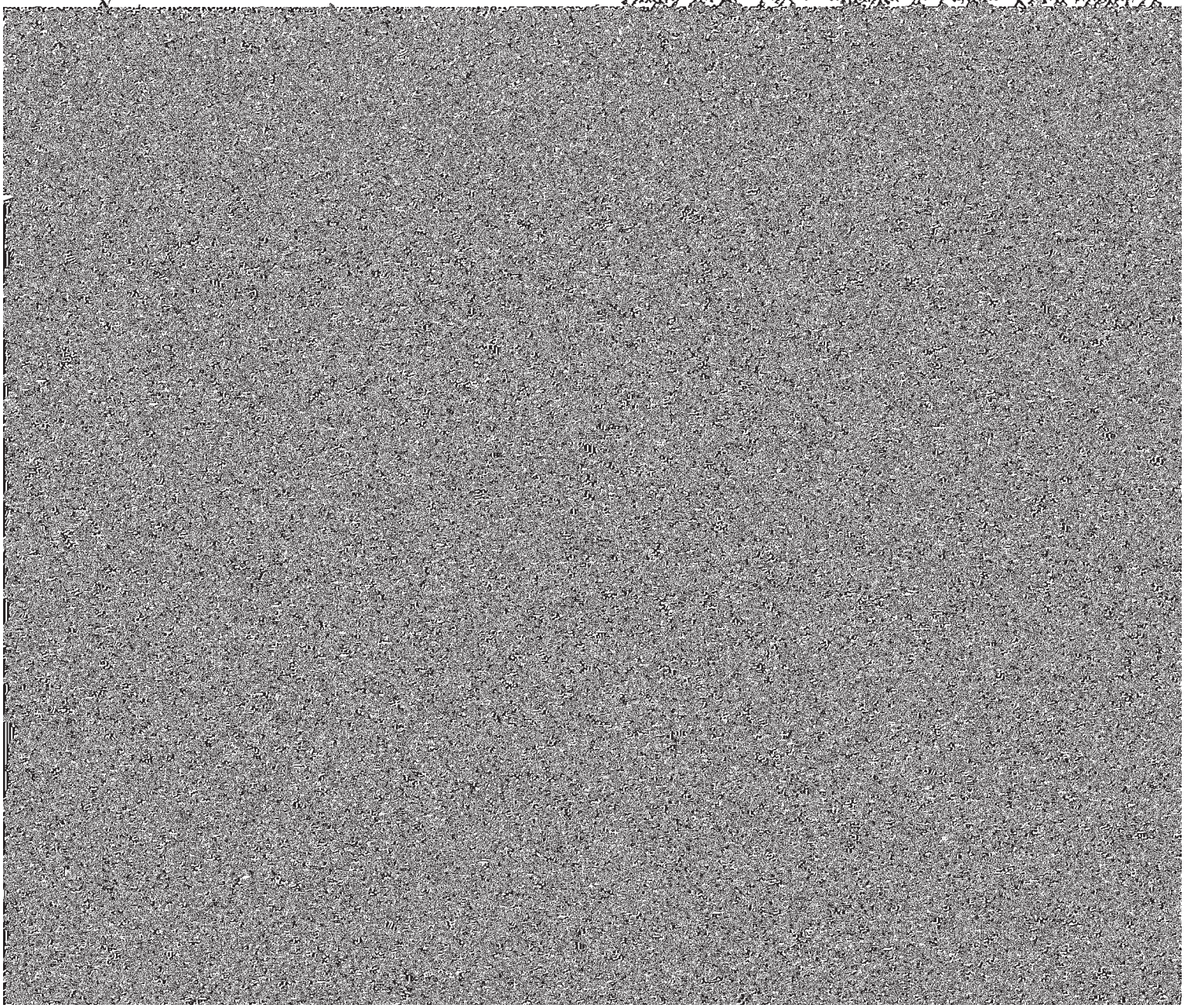
Most areas of this soil are used for corn, small grain, legumes, and pasture. Some areas are in unimproved pasture and native woodland. Management is needed to maintain organic-matter content and good tilth, to reduce runoff, and to control erosion. Even if managed well, this soil is poorly suited to row crops. Capability unit IVe–3; woodland suitability subclass 3d.

Longrie series

C—23 to 30 inches; brown (10YR 5/3) fine sandy loam; weak medium granular structure; very friable; slightly effervescent; mildly alkaline.

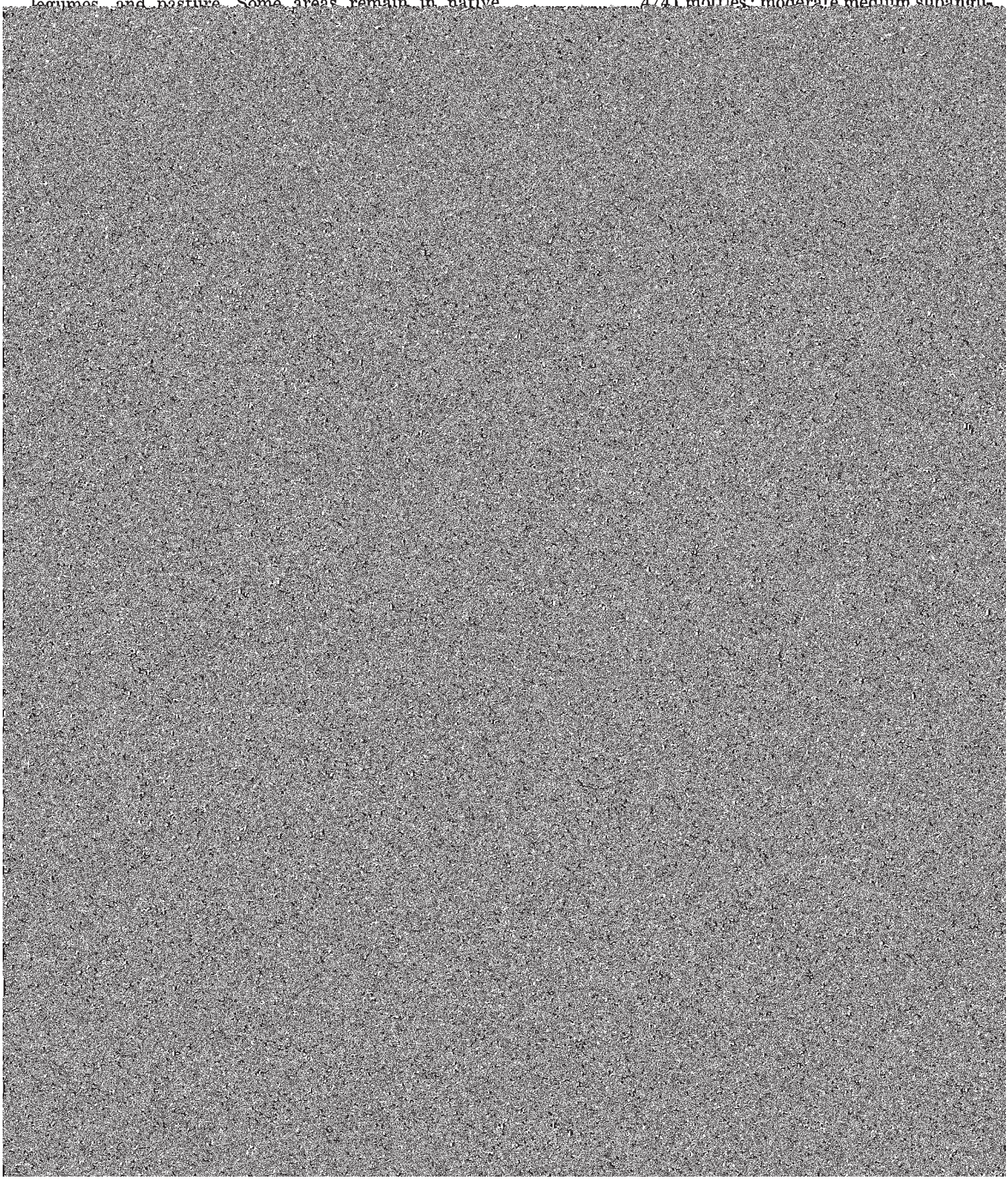
R—30 inches; light gray (10YR 7/2) consolidated bedrock.

The solum is medium acid to neutral. Depth to dolomite bedrock is 20 to 40 inches. In some areas, the solum contains as much as 12 percent coarse fragments of gravelly, cobbly, flaggy, and stony sizes throughout. The A1 horizon is black, very dark brown, or very dark gray. In cultivated areas, the Ap horizon is very dark gray, dark brown, or very dark brown. The A2 horizon is sandy loam or loam. The Bir horizon is brown or dark brown and is sandy loam or loam. The B3 horizon is predominantly reddish brown, brown, or dark brown. It is commonly loam but ranges to sandy loam or fine sandy loam. The C horizon is brown, light reddish



Most areas of this soil are used for corn, small grain, legumes, and pasture. Some areas remain in native

loam; many coarse faint brown (7.5YR 4/4) mottles; moderate medium subangu-



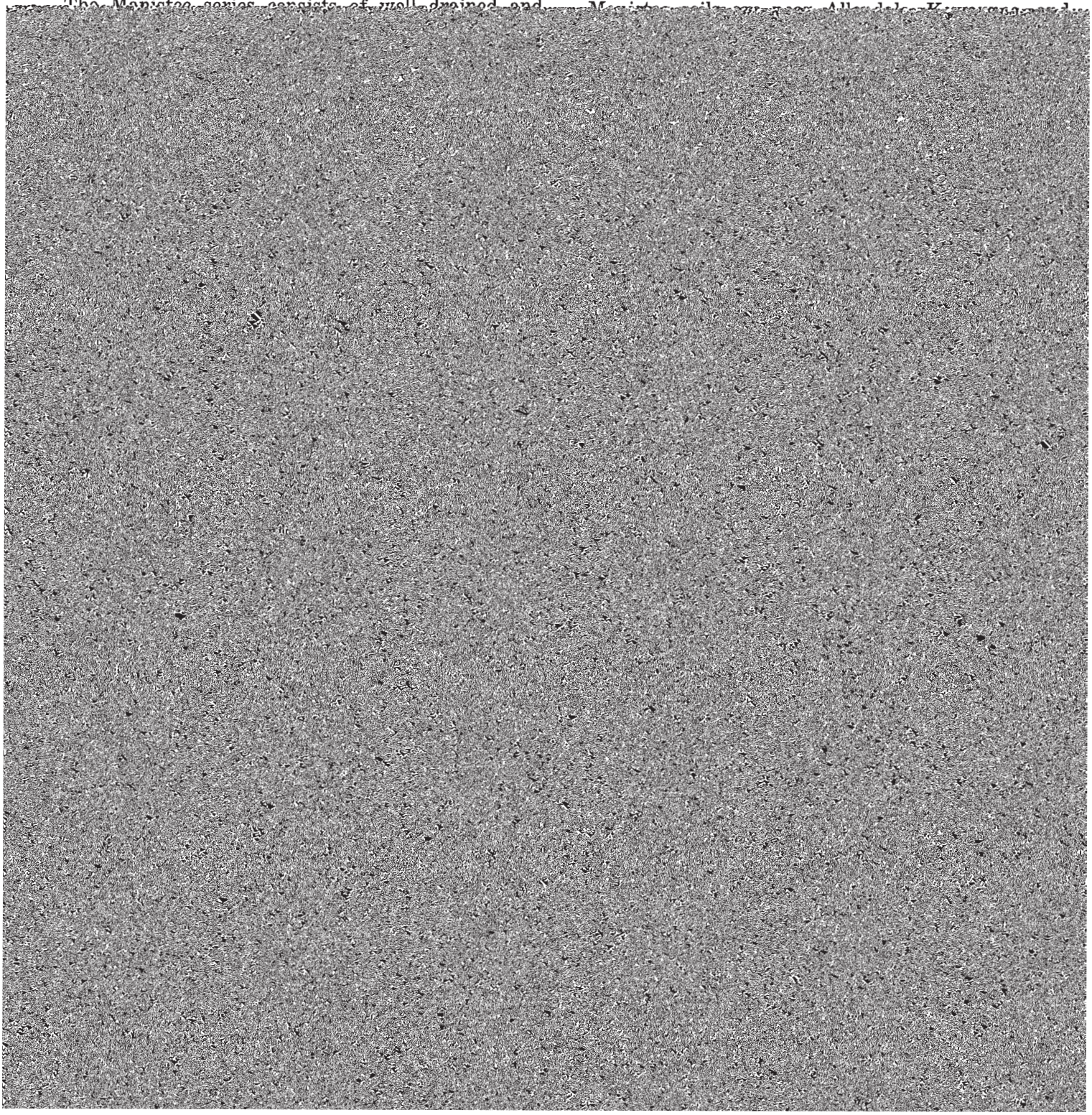
legumes such as red clover, and pasture. Some truck crops are also grown. Undrained areas are used for unimproved pasture, but are better suited to wetland wildlife habitat than to most other uses. Capability unit IIw–2; woodland suitability subclass 2o.

Manistee series

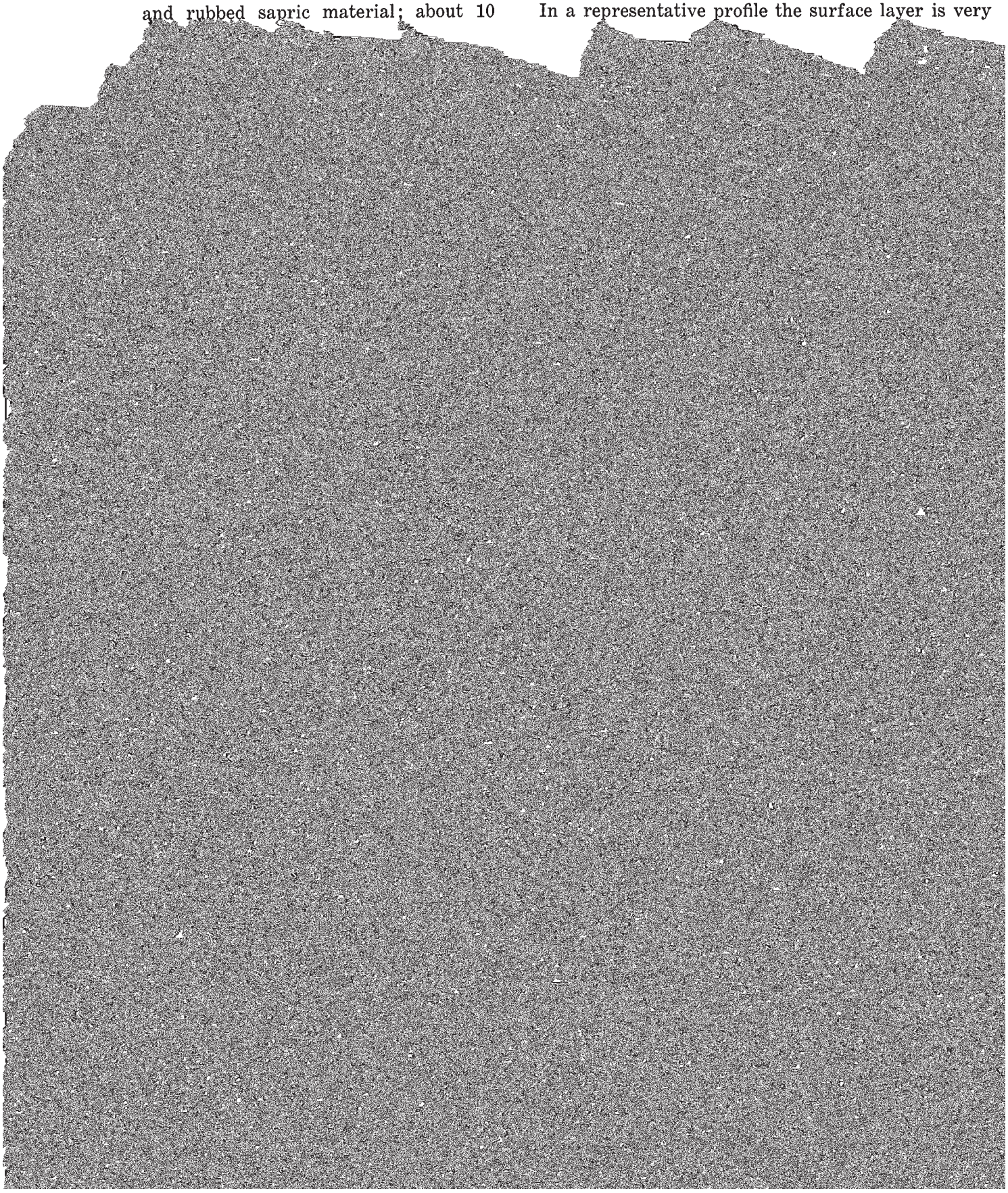
The Manistee series consists of well drained and

sand. Depth to the clayey horizons ranges from 20 to 40 inches. The clayey horizons are reddish brown silty clay or clay. Contents of coarse fragments in the IIC horizon ranges from 0 to 10 percent, by volume.

In Door County, these soils lack an eluvial horizon between the spodic and argillic horizons and the argillic horizon is thinner than the defined range for the series. These differences do not alter usefulness and behavior.



and rubbed sapric material; about 10 In a representative profile the surface layer is very



Included with this soil in mapping are small areas of Summerville soils. Also included are small areas of moderately steep Namur soils.

Runoff is medium. The hazard of erosion is moderate. Droughtiness is the main limitation of this soil.

Most areas of this soil are used for unimproved pasture or remain in native woodland. Management is

dolomite bedrock. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 40 acres in size. Dolomite flagstones are common in this soil.

Included with this soil in mapping are small areas of Namur soils. Also included are areas of soils in which dolomite bedrock is at a depth of 12 to 20 inches.

Runoff is slow. The hazard of erosion is slight. Depth

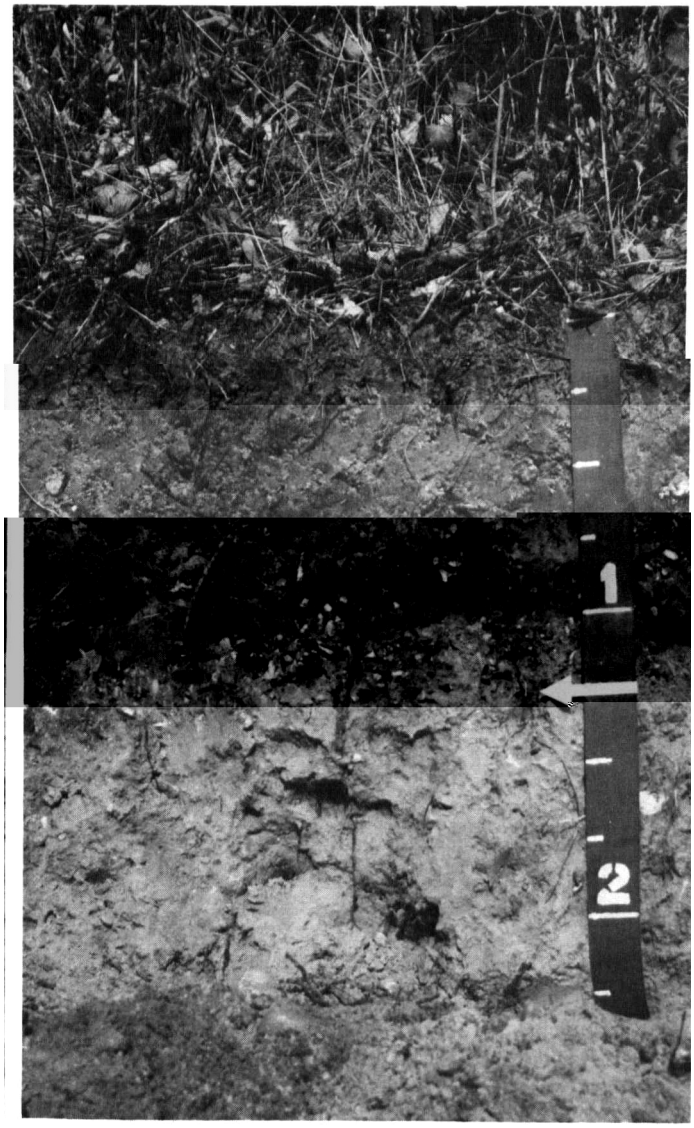


Figure 4.—**Profile of Omena sandy loam.**

discontinuous horizon; neutral; abrupt irregular boundary.

B'2t—10 to 12 inches; dark reddish brown (5YR 3/4) heavy loam; weak medium subangular blocky structure; friable; clay bridging of sand grains, thickness ranges from 1 to 3 inches; neutral; clear wavy boundary.

B'3t—12 to 17 inches; dark brown (7.5YR 4/4) [illegible]

sites, and 12 to 18 inches thick in cultivated areas. The solum is commonly neutral to mildly alkaline but ranges to slightly acid in some pedons. The C horizon is dominantly mildly alkaline but ranges to moderately alkaline. The A1 or Ap horizon is very dark brown, very dark gray, very dark grayish brown, and dark brown. In cultivated areas, the A2 horizon, and most or all of the Bir horizon, is incorporated into the plowed layer. The A'2 horizon is not in some pedons, especially where the solum is less than 16 inches thick. The Bt horizon is reddish brown, dark reddish brown, or dark brown. It is sandy loam or loam and has a weighted clay content estimated at 10 to 18 percent. In some pedons the texture ranges to sandy clay loam or clay loam. Coarse fragments make up 5 to 20 percent, by volume, of the C horizon.

Omena soils are near Angelica and Emmet soils. They have a thinner solum than Emmet soils and are better drained than Angelica soils.

OmB—Omena sandy loam, 2 to 6 percent slopes. This gently sloping soil is on glacial till plains. Most areas are irregular in shape and are 5 to 200 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a thicker surface layer. This soil also is less susceptible to erosion and generally produces higher crop yields.

Included with this soil in mapping are small areas of Omena Variant and Emmet soils. Also included are small areas of nearly level and sloping Omena sandy loams, and some small areas of soils that are underlain by dolomite bedrock at a depth of 40 to 60 inches.

Runoff is slow. The hazard of erosion is moderate, and it is the main limitation of this soil.

Most areas of this soil are used for corn, small grain, legumes, and pasture. Truck crops and fruit trees are also grown. Management practices such as protection from water erosion and maintenance of organic matter are necessary for sustained crop production. If properly managed, this soil is well suited to all crops, including orchard crops, commonly grown in the county. Capability unit IIe–2; woodland suitability subclass 3o.

OmC—Omena sandy loam, 6 to 12 percent slopes. This sloping soil is on low ridges on glacial till plains. Most areas are irregular in shape and are 5 to 200 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Emmet soils. Also included are small areas of gently sloping and moderately steep Omena sandy loams, and small areas of soils in which dolomite bedrock is at a depth of 40 to 60 inches.

Runoff is medium. The hazard of erosion is moderate, and it is the main limitation of this soil.

Most areas of this soil [illegible]

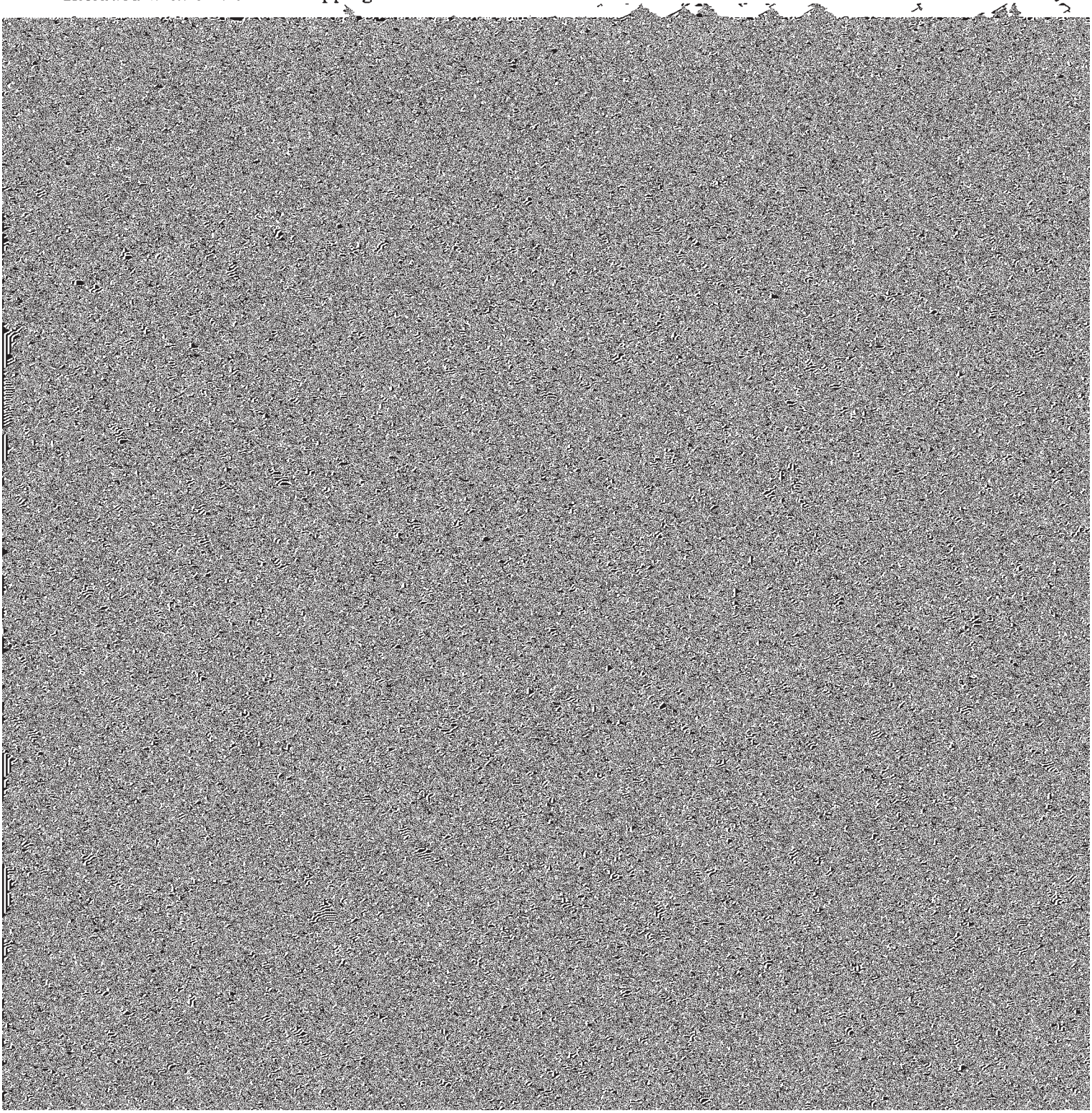
glacial till plains. Most areas are irregular in shape and are 5 to 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a thinner surface layer and subsoil. This soil is also more susceptible to erosion and generally produces lower yields. This soil is too steep for the use of most farm implements.

Included with this soil in mapping are small areas of

sandy loam; many medium prominent strong brown (7.5YR 5/6) and many medium faint light gray (10YR 7/2) mottles; weak thick platy structure parting to weak coarse subangular blocky; friable; strongly effervescent; mildly alkaline.

The solum is 12 to 20 inches thick and is commonly



loamy substratum. Some areas of these soils are seasonally ponded for short periods. Depth of the root zone is more than 6 feet. Natural fertility is high, and the organic-matter content of the surface layer is moderate.

Most areas of these soils are used for all farm crops commonly grown in the county.

Representative profile of Omro silt loam, 2 to 6 percent slopes, in a cultivated field, 330 feet west and 50 feet south of the northeast corner of the NE¼ sec. 17, T. 26 N., R. 24 E.:

soils, and they do not have the silty clay C horizon of Kewaunee soils.

OzB—Omro silt loam, 2 to 6 percent slopes. This gently sloping soil is on glacial till plains. Most areas are irregular in shape and are 5 to 250 acres in size.

Included with this soil in mapping are small areas of Emmet and Kewaunee soils. Also included are areas of soils that have a loamy substratum or dolomite bedrock at a depth of 40 to 60 inches.

Runoff is medium. The hazard of erosion is moderate,

IIC4—30 to 60 inches; reddish brown (5YR 4/3) silty clay; common medium prominent yellowish red (5YR 5/6) mottles; massive; very firm; strongly effervescent; moderately alkaline.

The sandy upper horizons are commonly slightly acid or neutral but range to medium acid in some pedons. The sandy upper sediment is 18 to 36 inches thick. It is sand, loamy sand, or loamy fine sand. In some places there is an organic surface layer as much as 12 inches thick. The IIC horizon is dark reddish brown, dark reddish gray, dark brown, or reddish brown clay or silty clay. Thin layers of silt are in some places. Coarse fragments make up 0 to 10 percent, by volume, of the IIC horizon.

In Door County, the IIC horizon is redder than the defined range for the series, but this difference does not alter the usefulness and behavior of these soils.

Pinconning soils are near Allendale and Poygan soils. They are sandy in the A horizon and upper part of the C horizon, whereas Poygan soils are not. Pinconning soils are wetter than the somewhat poorly drained Allendale soils.

Pn—Pinconning loamy fine sand. This nearly level soil is in depressions on glacial till plains. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 150 acres in size.

Included with this soil in mapping are small areas of Allendale soils. In some areas, the surface layer is fine sandy loam.

Runoff is slow. The hazard of erosion is slight. Wetness is the main limitation of this soil. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage removes excess surface water rapidly. Deep ditches provide internal drainage.

Some areas of this soil are drained and are used for corn, small grain, or pasture. Even if drained, this soil is poorly suited to crops because of the frost hazard. Some undrained areas are used for unimproved pasture, but are better suited to wetland wildlife habitat than to most other uses. Capability unit IIIw–6; woodland suitability subclass 4w.

Poygan series

The Poygan series consists of poorly drained, nearly level soils in depressions on glacial till plains. The native vegetation is American elm, white ash, and sugar maple.

In a representative profile the surface layer is black silty clay loam about 9 inches thick. The subsoil is about 20 inches thick and is mottled. It is very dark gray, firm silty clay loam in the upper part; gray, firm silty clay in the middle part; and reddish brown, firm silty clay in the lower part. The substratum is mottled reddish brown, very firm silty clay to a depth of about 60 inches.

The available water capacity is moderate, and permeability is slow. These soils are seasonally saturated at a depth of less than 1 foot, unless they are drained. The depth of the root zone is limited by the water table. Natural fertility and the organic-matter content of the surface layer are high.

Representative profile of Poygan silty clay loam in a cultivated field, 150 feet west and 30 feet north of the southeast corner of the SW¼ sec. 18, T. 26 N., R. 24 E.:

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam; moderate medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

B1g—9 to 12 inches; very dark gray (5Y 3/1) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; many roots; mildly alkaline; clear irregular boundary.

B2g—12 to 20 inches; gray (10YR 5/1) silty clay; many fine and medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; many roots, mildly alkaline; clear irregular boundary.

B3—20 to 29 inches; reddish brown (5YR 4/3) silty clay; common medium prominent strong brown (7.5YR 5/6) and common medium prominent grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; mildly alkaline; gradual irregular boundary.

C—29 to 60 inches; reddish brown (5YR 5/3) silty clay; common medium prominent yellowish red (5YR 4/6) and common fine prominent light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very firm; slightly effervescent; mildly alkaline.

The solum is 20 to 30 inches thick and is neutral to mildly alkaline. Uncultivated areas have a thin organic surface layer in some pedons. If the soils are cultivated, the Ap horizon is black, very dark gray, or very dark brown. The B horizon is 40 to 70 percent clay and 5 to 10 percent sand. The B horizon is dominantly silty clay but ranges to clay or silty clay loam in places. The C horizon is 40 to 60 percent clay.

In Door County, the annual temperature of these soils is a few degrees cooler than the defined range for the series, but this difference does not alter their usefulness and behavior.

Poygan soils are near Kewaunee, Manawa, and Pinconning soils. They are wetter than the well drained Kewaunee and the somewhat poorly drained Manawa soils. Poygan soils are not sandy in the A horizon and upper part of the C horizon, as is characteristic of Pinconning soils.

Po—Poygan silty clay loam. This nearly level soil is in depressions on glacial till plains. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 100 acres in size.

Included with this soil in mapping are small areas of Manawa soils. Also included are small areas of soils that have a silt loam surface layer and few areas of gently sloping soils.

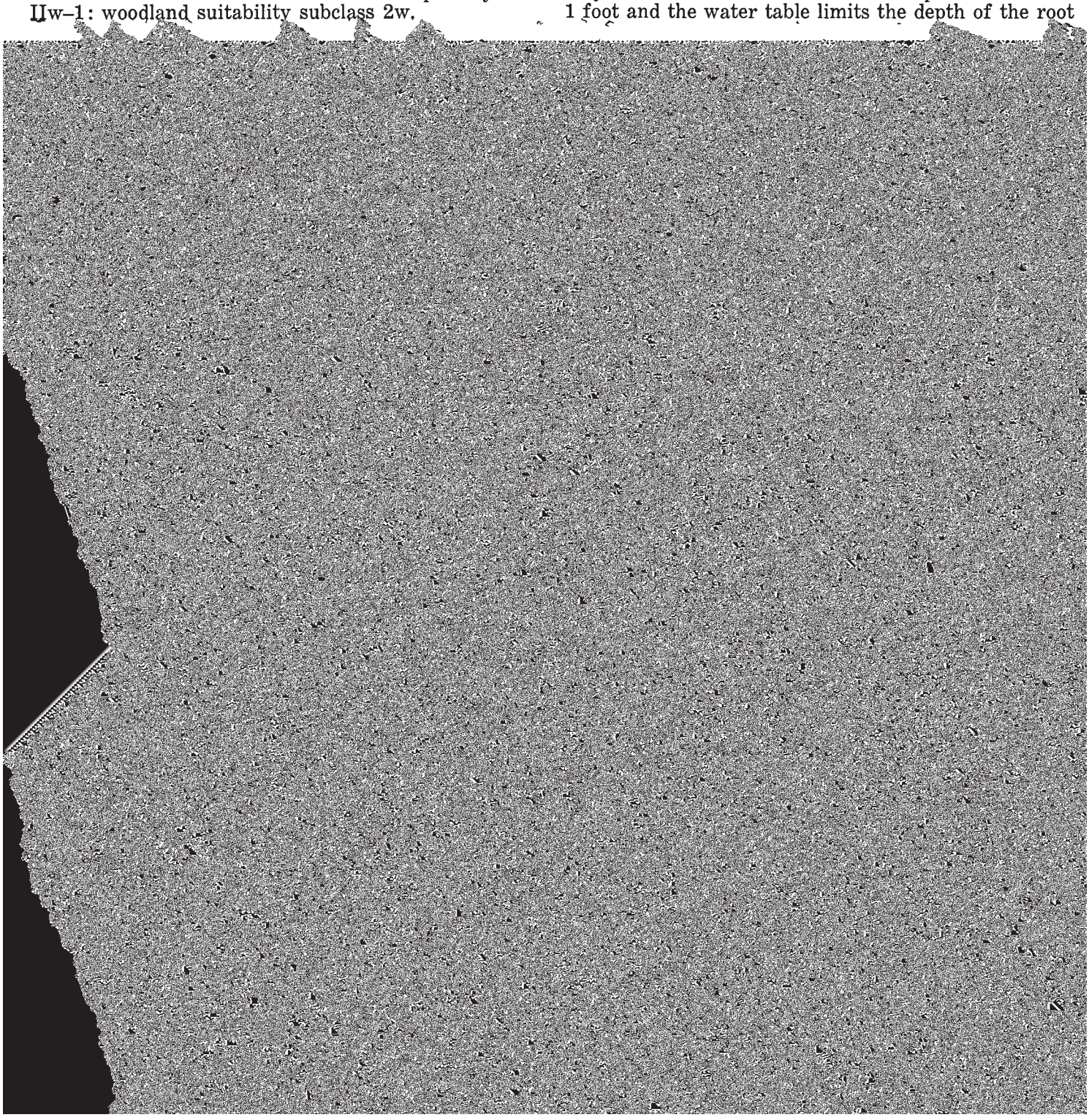
Runoff is very slow. The hazard of erosion is slight. Wetness is the main limitation of this soil. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Sur-

face drainage removes excess water rapidly. Deep ditches and subsurface drainage provide internal drainage.

If drained, this soil is suited to corn, small grain, legumes such as red clover, and pasture. Some truck crops are also grown. Tilling at proper moisture conditions helps to maintain good tilth. Undrained areas are used for unimproved pasture, but are better suited to native woodland or to wildlife habitat. Capability unit IIw–1; woodland suitability subclass 2w.

In a representative profile in an undisturbed area, the upper 26 inches is black muck that is about 20 percent recognizable plant fiber if undisturbed. The substratum is light gray, friable marl to a depth of about 60 inches.

The available water capacity is very high. Permeability is moderately rapid in the organic part and slow in the marl substratum. If these soils are not drained, they are saturated with water at a depth of less than 1 foot and the water table limits the depth of the root



remove excess water rapidly. Deep ditches and subsurface drainage can be used to remove internal water where outlets are available.

Even if drained, this soil is only poorly suited to most crops because of the frost hazard. Undrained areas are better suited to wetland wildlife habitat than to most other uses. Capability unit IIIw–7; woodland suitability subclass 3w.

Rousseau series

The Rousseau series consists of well drained or moderately well drained, gently sloping to very steep soils on old lake border dunes, lake plains, and outwash plains. The native vegetation is red oak, sugar maple, aspen, and white birch.

In a representative profile the surface layer is black fine sand about 3 inches thick. The subsurface layer is grayish brown fine sand about 3 inches thick. The subsoil is about 21 inches thick; it is dark reddish brown, loose fine sand in the upper part and strong brown, loose fine sand in the lower part. The substratum is yellowish brown, loose fine sand to a depth of about 60 inches.

Rousseau soils are near Deford, Manistee, and Wainola soils. They are better drained than Wainola and Deford soils. They do not have the clayey texture in the lower part of the B horizon and in the C horizon that is characteristic of Manistee soils.

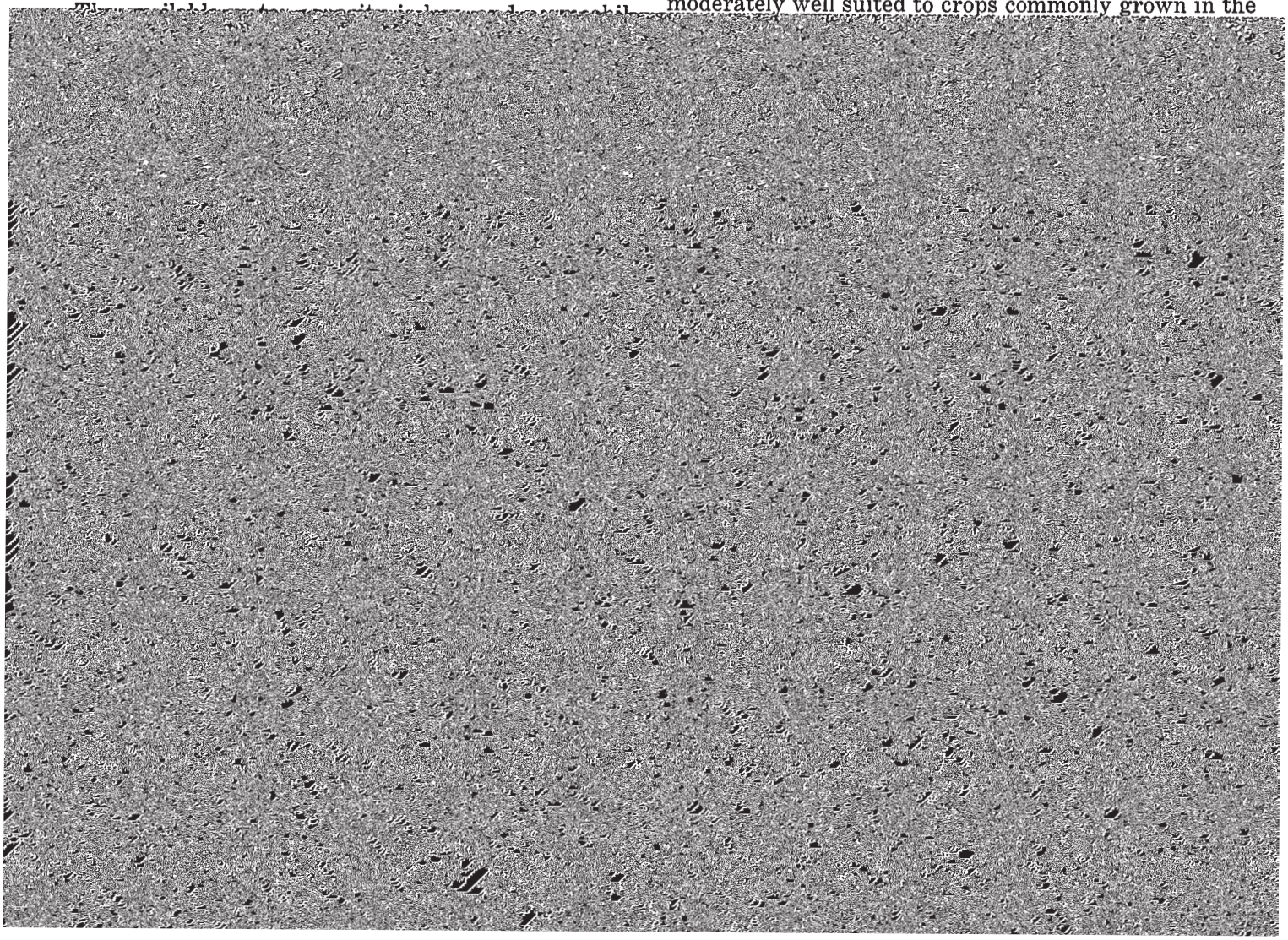
RoB—Rousseau fine sand, 2 to 6 percent slopes. This gently sloping soil is on sandy outwash plains and lake plains. Most areas are irregular in shape and are 10 to 200 acres in size.

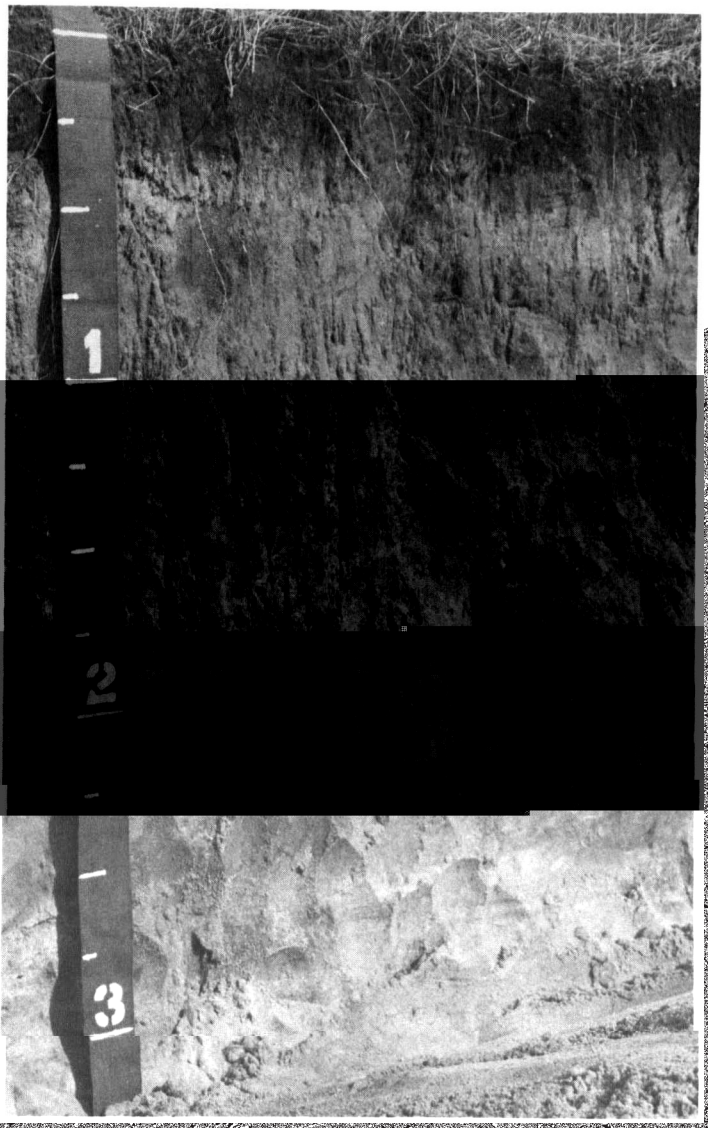
This soil has a profile similar to the one described as representative of the series, but it has a thicker surface layer and more distinct horizon development. This soil is also less susceptible to soil blowing than the representative soil.

Included with this soil in mapping are small areas of Manistee and Wainola soils. Also included are small areas of sloping Rousseau fine sand and areas of gently sloping and sloping Rousseau-Shawano fine sands.

Runoff is slow. The hazard of erosion is moderate. Droughtiness is the main limitation of this soil.

Most areas of this soil are used for hay, unimproved pasture, native woodland, and wildlife habitat. Management is needed to supply regular additions of organic matter and to conserve moisture. This soil is moderately well suited to crops commonly grown in the





sand, less natural fertility, and lower organic-matter content. The Shawano soil is in unvegetated depressions and on hummocks. It has lost a considerable amount of material by soil blowing.

Included with these soils in mapping are small areas of gently sloping or sloping Rousseau soils.

Runoff is slow. The hazard of erosion is moderate. Low available water capacity, slope, and the hazard of soil blowing are the main limitations of these soils.

Most areas of this complex are in unimproved pasture or native woodland. Some areas are in pine trees.

Figure 6.—**Typical area of Rousseau-Shawano fine sands, 12 to 35 percent slopes, near Clark Lake.**

vegetation is red oak, sugar maple, white birch, and white-cedar.

In a representative profile the surface layer is very dark grayish brown fine sand about 4 inches thick. The subsurface layer is pale brown fine sand about 3 inches thick. The subsoil is about 17 inches thick; it is strong brown, loose fine sand in the upper part and reddish yellow, loose fine sand in the lower part. The substratum is light yellowish brown fine and medium sand to a depth of about 60 inches.

The available water capacity is low, and permeability is rapid. These soils are seasonally saturated at a depth of 6 feet or more. Depth of the root zone is more than 6 feet. Natural fertility and the organic-matter content of the surface layer are very low.

In Door County, Shawano soils are mapped only in complexes with Rousseau soils.

Representative profile of Shawano fine sand in an

granular structure; very friable; few fine fibrous roots; slightly acid; clear wavy boundary.

A2—4 to 7 inches; pale brown (10YR 6/3) fine sand; single grained; loose; few fine fibrous roots; medium acid; clear wavy boundary.

B2—7 to 12 inches; strong brown (7.5YR 5/6) fine sand; single grained; loose; few fine fibrous roots; medium acid; clear irregular boundary.

B3—12 to 24 inches; reddish yellow (7.5YR 6/6) fine sand; single grained; loose; neutral; gradual wavy boundary.

C—24 to 60 inches; light yellowish brown (10YR 6/4) fine and medium sand; single grained; loose; mildly alkaline.

The solum is 18 to 36 inches thick, and depth to free

about 1 to 4 inches thick. In areas that have active soil blowing, some or all of the horizons are missing, or several inches of sandy overburden cover the A1 horizon. In some places, the A2 horizon is absent. The B and C horizons are dominantly fine sand but range to very fine sand. The profile is less than 5 percent coarse fragments throughout.

Shawano soils are near Rousseau soils and have formed in similar materials. Shawano soils lack the distinct subsoil layer of iron accumulation that is present in Rousseau soils.

Sisson series

The Sisson series consists of well drained, nearly level to sloping soils on old lake plains. The native vegetation is northern hardwoods, primarily sugar maple and red oak.

In a representative profile the surface layer is dark [illegible] fine sandy loam about [illegible] inches thick [illegible]

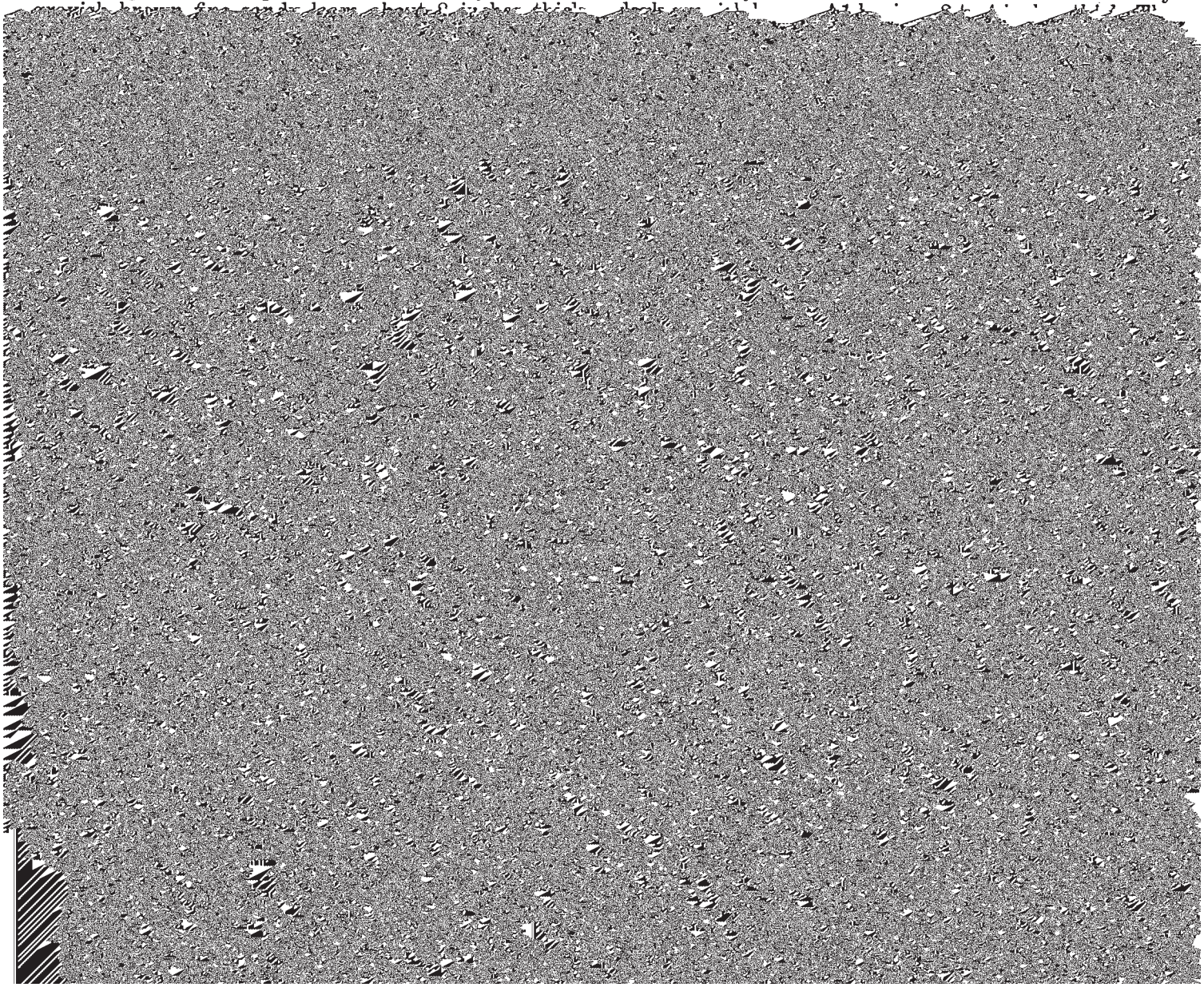
subangular blocky structure; friable; slightly acid; gradual wavy boundary.

B22t—23 to 27 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; patchy clay films on ped faces and in root channels; slightly acid; clear wavy boundary.

B3—27 to 33 inches; brown (7.5YR 5/4) fine sandy loam; weak fine subangular blocky structure; friable; neutral; abrupt wavy boundary.

C—33 to 60 inches; brown (10YR 5/3) stratified silt; very fine sand and fine sand; massive; friable; slightly effervescent; mildly alkaline.

The solum is 24 to 40 inches thick. It is slightly acid to neutral but ranges to mildly alkaline in some pedons. The C horizon is commonly mildly alkaline but ranges to moderately alkaline. Uncultivated areas have a very [illegible]



This gently sloping and sloping soil is on old glacial lake plains. Most areas are irregular in shape and are 10 to 150 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Yahara soils. Also included are small areas of nearly level and sloping eroded Sisson fine sandy loams and small areas of soils that have a silt loam surface layer or fine sandy loam subsoil.

Runoff is slow. The hazard of erosion is slight, and it is the main limitation of this soil.

Most areas of this soil are used for corn, small grain, and legumes. Some truck crops are also grown. Management is needed to prevent water erosion and to maintain organic-matter content and good tilth. Practices such as the use of green manure crops and barnyard manure are necessary to sustain crop yields. If properly managed, this soil is well suited to all crops commonly grown in the county. Capability unit IIe–1; woodland suitability subclass 1o.

Solona series

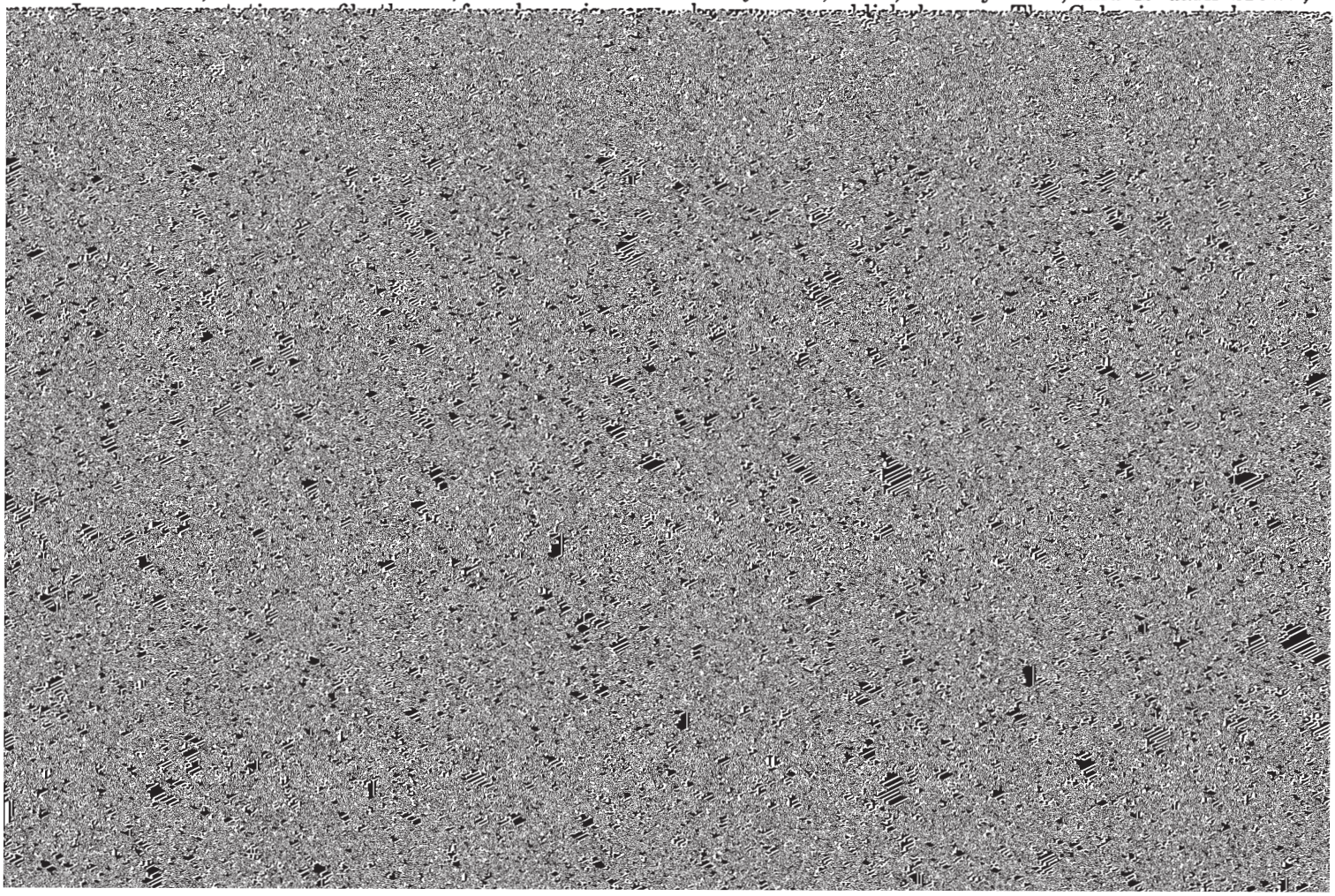
The Solona series consists of somewhat poorly drained, nearly level soils in depressions and drainageways on glacial till plains. The native vegetation is American elm, northern white-cedar, and white ash.

ate medium subangular blocky structure; friable; many roots; mildly alkaline; gradual wavy boundary.

B2t—18 to 27 inches; reddish brown (5YR 4/4) loam; common medium prominent yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; thin patchy clay films in pores; friable; mildly alkaline; gradual smooth boundary.

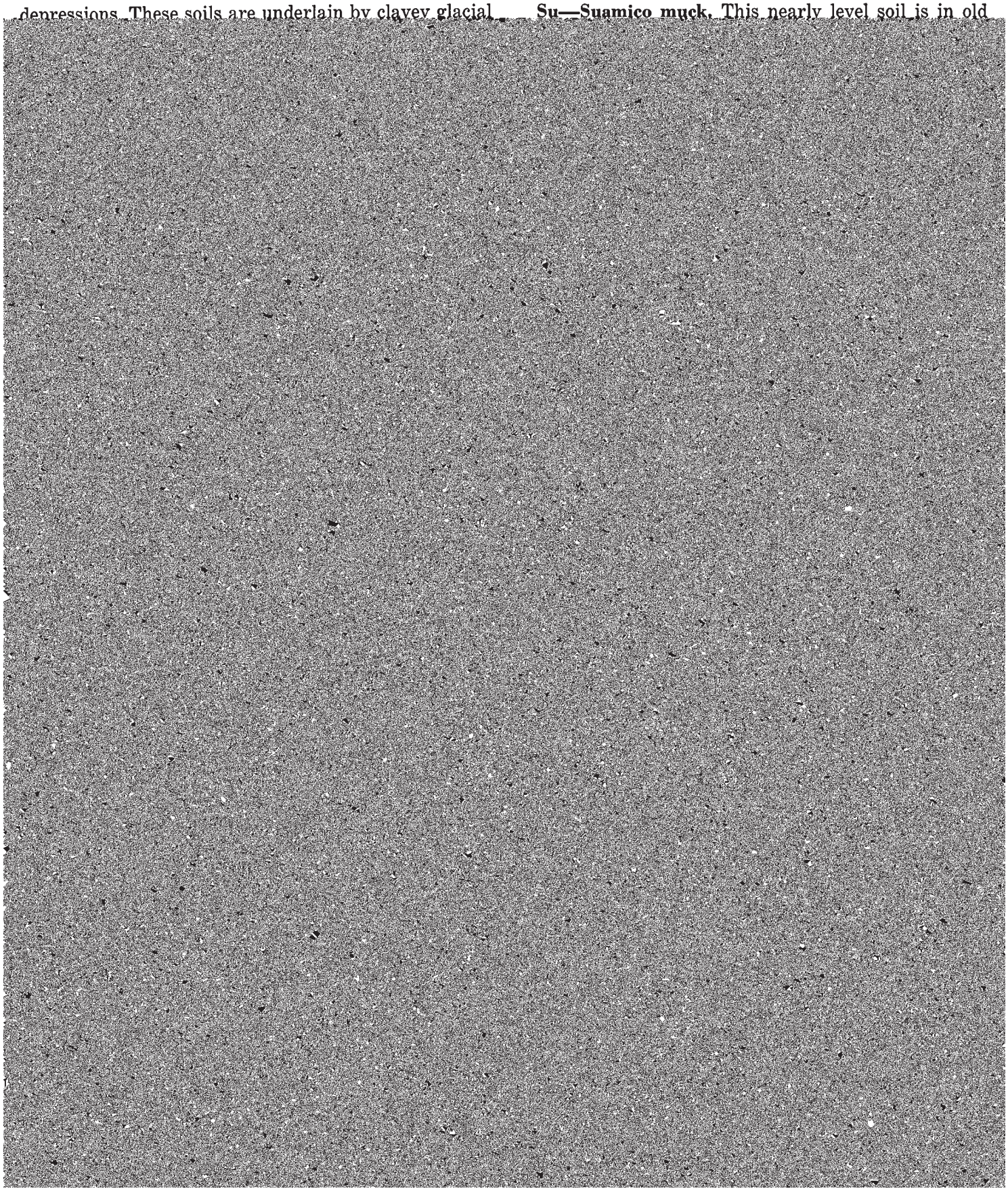
C—27 to 60 inches; light brown (7.5YR 6/4) sandy loam; common medium distinct strong brown (7.5YR 5/6) and light gray (10YR 7/2) mottles; weak medium subangular blocky structure; friable; strongly effervescent; moderately alkaline.

The solum is 24 to 30 inches thick and is neutral to mildly alkaline. The C horizon is commonly moderately alkaline but ranges to mildly alkaline in some pedons. The surface layer is dominantly loam. The A1 or Ap horizon is very dark grayish brown, very dark brown, or dark brown. The A2 horizon is dark grayish brown, brown, or dark yellowish brown. The B1 horizon is loam, sandy loam, or silt loam. The Bt horizon is heavy sandy loam, loam, or clay loam, and is dark brown,



depressions. These soils are underlain by clayey glacial

Su—Suamico muck. This nearly level soil is in old

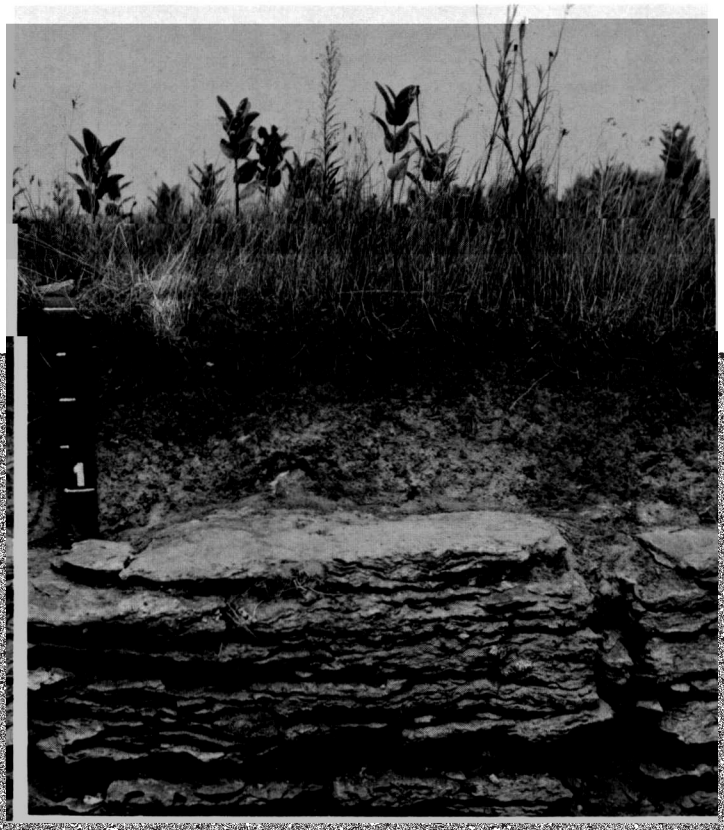


grayish brown loam or sandy loam. Where present, the Bir horizon is dark brown, brown, or reddish brown loam or sandy loam.

Summerville soils are near Bonduel Shallow Variant, Longrie, and Namur soils. They are not so wet as Bonduel Shallow Variant soils. Summerville soils are thinner over dolomite than Longrie soils and mostly thicker over dolomite than Namur soils.

SvA—Summerville loam, 0 to 2 percent slopes. This nearly level soil is on glacial till plains that are underlain by dolomite bedrock. Most areas are irregular in shape and are 5 to 200 acres in size.

This soil has a profile similar to the one described as



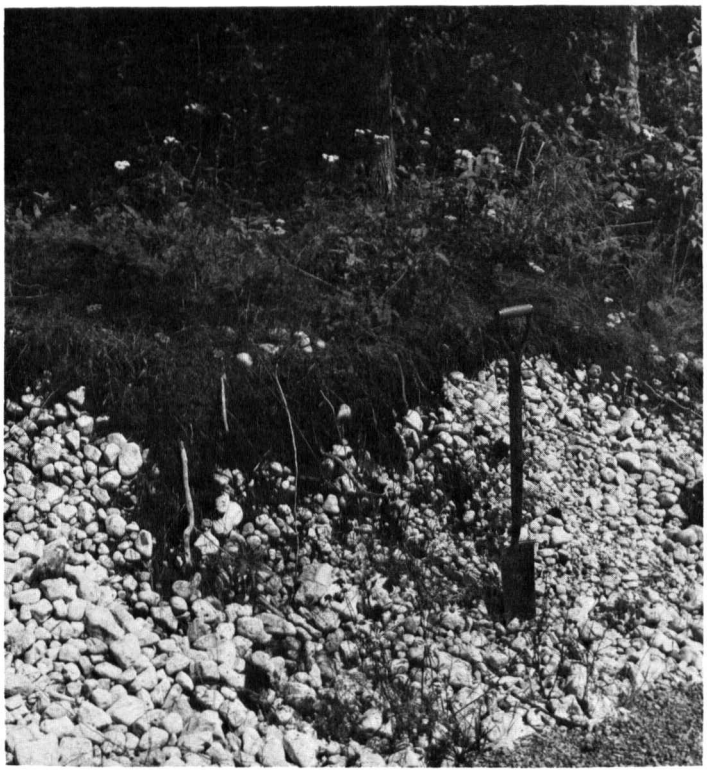


Figure 8.—Washed gravel and cobble ridges located on old glacial lake beaches.

Udipsamments

Ud—Udipsamments. These areas consist of well drained to excessively drained, gently sloping and sloping beach deposits along major lakes. Slopes are mainly 2 to 12 percent. Some areas are moderately steep and steep. The deposits have very little or no evidence of soil profile development. Adjacent to the present lakes and as far as 100 feet from them there is little, if any, vegetation. At greater distances from the lakes, the native vegetation is mainly white birch, northern white-cedar, and drought-tolerant grasses. Most areas are long and narrow.

Due to the very droughty nature of these sandy deposits, soil blowing, and erosion by wave action, these areas are unsuited to and are not used for cultivated crops or pasture. They are used extensively for recreation and in a few places for homesites. Capability unit VIIs–9; woodland suitability subclass 6s.

drought-tolerant grasses. Most areas are long and narrow.

Due to the very droughty nature of these deposits, soil blowing, and erosion by wave action, these areas are unsuited to and are not used for cultivated crops or pasture. They are used extensively for recreation and in a few places for homesites. Capability unit VIIs–9; woodland suitability subclass 6s.

Wainola series

The Wainola series consists of somewhat poorly drained, nearly level soils on sandy lacustrine and outwash plains. The native vegetation is aspen, willow, and black spruce.

In a representative profile the surface layer is black loamy fine sand about 5 inches thick. The subsurface layer is grayish brown fine sand about 8 inches thick. The subsoil is about 17 inches thick and is mottled; it is dark reddish brown, loose fine sand in the upper part and dark brown, loose fine sand in the lower part. The substratum is mottled, yellowish brown, loose fine sand to a depth of about 60 inches.

The available water capacity is low, and permeability is rapid. These soils are seasonally saturated at a depth of 1 to 2 feet, unless they are drained. If these soils are not drained, the depth of the root zone is limited by the water table. Natural fertility and the organic-matter content of the surface layer are low.

If drained, most areas of these soils are used for pasture or general farm crops commonly grown in the county. Undrained areas are used for unimproved pasture, woodland, or wetland wildlife habitat.

Representative profile of Wainola loamy fine sand in a wooded area, 740 feet east and 10 feet south of the center of sec. 23, T. 32 N., R. 28 E.:

A1—0 to 5 inches; black (10YR 2/1) loamy fine sand; weak fine granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

A2—5 to 13 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; common roots; slightly acid; abrupt smooth boundary.

B21ir—13 to 24 inches; dark reddish brown (5YR 3/4) fine sand; common medium distinct strong brown (7.5YR 5/6) mottles; single grained; loose; common roots; slightly acid; clear wavy boundary.

B22ir—24 to 30 inches; dark brown (7.5YR 4/4) fine sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slightly acid; abrupt

is brown, yellowish brown, pale brown, or very pale brown. Coarse fragments are less than 5 percent, by volume. The B and C horizons are commonly fine sand but range to loamy fine sand in some pedons.

Wainola soils are near Deford, Rousseau, and Yahara soils. They form a drainage sequence with the poorly drained Deford soils and the well drained Rousseau soils. Wainola soils do not have the stratified silt and fine sand C horizon that Yahara soils have.

Wa—Wainola loamy fine sand. This nearly level soil is on sandy lacustrine and outwash plains. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 200 acres in size.

Included with this soil in mapping are small areas of Deford and Rousseau soils. Some small areas have a fine sandy loam surface layer.

Runoff is slow. The hazard of erosion is slight. Wetness is the main limitation of this soil. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage removes excess surface water rapidly. Deep ditches provide internal drainage.

Even if drained, this soil is poorly suited to most crops commonly grown in the county because of the frost hazard. Undrained areas are used for unimproved pasture, woodland, or wetland wildlife habitat. Capability unit IVw–5; woodland suitability subclass 3o.

Yahara series

The Yahara series consists of somewhat poorly drained, nearly level and gently sloping soils on old glacial lake plains. The native vegetation is American elm, northern white-cedar, and white ash.

In a representative profile the surface layer is black fine sandy loam about 8 inches thick. The subsoil is about 13 inches thick and is mottled. It is brown, friable fine sandy loam in the upper part; yellowish brown, friable silt loam in the middle part; and brown, loam; few medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; neutral; clear wavy boundary.

B2—9 to 17 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and many coarse prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; neutral; abrupt wavy boundary.

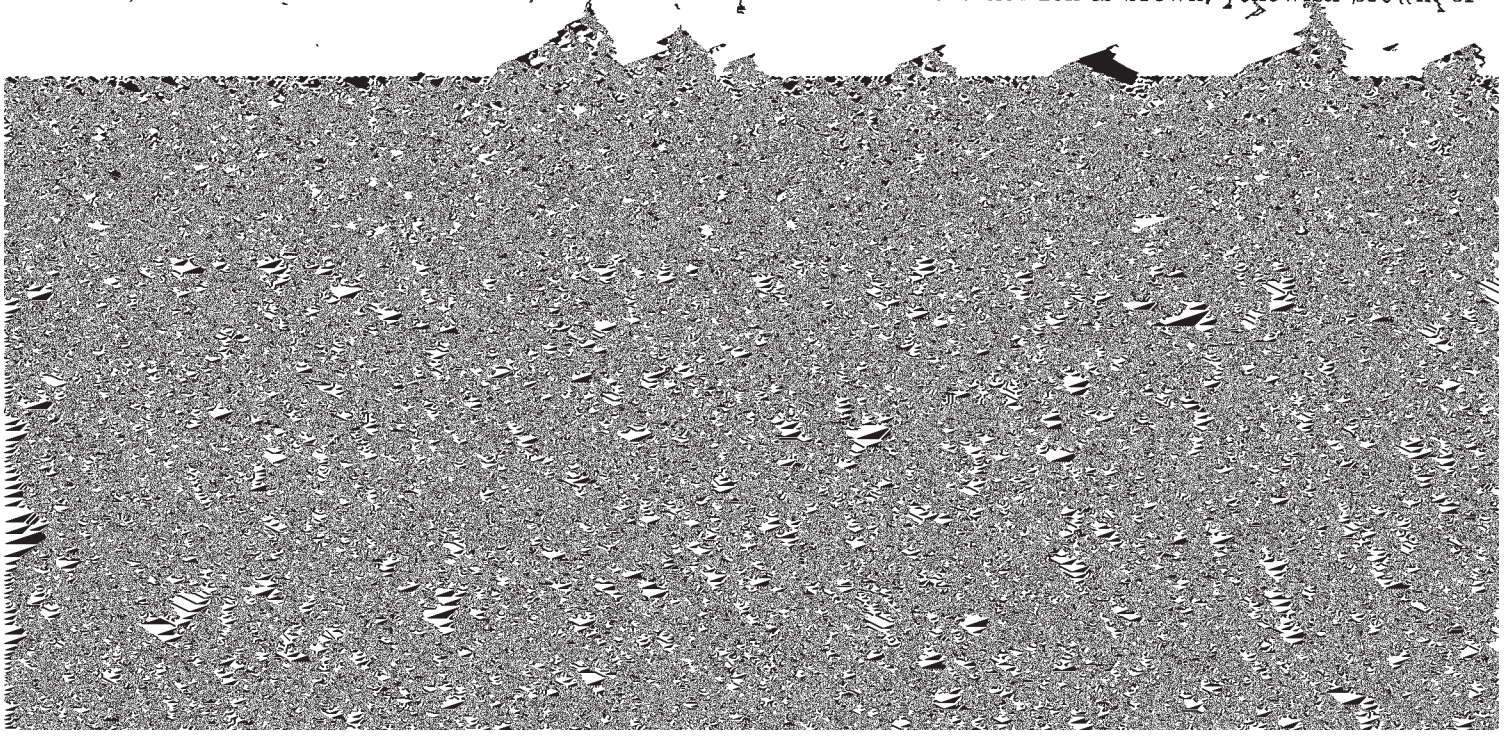
B3—17 to 21 inches; brown (10YR 5/3) medium sand; few medium faint light brownish gray (10YR 6/2) and many medium prominent yellowish brown (10YR 5/6) mottles; single grained; loose; neutral; abrupt smooth boundary.

C1—21 to 40 inches; yellowish brown (10YR 5/4) silt with thin strata of fine sand; common medium faint brown (7.5YR 4/4) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure; friable; slightly effervescent; mildly alkaline; abrupt wavy boundary.

C2—40 to 48 inches; brown (7.5YR 5/4) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; slightly effervescent; mildly alkaline; abrupt wavy boundary.

C3—48 to 60 inches; grayish brown (10YR 5/2) very fine sand; few fine prominent brownish yellow (10YR 6/6) mottles; single grained; loose; strongly effervescent; moderately alkaline.

The solum is 20 to 40 inches thick. The solum is commonly neutral but in some pedons ranges to mildly alkaline. The C horizon is mildly alkaline or moderately alkaline. The B horizon is brown, yellowish brown, or



during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Deep ditches provide internal drainage. Where field tiles are used, silt and fine sand enter the tile lines unless precautions are taken to prevent their entry.

If drained, this soil is suited to corn, small grain, legumes such as red clover, and pasture. Some truck crops are also grown. Undrained areas are used for unimproved pasture, but are better suited to woodland or wetland wildlife habitat. Capability unit IIw–4; woodland suitability subclass 1o.

Yahara Variant

The Yahara Variant consists of poorly drained, nearly level soils on glacial lake plains. The native vegetation is American elm, white ash, redosier dogwood, and marsh grasses.

In a representative profile the surface layer is very dark gray silt loam about 9 inches thick. The subsoil is mottled, light brownish gray, friable silt loam about 14 inches thick. The substratum is mottled light gray and light brownish gray, friable, stratified silt, very fine sand, and silty clay loam to a depth of about 60 loam to silt loam. The C horizon is typically stratified silt and very fine sand but in places has thin layers of silty clay loam.

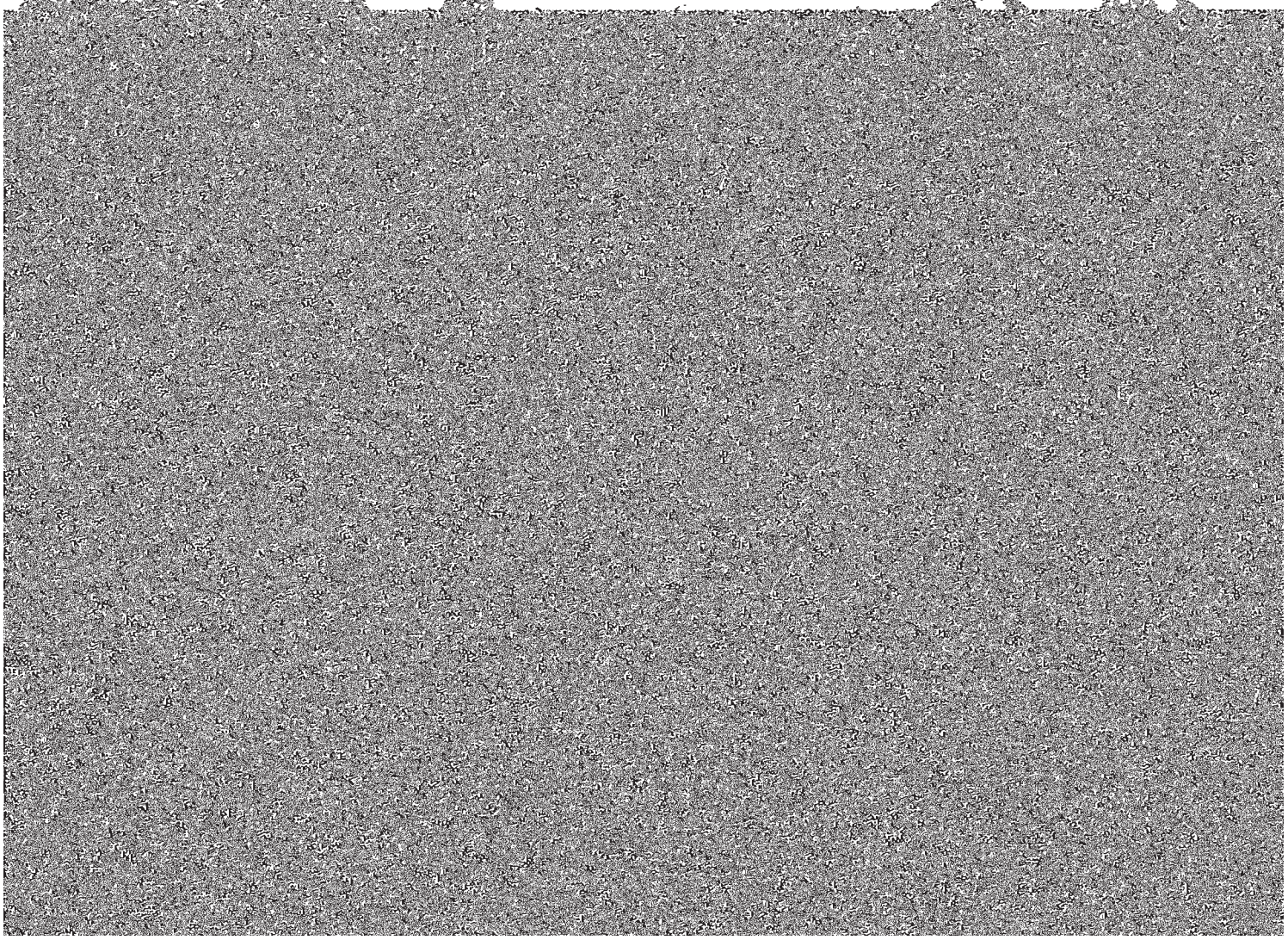
Yahara Variant soils are near Yahara soils. They are wetter and have a higher silt and clay content than Yahara soils.

Yv—Yahara Variant silt loam. This nearly level soil is on glacial lake plains. Slopes are 0 to 2 percent. Most areas are irregular in shape and are 5 to 100 acres in size.

Included with this soil in mapping are small areas of Yahara soils. Also included are small areas of soils that have a fine sandy loam surface layer.

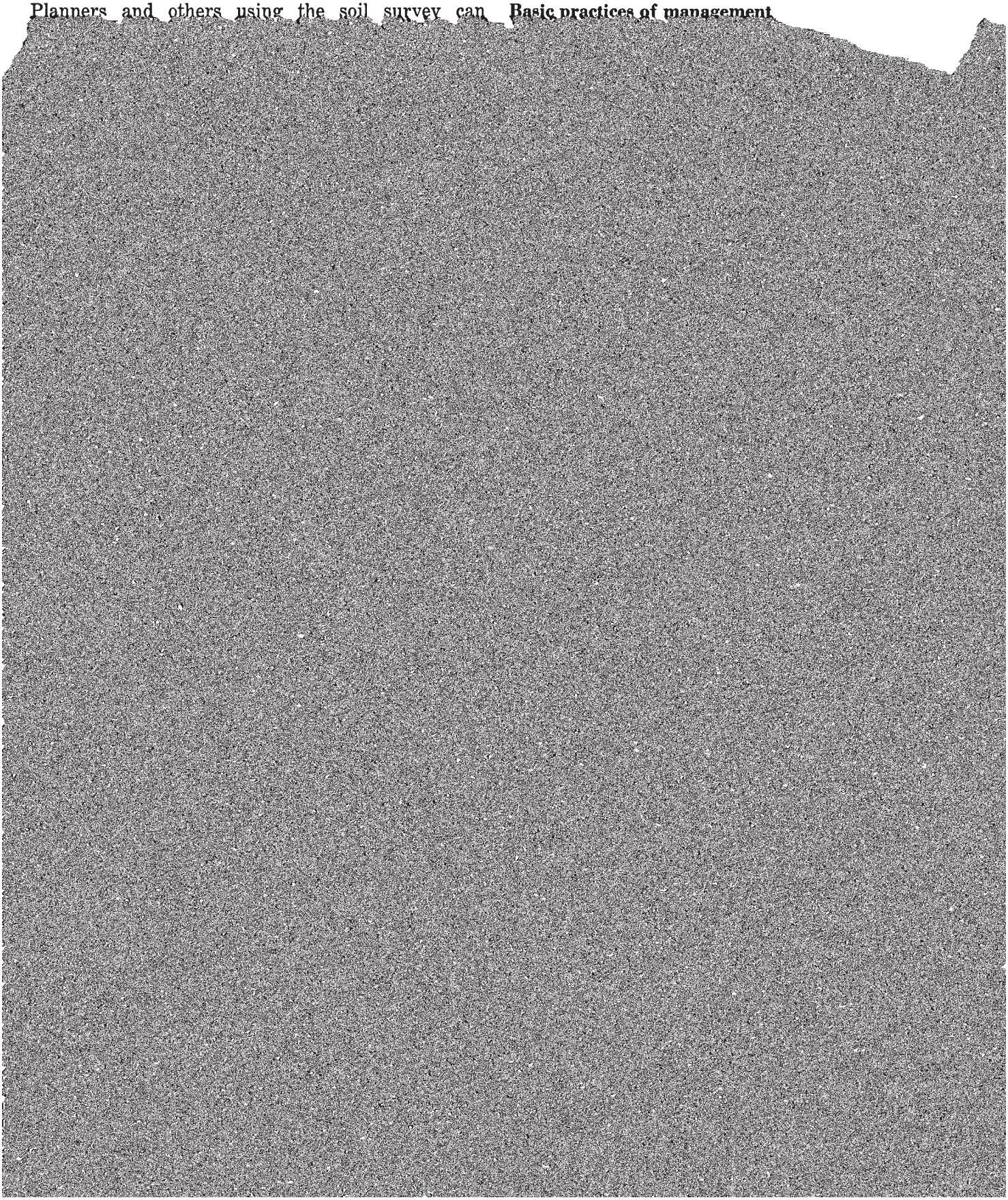
Runoff is very slow. The hazard of erosion is slight. Wetness is the main limitation of this soil. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Deep ditches provide internal drainage. Where field tiles are used, silt and fine sand will enter the tile lines unless precautions are taken to prevent their entry.

If drained, this soil is suited to corn, small grain, legumes such as red clover, and pasture. Undrained areas are used for unimproved pasture, but are better



Planners and others using the soil survey can

Basic practices of management

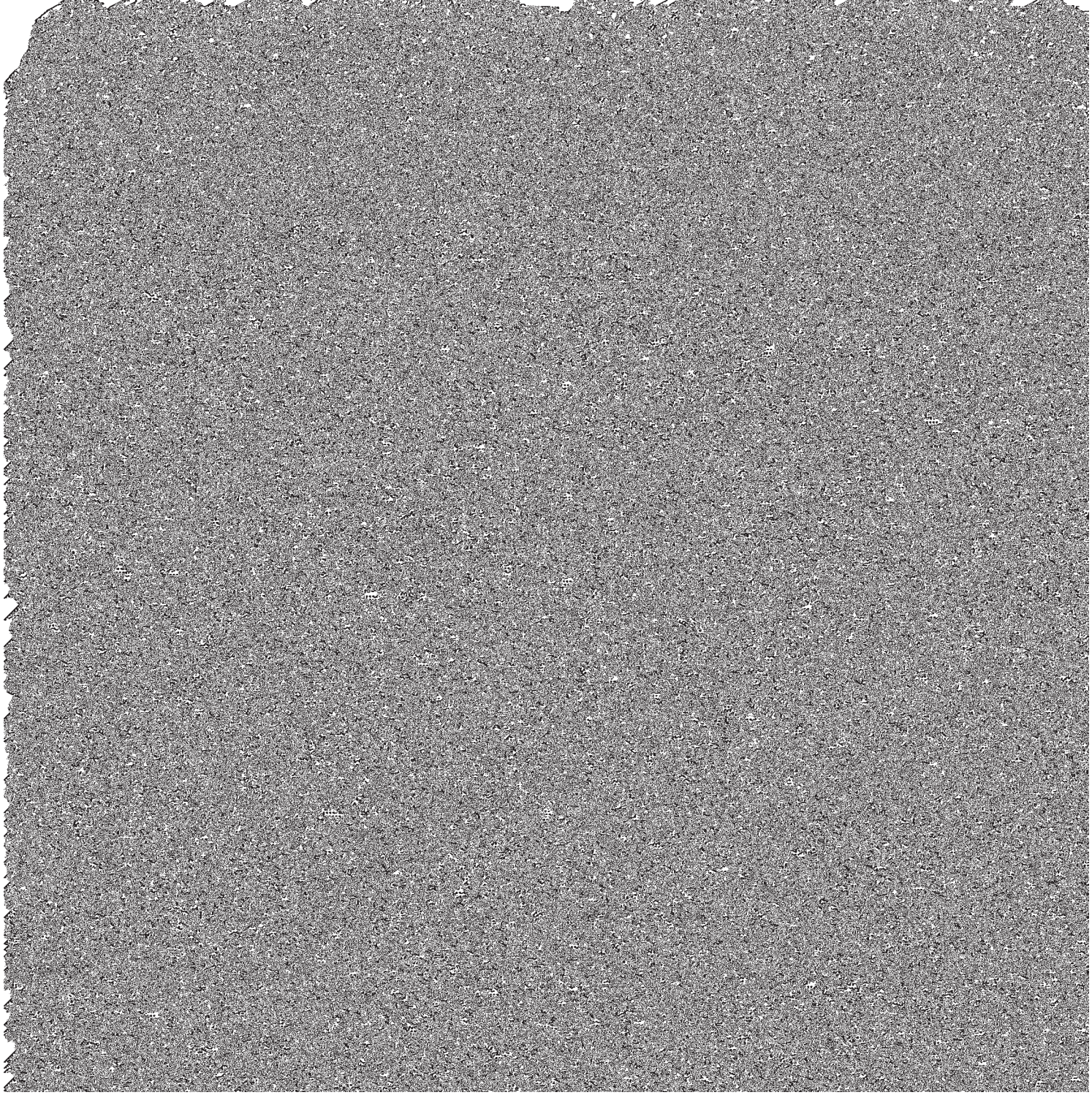


Rousseau soils and on the muck soils, Carbondale, Cathro, Markey, and Suamico soils, where they are drained. Blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Soil blowing can be minimized by maintaining plant cover, surface mulch, or a rough surface through proper tillage. Windbreaks of adapted trees and shrubs are also effective on cultivated muck soils.

[illegible]

progresses until mineral material or the water table is reached. The deeper the water table, the faster the rate of continued subsidence. Subsidence of organic soils can be stopped by maintaining the water level at the surface. It can be reduced by maintaining the water level as high as possible for the land use. Only a small percentage of the area of organic soils in the county is presently used for crops.

Soil fertility is naturally low or medium in most upland soils in Door County. Most soils range from

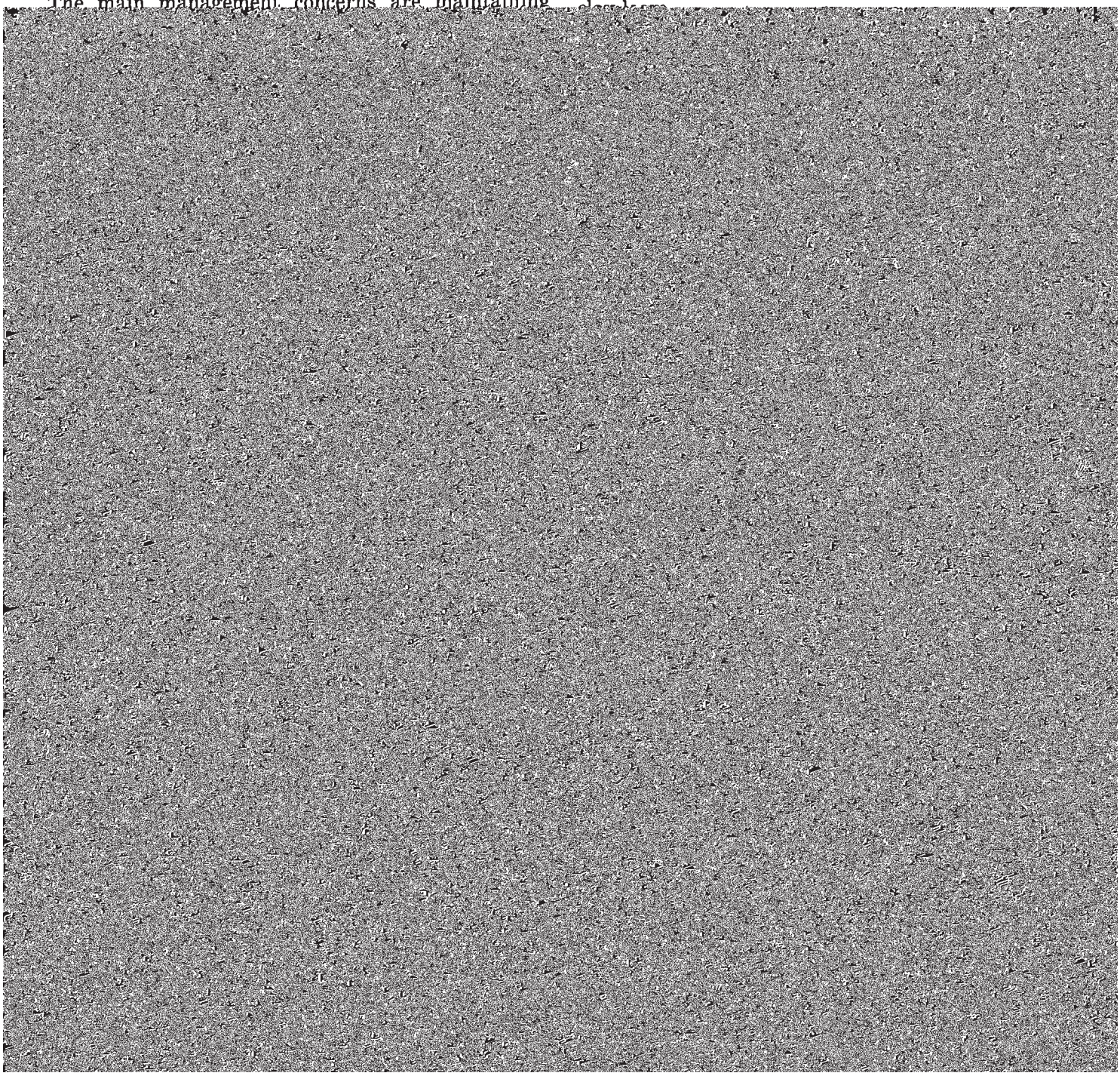


area have a frost hazard and are poorly suited to most pasture plants, they require about the same manage-

have a subsoil of silty clay that is underlain by dolomite bedrock.

Available water capacity is moderate, natural fertility is medium to high, and organic-matter content is moderate in most of these soils. Those soils that have a sandy loam surface layer have lower available water capacity and low natural fertility and organic-matter content. Most of the soils in this unit have moderate permeability, but permeability is moderately slow in a small area. These soils are medium acid to mildly alkaline. The hazard of erosion is moderate. The silt loam soils have a moderate frost hazard.

The main management concerns are maintaining



and minimum tillage are some intensive management practices.

These soils are well suited to all crops commonly grown in the county. Corn, oats, hay, and orchard fruits are the main crops. These soils are also suited to pasture and hardwood.

Capability unit IIs–2

Kolberg silt loam, 0 to 2 percent slopes, is the only soil in this unit. It is moderately deep and well drained, is on glacial till plains, and is underlain by bedrock. This soil has a subsoil of silty clay, clay loam, and silty

Figure 9.—**A series of waterways and diversions safely remove excess water. University of Wisconsin Experimental Station.**

subject to frequent ponding or flooding. Tilth is difficult to maintain where the surface layer is silty clay loam. Surface or tile drains or both are used to remove excess water. Diversions also provide some overflow protection from adjoining slopes. Returning crop residue and applying manure and fertilizer help to maintain organic-matter content, fertility, and tilth. This type of intensive management allows continuous row cropping.

These soils are suited to crops if they are protected from flooding and if adequate drainage is provided. The main crops are corn, oats, and hay. Unimproved areas are suited to pasture, woodland, and wildlife habitat.

Capability unit IIw–2

This soil consists of nearly level and gently sloping, deep, somewhat poorly drained soils in depressions and drainageways on glacial till plains. These soils have a surface layer of silt loam and sandy loam. Most have a subsoil and substratum of loam. Some have a subsoil and substratum of silty clay.

In the loam and sandy loam soils, permeability is moderate; and in the silt loam soil, it is slow. Natural fertility is high in the silt loam soil, medium in the loam soil, and low in the sandy loam soil. Available water capacity of all soils is moderate or high. Organic-matter content is low or moderate. These soils are neutral to moderately alkaline. The hazard of erosion is moderate in a few gently sloping areas. These soils have a slight or moderate hazard of flooding, and they have a high water table. They are seasonally saturated at a depth of 1 to 3 feet, unless they are drained.

Applying manure and fertilizer, returning crop residue, and minimum tillage help to maintain organic-matter content, fertility, and tilth. Diversions provide overflow protection, and surface or tile drains remove excess water (fig. 9).

These soils are suited to continuous row crops if they are protected from overflow and if adequate drainage is provided. Corn, oats, and hay are commonly grown. Unimproved areas are generally suited to pasture, woodland, or wildlife habitat.

Capability unit IIw–3

This unit consists of nearly level, shallow and moderately deep, somewhat poorly drained to poorly drained soils in depressions and drainageways on glacial till plains. The surface layer is loam. These soils are underlain by dolomite bedrock.

Available water capacity is low. Permeability and organic-matter content are moderate. Natural fertility is medium. These soils are neutral to moderately alkaline. The hazard of flooding is slight or moderate.

Minimum tillage, returning crop residue, and applying manure and fertilizer help to maintain the organic-matter content, fertility, and tilth. Diversions protect the soils from flooding, and surface drainage removes excess water from a high water table. In places, bedrock prevents the installation of tile drains. These soils are seasonally saturated at a depth of less than 3 feet, unless they are drained.

These soils are moderately well suited to most crops commonly grown in the county if they are protected from flooding and the high water table is lowered. If they are not protected, the soils are generally suited to pasture, woodland, and wildlife. Corn, oats, and hay are the main crops.

Capability unit IIw–4

Yahara fine sandy loam, 0 to 3 percent slopes, is the only soil in this unit. It is deep and somewhat poorly drained and is on lacustrine plains. The substratum is mainly stratified silt and very fine sand.

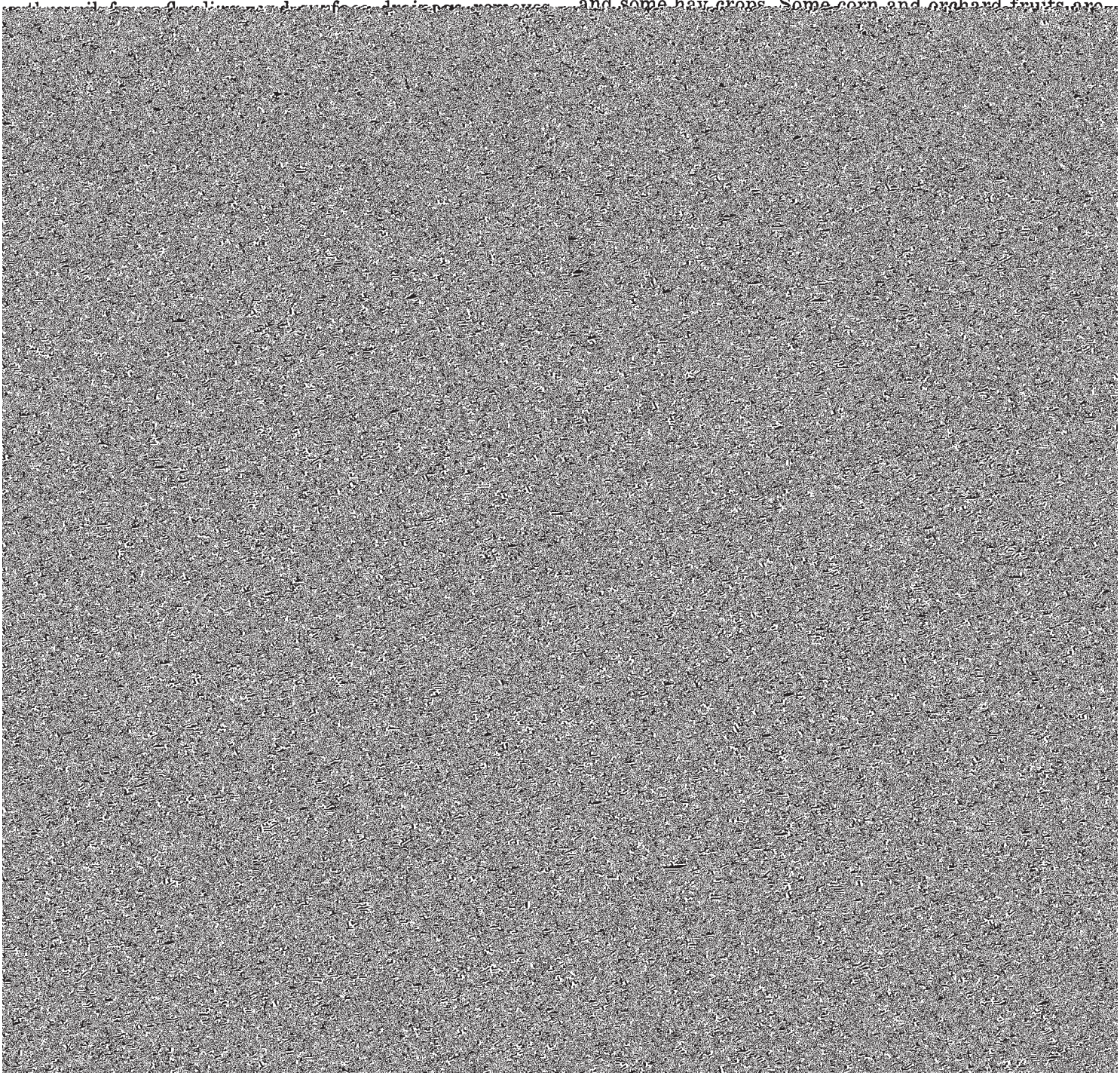
Available water capacity is high. Permeability and organic-matter content are moderate. Natural fertility is medium. This soil is neutral to mildly alkaline. The hazard of flooding is slight or moderate.

Minimum tillage, returning crop residue, and applying manure and fertilizer help to maintain the organic-matter content, fertility, and tilth. Diversions protect

permeable substratum. Organic-matter content is moderate. The available water capacity is low or very low. Natural fertility is medium or low. These soils are slightly acid to mildly alkaline. The hazards of erosion and drought are moderate.

Returning crop residue and applying manure and fertilizer help to maintain organic-matter content, fertility, and moisture. Management practices such as stripcropping and waterways help to control runoff and erosion.

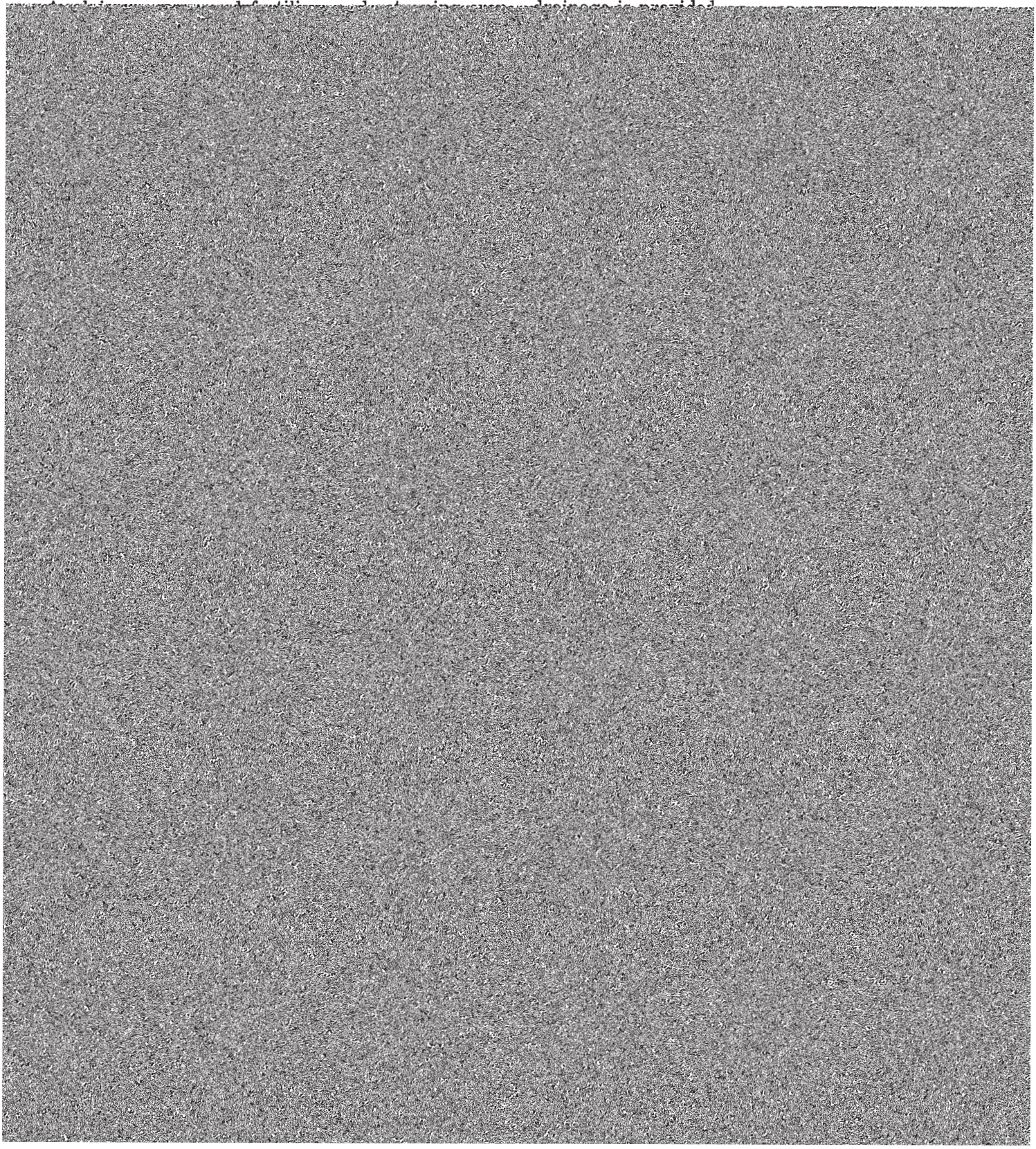
These soils are moderately well suited to the more drought resistant crops in the county, such as oats and some hay crops. Some corn and orchard fruits are



in some areas has slow permeability. Organic-matter content and natural fertility are low. These soils are medium acid to mildly alkaline. The hazard of erosion is moderate. Droughtiness is the main limitation.

installed, precautions should be taken to prevent silt and very fine sand from filling the tile.

This soil is suited to all crops commonly grown in the county if it is protected from flooding and if adequate

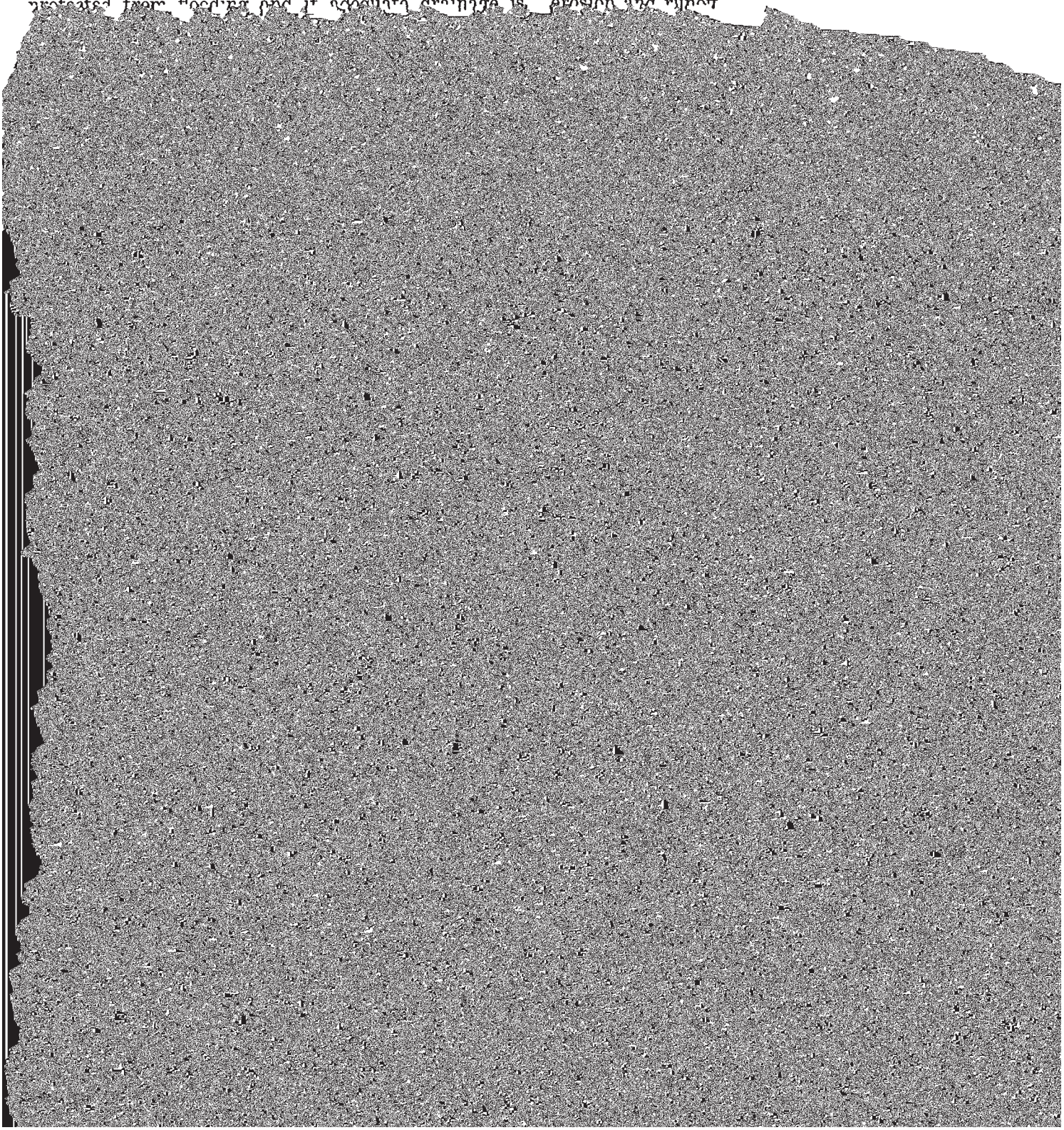


Surface drainage removes excess water. This soil is saturated at a depth of less than 1 foot, unless it is drained. Diversions and channeling protect the soil from flooding. Minimum tillage and applying fertilizer are important management practices.

This soil is suited to corn and truck crops if it is protected from flooding and if adequate drainage is

content are low. This soil is medium acid to mildly alkaline.

Minimum tillage and applying fertilizer and manure help to maintain organic-matter content and fertility and to conserve moisture. Waterways, stripcropping, suitable crop rotations, and renovation help to prevent erosion and runoff.



lake plains. These soils have a substratum of clay or loam.

Permeability is moderately rapid in the organic layer and slow to moderate in the substratum. Available water capacity and organic-matter content are very high. Natural fertility is low. These soils are neutral to moderately alkaline. The hazard of flooding is severe, and the frost hazard is moderate. Soil blowing and subsidence are concerns if the water table is lowered too far.

Minimum tillage and applying fertilizer help to maintain organic-matter content and fertility. Surface or tile drains remove excess water, and diversions protect the soils from flooding. They are saturated with water at a depth of less than 1 foot, unless they are drained.

These soils are poorly suited to most crops commonly grown in the county even if adequate drainage and flood protection are provided. Early frost limits crops. These soils are better suited to woodland and wildlife habitat.

Capability unit IVw–9

Carbondale muck is the only soil in this unit. It is a deep, very poorly drained, organic soil in glacial lake basins and in depressions in stream valleys. Slopes are 0 to 2 percent.

Permeability is moderately rapid. Available water

Capability unit VIe–2

Emmet sandy loam, 20 to 35 percent slopes, is the only soil in this unit. It is deep and well drained and is on ridges on glacial till plains. This soil has a loamy sand, sandy loam, and loam subsoil that is underlain by a sandy loam substratum.

Permeability is moderate, but in the substratum it is moderately rapid. Available water capacity is moderate. Organic-matter content and natural fertility are low. The soil is slightly acid to mildly alkaline. The hazard of erosion is very severe. There is also a hazard of drought.

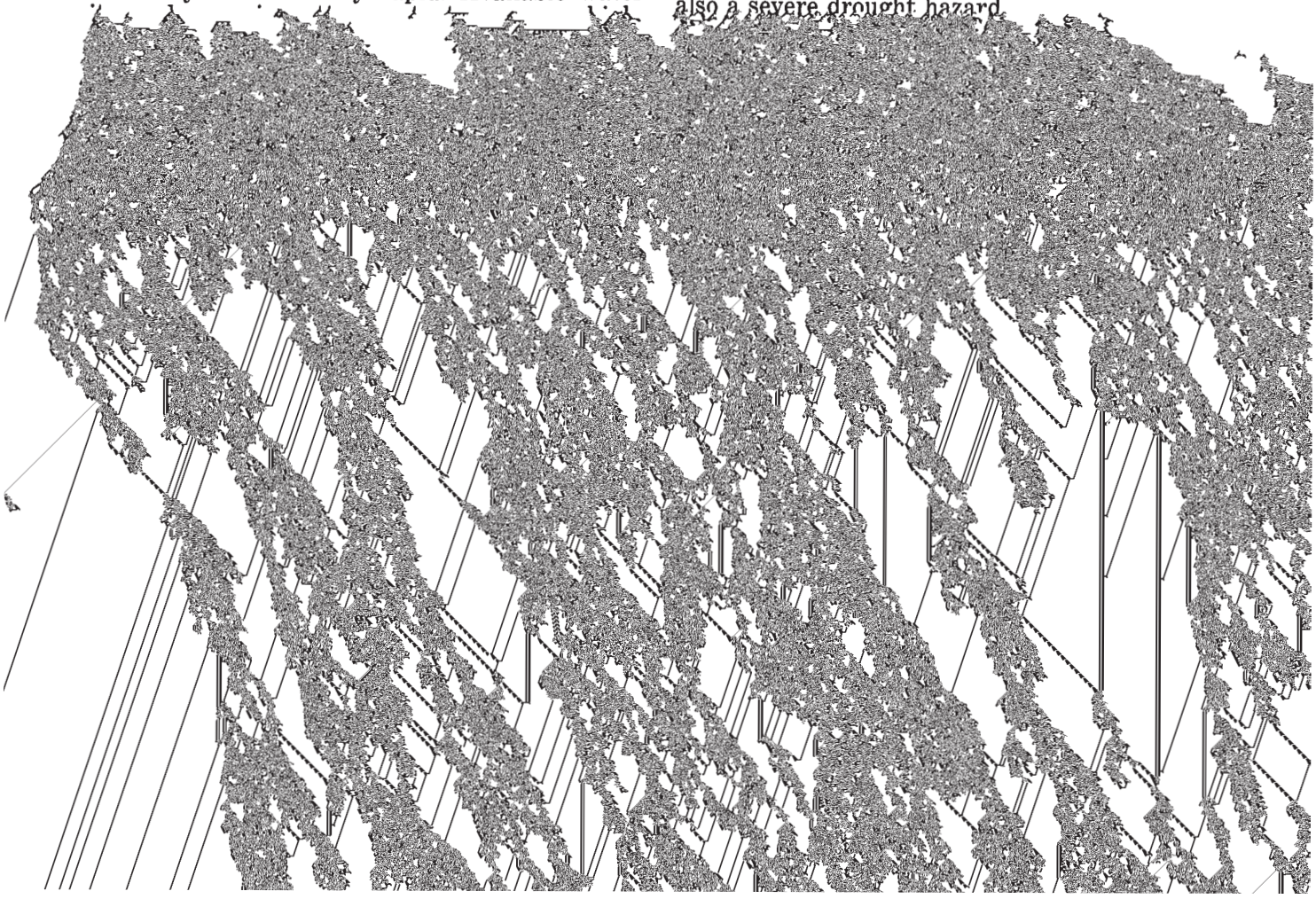
Pasture and hayland are difficult to renovate. Controlled grazing, renovation, and fertilization help to maintain plant cover and control erosion.

This soil is generally unsuited to cultivated crops. If properly managed, it is suited to hay and pasture. This soil is used mostly for woodland and wildlife habitat.

Capability unit VIe–3

Summerville loam, 12 to 20 percent slopes, is the only soil in this unit. It is on glacial till plains and is underlain by dolomite bedrock.

Natural fertility is medium or low. Organic-matter content is moderate. Available water capacity is very low. Permeability is moderate. This soil is slightly acid to neutral. The hazard of erosion is severe. There is also a severe drought hazard.



Controlled grazing, renovation, fertilization, and windbreaks or solid plantings help to maintain plant cover and control soil blowing.

These soils are generally unsuited to cultivated crops. If properly managed, they are suited to pasture. These soils are used mostly for unimproved pasture, woodland, or wildlife habitat.

Capability unit VIs–5

This unit consists of nearly level to sloping, deep, shallow or very shallow soils on glacial lake beach ridges and bedrock controlled glacial till plains. These soils have a surface layer of loam to gravelly sandy loam and are underlain by stratified sand and gravel or by dolomite bedrock. Most of these soils are well drained to excessively drained, but some range to poorly drained.

These soils have moderate to very rapid permeability. Available water capacity is low to very low. Organic-matter content is moderate or low. Natural fertility is low. The hazard of erosion is slight to moderate. These soils are neutral to mildly alkaline. Droughtiness is a severe limitation, but some soils are seasonally saturated at a depth of less than 1 foot. Bedrock generally limits use of drainage measures.

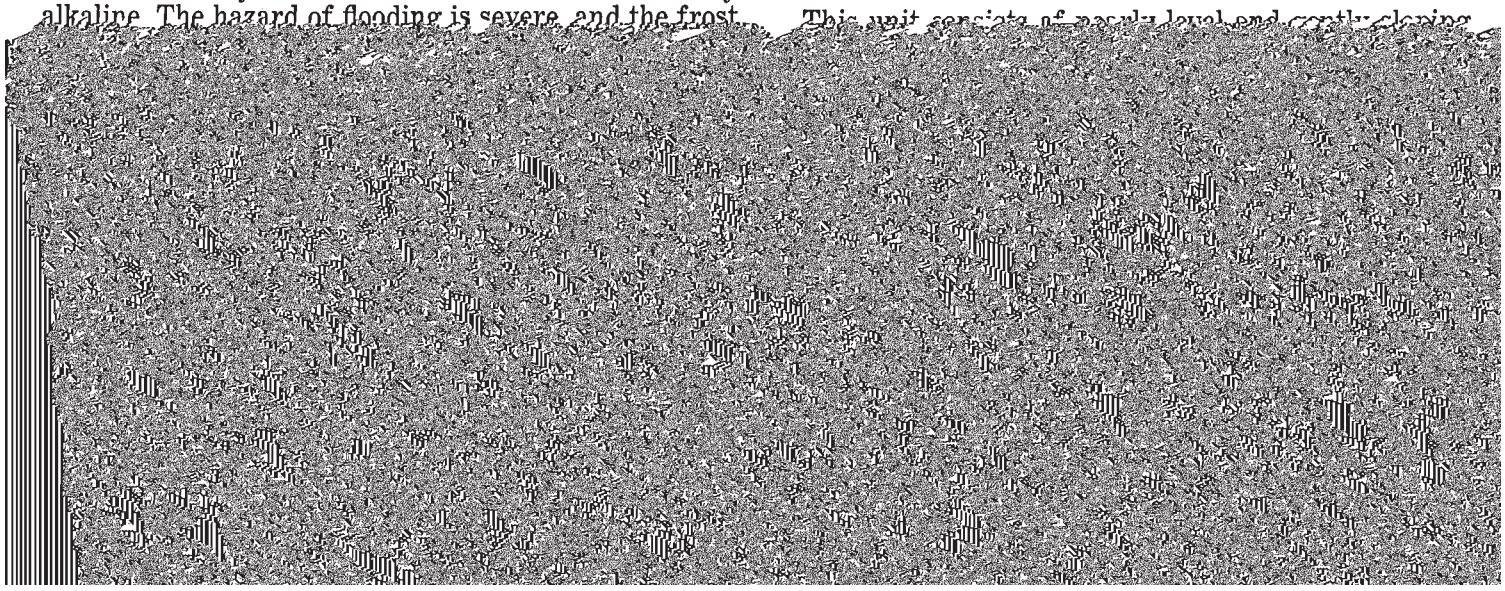
Controlled grazing, renovation, and fertilization help to maintain plant cover, control erosion, and conserve moisture.

These soils are generally unsuited to cultivated crops. If properly managed, they are suited to pasture. These soils are used mostly for unimproved pasture, woodland, and wildlife habitat.

Capability unit VIw–7

Markey muck is the only soil in this unit. It is a nearly level, deep, very poorly drained, muck soil that is underlain by sand and is on glacial lake basins and in depressions in stream valleys. Slopes are 0 to 2 percent.

Permeability is moderately rapid in the organic layer and rapid in the sand substratum. Available water capacity is high. Organic-matter content is very high. Natural fertility is low. This soil is neutral to mildly alkaline. The hazard of flooding is severe, and the frost



alkaline. The hazard of soil blowing is moderate. These soils are also severely droughty.

Controlled grazing, proper woodland management, and tree planting in open areas help to provide plant cover and control soil blowing.

These soils are unsuited to cultivated crops. They are mostly used for unimproved pasture, native woodland, recreation, or wildlife habitat.

Capability unit VIIs–9

This unit consists of gently sloping and sloping, excessively drained beach deposits along major lakes. These soils are sandy and cobbly.

Natural fertility and organic-matter content are low. Permeability is rapid or very rapid. Available water capacity is very low. The hazard of soil blowing is severe if these soils are cultivated. There is also a severe drought hazard.

Management consists of renovation for pasture areas. Protection from grazing is important for woodland and wildlife habitat. Tree plantings in open areas help to provide plant cover and control soil blowing.

These soils are unsuited to cultivated crops. They are better suited to pine plantations. Some areas are in pasture. The soils are also well suited to wildlife habitat.

Capability unit VIIs–10

Chippeny muck is the only soil in this unit. It is an organic soil on old glacial lake basins and is underlain by dolomite bedrock. Slopes are 0 to 2 percent.

Permeability is moderately slow to moderate. Available water capacity is high. Organic-matter content is very high. Natural fertility is low. This soil is neutral to mildly alkaline. The hazard of flooding is severe. This soil is subject to a moderate frost hazard.

This soil is saturated at a depth of less than 1 foot. Underlying bedrock generally limits use of surface or tile drains.

This soil is unsuited to cultivated crops. It is better suited to woodland or wildlife habitat.

Capability unit VIIIs–10

This unit consists of nearly level and gently sloping

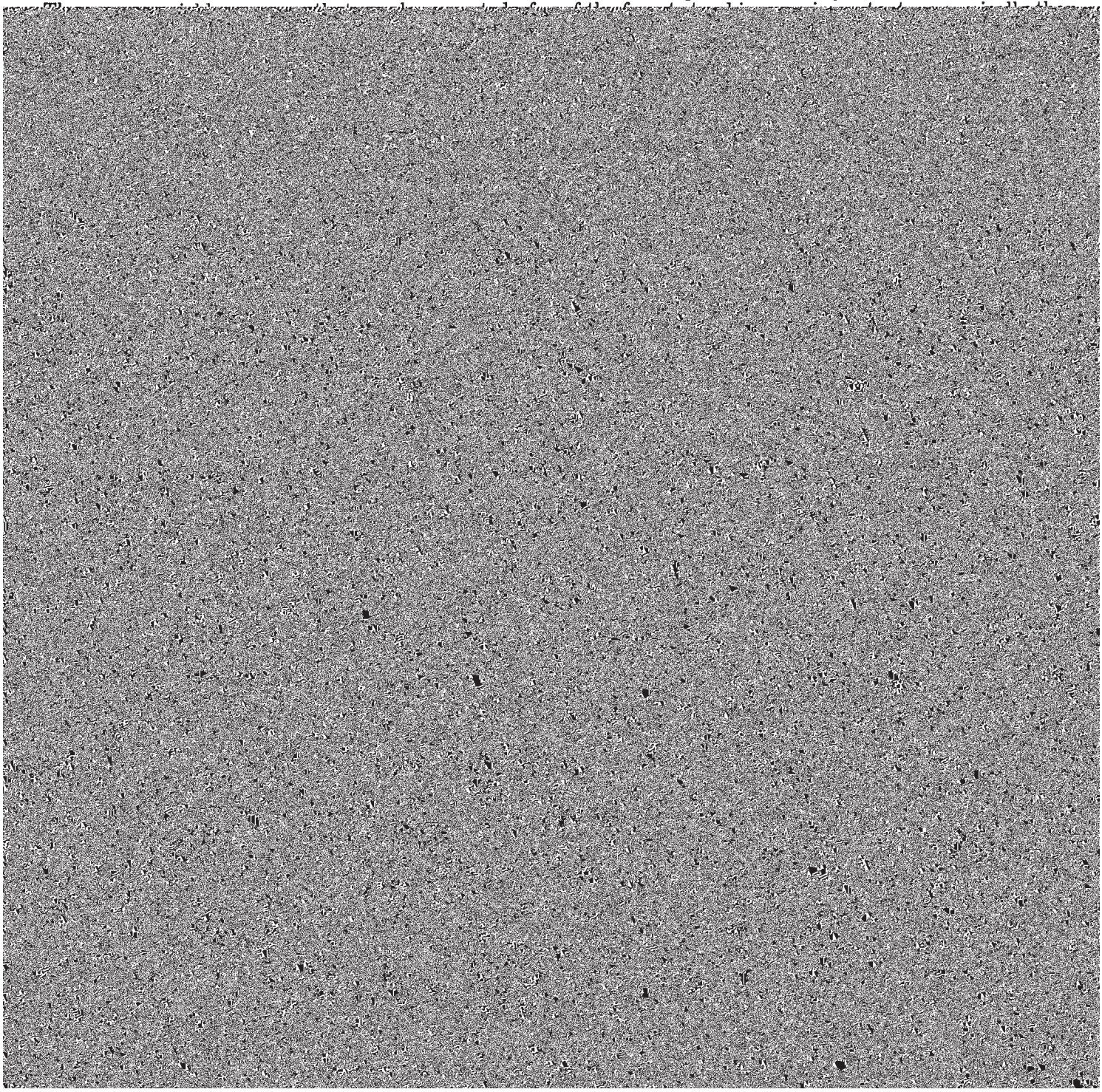
These soils are too wet to be used for common farm crops and pasture. Drainage is generally not feasible because there are no suitable outlets. These soils are suited to wetland wildlife habitat. In dry seasons these areas need protection from grazing and from fire. Areas that have completely filled with sediment and that are entirely grown over with cattails can be blasted out with dynamite to form potholes for waterfowl and other wildlife.

Yields per acre

settled. This forest was a mixture of conifers and hardwoods. Currently 33 percent of the county, or 106,000 acres, is in forest. About 96,000 acres is classified as commercial forest in the forest inventory published in 1968 (fig. 10).

The present forest area is 21 percent conifers; 0.7 percent oak and hickory; 14 percent elm, ash, and maple; 33 percent maple, beech, and birch; 22 percent aspen and white birch; and 3 percent nonstocked (*11*).

Although a third of the county is forested, forestry is not an important industry. The recreational value



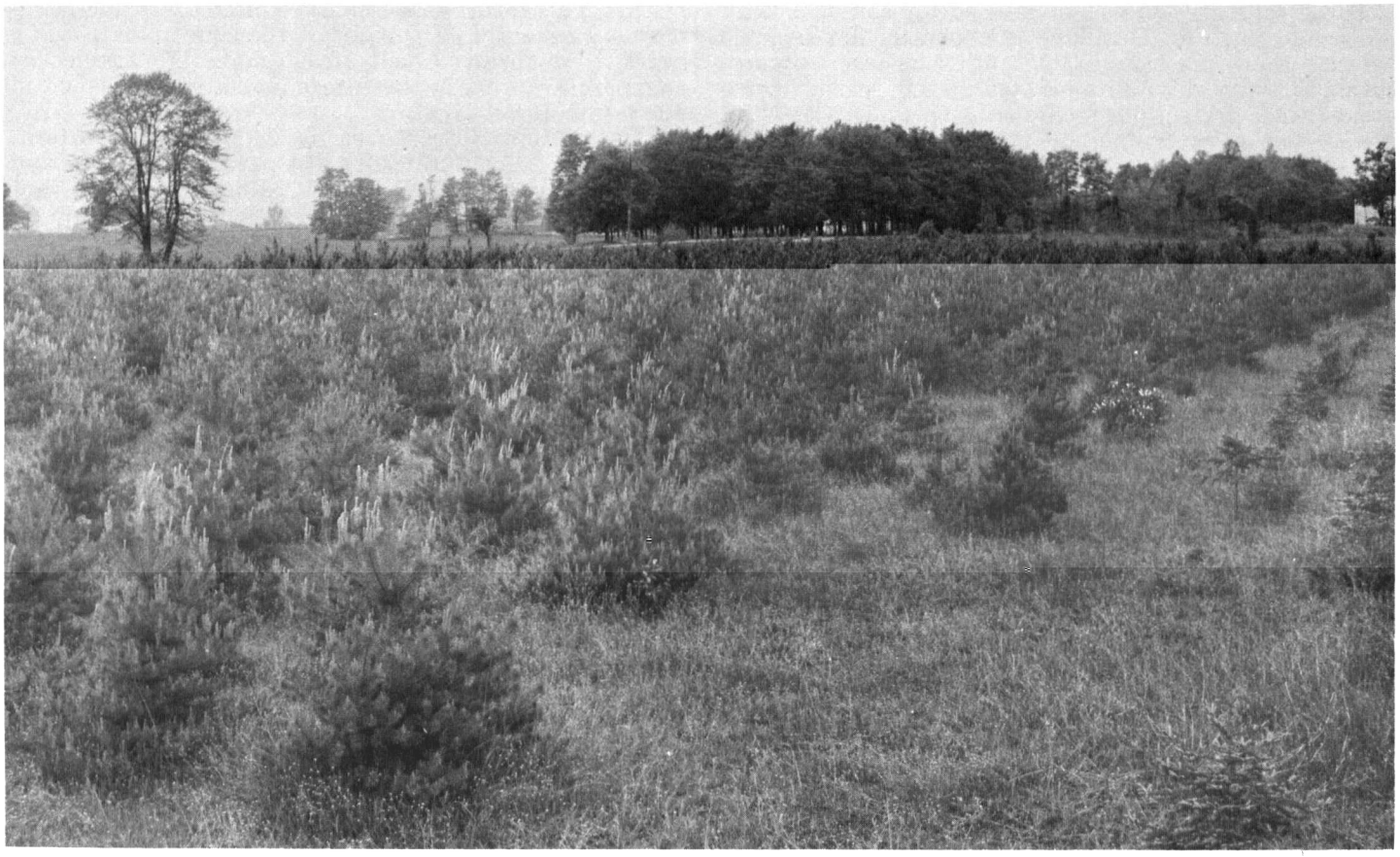


Figure 10.—Tree planting is an established program in the county. This planting is on soils of the Emmet and Omena series.

cent; *moderate*, 25 to 50 percent; and *severe*, more than . trees of a given species attain in a specified number

TABLE 2.—*Yields per acre of crops and pasture*

[All yields were estimated for a high level of management in 1974. Absence of a yield figure indicates the crop is seldom grown

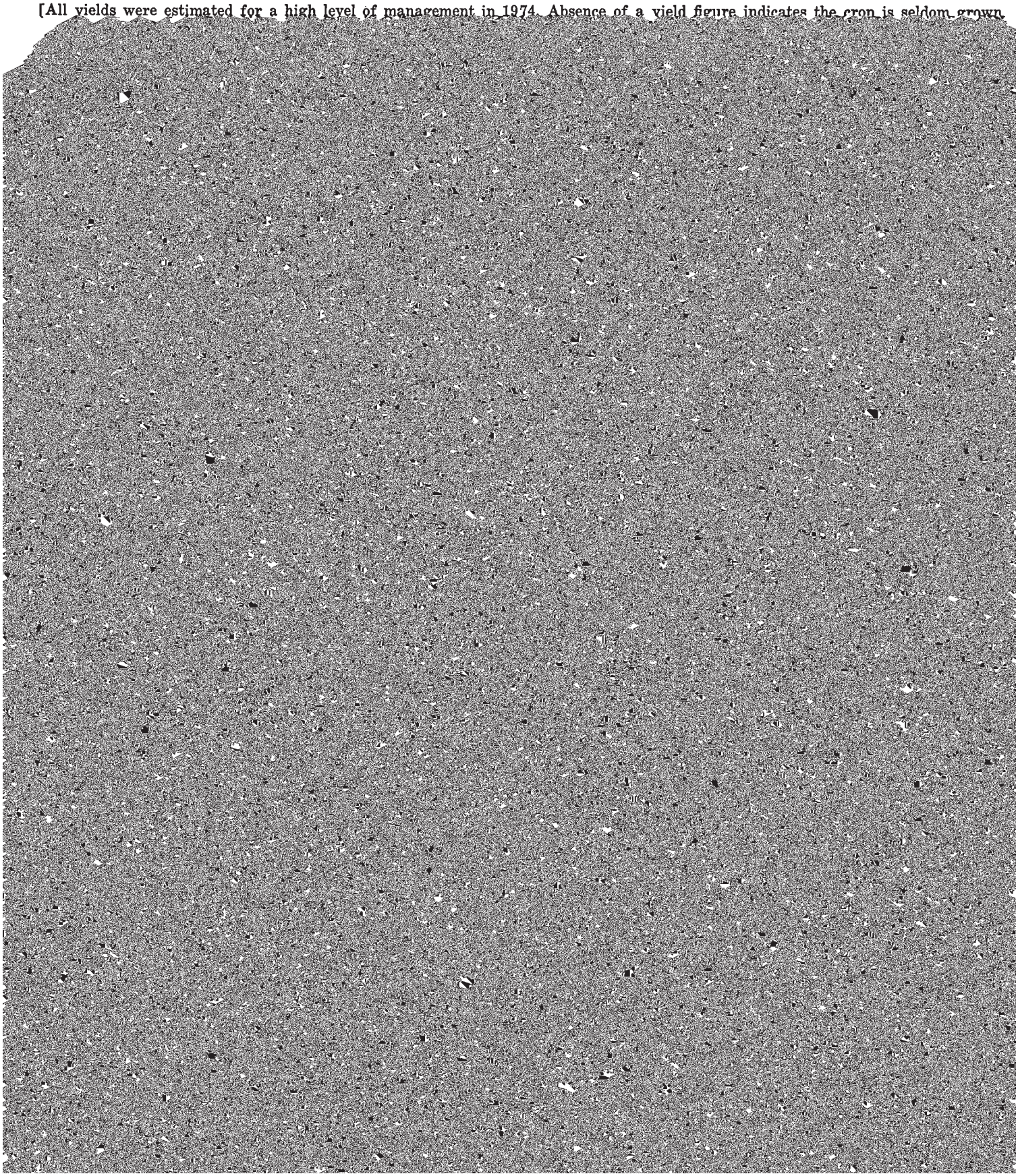


TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay	Kentucky bluegrass
	Bu	*Ton*	*Bu*	*Ton*	*AUM* [1]
KhC2	80	13	75	4.5	3.2
KkD3	60	10	60	4.0	2.5
Kiva:					
KmB	----------	12	60	2.0	1.6
KmC	----------	8	50	1.9	1.6
Kolberg:					
KoA	90	15	70	3.7	3.0
KoB	80	13	65	3.7	3.0
KoC2	65	11	55	3.0	2.6
Kolberg Variant:					
KvB	70	12	65	3.2	2.3
KvC2	60	10	60	3.2	2.0
Longrie:					
LoA	80	13	65	3.5	3.5
LoB	75	12	60	3.0	3.0
LoC	70	12	55	2.5	2.5
Manawa:					
McA	90	15	75	4.5	3.5
Manistee:					
MeB	65	11	60	3.0	2.0
Markey:					
Mk	----------	12	55	2.5	----------
Namur:					
NaB, NaC	----------	----------	30	2.0	1.3
Namur Variant:					
Nv	30	5	35	1.7	1.3
Omena:					
OmB	75	12	75	3.5	3.0
OmC	70	12	70	3.3	2.5
OmD	----------	----------	60	3.1	2.5
Omena Variant:					
OvB	90	15	65	4.0	3.5
Omro:					
OzB	85	14	70	4.5	3.5
Pinconning:					
Pn	80	13	60	3.5	2.5
Poygan:					
Po	100	17	65	4.0	3.5
Rock outcrop:					
Ra.					
Namur:					
[2] Rb	----------	----------	30	2.0	3.0
Rondeau:					
Rn	----------	12	50	----------	----------

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay	Kentucky bluegrass
	Bu	*Ton*	*Bu*	*Ton*	*AUM* [1]
Rousseau:					
RoB	45	8	40	2.0	2.5
RoC	40	7	35	2.0	2.0
[2] RpC	45	8	35	2.4	2.0
[2] RpD	----	----	----	1.8	1.5
[2] RrB	50	8	45	2.0	2.5
Saprists:					
Sa.					
Sisson:					
SnA	100	17	75	4.5	3.5
SnB	95	16	70	4.5	3.5
Solona:					
SoA	90	15	65	4.0	3.5
Suamico:					
Su	----	12	55	2.5	----
Summerville:					
SvA	75	12	70	3.5	3.0
SvB	70	12	65	3.5	3.0
SvC	60	10	60	3.0	2.5
SvD	----	----	----	2.5	2.0
Udipsamments:					
Ud.					
Udorthents:					
Uo.					
Wainola:					
Wa	55	9	45	2.0	2.0
Yahara:					
YaA	75	12	50	3.0	3.0
Yahara Variant:					
Yv	85	14	60	3.5	4.0

[1] 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 a period of 30 days.

[2] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

various kinds of soils in 20 years. The estimates in this table, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from the local office of the Soil Conservation Service, Cooperative Extension Service, local nurserymen, or the Wisconsin Department of Natural Resources forester.

Recreation [4]

The demand for land and facilities for recreational activities is increasing everywhere in the survey area. Such activities include golfing, camping, snowmobiling, picnicking, bicycling, hiking, boating, and tennis (fig. 11). Hundreds of acres have been removed from

[4] RAYMOND E. HOAGUE, district conservationist, Soil Conservation Service, assisted in preparing this section.

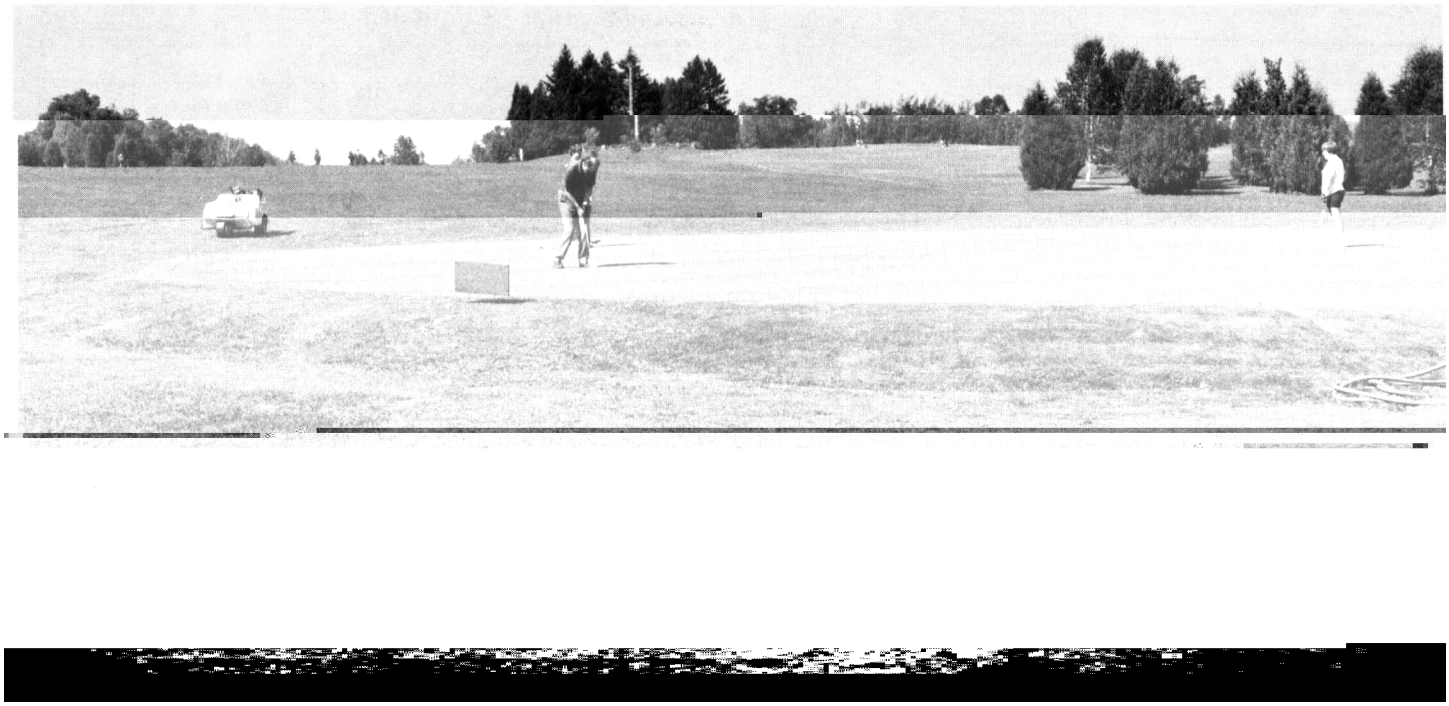


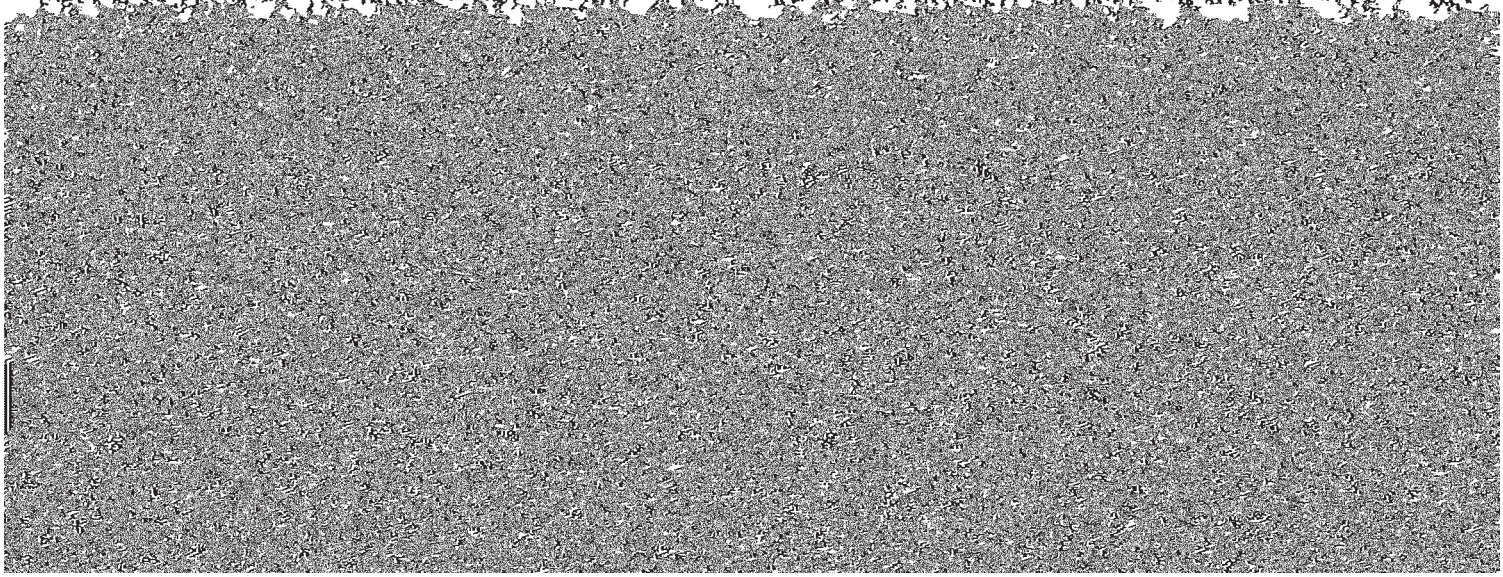
Figure 11.—**Golf course on gently sloping soils of the Longrie series. These soils are well suited to most farm crops but have severe limitations for some nonfarm uses, such as septic tank absorption fields.**

agricultural production and are used for second-home areas for numerous nonresidents.

The soils of the survey area are rated in table 5 (See page 73) according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, 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 available, and either access to public sewer

for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling 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 best soils for this use are mildly sloping, are not wet, and are not subject to flooding during the period of use. The surface has few or no stones or boulders; absorbs rainfall readily, but remains firm; and is not dusty when dry. The cost of constructing camping sites greatly increases if the soils are strongly sloping and



use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should be moderately sloping and have few or no stones or boulders on the surface.

Wildlife habitat [5]

The soils of Door County range widely in physical and chemical composition. Most of the soils in the northern two-thirds of the county are rough or are shallow over dolomite bedrock. Many areas in this part of the county are not farmed, but they remain in woodland or wetland. The southern one-third of the county is smoother, and most of this area is farmed. Most of the wetlands are in this section. According to an inventory made in 1961, there is approximately 28,000 acres of wetlands. Most of these wetlands are wooded swamps.

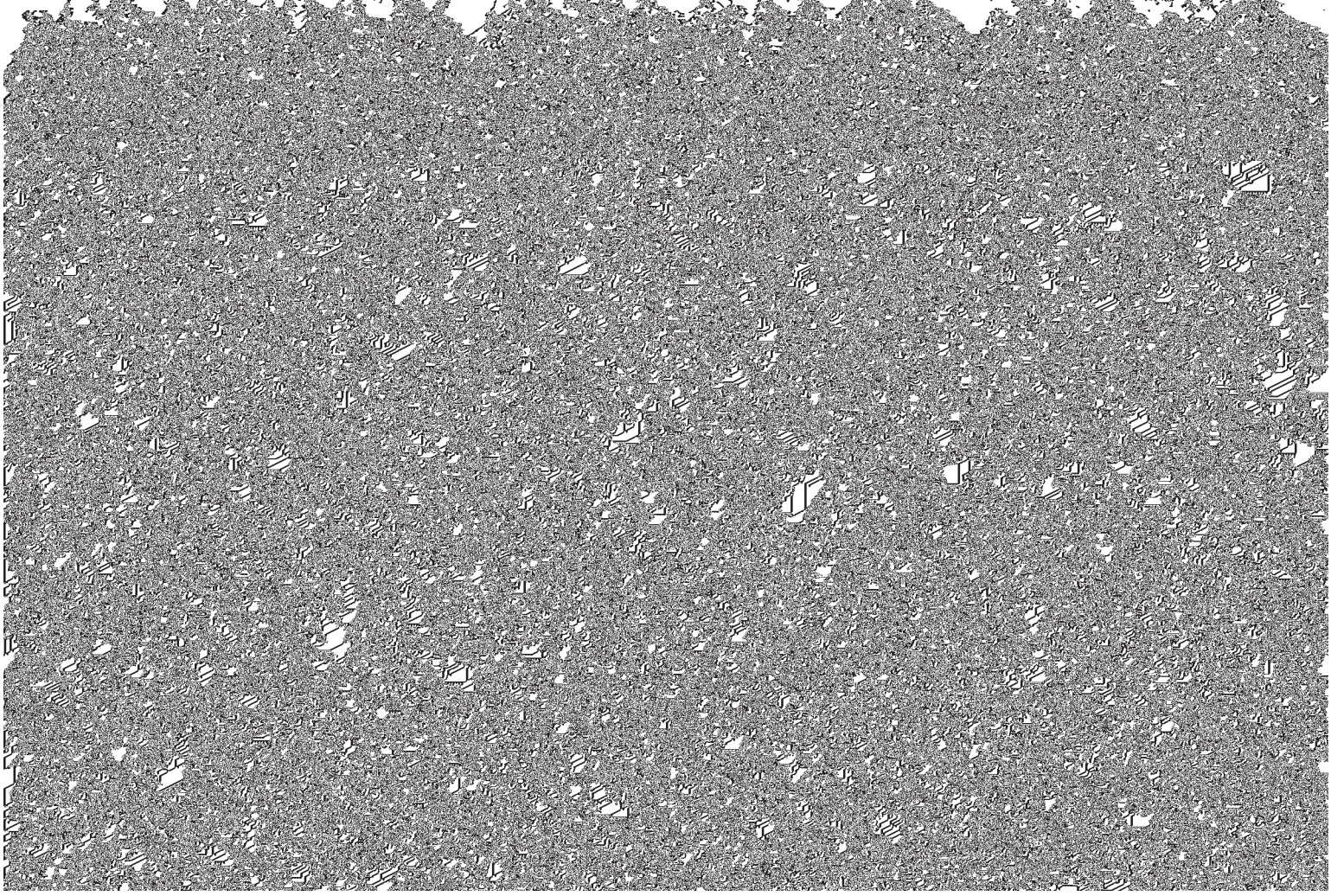
The habitat elements needed by a wildlife species generally require several kinds of soil and commonly a combination of land uses. For this reason, interpretations of the soils can be best related to the soil associations described in the section, "General Soil Map." In the following paragraphs, the soil associations of Door County are described as wildlife areas that differ in potential species, mainly as affected by environmental

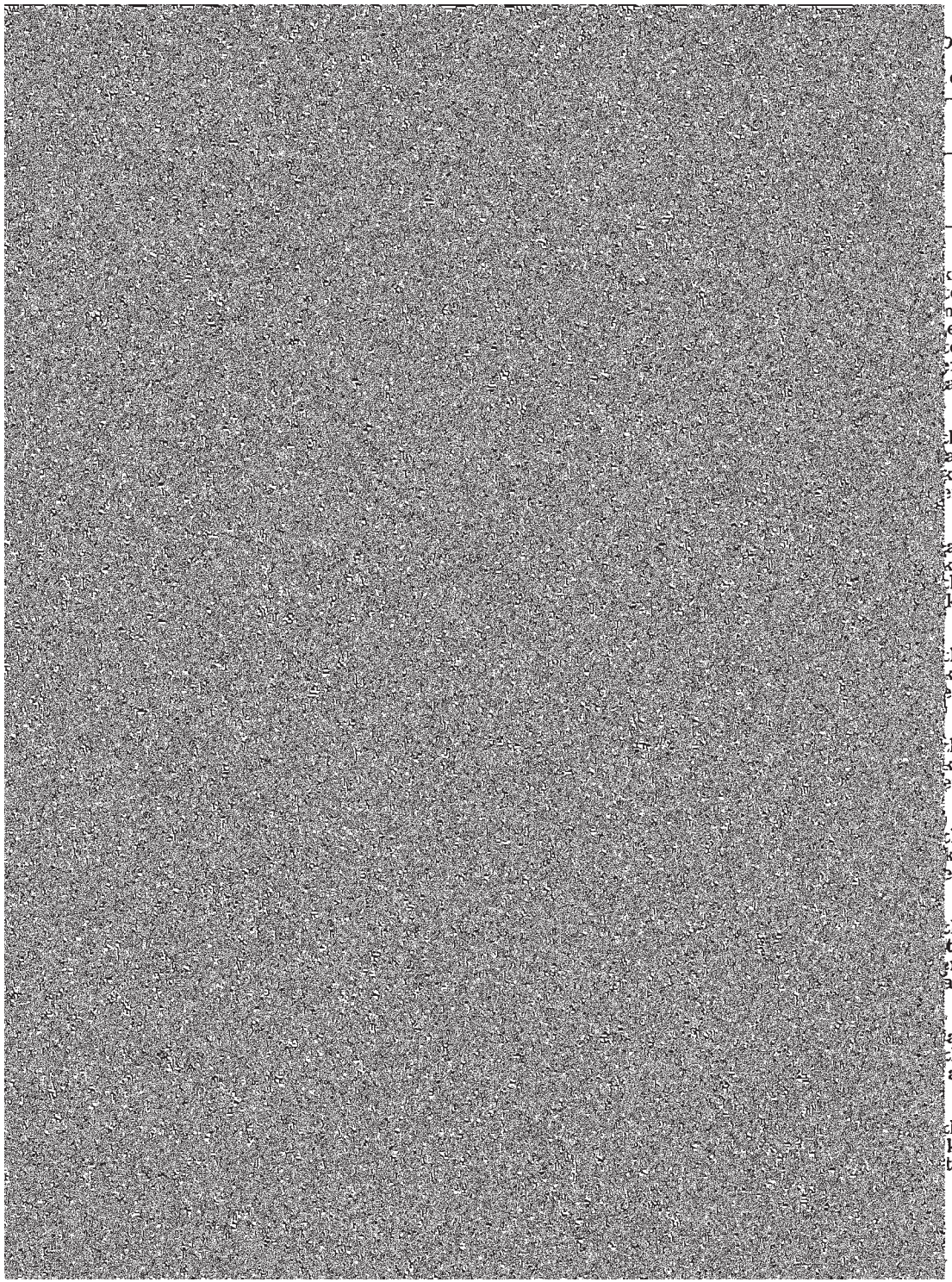
Wildlife area 3—This area is in the Deford-Yahara Variant-Carbondale and Carbondale-Cathro associations, which are in the southern one-third of the county. The soils are nearly level and are medium textured, coarse textured, and organic that remain wet much of the year. Most of this area is used for pasture, woodland, or wetland wildlife habitat. Most of the wetlands in Door County are in Area 3. This area is closely interspersed with better drained soils of Area 2, and so it provides a variety of soil and land use conditions which favor wildlife.

Wildlife in this area includes mallards, wood ducks, and many species of diving ducks; white-tailed deer; ruffed grouse; cottontail rabbits; gray squirrels; and a limited number of ringneck pheasants and snowshoe hares.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife will either be scarce or will not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegeta-

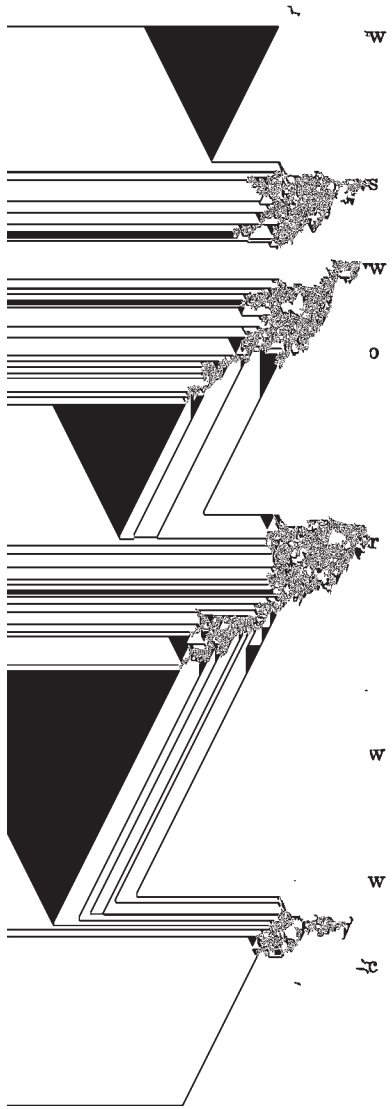




ductivity

entry in a column means the information was not available]

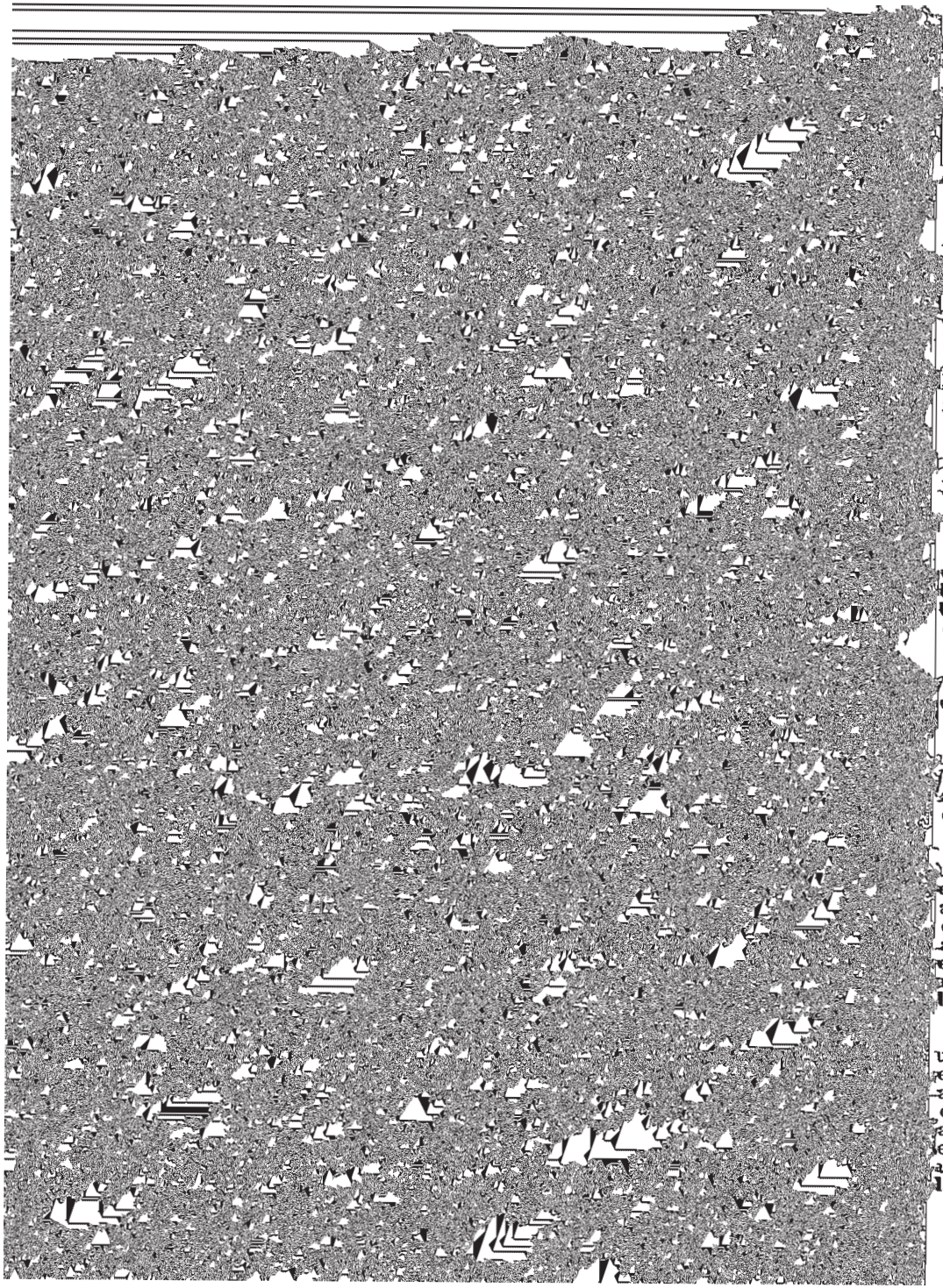
Potential productivity		Trees to plant
Important trees	Site index	
king aspen	60	White spruce, eastern white pine.
te ash		
mp white oak		
ern white pine		
te spruce		
r birch		
am fir		
hern white-cedar	29	Red pine, white spruce.
am fir		
king aspen		
r birch		
am fir	45	White ash, northern white-cedar.
king aspen		
hern white-cedar		
k ash		
hern white-cedar	35	Poplars, white spruce.
king aspen		
r birch		
hern white-cedar	35	Poplars, white spruce.
king aspen		
r birch		
hern white-cedar	25	Poplars, white spruce.
king aspen		
r birch		
hern red oak	66	Eastern white pine, red pine.
te oak		
rican basswood		
ar maple		
am fir		
hern white-cedar	34	
arack	45	
hern red oak	55	Red pine, jack pine.
k oak		
te oak		



w	Severe	Severe	Severe	Severe	Balsam fir		
					Tamarack	50	
					Northern white-cedar	33	
					Red maple		
					White ash		
w	Severe	Severe	Severe	Severe	Balsam fir	50	
					Black ash		
					Paper birch		
					Northern white-cedar		
					Red maple		
					Quaking aspen		
					Tamarack		
w	Severe	Severe	Severe	Severe	Quaking aspen	45	Red maple, white ash.
					Balsam fir		
					Red maple		
					Silver maple		
					White ash		
s	Slight	Moderate	Slight	Slight	Northern red oak	53	Red pine, jack pine.
					Paper birch		
w	Severe	Moderate	Moderate	Severe	White ash	55	White ash, red maple, white spruce.
					Red maple		
o	Slight	Slight	Slight	Moderate	Sugar maple	61	White spruce, red pine, eastern white pine.
					Yellow birch		
					Red pine		
					American basswood		
					American beech		
					Quaking aspen	75	
					Eastern white pine		
					Northern red oak		
r	Moderate	Slight	Slight	Moderate	Sugar maple	61	White spruce, red pine.
					Yellow birch		
					Red pine		
					American basswood		
					American beech		
					Quaking aspen	75	
					Eastern white pine		
					Northern red oak		
w	Moderate	Moderate	Moderate	Severe	Northern red oak	65	White spruce, Norway spruce, eastern white pine, northern white-cedar.
					Pin oak		
					White ash		
					American basswood		
w	Severe	Moderate	Moderate	Severe	Red maple	50	Red maple, white ash, poplars.
					White ash		
c	Slight	Slight	Slight	Moderate	Northern red oak	66	Eastern white pine, red pine, white spruce.
					Sugar maple		
					White ash		
					American basswood		

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
KkD3	2c	Severe	Severe	Slight	Moderate	Northern red oak	66	Eastern white pine, red pine, white spruce.
						Sugar maple		
						White ash		
						American basswood		
Kiva:								
KmB, KmC	2s	Slight	Slight	Slight	Moderate	Sugar maple	61	Red pine, white spruce, eastern white pine, Austrian pine.
						American basswood		
						Quaking aspen		
						Bigtooth aspen		
Kolberg:								
KoA, KoB, KoC2	2c	Slight	Moderate	Moderate	Moderate	Northern red oak	66	Eastern white pine, red pine, white spruce.
						Sugar maple	67	
						White ash		
						American basswood		
Kolberg Variant:								
KvB, KvC2	3d	Slight	Moderate	Moderate	Slight	Sugar maple	53	Red pine.
						Red pine		
						Eastern white pine		
						Northern red oak		
						Northern white-cedar		
Longrie:								
LoA, LoB, LoC	2o	Slight	Slight	Slight	Moderate	Sugar maple	61	White spruce, eastern white pine, red pine.
						Yellow birch		
						American beech		
						American basswood		
						Northern red oak		
						Red pine		
Manawa:								
McA	2c	Slight	Slight	Slight	Moderate	Sugar maple	58	Red maple, green ash, white ash, white spruce.
						American beech		
						Green ash	52	
						Red maple	52	
Manistee:								
MeB	2s	Slight	Moderate	Slight	Moderate	Sugar maple	61	Red pine.
						Eastern white pine		
						Red maple		
						Red pine		
						American basswood		
						Eastern hemlock		
						Northern red oak		
						White ash		
Markey:								
Mk	3w	Severe	Severe	Severe	Severe	Balsam fir	50	
						Tamarack		
						Quaking aspen		
						Northern white-cedar		
						Red maple		



ugar maple	49	Red pine, eastern white pine.
hite ash	50	
astern white pine		
orthern white-cedar		
orthern white-cedar	25	
hite ash		
ugar maple	61	White spruce, eastern cottonwood.
ellow birch		
astern white pine		
hite ash		
merican basswood		
ugar maple	60	Eastern white pine, white spruce.
ellow birch		
merican beech		
ugar maple	58	Eastern white pine, red pine, white spruce.
orthern red oak		
hite ash		
ed maple		
uaking aspen	40	
lack ash		
lack spruce		
orthern white-cedar		
hite ash	65	White spruce, red maple, white ash.
ed maple		
ugar maple	49	Red pine, eastern white pine.
hite ash	50	
astern white pine		
orthern white-cedar		
ugar maple	61	Red pine, jack pine, white spruce.
ed maple		
alsam fir		
orthern red oak	70	
astern white pine	65	
ed pine	65	
ack pine	55	
lack oak	66	
ugar maple	61	Red pine, jack pine, white spruce.
ed maple		
alsam fir		
orthern red oak	70	
astern white pine	65	
ed pine	65	
ack pine	55	
lack oak	66	

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
Shawano part	2s	Slight	Slight	Slight	Moderate	Northern red oak	66	Red pine, eastern white pine.
						Red pine	62	
						Eastern white pine	66	
						Red maple		
						Paper birch		
[1] RpD: Rousseau part	2s	Severe	Severe	Slight	Moderate	Sugar maple	61	Red pine, jack pine, white spruce.
						Red maple		
						Balsam fir		
						Northern red oak	70	
						Eastern white pine	65	
						Red pine	65	
						Jack pine	55	
						Black oak	66	
Shawano part	2s	Moderate	Slight	Slight	Moderate	Northern red oak	66	Red pine, eastern white pine.
						Red pine	62	
						Eastern white pine	66	
						Red maple		
						Paper birch		
[1] RrB: Rousseau part	2s	Slight	Severe	Slight	Moderate	Sugar maple	61	Red pine, jack pine, white spruce.
						Red maple		
						Balsam fir		
						Northern red oak	70	
						Eastern white pine	65	
						Red pine	65	
						Jack pine	55	
						Black oak	66	
Deford part	5w	Severe	Severe	Severe	Severe	Quaking aspen	45	
						Balsam fir		
						Northern white-cedar		
						American basswood		
						Red maple		
						Silver maple		
Sisson: SnA, SnB	1o	Slight	Slight	Slight	Moderate	Northern red oak	70	Eastern white pine, white spruce, Norway spruce, red pine.
						White ash		
						American basswood		
						Sugar maple		
Solona: SoA	2o	Slight	Slight	Slight	Moderate	Sugar maple	63	Eastern white pine, red pine, white spruce.
						Northern red oak	68	
						White ash		
						American basswood		
Suamico: Su	3w	Severe	Severe	Severe	Severe	Northern white-cedar	35	
						Tamarack		
						Red maple		
						White ash		

gar maple	50	Red pine, eastern white pine.
per birch		
aking aspen		
rthern white-cedar		
aking aspen	60	White spruce, Norway spruce, eastern white pine.
ite ash		
l maple		
gar maple		
rthern red oak		
l maple	70	Eastern white pine, white spruce, silver maple, white ash.
gar maple	60	
rthern red oak	70	
erican basswood		
erican beech		
ver maple	93	Silver maple, red maple, white ash.
l maple	90	
ite ash	80	

nit description for the composition and behavior of the whole

TABLE 4.—*Windbreaks and environmental plantings*

[The symbol < means less than; the symbol > means greater than. Absence of an entry means soil does not normally grow trees of this height class]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of—				
	<8	8–15	16–25	26–35	>35
Allendale: AdA		White spruce, American cranberrybush, silky dogwood.	Black spruce, northern white-cedar, tall purple willow.		
Alpena: ApC		White spruce nannyberry viburnum.	Red pine, eastern white pine, northern white-cedar, Austrian pine, Siberian crabapple, hawthorn.	American mountain-ash.	
Angelica: Ax		White spruce, silky dogwood.	Northern white-cedar, black spruce.		Carolina poplar.
Beaches: Be.					
Bonduel: Bn		Northern white-cedar, red-osier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	
Bonduel Variant: Bo, Bp		Northern white-cedar, red-osier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	
Boyer: BrB, BrC, BrD		Autumn-olive, Vanhoutte spirea, Tatarian honeysuckle, Amur privet.	Red pine	Eastern white pine, jack pine.	
Carbondale: Ca		Black spruce, silky dogwood.	Austrian pine, nannyberry viburnum.	Northern white-cedar, Scotch pine.	
Casco: CcB, CcC2		Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	
Cathro: Cm		Tatarian honeysuckle, silky dogwood, white spruce.	Austrian pine, laurel willow.	Northern white-cedar, eastern white pine.	
Chippeny: Cp		Silky dogwood, Tatarian honeysuckle.		Northern white-cedar.	Red maple.
Deford: De		Nannyberry viburnum, arrowwood.	Northern white-cedar, eastern white pine, black spruce.		

TABLE 4.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of—				
	<8	8–15	16–25	26–35	>35
Duel: DuB		White spruce	Eastern white pine, hawthorn, Siberian crabapple.	Red pine, red maple, jack pine.	
Duel Variant: Dv		Northern white-cedar, red-osier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	
Emmet: EmA, EmB, EmC2, EmD2, EmE.		White spruce, arrowwood, lilac, blue spruce, Amur honeysuckle.	Red pine		Red maple.
Fabius: Fa.					
Fluvaquents: Fu		Northern white-cedar, red-osier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	
Gravel pits: Gp.					
Kewaunee: KhA, KhB, KhC2, KkD3.		Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	
Kiva: KmB, KmC		White spruce, nannyberry viburnum, shadblow serviceberry.	Red pine, eastern white pine, Austrian pine, hawthorn, Siberian crabapple.		
Kolberg: KoA, KoB, KoC2		Northern white-	White spruce,	Eastern white pine,	

TABLE 4.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of—				
	<8	8–15	16–25	26–35	>35
Markey: Mk		Silky dogwood	Austrian pine, laurel willow.	Eastern white pine, Scotch pine, northern white-cedar.	
Namur: NaB, NaC	Manyflower cotoneaster.	Lilac	Norway spruce, Siberian peashrub.	Eastern white pine, red pine, jack pine.	
Namur Variant: Nv		Northern white-cedar, red-osier dogwood, nanny-berry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	
Omena: OmB, OmC, OmD		White spruce, Amur privet.	Northern white-cedar.	White ash	Carolina poplar.
Omena Variant: OvB		Northern white-cedar, red-osier dogwood, nanny-berry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	
Omro: OzB		Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	
Pinconning: Pn		Silky dogwood	Northern white-cedar, black spruce, red maple.		
Poygan: Po.					
Rock outcrop: Ra.					
Namur: [1] Rb	Manyflower cotoneaster.	Lilac	Norway spruce, Siberian peashrub.	Eastern white pine, red pine, jack pine.	
Rondeau: Rn		Late lilac, nanny-berry viburnum, common ninebark.	Japanese tree lilac	Laurel willow	Carolina poplar, almondleaf willow.
Rousseau: RoB, RoC	Vanhoutte spirea	White spruce, Tatarian honey-suckle, autumn-olive.	Eastern white pine, Austrian pine, Norway spruce.	Red pine, jack pine.	Carolina poplar.
[1] RpC: Rousseau part	Vanhoutte spirea	White spruce, Tatarian honey-suckle, autumn-olive.	Eastern white pine, Austrian pine, Norway spruce.	Red pine, jack pine.	Carolina poplar.
Shawano part	Manyflower cotoneaster.	Lilac	Norway spruce, Siberian peashrub.	Eastern white pine, red pine, jack pine.	

TABLE 4.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of—				
	<8	8–15	16–25	26–35	>35
[1] RpD: Rousseau part	Vanhoutte spirea	White spruce, Tatarian honeysuckle, autumn-olive.	Eastern white pine, Austrian pine, Norway spruce.	Red pine, jack pine.	Carolina poplar.
Shawano part	Manyflower cotoneaster.	Lilac	Norway spruce, Siberian peashrub.	Eastern white pine, red pine, jack pine.	
[1] RrB: Rousseau part	Vanhoutte spirea	White spruce, Tatarian honeysuckle, autumn-olive.	Eastern white pine, Austrian pine, Norway spruce.	Red pine, jack pine.	Carolina poplar.
Deford part		Nannyberry viburnum, arrowwood.	Northern white-cedar, eastern white pine, black spruce.		
Saprists: Sa.					
Sisson: SnA, SnB	Silky dogwood	Tatarian honeysuckle, Amur privet.	Laurel willow, red pine.	Eastern white pine	Green ash, Carolina poplar.
Solona:					

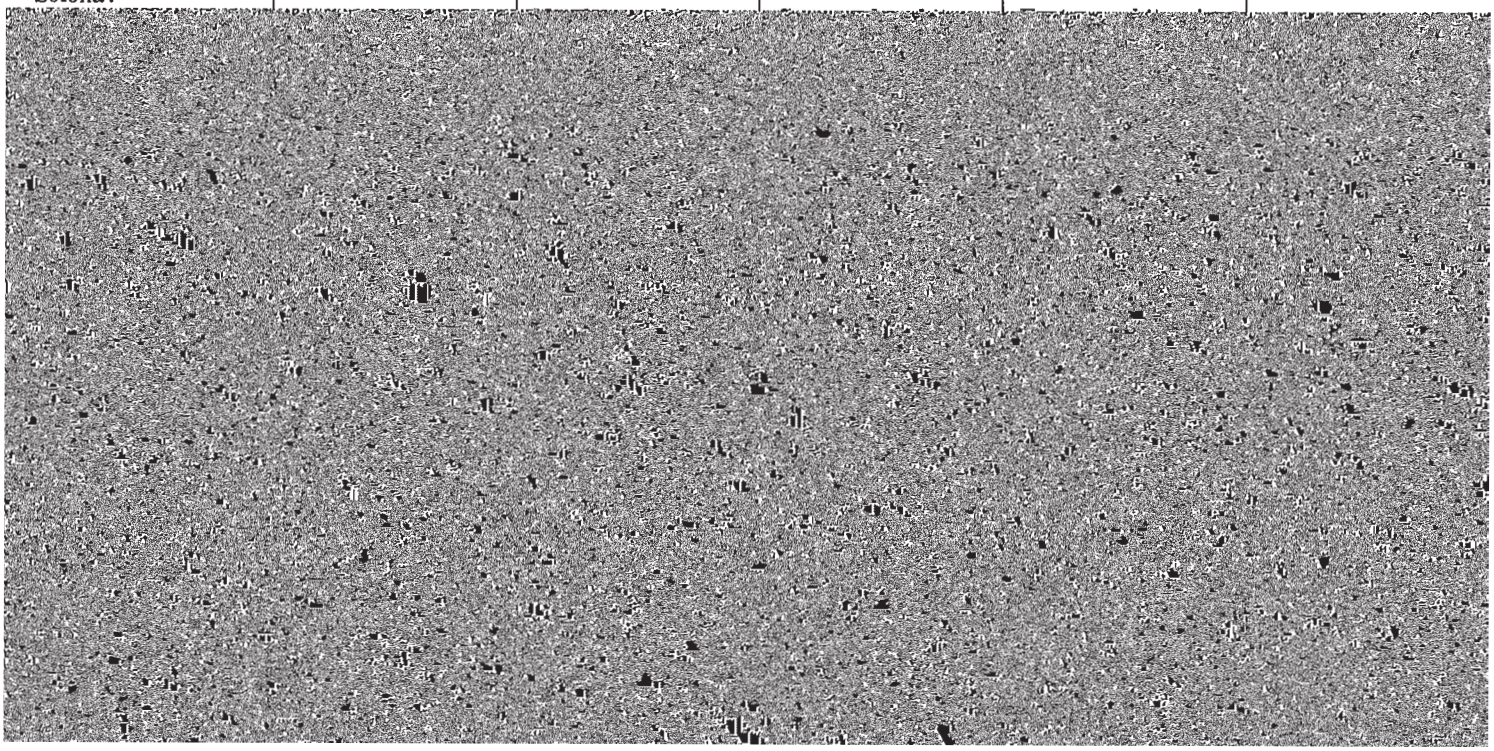


TABLE 4.—*Windbreaks and environmental plantings*—Continued

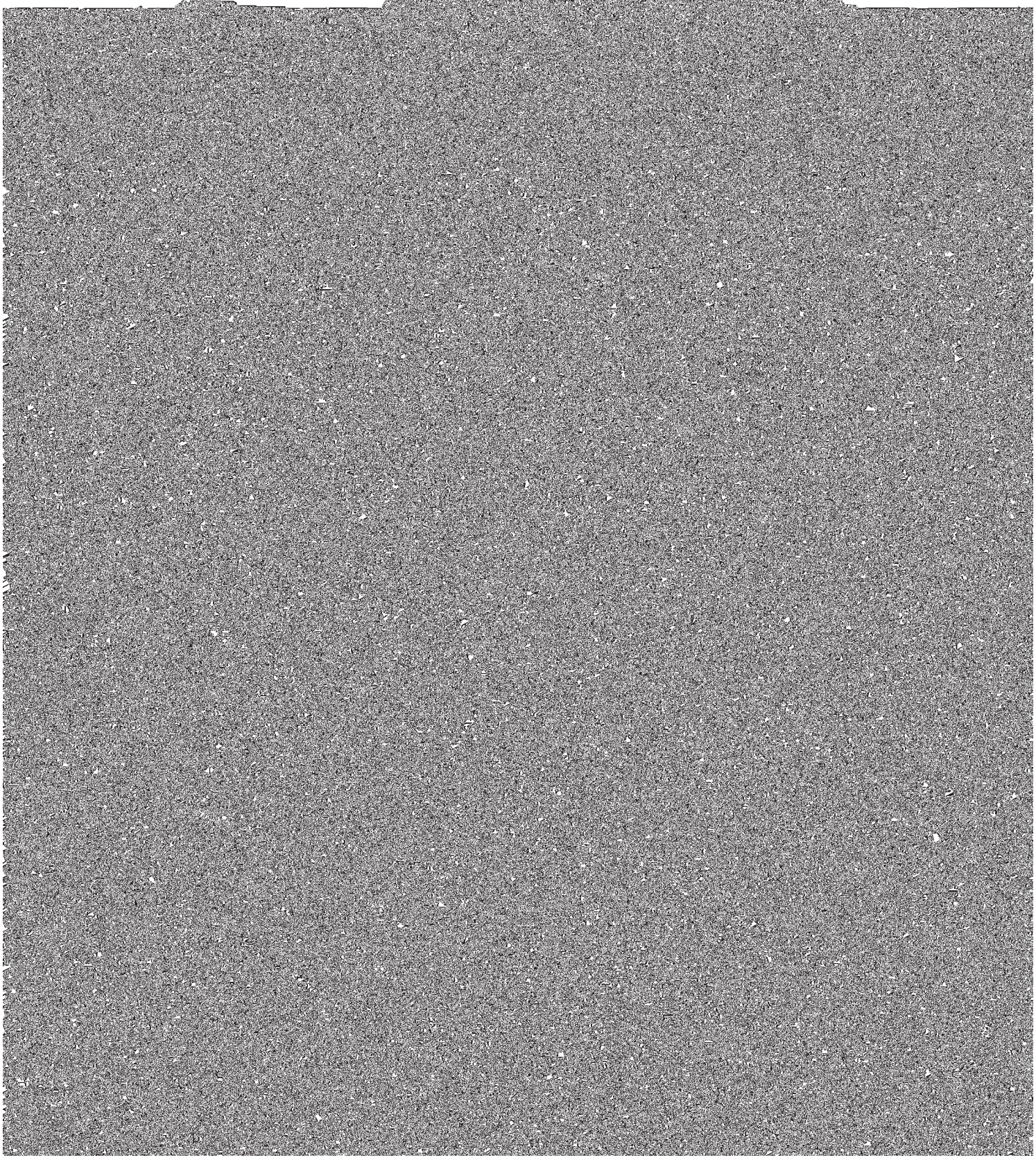


TABLE 5.—*Recreational development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Allendale: AdA	Severe: wetness	Moderate: wetness, too sandy.	Severe: wetness	Moderate: wetness, too sandy.
Alpena: ApC	Moderate: small stones.	Moderate: small stones.	Severe: slope	Slight.
Angelica: Ax	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Beaches: Be.				
Bonduel: Bn	Moderate: wetness	Moderate: wetness	Moderate: wetness, depth to rock.	Moderate: wetness.
Bonduel Shallow Variant: Bo	Moderate: wetness	Moderate: wetness	Severe: depth to rock	Moderate: wetness.
Bonduel Wet Variant: Bp	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Boyer: BrB	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
BrC, BrD	Moderate: too sandy	Moderate: too sandy	Severe: slope	Moderate: too sandy.
Carbondale: Ca	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.
Casco: CcB	Slight	Slight	Moderate: slope	Slight.
CcC2	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Cathro: Cm	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.
Chippeny: Cp	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.
Deford: De	Severe: wetness, floods	Severe: wetness	Severe: wetness, floods.	Severe: wetness.
Duel: DuB	Moderate: too sandy	Moderate: too sandy	Moderate: depth to rock, too sandy.	Moderate: too sandy.
Duel Variant: Dv	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness.
Emmet: EmA	Slight	Slight	Slight	Slight.
EmB	Slight	Slight	Moderate: slope	Slight.
EmC2	Moderate: slope	Moderate: slope	Severe: slope	Slight.
EmD2	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
EmE	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Fabius: Fa	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness.
Fluvaquents: Fu	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Gravel pits: Gp.				
Kewaunee: KhA, KhB	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
KhC2	Moderate: percs slowly.	Moderate: slope	Severe: slope	Slight.
KkD3	Severe: too clayey, slope.	Severe: slope	Severe: too clayey, slope.	Severe: too clayey.
Kiva: KmB	Slight	Slight	Moderate: slope, small stones.	Slight.
KmC	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Kolberg:				

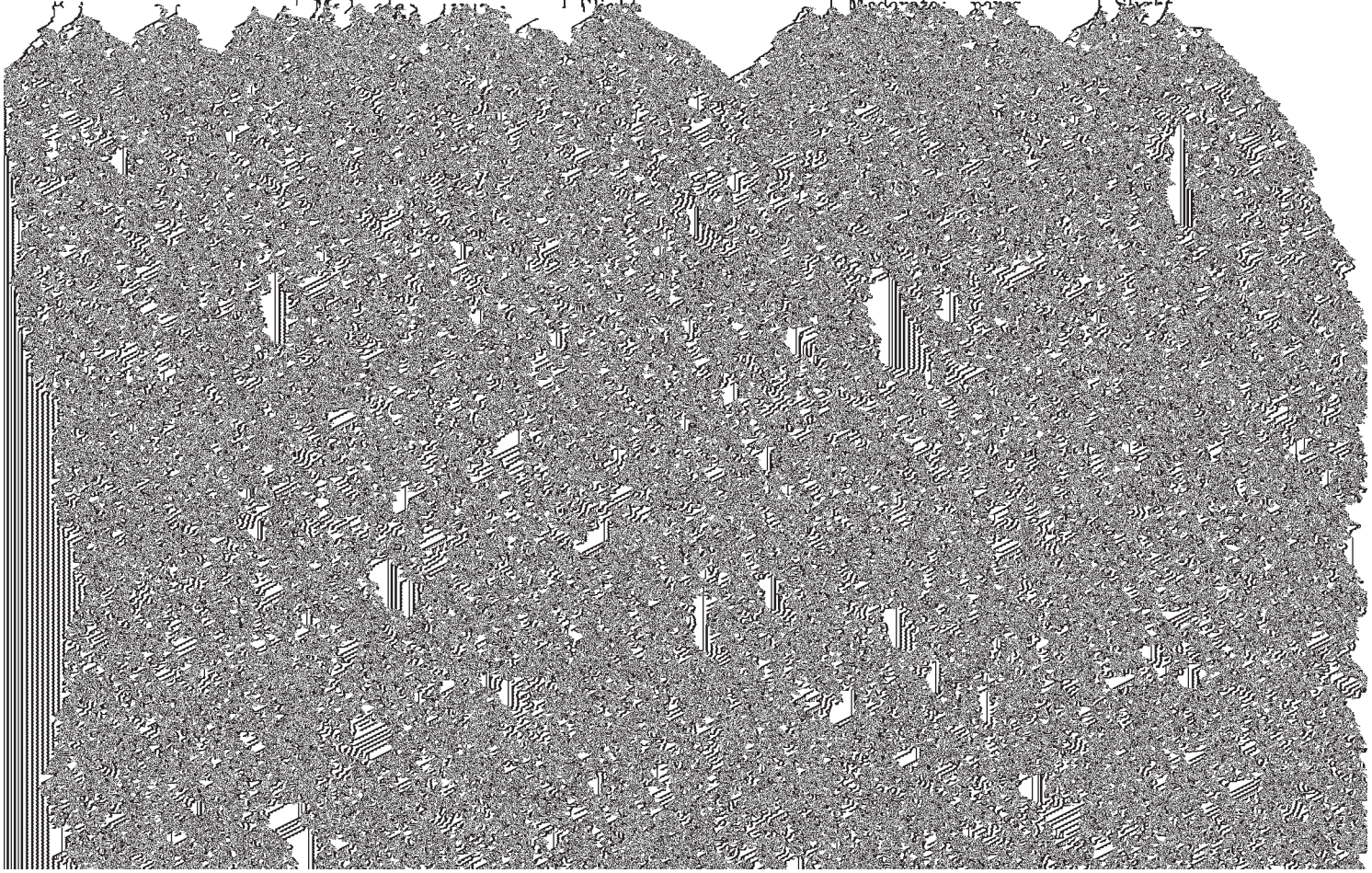


TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Omena:				
OmB	Slight	Slight	Moderate: slope	Slight.
OmC	Moderate: slope	Moderate: slope	Severe: slope	Slight.
OmD	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Omena Variant:				
OvB	Moderate: wetness	Moderate: wetness	Moderate: wetness, slope.	Moderate: wetness.
Omro:				
OzB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Pinconning:				
Pn	Severe: wetness, floods.	Severe: wetness	Severe: wetness, floods.	Severe: wetness.
Poygan:				
Po	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Rock outcrop:				
Ra.				
Namur:				
[1] Rb	Moderate: slope	Moderate: slope	Severe: depth to rock, slope.	Slight.
Rondeau:				
Rn	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.
Rousseau:				
RoB	Moderate: soil blowing, too sandy.	Moderate: soil blowing, too sandy.	Severe: soil blowing, too sandy.	Severe: soil blowing, too sandy.
RoC	Moderate: soil blowing, slope, too sandy.	Moderate: soil blowing, slope, too sandy.	Severe: soil blowing, slope, too sandy.	Severe: soil blowing, too sandy.
[1] RpC:				
Rousseau part	Moderate: soil blowing, too sandy.	Moderate: soil blowing, too sandy.	Severe: soil blowing, slope, too sandy.	Severe: soil blowing, too sandy.
Shawano part	Moderate: too sandy, soil blowing.	Moderate: too sandy, soil blowing.	Severe: too sandy, slope.	Severe: too sandy, soil blowing.
[1] RpD:				
Rousseau part	Severe: slope	Severe: slope	Severe: soil blowing, slope, too sandy.	Severe: soil blowing, too sandy.
Shawano part	Severe: slope	Severe: slope	Severe: too sandy, slope.	Severe: too sandy, soil blowing.
[1] RrB:				
Rousseau part	Moderate: soil blowing, too sandy.	Moderate: soil blowing, too sandy.	Severe: soil blowing, too sandy.	Severe: soil blowing, too sandy.
Deford part	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness

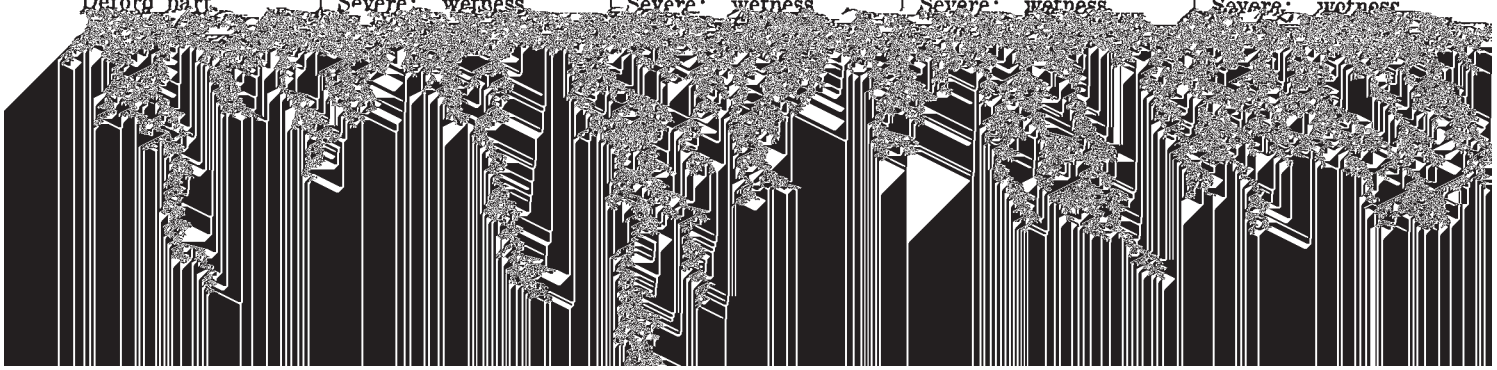


TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Suamico: Su	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.
Summerville: SvA, SvB	Slight	Slight	Severe: depth to rock.	Slight.
SvC	Moderate: slope	Moderate: slope	Severe: depth to rock, slope.	Slight.
SvD	Severe: slope	Severe: slope	Severe: depth to rock, slope.	Moderate: slope.
Udipsamments: Ud	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Udorthents: Uo	Severe: small stones	Severe: small stones	Severe: small stones	Severe: small stones.
Wainola: Wa	Severe: wetness	Moderate: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.
Yahara: YaA	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness.
Yahara Variant: Yv	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

geese, herons, shore birds, rails, kingfishers, muskrat of the soil material. Where pertinent data about kinds

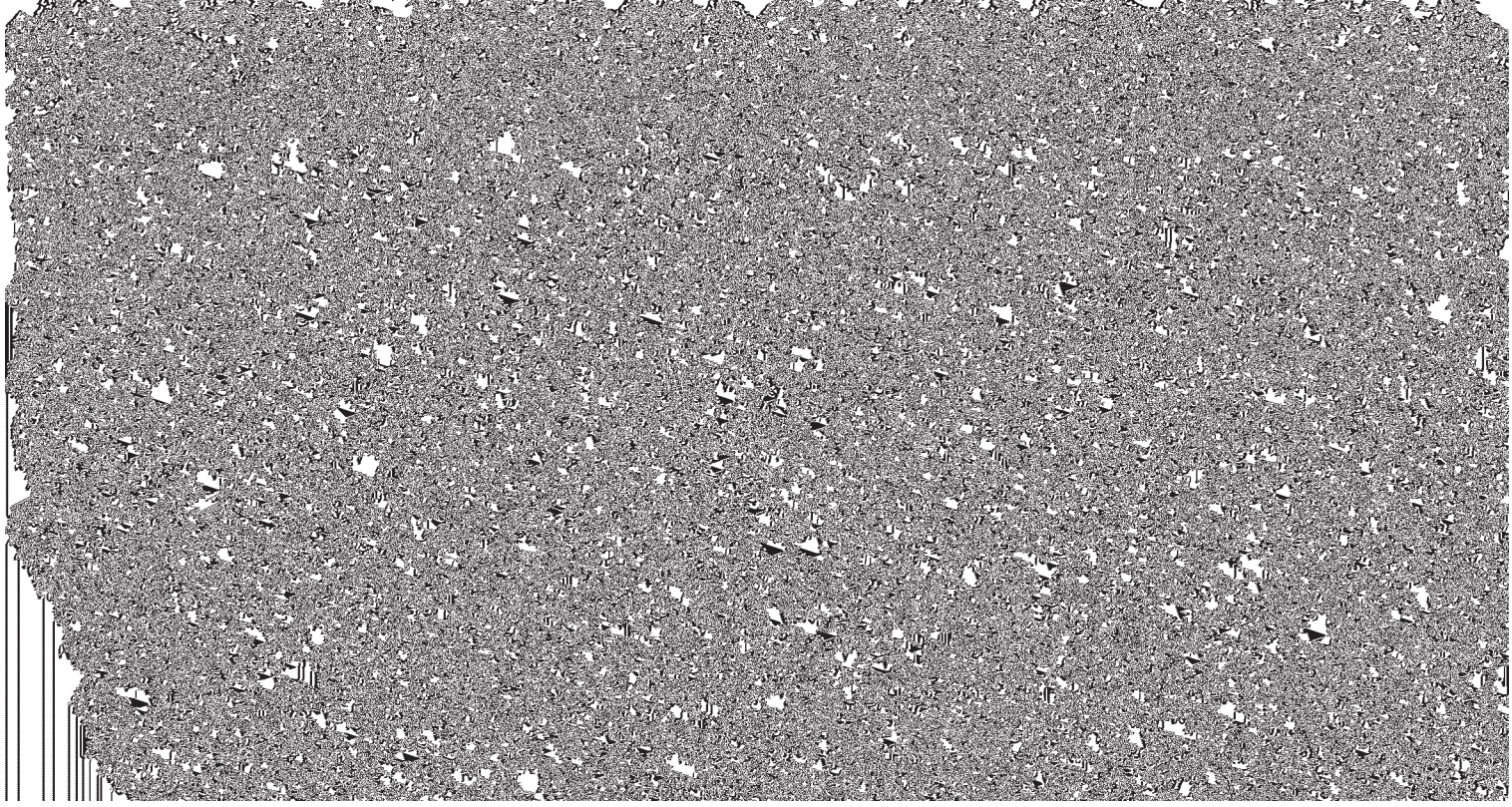


TABLE 6.—*Wildlife habitat potentials*

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Allendale: AdA	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Alpena: ApC	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Angelica: Ax	Good	Fair	Good	Good	Fair	Good	Good	Good	Good	Good.
Beaches: Be.										
Bonduel: Bn	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Bonduel Shallow Variant: Bo	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor.
Bonduel Wet Variant: Bp	Fair	Good	Good	Good	Good	Good	Good	Good	Good	Good.
Boyer: BrB, BrC, BrD	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Carbondale: Ca	Poor	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good.
Casco: CcB, CcC2	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
Cathro: Cm	Poor	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good.
Chippeny: Cp	Poor	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good.
Deford: De	Poor	Poor	Fair	Good	Fair	Good	Good	Poor	Fair	Good.
Duel: DuB	Poor	Fair	Fair	Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor.
Duel Variant: Dv	Fair	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
Emmet: EmA, EmB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
EmC2	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
EmD2	Poor	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
EmE	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Fabius: Fa	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.

TABLE 6.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Fluvaquents: Fu	Poor	Poor	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair.
Gravel pits: Gp.										
Kewaunee: KhA	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
KhB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
KhC2	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
KkD3	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Kiva: KmB	Fair	Good	Good	Fair	Fair	Poor	Very poor	Good	Fair	Very poor.
KmC	Fair	Good	Good	Fair	Fair	Very poor	Very poor	Good	Fair	Very poor.
Kolberg: KoA, KoB, KoC2	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Kolberg Variant: KvB	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
KvC2	Poor	Fair	Fair	Poor	Poor	Poor	Very poor	Fair	Poor	Very poor.
Longrie: LoA, LoB	Fair	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
LoC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Manawa: McA	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
Manistee: MeB	Poor	Fair	Good	Good	Good	Poor	Very poor	Fair	Good	Very poor.
Markey: Mk	Poor	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
Namur: NaB, NaC	Poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Fair	Very poor.
Namur Variant: Nv	Very poor	Very poor	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor.
Omena: OmB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
OmC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
OmD	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Omena Variant: OvB	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Omro: OzB	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Pinconning: Pn	Fair	Poor	Fair	Good	Fair	Good	Good	Fair	Fair	Good.

Poygan: Po	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
Rock outcrop: Ra.										
Namur: [1] Rb	Poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Fair	Very poor.
Rondeau: Rn	Poor	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good.
Rousseau:										
RoB	Poor	Poor	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Poor.
RoC	Poor	Poor	Good	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
[1] RpC:										
Rousseau part	Poor	Poor	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Poor.
Shawano part	Poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor.
[1] RpD:										
Rousseau part	Poor	Poor	Good	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
Shawano part	Very poor	Very poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor.
[1] RrB:										
Rousseau part	Poor	Poor	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Poor.
Deford part	Poor	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.
Saprists: Sa	Very poor	Fair	Fair	Fair	Good	Good	Good	Poor	Good	Good.
Sisson:										
SnA	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
SnB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Solona: SoA	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
Suamico: Su	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Summerville:										
SvA, SvB	Very poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor	Very poor	Very poor.
SvC, SvD	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Udipsamments: Ud	Poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Udorthents: Uo	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Wainola: Wa	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Yahara: YaA	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
Yahara Variant: Yv	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

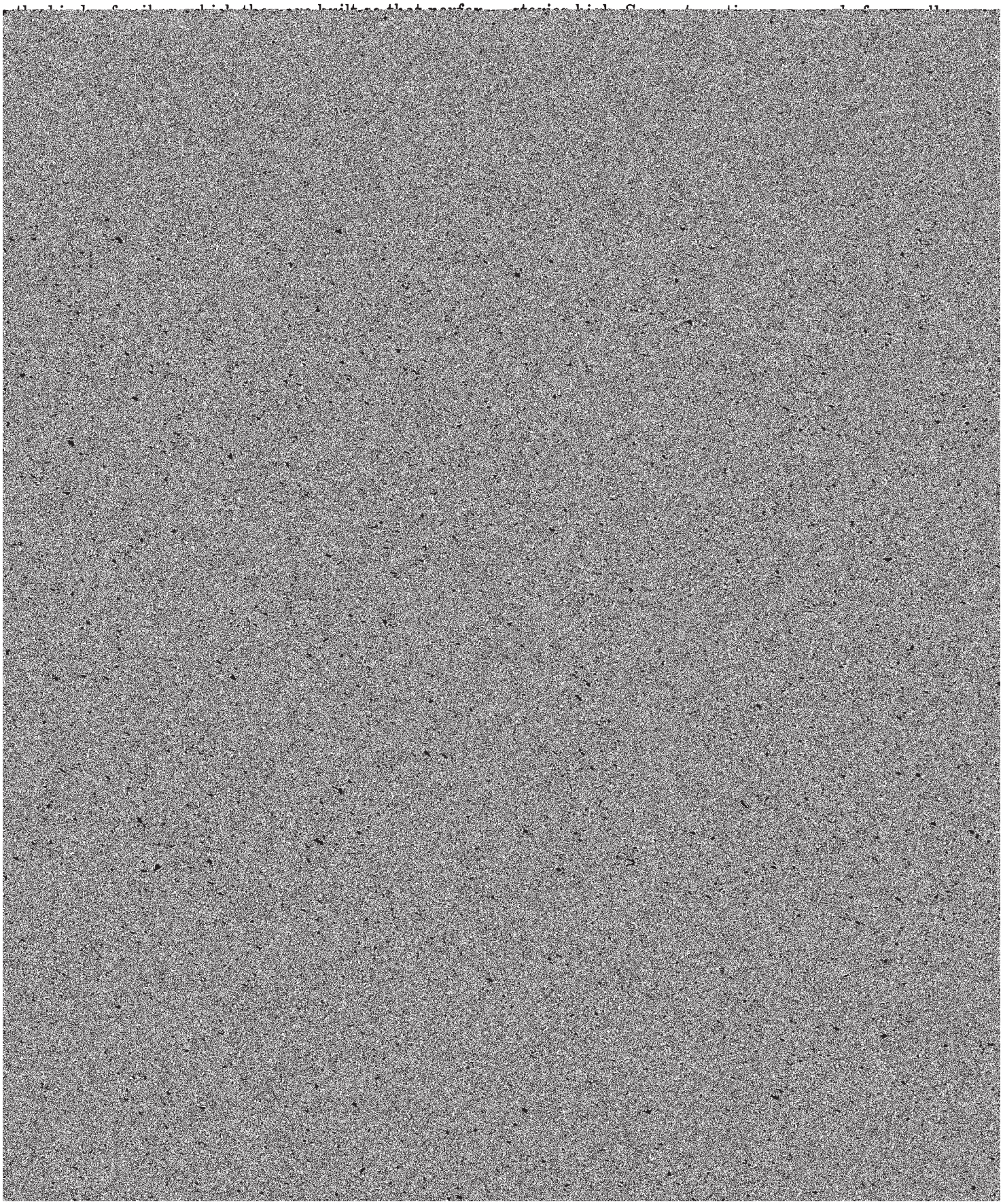


TABLE 7.—*Building site development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Allendale: AdA	Severe: wetness, cutbanks cave.	Severe: wetness, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, low strength, shrink-swell.	Severe: low strength, shrink-swell.
Alpena: AnC	Severe: cutbanks	Slight	Slight	Moderate: slope	Slight

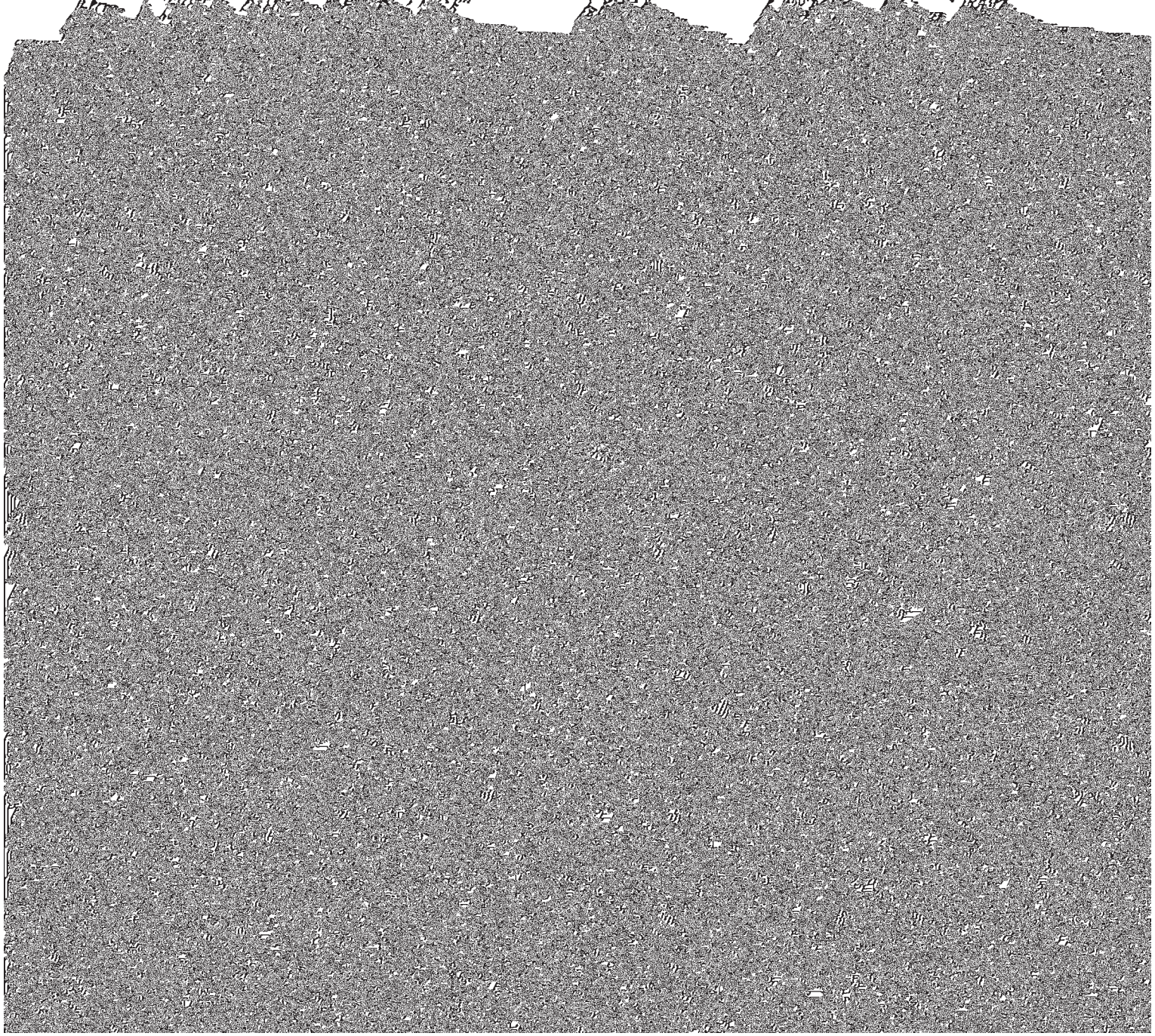


TABLE 7.—*Building site development*—Continued

Soil name and	Shallow	Dwellings without	Dwellings with	Small commercial	Local roads

TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Kolberg Variant:					
KvB	Moderate: depth to rock.	Moderate: low strength, shrink-swell, depth to rock.	Moderate: depth to rock.	Moderate: low strength, shrink-swell, depth to rock.	Severe: low strength.
KvC2	Moderate: depth to rock, slope.	Moderate: low strength, depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope	Severe: low strength.
Longrie:					
LoA, LoB	Severe: depth to rock.	Moderate: depth to rock, frost action.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, frost action.
LoC	Severe: depth to rock.	Moderate: depth to rock, slope, frost action.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: depth to rock, frost action.
Manawa:					
McA	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, low strength.
Manistee:					
MeB	Moderate: cutbanks cave.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Markey:					
Mk	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods, frost action.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
Namur:					
NaB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
NaC	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
Namur Variant:					
Nv	Severe: wetness	Severe: wetness	Severe: wetness, depth to rock.	Severe: wetness	Severe: wetness.
Omena:					
OmB	Slight	Moderate: frost action.	Slight	Moderate: frost action, slope.	Moderate: frost action.
OmC	Moderate: slope	Moderate: slope, frost action.	Moderate: slope	Severe: slope	Moderate: frost action, slope.
OmD	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Omena Variant:					
OvB	Severe: wetness	Moderate: wetness.	Severe: wetness	Moderate: wetness, slope.	Severe: frost action.
Omro:					
OzB	Severe: too clayey.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.
Pinconning:					
Pn	Severe: floods, cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Poygan:					
Po	Severe: wetness, floods, too clayey.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.

TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Rock outcrop: Ra.					
Namur: [1] Rb	Severe: depth to	Severe: depth to	Severe: depth to	Severe: depth to	Severe: depth to

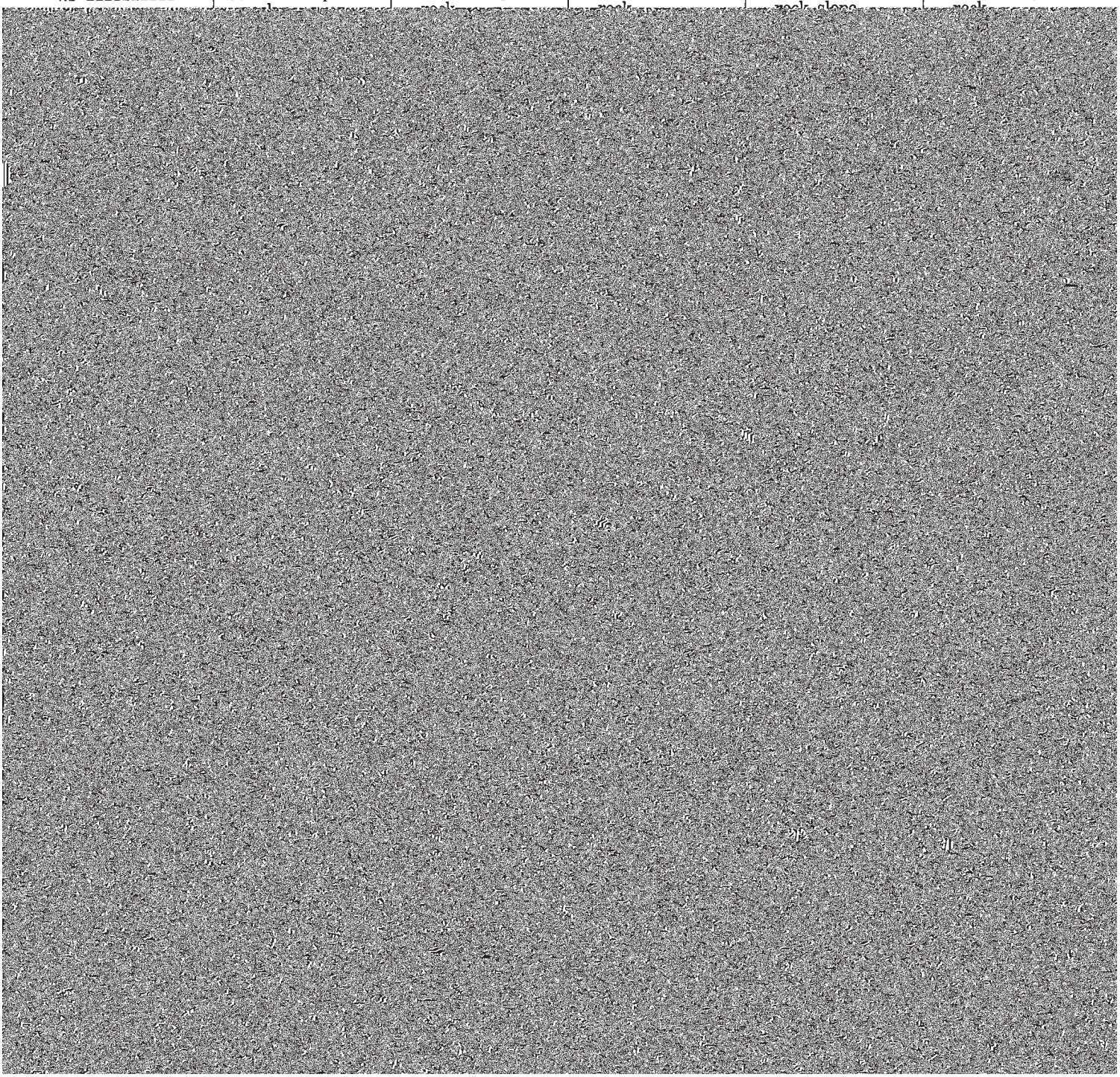
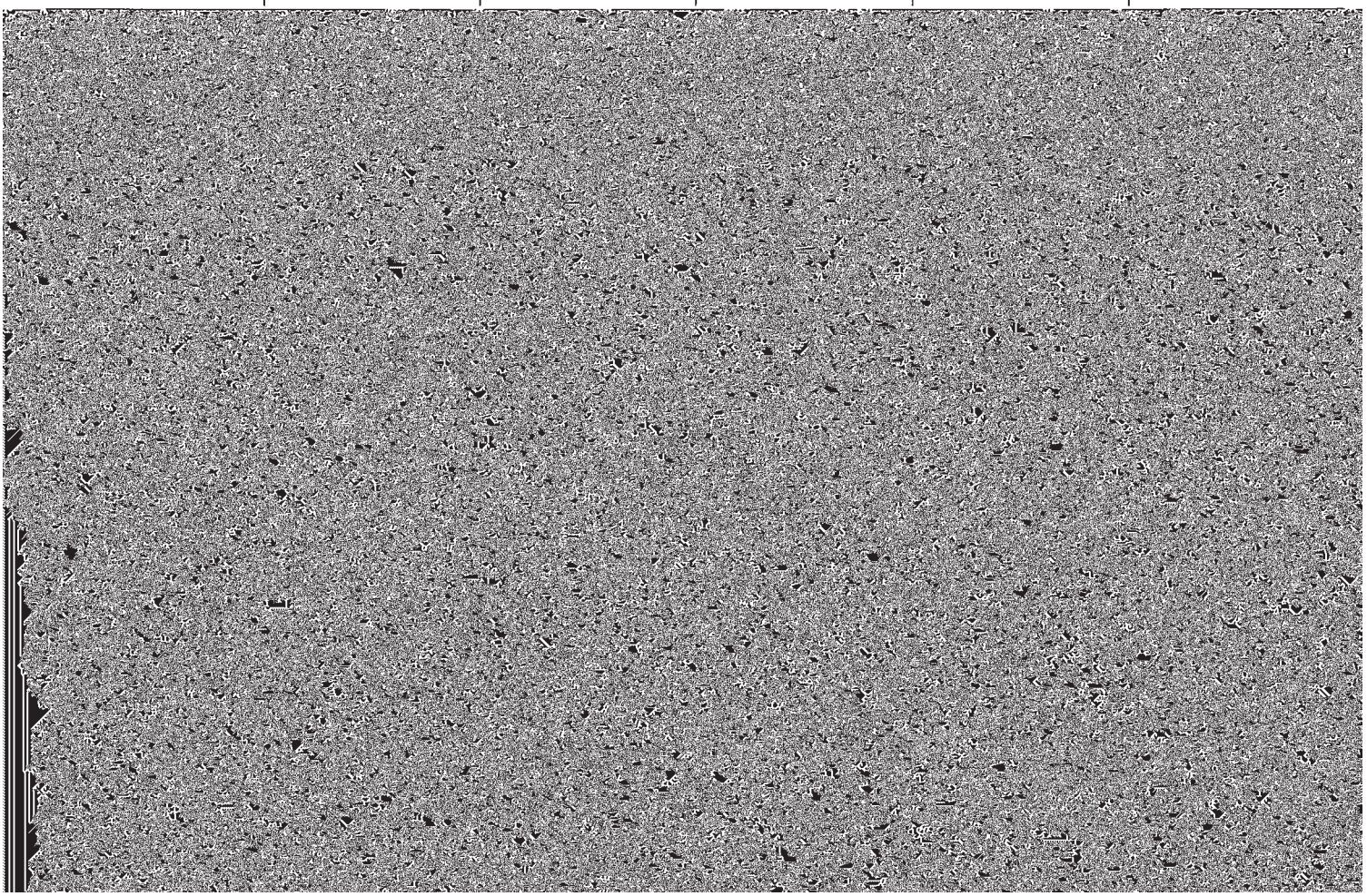


TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Summerville:—Con. SvD	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
Udipsamments: Ud	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Udorthents: Uo	Severe: small stones, cutbanks cave.	Slight	Slight	Slight	Slight.
Wainola: Wa	Severe: wetness, cutbanks cave.	Severe: wetness	Severe: wetness	Severe: wetness	Moderate: wetness, frost action.
Yahara: YaA	Severe: wetness	Severe: wetness, floods, frost action.	Severe: wetness, floods, frost action.	Severe: wetness, floods, frost action.	Severe: frost action.
Yahara Variant: Yv	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods, frost action.	Severe: wetness, floods, frost action.	Severe: wetness, floods, frost action.



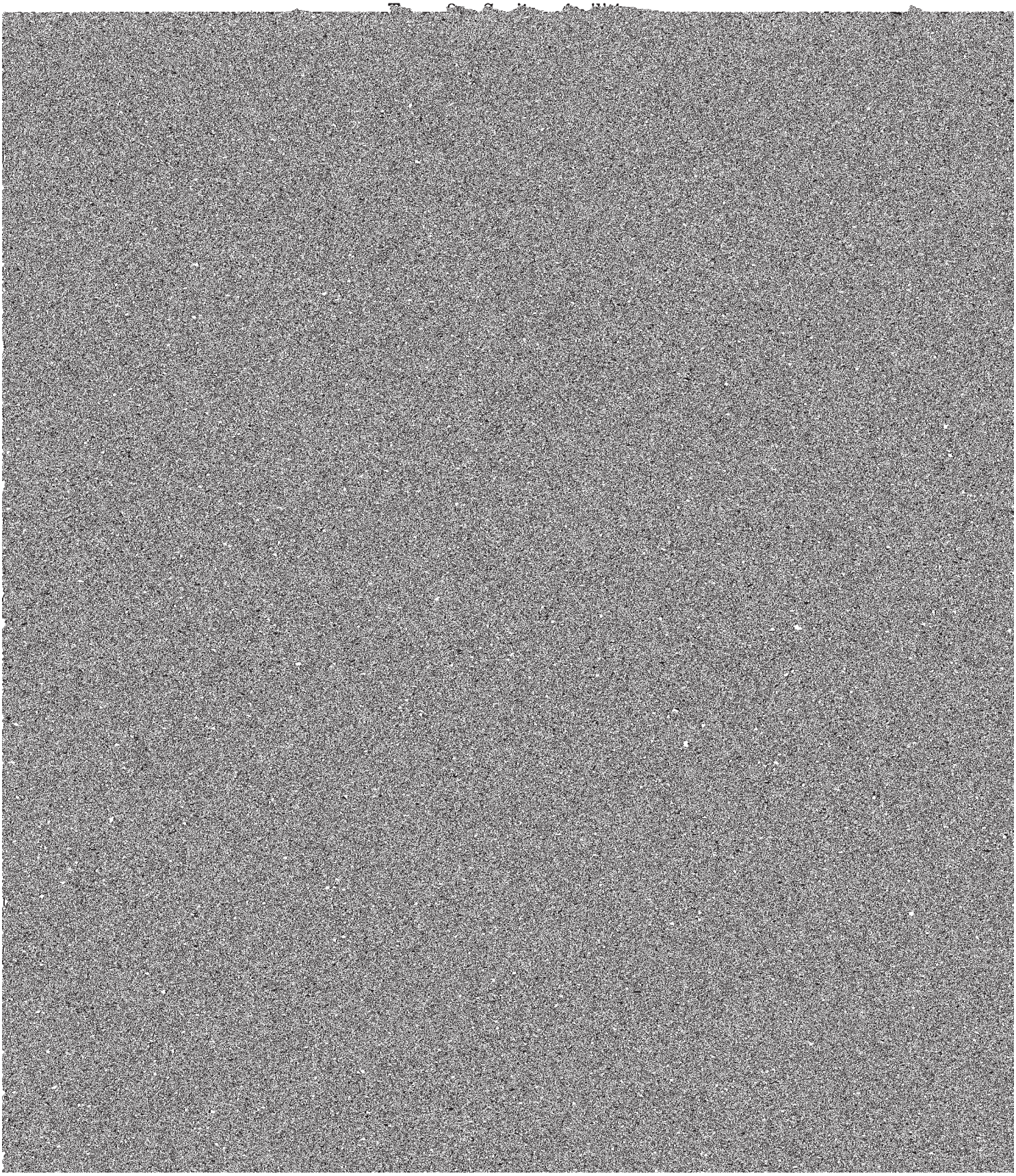


TABLE 8.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
EmC2	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope.
EmD2, EmE	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Fabius: Fa	Severe: wetness	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage	Poor: thin layer.
Fluvaquents: Fu	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Gravel pits: Gp.					
Kewaunee: KhA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
KhB	Severe: percs slowly.	Moderate: slope	Severe: too clayey.	Slight	Poor: too clayey.
KhC2	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Moderate: slope	Poor: too clayey.
KkD3	Severe: percs slowly, slope.	Severe: slope	Severe: too clayey.	Severe: slope	Poor: too clayey, slope.
Kiva: KmB	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Poor: thin layer

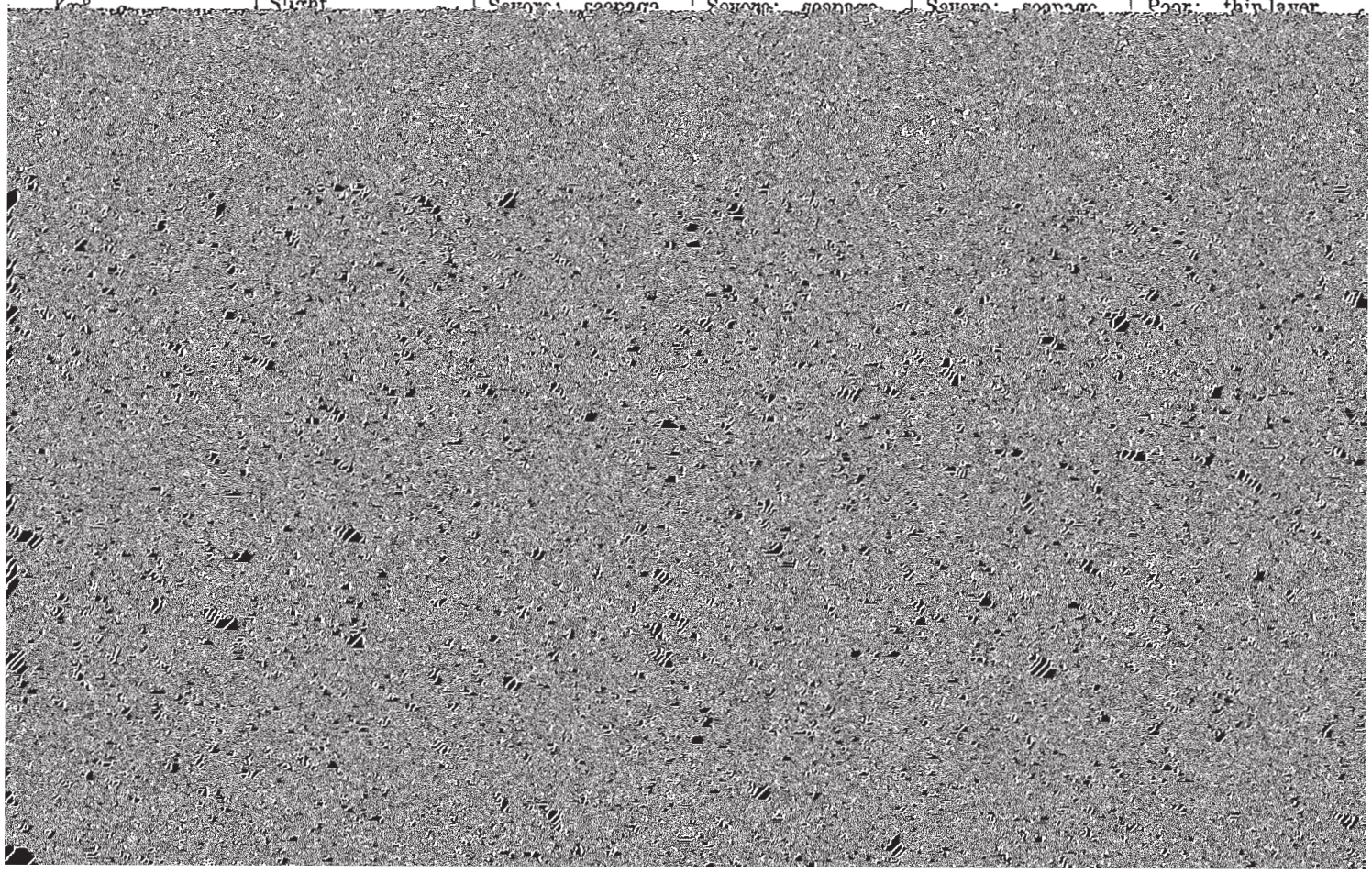


TABLE 8.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Namur:					
NaB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: seepage	Poor: thin layer, small stones, area reclaim.
NaC	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: seepage	Poor: thin layer, small stones, area reclaim.
Namur Variant:					
Nv	Severe: wetness, depth to rock.	Severe: wetness, depth to rock.	Severe: wetness, depth to rock.	Severe: wetness	Poor: thin layer.
Omena:					
OmB	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
OmC	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope.
OmD	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Omena Variant:					

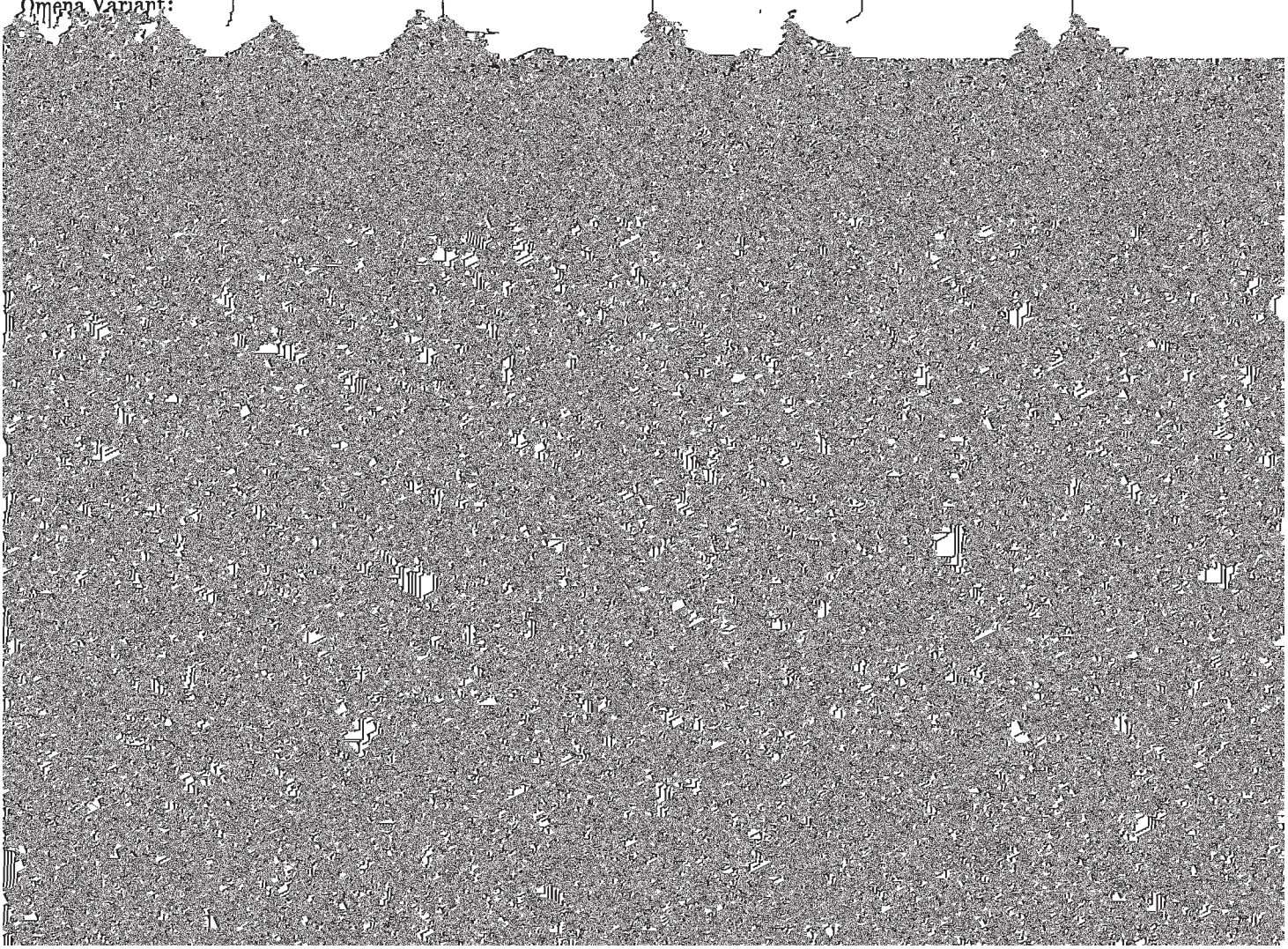


TABLE 8.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
[1] RrB:					
Rousseau part	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Poor: too sandy.
Deford part	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, seepage, floods.	Poor: seepage, too sandy, wetness.
Saprists:					
Sa	Severe: wetness, floods.	Severe: excess humus, wetness, floods.	Severe: excess humus, wetness, floods.	Severe: excess humus, wetness, floods.	Poor: wetness, excess humus.
Sisson:					
SnA	Slight	Moderate: seepage.	Slight	Slight	Good.
SnB	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Solona:					
SoA	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Suamico:					
Su	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, excess humus.
Summerville:					
SvA, SvB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
SvC	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope	Poor: thin layer, area reclaim.
SvD	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope	Poor: thin layer, area reclaim, slope.
Udipsamments:					
Ud	Slight	Severe: seepage	Severe: seepage, too sandy.	Severe: seepage	Poor: too sandy.
Udorthents:					
Uo	Slight	Severe: seepage, small stones.	Severe: seepage, small stones.	Severe: seepage	Poor: small stones.
Wainola:					
Wa	Severe: wetness	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: seepage, too sandy.
Yahara:					
YaA	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness, floods.	Fair: thin layer.
Yahara Variant:					
Yv	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 8 apply only to soil properties and features above a depth of about 5 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

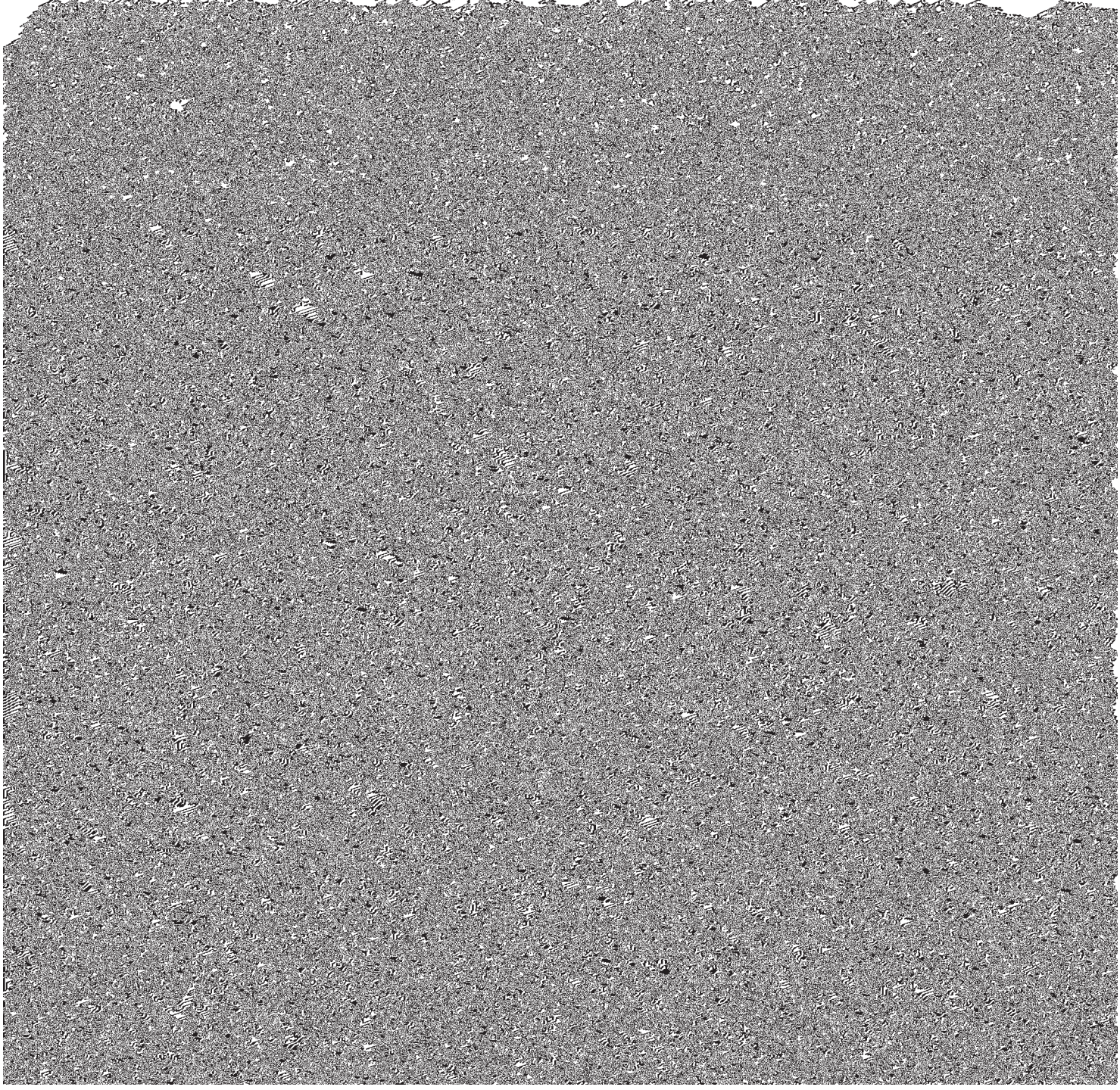
In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill during both

wet and dry weather. Soils that are loamy or silty and free of stones and boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soil selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area type or trench type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for [illegible]



gravel. Fine grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 11.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also consid-

TABLE 9.—*Construction materials*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Allendale: AdA	Poor: low strength, shrink-swell.	Poor: thin layer	Unsuited	Poor: too sandy.
Alpena: ApC	Good	Fair: excess fines	Good	Poor: small stones, thin layer.
Angelica: Ax	Poor: wetness, frost action.	Unsuited	Unsuited	Poor: wetness.
Beaches: Be.				
Bonduel: Bn	Poor: frost action	Unsuited	Unsuited	Fair: thin layer.
Bonduel Shallow Variant: Bo	Poor: frost action, thin layer.	Unsuited	Unsuited	Fair: thin layer, area reclaim.
Bonduel Wet Variant: Bp	Poor: frost action, wetness.	Unsuited	Unsuited	Poor: wetness.
Boyer: BrB, BrC, BrD	Good	Good	Good	Poor: too sandy.
Carbondale: Ca	Poor: excess humus, frost action, low strength.	Unsuited	Unsuited	Poor: wetness.
Casco: CcB, CcC2	Good	Good	Good	Fair: thin layer.
Cathro: Cm	Poor: excess humus, wetness, frost action.	Unsuited	Unsuited	Poor: wetness.
Chippeny: Cp	Poor: wetness, excess humus, frost action.	Unsuited	Unsuited	Poor: wetness.
Deford: De	Poor: wetness	Good	Unsuited	Poor: too sandy, wetness.
Duel: DuB	Poor: thin layer, area reclaim.	Poor: thin layer	Unsuited	Poor: too sandy.
Duel Variant: Dv	Poor: wetness	Poor: thin layer	Unsuited	Fair: thin layer.
Emmet: EmA, EmB	Fair: frost action	Unsuited	Unsuited	Fair: thin layer.
EmC2	Fair: frost action	Unsuited	Unsuited	Fair: thin layer, slope.
EmD2	Fair: frost action, slope.	Unsuited	Unsuited	Poor: slope.
EmE	Poor: slope	Unsuited	Unsuited	Poor: slope.
Fabius: Fa	Poor: wetness, frost action.	Good	Fair: excess fines	Fair: thin layer, area reclaim.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Fluvaquents: Fu	Poor: frost action, wetness.	Unsuited	Unsuited	Poor: wetness.
Gravel pits: Gp.				
Kewaunee: KhA, KhB	Poor: low strength	Unsuited	Unsuited	Fair: thin layer.
KhC2	Poor: low strength	Unsuited	Unsuited	Fair: thin layer, slope.
KkD3	Poor: low strength	Unsuited	Unsuited	Poor: slope.
Kiva: KmB, KmC	Good	Good	Good	Fair: small stones.
Kolberg: KoA, KoB	Poor: low strength, area reclaim.	Unsuited	Unsuited	Fair: thin layer.
KoC2	Poor: low strength, area reclaim.	Unsuited	Unsuited	Fair: thin layer, slope.
Kolberg Variant: KvB, KvC2	Poor: low strength, thin layer, area reclaim.	Unsuited	Unsuited	Fair: thin layer.
Longrie: LoA, LoB, LoC	Poor: thin layer	Unsuited	Unsuited	Fair: area reclaim, small stones.
Manawa: McA	Poor: low strength	Unsuited	Unsuited	Fair: thin layer.
Manistee: MeB	Fair: thin layer, area reclaim.	Poor: excess fines	Unsuited	Poor: too sandy.
Markey: Mk	Poor: excess humus, wetness.	Poor: excess fines	Unsuited	Poor: wetness.
Namur: NaB, NaC	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: thin layer, area reclaim.
Namur Variant: Nv	Poor: wetness, thin layer, area reclaim.	Unsuited	Unsuited	Poor: wetness, thin layer.
Omena: OmB	Fair: frost action	Unsuited	Unsuited	Fair: too clayey.
OmC	Fair: frost action	Unsuited	Unsuited	Fair: too clayey, slope.
OmD	Fair: frost action, slope.	Unsuited	Unsuited	Poor: slope.
Omena Variant: OvB	Poor: frost action	Unsuited	Unsuited	Good.
Omro: OzB	Poor: low strength	Unsuited	Unsuited	Fair: thin layer.
Pinconning: Pn	Poor: wetness	Poor: thin layer	Unsuited	Poor: wetness, too sandy.
Poygan: Po	Poor: wetness, low strength.	Unsuited	Unsuited	Poor: wetness.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Rock outcrop: Ra.				
Namur: [1] Rb	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: thin layer, area reclaim.
Rondeau: Rn	Poor: excess humus, wetness.	Unsuited	Unsuited	Poor: wetness.
Rousseau: RoB, RoC	Good	Good	Unsuited	Poor: too sandy.
[1] RpC: Rousseau part	Good	Good	Unsuited	Poor: too sandy.
Shawano part	Good	Good	Unsuited	Poor: too sandy.
[1] RpD: Rousseau part	Fair: slope	Good	Unsuited	Poor: too sandy, slope.
Shawano part	Fair: slope	Good	Unsuited	Poor: too sandy, slope.
[1] RrB: Rousseau part	Good	Good	Unsuited	Poor: too sandy.
Deford part	Poor: wetness	Good	Unsuited	Poor: too sandy, wetness.
Saprists: Sa	Poor: wetness, frost action, excess humus.	Unsuited	Unsuited	Poor: wetness.
Sisson: SnA, SnB	Fair: frost action, low	Unsuited	Unsuited	Good

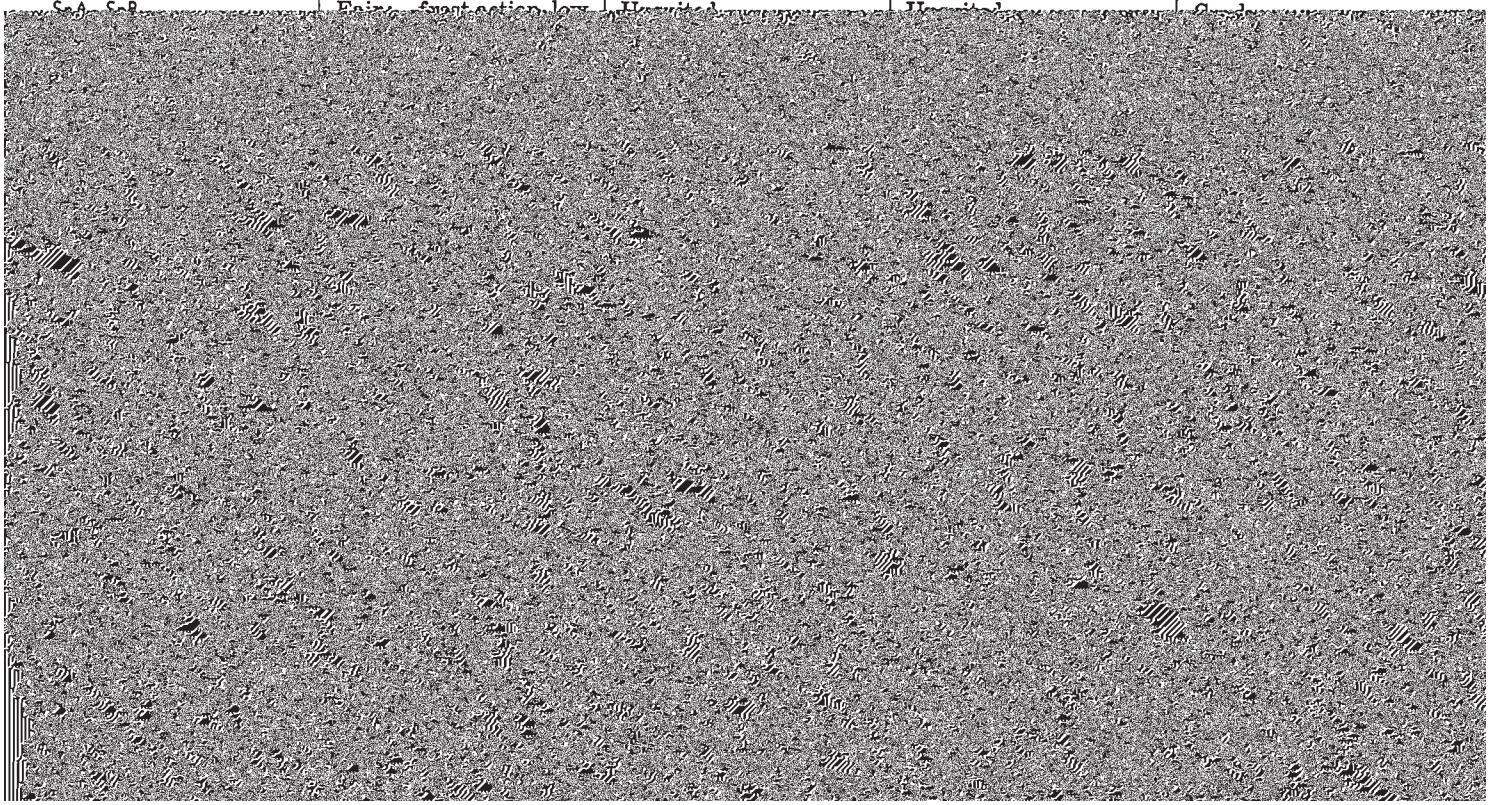


TABLE 10.—*Water management*

["Seepage," and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Allendale: AdA	Seepage	Thin layer	Slow refill	Cutbanks cave	Not needed	Not needed.
Alpena: ApC	Seepage	Seepage, piping.	No water	Not needed	Not needed	Not needed.
Angelica: Ax	Favorable	Piping, low strength.	Favorable	Poor outlets, floods.	Not needed	Wetness.
Beaches: Be.						
Bonduel: Bn	Depth to rock, seepage.	Low strength, piping, thin layer.	Deep to water	Depth to rock, frost action, wetness.	Wetness, depth to rock.	Wetness, rooting depth.
Bonduel Shallow Variant: Bo	Depth to rock, seepage.	Thin layer	Deep to water	Depth to rock, frost action, wetness.	Wetness, depth to rock.	Wetness, rooting depth.
Bonduel Wet Variant: Bp	Depth to rock, seepage.	Low strength, thin layer.	Deep to water	Depth to rock, frost action, wetness.	Wetness, depth to rock.	Wetness, rooting depth.
Boyer: BrB, BrC, BrD	Seepage, slope	Seepage	No water	Not needed	Complex slope, soil blowing.	Slope.
Carbondale: Ca	Seepage	Excess humus	Favorable	Floods, wetness, cutbanks cave.	Not needed	Not needed.
Casco: CcB, CcC2	Seepage	Seepage	No water	Not needed	Rooting depth	Droughty, rooting depth.
Cathro: Cm	Seepage	Compressible, hard to pack, low strength.	Favorable	Wetness, floods, cutbanks cave.	Not needed	Not needed.
Chippeny: Cp	Depth to rock	Compressible, unstable fill, thin layer.	Favorable	Wetness, floods, depth to rock.	Not needed	Not needed.
Deford: De	Seepage	Piping, seepage.	Favorable	Cutbanks cave	Not needed	Not needed.
Duel: DuB	Depth to rock, seepage.	Seepage, piping.	No water	Not needed	Not needed	Not needed.
Duel Variant: Dv	Depth to rock, seepage.	Seepage, piping, thin layer.	No water	Cutbanks cave, depth to rock, wetness.	Wetness, piping, too sandy.	Wetness.
Emmet: EmA	Seepage	Piping	Deep to water	Not needed	Favorable	Favorable.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
EmB	Seepage	Piping	Deep to water	Not needed	Favorable	Slope, erodes easily.
EmC2, EmD2, EmE	Seepage	Piping	Deep to water	Not needed	Slope, erodes easily.	Slope, erodes easily.
Fabius: Fa	Seepage	Seepage	Deep to water	Cutbanks cave	Not needed	Not needed.
Fluvaquents: Fu	Seepage	Low strength, piping, seepage.	Favorable	Floods, wetness.	Not needed	Wetness.
Gravel pits: Gp.						
Kewaunee: KhA, KhB, KhC2, KkD3	Favorable	Shrink-swell, low strength.	No water	Not needed	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Kiva: KmB, KmC	Seepage	Seepage, piping.	No water	Not needed	Not needed	Not needed.
Kolberg: KoA, KoB, KoC2	Depth to rock, seepage.	Low strength, thin layer, shrink-swell.	No water	Not needed	Depth to rock, erodes easily, percs slowly.	Erodes easily, percs slowly, rooting depth.
Kolberg Variant: KvB, KvC2	Depth to rock	Thin layer, low strength.	No water	Not needed	Depth to rock, rooting depth.	Rooting depth, droughty.
Longrie: LoA, LoB, LoC	Depth to rock, seepage.	Thin layer, piping.	No water	Not needed	Depth to rock, complex slope.	Rooting depth.
Manawa: MaA	Favorable	Shrink-swell	Deep to water	Percs slowly	Wetness, percs	Wetness, percs

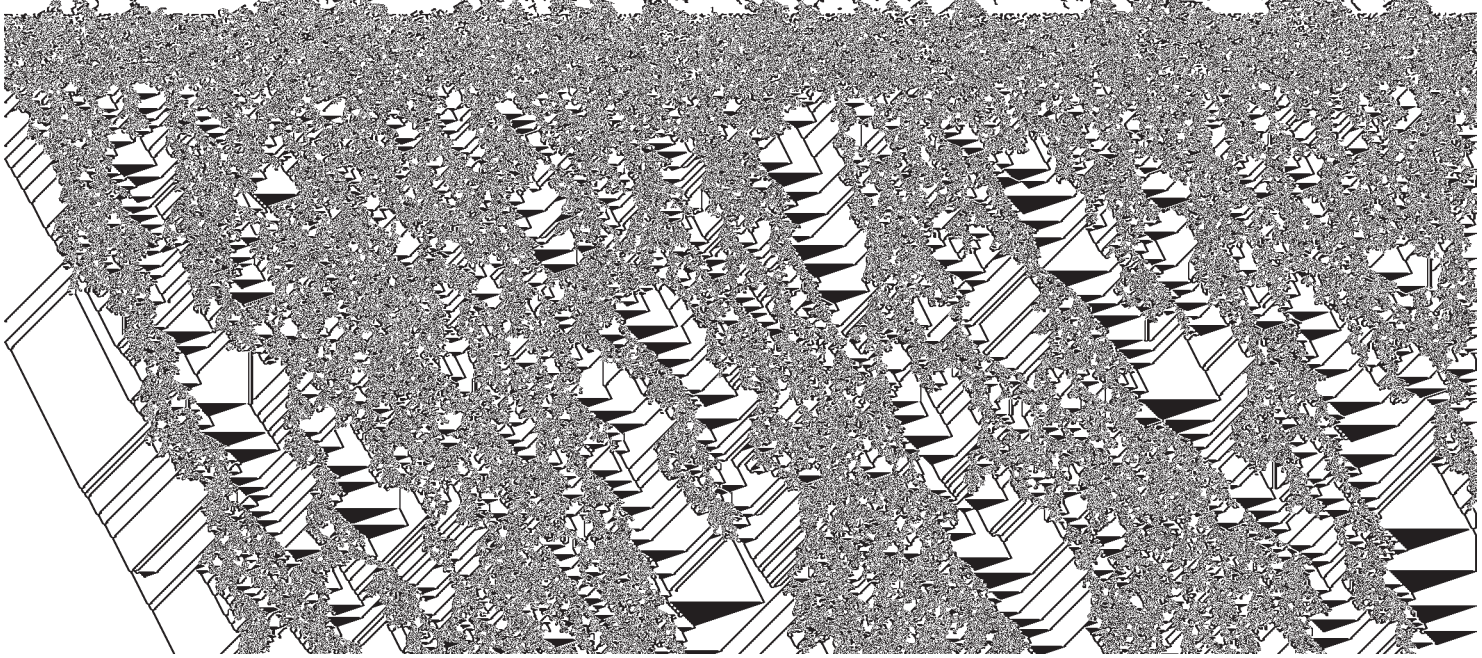


TABLE 10.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Omro: OzB	Seepage, slope	Low strength, piping	Deep to water	Not needed	Erodes easily, percs slowly	Erodes easily, percs slowly

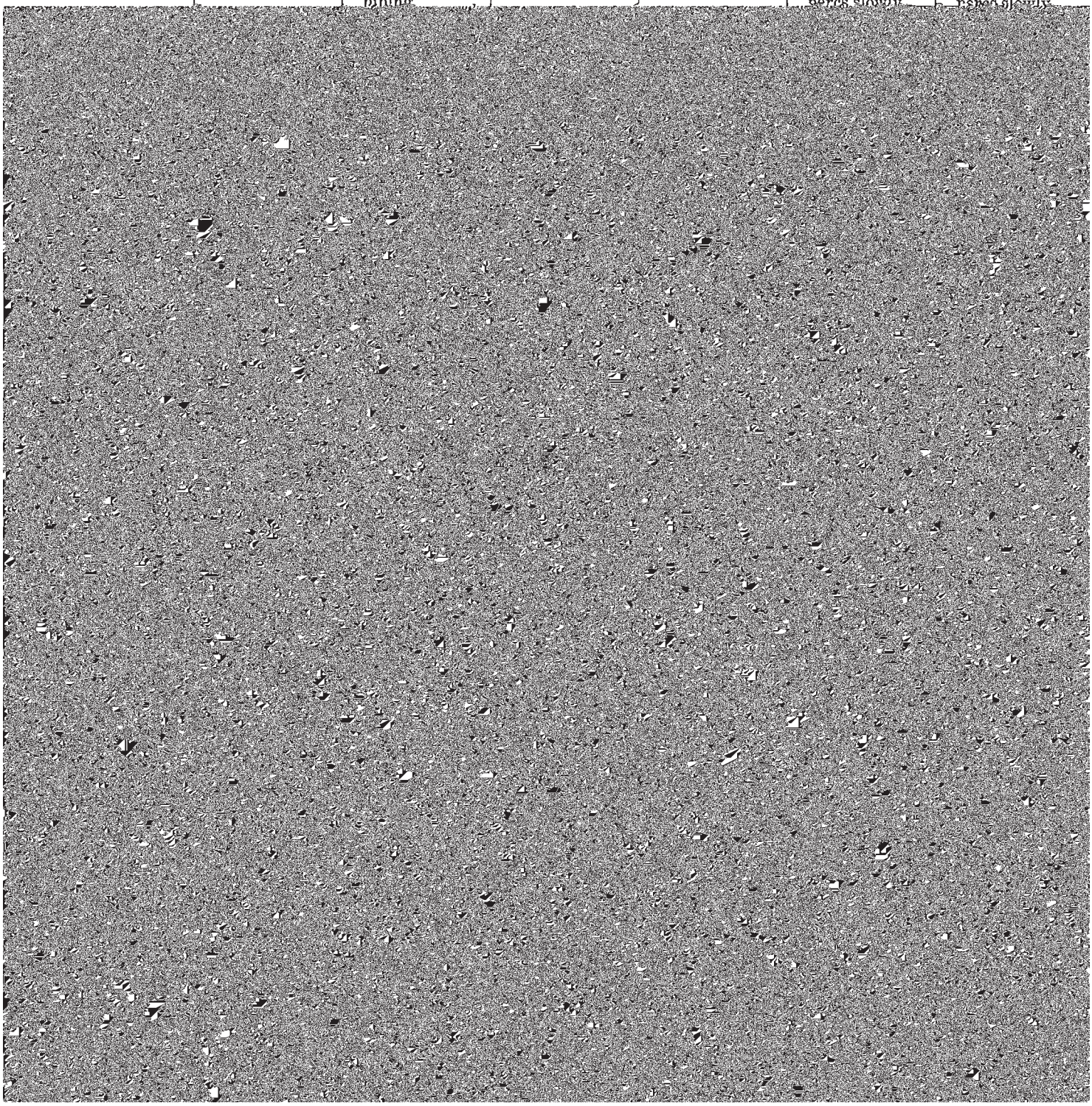


TABLE 10.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Udipsamments: Ud	Seepage, slope	Low strength, seepage, piping.	No water	Not needed	Too sandy, soil blowing, complex slope.	Droughty, slope.
Udorthents: Uo	Seepage	Seepage	No water	Not needed	Rooting depth	Droughty, rooting depth.
Wainola: Wa	Seepage	Piping, seepage.	Deep to water	Cutbanks cave	Not needed	Not needed.
Yahara: YaA	Seepage	Piping, low strength.	Deep to water	Favorable	Wetness, piping.	Wetness.
Yahara Variant: Yv	Seepage	Low strength, piping.	Deep to water	Wetness, floods, frost action.	Wetness, piping.	Wetness.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability, texture, structure, depth to claypan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, alkalinity, and availability of outlets for drainage.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness; depth to bedrock or other unfavorable material; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff at nonerosive velocities to outlets. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

Soil properties

Extensive data about soil properties collected during the soil survey are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist can identify several important soil properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness; color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in-place under the existing soil moisture conditions. He records the root depth of existing plants; determines soil pH, or reaction; and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each major horizon of each soil in the survey area. Also presented are pertinent soil and water features and engineering test data.

Engineering properties

Table 11 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a representative profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil series in the section "Descriptions of the soils."

TABLE 11.—*Engineering properties*

[The symbol < means less than; > means greater than. Absence

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Allendale:				
AdA	0–9	Loamy sand	SM	A–2–4
	9–26	Sand, loamy sand, loamy fine sand	SP, SM	A–2–4, A–3
	26–60	Silty clay, clay	CH, MH	A–7
Alpena:				
ApC	0–12	Gravelly sandy loam	SM, ML, SP–SM	A–2–4, A–4, A–1
	12–60	Stratified very gravelly sand to sand	SP, SP–SM, GP, GW	A–1
Angelica:				
Ax	0–5	Loam	ML, CL, CL–ML	A–4
	5–25	Sandy clay loam, loam, clay loam	SC, CL, SM–SC, CL–ML	A–2–4, A–6, A–4, A–2–6
	25–60	Loam, silt loam, sandy loam	ML, SM	A–2–4, A–4
Beaches:				
Be.				
Bonduel:				
Bn	0–9	Loam	ML, CL, CL–ML	A–4
	9–11	Loam, silt loam	CL, CL–ML	A–4, A–6
	11–23	Sandy clay loam, clay loam, loam	CL, SC	A–4, A–6
	23–28	Loam	CL, CL–ML	A–4, A–6
	28–60	Unweathered bedrock.		
Bonduel Shallow Variant:				
Bo	0–10	Fine sandy loam	SM, ML	A–4
	10–14	Loam	CL	A–4, A–6
	14–17	Sandy loam, loam	SM, SC, ML, CL	A–4, A–6
	17–60	Unweathered bedrock.		
Bonduel Wet Variant:				
Bp	0–3	Sapric material	Pt	A–8
	3–6	Loam	CL, ML	A–4
	6–24	Loam	CL	A–4, A–6
	24–32	Loam	CL, CL–ML	A–4, A–6
	32–60	Unweathered bedrock.		
Boyer:				
BrB, BrC, BrD	0–17	Loamy sand	SM, SM–SC	A–2
	17–33	Sandy loam, sandy clay loam, loamy sand	SM, SC, SM–SC	A–2, A–4, A–6
	33–60	Stratified sand to gravel	SP, SP–SM, GP, GP–GM	A–1, A–3, A–2–4
Carbondale:				
Ca	0–8	Sapric material	Pt	A–8
	8–60	Sapric material, hemic material	Pt	A–8
Casco:				
CcB, CcC2	0–9	Sandy loam	SM	A–4
	9–18	Clay loam, loam, sandy clay loam	SC, CL	A–6, A–7
	18–60	Sand [illegible]	GP, SP, GP–GM	[illegible]

and classifications

of an entry means data were not estimated. NP means nonplastic]

Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	95–100	50–75	10–25	----------	NP
0	100	95–100	50–70	0–20	----------	NP
0	100	90–100	90–100	75–95	50–70	20–40
0–2	50–85	40–85	20–85	5–70	0–35	NP–10
0–2	35–60	25–50	10–35	0–10	----------	NP
0–10	90–100	85–100	55–100	55–90	25–40	2–9
0–10	90–100	85–100	70–90	25–70	15–40	5–23
0–15	85–100	80–100	60–100	30–90	12–38	2–9
0	100	100	85–100	60–90	20–30	3–10
0–2	95–100	95–100	85–95	60–90	20–30	5–12
0–5	95–100	95–100	80–90	35–80	25–40	7–20
0–5	80–95	80–95	75–85	50–65	20–30	5–12
0	100	100	70–85	40–55	10–20	1–4
0–5	95–100	95–100	80–90	60–70	25–35	7–20
0–5	95–100	95–100	65–90	35–70	10–30	2–12
0						
0	100	100	85–95	60–75	20–30	3–10
0–5	95–100	95–100	80–90	60–70	25–35	7–20
0–5	80–95	80–95	75–85	50–65	20–30	5–12
0–5	95–100	65–95	45–75	15–30	<20	NP–6
0–5	80–100	65–95	55–85	10–45	10–35	NP–16
0–10	40–100	35–100	30–70	0–10	----------	NP
0						
0						
0	80–100	80–100	60–70	35–50	<20	1–4
0–5	75–100	75–100	70–100	45–70	10–35	11–25
0–10	30–100	30–90	10–90	3–10	----------	NP
0						
0	100	95–100	60–100	35–90	15–26	3–10
0–10	95–100	90–100	55–100	25–90	10–40	NP–25
0	100	95–100	65–80	20–35	----------	NP
0	100	95–100	50–80	15–35	----------	NP

TABLE 11.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Duel:				
DuB	0–2	Loamy sand	SM	A–2–4, A–1–B
	2–28	Sand, loamy sand	SP–SM, SM, SM–SC	A–3, A–2–4, A–1–B
	28–60	Unweathered bedrock.		
Duel Variant:				
Dv	0–9	Sandy loam	SM	A–2, A–4
	9–32	Sand	SM, SP–SM	A–2, A–3
	32–60	Unweathered bedrock.		
Emmet:				
EmA, EmB, EmC2, EmD2, EmE	0–9	Sandy loam	SM, SC, SM–SC	A–2
	9–24	Sandy loam	SM, SC, SM–SC	A–2
	24–34	Loam, sandy loam, sandy clay loam	SM–SC, CL	A–2, A–4, A–6
	34–60	Sandy loam	SM, SC, SM–SC	A–2
Fabius:				
Fa	0–7	Silt loam	ML, CL, CL–ML	A–4
	7–19	Sandy loam, sandy clay loam	SC, CL	A–4, A–6
	19–60	Sand and gravel	SP, GP, SP–SM	A–1, A–2–4

and classifications—Continued

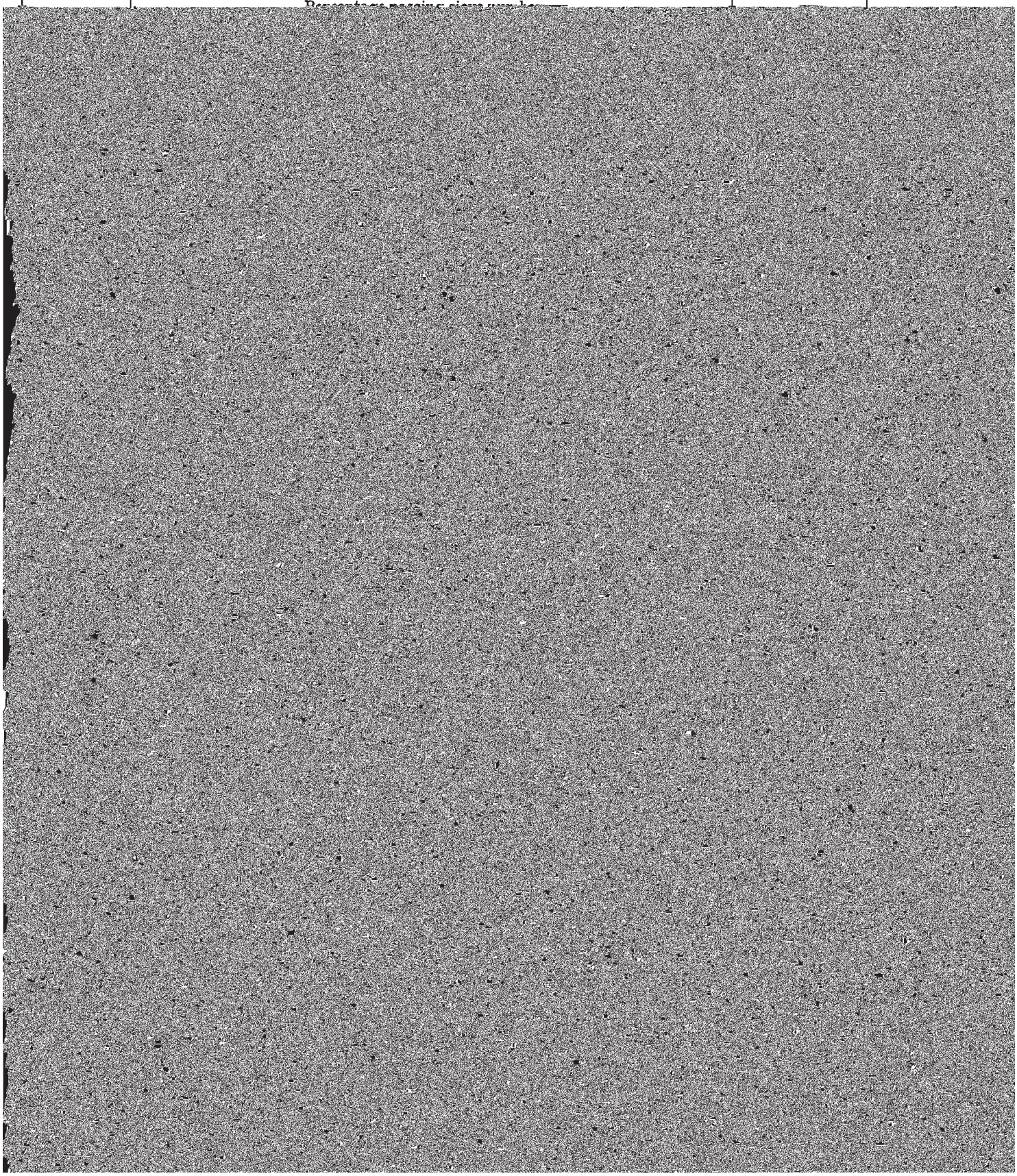
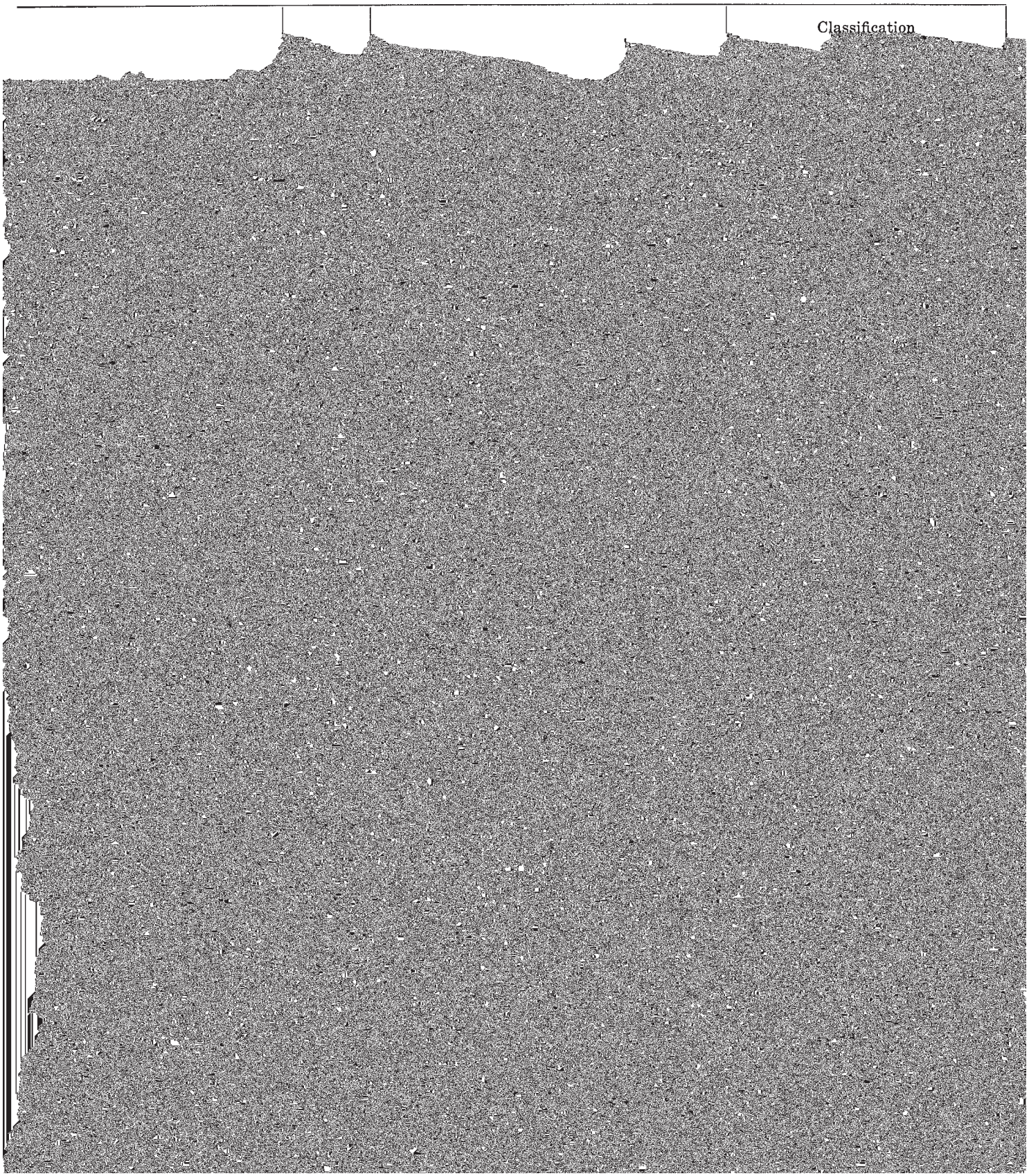


TABLE 11.—*Engineering properties*



and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	90–100	60–75	0–20	----------	NP
0–5	90–100	90–100	85–100	60–90	20–30	NP–5
0	100	100	85–95	60–75	20–30	1–5
0	100	100	85–95	50–65	10–19	1–5
0–10	90–100	85–100	55–65	25–35	12–25	2–9
0–15	85–100	80–100	70–90	36–65	25–30	12–16
5–20	80–95	80–90	55–65	25–35	15–25	2–8
0	100	100	60–70	30–40	10–19	1–4
0–1	95–100	95–100	65–90	30–70	<20	2–6

TABLE 11.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Deford part	0–4	Loamy fine sand	SM	A–2–4
	4–60	Fine sand, very fine sand, loamy fine sand	SM	A–2–4
Saprists:				
Sa	0–60	Sapric material	Pt	
Sisson:				
SnA, SnB	0–13	Fine sandy loam	SM, ML, SC, CL	A–4
	13–33	Silt loam, very fine sandy loam	CL–ML, CL	A–4, A–6
	33–60	Stratified silt loam to fine sand	ML, CL–ML	A–4
Solona:				
SoA	0–12	Loam	ML, CL, CL–ML	A–4
	12–18	Loam, silt loam, sandy loam	CL, SC, CL–ML, SM–SC	A–2, A–4
	18–27	Clay loam, loam, sandy loam	CL, SC	A–6
	27–60	Loam, sandy loam	ML, CL, SM, SC	A–2, A–4, A–6
Suamico:				
Su	0–33	Sapric material	Pt	A–8
	33–60	Silty clay, clay, clay loam	CL, CH	A–7
Summerville:				
SvA, SvB, SvC, SvD	0–12	Loam	CL, ML, CL–ML	A–4
	12–15	Fine sandy loam, angular cobbly fine sandy loam, angular cobbly sandy loam.	SM, SC, CL, ML	A–2–4, A–4
	15–60	Unweathered bedrock.		
Udipsamments:				
Ud	0–60	Sand	SP, SM, SP–SM	A–2, A–3
Udorthents:				
Uo	0–60	Cobbly gravel	GP, GP–GM	A–1
Wainola:				
Wa	0–5	Loamy fine sand	SM	A–2–4
	5–30	Fine sand, loamy fine sand	SM	A–2–4
	30–60	Fine sand, loamy fine sand	SM	A–2–4
Yahara:				
YaA	0–17	Fine sandy loam	ML, CL–ML, SM, SM–SC	A–4
	17–60	Stratified fine sand to silt loam	ML	A–4
Yahara Variant:				
Yv	0–9	Silt loam	ML, CL–ML	A–4
	9–23	Silt loam, very fine sandy loam	CL, CL–ML	A–4
	23–42	Stratified silt to very fine sand	ML, SM, CL–ML, SM–SC	A–4
	42–60	Stratified silt to silty clay loam	CL	A–4, A–6

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

Texture is described in table 11 in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified soil classification system and the American Association of State Highway and Transportation Officials soil classification system (AASHTO). In table 11 soils in the survey area are classified according to both systems.

The Unified system classifies soils according to prop-

and classifications—Continued

Fragments	Percentage passing sieve number—				Liquid	Plasticity

tent of fines. At the other extreme, in group A–7, are fine grained soils. Highly organic soils are classified as A–8 on the basis of visual inspection.

When laboratory data are available, the A–1, A–2, and A–7 groups are further classified as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 14. The estimated classification, without group index numbers, is given in table 11. Also in table 11 the percentage, by weight, of cobbles or the rock fragments more than 3 inches in diameter are estimated for each major horizon. These estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

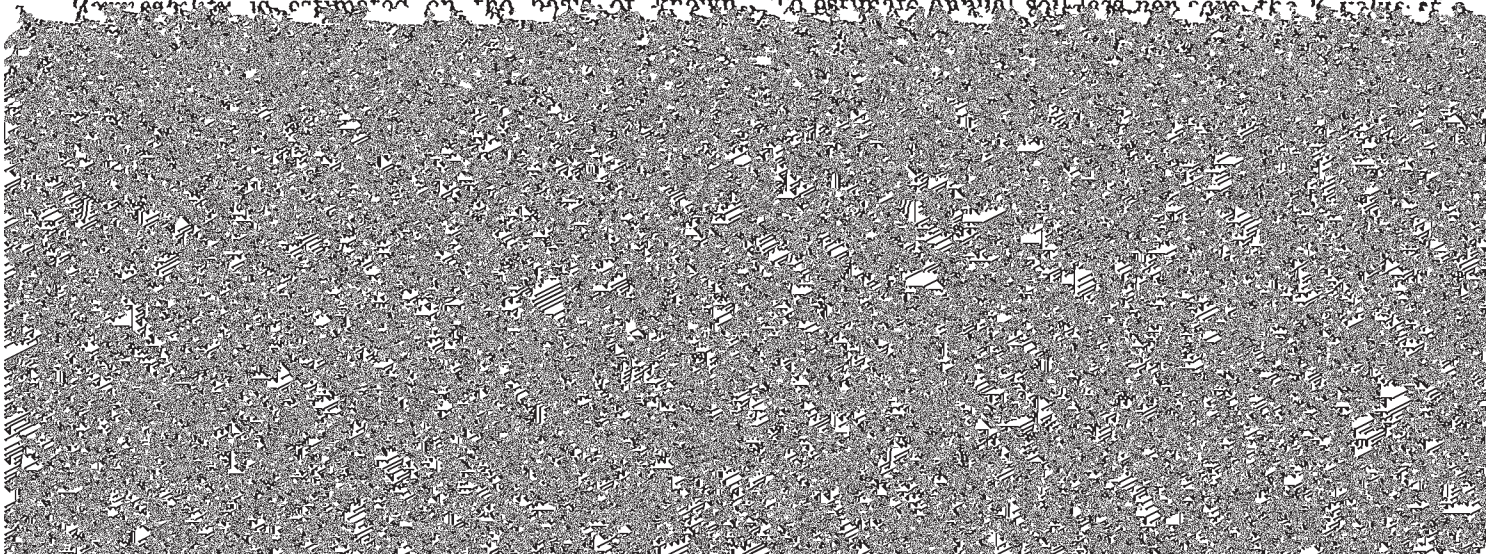
Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil. These indexes are used in both the Unified and AASHTO systems. They are also used as indicators in making general predictions of soil behavior.

Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and chemical properties

Table 12 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known



Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 12, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material; and the rate of corrosion of concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64.

To estimate annual soil loss per acre, the K value of a

fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3.—Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L.—Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4.—Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5.—Loamy soils that are less than 18 percent clay

water; irregular decrease in organic-matter content with increasing depth; absence of distinctive soil horizons that form in soils that are not subject to flooding; local information about floodwater heights and the extent of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods.

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

A *high water table* is the highest level of a saturated zone more than 6 inches thick in soils for a continuous period of more than 2 weeks during most years. The depth to a high water table applies to undrained soils. Estimates are based mainly on the relationships between grayish colors or mottles in the soil and the depth to free water observed during the course of the soil survey. Indicated are the depth to the high water

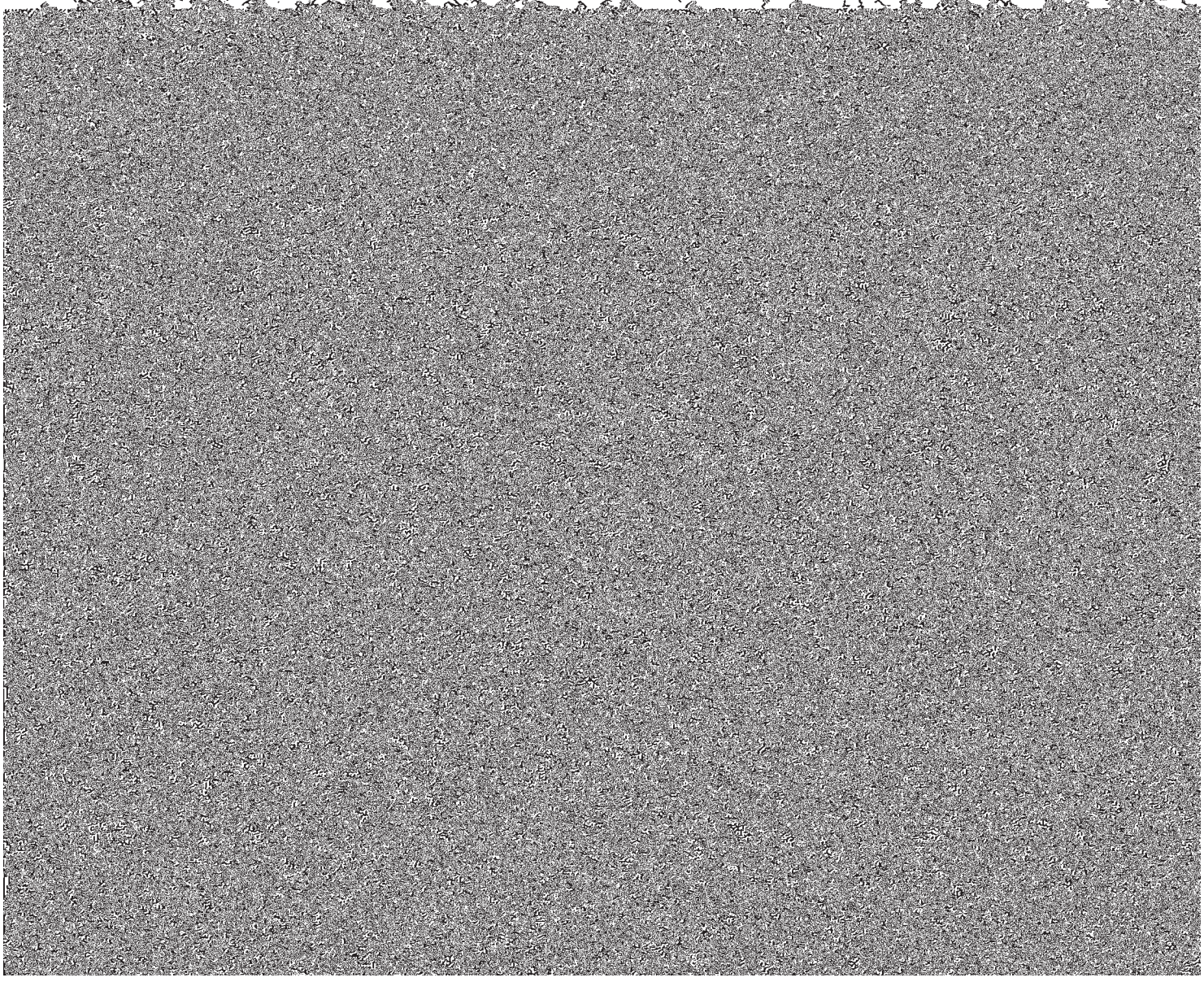


TABLE 12.—*Physical and chemical*

[The symbol < means less than; > means greater than. The erosion tolerance factor

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Allendale:				
AdA	0–9	2.0–20	0.07–0.12	5.1–7.3
	9–26	6.0–20	0.06–0.10	5.1–7.3
	26–60	0.06–0.2	0.08–0.12	6.1–8.4
Alpena:				
ApC	0–12	2.0–20	0.05–0.17	6.6–7.8
	12–60	>20	0.02–0.04	7.9–8.4
Angelica:				
Ax	0–5	0.6–2.0	0.18–0.22	6.1–7.3
	5–25	0.2–0.6	0.10–0.20	6.1–7.3
	25–60	0.2–0.6	0.10–0.20	7.9–8.4
Beaches:				
Be.				
Bonduel:				
Bn	0–9	0.6–2.0	0.20–0.24	6.6–7.8
	9–11	0.6–2.0	0.17–0.22	6.6–7.8
	11–23	0.6–2.0	0.15–0.19	5.6–7.8
	23–28	0.6–2.0	0.17–0.19	6.6–8.4
	28–60			
Bonduel Shallow Variant:				
Bo	0–10	0.6–2.0	0.16–0.18	7.4–7.8
	10–14	0.6–2.0	0.17–0.19	7.4–7.8
	14–17	0.6–2.0	0.12–0.19	7.4–7.8
	17–60			
Bonduel Wet Variant:				
Bp	0–3	0.2–6.0	0.35–0.45	6.6–7.8
	3–6	0.6–2.0	0.20–0.22	6.6–7.8
	6–24	0.6–2.0	0.17–0.19	6.6–7.8
	24–32	0.6–2.0	0.17–0.19	6.6–7.8
	32–60			
Boyer:				
BrB, BrC, BrD	0–17	6.0–20	0.10–0.12	5.6–7.3
	17–33	2.0–6.0	0.12–0.18	5.6–7.8
	33–60	>20	0.02–0.04	7.4–8.4
Carbondale:				
Ca	0–8	0.2–6.0	0.35–0.45	5.6–7.8
	8–60	0.6–6.0	0.45–0.55	5.6–7.8
Casco:				
CcB, CcC2	0–9	0.6–2.0	0.13–0.15	5.6–7.3
	9–18	0.6–2.0	0.15–0.19	5.6–7.8
	18–60	>20	0.02–0.04	7.4–8.4
Cathro:				
Cm	0–30	0.2–6.0	0.45–0.55	5.6–7.8
	30–60	0.2–2.0	0.11–0.22	6.6–8.4
Chippeny:				
Cp	0–27	0.2–0.6	0.35–0.45	5.6–7.8
	27–38	0.2–2.0	0.12–0.19	6.6–8.4
	38			
Deford:				
De	0–4	6.0–20	0.07–0.09	5.6–6.0
	4–60	6.0–20	0.05–0.07	5.6–8.4
Duel:				
DuB	0–2	6.0–20	0.10–0.12	5.1–6.5
	2–28	>6.0	0.05–0.10	5.1–7.3
	28–60			

properties of soils

(T) is for the entire profile. Absence of an entry means data were not estimated]

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Low	Moderate	0.15	4	2
Low	Low	Moderate	0.15		
High	High	Low	0.32		
Very low	Low	Low	0.17	2	3
Very low	Low	Low	0.10		
Low	High	Low			5
Moderate	High	Low			
Low	High	Low			
Low	Moderate	Low	0.28	4–3	5
Low	Moderate	Low	0.28		
Moderate	Moderate	Low	0.28		
Low	Moderate	Low	0.28		
Low	Moderate	Low			3
Moderate	Moderate	Low			
Low	Moderate	Low			
Low	Moderate	Low			5
Low	Moderate	Low			
Moderate	Moderate	Low			
Low	Moderate	Low			
Low	Low	Moderate	0.17	4–3	2
Low	Low	Moderate	0.24		
Low	Low	Low	0.10		
	High	Moderate			3
	High	Moderate			
Low	Low	Low	0.32	3	3
Moderate	Low	Low	0.32		
Very low	Low	Low	0.10		
	High	Low			8
Low	High	Low			
High	High	Moderate			3
Low	High	Low			
Very low	Low	Moderate			2
Very low	Low	Low			
Very low	Low	Moderate	0.15	4	2
Very low	Low	Moderate	0.15		

TABLE 12.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Duel Variant:				
Dv	0–9	2.0–6.0	0.13–0.15	6.6–7.8
	9–32	6.0–20	0.06–0.08	6.6–7.8
	32–60			
Emmet:				
EmA, EmB, EmC2, EmD2, EmE	0–9	2.0–6.0	0.12–0.15	6.1–6.5
	9–24	2.0–6.0	0.08–0.12	7.4–8.4
	24–34	0.6–2.0	0.11–0.18	6.6–7.8
	34–60	2.0–6.0	0.08–0.12	7.4–8.4
Fabius:				
Fa	0–7	2.0–6.0	0.16–0.22	5.6–7.3
	7–19	2.0–6.0	0.15–0.18	5.6–7.3
	19–60	>20	0.02–0.04	7.9–8.4
Fluvaquents:				
Fu	0–60			
Gravel pits:				
Gp.				
Kewaunee:				
KhA, KhB, KhC2	0–12	0.6–2.0	0.20–0.24	5.6–7.3
	12–28	0.06–0.6	0.09–0.13	5.6–7.8
	28–60	0.2–0.6	0.08–0.20	7.4–8.4
KkD3	0–8	0.2–0.6	0.21–0.23	5.6–7.3
	8–20	0.06–0.6	0.09–0.13	5.6–7.8
	20–60	0.2–0.6	0.08–0.20	7.4–8.4
Kiva:				
KmB, KmC	0–18	0.6–2.0	0.08–0.18	6.1–7.8
	18–60	>20	0.02–0.04	7.9–8.4
Kolberg:				
KoA, KoB, KoC2	0–9	0.6–2.0	0.20–0.24	5.6–7.3
	9–33	0.06–0.6	0.09–0.20	6.6–7.8
	33–38	0.2–2.0	0.15–0.19	6.6–7.8
	38–60			
Kolberg Variant:				
KvB, KvC2	0–8	0.6–2.0	0.20–0.22	6.6–7.8
	8–18	0.2–0.6	0.11–0.20	6.6–7.8
	18–60			
Longrie:				
LoA, LoB, LoC	0–3	2.0–6.0	0.10–0.20	5.6–7.3
	3–23	0.6–6.0	0.09–0.19	5.6–7.3
	23–30	0.6–6.0	0.08–0.18	6.6–8.4
	30–60			
Manawa:				
McA	0–12	0.6–2.0	0.21–0.23	6.6–7.8
	12–28	0.06–0.2	0.09–0.20	6.1–8.4
	28–60	0.06–0.2	0.08–0.20	7.9–8.4
Manistee:				
MeB	0–8	6.0–20	0.10–0.12	5.1–6.5
	8–34	6.0–20	0.06–0.10	5.1–7.3
	34–60	0.06–0.2	0.08–0.12	5.6–8.4
Markey:				
Mk	0–28	0.2–6.0	0.35–0.45	5.6–7.8
	28–60	6.0–20	0.03–0.08	6.1–8.4
Namur:				
NaB, NaC	0–8	0.6–2.0	0.20–0.24	6.1–7.8
	8–60			

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Very low	Low	Low			3
Very low	Low	Low			
Low	Low	Moderate	0.20	5–4	3
Low	Low	Low	0.32		
Moderate	Low	Low	0.32		
Low	Low	Low	0.32		
Low	Moderate	Moderate	0.28	3–2	5
Low	Moderate	Moderate	0.20		
Low	Low	Low	0.10		
					5
Low	Low	Low	0.37	3	5
Moderate	Moderate	Low	0.37		
Moderate	Moderate	Low	0.37		
Moderate	Moderate	Low	0.37	3	4
Moderate	Moderate	Low	0.37		
Moderate	Moderate	Low	0.37		
Low	Low	Low	0.24	3–2	3
Very low	Low	Low	0.10		
Low	Moderate	Moderate	0.43	3–2	5
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.32		
Low	Moderate	Low	0.32	2	5
Moderate	Moderate	Low	0.32		
Very low	Low	Low	0.32	4–3	3
Very low	Low	Low	0.32		
Very low	Low	Low	0.32		

TABLE 12.—*Physical and chemical*

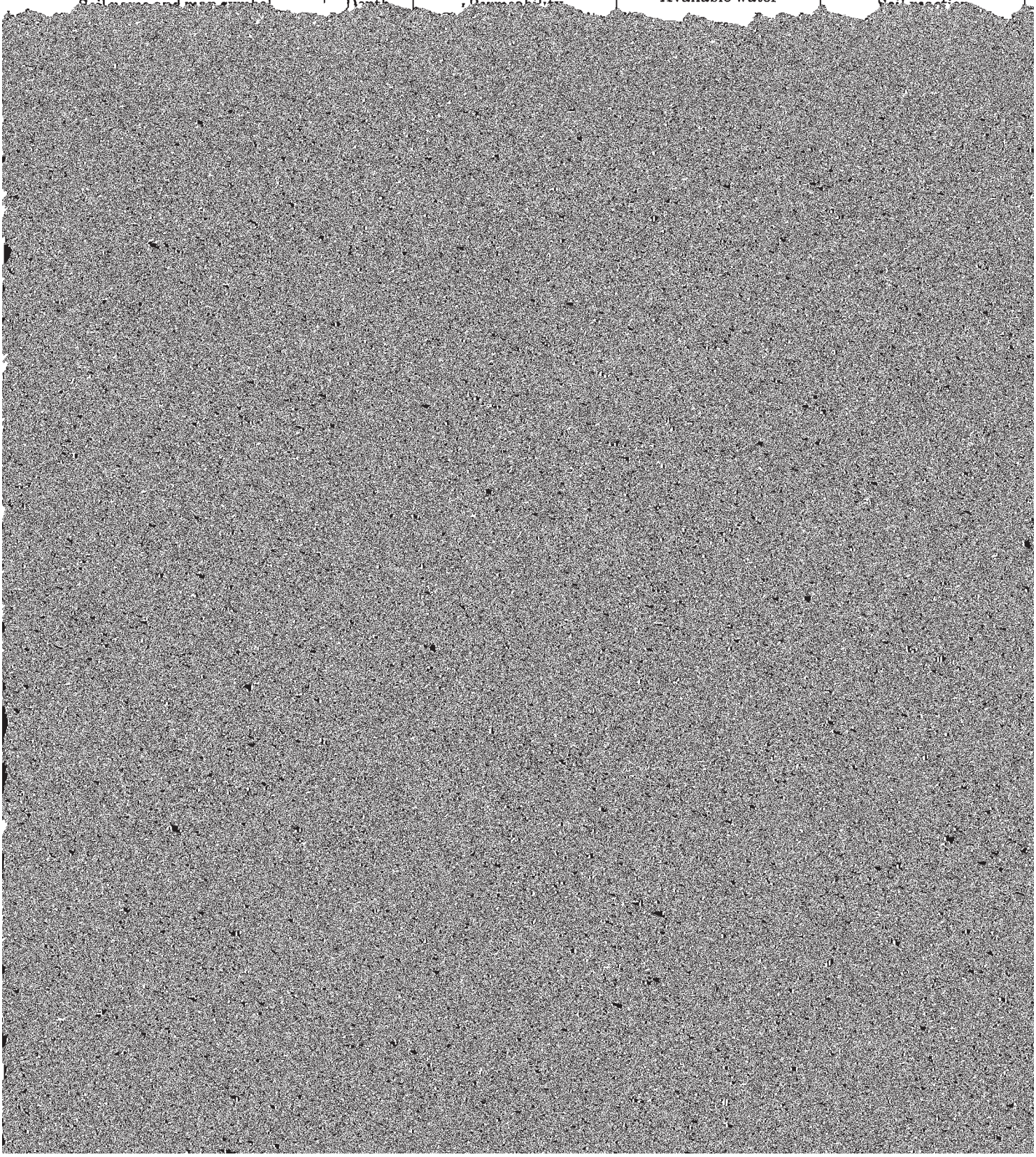
Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*pH*	*pH*
Namur Variant:				
Nv	0–5	0.6–2.0	0.20–0.22	7.4–7.8
	5–9	0.6–2.0	0.20–0.22	7.4–7.8
	9–60			
Omena:				
OmB, OmC, OmD	0–10	2.0–6.0	0.11–0.15	6.1–7.8
	10–17	0.6–2.0	0.10–0.20	6.1–7.8
	17–60	0.6–2.0	0.08–0.12	7.4–8.4
Omena Variant:				
OvB	0–7	2.0–6.0	0.13–0.15	6.6–8.4
	7–15	0.6–2.0	0.12–0.19	6.6–8.4
	15–60	0.6–2.0	0.11–0.16	6.6–8.4
Omro:				
OzB	0–6	0.6–2.0	0.20–0.24	6.1–7.8
	6–30	0.06–0.6	0.09–0.13	6.1–7.8
	30–60	0.6–2.0	0.08–0.19	7.9–8.4
Pinconning:				
Pn	0–6	2.0–6.0	0.10–0.12	5.6–6.5
	6–30	6.0–20	0.06–0.11	6.1–7.3
	30–60	0.06–0.2	0.08–0.12	7.9–8.4
Poygan:				
Po	0–12	0.2–0.6	0.14–0.21	7.4–7.8
	12–29	0.06–0.2	0.09–0.18	6.6–7.8
	29–60	0.06–0.2	0.08–0.12	7.4–7.8
Rock outcrop:				
Ra.				
Namur:				
[1] Rb	0–8	0.6–2.0	0.20–0.24	6.1–7.8
	8			
Rondeau:				
Rn	0–26	0.2–6.0	0.35–0.48	7.4–7.8
	26–60	<0.2	0.20–0.22	7.4–7.8
Rousseau:				
RoB, RoC	0–6	6.0–20	0.07–0.09	5.1–6.0
	6–27	6.0–20	0.06–0.08	5.1–6.0
	27–60	6.0–20	0.05–0.07	5.6–6.5
[1] RpC, [1] RpD:				
Rousseau part	0–6	6.0–20	0.07–0.09	5.1–6.0
	6–27	6.0–20	0.06–0.08	5.1–6.0
	27–60	6.0–20	0.05–0.07	5.6–6.5
Shawano part	0–7	6.0–20	0.07–0.09	5.6–6.5
	7–24	6.0–20	0.06–0.08	5.1–6.5
	24–60	6.0–20	0.05–0.07	5.6–7.8
[1] RrB:				
Rousseau part	0–6	6.0–20	0.07–0.09	5.1–6.0
	6–27	6.0–20	0.06–0.08	5.1–6.0
	27–60	6.0–20	0.05–0.07	5.6–6.5
Deford part	0–4	6.0–20	0.07–0.09	5.6–6.0
	4–60	6.0–20	0.05–0.07	5.6–8.4
Saprists:				
Sa	0–60	0.2–6.0	0.35–0.45	

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Moderate	Low			5
Low	Moderate	Low			
Low	Low	Low	0.24	5–4	3
Moderate	Low	Low	0.32		
Low	Low	Low	0.32		
Low	Moderate	Low	0.20	5	3
Low	Moderate	Low	0.20		
Low	Moderate	Low	0.20		
Low	Moderate	Low	0.43	3–2	5
Moderate	High	Low	0.32		
Low	High	Low	0.32		
Low	High	Moderate			2
Low	High	Low			
High	High	Low			

TABLE 12.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water	Soil reaction



properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Low	Low	0.20	5–4	3
Low	Low	Low	0.32		
Low	Low	Low	0.32		
Low	High	Low	0.28	5	5
Low	High	Low	0.28		
Low	High	Low	0.28		
Low	High	Low	0.37		
	Moderate	Moderate			8
Moderate	Moderate	Low			
Very low	Low	Low	0.24	2	5
Very low	Low	Low	0.24		
Very low	Low	High	0.15	5	1
Very low			0.10	5	8
Low	Low	Moderate	0.15	5	2
Low	Low	Moderate	0.15		
Low	Low	Moderate	0.15		
Low	Moderate	Low	0.32	5	3
Low	Moderate	Low	0.43		
Low	High	Low			5
Low	High	Low			
Low	High	Low			
Low	High	Low			

the soil material has accumulated and existed since accumulation; (2) the plants and animals on and in the soil; (3) the relief, or lay of the land; (4) the physical and mineralogical composition of the parent material; and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plants and animals, chiefly plants, are

Climate

Climate greatly influences the formation of soils because it not only affects the weathering processes, but also determines the kinds of plants and animals in an area and controls the rate of plant growth. Door County has a cool, humid, continental type of climate

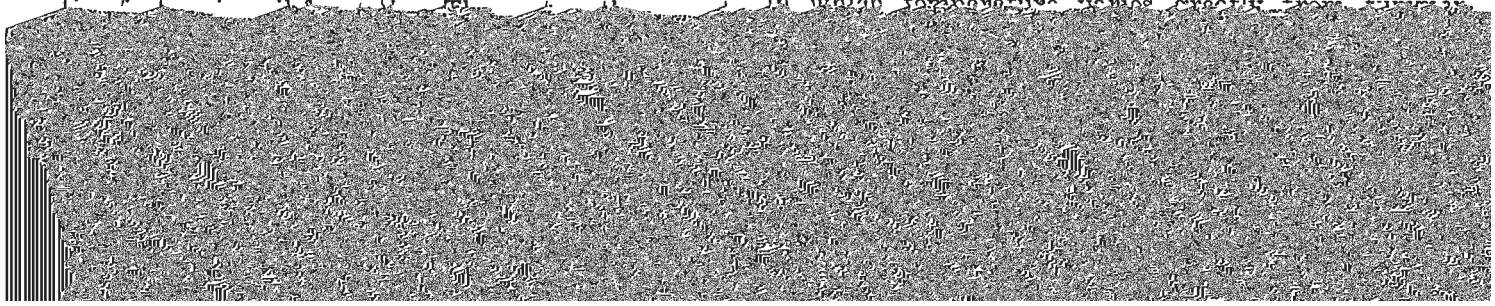
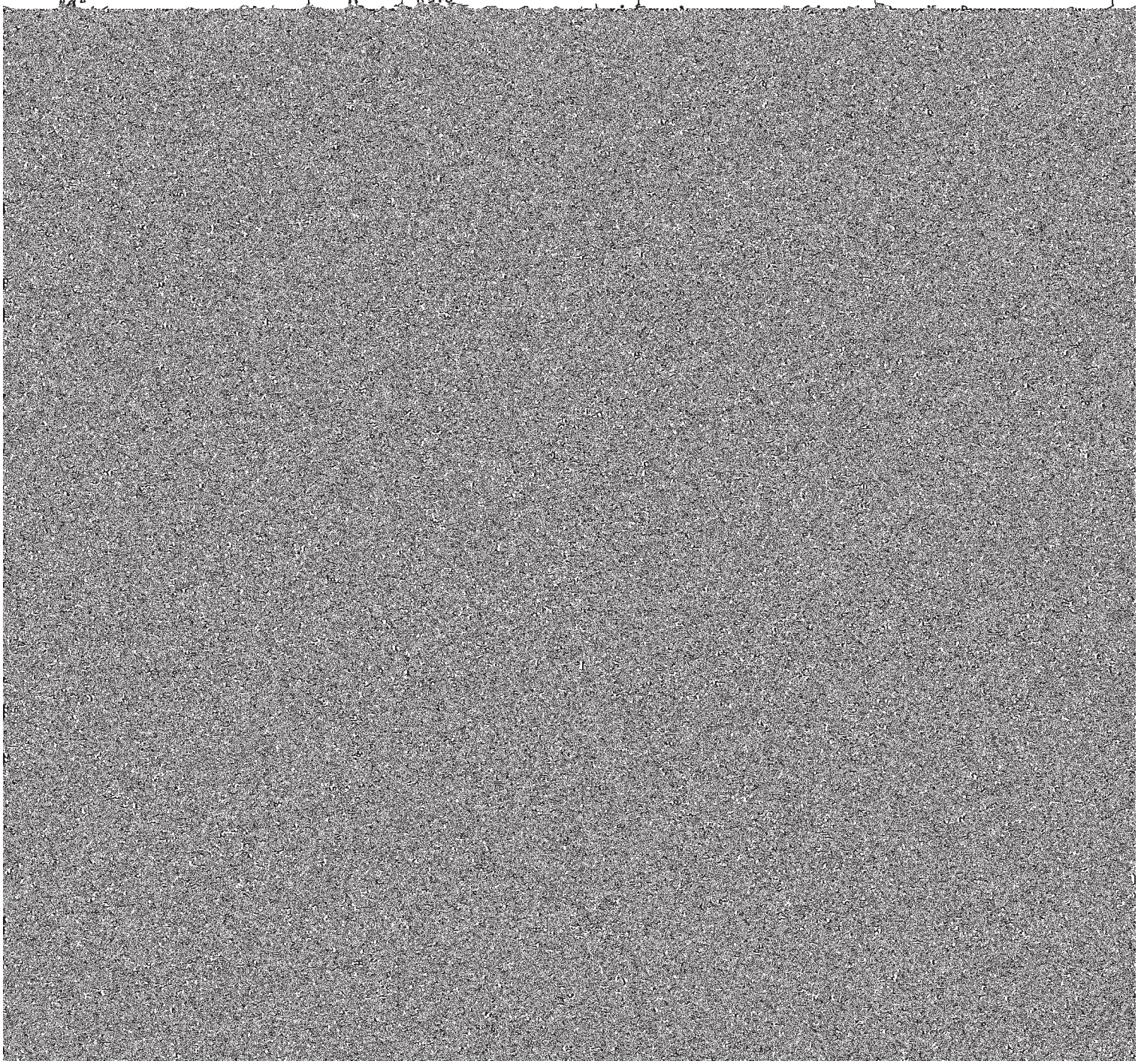


TABLE 13.—*Soil and*

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Allendale:				
Ad	B	Rare		



water features

such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

High water table			Bedrock		Subsidence	Potential frost action
Depth	Kind	Months	Depth	Hardness	Total	
Ft			*In*		*In*	
0.5–1.5	Apparent	Nov-May	>60			Moderate.
>6.0			>60			Low.
0–1.0	Apparent	Oct-Jun	>60			High.
1.0–3.0	Apparent	Sep-Jun	20–40	Rippable		High.
1.0–3.0	Apparent	Sep-Jun	10–20	Rippable		Moderate.
0–1.0	Apparent	Sep-Jun	20–40	Rippable		High.
>6.0			>60			Low.
0–1.0	Apparent	Sep-May	>60			High.
>6.0			>60			Low.
0–1.0	Apparent	Nov-Jun	>60		19–22	High.
0–1.0	Apparent	Sep-May	20–51	Rippable	15–18	High.
0–1.0	Apparent	Jan-May	>60			Moderate.
>6.0			20–40	Rippable		Low.
0–3.0	Apparent	Sep-Jun	24–40	Rippable		Moderate.
>2.5			>60			Moderate.
1.5–2.0	Apparent	Nov-May	>60			High.
0–1.0	Apparent	Jan-Dec	>60			High.
>3.0	Perched	Nov-May	>60			Moderate.
>6.0			>60			Low.
>6.0			20–40	Rippable		Moderate.

TABLE 13.—*Soil and*

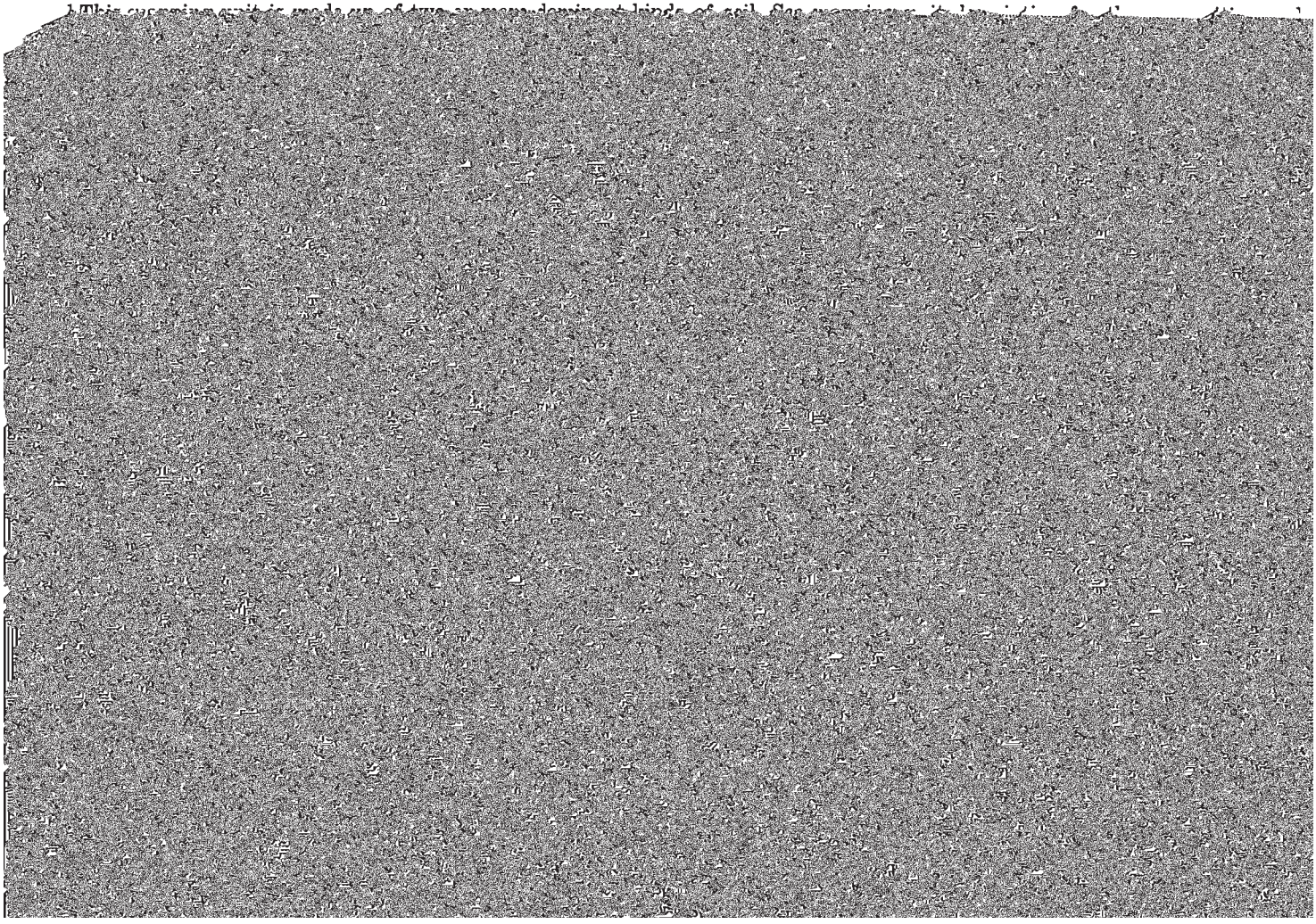
Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Kolberg Variant: KvB, KvC2	C	None		
Longrie: LoA, LoB, LoC	C	None		
Manawa: McA	C	Occasional	Brief	Nov-May
Manistee: MeB	A	None		
Markey: Mk	D	Frequent	Long	Nov-May
Namur: NaB, NaC	D	None		
Namur Variant: Nv	D	None		
Omena: OmB, OmC, OmD	B	None		
Omena Variant: OvB	C	None		
Omro: OzB	C	None		
Pinconning: Pn	D	Common	Long	Nov-Apr
Poygan: Po	D	Frequent	Long	Nov-Jun
Rock outcrop: Ra.				
Namur: [1] Rb	D	None		
Rondeau: Rn	D	Frequent	Long	Nov-May
Rousseau: RoB, RoC	A	None		
[1] RpC, [1] RpD: Rousseau part	A	None		
Shawano part	A	None		
[1] RrB: Rousseau part	A	None		

water features—Continued

High water table			Bedrock		Subsidence	Potential frost action
Depth	Kind	Months	Depth	Hardness	Total	
Ft			*In*		*In*	
>6.0			12–20	Rippable		Moderate.
>6.0			20–40	Hard		Moderate.
1.0–3.0	Perched	Nov-Jun	>60			High.
>2.5			>60			Low.
0–1.0	Apparent	Nov-Jun	>60		25–30	High.
>6.0			5–12	Hard		Moderate.
1.0–3.0	Apparent	Nov-Jun	5–10	Rippable		Low.
>6.0			>60			Moderate.

TABLE 13.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Suamico: Su	D	Frequent	Very long	Nov-May
Summerville: SvA, SvB, SvC, SvD	C	None		
Udipsamments: Ud	A	None		
Udorthents: Uo		None		
Wainola: Wa	A	Rare		
Yahara: YaA	B	Rare		
Yahara Variant: Yv	D	Frequent	Brief	Mar-May



water features—Continued

High water table			Bedrock		Subsidence	Potential frost action
Depth	Kind	Months	Depth	Hardness	Total	
Ft			*In*		*In*	
0–1.0	Apparent	Nov-May	>60		25–30	High.
>6.0			10–20	Hard		Moderate.
>6.0			>60			Low.
>6.0			>60			Low.
1.0–2.0	Apparent	Nov-May	>60			Moderate.
1.0–3.0	Apparent	Nov-May	>60			High.
0–1.0	Apparent	Apr-Jun	>60			High.

eastern part of the county. Emmet, Longrie, and Omena series are examples of these soils.

Time

Time is needed for the transformation of parent material into a soil. It may be much or little, but time is always required for horizon differentiation. Soils can have a profile that is well developed, that is poorly developed, or that is somewhere in between, depending on the length of time the soil-forming factors have been active. Emmet and Kewaunee soils, for example, have

ent soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 15 the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming pro-

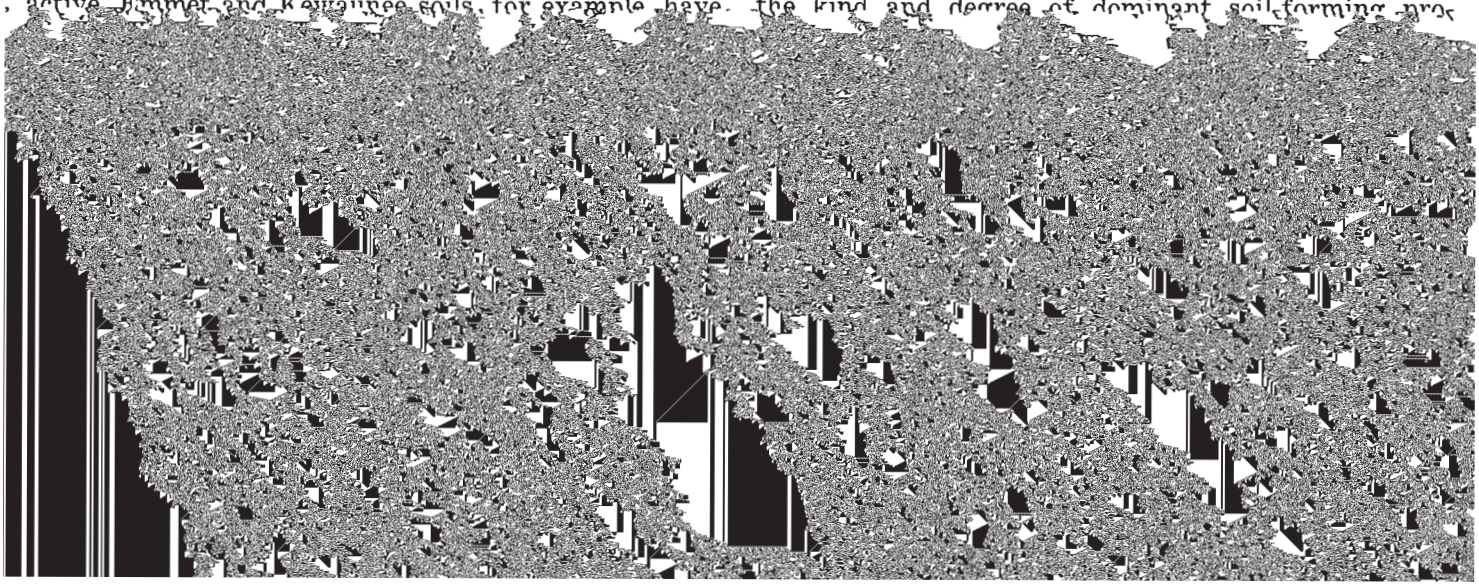


TABLE 14.—*Engineering*

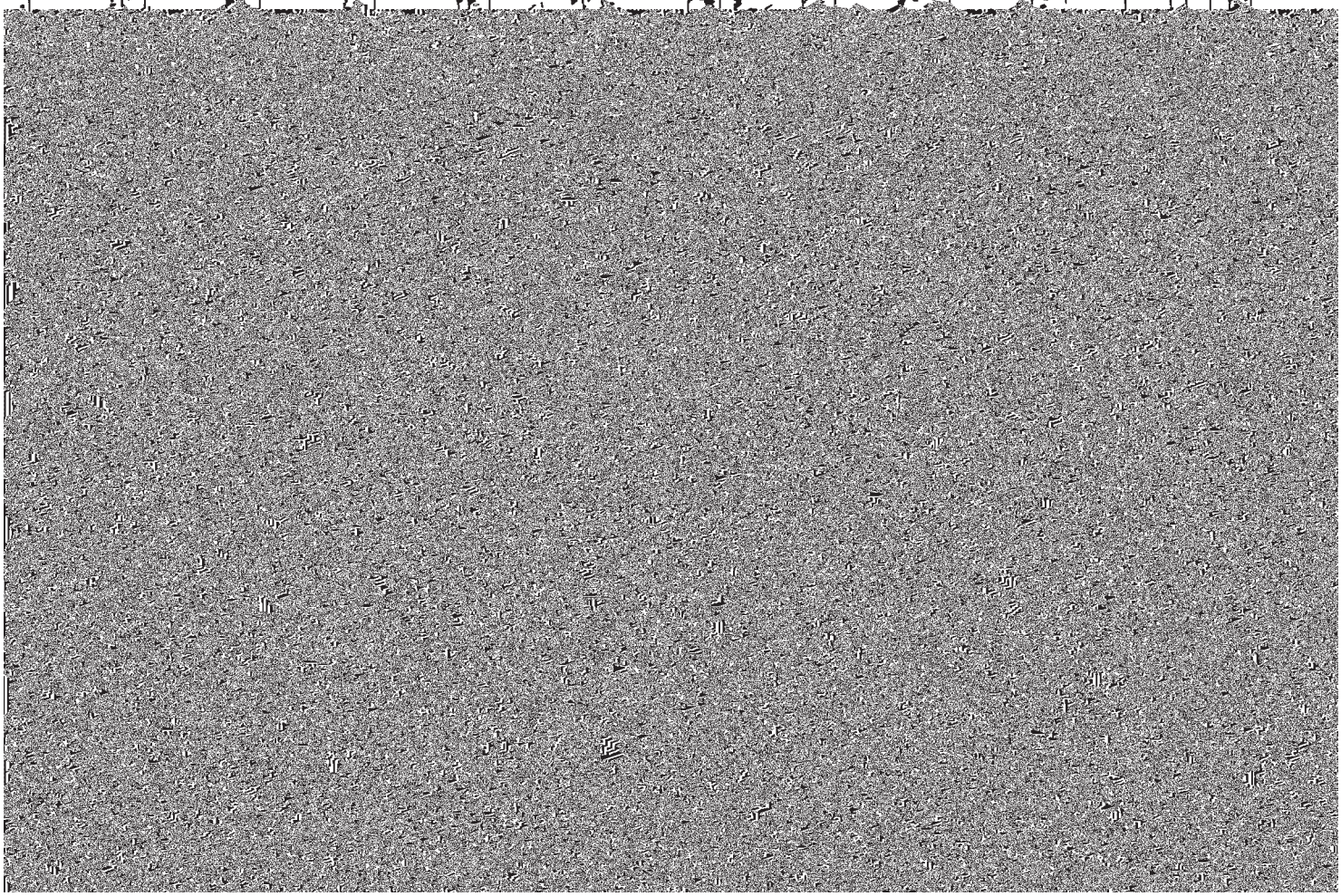
[Tests performed by Wisconsin Department of Transportation, Division of Highways, and in cooperation with the Federal

Soil name and location	Parent material	Report number	Depth	Moisture density[1]	
				Maximum	Optimum
			In	*lb/ft³*	*Pct*
Angelica loam:					
SW¼SE¼ sec. 28, T. 26 N., R. 25 E. (Modal)	Loamy glacial till	S71WI-15-1			
		1-1	17-25		
		1-2	35-39		
Emmet sandy loam:					
NW¼NE¼ sec. 6, T. 26 N., R. 26 E. (Modal)	Loamy glacial till	S71WI-15-5			
		5-1	20-26		
		5-2	30-60	132.4	8.4
Kiva gravelly loam:					
NE¼SE¼ sec. 15, T. 32 N., R. 28 E. (Surface layer has more coarse fragments than modal)	Glacial outwash	S71WI-15-2			
		2-1	5-13		

test data

Highway Administration, Department of Transportation. Absence of an entry indicates that no determination was made]

Percentage passing sieve—[2]			Percentage smaller than—[2]				Liquid limit	Plasticity index	Classification	
No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO [3]	Unified [4]
							Pct			
95	88	71	66	54	34	23	22.5	8.9	A–4 (7)	CL
80	72	52	46	34	20	13	17.3	4.3	A–4 (3)	CL–ML
94	81	50	45	37	28	24	24.2	9.3	A–4 (3)	CL
81	70	39	33	22	13	10	15.4	[5] NP	A–4 (1)	SM
84	38	27	26	18	9	5	----------	NP	A–2–4 (0)	SM
14	10	6	5	3	1	1	----------	NP	A–1–a (0)	GM–GW
100	98	87	83	71	50	37	38.0	20.0	A–6 (12)	CL
84	79	71	64	42	24	17	20.8	5.8	A–4 (7)	CL–ML



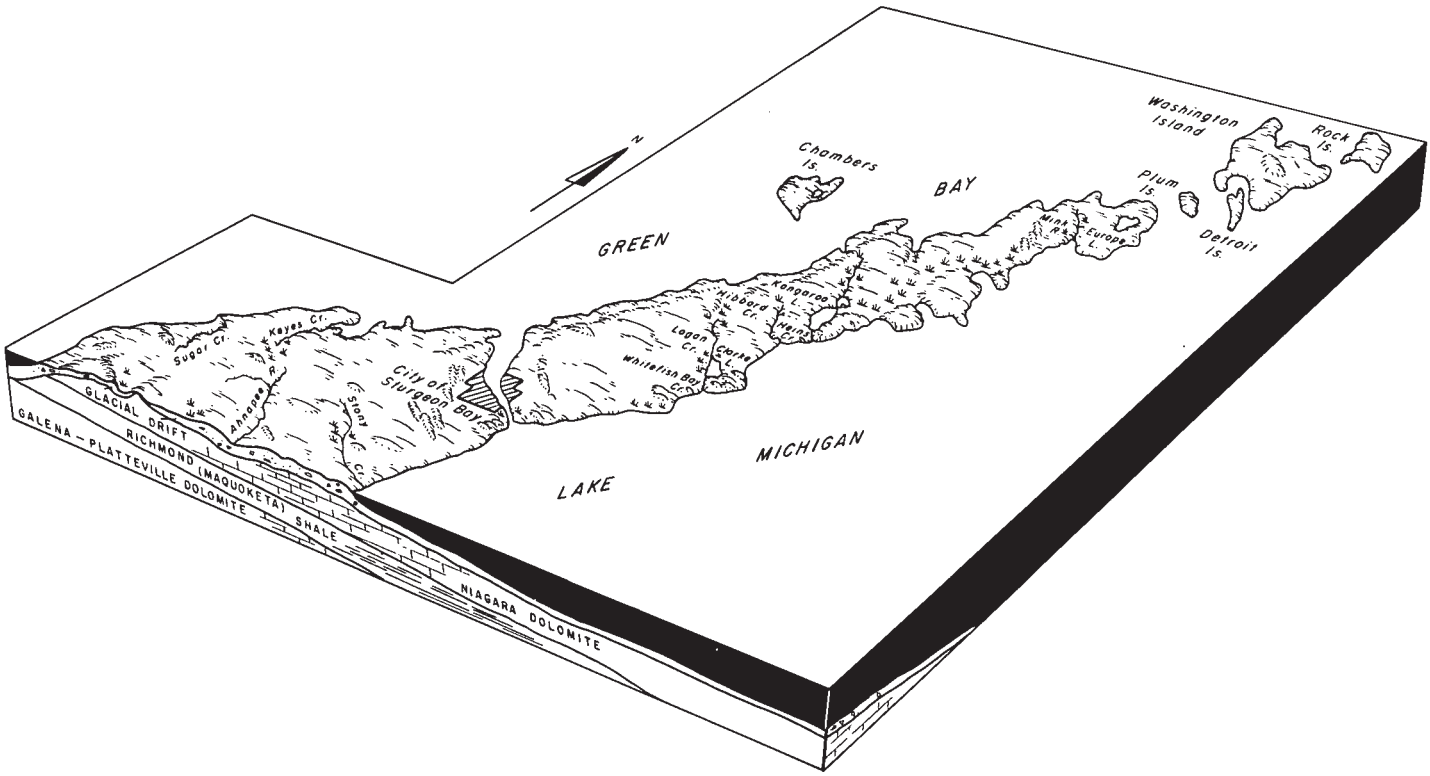


Figure 12.—**Physiography, drainage, and geology of Door County, Wisconsin.**

County. There are many smaller creeks that flow into Green Bay and Lake Michigan from the southern half of the county.

Kangaroo, Clark, and Europe lakes are inland lakes of the county. They were once bays along Lake Michigan. Beach ridges across the mouths of these bays have caused them to become inland lakes. Small streams provide outlets for Clark and Kangaroo lakes into Lake Michigan. Europe lake is landlocked.

Mink River drains much of Liberty Grove township in the north and empties into Rowleys Bay. Small, short streams drain most of the northern part of Door County into Lake Michigan. Water flows only a few miles from most points before reaching the lake. Door County contains 3,370 acres of streams and inland lakes.

Geology

The landscape of Door County is dominated basically by the Niagara Dolomite, which is of Silurian age. A Niagara escarpment appears as an almost continuous bluff along the Green Bay shoreline on the western side

for highway construction and riprap for breakwater construction.

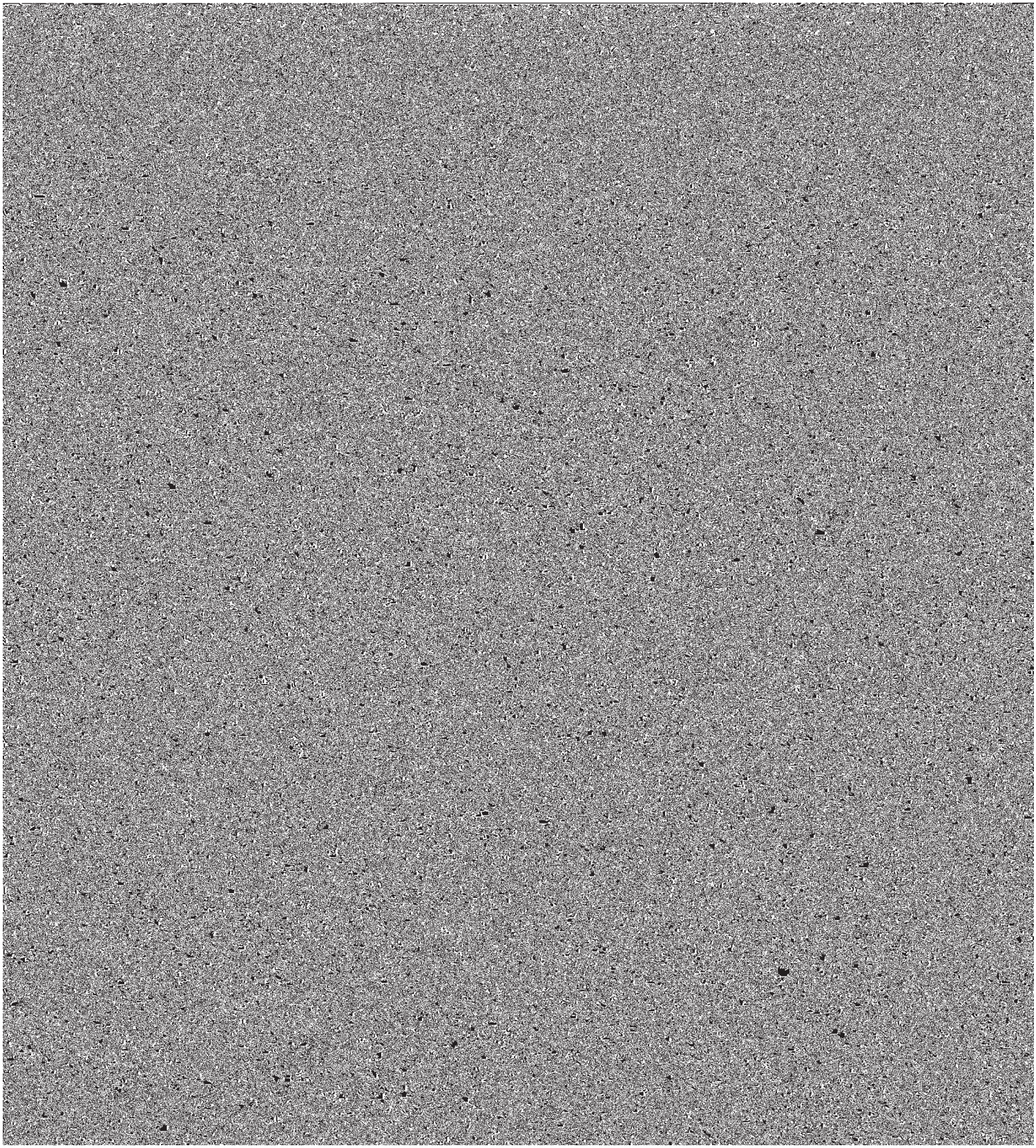
The Niagara Dolomite has many natural crevices and fissures. These crevices present problems for certain uses of soils that are underlain by dolomite. For example, the danger of ground water pollution from unfiltered septic tank effluent moving down these crevices is a serious hazard. Where crevices in the dolomite are large, soil material has filled or partially filled these openings. This material provides a source of plant nutrients and moisture to native vegetation.

There is also a danger of ground water contamination through sinkholes in the underlying dolomite. These sinkholes are scattered throughout the county.

Glaciation has eroded the dolomite bedrock, resulting in drift that has many dolomite fragments and a high lime content. In many areas the dolomite bedrock is very close to the surface. In other areas glacial drift is more than 100 feet thick. These deep deposits commonly occur as drumlins or as recessional and end moraines. Two basic types of glacial till are in the survey area. The loam and sandy loam till, comprising the parent materials of Emmet and Omena soils, are de-

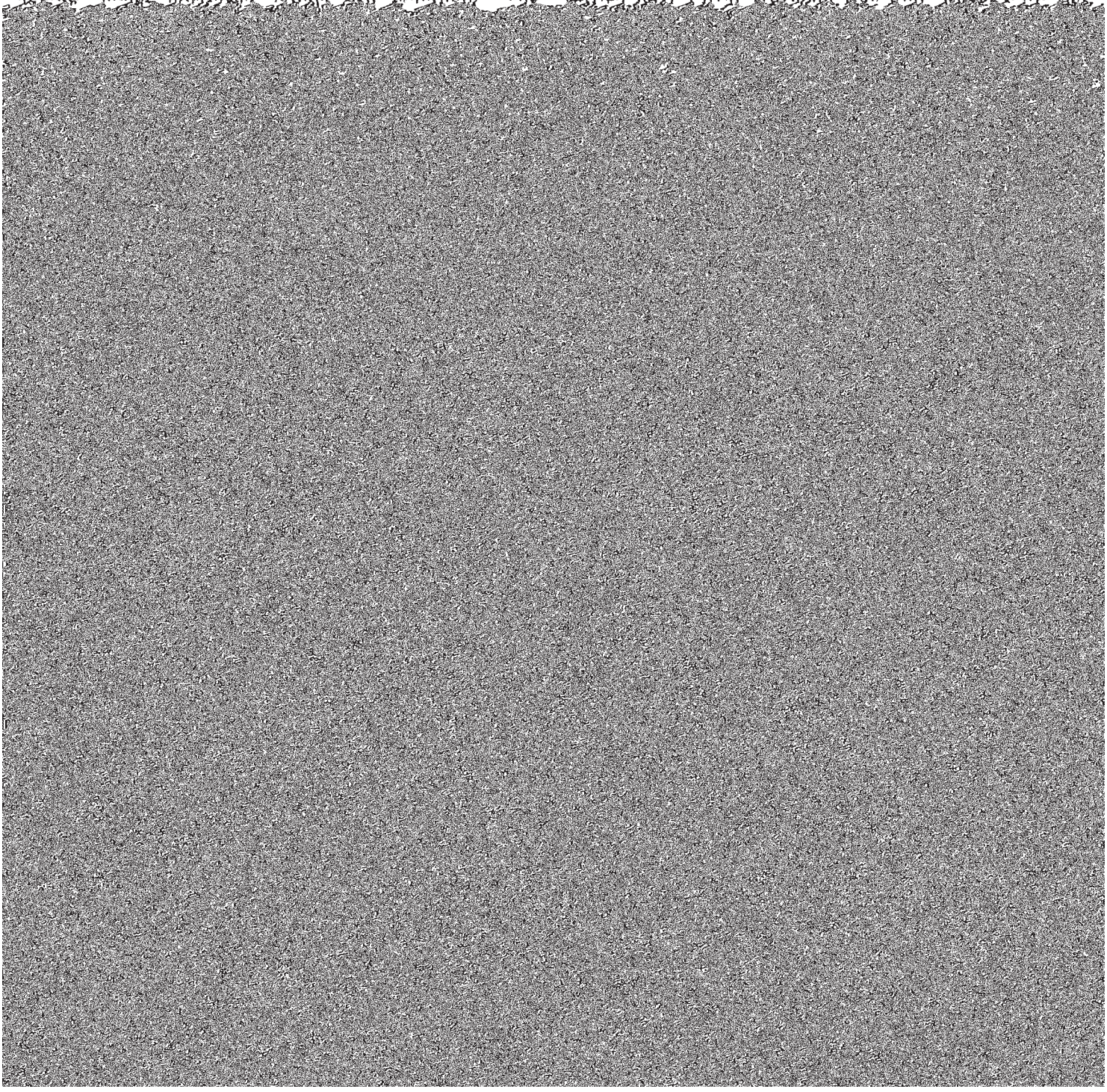
TABLE 15.—*Classification of the soils*

[An asterisk in the first column indicates a taxadjunct to the series; a double asterisk, special information. See text for characteristics of the taxadjunct that are outside the range of the series or for special information]



of August than any other time in summer; the probability is 2 times in 10 years. Rainfall intensities of about 1.10 inches in 1 hour, 1.70 inches in 6 hours, and 2.30 inches in 24 hours can be expected about once in 2 years. The greatest amount of rain in a 24-hour period was 4.57 inches on August 25, 1910. Annual snowfall has ranged from 12 inches in 1958 to 74 inches in 1959.

Observations of wind, sunshine, and humidity are not recorded at Sturgeon Bay; but data from Green Bay should be representative. Prevailing winds are from the northwest and the southwest except in early spring, when northeast winds are dominant. The



grass, marsh grasses and sedges, and water-tolerant trees and shrubs such as American elm, tamarack, dogwood, and white-cedar. Most wetlands remain in native vegetation.

History

In 1634 Jean Nicolet was the first white explorer to land in Door County. Door County was opened for settlement in 1831. The first permanent settlers on the peninsula were Increase Claflin and his family. He settled near Little Sturgeon Bay and traded with the

TABLE 16.—*Temperature and precipitation*

[All data from Sturgeon Bay, Wisconsin, based on records 1930–1959]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	2 years in 10 monthly average will be—		Average total	1 year in 10 will have—		Days with 0.1 inch or more precipitation	Average snowfall
			Equal to or higher than—	Equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	In	In	In		In
January	26.7	10.4	22	13	1.19	0.47	2.04	4	10.0
February	28.3	10.2	22	17	1.30	0.43	2.63	3	9.0

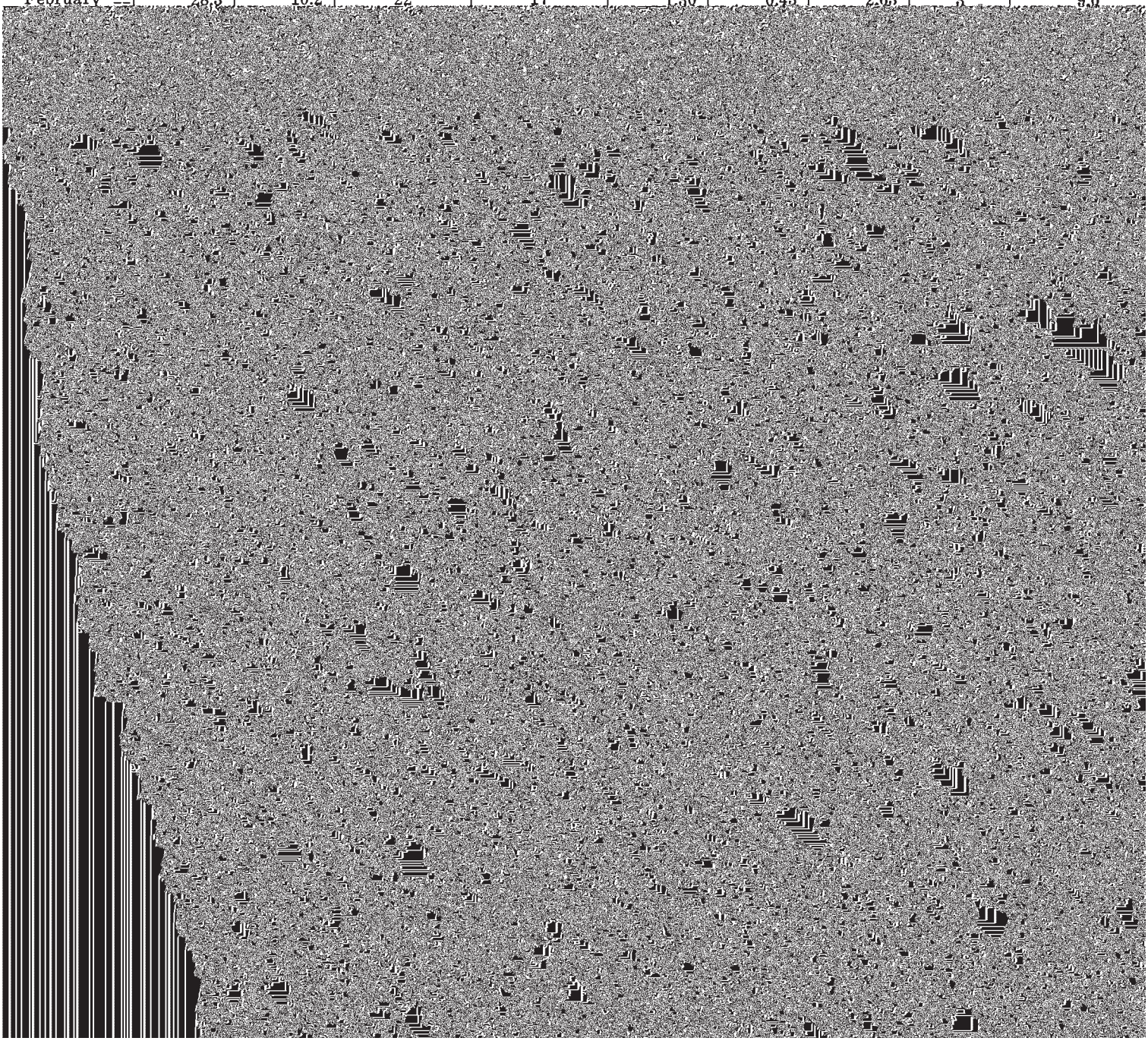


Figure 13.—**Residential development on former farmland of gently sloping Emmet soils.**

75,000 or more per week. Land use for summer and vacation homes is expected to increase.

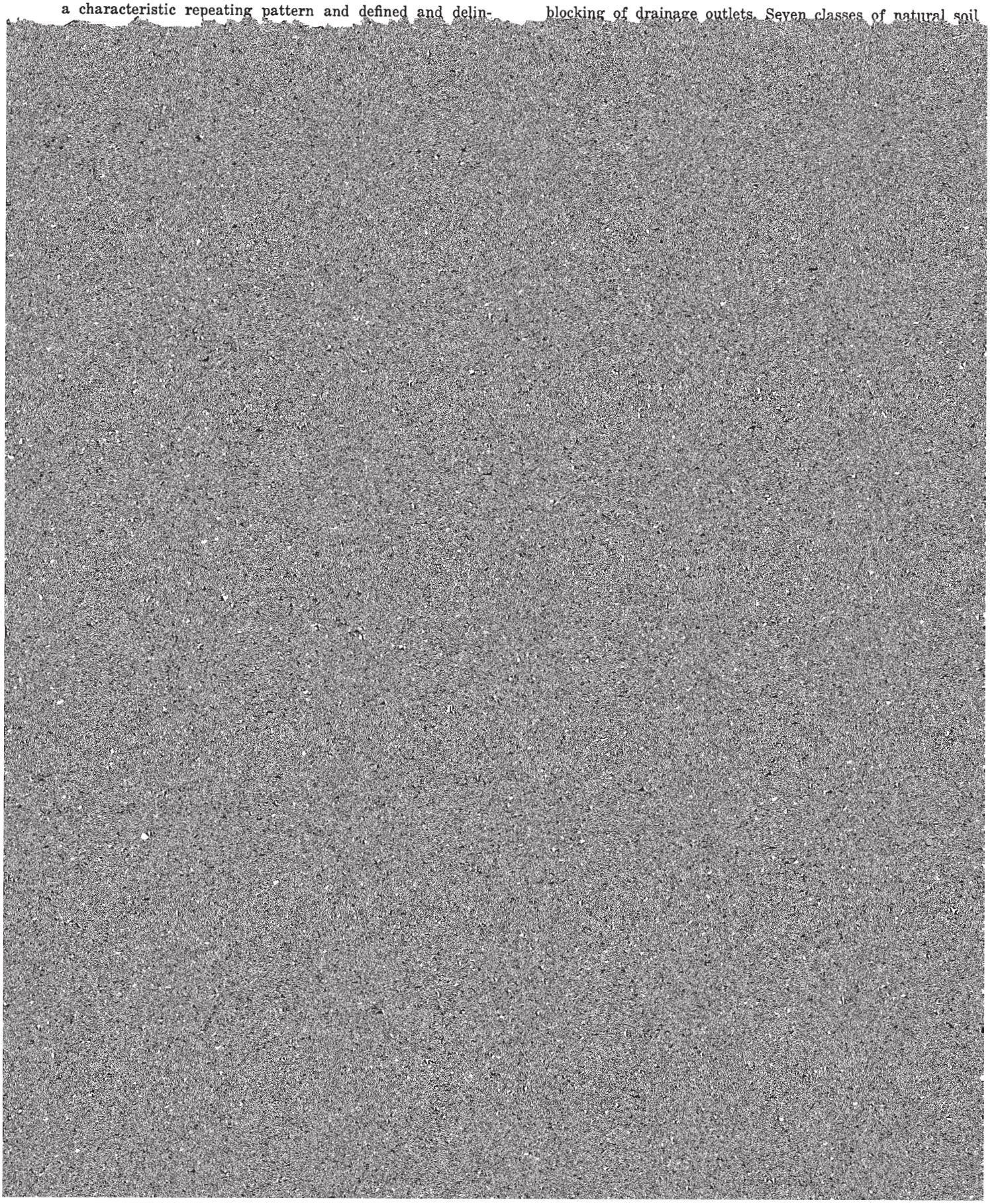
The number of small farms is decreasing as larger units take over much of the land. The total number of farms likewise is decreasing and the average acreage increasing. Washington Island Township currently has no dairy farming.

The trend in land use for fruit enterprises is downward. The acreage in fruit trees was 8,500 in 1973, 10,800 in 1970, 13,100 in 1960, 12,640 in 1950, and 11,600 in 1940.

This soil survey can provide important basic data and aid in making needed inventories, so land can be used wisely and projected orderly developments can be carried out. Soil information has been widely used in the past for conservation planning in Door County. In this way, farmers especially have been helped to bring

highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.
(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487–69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.
(3) Beatty, M. T., E. A. Brickbauer, A. J. Klingelhoets, and D. A. Rohweder. 1966. Wheat yields from Wisconsin soils. Univ. of Wis. Ext. Service, Special Cir. 65, 19 pp.
(4) Simonson, Roy W. 1962. Soil classification in the United States. Sci. 137: 1027–1034.
(5) Thwaites, F. T. and Kenneth Bertrand. 1957. Pleistocene geology of the Door Peninsula, Wisconsin. Geol. Soc. Am. Bull. 68: 831–880.
(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173–188 issued May 1962]
(7) United States Department of Agriculture. 1960. Soil classification, a comprehensive system, 7th approximation. Soil Conserv. Serv., 265 pp., illus. [Supplements issued March 1967, September 1968, April 1969]

a characteristic repeating pattern and defined and delin-



blocking of drainage outlets. Seven classes of natural soil

estimated. Frequency is expressed as none, rare, occasional, and frequent. None means that flooding is not probable; rare that it is unlikely but possible under unusual weather conditions; occasional that it occurs on an average of once or less in 2 years; and frequent that it occurs on an average of more than once in 2 years. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, and long if more than 7 days. Probable dates are expressed in months; November–May, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals

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

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

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

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

Piping. Moving water forms subsurface tunnels or pipelike cavities in 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 a semisolid to a plastic state.

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

building foundations, and other structures. It can also damage plant roots.

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.

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 feet.

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.

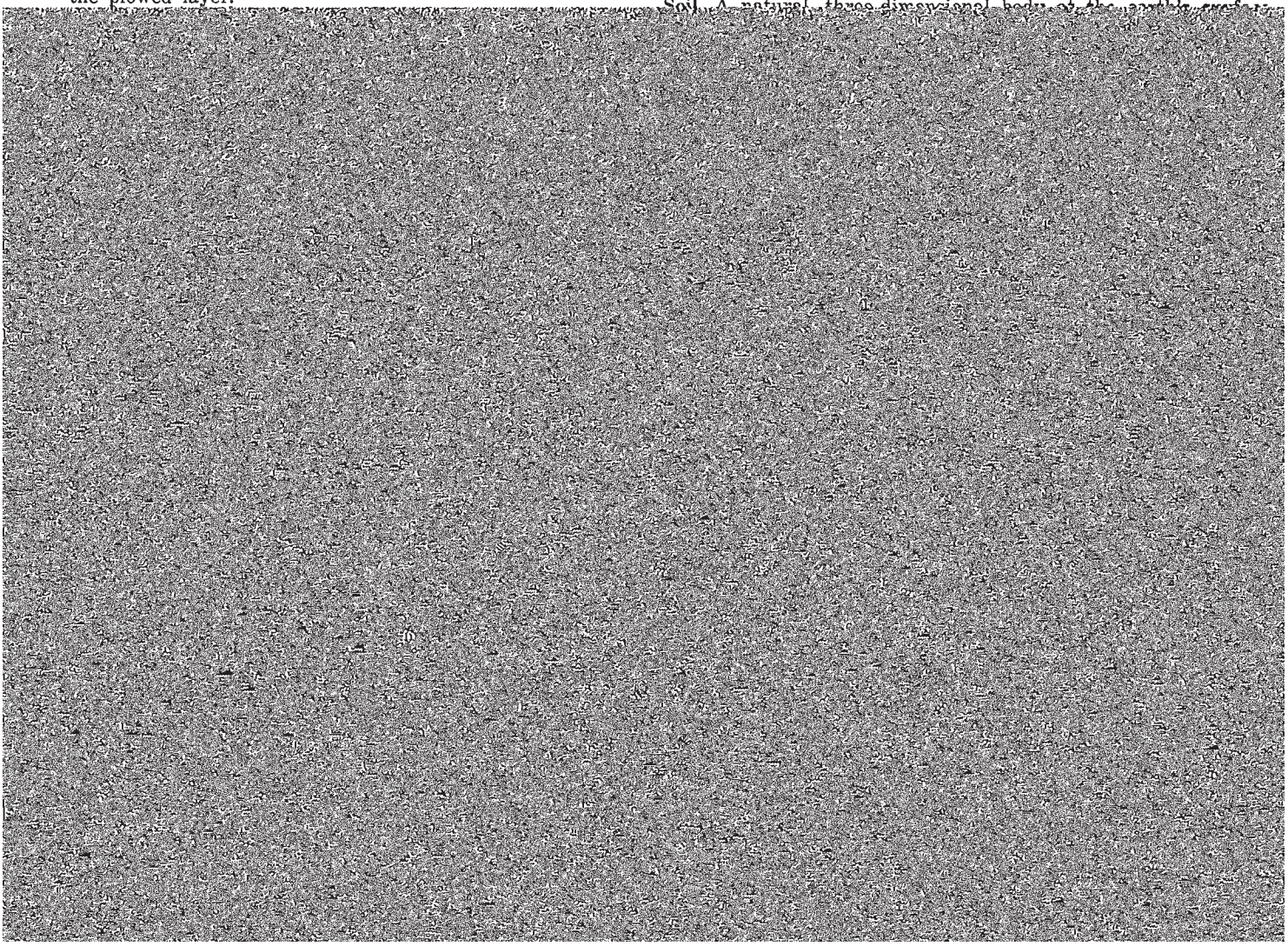
Letters	*Percent*	*Description*
A	0–2	Nearly level
B	2–6	Gently sloping
C	6–12	Sloping
D	12–20	Moderately steep
E	20–30	Steep
F	30+	Very steep

Slow intake. The slow movement of water into the soil.

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

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three dimensional body at the earth's surface,

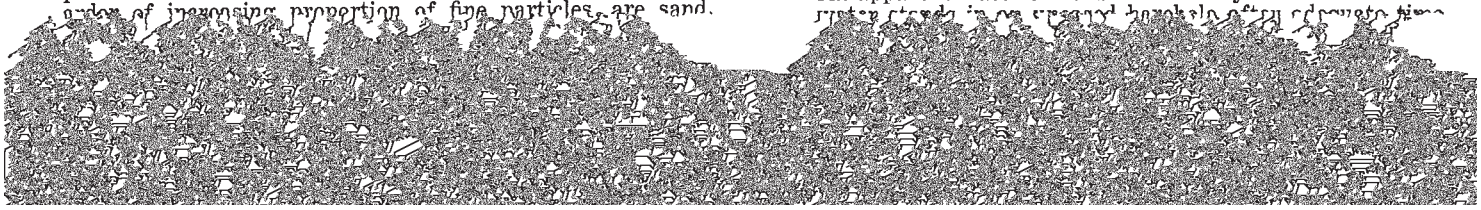


Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

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 it can soak into the soil or flow slowly to a prepared outlet without harm. 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. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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,



Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

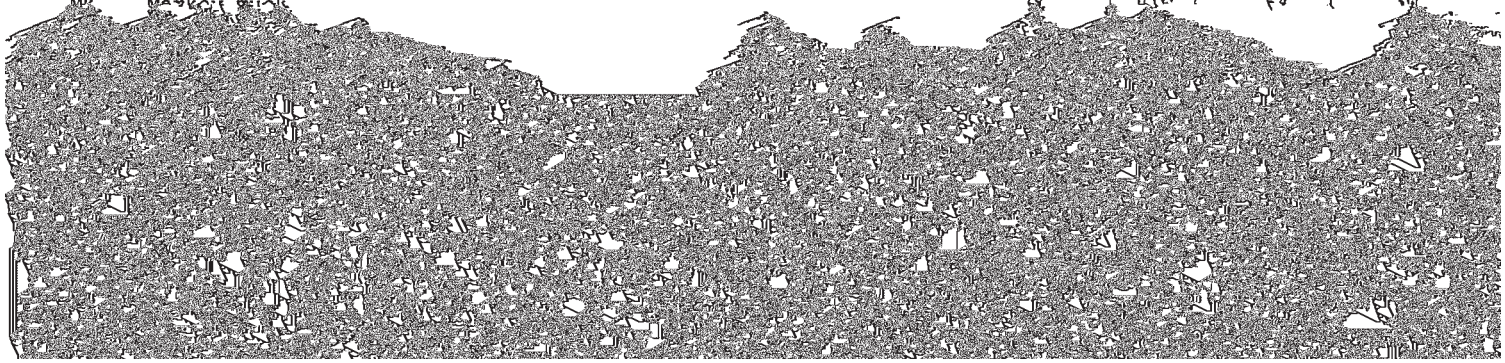
Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which

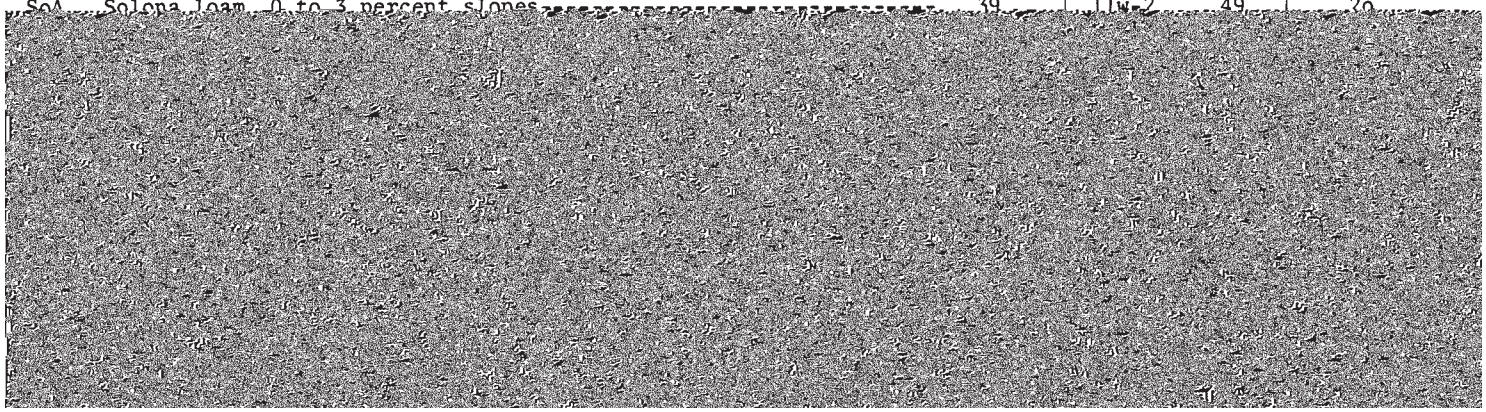
GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit or a woodland suitability subclass, read the introduction to the section it is in for general information about its mangement.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability subclass
			Symbol	Page	Symbol
AdA	Allendale loamy sand, 0 to 3 percent slopes	6	IIIw-6	51	3o
ApC	Alpena gravelly sandy loam, 0 to 12 percent slopes	8	VIs-5	54	4f
Ax	Angelica loam	9	IIw-1	48	3w
Be	Beaches	9	VIIIs-10	54	6s
Bn	Bonduel loam	10	IIw-3	49	3o
Bo	Bonduel Shallow Variant fine sandy loam	10	IVw-5	52	4w
Bp	Bonduel Wet Variant loam	11	IIw-3	49	4w
BrB	Boyer loamy sand, 2 to 6 percent slopes	12	IIIs-4	51	3o
BrC	Boyer loamy sand, 6 to 12 percent slopes	12	IIIe-7	50	3o
BrD	Boyer loamy sand, 12 to 20 percent slopes	12	IVe-7	52	3r
Ca	Carbondale muck	13	IVw-9	53	3w
CcB	Casco sandy loam, 2 to 6 percent slopes	14	IIIe-3	50	3d
CcC2	Casco sandy loam, 6 to 12 percent slopes, eroded	14	IVe-3	52	3d
Cm	Cathro muck	15	IVw-7	52	3w
Cp	Chippeny muck	15	VIIs-10	54	3w
De	Deford loamy fine sand	16	IVw-5	52	4w
DuB	Duel loamy sand, 1 to 6 percent slopes	16	IVs-3	52	3s
Dv	Duel Variant sandy loam	17	IVw-5	52	4w
EmA	Emmet sandy loam, 0 to 2 percent slopes	18	IIs-1	48	2o
EmB	Emmet sandy loam, 2 to 6 percent slopes	18	IIe-2	47	2o
EmC2	Emmet sandy loam, 6 to 12 percent slopes, eroded	18	IIIe-2	50	2o
EmD2	Emmet sandy loam, 12 to 20 percent slopes, eroded	18	IVe-2	52	2r
EmE	Emmet sandy loam, 20 to 35 percent slopes	18	VIe-2	53	2r
Fa	Fabius silt loam	20	IIIw-5	51	3o
Fu	Fluvaquents	20	Vw-14	53	4w
Gp	Gravel pits	20	NG 1/	--	NG
KhA	Kewaunee silt loam, 0 to 2 percent slopes	21	IIs-8	48	2c
KhB	Kewaunee silt loam, 2 to 6 percent slopes	21	IIe-6	48	2c
KhC2	Kewaunee silt loam, 6 to 12 percent slopes, eroded	21	IIIe-6	50	2c
KkD3	Kewaunee soils, 12 to 20 percent slopes, severely eroded	21	VIe-6	53	2c
KmB	Kiva sandy loam, 2 to 6 percent slopes	22	VIs-5	54	2s
KmC	Kiva sandy loam, 6 to 12 percent slopes	22	VIs-5	54	2s
KoA	Kolberg silt loam, 0 to 2 percent slopes	23	IIs-2	48	2c
KoB	Kolberg silt loam, 2 to 6 percent slopes	23	IIe-2	47	2c
KoC2	Kolberg silt loam, 6 to 12 percent slopes, eroded	24	IIIe-2	50	2c
KvB	Kolberg Variant loam, 1 to 6 percent slopes	24	IIIe-3	50	3d
KvC2	Kolberg Variant loam, 6 to 12 percent slopes, eroded	24	IVe-3	52	3d
LoA	Longrie loam, 0 to 2 percent slopes	25	IIs-1	48	2o
LoB	Longrie loam, 2 to 6 percent slopes	25	IIe-2	47	2o
LoC	Longrie loam, 6 to 12 percent slopes	26	IIIe-2	50	2o
McA	Manawa silt loam, 0 to 3 percent slopes	26	IIw-2	49	2o
MeB	Manistee loamy sand, 2 to 6 percent slopes	27	IIIs-3	50	3o
Mr	Marsh muck	28	VIw-7	54	3w



Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability subclass
			Symbol	Page	Symbol
Rb	Rock outcrop-Namur complex, 6 to 20 percent slopes	34	VIIIs-10	54	6s and 4d
Rn	Rondeau muck	34	IIIw-7	51	3w
RoB	Rousseau fine sand, 2 to 6 percent slopes	35	IIIs-3	50	3s
RoC	Rousseau fine sand, 6 to 12 percent slopes	35	IIIe-7	50	3s
RpC	Rousseau-Shawano fine sand, 2 to 12 percent slopes	35	VIs-3	53	3s and 6s
RpD	Rousseau-Shawano fine sands, 12 to 35 percent slopes	36	VIIs-3	54	3s and 6s
RrB	Rousseau-Deford fine sands, 2 to 6 percent slopes	36	IVw-5	52	3s and 4w
Sa	Saprists	36	VIIIw-15	54	6w
SnA	Sisson fine sandy loam, 0 to 2 percent slopes	38	I-4	47	1o
SnB	Sisson fine sandy loam, 2 to 8 percent slopes	38	IIe-1	47	1o
SoA	Solona loam, 0 to 3 percent slopes	39	IIw-2	49	2o



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