Appendix C: Soil Series Descriptions

LOCATION ARLAND WI

Established Series
Rev. HFG-TAM-TWN
07/2009

ARLAND SERIES

The Arland series consists of moderately deep, well drained soils formed in 50 to 100 centimeters of till underlain by sandstone bedrock. These soils are on knolls, ridge tops, and side slopes of glaciated bedrock-controlled uplands. Slope ranges from 1 to 35 percent. Mean annual precipitation is about 760 millimeters. Mean annual air temperature is about 5 degrees C.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, frigid Haplic Glossudalfs

TYPICAL PEDON: Arland fine sandy loam, on a convex, north-facing slope of 10 percent, in a cultivated field, at an elevation of about 337 meters above sea level. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 20 centimeters; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; common fine roots; some brown (7.5YR 4/3) soil mixed in by plowing; about 1 percent gravel; slightly acid; abrupt smooth boundary.

E--20 to 25 centimeters; brown (7.5YR 4/3) sandy loam, pink (7.5YR 7/3) dry; weak medium platy structure; friable; few fine roots; some very dark grayish brown (10YR 3/2) soil in worm and root channels; about 1 percent gravel; moderately acid; clear smooth boundary.

E/B--25 to 38 centimeters; about 80 percent brown (7.5YR 4/3) sandy loam (E), pink (7.5YR 7/3) dry; weak medium platy structure; friable; extends as tongues into and surrounds remnants of reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few fine roots; few distinct dark brown (7.5YR 3/3) clay films on faces of peds and in pores; about 2 percent gravel; moderately acid; clear smooth boundary.

B/E--38 to 58 centimeters; about 55 percent reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; common distinct dark brown (7.5YR 3/3) clay films on faces of peds and in pores; penetrated by tongues of brown (7.5YR 4/3) sandy loam (E), pink (7.5YR 7/3) dry; moderate medium subangular blocky structure; friable; few fine roots; about 4 percent gravel; strongly acid; clear wavy boundary.

Bt--58 to 91 centimeters; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 3/3) clay films on faces of peds and in pores; about 6 percent gravel; strongly acid; clear smooth boundary.

2Cr--91 to 152 centimeters; yellowish brown (10YR 5/6) sandstone.

TYPE LOCATION: Major Land Resource Area (MLRA) 90B-Wisconsin and Minnesota Thin Loess and Till,, Southern Part, Barron County, Wisconsin subset; about 4 miles east of Chetek; located about 500 feet south and 400 feet west of the northeast corner of section 26, T. 33 N., R. 10 W.; USGS Moose Ear Lake topographic quadrangle; lat. 45 degrees 19 minutes 10 seconds N. and long. 91 degrees 33

minutes 48 seconds W., NAD 83.

RANGE IN CHARACTERISTICS:
Thickness of loess or silty mantle--0 to 60 centimeters
Depth to paralithic contact with sandstone--50 to 100 centimeters
Clay content of the particle-size control section (weighted average)--10 to 18 percent
Sand content of the particle-size control section (weighted average)--30 to 70 percent

Ap horizon:
Hue--7.5YR or 10YR
Value--3 or 4
Chroma--2 or 3 (where value is 3, moist, value is 6 or more, dry)
Texture--fine sandy loam, sandy loam, loam, or silt loam
Clay content--5 to 15 percent
Sand content--20 to 70 percent
Rock fragment content--0 to 15 percent, igneous-mixed lithology
Reaction--pH 4.5 to 7.3
Thickness--15 to 25 centimeters

A horizon (when present):
Hue--7.5YR or 10YR
Value--2 or 3
Chroma--1 or 2
Texture--fine sandy loam, sandy loam, loam, or silt loam
Clay content--5 to 15 percent
Sand content--20 to 70 percent
Rock fragment content--0 to 15 percent, igneous-mixed lithology
Reaction--pH 4.5 to 7.3
Thickness--0 to 13 centimeters

E horizon and the E part of the E/B or B/E horizon (when present):
Hue--7.5YR or 10YR
Value--4 to 6
Chroma--2 or 3
Texture--sandy loam, fine sandy loam, loam, or silt loam
Clay content--5 to 15 percent
Sand content--20 to 70 percent
Rock fragment content--0 to 15 percent, igneous-mixed lithology
Reaction--pH 4.5 to 7.3
Thickness of the E horizon--0 to 20 centimeters
Thickness of the E/B horizon--0 to 40 centimeters

Bt part of the E/B or B/E horizon (when present) and Bt horizon (when present):
Hue--5YR, 7.5YR, or 10YR
Value--3 to 6
Chroma--4 to 6
Texture--sandy loam, fine sandy loam, loam, or silt loam
Clay content--10 to 18 percent
Sand content--30 to 70 percent
Rock fragment content--0 to 15 percent, igneous-mixed lithology
Reaction--pH 4.5 to 6.5

Thickness of the B/E horizon--5 to 75 centimeters
Thickness of the Bt horizon--0 to 40 centimeters

Some pedons with B/E horizons do not have Bt horizons

Some pedons have a layer of sandy residuum above the sandstone

2Bt or 2BC horizon (3Bt or 3BC horizon in pedons with a silty mantle) (when present):
Hue--5YR, 7.5YR, or 10YR
Value--4 to 8
Chroma--2 to 8
Texture--loamy sand, loamy fine sand, sand, or fine sand
Clay content--2 to 10 percent
Sand content--75 to 99 percent
Rock fragment content--0 to 15 percent, sandstone channers
Reaction--pH 4.5 to 6.5
Thickness of the 2Bt horizon--0 to 15 centimeters
Thickness of the 2BC horizon--0 to 15 centimeters

COMPETING SERIES: These are the Amery, Automba, Goodland, Itasca, Kennan, Langlade, Marathon, Pemene, Rosholt, Santiago, Scoba, and Steamboat series.
All of these competitors do not have a paralithic contact with sandstone within a depth of 100 centimeters

GEOGRAPHIC SETTING:
Parent material--50 to 10 centimeters of till underlain by sandstone
Landform--knolls, ridge tops, and side slopes of glaciated bedrock-controlled uplands
Slope--1 to 35 percent
Elevation--205 to 595 meters above sea level
Mean annual air temperature--3 to 8 degrees C
Mean annual precipitation--660 to 865 millimeters
Frost-free period--110 to 180 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Amery, Haugen, Freeon, Magnor, Santiago, and Siouxcreek soils.
Amery--are on landscape positions similar to those of Arland soils and do not have a paralithic contact with sandstone within a depth of 100 centimeters
Freeon--are on landscape positions similar to those of the Arland soils or are on slightly lower landscape positions and have a frequently saturated zone between depths of 0.75 and 1 meter during the wettest periods of years when precipitation is within one standard deviation of 30 year mean of annual precipitation
Haugen--are on landscape positions similar to those of the Arland soils or are on slightly lower landscape positions and have a frequently saturated zone between depths of 0.75 and 1 meter during the wettest periods of years when precipitation is within one standard deviation of 30 year mean of annual precipitation
Magnor--are on lower landscape positions in drainageways and depressions and have a frequently saturated zone between depths of 0.3 and 0.75 meter during the wettest periods of years when precipitation is within one standard deviation of 30 year mean of annual precipitation
Santiago--are on landscape positions similar to those of the Arland soils and do not have a paralithic contact with sandstone within a depth of 100 centimeters
Siouxcreek--are on lower landscape positions in drainageways and depressions and have a frequently saturated zone between depths of 0.45 and 0.75 meter during the wettest periods of years when

precipitation is within one standard deviation of 30 year mean of annual precipitation

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--well drained--a frequently saturated zone does not occur within a depth of 1.8 meters during the wettest periods of years when precipitation is within one standard deviation of 30 year mean of annual precipitation
Saturated hydraulic conductivity--4.00 to 42.00 micrometers per second in the silty and loamy mantle and 1.00 to 42.00 micrometers per second in the sandstone

USE AND VEGETATION:
The more gently sloping areas are cultivated. The principal crops are corn, small grains, and hay. The more steeply sloping areas are pastured or forested. The native vegetation is mixed hardwood forest, with principal species including northern red oak, northern pin oak, white oak, white ash, American basswood, quaking aspen, bigtooth aspen, yellow birch, sugar maple, and black cherry.

DISTRIBUTION AND EXTENT:
Physiographic division--Interior Plains
Physiographic Province--Central Lowland
Physiographic section--Western Lake section
MLRAs--Wisconsin and Minnesota Thin Loess and Till, Northern Part (90A), and Wisconsin and Minnesota Thin Loess and Till, Southern Part (90B)
LRR K; central and northwestern Wisconsin
Extent--moderate

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota; MLRA SSO 10-9 (Rhinelander, Wisconsin).

SERIES ESTABLISHED: Barron County, Wisconsin, 1950.

REMARKS:
Particle size control section--the zone from a depth of 38 to 88 centimeters;
series control section--the zone from the surface of the soil to a depth of 116 centimeters.

Diagnostic horizons and features recognized in this pedon are:
ochric epipedon--the zone from the surface of the soil to a depth of 38 centimeters (Ap, E, and E/B horizons);
albic horizon--the zone from a depth of 20 to 38 centimeters (E and E/B horizons);
glossic horizon--the zone from a depth of 25 to 58 centimeters (E/B and B/E horizons);
argillic horizon--the zone from a depth of 38 to 91 centimeters (B/E and Bt horizons);
paralithic contact--at a depth of 91 centimeters (2Cr horizon);
udic moisture regime.

Cation-exchange activity class is based on laboratory data of similar or adjacent soils.

Taxonomy version--Keys to Soil Taxonomy, tenth edition, 2006.

National Cooperative Soil Survey
U.S.A.

LOCATION BILLETT IL+IA IN MN WI

Established Series
Rev. MWB-TJE-TWN
02/2007

BILLETT SERIES

The Billett series consists of very deep, well drained and moderately well drained soils formed in water-deposited or wind-deposited loamy or sandy sediments. These soils are on nearly level to moderately steep convex crests and side slopes on outwash plains, stream terraces, or hills that border river valleys. Slope ranges from 0 to 20 percent. Mean annual air temperature is about 9 degrees C. Mean annual precipitation is about 885 millimeters.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, mesic Mollic Hapludalfs

TYPICAL PEDON: Billett sandy loam, on a southeast-facing slope of 1 percent, in a cultivated field, at an elevation of about 226 meters above mean sea level. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 20 centimeters; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; many fine roots; moderately acid; abrupt smooth boundary. (13 to 24 centimeters thick)

E--20 to 33 centimeters; brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; friable; few fine roots; moderately acid; abrupt smooth boundary. (0 to 16 centimeters thick)

Bt1--33 to 71 centimeters; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; few fine roots; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and bridges between sand grains; slightly acid; clear smooth boundary.

Bt2--71 to 104 centimeters; yellowish brown (10YR 5/4) loamy sand; weak coarse prismatic structure; very friable; few fine roots; very few distinct dark brown (10YR 3/3) clay bridges between sand grains; slightly acid; abrupt smooth boundary.

Bt3--104 to 119 centimeters; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; about 2 percent fine gravel; slightly acid; abrupt smooth boundary. (Combined thickness of the Bt horizon is 45 to 102 centimeters.)

C1--119 to 132 centimeters; dark yellowish brown (10YR 4/4) loamy sand; single grain; loose; few fine roots; about 8 percent fine gravel; slightly acid; abrupt smooth boundary.

C2--132 to 152 centimeters; dark yellowish brown (10YR 4/4) gravelly loamy sand; single grain; loose; about 15 percent fine gravel; slightly acid.

TYPE LOCATION: Major Land Resource Area (MLRA) 95B-Southern Wisconsin and Northern Illinois Drift Plain, Winnebago County, Illinois subset; about 5 miles southeast of Rockford; located about 520 feet south and 1,840 feet west of the center of section 13, T. 43 N., R. 2 E.; USGS Cherry

Valley topographic quadrangle; lat. 42 degrees 12 minutes 08 seconds N. and long. 88 degrees 57 minutes 26 seconds W., NAD 83.

RANGE IN CHARACTERISTICS:
Clay content in the particle-size control section (weighted average)--10 to 18 percent
Sand content in the particle-size control section (weighted average)--40 to 80 percent, less than 50 percent very fine sand

A or Ap horizon:
Hue--7.5YR or 10YR
Value--2 or 3
Chroma--1 to 3
Texture--fine sandy loam, sandy loam, or loam
Clay content--7 to 18 percent
Sand content--50 to 75 percent
Rock fragment content--0 to 10 percent
Reaction--moderately acid to slightly alkaline
Special features--when mixed to a depth of 18 centimeters, matrix value is 3 or less, moist, 5 or less, dry

E horizon (when present):
Hue--7.5YR or 10YR
Value--4 or 5
Chroma--2 to 4
Texture--fine sandy loam or sandy loam
Clay content--7 to 18 percent
Sand content--50 to 75 percent
Rock fragment content--0 to 10 percent
Reaction--strongly acid to neutral

Some pedons have BE or BA horizons

Bt horizon:
Hue--7.5YR or 10YR
Value--4 to 6
Chroma--3 to 6
Texture--sandy loam, fine sandy loam, loam, loamy sand, loamy fine sand, sandy clay loam, fine sand or sand
Clay content--7 to 22 percent
Sand content--50 to 95 percent
Rock fragment content--0 to 15 percent, gravel and 0 to 5 percent, cobbles
Reaction--strongly acid to neutral

Some pedons have redoximorphic features in the lower part

Some pedons have Bw or BC horizons

C horizon:
Hue--7.5YR or 10YR
Value--4 to 7
Chroma--3 to 6
Texture--loamy sand, loamy fine sand, sand, fine sand, or the gravelly analogs of these textures

Clay content--1 to 7 percent
Sand content--70 to 95 percent, coarse and very coarse sand content averages less than 10 percent
Rock fragment content--0 to 35 percent, gravel and 0 to 5 percent, cobbles
Reaction--strongly acid to slightly alkaline

Silt plus clay content is less than 10 percent

Some pedons have redoximorphic features in the lower part

Some pedons have thin lamellae of sandy loam, loam, or finer textured material

COMPETING SERIES: These are the Backbone, Brownchurch, Desker, Kingsley, Oronoco, and Ulster series.
Backbone--have a lithic contact at a depth of 100 centimeters
Brownchurch--have a sand content of less than 70 percent in the lower part of the series control section
Desker--have a rock fragment content that averages more than 12 percent in the upper part of the series control section
Kingsley--have a sand content that averages less than 70 percent and have more than 10 percent silt plus clay in the lower one-quarter of the control section
Oronoco--have a sand content that averages less than 70 percent and have more than 10 percent silt plus clay in the lower one-quarter of the control section
Ulster--have a fine and very fine sand content that averages more than 50 percent in the particle-size control section

GEOGRAPHIC SETTING:
Parent material--water-deposited or wind-deposited loamy or sandy sediments
Landform--nearly level to moderately steep convex crests and side slopes on outwash plains, stream terraces, or hills that border river valleys
Slope--0 to 20 percent
Elevation--185 to 315 meters above mean sea level
Mean annual air temperature--7 to 11 degrees C
Mean annual precipitation--750 to 1,020 millimeters
Frost-free period--140 to 180 days
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GEOGRAPHICALLY ASSOCIATED SOILS: These are the Ade, Alvin, Bloomfield, Dickman, Gotham, and Onarga soils.
Ade--are on similar landscape positions as the Billett soils and have a mollic epipedon
Alvin--are on similar landscape positions as the Billett soils and have a thinner, dark-colored surface layer
Bloomfield--are on similar landscape positions as the Billett soils and have an argillic horizon consisting of lamellae
Dickman--are on similar landscape positions as the Billett soils and have a mollic epipedon and do not have and argillic horizon
Gotham--are on similar landscape positions as the Billett soils and have an average clay content of less than 10 percent in the particle-size control section
Ongara--are on similar landscape positions as the Billett soils and have a mollic epipedon

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--well drained and moderately well drained--a frequently saturated zone may occur at a depth of 1.2 meters during the wettest periods of normal years

Saturated hydraulic conductivity--10.00 to 100.00 micrometers per second (high) in the upper two thirds of the series control section and 10 to 705 micrometers per second (high or very high) in the lower third of the series control section
Surface runoff potential--negligible to low

USE AND VEGETATION:
Most areas are cultivated. The principal crops are corn and soybeans. Some areas are pastured. The native vegetation is big bluestem, little bluestem, switchgrass, other grasses of the tall grass prairie and mixed deciduous trees.

DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains
Physiographic Province--Central Lowland
Physiographic sections--Eastern lake section, Western lake section, Dissected till plains, Wisconsin driftless section, and Till plains
MLRAs--Wisconsin and Minnesota Thin Loess and Till (90),
Wisconsin and Minnesota Sandy Outwash (91),
Southern Wisconsin and Northern Illinois Drift Plain (95B),
Central Iowa and Minnesota Till Prairies (103),
Eastern Iowa and Minnesota Till Prairies (104),
Northern Mississippi Valley Loess Hills (105),
Illinois and Iowa Deep Loess and Drift (108),
Indiana and Ohio Till Plain (111), and
Central Mississippi Valley Wooded Slopes (115)
LRR K and M; Illinois, Indiana, Iowa, Minnesota, and Wisconsin
Extent--large

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Lawrence County, Illinois, 1952.

REMARKS:
Particle-size control section--the zone from a depth of 33 to 83 centimeters (Bt1 and Bt2 horizons); series control section--the zone from the surface to a depth of 150 centimeters (Ap, E, Bt1, Bt2, Bt3, C1 and C2 horizons).

Diagnostic horizons and features recognized in this pedon include:
ochric epipedon--the zone from the surface to a depth of 33 centimeters (Ap and E horizons);
argillic horizon--the zone from a depth of 33 to 119 centimeters (Bt1, Bt2, and Bt3 horizons);
udic moisture regime.

Mollic subgroup based on colors and thickness of the ochric epipedon.

Cation-exchange activity class is inferred from lab data from similar soils in the surrounding area.

Taxonomy version--Keys to Soil Taxonomy, tenth edition, 2006.

National Cooperative Soil Survey
U.S.A.

LOCATION BOONE WI+IA IL MN NE

Established Series
Rev. JEL-TAM-PMW
10/2008

BOONE SERIES

The Boone series consists of excessively drained soils which are moderately deep to a paralithic contact with sandstone. These soils formed in 50 to 100 centimeters of siliceous sandy residuum from the underlying sandstone and/or in siliceous sandy colluvium or slope alluvium. These soils are on hills in bedrock controlled uplands. Slope ranges from 1 to 90 percent. Mean annual precipitation is about 775 millimeters. Mean annual air temperature is about 9 degrees C.

TAXONOMIC CLASS: Mesic, uncoated Typic Quartzipsamments

TYPICAL PEDON: Boone sand, from an area of Boone-Elevasil complex, on a convex, west-facing slope of 28 percent, at an elevation of about 293 meters above sea level. (Colors are for moist soil unless otherwise stated.)

Oe--0 to 2 centimeters; very dark grayish brown (10YR 3/2) moderately decomposed plant material; about 45 percent fiber and 20 percent rubbed; weak thin platy structure; non-sticky; very strongly acid; abrupt smooth boundary. (0 to 8 centimeters thick)

A--2 to 8 centimeters; very dark grayish brown (10YR 3/2) sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many very fine and fine roots; pale brown (10YR 6/3) clean sand grains throughout; strongly acid; abrupt wavy boundary. (2 to 16 centimeters thick)

E--8 to 20 centimeters; brown (10YR 4/3) sand, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; very friable; common very fine and fine roots; about 14 percent sandstone channers; strongly acid; abrupt wavy boundary. (0 to 21 centimeters thick)

Bw--20 to 53 centimeters; dark yellowish brown (10YR 4/4) sand; weak coarse subangular blocky structure; very friable; few fine roots; about 13 percent sandstone channers; strongly acid; clear wavy boundary. (9 to 64 centimeters thick)

C--53 to 89 centimeters; brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; about 10 percent sandstone channers; strongly acid; gradual smooth boundary. (25 to 77 centimeters thick)

Cr--89 to 152 centimeters; very pale brown (10YR 8/2) weakly cemented sandstone.

TYPE LOCATION: Major Land Resource Area (MLRA) 105-Northern Mississippi Valley Loess Hills, Jackson County, Wisconsin; located about 1.5 miles south and 2 miles west of Melrose; about 1,280 feet north and 2000 feet west of the southeast corner of section 24, T. 19 N., R. 6 W.; USGS North Bend topographic quadrangle; latitude 44 degrees 6 minutes 13 seconds N., longitude 91 degrees 02 minutes 24 seconds W., NAD 83.

RANGE IN CHARACTERISTICS:
Depth to the paralithic contact with sandstone--50 to 100 centimeters

The weighted average content of silt plus clay is 5 percent or less in the particle-size control section and the weighted average content of weatherable minerals is less than 10 percent (0.02 to 2 mm fraction)
Rock outcrops are in some areas and a rocky phase is recognized

O horizon (when present):
Hue--7.5YR, 10YR or is neutral
Value--2 or 3
Chroma--0 to 2
Moderately decomposed plant material

A horizon:
Hue--7.5YR or 10YR
Value--2 to 5
Chroma--1 to 3
Texture--sand, fine sand, loamy sand, loamy fine sand, fine sandy loam
Clay content--2 to 12 percent
Sand content--70 to 95 percent
Rock fragment content--0 to 15 percent channers, 0 to 5 percent flagstones
Reaction--extremely acid to slightly acid

Ap horizon (when present):
Hue--7.5YR or 10YR
Value--3 to 5
Chroma--2 or 3
Texture--sand, fine sand, loamy sand, loamy fine sand, fine sandy loam
Clay content--2 to 12 percent
Sand content--70 to 95 percent
Rock fragment content--0 to 15 percent channers, 0 to 5 percent flagstones
Reaction--extremely acid to neutral

E horizon (when present):
Hue--7.5YR or 10YR
Value--4 or 5
Chroma--2 or 3
Texture--sand, fine sand, loamy sand, loamy fine sand, or the channery analogues of these textures
Clay content--1 to 5 percent
Sand content--85 to 98 percent
Rock fragment content--0 to 35 percent channers, 0 to 5 percent flagstones
Reaction--extremely acid to neutral

Bw horizon:
Hue--10YR or 7.5YR
Value--4 to 6
Chroma--3 to 6
Texture--sand, fine sand, loamy sand, loamy fine sand, or the channery analogues of these textures
Clay content--1 to 5 percent
Sand content--85 to 98 percent
Rock fragment content--0 to 35 percent channers, 0 to 5 percent flagstones
Reaction--very strongly acid to neutral

Horizons with spodic colors have pH greater than 5.9 or have less than 0.6 percent organic carbon

C horizon:
Hue--7.5YR or 10YR
Value--5 to 8
Chroma--1 to 6 (uncoated sand grains)
Texture--sand, fine sand, or the channery analogues of these textures
Clay content--1 to 5 percent
Sand content--90 to 98 percent
Rock fragment content--0 to 35 percent channers, 0 to 5 percent flagstones
Reaction--very strongly acid to slightly acid

Cr horizon:
Hue--7.5YR or 10YR
Value--5 to 8
Chroma--1 to 6 (uncoated sand grains)
Texture--sand, fine sand, or the channery analogues of these textures (sandstone)
Clay content--0 to 3 percent
Sand content--90 to 100 percent
Rock fragment content--0 to 35 percent channers, 0 to 5 percent flagstones
Reaction--very strongly acid to slightly acid

COMPETING SERIES: These are the Carver, Goodharbor, Hooksan, Tarr, and Tint series. None of these soils have a paralithic contact within a depth of 150 centimeters

GEOGRAPHIC SETTING:
Parent material--50 to 100 centimeters of siliceous sandy residuum from the underlying sandstone and/or in siliceous sandy colluvium or slope alluvium
Landform--hills in bedrock controlled uplands
Slope--1 to 90 percent
Elevation--200 to 430 meters above sea level
Mean annual air temperature--8 to 11 degrees C
Mean annual precipitation--700 to 850 millimeters
Frost-free period--135 to 160 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Council, Elevasil, Gale, Hixton, and Tarr soils.
Council--are in lower landscape positions, have an argillic horizon, have an average clay content of 10 to 17 percent in the particle-size control section and do not have a paralithic contact within a depth of 150 centimeters
Elevasil--are in landscape positions similar to the Boone soils, have an argillic horizon and have an average clay content of 10 to 17 percent in the particle-size control section
Gale--are in landscape positions similar to the Boone soils, have an argillic horizon, have an average clay content of more than 18 percent and an average sand content of less than 15 percent in the upper two thirds of the particle-size control section
Hixton--are in landscape positions similar to the Boone soils, have an argillic horizon, have an average clay content of 18 to 27 percent and an average sand content of 40 to 65 percent in the upper two thirds of the particle-size control section
Tarr--are in lower landscape positions on base slopes, do not have an argillic horizon and do not have a paralithic contact within a depth of 150 centimeters

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--excessively drained--these soils are not frequently saturated within a depth of 1.8 meters

during the wettest portions of normal years
Saturated hydraulic conductivity--10.00 to 100.00 micrometers per second (high) in the siliceous sandy residuum or in siliceous sandy colluvium or slope alluvium and 1.00 to 100.00 micrometers per second (moderately high or high) in the sandstone
Surface runoff potential--negligible to medium

USE AND VEGETATION:
Many areas are forested. The native vegetation is deciduous and coniferous trees. Common trees are northern pin oak or black oak, jack pine, and eastern white pine. Some areas are cultivated. Common crops are corn, small grain, and hay. Some areas are pastured.
DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains
Physiographic Province--Central Lowland
Physiographic sections--Western lake section, Wisconsin driftless section, Till plains, and Dissected till plains
MLRAs--Wisconsin and Minnesota Thin Loess and Till (90),
Wisconsin and Minnesota Sandy Outwash (91),
Central Iowa and Minnesota Till Prairies (103),
Eastern Iowa and Minnesota Till Prairies (104),
Northern Mississippi Valley Loess Hills (105),
Iowa and Missouri Deep Loess Hills (107), and
Illinois and Iowa Deep Loess and Drift (108)
LRRs K & M; West-central and southwestern Wisconsin, southeastern Minnesota, northeastern Iowa, and northwestern Illinois, and northeastern Nebraska
Extent--large

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Bates County, Missouri, 1908.

REMARKS:
Particle-size control section--the zone from a depth of 25 to 100 centimeters;
Series control section--the zone from the surface of the soil to a depth of 150 centimeters

Diagnostic horizons and features recognized in this pedon include:
ochric epipedon--the zone from the surface of the soil to a depth of 20 centimeters (Oe, A, and E horizons);
cambic horizon--the zone from a depth of 20 to 53 centimeters (Bw horizon); paralithic contact--the contact with sandstone bedrock at a depth of 89 centimeters;
siliceous feature--less than 10 percent weatherable minerals (.02 to 2 mm fraction) in the particle-size control section;
uncoated class--weighted average content of silt plus clay of 5 percent or less in the particle-size control section.

The Type Location is associated with the Wonewoc formation. The Boone series concept could occur on any of the dominantly quartz Cambrian sandstone formations as well as the Ordovician St. Peter formation.

Taxonomy version--Keys to Soil Taxonomy, tenth edition, 2006.

ADDITIONAL DATA:

Laboratory data--National Soil Survey Laboratory, Lincoln, Nebraska - user pedon ID 90WI019036 (http://ssldata.nrcs.usda.gov/).

National Cooperative Soil Survey
U.S.A.

LOCATION CHETEK WI+MN

Established Series
Rev. DEJ-HFG-JJJ
06/2006

CHETEK SERIES

The Chetek series consists of very deep, somewhat excessively drained soils which are shallow to sandy outwash. They formed mostly in loamy alluvium and in the underlying sandy and gravelly outwash. Typically, they are on outwash plains and stream terraces but some are on moraines or kame terraces. Permeability is moderate or moderately rapid in the loamy mantle and rapid or very rapid in the sandy outwash. Slopes range from 0 to 45 percent. Mean annual precipitation is about 30 inches. Mean annual temperature is about 42 degrees F.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, frigid Inceptic Hapludalfs

TYPICAL PEDON: Chetek sandy loam - on a plane 3 percent slope in a cultivated field at an elevation of about 1,070 feet. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 10 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common fine roots; about 10 percent gravel; slightly acid; abrupt smooth boundary. (6 to 10 inches thick)

Bt1--10 to 16 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct reddish brown (5YR 4/4) clay films on faces of peds and clay bridging of sand grains; about 10 percent gravel; moderately acid; clear smooth boundary. (4 to 10 inches thick)

2Bt2--16 to 20 inches; reddish brown (5YR 4/4) gravelly loamy sand; weak medium subangular blocky structure; very friable; clay bridging between sand grains; about 20 percent gravel; strongly acid; clear smooth boundary. (0 to 6 inches thick)

2C--20 to 60 inches; yellowish brown (10YR 5/6) stratified gravelly sand and sand; single grain; loose; about 20 percent gravel as an average; strongly acid.

TYPE LOCATION: Barron County, Wisconsin; about 5 miles east and 1 mile south of Chetek; 650 feet west and 100 feet south of the northeast corner, sec. 36, T. 33 N., R. 10 W.

RANGE IN CHARACTERISTICS: Depth to the base of the argillic horizon ranges from 12 to 24 inches. Thickness of the loamy deposits ranges from 12 to 20 inches. The clay content of the particle-size control section ranges from 10 to 17 percent and the content of fine sand or coarser ranges from 50 to 70 percent as a weighted average. Volume of gravel ranges from 0 to 35 percent in the loamy mantle but typically is less than 15 percent. Volume of gravel ranges from 3 to 45 percent in the sandy outwash as a weighted average but ranges from 0 to 60 percent in individual strata. Volume of cobbles ranges from 0 to 10 percent throughout the pedon. Volume of stones ranges from 0 to 3 percent throughout the pedon. Reaction typically ranges from very strongly acid to moderately acid in the solum but ranges to neutral in the upper part, where the soil is limed. Reaction ranges from strongly acid to slightly acid in the substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. Dry color value is 6 or more. Uncultivated pedons have an A horizon, 1 to 5 inches thick with hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3. The Ap or A horizon is loam or sandy loam.

Some pedons have an E horizon with hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam, sandy loam or the gravelly analogs.

The Bt horizon has hue of 5YR, 7.5YR or 10YR; value of 3 to 5; and chroma of 3 or 4. Value and chroma of 3 do not occur together. It is loam or sandy loam or the gravelly analogs.

The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 4 to 6. It typically is gravelly loamy sand but in some pedons it is gravelly loamy coarse sand, gravelly sand, gravelly coarse sand, or the very gravelly or non-gravelly analogs.

The 2C horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 4 to 6. It is stratified layers of sand or coarse sand or the gravelly or very gravelly analogs.

COMPETING SERIES: These are the Anoka, Hayriver, and Hodenpyl series. Similar soils in other families are the Cress, Cromwell, Pence, and Rosholt series. Anoka soils also have less than 5 percent gravel and less than 40 percent fine sand or coarser in the argillic horizon and have E and Bt horizons in the lower part of the argillic. Hayriver soils have a paralithic contact within the series control section at a depth of 20 to 40 inches. Hodenpyl soils have a loamy mantle 25 to 45 inches thick over a sandy E and Bt horizon. Cress and Cromwell soils do not have argillic horizons. Rosholt soils have a glossic horizon and have a loamy mantle 20 to 40 inches thick over sand and gravel outwash. Pence soils have a spodic horizon and do not have an argillic horizon.

GEOGRAPHIC SETTING: Chetek soils typically are on outwash plains (either smooth or pitted), stream terraces, and valley benches but some are in outwash areas on moraines. Slopes range from 0 to 45 percent. Chetek soils formed in loamy deposits 12 to 20 inches thick and the underlying sandy and gravelly outwash. Mean annual precipitation ranges from about 28 to 33 inches. Mean annual air temperature ranges from 39 to 45 degrees F. The frost free period ranges from about 120 to 135 days. Elevation ranges from 800 to 1950 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Mahtomedi, Menahga, and Rosholt soils. The excessively drained Mahtomedi and Menahga soils are nearby on landscape positions similar to those of Chetek soils where the soil is sandy throughout. The well drained Rosholt soils are in similar landscape positions where the loamy mantle is 20 to 40 inches thick over the sandy outwash.

DRAINAGE AND PERMEABILITY: Somewhat excessively drained. Surface runoff is slow to very rapid. Permeability is moderate or moderately rapid in the loamy mantle and rapid or very rapid in the sandy outwash.

USE AND VEGETATION: Many areas are cleared and are used for cropland or pastureland. Common crops are corn, small grains, and hay. Many areas remain in woodland particularly where slopes are irregular and exceed 5 percent. The native vegetation is mixed deciduous and coniferous forest.

DISTRIBUTION AND EXTENT: Northwestern Wisconsin and central and northeastern Minnesota. The Chetek series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Langlade County, Wisconsin, 1947.

REMARKS: Diagnostic horizons and features recognized in this pedon: ochric epipedon - 0 to 10 inches (Ap); argillic horizon - 10 to 20 inches (Bt1, 2Bt2).

ADDITIONAL DATA: Soil Interpretation Record - WI0120.

National Cooperative Soil Survey
U.S.A.

LOCATION ELEVA WI+IA IL MI MN

Established Series
Rev. PHC-BB-TWN
03/2006

ELEVA SERIES

The Eleva series consists of moderately deep, well drained and somewhat excessively drained soils formed in 50 to 102 centimeters of loamy deposits over sandstone. These soils are on undulating to very steep slopes on uplands and on lake terraces. Slope ranges from 1 to 60 percent. Mean annual precipitation is about 800 millimeters. Mean annual air temperature is about 9 degrees C.

TAXONOMIC CLASS: Coarse-loamy, mixed, active, mesic Typic Hapludalfs

TYPICAL PEDON: Eleva sandy loam, on an 8 percent slope, in a cornfield, at an elevation about 288 meters. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 13 centimeters; dark grayish brown (10YR 4/2) sandy loam, pale brown (10YR 6/3) dry; weak coarse subangular blocky structure; very friable; many fine roots; moderately acid; abrupt smooth boundary. (5 to 15 centimeters thick)

BE--13 to 30 centimeters; dark yellowish brown (10YR 4/4) sandy loam; weak medium and coarse subangular blocky structure; friable; many fine roots; moderately acid; clear smooth boundary. (0 to 20 centimeters thick)

Bt1--30 to 51 centimeters; brown (7.5YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; common faint brown (7.5YR 4/3) clay films on faces of peds; common fine roots; strongly acid; clear wavy boundary.

Bt2--51 to 76 cm (20 to 30 inches); brown (7.5YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; few faint brown (7.5YR 4/3) clay films, mostly near upper boundary, and clay bridging of sand grains; few fine roots; moderately acid; gradual irregular boundary. (Combined thickness of the Bt horizon is 30 to 58 centimeters.)

2C--76 to 91 centimeters; yellowish brown (10YR 5/6) sand; single grain; loose; strongly acid; abrupt smooth boundary. (0 to 25 centimeters thick)

2Cr--91 to 117 centimeters; brownish yellow (10YR 6/6) weakly cemented sandstone.

2R--117 centimeters; brownish yellow (10YR 6/6) medium grained strongly cemented sandstone bedrock.

TYPE LOCATION: Major Land Resource Area (MLRA) 105-Northern Mississippi Valley Loess Hills; Trempealeau County, Wisconsin subset; about 1 1/2 miles southeast of Pleasantville; located about 900 feet north and 1,750 feet east of the southwest corner of section 30, T. 23 N., R. 7 W.; USGS Pleasantville topographic quadrangle; lat. 44 degrees 26 minutes 21 seconds N. and long. 91 degrees 16 minutes 46 seconds W., NAD 83.

RANGE IN CHARACTERISTICS:
Depth to a paralithic or lithic contact with sandstone--50 to 102 centimeters
Content of clay in the particle-size control section (weighted average)--10 to 18 percent
Content of sand in the particle-size control section (weighted average)--40 to 70 percent, fine sand and sand coarser than fine sand

Ap or A horizon:
Hue--7.5YR or 10YR
Value--2 to 5, low value moist colors have value of 6 or more dry
Chroma--1 to 4
Texture--sandy loam, fine sandy loam, loam, silt loam, loamy sand or the cobbly or channery analogues of these textures
Clay content--3 to 15 percent
Sand content--25 to 80 percent
Rock fragment content--0 to 35 percent, dominantly sandstone channers Reaction--extremely acid to neutral

E horizon (when present):
Hue--7.5YR or 10YR
Value--4 or 5
Chroma--2 to 4
Texture--sandy loam, fine sandy loam, loam or the cobbly or channery analogues of these textures
Clay content--5 to 20 percent
Sand content--25 to 65 percent
Rock fragment content--0 to 35 percent, dominantly sandstone channers Reaction--extremely acid to slightly acid

BE horizon (when present):
Hue--7.5YR or 10YR
Value--3 to 6
Chroma--3 to 6
Texture--sandy loam, fine sandy loam, loam or the cobbly or channery analogues of these textures
Clay content--10 to 20 percent
Sand content--25 to 65 percent
Rock fragment content--0 to 35 percent, dominantly sandstone channers Reaction--extremely acid to slightly acid

Bt horizon:
Hue--7.5YR or 10YR
Value--4 or 5
Chroma--3 to 6
Texture--sandy loam, fine sandy loam, loam or the cobbly or channery analogues of these textures
Clay content--10 to 18 percent, some pedons have subhorizons with more than 18 percent
Sand content--40 to 70 percent
Rock fragment content--0 to 35 percent, dominantly sandstone channers Reaction--extremely acid to slightly acid

BC horizon (when present):
Hue--7.5YR or 10YR
Value--4 to 7
Chroma--4 to 6

Texture--sandy loam, fine sandy loam, loamy sand, loamy fine sand, fine sand, sand or the cobbly, very cobbly, channery or very channery analogues of these textures
Clay content--1 to 15 percent
Sand content--55 to 90 percent
Rock fragment content--0 to 40 percent, dominantly sandstone channers Reaction--extremely acid to slightly acid

2C horizon (when present):
Hue--7.5YR or 10YR
Value--4 to 7
Chroma--4 to 6
Texture--sand, fine sand, loamy sand, loamy fine sand or the cobbly, very cobbly, channery or very channery analogues of these textures
Clay content--1 to 15 percent
Sand content--55 to 90 percent
Rock fragment content--0 to 40 percent, dominantly sandstone channers Reaction--extremely acid to slightly acid

COMPETING SERIES: These are the Brownsburg, Crumstown, Hillsdale, Mecan, and Oshtemo series.
Brownsburg--have a lithic contact with red metamorphic shale and siltstone residuum at a depth of 102 centimeters and are in areas that have a mean annual precipitation range of 1,060 to 1,140 milimeters
Crumstown--do not have a paralithic or lithic contact within a depth of 200 centimeters
Hillsdale--do not have a paralithic or lithic contact within a depth of 200 centimeters
Mecan--do not have a paralithic or lithic contact within a depth of 150 centimeters
Oshtemo--do not have a paralithic or lithic contact within a depth of 200 centimeters

GEOGRAPHIC SETTING:
Parent material--50 to 102 centimeters of loamy deposits over sandstone, St. Peter and Wonewoc formations
Landform--undulating to very steep slopes on uplands and on lake terraces
Slope--1 to 60 percent
Elevation--207 to 415 meters above sea level
Mean annual air temperature--6 to 12 degrees C
Mean annual precipitation--700 to 900 millimeters
Frost-free period--120 to 160 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Boone, Elkmound, Gale, Hixton and Northfield soils.
Boone--are in similar landscape positions on steeper slopes and are sandy throughout the series control section
Elkmound--are in similar landscape positions and do not have an argillic horizon
Gale--are in similar landscape positions near drainageways and have a clay content that averages more than 18 percent in the upper two thirds of the particle-size control section
Hixton--are in similar landscape positions and have a clay content that averages more than 18 percent in the upper two thirds of the particle-size control section
Northfield--are in similar landscape positions and have a lithic contact with sandstone within a depth of 50 centimeters

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--well drained and somewhat excessively drained--a frequently saturated zone does not occur within a depth of 1.8 meters in normal years

Saturated hydraulic conductivity--4.23 to 42.34 micrometers per second (moderately high or high) in the loamy deposits and less than 10 to 100 micrometers per second (moderately high or high) in the sandstone
Surface runoff potential--low to high

USE AND VEGETATION:
More gently sloping areas are cultivated. The principal crops are corn, soybeans, small grains, and legume hays. The more steeply sloping areas are pastured or wooded. The native vegetation is mixed deciduous hardwoods with some conifers.

DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains
Physiographic Province--Central Lowland
Physiographic sections--Eastern lake section, Western lake section, Wisconsin driftless section, Till plains and Dissected till plains
MLRAs--Central Wisconsin and Minnesota Thin Loess and Till (90),
Northeastern Wisconsin Drift Plain (95A),
Southern Wisconsin and Northern Illinois Drift Plain (95B),
Southern Michigan and Northern Indiana Drift Plain (98),
Eastern Iowa and Minnesota Till Prairies (104),
Northern Mississippi Valley Loess Hills (105),
Illinois and Iowa Deep Loess and Drift (108) and
Indiana and Ohio Till Plain (111)
LRR M and K; southwestern Wisconsin, northwestern Illinois, northeastern Iowa, southeastern Minnesota, and the southern part of lower Michigan
Extent--large

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Trempealeau County, Wisconsin, 1969.

REMARKS:
Particle-size control section--the zone from a depth of 30 to 76 centimeters (Bt1 and Bt2 horizons); series control section--the zone from the surface to a depth of 117 centimeters (Ap, BE, Bt1, Bt2, 2C and 2Cr horizons).

Diagnostic horizons and features recognized in this pedon include:
ochric epipedon--the zone from the surface to a depth of 30 centimeters (Ap and BE horizons);
argillic horizon--the zone from a depth of 30 to 76 centimeters (Bt1 and Bt2 horizons);
paralithic contact--at a depth of 91 centimeters (2Cr horizon);
lithic contact--at a depth of 117 centimeters;
udic moisture regime.

Cation-exchange activity class is inferred from lab data from similar soils in the surrounding area.

Taxonomy version--Keys to Soil Taxonomy, ninth edition, 2003.

National Cooperative Soil Survey
U.S.A.

LOCATION ELKMOUND WI

Established Series
Rev. TAM-HFG-JJJ
12/2006

ELKMOUND SERIES

The Elkmound series consists of well drained soils that are shallow to a paralithic contact with sandstone. They formed in loamy deposits that are a mixture of loess, slope alluvium, and residuum. Permeability is moderate or moderately rapid in the loamy mantle and moderately slow or moderate in the sandstone. Slopes range from 0 to 60 percent. Mean annual precipitation is about 32 inches. Mean annual air temperature is about 47 degrees F.

TAXONOMIC CLASS: Loamy, mixed, superactive, mesic, shallow Typic Dystrudepts

TYPICAL PEDON: Elkmound loam - on a 9 percent convex slope in a cultivated field at an elevation of about 920 feet. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 6 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; about 12 percent sandstone channers and about 2 percent igneous gravel and cobble; slightly acid; abrupt smooth boundary. (6 to 9 inches thick)

Bw--6 to 12 inches; yellowish brown (10YR 5/4) channery loam; weak medium subangular blocky structure; very friable; about 30 percent sandstone channers; moderately acid; clear wavy boundary. (6 to 11 inches thick)

2Cr--12 to 60 inches; yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) fine grained weakly cemented platy sandstone.

TYPE LOCATION: Dunn County, Wisconsin; about 1.5 miles southeast of Elkmound; 1950 feet south and 2100 feet east of the northwest corner of sec. 36, T. 28 N., R. 11 W. USGS Elk Creek Lake, Wis. Quad. Latitude - 44 degrees 51 minutes 53 seconds N. Longitude - 91 degrees 31 minutes 48.4 seconds W. NAD 27.

RANGE IN CHARACTERISTICS: Depth to the base of soil development and depth to the paralithic contact with sandstone range from 10 to 20 inches. Clay content of the particle-size control section ranges from 5 to 20 percent. Volume of sandstone channers or other gravel ranges from 0 to 20 percent in the A or Ap horizon. Volume of sandstone channers ranges from 0 to 35 percent in the Bw horizon and volume of other gravel from 0 to 20 percent. Volume of cobbles or sandstone flagstones ranges from 0 to 5 percent throughout the soil. Reaction ranges from very strongly acid to slightly acid.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. Where value moist is 3, value dry is 6 or more. Uncultivated pedons have a thin A horizon with hue of 7.5YR or 10YR, value of 2 or 3 and chroma of 1 or 2. Texture of the Ap or A horizon is loam or sandy loam or the gravelly analogues.

Some pedons have an E horizon with hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. Texture is the same as the Ap or A horizon above.

The Bw horizon has hue of 10YR, and value and chroma of 3 through 6. Value and chroma of 3 do not occur together. Texture is loam or sandy loam or the gravelly analogues.

Some pedons have a 2BC horizon with hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. Texture is loamy sand, loamy fine sand, sand or fine sand.

The 2Cr horizon has color like the 2BC horizon. It is weakly cemented sandstone with horizontal cleavage. In some areas the sandstone formations contain thin, hard, iron-cemented layers.

COMPETING SERIES: There are no competing series. Related series in other families are Basehor, Boone, Hixton, Northfield, and Ramsey. Basehor, Boone, and Ramsey soils are siliceous. Hixton and Northfield soils have an argillic horizon.

GEOGRAPHIC SETTING: Elkmound soils are on convex slopes on upland ridges underlain by sandstone, but in some places are on lake terraces. In Dunn County, Elkmound soils are in previously glaciated, bedrock controlled landscapes and typically on the Eau Claire and Mt. Simon formations. Slopes range from 0 to 60 percent. Elkmound soils formed in a mixture of loess, slope alluvium, and residuum underlain by sandstone. Mean annual precipitation ranges from 28 to about 35 inches. Mean annual air temperature ranges from 46 to about 51 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Boone, Gale, Hixton, and Northfield soils. They are all on similar landscapes but not easily distinguished from one another on surface features alone. Gale soils have thicker, finer textured sola and argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained. The potential for surface runoff ranges from negligible to high. Permeability is moderate or moderately rapid in the loamy mantle and moderately slow or moderate in the sandstone.

USE AND VEGETATION: Some of the less sloping areas of these soils are used for cropland. Common crops are corn, small grain, and hay. Many areas are used for woodland and some are used for pastureland. Native vegetation is mixed deciduous forests, with oak predominating.

DISTRIBUTION AND EXTENT: Western and west-central Wisconsin. This soil is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Green County, Wisconsin, 1969. Source of the name is the city of Elkmound in Dunn County.

REMARKS: There is some question as to whether the mineralogy would be best characterized as siliceous rather than mixed mineralogy.

2006- Due to the shale seams that are common to the Eau Claire and Mt. Simon Formations, it remains classified as mixed. In Dunn, Chippewa, and Eau Claire Counties, previous glacial ice events provided the Precambrian rock fragments that are commonly on the surface of and mixed in the Elkmound soil. This revision provides a new typical pedon in Dunn County which gets the type location back to where it was originally proposed. This revision also changes the bedrock from R to Cr which in turn changes the classification from Lithic Dystrudepts to Typic Dystrudepts. Field study is needed to determine if Elkmound mapped in other counties is on different unglaciated bedrock formations where the soil may be siliceous.

Diagnostic horizons and features recognized in this pedon are: ochric epipedon - 0 to 6 inches (Ap);

cambic horizon - 6 to 12 inches (Bw);
other features - paralithic contact - 12 inches (Cr).

National Cooperative Soil Survey
U.S.A.

LOCATION HUMBIRD WI

Established Series
Rev. DTS-HFG
06/98

HUMBIRD SERIES

The Humbird series consists of moderately well drained soils which are moderately deep to a paralithic contact with interbedded sandstone and shale. They formed in loamy alluvium and in clayey residuum from the underlying interbedded sandstone and shale on pediments. Permeability is moderate or moderately rapid in the loamy mantle, slow in the clayey residuum, and very slow to moderately slow in the sandstone and shale. Slopes range from 1 to 20 percent. Mean annual precipitation is about 30 inches. Mean annual temperature is about 42 degrees F.

TAXONOMIC CLASS: Coarse-loamy over clayey, mixed, semiactive, frigid Oxyaquic Ultic Haplorthods

TYPICAL PEDON: Humbird fine sandy loam - on a convex, east-facing 3 percent slope in a woodland at an elevation of about 1,040 feet. (Colors are for moist soil unless otherwise stated.)

Oe--0 to 1 inch; very dark grayish brown (10YR 3/2) mucky peat (hemic material which is a mat of partially decomposed forest litter); about 35 percent fiber and 20 percent rubbed; weak thin platy structure; non-sticky; common very fine and fine and few medium roots; very strongly acid; abrupt smooth boundary. (0 to 3 inches thick)

A--1 to 2 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; common very fine and fine and few medium roots; extremely acid; abrupt wavy boundary. (0 to 3 inches thick)

E--2 to 9 inches; pinkish gray (7.5YR 6/2) fine sandy loam, pinkish gray (7.5YR 7/2) dry; weak medium platy structure; very friable; common very fine and fine roots; very strongly acid; abrupt wavy boundary.

Bs--9 to 14 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; very friable; common very fine and fine roots; very strongly acid; clear wavy boundary. (4 to 12 inches thick.)

Bw--14 to 21 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; very friable; few very fine and fine roots; very strongly acid; abrupt wavy boundary. (0 to 20 inches thick)

2Bt--21 to 27 inches; light olive gray (5Y 6/2) clay loam; moderate fine subangular blocky structure; firm; few very fine and fine roots; few faint gray (5Y 6/1) clay) films on faces of some peds; few fine prominent brownish yellow (10YR 6/8) masses of iron accumulation; about 8 percent sandstone channers; extremely acid; clear wavy boundary. (4 to 20 inches thick)

2Cr--27 to 60 inches; interbedded very pale brown (10YR 7/3) sandstone and light gray (5Y 7/2) shale.

TYPE LOCATION: Clark County, Wisconsin; about 2 miles south and 2.25 miles west of Sherwood;

100 feet north and 2,500 feet west of the southeast corner of sec. 29, T. 23 N., R. 1 E.; USGS City Point NW, WI quad.; lat. 44 degrees, 26', 15" N., long. 90 degrees, 24', 19" W.

RANGE IN CHARACTERISTICS: (Unless otherwise stated, thickness and depth are measured from the top of the mineral soil.) Depth to the base of the argillic horizon and depth to the paralithic contact with interbedded sandstone and shale ranges from 20 to 40 inches. Thickness of the loamy mantle and depth to the clayey residuum ranges from 12 to 30 inches. The upper part of the particle-size control section averages from 8 to 17 percent clay and from 45 to 70 percent fine sand or coarser. The lower part of the particle-size control section averages from 35 to 60 percent clay. Base saturation (by sum of cations) is less than 35 percent in the argillic horizon. Coarse fragments are mostly sandstone channers but in many places, these soils occur near higher lying glacial soils and igneous pebbles are in the upper part of some pedons. Volume of gravel or sandstone channers ranges from 0 to 15 percent in the loamy mantle. Volume of sandstone channers ranges from 3 to 15 percent in the residuum. Reaction typically ranges from very strongly acid to moderately acid in the loamy mantle but ranges to neutral in the Ap horizon, where the soil is limed. Reaction ranges from extremely acid to strongly acid in the residuum. Redox accumulations are below the spodic horizon and within 40 inches. Saturation occurs within 40 inches for 1 month or more per year in most years.

The O horizon has hue of 7.5YR or 10YR or is neutral in hue. Value is 2 or 3 and chroma is 0 to 3. The O horizon is a mat of partially decomposed forest litter.

The A horizon has value of 2 or 3 and chroma of 1 or 2. Cultivated pedons have an Ap horizon with value of 3 or 4 and chroma of 2 or 3. The A or Ap horizon is fine sandy loam or sandy loam.

The E horizon has value of 4 to 6 and chroma of 2 or 3. Colors of 4/3 or 5/3 have value dry of 7 or more. The E horizon is fine sandy loam or sandy loam.

The Bs horizon has hue of 5YR value of 3 to 6, and chroma of 4 to 6 or hue of 7.5YR, value of 3 to 5, and chroma of 4. It is sandy loam or fine sandy loam.

The Bw horizon has value and chroma of 4 to 6. It is sandy loam or fine sandy loam.

The 2Bt horizon has hue of 2.5YR, 5YR, 7.5YR, 10YR, 2.5Y, or 5Y; value of 4 to 8; and chroma of 2 to 6. It is dominantly clay loam, silty clay loam, silty clay, or clay but thin subhorizons of coarser texture are in some pedons.

The 2Cr horizon has color like the 2Bt horizon described above. It is interbedded sandstone and shale.

COMPETING SERIES: There are no competing series. Related soils are the Fairchild, Hiles, Kert, Ludington, and Merrillan series. Fairchild and Ludington soils have a 15 to 39 inch thick sandy mantle and have sandy over loamy particle-size. Hiles and Kert soils are fine-loamy Glossoboralfs. Merrillan soils have redox features and saturation in the spodic horizon.

GEOGRAPHIC SETTING: These soils are on pediments underlain by interbedded sandstone and shale (Eau Claire and Mt. Simon formations of the Elk Mound group). Slope gradients range from 1 to 20 percent. Humbird soils formed in 12 to 30 inches of loamy alluvium and in clayey residuum from the underlying interbedded sandstone and shale. Mean annual temperature ranges from 39 to 45 degrees F. Mean annual precipitation ranges from 28 to 33 inches. The frost free period ranges from about 120 to 135 days. Elevation ranges from 700 to 1,400 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Elm Lake, Merrillan, Fairchild, Hiles, Kert, Ludington, and Veedum soils. The poorly drained Elm Lake soils, the somewhat poorly drained

Fairchild soils, and the moderately well drained Ludington soils form a drainage sequence in nearby areas where there is a 15 to 39 inch thick sandy mantle over loamy residuum from the underlying interbedded sandstone and shale. The moderately well drained Hiles soils, the somewhat poorly drained Kert soils, and the poorly drained Veedum soils form a drainage sequence in nearby areas where there is a 12 to 30 inch thick silty mantle over loamy residuum from the underlying interbedded sandstone and shale. The somewhat poorly drained Merrillan soils form a drainage sequence with Humbird soils.

DRAINAGE AND PERMEABILITY: Moderately well drained. Surface runoff is medium or rapid. Permeability is moderate or moderately rapid in the loamy mantle; slow in the residuum; and very slow to moderately slow in the interbedded sandstone and shale. Humbird soils have a perched seasonal high water table at a depth of 1.5 to 3 feet for 1 month or more per year at some time during the period October to May in 6 or more out of 10 years.

USE AND VEGETATION: Most areas are used for woodland and are in second growth hardwood forest, principally oak and aspen. Native vegetation is mixed deciduous and coniferous forest with northern red oak, red maple, jack pine, northern pin oak, and quaking aspen predominating. Some areas are cleared and used for cropland. Common crops are corn, small grain, and hay. Some areas are used for pastureland.

DISTRIBUTION AND EXTENT: West central Wisconsin. These soils are moderately extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota.

SERIES ESTABLISHED: Wood County, Wisconsin, 1971.

REMARKS: Diagnostic horizons and features recognized in this pedon are: ochric epipedon - 0 to 8 inches (A, E); spodic horizon - 8 to 13 inches (Bs); argillic horizon - 20 to 26 inches (2Bt); oxyaquic feature - redox accumulations and saturation below the spodic horizon and within 40 inches for 1 month or more per year in most years; paralithic contact at 26 inches (2Cr).

ADDITIONAL DATA: Soil Interpretation Record - WI0236.

National Cooperative Soil Survey
U.S.A.

LOCATION MAGNOR WI+MN

Established Series
HEL-HFG-DJH
10/2006

MAGNOR SERIES

The Magnor series consists of very deep, somewhat poorly drained soils which are deep to a densic contact. They formed in loess or silty lacustrine deposits and in the underlying dense sandy loam till mostly on ground moraines, end moraines, disintegration moraines, drumlins, and ice-walled glacial lake plains. Permeability is moderate in the silty mantle, moderately slow or slow in the till subsoil, and very slow in the substratum. Slopes range from 0 to 6 percent. Mean annual precipitation is about 30 inches. Mean annual air temperature is about 42 degrees F.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, frigid Aquic Glossudalfs

TYPICAL PEDON: Magnor silt loam - on a northeast-facing concave slope of 2 percent in a hardwood forest at an elevation of about 1,500 feet. (Colors are for moist soil unless otherwise stated.)

A--0 to 4 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; friable; many fine and medium roots; about 2 percent gravel; extremely acid; abrupt wavy boundary. (1 to 6 inches thick)

E1--4 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate very fine subangular blocky structure; friable; common fine and medium roots; about 2 percent gravel; very strongly acid; clear wavy boundary.

E2--7 to 11 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate fine platy structure; friable; common fine and medium roots; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulations; about 2 percent gravel; extremely acid; clear wavy boundary. (Combined thickness of E horizons ranges from 0 to 7 inches thick)

E/B--11 to 16 inches; 70 percent brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; (E); moderate coarse platy structure; friable; moderate medium subangular blocky structure; friable; extends into or surrounds remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common fine and medium roots; few fine faint and distinct grayish brown (10YR 5/2) iron depletions; common medium prominent strong brown (7.5Y4 5/6) masses of iron accumulation; about 1 percent gravel; very strongly acid; gradual wavy boundary.

B/E--16 to 21 inches; 70 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few distinct brown (7.5YR 4/2) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E); very pale brown (10YR 7/3) dry; moderate coarse platy structure; friable; common fine and medium roots; common medium distinct and faint grayish brown (10YR 5/2) iron depletions and common medium prominent strong brown (7.5YR 5/6) masses of iron accumulations; about 4 percent gravel; very strongly acid; gradual wavy boundary. (The glossic horizon ranges from 2 to 30 inches thick.)

2Bt1--21 to 29 inches; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky

structure; firm; few fine and medium roots; common distinct reddish brown (5YR 4/3) clay films on faces of peds; few fine distinct reddish gray (5YR 5/2) iron depletions and common medium distinct yellowish red (5YR 5/8) masses of iron accumulations; about 9 percent gravel; very strongly acid; gradual wavy boundary.

2Bt2--29 to 39 inches; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky structure; firm; common distinct dark reddish gray (5YR 4/2) clay films on faces of peds; few fine distinct reddish gray (5YR 5/2) iron depletions and many medium distinct yellowish red (5YR 5/8) masses of iron accumulation; about 10 percent gravel; strongly acid; gradual wavy boundary.

2Bt3--39 to 58 inches; reddish brown (5YR 4/4) fine sandy loam; moderate medium subangular blocky structure; firm; few distinct dark reddish gray (5YR 4/2) clay films on faces of peds; few fine distinct yellowish red (5YR 5/8) masses of iron accumulations; about 12 percent gravel; moderately acid; gradual wavy boundary. (Combined thickness of the 2Bt horizons ranges from 6 to 45 inches.)

2Cd--58 to 60 inches; reddish brown (5YR 4/4) fine sandy loam; massive tending to part along horizontal cleavage planes to weak thin plates; firm; dense and compact; about 10 percent gravel; moderately acid.

TYPE LOCATION: Taylor County, Wisconsin; about 9 miles east of Medford; 2370 feet north and 100 feet west of the southeast corner of sec. 31, T.31N., R.3E. Rib River Lookout Tower USGS quadrangle; lat. 45 degrees 7 minutes 37 seconds N. and long. 90 degrees 8 minutes 47 seconds W.; NAD27. NAD27.

RANGE IN CHARACTERISTICS: Thickness of the silty mantle ranges from 12 to 36 inches. Depth to the base of the argillic horizon and to densic contact ranges from 40 to 60 inches. Content of clay averages from 7 to 17 percent in the particle-size control section and the content of fine sand or coarser averages 15 to 70 percent. The base saturation (by sum of cations) is less than 60 percent in some part of the argillic horizon. Volume of gravel ranges from 0 to 10 percent in the silty mantle and from 5 to 35 percent in the till. Volume of cobbles ranges from 0 to 3 percent in the silty mantle and from 0 to 5 percent in the till. Volume of stones ranges from 0 to 1 percent in the silty mantle and from 0 to 3 percent in the till. Surface stones have coverage ranging from 0 to 3 percent. Reaction ranges from extremely acid to slightly acid in the solum, except that it ranges to neutral in the Ap horizon where the soil is limed. Reaction ranges from strongly acid to neutral in the till. Redox concentrations are typically throughout the pedon below the Ap or A horizon. Redox depletions with chroma of 2 or less are in the upper 10 inches of the argillic and aquic conditions occur there at some time in most years.

The A horizon has value of 2 or 3, and chroma of 1 or 2. Cultivated areas have an Ap horizon, 6 to 9 inches thick, with hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. Ap horizons with color value moist of 3 have value dry of 6 or more.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. Colors of 4/3 or 5/3 have value dry of 7 or more. The E horizon is silt loam or silt.

Magnor soils have a glossic horizon. Horizonation has a wide range depending on thickness of the silty mantle and the extent to which eluviation has occurred. Therefore, there can be E/B, B/E, 2E/B, or 2B/E horizons singly or in combination.

The E part of the E/B or B/E horizon has color and texture like the E horizon described above. The Bt part has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6.

Some pedons have a Bt horizon with color and texture like the Bt part described above. Some pedons

have a Btg horizon, with dominant chroma of 2, below the upper 10 inches of the argillic horizon.

The 2E part of the 2E/B or 2B/E horizon has hue of 2.5YR, 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 2 or 3. Colors of 4/3 or 5/3 have value dry of 7 or more. The 2E part is typically sandy loam, fine sandy loam, loam, or their gravelly analogs, but in some pedons it is loamy sand or gravelly loamy sand. The 2Bt part has color and texture like the 2Bt horizon described below.

The 2Bt horizon has hue of 2.5YR, 5YR, 7.5YR, or 10YR; value of 3 to 5; and chroma of 3 to 6. It is typically sandy loam, fine sandy loam, loam, or their gravelly analogs. Bulk density ranges from 1.65 to 1.90. Some pedons have pockets or thin strata of loamy sand or gravelly loamy sand.

Some pedons have a 2BCd horizon with hue of 2.5YR, 5YR, or 7.5YR; value of 3 to 5; and chroma of 3 to 6. It is typically sandy loam, fine sandy loam, or their gravelly analogs. Clay content averages more than 7 percent. Bulk density ranges from 1.8 to 2.0. Some pedons have pockets or strata of loamy sand or gravelly loamy sand.

The 2Cd horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 3 to 5; and chroma of 3 to 6. It is typically sandy loam, fine sandy loam or their gravelly analogs. Clay content averages more than 7 percent. Bulk density ranges from 1.8 to 2.0. Some pedons have pockets or thin strata of loamy sand or gravelly loamy sand.

COMPETING SERIES: These are the Brennyville, Fallcreek, Hatley, Magroc, Oesterle, Plover, Rosy, and Stinnett series.

Brennyville soils have base saturation greater than 60 percent in all parts of the argillic horizon.

Fallcreek soils do not have a silty 12 to 36 inch thick mantle or it is less than 12 inches thick that is more than 50 percent silt.

Hatley, Oesterle, Plover, and Rosy soils do not have a Cd horizon do not have a densic contact within the series control section.

Magroc soils have a lithic contact with igneous or metamorphic bedrock at a depth of 40 to 60 inches.

Stinnett soils average less than 7 percent clay in the dense till.

GEOGRAPHIC SETTING:
Parent material: Formed in loess or silty lacustrine and in the underlying dense sandy loam till of Late Wisconsinan Age.
Landform: Flats, footslopes, and toe slopes of ground moraines, disintegration moraines, end moraines, drumlins, and ice-walled glacial lake plains.
Slope: 0 to 6 percent.
Elevation: 800 to 1950 feet.
Mean annual air temperature: 39 to 45 degrees F.
Mean annual precipitation: 28 to 33 inches.
Frost-free days: 120 to 135 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are Adolph, Amery, Auburndale, Cable, Capitola, Cebana, Freeon, Haugen, Newood, Newot, and Santiago series.

The well drained Santiago soils, the moderately well drained Freeon soils, the poorly drained Auburndale and Cebana soils, and the very poorly and poorly drained Adolph and Capitola soils are in a drainage

sequence with the Magnor soils. Santiago and Freeon soils are on steeper landscape positions. Auburndale, Cebana, Adolph, and Capitola soils are in depressions and drainageways.

The somewhat poorly drained Almena soils are on similar landforms to Magnor soils where the silty mantle is greater than 36 inches thick.

The well drained Amery and Newot soils and the moderately well drained Haugen and Newood soils are in on higher or more sloping landcape positions where the silty mantle is less than 12 inches thick, or is absent.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained. Surface runoff is medium to very low. Permeability is moderate in the silty mantle, moderately slow or slow in the till subsoil, and very slow in the substratum. Magnor soils have a perched seasonal high water table at a depth of 1 to 2.5+ feet for 1 month or more per year at some time during the period of September to June in normal years.

USE AND VEGETATION: Many areas of this soil are cleared and used for cropland or pastureland. Common crops are corn, small grains, and hay. Many areas remain in woodland. Native vegetation is deciduous forest with red maple, sugar maple, quaking aspen, yellow birch, and white ash predominating and with some balsam fir, American basswood, northern red oak, and American hophornbeam.

DISTRIBUTION AND EXTENT: North-central and northwestern Wisconsin. LRR K, MLRA 90A, and MLRA 90B. This soil is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: St. Croix County, Wisconsin, 1975. Type location moved to Taylor County, Wisconsin with the correlation of the soil survey in 2000. The source of the name is a lake in southeastern Polk County, Wisconsin.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Particle size control section - the zone from 16 to 36 inches.
Ochric epipedon - the zone from 0 to 16 inches (A, E1, E2, E/B).
Albic horizon - the zone from 7 to 16 inches (E2 and E part of the E/B).
Glossic horizon - the zone from 11 to 21 inches (E/B, B/E).
Argillic horizon - the zone from 16 to 58 inches (B/E, 2Bt1, 2Bt2, 2Bt3).
Densic contact - the contact with dense till (2Cd) at 58 inches.
Redoximorphic concentrations - oxidized color features in the zone from 7 to 58 inches.
Redoximorphic depletions - depleted color features in the zone from 11 to 58 inches.
Lithologic discontinuity - at the upper boundary of the 2Bt1 horizon at 21 inches.

Aquic conditions in the upper 10 inches of the argillic horizon.
The bulk density and platyness of the argillic horizon is considered to be relict of the till, but studies are needed to determine whether or not these horizons meet criteria for fragipans or fragic soil properties.

ADDITIONAL DATA: Former Soil Interpretation Record - WI0128; WI0355 (VERY STONY). Refer to soil survey sample number S94WI-119-002 for NSSL data on the typical pedon.

National Cooperative Soil Survey
U.S.A.

LOCATION MERIDIAN WI+MN

Established Series
Rev. TAM/HFG/JJJ
03/2007

MERIDIAN SERIES

The Meridian series consists of very deep, well drained soils which are moderately deep to sandy outwash. They formed dominantly in loamy alluvium underlain by sandy outwash on lake terraces and outwash terraces of valley trains. Permeability is moderate in the loamy alluvium and rapid or very rapid in the sandy outwash. Slopes range from 0 to 20 percent. Mean annual precipitation is about 30 inches. Mean annual temperature is about 49 degrees F.

TAXONOMIC CLASS: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Mollic Hapludalfs

TYPICAL PEDON: Meridian silt loam - on a plane 1 percent slope in a cultivated field at an elevation of about 805 feet. (Colors are for moist soils unless otherwise stated.)

Ap--0 to 9 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; few fine and very fine roots; about 1 percent gravel and 1 percent cobbles; slightly acid; abrupt smooth boundary. (6 to 9 inches thick)

Bt1--9 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few very fine and fine roots; few faint brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel and 1 percent cobbles; moderately acid; clear smooth boundary.

Bt2--15 to 22 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few very fine and fine roots; common faint brown (10YR 4/3) clay films on faces of peds and in pores; about 1 percent gravel and 1 percent cobbles; very strongly acid; clear smooth boundary.

Bt3--22 to 28 inches; brown (7.5YR 4/4) loam; moderate coarse subangular blocky structure; friable; few very fine and fine roots; many distinct brown (10YR 4/3) clay films on faces of peds and in pores; about 1 percent gravel and 1 percent cobbles; very strongly acid; gradual smooth boundary.

Bt4--28 to 32 inches; strong brown (7.5YR 4/6) sandy loam; moderate medium and coarse subangular blocky structure; friable; many distinct brown (10YR 4/3) clay films on faces of peds and in pores; about 3 percent gravel and 1 percent cobbles; very strongly acid; clear smooth boundary. (Combined thickness of the Bt horizon ranges from 16 to 34 inches.)

2BC--32 to 41 inches; brown (7.5YR 4/4) loamy coarse sand; single grain; loose; about 3 percent gravel and 1 percent cobbles; strongly acid; gradual smooth boundary. (7 to 30 inches thick)

2C1--41 to 50 inches; strong brown (7.5YR 5/6) sand; single grain; loose; moderately acid; gradual smooth boundary.

2C2--50 to 72 inches; multicolored coarse sand; single grain; loose; about 3 percent gravel and 1 percent

cobbles; slightly acid.

TYPE LOCATION: Pepin County, Wisconsin; about 1.5 miles south of Eau Galle; 150 feet north and 2300 feet east from the southwest corner of sec. 6, T. 25 N., R. 13 W.

RANGE IN CHARACTERISTICS: Thickness of the loamy alluvium and depth to sandy outwash ranges from 20 to 40 inches. Depth to the base of the argillic horizon ranges from 20 to 45 inches. The weighted average clay content in the upper part of the particle-size control section ranges from 18 to 27 percent. Volume of gravel ranges from 0 to 15 percent in the loamy alluvium and from 0 to 35 percent in the sandy outwash. Volume of cobbles ranges from 0 to 5 percent throughout the pedon. Reaction naturally ranges from strongly acid to slightly acid throughout the solum but ranges to neutral in the surface layer and upper subsoil, where the soil is limed.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. Typically, it is silt loam or loam. Less typically it is sandy loam or fine sandy loam. Uncultivated pedons have an A horizon with color and texture like the Ap horizon. A horizons less than 7 inches thick have colors like the Ap horizon after mixing to 7 inches.

Some pedons have an E horizon with hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. Typically, it is silt loam or loam but in some pedons it is sandy loam or fine sandy loam.

Some pedons have a BE horizon with hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4 . It is silt loam or loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. It typically is loam, silt loam, or sandy clay loam but includes subhorizons of sandy loam.

Some pedons have a 2Bt horizon with hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sand, loamy sand, coarse sand, loamy coarse sand, or the gravelly analogs.

The 2BC horizon has color and texture like the 2Bt horizon described above.

The 2C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 3 to 6 or it is multicolored. It is sand, coarse sand, or the gravelly analogs. The reaction is typically strongly acid to slightly acid. However, in MLRA-104 and the western part of MLRA-105, the reaction is slighlty acid to slightly alkaline with small amounts of calcium carbonate allowed in the range.

COMPETING SERIES: These are the Gardenvale, Menomin(T), Merimod, Merit and Sattre series. Gardenvale soils have siliceous sand and a paralithic contact in the lower part of the series control section. Menomin soils have redox features and an apparent water table in the lower part of the series control section. Merit soils have siliceous sand in the lower part of the series control section. Sattre soils have lamellae (E&Bt horizon) in the lower part of the series control section.

GEOGRAPHIC SETTING: Meridian soils are on lake terraces and outwash terraces of valley rains. Slope gradients range from 0 to 20 percent. These soils formed primarily in loamy alluvium overlying sandy outwash. Mean annual precipitation ranges from 28 to 33 inches. Mean annual temperature ranges from 46 to 51 degrees F. The frost free period ranges from about 135 to 160 days. Elevation ranges from 600 to 1000 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Dakota, Lows, Menomin(T), Rusktown(T), and Shiffer soils. Dakota soils are on landscape positions similar to those of Meridian soils where the dark colored surface layer is thicker. The poorly drained Lows soils , the somewhat poorly

drained Shiffer soils, and the moderately well drained Menomin soils form a drainage sequence with Meridian soils. The moderately well drained Rusktown soils are in slightly lower landscape positions where there is more sand and less clay in the soil

DRAINAGE AND PERMEABILITY: Well drained. Runoff is slow to rapid. Permeability is moderate in the loamy alluvium and rapid or very rapid in the sandy outwash.

USE AND VEGETATION: Most areas of Meridian soils are used for cropland. Common crops are corn, small grain, and hay. Some small areas remain in pastureland or woodland. A few small areas remain in native vegetation which is a mixture of deciduous trees and prairie grasses.

DISTRIBUTION AND EXTENT: Southwestern and west-central Wisconsin and southeastern Minnesota. Meridian soils are of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Richland County, Wisconsin, 1956.

REMARKS: Prior to 1969 the concept of Meridian covered two textural families. The coarser part is now part of the Billett series.

The concept of having free carbonates was added to allow use in other parts of MLRA-104 and 105.

Diagnostic horizons and features recognized in this pedon are: ochric epipedon too dark for the Typic subgroup - 0 to 9 inches (Ap); argillic horizon - 9 to 32 inches (Bt1, Bt2, Bt3, Bt4).

NSSL data indicates that Meridian soil have base saturation of 50 percent or more (by NH4OAc) in all horizons between the upper boundary of the argillic and a depth of 125 cm. However, it is suspected that the very low CEC in the sandy outwash results in drastic changes in base sat. with the addition of a few bases from fertilization in cropland areas. These soils may classify as Ultic subgroup in their natural state.

ADDITIONAL DATA: Soil Interpretation Record - WI0248.

National Cooperative Soil Survey
U.S.A.

LOCATION PLAINBO WI+MN

Established Series
Rev. TAM-HFG
06/2009

PLAINBO SERIES

The Plainbo series consists of excessively drained soils which are moderately deep to a paralithic contact with sandstone. They formed mostly in water laid or eolian sandy deposits on bedrock controlled outwash plains, sand sheets, and stream terraces. Permeability is rapid in the sandy mantle and moderately slow or moderate in the sandstone. Slopes range from 1 to 45 percent. Mean annual precipitation is about 30 inches. Mean annual air temperature is about 42 degrees F.

TAXONOMIC CLASS: Mixed, frigid Typic Udipsamments

TYPICAL PEDON: Plainbo sand, on a convex, northwest-facing 4 percent slope, in a wooded area, at an elevation of about 975 feet. (Colors are for moist soil unless otherwise stated.)

Oi--0 to 1 inches; slightly decomposed plant material.

A--1 to 3 inches; very dark grayish brown (10YR 3/2) sand, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; very friable; many very fine and fine and few medium and coarse roots; very strongly acid; abrupt smooth boundary. (0 to 4 inches thick)

Bw1--3 to 12 inches; dark yellowish brown (10YR 3/4) sand; very weak medium subangular blocky structure; very friable; many very fine and fine and common medium and coarse roots; moderately acid; clear smooth boundary.

Bw2--12 to 20 inches; brown (7.5YR 4/3) sand; weak, medium, subangular blocky structure; very friable; moderately acid; gradual wavy boundary. (Combined thickness of the Bw horizon is 10 to 25 inches.)

BC1--20 to 32 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; common very fine and fine roots; moderately acid; gradual wavy boundary.

2BC2--32 to 37 inches; yellowish brown (10YR 5/6) sand; single grain; loose; common very fine and fine roots; about 10 percent sandstone channers; strongly acid; abrupt smooth boundary. (0 to 10 inches thick)

2Cr--37 to 60 inches; 40 percent yellowish brown (10YR 5/6), 30 percent light yellowish brown (2.5Y 6/4), and 30 percent dark yellowish brown (10YR 4/6) sandstone bedrock.

TYPE LOCATION: Dunn County, Wisconsin; about 2 miles north and 1 mile east of Wheeler; located about 1,800 feet south and 200 feet west of the northeast corner of section 19, T. 30 N., R. 12 W. USGS Wheeler topographic quadrangle; lat. 45 degrees 04 minutes 11 seconds N. and long. 91 degrees 52 minutes 34 seconds W., NAD 83.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the paralithic contact with

sandstone range from 20 to 40 inches. Volume of gravel ranges from 0 to 30 percent in the water laid deposits. Volume of sandstone channers ranges from 0 to 15 percent in the residuum. Reaction naturally ranges from extremely acid to slightly acid, but ranges to neutral in the upper horizons where the soil is limed.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an Ap horizon, with hue of 10YR, value of 2 or 3, chroma of 1 or 2. The Ap or A horizon is sand, or loamy sand.

Where present, the E horizon has hue of 7.5YR or 10YR, value of 4 or 5 and chroma of 2 or 3. It is sand or loamy sand.

The Bw or BC horizons have hue of 7.5YR or 10YR and value and chroma of 3 to 6. Value and chroma of 3 do not occur together. It is sand or loamy sand or the gravelly analogs. Bw horizons with spodic color have less than 0.6 percent organic carbon.

The 2BC horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 7, and chroma of 3 to 8. Some pedons do not have a 2BC horizon.

The 2Cr horizon has colors like the 2BC horizon described above. In some pedons the 2Cr horizon grades to a 2R horizon below 50 inches. Thickness of the 2Cr is more than 10 inches.

COMPETING SERIES: These are Abbeylake(T), Cantlin(T), Champlain(T), Claire, Corliss, Feldtmann(T), Friendship, Grayling, Mahtomedi, Menahga, Nymore, Sartell, Serden, Shawano, and Sunday series. These soils do not have a paralithic contact with sandstone bedrock at depths of 20 to 40 inches.

GEOGRAPHIC SETTING:
Parent material--wind or water laid sandy deposits overlaying sandstone bedrock
Landform--bedrock controlled outwash plains, sand sheets and stream terraces
Slope--1 to 45 percent
Elevation--800 to 1,950 feet
Mean annual air temperature--39 to 45 degrees F
Mean annual precipitation--28 to 33 inches
Frost-free period--120 to 135 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Hayriver, Menahga, and Twinmound soils. The Menahga soils are nearby in landscape positions similar to those of Plainbo soil where the sandy deposits are more than 60 inches deep. The Hayriver and Twinmound soils are on backslopes, shoulders, and summits of adjacent sandstone bedrock controlled uplands.

DRAINAGE AND PERMEABILITY: Excessively drained. Surface runoff is low to very high. Permeability is rapid in the sandy mantle and moderately slow or moderate in the sandstone.

USE AND VEGETATION: Much of this soil is in permanent woodland or pastureland. Native vegetation is principally northern pin oak and some jack pine. Some areas are used for cropland. Common crops are corn, small grain, and hay.

DISTRIBUTION AND EXTENT: Central and Northwest Wisconsin and east central Minnesota, LRR K, MLRA 91 and 105. The Plainbo soils are of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Dunn County, Wisconsin, 1970.

REMARKS: Diagnostic horizons and features recognized in this pedon include:
Ochric epipedon--the zone from 0 to 3 inches (Oi and Ap horizons);
Paralithic contact--the contact with sandstone bedrock at a depth of less than 1 meter; have 10 percent or more (by weight) of weatherable minerals.

ADDITIONAL DATA: Soil Interpretation Record - WI0110

National Cooperative Soil Survey
U.S.A.

LOCATION RIB WI

Established Series
Rev. AJK-HFG-JJJ-DJH
01/2006

RIB SERIES

The Rib series consists of very deep, poorly drained soils which are moderately deep to stratified sandy outwash. These soils formed mostly in loess or silty alluvium underlain by sandy outwash. Typically they are on outwash plains, valley trains, and stream terraces but some are on glacial lake basins and moraines. Permeability is moderate in the silty mantle, moderate or moderately rapid in the loamy lower subsoil, and rapid or very rapid in the sandy outwash. Slope ranges from 0 to 2 percent. Mean annual precipitation is about 30 inches. Mean annual air temperature is about 40 degrees F.

TAXONOMIC CLASS: Fine-silty over sandy or sandy-skeletal, mixed, superactive, frigid Mollic Endoaqualfs

TYPICAL PEDON: Rib silt loam, on a south-facing, plane slope of 1 percent, in a willow and sedge wetland, at an elevation of about 1,325 feet. (Colors are for moist soil unless otherwise stated.)

A--0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many very fine and few fine, medium, and coarse roots; about 5 percent gravel and 1 percent cobbles; moderately acid; abrupt smooth boundary. (6 to 9 inches thick)

Eg--7 to 10 inches; dark gray (2.5Y 4/1) and gray (2.5Y 5/1) silt loam, light gray (2.5Y 7/1) dry; moderate medium subangular blocky structure parting to weak thin platy; friable; few very fine and fine roots; few fine distinct olive brown (2.5Y 4/4) masses of iron accumulation; about 5 percent gravel and 1 percent cobbles; moderately acid; clear wavy boundary. (0 to 10 inches thick)

Btg1--10 to 18 inches; grayish brown (2.5Y 5/2) silt loam; moderate medium subangular blocky structure; friable; common faint dark grayish brown (10YR 4/2) clay films on ped faces; many fine and medium distinct olive brown (2.5Y 4/4) masses of iron accumulation; about 5 percent gravel and 1 percent cobbles; slightly acid; clear wavy boundary.

Btg2--18 to 32 inches; grayish brown (2.5Y 5/2) silt loam; moderate medium and coarse subangular blocky structure; friable; common faint dark grayish brown (10YR 4/2) clay films on ped faces; many medium and coarse prominent dark yellowish brown (10YR 4/6) masses of iron accumulation and few fine prominent gray (10YR 5/1) iron depletions; about 5 percent gravel and 1 percent cobbles; neutral; clear wavy boundary. (Combined thickness of the Btg horizon is 15 to 30 inches.)

2Bg--32 to 35 inches; grayish brown (2.5Y 5/2) loam; moderate medium subangular blocky structure; friable; many medium and coarse prominent dark yellowish brown (10YR 4/6) masses of iron accumulation; about 5 percent gravel; neutral; clear wavy boundary. (2 to 4 inches thick)

3BC--35 to 37 inches; brown (10YR 4/3) and dark brown (10YR 3/3) gravelly loamy sand; weak medium subangular blocky structure; very friable; about 15 percent gravel and 2 percent cobbles; neutral; clear wavy boundary. (1 to 4 inches thick)

3C--37 to 60 inches; brown (10YR 4/3) and dark brown (10YR 3/3) gravelly coarse sand; single grain; loose; about 20 percent gravel and 2 percent cobbles; neutral.

TYPE LOCATION: Taylor County, Wisconsin; about 2 miles north and 3 miles east of Medford; located about 2,400 feet west and 20 feet south of the northeast corner of section 18, T. 31 N., R. 2 E.; USGS Medford topographic quadrangle; lat. 45 degrees 10 minutes 43 seconds N. and long. 90 degrees 16 minutes 46 seconds W., NAD 83.

RANGE IN CHARACTERISTICS: Depth to the base of the argillic horizon, thickness of the silty mantle, and depth to sandy outwash all range from 20 to 40 inches. The weighted average clay content of the argillic horizon ranges from 18 to 27 percent and the weighted average content of fine sand or coarser is less than 15 percent. Volume of gravel ranges from 0 to 5 percent in the silty mantle and from 0 to 40 percent in the loamy lower subsoil (transition zone). Volume of gravel ranges from 3 to 45 percent as a weighted average in the sandy outwash, but ranges from 0 to 65 percent in individual strata. Volume of cobbles ranges from 0 to 5 percent throughout. Reaction ranges from very strongly acid to slightly alkaline in the solum and from moderately acid to moderately alkaline in the substratum. Depth to carbonates is 5 feet or more. Redoximorphic concentrations are throughout the solum below the A horizon. Redoximorphic depletions are 50 percent or more of the matrix or of coats on faces of peds immediately below the Ap horizon and within 20 inches of the surface. Saturation occurs within a depth of 1 foot for long periods in normal years.

The Ap or A horizon has hue of 7.5YR or 10YR or is neutral in hue. Value is 2 or 3 and chroma is 0 to 2. It is silt loam or mucky silt loam.

The Eg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is silt loam.

The Btg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is silt loam or silty clay loam.

The 2Bg transition horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 to 6; and chroma of 1 or 2. It is loam or sandy loam or the gravelly or very gravelly analogs.

The 3BC or 3BCg horizon has hue of 7.5YR, 10YR or 2.5Y; value of 3 to 8; and chroma of 1 to 6. It is loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs.

The 3C or 3Cg horizon has color like the 3BC horizon described above. It is typically stratified layers of coarse sand, sand, or the gravelly or very gravelly analogs, but some individual strata may be extremely gravelly. Some pedons have strata of loamy sand or loamy coarse sand or the gravelly or very gravelly analogs.

COMPETING SERIES: There are no competing series.

GEOGRAPHIC SETTING:
Parent material--20 to 40 inches of loess or silty alluvium underlain by stratified sandy outwash
Landform--Outwash plain, valley trains, and stream terraces, but some are on glacial lake basins and small outwash areas within moraines
Slope--0 to 2 percent
Elevation--800 to 1,950 feet
Mean annual air temperature--38 to 42 degrees F
Mean annual precipitation--28 to 33 inches
Frost-free period--90 to 125 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Anigon, Antigo, Billyboy, Blackriver, Brander, Brill, Maplehurst, Oesterle, Ossmer, Poskin, Ribriver, Rosholt, Scoba, Sconsin, and Scott Lake series.
The well drained Anigon soils, the moderately well drained Brander and Brill soils, and the somewhat poorly drained Poskin soils are in a drainage sequence with Rib soils. All are on higher or more sloping landscape positions.
The moderately well drained Blackriver and Ribriver soils, and the somewhat poorly drained Maplehurst soils are on nearby landscapes with Rib soils where the silty mantle is more than 40 inches thick. All are on higher or more sloping landscape positions.
The well drained Antigo soils, moderately well drained Billyboy and Sconsin Lake soils, and the somewhat poorly drained Ossmer soils are on nearby landscapes with Rib soils. These soils are coarse-loamy over sandy or sandy skeletal with a silty mantle 12 to 40 inches thick. All are on higher or more sloping landscape positions.
The well drained Rosholt soils, moderately well drained Scoba and Scott Lake soils, and the somewhat poorly drained Oesterle soils are on nearby landscapes with Rib soils where the silty mantle is thin or absent. All are on higher or more sloping landscape positions.

DRAINAGE AND PERMEABILITY: Poorly drained. Surface runoff is very low or ponded. Permeability is moderate in the silty mantle, moderate or moderately rapid in the loamy lower subsoil, and rapid or very rapid in the sandy outwash. Rib soils have an apparent seasonal high water table at a depth from 1 foot above to 1 foot below the surface much of the time from September to June in normal years.

USE AND VEGETATION: Many areas remain in woodland. Common trees are American elm, black ash, silver maple, and red maple. Many areas are cleared and used for unimproved pastureland. Some areas are drained and used for cropland. Common crops are corn, small grain, and hay.

DISTRIBUTION AND EXTENT: North-central and northwestern Wisconsin. LRR K, MLRA 90A, and MLRA 90B. The soil is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Dunn County, Wisconsin, November, 1970. The type location was changed to Taylor County with the correlation of the soil survey in 2000.

REMARKS:
Particle size control section - the zone from 10 to 40 inches.

Diagnostic horizons and features recognized in this pedon include:
Ochric epipedon - the zone from 0 to 10 inches (A, Eg);
Albic horizon - the zone from 7 to 10 inches (Eg);
Argillic horizon - the zone from 10 to 32 inches (Btg1, Btg2);
Transition zone - the zone between the silty mantle and sandy outwash from 32 to 35 inches (2Bg);
Reduced matrix - in the zone from 7 to 35 inches (Eg, Btg1, Btg2, 2Bg);
Redoximorphic concentrations - oxidized color features in the zone from 7 to 35 inches;
Redoximorphic depletions - reduced color features in the zone from 18 to 32 inches and reduced color clay films in the zone from 10 to 32 inches;
Lithologic discontinuity - at the upper boundary of the 2Bg horizon at 32 inches and at the upper boundary of the 3BC horizon at 35 inches;
Aquic conditions within 20 inches of the surface.

ADDITIONAL DATA: Former Soil Interpretation Record - WI0144. Refer to S91WI-119-002 for NSSL data on the Rib series.

National Cooperative Soil Survey
U.S.A.

LOCATION ROSHOLT WI+MN

Established Series
Rev. AJO-HFG-JJJ
06/2006

ROSHOLT SERIES

The Rosholt series consists of very deep, well drained soils which are moderately deep to sandy outwash. These soils formed mostly in loamy alluvial deposits and are underlain by stratified sandy outwash on outwash plains, stream terraces, eskers, and kames. Permeability is moderate or moderately rapid in the loamy mantle and rapid or very rapid in the sandy outwash. Slopes range from 0 to 45 percent. Mean annual precipitation is about 30 inches. Mean annual temperature is about 42 degrees F.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, frigid Haplic Glossudalfs

TYPICAL PEDON: Rosholt fine sandy loam - on a convex 4 percent slope in a cultivated field at an elevation of about 1,200 feet. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 8 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; many roots; about 2 percent gravel; moderately acid; abrupt smooth boundary. (0 to 12 inches thick)

E--8 to 13 inches; brown (10YR 5/3) fine sandy loam; light gray (10YR 7/2) dry; weak thin platy structure; friable; common roots; about 5 percent gravel; moderately acid; clear wavy boundary. (0 to 10 inches thick)

B/E--13 to 20 inches; 70 percent brown (7.5YR 4/4) fine sandy loam (Bt); moderate fine subangular blocky structure; friable; common faint dark brown (7.5YR 3/4) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) fine sandy loam (E), light gray (10YR 7/2) dry; weak medium platy structure; friable; few roots; about 10 percent gravel; strongly acid; clear wavy boundary. (Glossic horizon - 2 to 30 inches thick)

Bt1--20 to 28 inches; brown (7.5YR 4/4) sandy loam; moderate fine and medium subangular blocky structure; friable; few roots; common faint dark brown (7.5YR 3/4) clay films on faces of peds; common brown (10YR 5/3) coatings of silt and sand grains on vertical faces of peds; about 10 percent gravel; strongly acid; abrupt wavy boundary. (4 to 15 inches thick)

2Bt2--28 to 34 inches; brown (7.5YR 5/4) gravelly loamy sand; weak medium subangular blocky structure; very friable; few roots; few faint dark brown (7.5YR 3/4) clay bridges between sand grains; about 25 percent gravel; strongly acid; clear wavy boundary. (0 to 10 inches thick)

2C1--34 to 52 inches; brown (7.5YR 5/4) stratified gravelly sand and sand; single grain; loose; about 25 percent gravel as an average; strongly acid; abrupt wavy boundary.

2C2--52 to 60 inches; yellowish brown (10YR 5/4) stratified coarse sand and medium sand; single grain; loose; about 2 percent gravel as an average; strongly acid.

TYPE LOCATION: Shawano County, Wisconsin; about 4.5 miles south and 3 miles east of Mattoon;

about 1,100 feet south and 1,000 feet west of the northeast corner of sec. 1, T. 28 N., R. 12 E.; USGS Burney Lake, WI quad.; lat. 44 degrees, 56', 23" N., long. 88 degrees, 59', 06" W.

RANGE IN CHARACTERISTICS: Thickness of the loamy mantle and depth to sandy outwash ranges from 20 to 40 inches. Some pedons have a silty mantle less than 12 inches thick. Volume of gravel is typically less than 15 percent in the upper part of the loamy mantle, but ranges from 0 to 35 percent throughout the loamy mantle. Volume of gravel ranges from 3 to 45 percent as a weighted average in the sandy outwash, but ranges from 0 to 65 percent in individual strata. Volume of cobbles ranges from 0 to 2 percent in the loamy mantle and from 0 to 15 percent in the sandy outwash. Reaction typically ranges from very strongly acid to slightly acid in the solum, but ranges to neutral in the Ap horizon where the soil is limed. Reaction ranges from strongly acid to slightly acid in the substratum.

Some uncultivated pedons have an O horizon of partially decomposed forest litter. It has hue of 7.5YR or 10YR or is neutral in hue. Value is 2 or 3 and chroma is 0 to 2.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Value is greater than 5.5 dry. Some uncultivated pedons have a 1 to 4 inch thick A horizon with hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Ap or A horizon is fine sandy loam, sandy loam, loam, or silt loam. Some pedons do not have an A horizon.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. Colors of 4/3 or 5/3 have value dry of 7 or more. The E horizon is loamy sand, sandy loam, fine sandy loam, loam, or the gravelly analogs or it is silt loam.

Some pedons have a Bw horizon with hue of 10YR, value of 3 to 5 , and chroma of 4. It is sandy loam, loam, or the gravelly analogs.

Rosholt soils have a glossic horizon (E/B or B/E horizons, or both). The E part has color like the E horizon described above. It is typically fine sandy loam, sandy loam, loam, loamy sand, or the gravelly analogs. The Bt part has hue of 5YR, 7.5YR or 10YR, value of 3 to 6, and chroma of 4 or 6. It is typically fine sandy loam, sandy loam, loam, or the gravelly analogs. In some pedons, the upper part of the glossic horizon is silt loam.

The Bt horizon has color like the Bt part described above. It is fine sandy loam, sandy loam, loam or the gravelly analogs.

The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 to 6; and chroma of 4 to 6. It is loamy sand, loamy coarse sand, sand, coarse sand, or the gravelly, very gravelly, or extremely gravelly analogs.

The 2C horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 3 to 6. It is typically stratified layers of sand, coarse sand, or the gravelly, very gravelly, or extremely gravelly analogs.

COMPETING SERIES: These are the Alban, Amery, Arland, Kennan, Langlade, Marathon, Mcginn, Santiago, and Scoba series. A similar soil is the Padus series. Alban soils have stratified loamy and sandy lacustrine deposits within 40 inches and do not have coarse fragments. Amery and Kennan soils do not average more than 85 percent sand within 40 inches. Langlade soils are more than 40 inches thick to sandy outwash with more than 85 percent sand. Marathon soils have a mantle, 15 to 35 inches thick, with more than 50 percent silt and are underlain by disintegrated granitic rock at a depth of 40 to 60 inches. Mcginn soils have a 14 to 20 inch thick sandy mantle over loamy glacial till and have free carbonates within 40 inches. Santiago soils have a mantle, 12 to 36 inches thick, with more than 50 percent silt and do not average more than 85 percent sand in the fine earth fraction within 40 inches. Scoba soils have redox accumulations and a zone of near saturation in the subsoil. Padus soils have a spodic horizon.

Arland soils have a paralithic contact at 20 to 40 inches.

GEOGRAPHIC SETTING: Rosholt soils are on outwash plains, stream terraces, eskers, and kames. Slope gradients range from 0 to 45 percent. These soils formed mostly in loamy alluvial deposits underlain by stratified sandy outwash. Mean annual precipitation ranges from 24 to 33 inches. Mean annual temperature ranges from 39 to 45 degrees F. The frost free period ranges from about 120 to 135 days. Elevation ranges from 800 to 1,950 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Chetek, Kennan, Oesterle, Scoba, and Scott Lake soils. Chetek soils occupy landscape positions similar to those of Rosholt soils where the loamy mantle is 12 to 20 inches thick. Kennan soils are on adjacent glacial moraines and drumlins. The somewhat poorly drained Oesterle soils and the moderately well drained Scott Lake soils form a drainage sequence with Rosholt soils. The moderately well drained Scoba soils are in landscape positions similar to those of Rosholt soils where there is a zone of near saturation with redox accumulations above the sandy outwash.

DRAINAGE AND PERMEABILITY: Well drained. Surface runoff is slow to very rapid. Permeability is moderate or moderately rapid in the loamy mantle and rapid or very rapid in the sandy outwash.

USE AND VEGETATION: Many areas have been cleared and are used for cropland. Common crops are corn, small grain, and hay. Some areas are used for pastureland and some are in woodland. Native vegetation is deciduous forest with some scattered conifers. Common trees are sugar maple, northern red oak, white ash, American basswood, paper birch, quaking aspen, big tooth aspen, red pine, and balsam fir.

DISTRIBUTION AND EXTENT: Central and west-central Wisconsin and east-central Minnesota. This soil is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota.

SERIES ESTABLISHED: Portage County, Wisconsin, 1972.

REMARKS: Diagnostic horizons recognized in this pedon are: ochric epipedon - 0 to 13 inches (Ap,E); albic horizon - 8 to 13 inches (E); glossic horizon - 13 to 20 inches (B/E); argillic horizon - from 13 to 34 inches (B/E, Bt1, 2Bt2).

ADDITIONAL DATA: Soil Interpretation Record - WI0226

National Cooperative Soil Survey
U.S.A.

LOCATION SCOTT NE+CO SD

Established Series
Rev. RDG, RRH, DJK
06/2012

SCOTT SERIES

The Scott series consists of very deep, poorly and very poorly drained soils that formed in loess. Scott soils are in closed depressions on loess uplands and stream terraces in the Central Loess Plains, MLRA 75. Slopes range from 0 to 1 percent. Mean annual precipitation is about 635 millimeters (25 inches) and the mean annual temperature is about 11 degrees C. (51 degrees F).

TAXONOMIC CLASS: Fine, smectitic, mesic Vertic Argialbolls

TYPICAL PEDON: Scott silt loam, on a concave, less than 1 percent slope in native rangeland at an elevation of 670 meters (2199 feet). (Colors are for moist soil unless otherwise stated.)

A--0 to 13 centimeters (0 to 5 inches); very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary. (5 to 15 centimeters (2 to 6 inches) thick)

E--13 to 20 centimeters (5 to 8 inches); gray (10YR 5/1) silt loam, gray (10YR 6/1) dry; moderate thin and medium platy structure parting to moderate fine subangular blocky; slightly hard, friable; slightly acid; abrupt smooth boundary. (3 to 13 centimeters (1 to 5 inches) thick)

Bt1--20 to 51 centimeters (8 to 20 inches); very dark gray (N 3/0) silty clay, dark gray (N 4/0) dry; common medium prominent yellowish brown (10YR 5/4) iron masses; strong coarse prismatic structure parting to strong medium angular blocky; very hard, very firm, shiny surfaces on faces of most peds; many hard 1 to 2 mm, spherically shaped iron-manganese concretions; neutral; clear smooth boundary.

Bt2--51 to 86 centimeters (20 to 34 inches); very dark gray (N 3/0) clay, dark gray (N 4/0) dry; few fine prominent yellowish brown (10YR 5/4) iron masses; strong coarse prismatic structure parting to strong fine angular blocky; very hard, very firm; shiny surfaces on faces of most peds; many hard 1 to 2 mm, spherically shaped iron-manganese concretions; neutral; clear smooth boundary. (Combined thickness of the Bt horizon is 41 to 102 centimeters (16 to 40 inches) thick)

BC--86 to 117 centimeters (34 to 46 inches); dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; moderate medium subangular blocky structure; hard, firm; neutral; gradual smooth boundary. (13 to 36 centimeters (5 to 14 inches) thick)

C1--117 to 142 centimeters (46 to 56 inches); brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse prismatic structure; slightly hard, friable; slightly alkaline; gradual smooth boundary. (20 to 51 centimeters (8 to 20 inches) thick)

C2--142 to 200 centimeters (56 to 80 inches); brown (10YR 4/3) silt loam, pale brown (10YR 6/3); moist; weak coarse prismatic structure; slightly hard, friable; carbonates disseminated throughout matrix;

violent effervescence; slightly alkaline.

TYPE LOCATION: Franklin County, Nebraska; 5 kilometers (3 miles) west and 3 kilometers (2 miles) south of Hildreth, Nebraska; 488 meters (1,600 feet) east and 15 meters (50 feet) north of the southwest corner, sec. 14, T. 4 N., R. 16 W. Hildreth USGS quadrangle, latitude 40 degrees, 18 minutes, 25.7 seconds N. and longitude 99 degrees, 6 minutes, 45.2 seconds W., NAD83.

RANGE IN CHARACTERISTICS:
Moisture regime: aquic
Mollic thickness: 30 to 152 centimeters (12 to 60 inches)
Depth to argillic horizon: 8 to 41 centimeters (3 to 16 inches)
Depth to redoximorphic features: 8 to 25 centimeters (3 to 10 inches), in some pedons it is at 0 centimeters (0 inches)
redoximorphic features: iron masses and/or 2 to 25 mm, dark brown, spherically shaped iron-manganese concretions or nodules, iron masses become larger and less bright with depth
Depth to episaturation: 0 to 61 centimeters (0 to 24 inches) in the poorly drained soil and 0 to 30 centimeters (0 to 12 inches) in the very poorly drained soil
Depth to secondary carbonates: 89 to 152 centimeters (35 to 60 inches), carbonates are below a depth of 152 centimeters (60 inches) in some pedons
calcium carbonates when present: soft to hard, common, fine to coarse, prominent, white (10YR 8/1) masses or concretions, masses sometimes occur as threads or coatings on faces of peds
Particle size control section:
Clay content: 40 to 55 percent
Sand content: 3 to 10 percent

A horizon:
Hue: 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 1 or 2 dry or moist
Texture: silt loam, silty clay loam
Clay content: 22 to 32 percent
Sand content: 5 to 10 percent
Reaction: strongly acid to slightly acid

E horizon:
Hue: 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 1 dry or moist
Texture: silt loam
Clay content: 12 to 22 percent
Sand content: 6 to 14 percent
Reaction: strongly acid to slightly acid

Bt horizon:
Hue: 10YR, 2.5Y, 5Y, N
Value: 3 to 6 dry, 2 to 5 moist
Chroma: 0 to 2 dry or moist
Texture: silty clay loam, silty clay, clay
Clay content: 35 to 55 percent
Sand content: 3 to 10 percent

Redoximorphic concentrations: Hue 5YR to 10YR, value 3 to 5 moist, chroma 4 to 8 moist.
Reaction: moderately acid to slightly alkaline

BC horizon:
Hue: 10YR or 2.5Y
Value 4 to 6 dry, 3 to 4 moist
Chroma: 2 dry or moist
Texture: silty clay loam or silty clay
Clay content: 32 to 42 percent
Sand content: 3 to 8 percent
Redoximorphic concentrations: Hue 5YR to 10YR, value 4 to 6 moist, chroma 4 to 8 moist.
Reaction: neutral to moderately alkaline

C horizon:
Hue: 10YR or 2.5Y
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 4 dry or moist
Texture: silt loam, silty clay loam
Clay content: 24 to 35 percent
Sand content: 4 to 8 percent
Redoximorphic concentrations: Hue 5YR to 10YR, value 4 to 6 moist, chroma 4 to 8 moist.
Reaction: neutral to moderately alkaline

COMPETING SERIES: These are the Barbert, Crestmeade, Edina, Filbert, Fillmore, Massie, Sturges and Triplett series.
Barbert soils allow for rock fragments in the series control section.
Crestmeade, Filbert, Fillmore, Sturges, and Triplett soils are somewhat poorly drained and do not pond water for long periods (7-30 days) during the growing season.
Massie soils are ponded for more than 45 consecutive days during the growing season.
Edina soils are poorly or very poorly drained but only pond water for brief periods during the growing season.

GEOGRAPHIC SETTING:
Parent material: loess
Landform: closed depressions on loess uplands and loess-capped stream terraces
Slopes: 0 to1 percent
Elevation: 335 to 975 meters (1100 to 3200 feet)
Mean annual temperature: 9 to 12 degrees C. (48 to 53 degrees F)
Mean annual precipitation: 508 to 762 millimeters (20 to 30 inches)
Frost-free period: 142 to 173 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Butler, Fillmore, Massie, and Holdrege series.
Butler soils on flat or slightly concave swales on uplands, do not have an albic horizon, and are somewhat poorly drained having saturation in the upper part of the solum for less than 7 consecutive days during the growing season.
Fillmore soils are on slightly higher landform positions of closed depressions, are somewhat poorly drained, and do not pond water for as long.
Massie soils are in slightly lower positions of closed depressions and pond water for more than 45 consecutive days during the growing season.

Holdrege soils are on higher hillslopes and interfluves of uplands, do not have an albic horizon, have 27 to 35 percent clay in the particle size control section, and are well drained.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage: poorly and very poorly
Saturated hydraulic conductivity: low
Saturation: a perched seasonal high water table fluctuates from around 15 cm above to 30 cm below the soil surface.
Ponding frequency: frequent
Ponding duration: long on the poorly drained soil with a depth of up to 30 centimeters (12 inches); very long on the very poorly drained soil with a depth of up to 61 centimeters (24 inches)

USE AND VEGETATION: Most areas are in pasture or wildlife habitat and used for livestock grazing and waterfowl. The plant community consists mainly of smartweed, curly dock, barnyard grass, plains coropsis, perennial bursage, sedges, and spikerush. Reed canarygrass has been seeded in some areas. The present rangeland ecological site is Clayey Overflow, (R075XY049NE) but Closed Depressions is being proposed. Minor use is cropping.

DISTRIBUTION AND EXTENT: Primarily south central, central, and extreme north central Nebraska; LRRs H, G, and M; MLRAs 71, 73, 75, 66, 102C, and 106. The series is moderately extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Denver, Colorado

SERIES ESTABLISHED: Scott County, Kansas, 1910. The Scott series is no longer used in Kansas.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Mollic epipedon: 0 to 86 centimeters (0 to 34 inches) (A, E, Bt horizons)
Albic horizon: 13 to 20 centimeters (5 to 8 inches) (E horizon)
Argillic horizon: 20 to 86 centimeters (8 to 34 inches) (Bt1 and Bt2 horizons)
Linear extensibility: exceeds 6.0 between the surface and 100 centimeters (99 inches)
The Scott, drained phase, is somewhat poorly drained and does not pond water but is saturated for long durations.
A terrace phase is recognized that has sand or coarse textured material below the loess cap at a depth of 3 to 9 meters (10 to 30 feet).

01/2008 RRH: The Scott soils mapped in the aridic-ustic and udic moisture regimes may need to be recorrelated to the Lodgepole and Filbert series, respectively, or new series may be needed for very poorly drained soils.

03/2006 LRM: metric conversion and changed permeability to saturated hydraulic conductivity

01/2008 RRH: Typical pedon: put moist colors first; Range of Characteristics, Bt horizon: added silty clay loam; Competing series: revised; Geographic Setting: revised, narrowed the mean annual precipitation and mean annual temperature ranges; Geographically Associated Soils: revised, used only those soils at type location; Drainage: revised; Distribution and Extent: revised; Use and Vegetation: revised, plant community based on A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Rainwater Basin Depressional Wetlands in Nebraska, the component existing plants in NASIS is incorrect; Additional Data: revised

12/2011 DJK: Updated basic formatting to meet MO5 standards. On landform changed depressions to

closed depressions. Edited MAP and MAAT in introduction. Added elevation to typical pedon. Changed Lat/Long to proper location (old put in wrong section about a mile away). Extended C2 horizon on typical pedon to 200 cm. Added clay and sand contents to each horizon in RIC. For textures in RIC deleted loam for E, clay loam and silt loam for BC, and clay loam and loam for the C. Added silty clay as possible texture for BC. Added redoximorphic concentrations for Bt, BC, and C horizons in RIC. Updated the competing series section to better define differences. Added elevation to geomorphic setting. Edited geographically associated soils by eliminating Hastings and adding Massie. In drainage and saturated hydraulic conductivity eliminated occasional in ponding frequency an reworded saturation statement. In distribution and extent deleted the northwest part of northeast NE.

ADDITIONAL DATA: Data is available from the National Soil Survey Center, Soil Survey Laboratory for Pedon IDs 77NE035001 and 79NE059007. Pedon ID 1978NE061020 represents the Typical Pedon and is in NASIS.

National Cooperative Soil Survey
U.S.A.

LOCATION SEATON IL+IA MN WI

Established Series
Rev. JBF-JWS-TWN
06/2005

SEATON SERIES

The Seaton series consists of very deep, well drained soils formed in coarse loess. These soils are on ridge tops and side slopes on uplands near the bluffs along the major valleys and on treads and risers on high stream terraces. Slopes range from 0 to 60 percent. Mean annual air temperature is about 9 degrees C (48 degrees F). Mean annual precipitation is about 89 centimeters (35 inches).

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Typic Hapludalfs

TYPICAL PEDON: Seaton silt loam, on a south-facing, convex slope of 5 percent, in an uncultivated area. (Colors are for moist soil unless otherwise stated.)

A--0 to 10 centimeters (0 to 4 inches); dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; slightly acid; clear smooth boundary. [5 to 13 centimeters (2 to 5 inches) thick]

E--10 to 23 centimeters (4 to 9 inches); brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak thin platy structure; friable; slightly acid; clear smooth boundary. [0 to 18 centimeters (0 to 7 inches) thick]

BE--23 to 38 centimeters (9 to 15 inches); yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; few faint brown (10YR 4/3) clay films and common faint light yellowish brown (10YR 6/4) silt coats on faces of peds; moderately acid; clear smooth boundary. [0 to 18 centimeters (0 to 7 inches) thick]

Bt1--38 to 53 centimeters (15 to 21 inches); yellowish brown (10YR 5/4) silt loam; moderate fine and medium subangular blocky structure; friable; few faint brown (10YR 4/3) clay films and few faint light yellowish brown (10YR 6/4) silt coats on faces of peds; moderately acid; clear smooth boundary.

Bt2--53 to 69 centimeters (21 to 27 inches); brown (7.5YR 5/4) silt loam; moderate fine and medium subangular blocky structure; firm; few faint brown (10YR 4/3) clay films and few faint light yellowish brown (10YR 6/4) silt coats on faces of peds; strongly acid; clear smooth boundary.

Bt3--69 to 86 centimeters (27 to 34 inches); yellowish brown (10YR 5/4) silt loam; moderate medium angular blocky structure; firm; common faint brown (10YR 4/3) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt4--86 to 112 centimeters (34 to 44 inches); brown (10YR 5/3) silt loam; weak medium and coarse prismatic structure; firm; few faint brown (10YR 4/3) clay films and few faint light yellowish brown (10YR 6/4) silt coats on vertical faces of peds; moderately acid; gradual smooth boundary. [Combined thickness of the Bt horizon is 64 to 114 centimeters (25 to 45 inches).]

BC--112 to 178 centimeters (44 to 70 inches); brown (10YR 4/3) silt loam; weak very coarse prismatic

structure; friable; few faint brown (7.5YR 4/2) clay films on vertical faces of peds; moderately acid; gradual smooth boundary. [0 to 76 centimeters (0 to 30 inches) thick]

C--178 to 241 centimeters (70 to 95 inches); light brownish gray (10YR 6/2) and brown (10YR 5/3) silt loam; massive; friable; common fine faint dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid; clear smooth boundary.

TYPE LOCATION: Major Land Resource Area (MLRA) 108B; Henderson County, Illinois; about 4 miles east and 2.25 miles north of Oquawka; about 201 meters (660 feet) north and 9 meters (30 feet) east of the center of section 8, T. 11 N., R. 4 W.; USGS Rozetta quadrangle; lat. 40 degrees 57 minutes 43 seconds N. and long. 90 degrees 52 minutes 23 seconds W., NAD 27.

RANGE IN CHARACTERISTICS:
Depth to carbonates--greater than 152 centimeters (60 inches)
Content of clay in the particle-size control section (weighted average)--18 to 24 percent
Content of sand coarser than very fine sand in the particle-size control section (weighted average)--less than 5 percent
Some pedons contain as much as 20 percent total sand
Coarse silt to fine silt ratio in the particle-size control section--1.5 or greater
Rock fragment content in the series control section--0 percent

A or Ap horizon:
Hue--10YR
Value--2 to 4 (5 or 6 dry)
Chroma--2 or 3
Texture--silt loam or silt
Clay content--10 to 22 percent
Reaction--moderately acid to neutral

Moderately or severely eroded phases:
Hue--10YR
Value--3 to 5
Chroma--2 to 4
Texture--silt loam
Clay content--15 to 22 percent
Reaction--moderately acid to neutral

E horizon (when present):
Hue--10YR
Value--4 to 6
Chroma--2 to 4
Texture--silt loam or silt
Clay content--10 to 22 percent
Reaction--moderately acid to neutral

The E horizon is incorporated into the Ap horizon in some pedons
Some pedons have an EB horizon instead of the BE horizon

Bt horizon:
Hue--7.5YR, 10YR, or 2.5Y
Value--4 or 5

Chroma--3 to 6
Texture--silt loam or silt
Clay content--18 to 24 percent
Reaction--very strongly acid to neutral

BC horizon (when present):
Hue--10YR or 2.5Y
Value--4 or 5
Chroma--3 or 4
Texture--silt loam or silt
Clay content--9 to 24 percent
Reaction--strongly acid to neutral

C horizon:
Hue--10YR or 2.5Y
Value--4 to 6
Chroma--2 to 6
Texture--silt loam or silt
Clay content--9 to 24 percent
Sand content--less than 15 percent
Reaction--moderately acid to moderately alkaline

Some pedons do not have redoximorphic features in the series control section
Some pedons have sandy materials below a depth of 150 centimeters (59 inches)

COMPETING SERIES: These are the Baraboo, Bertrand, Blackhammer, Camden, Dodge, Dubuque, Fayette, Flagg, Greenridge, Hackers, Jackson, Jemerson, Knowles, La Farge, Lambeau, Martinsburg, Menfro, Middletown, Navlys, Palermo, Palsgrove, Pepin, Piscasaw, Ridgway, Rozetta, Ruma, Rush, Russell, St. Charles, Stookey, Sylvan, Thebes, and Yellowriver series.
Baraboo--have a lithic contact of quartzite within a depth of 51 to 102 centimeters (20 to 40 inches)
Bertrand--have a sand content of more than 85 percent with 0 to 5 percent rock fragments in the lower third of the series control section
Blackhammer--have a rock fragment content, mostly chert and sandstone, of 5 to 35 percent in the lower third of the series control section
Camden--have a sand content of 15 to 65 percent in the lower third of the series control section
Dodge--have carbonates within depths 76 to 102 centimeters (30 to 40 inches) and have a calcium carbonate equivalent range of 10 to 40 percent in the lower third of the series control section
Dubuque--have a lithic contact of dolomitic limestone within a depth of 51 to 102 centimeters (20 to 40 inches)
Fayette--have a clay content of 24 to 32 percent in the particle-size control section and have a coarse silt to fine silt ratio of 0.9 to 1.5 in the in the particle-size control section
Flagg--have matrix hues of 2.5YR, 5YR, or 7.5YR and have a sand content of more than 15 percent in the lower third of the series control section
Greenridge--have matrix hues of 5Y, 5YG, 10GY, or 5G in the lower third of the series control section
Hackers--have matrix hues of 2.5YR or 5YR and have stratified layers in the lower third of the series control section
Jackson--have stratified layers with a sand content of more than 80 percent in the lower third of the series control section and have a frequently saturated zone within depths of 1 to 1.8 meters (3.5 to 6 feet) in normal years
Jemerson--have a clay content of 22 to 27 percent and a sand content of 5 to 15 percent in the particle-size control section

Knowles--have a lithic contact of dolomitic limestone within a depth of 51 to 102 centimeters (20 to 40 inches)
La Farge--have a paralithic contact of glauconitic sandstone within a depth of 51 to 102 centimeters (20 to 40 inches)
Lambeau--have a sand content of more than 20 percent in the lower one third of the series control section and have a paralithic contact of siliceous sandstone within depths of 114 to 203 centimeters (45 to 80 inches)
Martinsburg--have a clay content of 27 to 35 percent and a sand content of less than 15 percent in the particle-size control section and have ochric epipedons 46 to 74 centimeters (18 to 29 inches) thick
Menfro--are in areas that have a mean annual air temperature of 12 to 15 degrees C (54 to 59 degrees F) and have a mean annual precipitation of 81 to 107 centimeters (32 to 42 inches)
Middletown--have an average clay content of more than 27 percent in the particle-size control section and have a sand content of more than 80 percent in the lower third of the series control section
Navlys--have carbonates within depths of 56 to 102 centimeters (22 to 40 inches), have a clay content of 25 to 35 percent in the particle-size control section, and have a frequently saturated zone within depths of 1.2 to 1.8 meters (4 to 6 feet) in normal years
Palermo--have ochric epipedons 8 to 15 centimeters (3 to 6 inches) thick and are in areas that have a mean annual air temperature of 12 to 13 degrees C (53 to 55 degrees F) and have a mean annual precipitation of 91 to 97 centimeters (36 to 38 inches)
Palsgrove--have a lithic contact of dolomitic limestone within depths of 102 to 152 centimeters (40 to 60 inches) and have a clay content of 27 to 35 percent in the particle-size control section
Pepin--have a lithic contact of dolomitic limestone within depths of 114 to 203 centimeters (45 to 80 inches)
Piscasaw--have carbonates within a depth of 91 to 152 centimeters (36 to 60 inches) and have a sand content of 35 to 55 percent in the lower third of the series control section
Ridgway--have a sand content of more than 60 percent with lamellae in the lower third of the series control section
Rozetta--have a clay content of 27 to 35 percent in the particle-size control section and have a frequently saturated zone within depths of 1.2 to 1.8 meters (4 to 6 feet) in normal years
Ruma--have a clay content of 15 to 27 percent and a sand content of 7 to 15 percent in the lower third of the series control section and are in areas that have mean annual air temperature of 12 to 14 degrees C (54 to 57 degrees F) and have a mean annual precipitation of 91 to 102 centimeters (36 to 40 inches)
Rush--have a rock fragment content of 15 to 75 percent in the lower third of the series control section
Russell--have a carbonates within a depth of 102 to 152 centimeters (40 to 60 inches) and have moist bulk density of 1.75 to 2.00 g/cc in the lower third of the series control section
St. Charles--have stratified layers with a clay content of 10 to 25 percent and a sand content of 20 to 60 percent the lower third of the series control section
Stookey--are in areas that have a mean annual air temperature of 12 to 14 degrees C (54 to 57 degrees F) and have a mean annual precipitation of 91 to 112 centimeters (36 to 44 inches)
Sylvan--have carbonates within depths of 56 to 102 centimeters (22 to 40 inches) and have an average clay content of 25 to 35 percent and a sand content of less than 15 percent in the particle-size control section
Thebes--have an average sand content of more than 50 percent in the lower third of the series control section
Yellowriver--have a sand content of 10 to 50 percent in the upper part of the series control section

GEOGRAPHIC SETTING:

Parent material--coarse loess
Landform--ridge tops and side slopes on uplands near the bluffs along the major valleys and on treads and risers on high stream terraces
Slopes--0 to 60 percent

Elevation--104 to 415 meters (340 to 1,360 feet) above sea level
Mean annual air temperature--4 to 14 degrees C (39 to 57 degrees F)
Mean annual precipitation--64 to 114 centimeters (25 to 45 inches)
Frost-free period--140 to 200 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Dubuque, Fayette, Hickory, La Farge, Mt. Carroll, Palsgrove, Port Byron, Sylvan and Timula soils.
Dubuque--are at lower elevations on side slopes and have a lithic contact within depths of 51 to 102 centimeters (20 to 40 inches)
Fayette--are in landscape positions similar to those of the Seaton soils
Hickory--are in landscape positions similar to those of the Seaton soils and have an average clay content of 24 to 35 percent in the particle-size control section
La Farge--are at lower elevations on side slopes
Mt. Carroll--are in landscape positions similar to those of the Seaton soils and have a thicker, darker colored ochric epipedon
Palsgrove--are at lower elevations on side slopes
Port Byron--are in landscape positions similar to those of the Seaton soils and have a mollic epipedon 25 to 61 centimeters (10 to 24 inches) thick
Sylvan--are in landscape positions similar to those of the Seaton soils
Timula--are in landscape positions similar to those of the Seaton soils and do not have an argillic horizon and have a clay content of less than 18 percent in the particle-size control section

DRAINAGE AND PERMEABILITY:
Drainage class--well drained--saturation does not occur within a depth of 1.8 meters (6 feet) during the wettest periods in normal years
Some pedons are moderately well drained and have a frequently saturated zone within a depth of 0.9 to 1.8 meters (3 to 6 feet) in normal years
Saturated hydraulic conductivity--moderately high
Surface runoff potential--negligible to high relative to slope

USE AND VEGETATION:
Nearly level to strongly sloping areas are cultivated or pastured. The principal crops are corn, soybeans, small grains, and legume hays. Steeply sloping areas are mostly wooded or pastured. The native vegetation is deciduous trees, mainly oak, hickory, and birch.

DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains
Physiographic Province--Central Lowland
Physiographic section(s)--Wisconsin driftless section, Dissected till plains, Till plains
MLRA(s)--Wisconsin and Minnesota Thin Loess and Till, Southern Part (90B), Eastern Iowa and Minnesota Till Prairies (104), Northern Mississippi Valley Loess Hills (105), Illinois and Iowa Deep Loess and Drift (108), and Central Mississippi Valley Wooded Slopes (115)
LRR K and LRR M; northwestern and west-central Illinois, southwestern and west-central Wisconsin, eastern Iowa, and southeastern Minnesota
Extent--large

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Indianapolis, Indiana

SERIES ESTABLISHED: Henderson County, Illinois, 1947.

REMARKS:

Particle-size control section--the zone from a depth of 38 to 88 centimeters (15 to 35 inches) (Bt1, Bt2, Bt3, and Bt4 horizons);
series control section--the zone from the surface to a depth of 178 centimeters (0 to 70 inches) (A, E, BE, Bt1, Bt2, Bt3, Bt4, and BC horizons).

Diagnostic horizons and features recognized in this pedon:
ochric epipedon--the zone from the surface of the soil to a depth of about 23 centimeters (0 to 9 inches) (A and E horizons);
argillic horizon--the zone from a depth of 38 to 112 centimeters (15 to 44 inches) (Bt1, Bt2, Bt3, and Bt4 horizons);
udic moisture regime.

Research data from a project conducted jointly by UW-River Falls and the Soil Conservation Service indicates that Seaton soils formed in loess thicker than 80 inches typically have a perched zone of near saturation with redox features. Internal drainage appears to be restricted by structure differences in the lower part of the argillic horizon and/or contrasting pore size, resulting in the zone of near saturation during wet periods. Seaton soils, however, will be considered well drained.

Cation-exchange activity class is supported by lab data from National Soil Survey Laboratory, Lincoln, Nebraska.

Clay content in the particle-size control section and lower third of the series control section is based on analysis of laboratory data (NSSL)

Taxonomy version--Keys to Soil Taxonomy, ninth edition, 2003.

ADDITIONAL DATA:
Laboratory data--National Soil Survey Laboratory, Lincoln, Nebraska many pedons (http://ssldata.sc.egov.usda.gov/)
Laboratory data--Illinois Agricultural Experiment Station Bulletins 587, 701, and 739.

National Cooperative Soil Survey
U.S.A.

LOCATION SHIFFER WI

Established Series
Rev. PHC-AJK-GWH
06/2001

SHIFFER SERIES

The Shiffer series consists of deep, somewhat poorly drained soils formed in water-laid loamy deposits and the underlying sandy deposits on stream and lake terraces. These soils have moderate permeability in the loamy solum and rapid permeability in the substratum. Slopes range from 0 to 3 percent. Mean annual precipitation is about 31 inches, and mean annual temperature is about 46 degrees F.

TAXONOMIC CLASS: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Aquollic Hapludalfs

TYPICAL PEDON: Shiffer loam - on a slope of less than 1 percent cropped to corn at an elevation of about 890 feet. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 7 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; few roots; few pores; mildly alkaline; abrupt smooth boundary. (6 to 9 inches thick)

Bt1--7 to 11 inches; dark yellowish brown (10YR 3/4) loam; weak medium subangular blocky structure; firm; few roots; common pores; faint patchy clay films on faces of peds and in pores; some worm casts of very dark brown (10YR 2/2); some dark brown (10YR 3/3) coatings; slightly acid; clear wavy boundary. (3 to 6 inches thick)

Bt2--11 to 14 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct yellowish brown (10YR 5/6) and few fine distinct dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; firm; few roots; common pores; faint patchy clay films on faces of peds and in pores and channels; few pebbles; slightly acid; clear smooth boundary.

Bt3--14 to 24 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) and many medium distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few roots; common pores; faint patchy clay films on faces of peds and in pores and channels; few pebbles; strongly acid; clear wavy boundary. (Combined thickness of the Bt horizons is 7 to 18 inches.)

2Bt4--24 to 27 inches; dark yellowish brown (10YR 4/4) sandy loam; common fine and medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; common pores; faint patchy clay films on faces of peds and in pores and channels; few pebbles; strongly acid; clear wavy boundary. (2 to 4 inches thick)

2BC--27 to 32 inches; dark yellowish brown (10YR 4/4) loamy sand; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very friable; few pebbles; medium acid; clear wavy boundary. (0 to 5 inches thick)

2C--32 to 60 inches; yellowish brown (10YR 5/6) sand; common medium distinct yellowish brown

(10YR 5/4) mottles; single grain; loose; medium acid.

TYPE LOCATION: Sauk County, Wisconsin; about 2 1/2 miles northwest of Baraboo; 360 feet north and 1,290 feet west of the southeast corner of the NE1/4, sec. 29, T. 12 N., R. 6 E.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 20 to 50 inches. The A horizon is slightly acid to mildly alkaline. The B and C horizon is slightly acid to very strongly acid. Coarse fragments larger than 3 inches in diameter are not present in the pedon. Coarse fragments smaller than 3 inches are less than 2 percent by volume.

The Ap or A horizon has 10YR hue, value of 2 or 3, and chroma of 1 or 2. It is loam or sandy loam.

The Bt1 horizon has 10YR or 7.5YR hue, value of 3 through 6, and chroma of 3 or 4. It is loam or sandy loam.

The Bt2 or Bt3 horizon has 10YR or 7.5YR hue, value of 3 through 6, and chroma of 2 through 5. It is loam, sandy clay loam, or clay loam.

The 2bt and BC horizon has 10YR or 7.5YR hue, value of 4 through 6, and chroma of 2 through 6. It is sandy loam or loamy sand. Sandy loam texture is less than 5 inches thick. Both high and low chroma mottles are in the B horizon.

The 2C horizon has 10YR or 7.5YR hue, value of 5 through 8, and chroma of 2 through 6. It is loamy sand, sand, or coarse sand.

COMPETING SERIES: These are the Binghampton and Hayfield series in the same family. Binghampton soils have sola more than 40 inches thick and are in uplands. Hayfield soils have albic horizons and typically contain more coarse fragments.

GEOGRAPHIC SETTING: The Shiffer soils are on low stream and lake terraces. Slope gradients range from 0 to 3 percent. They formed in water-laid loamy deposits and the underlying sandy deposits, either water-laid or weathered directly from sandstone. Mean annual precipitation ranges from 28 to 35 inches, and mean annual temperature ranges from 45 to 53 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the lower-lying poorly drained Marshan soils and the higher-lying, well drained Meridian soils. In a few places there are the moderately well drained phases of the Meridian soils. In some nearby areas are the Dakota soils that occupy similar landscapea as the Meridian soils. Dakota soils do not have mottles and have darker or thicker surface horizons.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained. Runoff is slow. Permeability is moderate in the loamy deposit and rapid in the underlying sandy deposit. Shiffer soils are subject to rare or occasional but brief flooding.

USE AND VEGETATION: Drained areas are used for corn, small grain, and hay. Undrained areas are in pasture or woodland. Native vegetation was mixed deciduous hardwood forest with some sedges and grasses.

DISTRIBUTION AND EXTENT: Mainly in western Wisconsin and one county in southern Wisconsin. These soils are moderately extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Trempealeau County, Wisconsin, 1969.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface of the soil to a depth of 7 inches (Ap horizon).

Argillic horizon - zone from 7 to 24 inches (Bt1, Bt2, Bt3 horizons).

Other features - strongly contrasting particle-size class below the argillic and within a depth of 40 inches - mottles with chroma of 2 or less within the upper 10 inches of the argillic horizon.

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