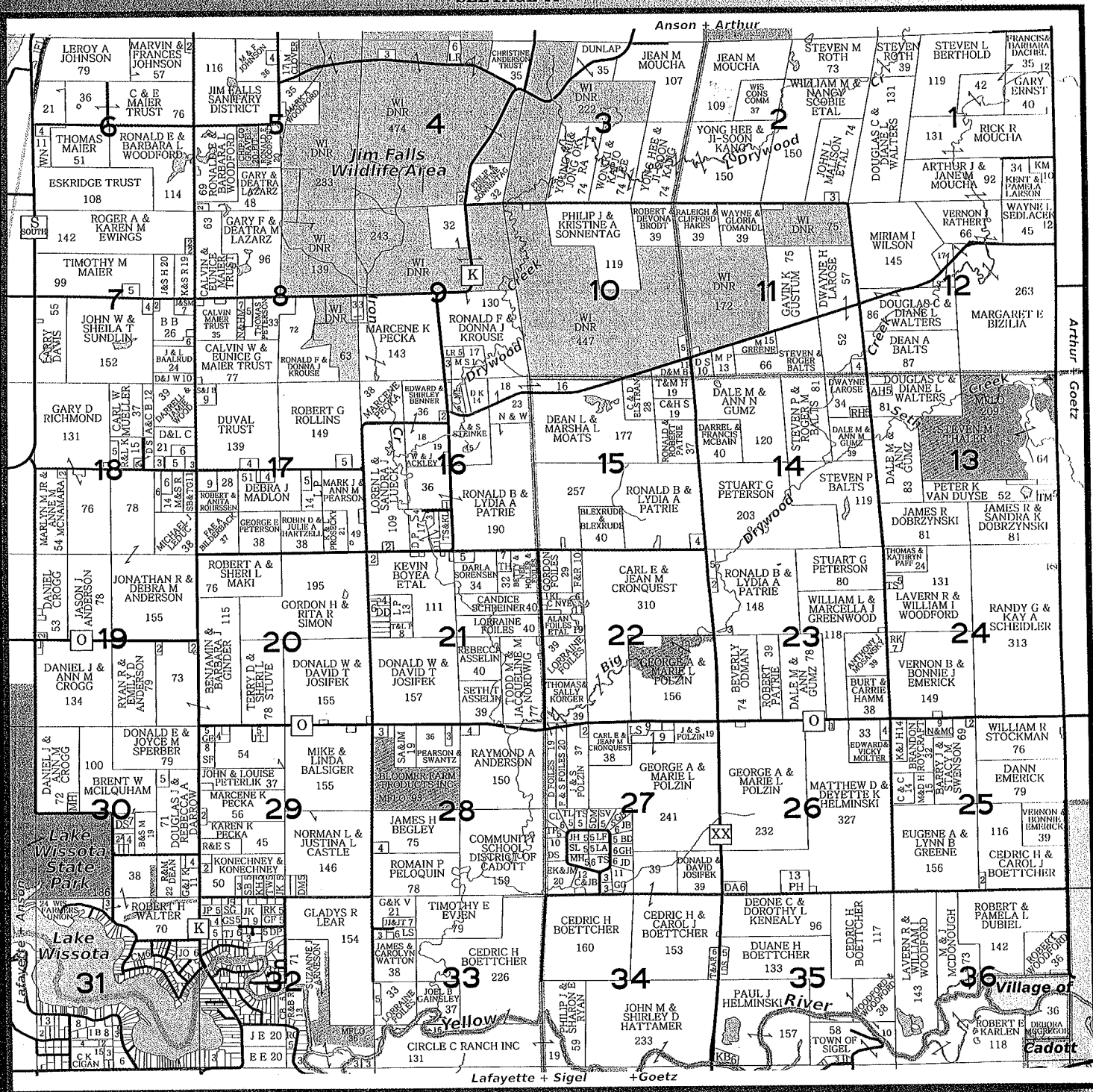


SEE PAGE 44



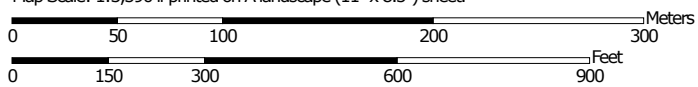
SEE PAGE 34

Figure 1. Plat Book Location of the Patrie Pit

Soil Map—Chippewa County, Wisconsin



Map Scale: 1:3,590 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge ticks: UTM Zone 15N WGS84



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

3/27/2015
Page 1 of 3

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chippewa County, Wisconsin
Survey Area Data: Version 10, Sep 9, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 1, 2010—Sep 10, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Chippewa County, Wisconsin (WI017)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FrA	Friendship loamy sand, 0 to 3 percent slopes	4.4	16.0%
Ha	Halder loam, 0 to 2 percent slopes	1.6	5.8%
MbB	Magnor silt loam, 1 to 6 percent slopes	3.1	11.3%
Px	Poskin silt loam, 0 to 2 percent slopes	3.3	12.0%
Rb	Rib silt loam, 0 to 2 percent slopes	0.6	2.0%
RoB	Rosholt sandy loam, 2 to 6 percent slopes	1.6	5.8%
ScB	Scott Lake sandy loam, 1 to 6 percent slopes	3.9	14.1%
SdA	Scott Lake loam, 0 to 3 percent slopes	9.1	33.1%
Totals for Area of Interest		27.6	100.0%

Chippewa County, Wisconsin

FrA—Friendship loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: g4mp

Elevation: 700 to 2,000 feet

Mean annual precipitation: 24 to 33 inches

Mean annual air temperature: 36 to 45 degrees F

Frost-free period: 90 to 140 days

Farmland classification: Not prime farmland

Map Unit Composition

Friendship and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Friendship

Setting

Landform: Stream terraces, outwash plains

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy outwash

Typical profile

Ap - 0 to 8 inches: loamy sand

Bw,BC - 8 to 36 inches: sand

C1,C2 - 36 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Moderately well drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: About 54 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Other vegetative classification: Low AWC, adequately drained
(G090BY002WI)

Data Source Information

Soil Survey Area: Chippewa County, Wisconsin
Survey Area Data: Version 10, Sep 9, 2014

Chippewa County, Wisconsin

Ha—Halder loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: g4mv

Elevation: 700 to 1,900 feet

Mean annual precipitation: 24 to 33 inches

Mean annual air temperature: 37 to 45 degrees F

Frost-free period: 100 to 150 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Halder and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Halder

Setting

Landform: Stream terraces, outwash plains

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Linear, concave

Across-slope shape: Concave

Parent material: Loamy drift over sandy and gravelly outwash

Typical profile

Ap - 0 to 8 inches: loam

E,B/E,Bt - 8 to 28 inches: sandy clay loam

2BC - 28 to 32 inches: gravelly sandy loam

2C - 32 to 60 inches: Error

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Somewhat poorly drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B/D

Other vegetative classification: Mod AWC, high water table
(G090BY004WI)

Minor Components

Rib

Percent of map unit:

Landform: Depressions

Data Source Information

Soil Survey Area: Chippewa County, Wisconsin

Survey Area Data: Version 10, Sep 9, 2014

Chippewa County, Wisconsin

MbB—Magnor silt loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: g4n7

Elevation: 800 to 1,950 feet

Mean annual precipitation: 28 to 33 inches

Mean annual air temperature: 39 to 45 degrees F

Frost-free period: 120 to 135 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Magnor and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Magnor

Setting

Landform: Drainageways on ground moraines

Landform position (two-dimensional): Footslope

Down-slope shape: Linear

Across-slope shape: Concave

Parent material: Silty drift over sandy loam till

Typical profile

Ap - 0 to 8 inches: silt loam

E - 8 to 11 inches: silt loam

E/B,B/E - 11 to 18 inches: silt loam

2Bt1,2Bt2 - 18 to 32 inches: sandy loam

2C - 32 to 60 inches: sandy loam

Properties and qualities

Slope: 1 to 6 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Somewhat poorly drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low
(0.00 in/hr)

Depth to water table: About 6 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C/D

Other vegetative classification: Mod AWC, high water table
(G090AY004WI)

Minor Components

Auburndale

Percent of map unit:

Landform: Depressions

Data Source Information

Soil Survey Area: Chippewa County, Wisconsin

Survey Area Data: Version 10, Sep 9, 2014

Chippewa County, Wisconsin

Px—Poskin silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: g4p2

Elevation: 800 to 1,950 feet

Mean annual precipitation: 28 to 33 inches

Mean annual air temperature: 39 to 45 degrees F

Frost-free period: 120 to 135 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Poskin and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Poskin

Setting

Landform: Depressions on stream terraces, depressions on outwash plains

Landform position (two-dimensional): Footslope

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Loamy drift and/or silty drift over sandy and gravelly outwash

Typical profile

Ap - 0 to 10 inches: silt loam

E - 10 to 14 inches: silt loam

E/B, B/E - 14 to 23 inches: silt loam

Bt1 - 23 to 29 inches: silt loam

2Bt2 - 29 to 38 inches: sandy loam

2C - 38 to 60 inches: Error

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Somewhat poorly drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 6 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B/D

Other vegetative classification: High AWC, high water table
(G090AY007WI)

Minor Components

Rib

Percent of map unit:

Landform: Depressions

Data Source Information

Soil Survey Area: Chippewa County, Wisconsin

Survey Area Data: Version 10, Sep 9, 2014

Chippewa County, Wisconsin

Rb—Rib silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: g4p3

Elevation: 800 to 1,950 feet

Mean annual precipitation: 28 to 33 inches

Mean annual air temperature: 37 to 43 degrees F

Frost-free period: 110 to 125 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Rib and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rib

Setting

Landform: Drainageways on outwash plains, drainageways on stream terraces

Landform position (two-dimensional): Toeslope

Down-slope shape: Linear

Across-slope shape: Concave

Parent material: Loamy drift and/or silty drift over stratified sandy and gravelly outwash

Typical profile

Ap - 0 to 8 inches: silt loam

Bg1,Bg2,Bg3 - 8 to 28 inches: silt loam

2Bg4 - 28 to 33 inches: loam

2C - 33 to 60 inches: stratified coarse sand to loamy sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: Occasional

Frequency of ponding: Frequent

Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B/D

Other vegetative classification: High AWC, high water table
(G090BY007WI)

Data Source Information

Soil Survey Area: Chippewa County, Wisconsin

Survey Area Data: Version 10, Sep 9, 2014

Chippewa County, Wisconsin

RoB—Rosholt sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: g4p7

Elevation: 800 to 1,950 feet

Mean annual precipitation: 24 to 33 inches

Mean annual air temperature: 39 to 45 degrees F

Frost-free period: 120 to 135 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Rosholt and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rosholt

Setting

Landform: Stream terraces, outwash plains

Landform position (three-dimensional): Tread, rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy drift over stratified sandy and gravelly outwash

Typical profile

Ap - 0 to 8 inches: sandy loam

E/B - 8 to 16 inches: sandy loam

Bt1 - 16 to 24 inches: sandy loam

Bt2 - 24 to 31 inches: gravelly loamy sand

2C - 31 to 60 inches: stratified coarse sand to gravelly coarse sand to very gravelly coarse sand

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.57 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: A

Other vegetative classification: Mod AWC, adequately drained
(G090BY005WI)

Minor Components

Scott lake

Percent of map unit: 10 percent

Landform: Stream terraces, outwash plains

Landform position (three-dimensional): Riser, rise

Down-slope shape: Linear

Across-slope shape: Linear

Other vegetative classification: Low AWC, adequately drained
(G090BY002WI)

Data Source Information

Soil Survey Area: Chippewa County, Wisconsin

Survey Area Data: Version 10, Sep 9, 2014

Chippewa County, Wisconsin

ScB—Scott Lake sandy loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: g4pj

Elevation: 800 to 1,950 feet

Mean annual precipitation: 28 to 33 inches

Mean annual air temperature: 39 to 45 degrees F

Frost-free period: 90 to 140 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Scott lake and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scott Lake

Setting

Landform: Stream terraces, outwash plains

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Loamy drift over sandy and gravelly outwash

Typical profile

Ap - 0 to 8 inches: sandy loam

B/E - 8 to 14 inches: loam

Bt1,2Bt2 - 14 to 36 inches: loam

2C - 36 to 60 inches: Error

Properties and qualities

Slope: 1 to 6 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Moderately well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 30 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C

Other vegetative classification: Mod AWC, adequately drained
(G090BY005WI)

Data Source Information

Soil Survey Area: Chippewa County, Wisconsin
Survey Area Data: Version 10, Sep 9, 2014

Chippewa County, Wisconsin

SdA—Scott Lake loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: g4pk

Elevation: 800 to 1,950 feet

Mean annual precipitation: 28 to 33 inches

Mean annual air temperature: 39 to 45 degrees F

Frost-free period: 90 to 140 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Scott lake and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scott Lake

Setting

Landform: Stream terraces, outwash plains

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Loamy drift over sandy and gravelly outwash

Typical profile

Ap - 0 to 8 inches: loam

B/E - 8 to 14 inches: loam

Bt1,2Bt2 - 14 to 36 inches: loam

2C - 36 to 60 inches: Error

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Moderately well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 30 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: C

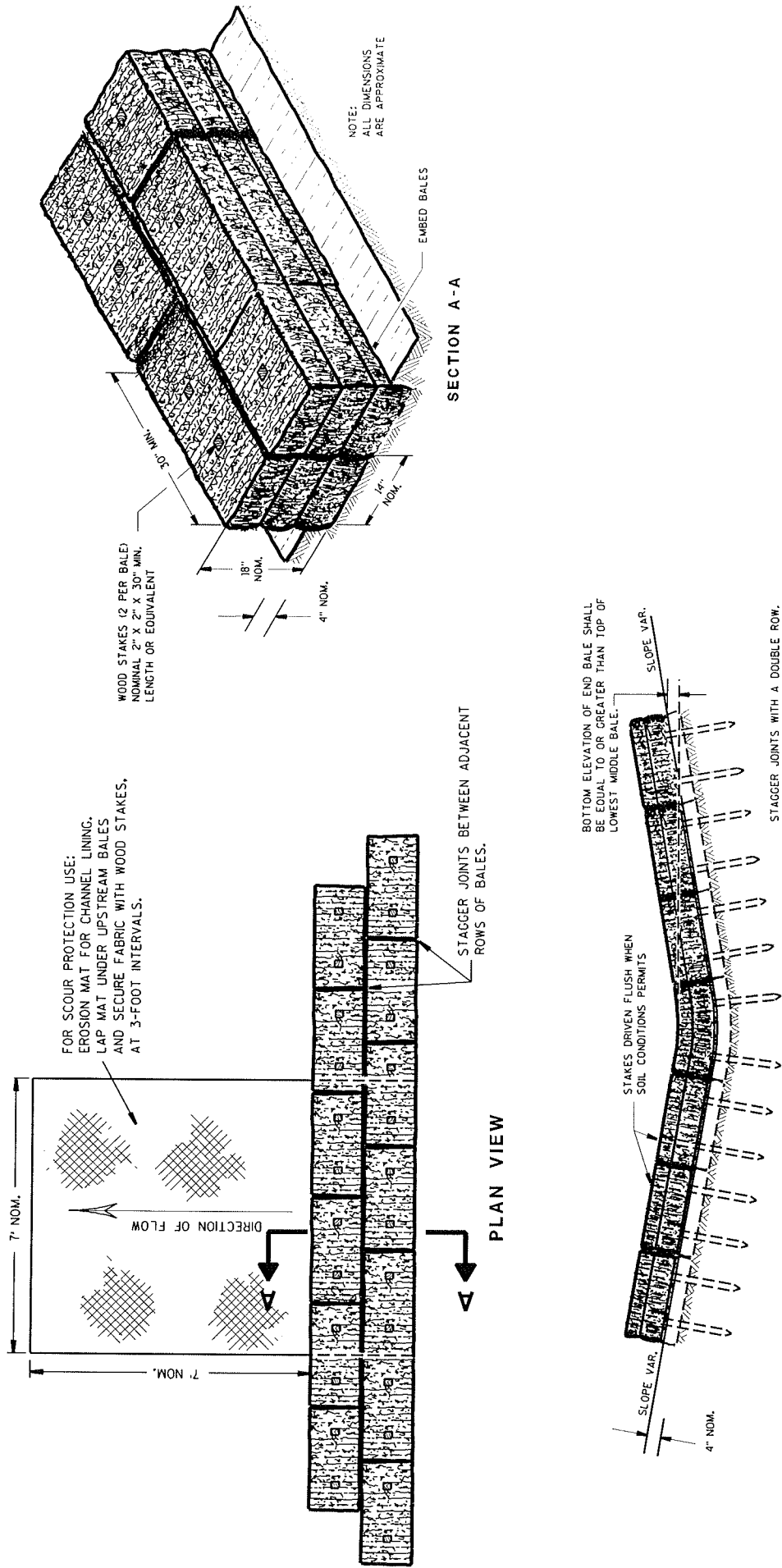
Other vegetative classification: Mod AWC, adequately drained
(G090BY005WI)

Data Source Information

Soil Survey Area: Chippewa County, Wisconsin

Survey Area Data: Version 10, Sep 9, 2014

Figure 1



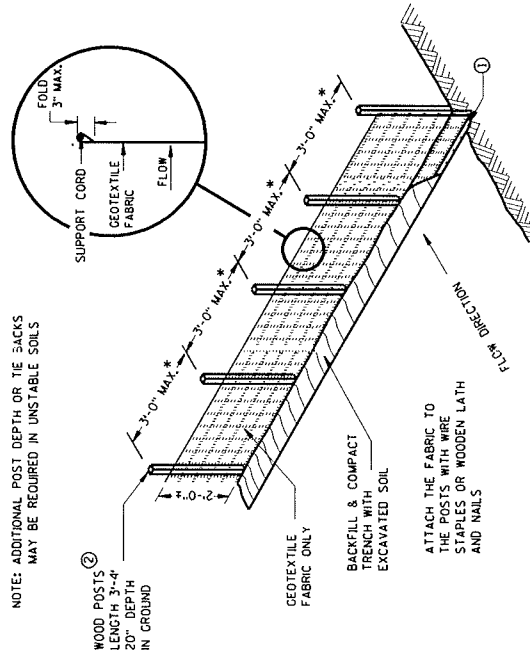
This drawing based on Wisconsin
Department of Transportation
Standard Detail Drawing 8 E 8-3.

**TYPICAL INSTALLATIONS OF
EROSION BALES / TEMPORARY
DITCH CHECKS**

GENERAL NOTES

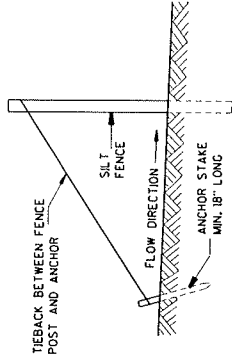
- ① TRENCH SHALL BE A MINIMUM OF 4" WIDE & 6" DEEP TO BURY AND ANCHOR THE GEOTEXTILE FABRIC. FOLD MATERIAL TO FIT TRENCH AND BACKFILL & COMPACT TRENCH WITH EXCAVATED SOIL.
- ② WOOD POSTS SHALL BE A MINIMUM SIZE OF 1/2" X 1/2" OF OAK OR HICKORY.
- ③ CONSTRUCT SILT FENCE FROM A CONTINUOUS ROLL IF POSSIBLE BY CUTTING LENGTHS TO AVOID JOINTS. IF A JOINT IS NECESSARY USE ONE OF THE FOLLOWING TWO METHODS: A) TWIST METHOD -- OVERLAP THE END POSTS AND TWIST OR ROTATE, AT LEAST 180 DEGREES; B) HOOK METHOD -- HOOK THE END OF EACH SILT FENCE LENGTH.

NOTE: ADDITIONAL POST DEPTH OR TIE BACKS MAY BE REQUIRED IN UNSTABLE SOILS

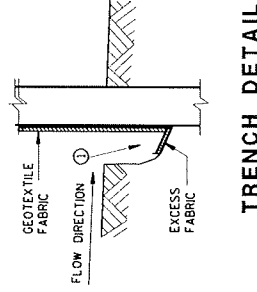


* NOTE: 8'-0" POST SPACING ALLOWED IF A WOVEN GEOTEXTILE FABRIC IS USED.

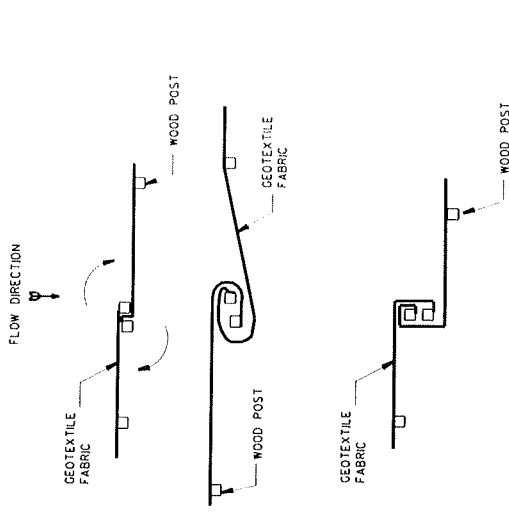
SILT FENCE



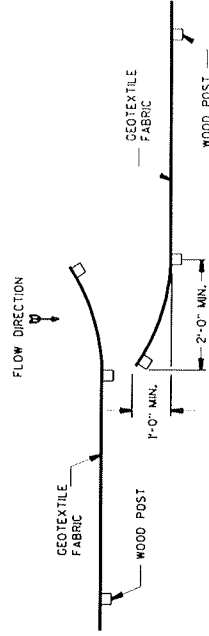
SILT FENCE TIE BACK (WHEN ADDITIONAL SUPPORT REQUIRED)



TRENCH DETAIL



TWIST METHOD



JOINING TWO LENGTHS OF SILT FENCE ④

HOOK METHOD

This drawing based on Wisconsin
Department of Transportation
Standard Detail Drawing 8 E 9-6.

SILT FENCE

WISCONSIN CONSTRUCTION SPECIFICATION

26. Topsoiling

1. SCOPE

The work consists of furnishing and spreading topsoil to specified depths at locations shown on the drawings. This specification does not apply to any other earthfill.

2. MATERIALS

Topsoil shall consist of naturally occurring friable surface soil reasonably free of grass, roots, weeds, sticks, rocks, other unsuitable material, herbicides, or other compounds whose presence would prevent establishment of grass and/or legume sod cover.

Topsoil shall be obtained from soil surfaces containing USDA soil textural classifications of loam, sandy loam, silt loam, silty clay loam, sandy clay loam, or clay loam soils shown on the drawings or acceptable to the Technician.

Topsoil shall:

- be salvaged from designated areas that will be disturbed by construction activities or be furnished from an offsite source designated by the Contractor. The Technician shall be granted access to the source for inspection and acceptance before delivery to the site.
- meet the following requirements (when testing is required):
 - 100% passing the ¾-inch sieve.
 - minimum 95% passing the #10 sieve.
 - minimum 25% passing the #200 sieve.
 - 3% - 15% organic material.
 - non-positive herbicide carryover (UW Extension Publication A3819, Herbicide Persistence and Carryover).

3. TESTING

The Technician will determine the need for testing the topsoil for gradation, percent organic matter content, and herbicide carryover effect. The testing will be at the expense of the Contractor.

4. FOUNDATION PREPARATION AND PLACEMENT

The surfaces designated to receive a topsoil application shall be cleared of all objectionable materials including trees, stumps, roots, brush, rubbish, and stones having a maximum dimension greater than 6 inches. The surfaces shall be lightly scarified just before the spreading operation. Topsoil shall not be placed until the required excavation, fill and preparation of the surfaces is complete and approved by the Technician.

Spreading shall not be conducted when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Snow, ice, or frozen material shall not be incorporated in the topsoil.

Topsoil shall be placed in approximately horizontal layers no greater than 8 inches thick.

Placement of topsoil adjacent to concrete structures may begin after the concrete has cured for the minimum time specified. Heavy equipment shall not be operated within 2 feet of any structure.

Following the spreading operation, the topsoil surface shall be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

5. MOISTURE CONTENT

Topsoil shall have a moisture content sufficient to insure the spreading of the material to the required thickness. When kneaded in the hand the soil will form a ball which does not readily separate and will not extrude out of the hand when squeezed tightly. The adequacy of the moisture content will be determined by the Technician.

6. COMPACTION

The Contractor shall furnish and operate the types and kinds of equipment necessary to compact the topsoil material when specified. The Technician shall determine if adequate compaction is being achieved.

Adequate compaction is defined as a firm surface able to support the growth of vegetation. Methods for compaction may include back-blading or a single pass from a rubber tire, track, or roller. A pass shall consist of complete coverage by the rubber tire, track, or roller over the entire surface of the topsoil. Care must be taken to avoid excessive compaction of topsoil.

Adjacent to structures or in confined areas, compaction of topsoil shall be accomplished by means of manually directed power tampers or plate vibrators or hand tamping, unless otherwise specified.

Where compacted earthfill is designated to be topsoiled, the topsoil shall be placed concurrently with the earthfill and shall be bonded to the compacted fill with the compacting equipment.

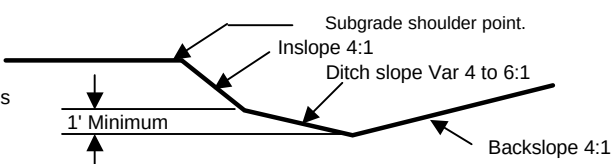
CHANNEL EROSION CONTROL MATRIX

(Concentrated Flow Application)

TYPE OF EROSION CONTROL DEVICE	PERMISSIBLE SHEAR LBS/F.	DITCH GRADE															REMARKS
		< 2%			2% - 4%			4% - 6%			6% - 9% *			9% - 12% *			
		Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			
		300	600	1200	300	600	1200	300	600	1200	300	600	1200	300	600	1200	
Seed with properly anchored mulch	0.6																Anchor mulch per specifications.
Sod ditch checks with seed and mulch	N/A				C												Install one ditch check for every 1 foot of drop. Sod stakes required.
Temporary ditch checks (hay bales or approved manufactured alternatives lisited in the WisDOT PAL)	N/A																Install one ditch check for every 2 feet of drop. Maximum 200' spacing. Not recommended for slopes less than 1%.
Sod ditch liner	1.0																Upstream end must be buried. Additional sod stakes required.
Double netted light duty (WisDOT Class I Type B) erosion mat	1.5																Only mat type products allowed.
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat	1.5																Upstream end must be buried. Additional sod stakes required. Two bid items needed.
Stone or rock ditch checks, or Rock-Filled Filter Bags	N/A																Use No. 2 coarse aggregate, railroad ballast, or breaker run. Install one ditch check for every 2 feet of drop. Use in conjunction with a channel lining.
Medium duty coconut erosion mat (WisDOT Class II Type B or C)	2.0																
Heavy duty synthetic (WisDOT Class III Type A) erosion mat or turf reinforcement mat (WisDOT Class III Type B)	2.0																Germination may be a problem with Class III Type A mats. An ECRM is required for initial erosion protection for Class III Type B mats.
Heavy duty synthetic turf reinforcement (WisDOT Class III Type C) mat	3.5																An ECRM is required for initial erosion protection. Contact manufacturer if higher shears are needed.
Riprap ditch checks	N/A																Place top of downstream ditch check level with bottom of upstream ditch check. Use in conjunction with a channel lining.
Heavy duty synthetic turf reinforcement (Class III Type D) mat	5																An ECRM is required for initial erosion protection. Contact manufacturer if higher shears are needed.
Light riprap	4																Outfalling, overtopping and scour need to be addressed. Use 2' minimum ditch depth.
Medium riprap	5																
Heavy riprap	8																
Riprap measures apply to all ditch types. Use of these measure requires engineering judgement and design.																	

CHANNEL EROSION CONTROL MATRIX

(Concentrated Flow Application)

TYPE OF EROSION CONTROL DEVICE	PERMISSIBLE SHEAR LB/S.F.	DITCH GRADE															REMARKS
		< 2%			2% - 4%			4% - 6%			6% - 9% *			9% - 12% *			
		Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			
		300	600	1200	300	600	1200	300	600	1200	300	600	1200	300	600	1200	
Grouted rip rap	N/A	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	Address outfalling, overtopping and scour. Line with Grotexile fabric Type "HR", (see Chap. 10, Const. Detail and special provision). Use 2' minimum ditch depth.	
Articulated Concrete Block Type A	5	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	ACBs apply to all ditch types. Use of these measures requires engineering judgement and design.	
Articulated Concrete Block Type B	10	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●		
Articulated Concrete Block Type C	15	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●		
Articulated Concrete Block Type D	20	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●		
Articulated Concrete Block Type E	30	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●	●●●●●●●●●●●●●●●●		
Standard Ditch Section  Erosion control for ditches not conforming to the typical at right, that complies with FDM procedures 11-15-1 Figures 6 & 7, should be designed according to FDM Chapter 13. KEY Effective range of device for Sandy or Clayey Soil: ●●●●●●●●●●●●●●●● Device applicable, may not be cost effective: ●●●●●●●●●●●●●●●● " C " effective for clayey soil only Not applicable. Use in conjunction with other BMPs: ⊗ ECRM - Erosion control revegetation mat. All Class I and II mats are ECRMs. TRM - Turf reinforcement mat. FDM - WisDOT Facilities Development Manual BMP - Best Management Practice PAL - See Note 6 * For ditch grades over 9% special design considerations may be required. ** Soils that are not sandy should be treated as clay soils.																	NOTES 1) Ditch flow rates used to develop bar chart are based on a 60 ft. right of way from pavement centerline and a 2-Yr. rainfall event for temporary liners or a 25-Yr. rainfall event for permanent (Class III mat or riprap) liners. If the drainage area extends outside the 60 foot right of way or unusual flows are expected, use the shear stress column values to determine the suitability of a liner. See FDM procedures in Chapter 10 and in Section 13-30-10. 2) Erosion mats shall extend upslope 1.0 ft. min. vertically from the ditch bottom or 6" higher than the design flow depth. There shall be no joints within 18" of the low point. 3) Cost shall be a consideration in the selection of these devices. 4) Add sediment traps at the bottom of channel slopes. 5) Refer to FDM Chapter 10 for any channels exceeding the limits shown. 6) Approved materials for erosion products are referenced from the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL), found at the web site: http://www.dot.wisconsin.gov/business/engrserv/pal.htm 7) On long or steep channels that require a higher class mat, use the appropriate lower class mat for the first 300 ft to 600 ft of the channel. 8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.

SLOPE EROSION CONTROL MATRIX

TYPE OF EROSION CONTROL	SLOPE																		REMARKS
	6:1 or flatter (7)			4:1			3:1			2.5:1			2:1			1:1			
	SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			SLOPE LENGTH			
	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	0 - 30'	30 - 60'	60 - 120'	
Seed with properly anchored mulch																			
Single netted light duty (WisDOT Class I Type A) erosion mat																			
Light duty single netted 100% biodegradable (WisDOT Urban Type A) erosion mat																			Use only 100% biodegradeable anchors for urban mats.
Light duty double netted 100% biodegradeable (WisDOT Urban Type B) erosion mat																			Use only 100% biodegradeable anchors for urban mats.
Bonded Mulch (WisDOT Type A Soil Stabilizer)																			May be applied over Class III Type B, C, or D mats in place of erosion control revegetation mats.
Polymer (WisDOT Type B Soil Stabilizer)	Used in conjunction with other BMPs effective up to a 2:1 slope. Not effective in sand. When used alone effective up to a 3:1 slope. Stand alone use appropriate for earthen stock piles, temporary, and late season applications																		
Double netted light duty (WisDOT Class I Type B) erosion mat																			
Sod																			
Medium duty coconut erosion mat (WisDOT Class II Type B or C)																			
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat																			Sod stakes required. Two bid items needed.
Heavy duty synthetic erosion control revegetation mat (WisDOT Class III Type A)																			Germination may be a problem with Class III Type A mats
Riprap																			Angle of repose must be considered, see FDM Chapter 13.
Heavy duty synthetic turf reinforcement (WisDOT Class III Type B or C) mat																			A soil stabilizer or ECRM will be required for initial erosion protection.
Heavy duty synthetic turf reinforcement (WisDOT Class III Type D) mat																			A soil stabilizer or ECRM will be required for initial erosion protection.
Slope paving or grouted riprap																			Consider clear zone requirements. Only use in limited circumstances such as overflow areas near bridges.

SLOPE EROSION CONTROL MATRIX

Benches	Consider benches when cuts exceed 20', bench at approximately 15' vertical intervals to collect and drain water. Treat benches as channels (ditches). Adjust elevations to provide drainage. Consider flumes at transitions.
Intercepting embankments	Used to intercept runoff from abutting lands. Flumes may be necessary to direct runoff.
Silt fence	Used at toe of slopes to intercept and detain small amounts of sediment. Use only WisDOT approved silt fence as listed in the PAL.
Temporary ditch checks or Erosion bales	Used at toe of slopes to intercept and detain small amounts of sediment.
Slope drains/flumes	May be necessary on slopes (see channel matrix for design guidance).
Sediment traps	Used to trap sediment laden runoff. Could be used at the inlet or outlet end of slope drain.
<u>KEY:</u> Not applicable. Use in conjunction with other BMPs:  Effective range of device for Sandy or Clayey Soil:  Device applicable, may not be cost effective:  * Soils that are not sandy should be treated as clay soils. ECRM - Erosion control revegetation mat. All Class I and II mats are ECRMs. TRM - Turf reinforcement mat. FDM - WisDOT Facilities Development Manual PAL - See Note 5 <u>NOTES</u> 1) Cost shall be a consideration in the selection of these devices. 2) Designers should review FDM Chapter 10 prior to selection of erosion mats. 3) Install intercepting ditches to limit slope lengths to 15' vertical intervals. (See FDM Chapter 10) 4) Refer to FDM Chapter 10 for any slopes exceeding the limits shown. 5) Approved materials for erosion products are referenced from the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL), found at the web site: http://www.dot.wisconsin.gov/business/engrserv/pal.htm 6) On steeper slopes that require a higher class mat, use the appropriate lower class mat or seed and mulch for the first 30 ft to 60 ft of the slope. 7) Unless project conditions require otherwise, seed and mulch all slopes that are flatter than a 5% grade, regardless of length. If practicable, bench the slopes. 8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.	

CRITICAL AREA PLANTING

(Acre)
Code 342

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

Establishing permanent vegetation on sites that have or are expected to have high erosion rates, and on sites that have physical, chemical, or biological conditions that prevent the establishment of vegetation with normal practices.

II. Purposes

This practice may be applied as part of a conservation management system to support one or more of the following purposes.

- Stabilize and restore riparian areas.
- Stabilize stream and channel banks and shorelines.
- Stabilize areas with existing or expected high rates of soil erosion by water or wind.
- Rehabilitate and revegetate degraded sites that cannot be stabilized using normal establishment techniques.

III. Conditions Where Practice Applies

This practice applies to highly disturbed areas such as:

- active or abandoned surface mine sites,
- urban conservation sites,
- road construction areas,
- conservation practice construction sites,
- areas needing stabilization before or after natural disasters such as floods, tornados, and wildfires,
- eroded banks of natural channels, banks of newly constructed channels, and lake shorelines, and
- areas degraded by human activities.

IV. Federal, Tribal, State and Local Laws

Critical area planting practices shall comply with all federal, tribal, state and local laws, rules or regulations. The landowner and/or operator is responsible for securing required permits. This

standard does not contain the text of the federal, tribal, state or local laws.

V. Criteria

A. General Criteria Applicable To All Purposes.

1. Site Assessment

A site investigation shall be conducted to identify any physical, chemical, or biological conditions that could affect the successful establishment of vegetation. The site investigation shall include evaluation of: soil characteristics, soil fertility, slope, *aspect*¹, moisture regime, climatic patterns, proximity to natural plant community, and site history.

Areas to be planted will be cleared of unwanted materials and smoothed or shaped, if needed, to meet planting and landscaping purposes.

Compacted layers will be ripped and the soil re-firmed prior to seedbed preparation.

On tilled or disturbed sites, prepare a firm seedbed. The seedbed shall contain enough fine particles for uniform shallow coverage of seed and contact with moisture and nutrients. For details on seedbed preparation, refer to Wisconsin Agronomy Technical Notes 5, Establishing and Maintaining Native Grasses, Legumes, and Forbs; and 6, Establishing and Maintaining Introduced Grasses and Legumes.

2. Specie Selection and Seed Quality

Species selected for planting shall be suited to current site conditions, intended use, and be resistant to diseases and insects common to the site location.

¹Words in the standard that are shown in italics are described in X. Definitions. The words are italicized the first time they are used in the text.

Selected species will have the capacity to achieve adequate density and vigor to stabilize the site within an appropriate period.

Native herbaceous or woody vegetation selected for planting shall be suitable for the site.

Species identified as restricted or prohibited by law shall not be planted.

Certified Seed shall be used, and seeding rates will be based on *Pure Live Seed* (PLS). Seed tag information such as purity and germination and any computations to adjust seeding rates must be submitted to document actual seeding rates. *Actual adjusted seeding rates* will be based on the equivalent of 100 percent PLS, determined by multiplying the percent purity by total percent germination.

Untested introduced and native grass and forb seed are not approved for planting.

When certified seed is unavailable or difficult to locate, *non-certified* seed can be used, after testing for varietal purity, germination, and other mechanical qualities, such as inert matter and other crop or weed seeds.

If more than 20 percent of legume seed is hard seed, increase the seeding rate for legumes by the percentage of hard seed.

Introduced and native legume seed shall be inoculated immediately prior to planting. Rhizobia inoculant shall be specific to the legume seeded. When more than one legume specie is used, each specie will be inoculated separately.

3. Seeding Periods

The specific date that provides the best chance for success will vary from south to north and from year to year with prevailing moisture and temperature conditions. Late summer seeding is generally riskier than spring seeding. Planting at either end of the allowable range is riskier than the middle of the range. Refer to Figure 1 for planting zones and Tables 1 and 2 for seeding dates.

Seeding outside of the recommended dates must be approved by the Area Resource Conservationist or State Agronomist.

Frost seeding is not an authorized seeding method when using this standard.

Dormant seeding can be used when planting introduced species. When using dormant seedlings in concentrated flow areas, the site must be mulched according to the engineering design (if applicable) and Wisconsin NRCS Field Office Technical Guide, Section IV, (WI FOTG) Conservation Practice Standard 484, Mulching.

4. Nutrient and Soil Amendment Requirements

When seeding *introduced species*, soil fertility and pH level will be amended to satisfy the needs of the plant species to be established. Fertilizer and lime recommendations will be determined by a soil test, and all nutrients will be applied following WI FOTG Standard 590, Nutrient Management. If no soil test is available, apply a minimum of 150 pounds of 20-10-10 fertilizer and 2 tons of 80-89 lime or equivalent per acre. Soil amendments may be waived at the discretion of a certified conservation planner. The basis for waiving the use of soil amendments shall be documented in the client's case file.

For establishment of *native species*, use of soil amendments are not required.

5. Seedbed Preparation

Prior to planting into cropland fields, verify that herbicides previously applied to the site will not "carry over" and damage the new seeding.

Site preparation shall be adequate to assure weed suppression and to promote germination and growth of the species planted.

Planting equipment type, use, and timing shall be appropriate for the site conditions, soil characteristics, and type of seeds (size, etc.) selected to assure uniform placement and germination.

Refer to Wisconsin Agronomy Technical Notes 5 and 6 for detailed guidance for specific situations.

6. **Mulching, Temporary Cover, and Companion Crop**

Mulching, temporary cover, and companion crops are vital practices utilized to support the establishment of a critical area planting. Temporary cover and companion crops suppress weed growth and limit soil erosion during the establishment period. Use depends on the site conditions, method of planting, and seed mixture.

For further details on mulching, temporary cover and companion crop recommendations, refer to Wisconsin Agronomy Technical Notes 5 and 6.

B. Criteria for Seed Mixture Development

Seeding rates are based on seeds per square foot of Pure Live Seeds. Refer to Tables 3 and 4 for common species and seeding rates.

Additional approved species for critical area planting can be found in Wisconsin Agronomy Technical Notes 5 and 6. Species not listed in the technical notes must be approved in advance by the State Agronomist.

a. **Introduced Grass and Legume Plantings on Critical Sites**

Custom and standard mixtures will comprise of at least 50 percent grass seed, consisting of at least 25 percent sod forming grass seed per square foot.

A minimum of 160 seeds per square foot is required for either a solid stand of grasses or a combination of grasses and legumes. Increase seeding rate by 15 percent when dormant seeding occurs.

Standard mixes listed in Table 5 will meet the minimum seed mixture criteria.

b. **Native Herbaceous Plantings on Critical Sites**

Native species are generally not recommended for critical area plantings due to their slow establishment and because they are clump grasses, not the preferred sod-

forming grasses. Native plantings are not permitted in concentrated flow channels.

- 1) A minimum of 60 seeds per square foot for solid native grass plantings is required.
- 2) For native grass and forb/legume mixtures, a minimum of 40 seeds per square foot of grass and a minimum of 20 seeds per square foot for the forb/legume component is required. The minimum of 20 forb/legume seeds per square foot is not required when the solid stand native grass mixture comprise of 60 grass seeds per square foot is utilized.

Canada/Virginia wildrye and sideoats grama shall not exceed a maximum of 20 percent of the required grass seeds per square foot in custom seed mixtures.

C. Additional Criteria to Stabilize Stream Channel Banks and Shorelines

Wisconsin FOTG Standard 580, Streambank and Shoreline Protection, shall be used to stabilize the toe and/or bank hydrologic zones before vegetation establishment.

1. **Bank and Channel Slopes**

Identify, mark, and protect desirable existing vegetation during practice installation.

On sites with a disturbed soil profile, topsoil will be stockpiled and spread over areas to be planted as needed to meet planting and land shaping needs.

Channel side slopes shall be shaped to a stable slope to facilitate establishment and maintenance of desired vegetation.

Slopes steeper than 2H:1V shall not be stabilized using vegetation alone. A combination of vegetative and structural measures will be used on these slopes to ensure adequate stability.

Grazing shall be permanently excluded on high hazard sites, such as cut banks, areas of seepage or other potentially unstable areas.

2. **Species Selection**

Plant material used for this purpose shall:

- be adapted to the hydrologic zone into which they will be planted.
- be adapted and proven in the regions in which they will be used.
- when mature, produce plant communities that are compatible with those already existing in the area.
- protect the channel banks but not restrict channel capacity.

D. Additional Criteria to Stabilize Areas of Erosion By Wind and Water

1. The amount of plant biomass and cover needed to reduce wind and water erosion to the planned soil loss objective shall be determined using the current approved wind and/or water erosion prediction technology.
2. Do not use tillage where desirable vegetation is already present or where soil disturbance will increase the potential for erosion or cause sedimentation to environmentally sensitive areas.
3. Use a companion crop as added protection.

E. Additional Criteria to Rehabilitate and Revegetate Degraded Sites That Cannot Be Stabilized Using Normal Establishment Techniques

Slope Stabilization

1. On sites that are too steep for regular seeding equipment to operate, the use of hydroseeding and mechanically blown

mulch is recommended. For more information regarding hydroseeding, refer to Wisconsin Agronomy Technical Note 6.

2. Grade to a stable slope when shaping and eliminate all overfalls. For slopes steeper than 2H:1V, enhanced stabilization activities such as soil bioengineering may be required. These practice concepts shall follow approved design procedures located in the NRCS Engineering Field Handbook, Chapter 18.
3. The toe of the slope, or the outlet of the concentrated flow channel, shall be stable before attempting seeding on the slope.
4. Concentrated flow may need to be diverted from the critical area during the establishment period.
5. All gullies and deep rills will be filled and leveled during seedbed preparation.
6. A minimum of 4 inches of friable soil material or topsoil shall be added and mixed to exposed rocky, sandy, gravelly, shaley material, or extremely fine textured subsoil.
7. Sod placement shall be limited to areas that can naturally supply needed moisture or sites that can be irrigated during the establishment period.
8. Sod will be placed and anchored using techniques to ensure that it remains in place until established.

Figure 1
Planting Zones

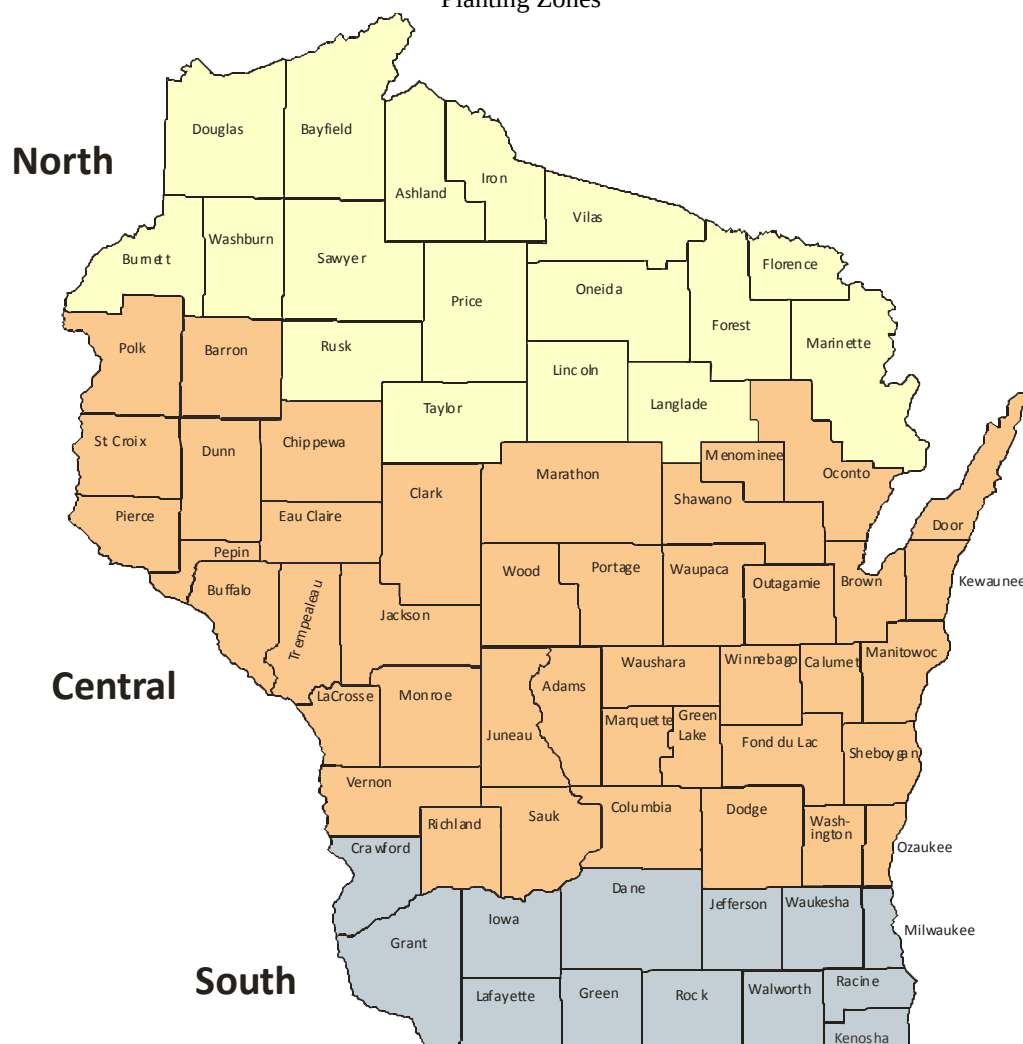


Table 1
Seeding Date/Ranges for Native Mixtures and
Companion Crops

Zone	Spring Seeding
Northern	Thaw - 7/15
Central	Thaw - 6/30
Southern	Thaw - 6/30

Table 2
Seeding Date/Ranges for Introduced Grasses,
Legumes, and Companion Crops

Planting Zone	Spring	Late Summer	Dormant
North	5/1 - 6/15	7/15 - 8/10	11/1 - Freeze up
Central	4/15 - 6/1	8/1 - 8/21	11/1 - Freeze up
South	4/1 - 5/15	8/7 - 8/29	11/1 - Freeze up

VI. Considerations

Additional recommendations relating to design that may enhance the use of, or avoid problems with, this practice but are not required to ensure its basic conservation functions are as follows.

- A. Minimize activities which disturb wildlife during the primary nesting season May 15 through August 1.
- B. Consider seeding at a lower rate and making 2 passes to ensure uniform coverage. Check seed boxes regularly to ensure even distribution.
- C. Heavy traffic and/or compacted soil areas may need special site preparation prior to seeding.
- D. Sprigs, root stocks, crowns, cones, culms, and sod may be considered where appropriate to accelerate the establishment of cover.
- E. Woody shrubs or trees may be used only after initial stabilization. Plant in accordance with the purpose of the planting. See WI FOTG Standards 612, Tree/Shrub Planting; and 580, Streambank and Shoreland Protection. Also see NRCS Engineering Field Handbook, Chapter 16, Streambank and Shoreline Protection and Chapter 18, Soil Bioengineering for Upland Slope Protection.
- F. Consider using carriers such as vermiculite, sawdust, and soybean meal to increase volume and weight for uniform seed distribution.
- G. Consider limited or no use of herbicides one year prior to seeding. If herbicides must be used, ensure there is no potential for carryover and follow label recommendations. Follow WI FOTG Standard 595, Integrated Pest Management, for pesticide use and safety.
- H. Consider sodding to establish vegetation on steep slopes. For further details on this special erosion control measure, refer to Wisconsin Agronomy Technical Note 6.
- I. Consider establishing a buffer of trees and/or grasses next to intermittent or perennial streams.
- J. Consider planting native vegetation and/or local *genotypes* when restoring riparian corridors to its pre-settlement conditions.
- K. High seed counts per square foot much above the recommended minimums may lead to excessive

competition and poor establishment of some species. Seeds per square foot should not exceed 25 percent of the minimum requirement, with the exception of mixtures designed for wet mesic and wet sites.

- L. Consider the use of *soil bioengineering* techniques to arrest and prevent slope failures and erosion. For approved design procedures, refer to Chapter 18 of the NRCS Engineering Field Handbook (EFH).
- M. Consider alternatives to reduce or eliminate the delivery of sediment and associated pollutants into the riparian zone by implementing upland treatment practices.

VII. Plans and Specifications

Prepare plans and specifications for each field or management unit according to the Criteria and Operation and Maintenance sections of this standard. Specifications shall describe the requirements for applying this practice to meet the intended purpose using the appropriate specification and/or job sheets. The following elements shall be addressed in the plan, as applicable, to meet the intended purpose.

- Site preparation.
- Fertilizer application.
- Methods of seeding/planting.
- Selection of species.
- Analysis of seed quality.
- Seeding rate (adjusted based on pure live seed calculations).
- Target number of plants per square foot after emergence.
- Mulching (if applicable).
- Temporary cover (if applicable).
- Companion crop (if applicable).
- Weed control activities during the establishment period.

Specifications shall be recorded using Wisconsin Job Sheets 134, How to Establish and Maintain Introduced Grasses and Legumes; and 135, How to Establish and Maintain Native Grasses, Forbs, and Legumes.

VIII. Operation and Maintenance

- A. Noxious weeds and other undesirable species must be controlled at all sites. During the first year, mow plantings at 14 to 21-day intervals or when weeds are 12-14 inches high and before the development of mature seed. Mowing height

should be 4 inches for introduced and 7 inches for native plants. Small grain companion crops should be mowed at boot stage and prior to heading. Spot spraying or hand pulling may be needed for some invasive species such as thistles and purple loosestrife.

- B. Sites may require on-going periodic maintenance consisting of mowing, burning, or herbicide treatment.
- C. Sites should be inspected periodically to ensure site stabilization objectives are being met.

IX. References

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Rock, H. W. 1971. Prairie Propagation Handbook. Boerner Botanical Gardens.

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USDA, NRCS, Wisconsin Agronomy Technical Note 5, Establishing and Maintaining Native Grasses, Forbs, and Legumes.

USDA, NRCS, Wisconsin Agronomy Technical Note 6, Establishing and Maintaining Introduced Grasses and Legumes.

USDA, NRCS, Wisconsin Job Sheet 134, How to Establish and Maintain Introduced Grasses and Legumes.

USDA, NRCS, Wisconsin Job Sheet 135, How to Establish and Maintain Native Grasses, Forbs, and Legumes.

X. Definitions

Actual Adjusted Seeding Rates (V.A.2.) – an increase in seeds per square foot or pounds per acre, when the PLS is less than 100 percent.

Aspect (V.A.1.) – The exposure of the site to direct sunlight, prevailing winds, and other factors that influence plant growing conditions. For example, a north slope tends to be cooler and moister while a south-facing slope tends to be drier and warmer.

Soil Bioengineering (VI.L.) – Practice of combining mechanical, biological, and ecological concepts to arrest and prevent shallow slope failures and erosion.

Certified Seed (V.A.2.) – Seed that meets the standards established by the designated official seed certifying agency for the purpose of ensuring species/variety, species/variety purity and mechanical quality. The Wisconsin Crop Improvement Association is the official seed certifying agency for Wisconsin.

Genotype (VI.J.) – A group of individual plants which share a specified genetic makeup. For example, all big bluestem plants that are genetically adapted to grow and mature in the climatic conditions found in the driftless region could be considered a genotype.

Introduced Species (V.A.4.) – Plant species that historically were not native to North America and were brought here from other parts of the world, for example, smooth brome grass and alfalfa.

Native Species (V.A.4.) – Plants species that historically would have been found growing in North America such as big bluestem or green needle-grass.

Non-Certified Seed (V.A.2.) – Seed that is grown, processed, tested and labeled for species/variety and mechanical quality factors, but is not certified by an official seed certifying agency.

Pure Live Seed (PLS) (V.A.2.) – PLS is a means of expressing seed quality, based on the percentage of seed in a seed lot that is both pure and viable. PLS is calculated by multiplying the percentage of total viable seed (germination + hard seed + dormant seed) by the percentage of pure seed divided by 100.

Untested Seed (V.A.2.) – Seed that has no assurances of testing for species/variety and mechanical quality, i.e., species/variety purity, inert matter, other crop or weed seeds and germination potential. Untested seed legally cannot be labeled.

Table 3
Common Species and Seeding Rates for Critical Area Plantings

Common Name	Scientific Name	Moisture Regime	Single Species Seeding Rate (PLS) Lbs./Ac.	Seeds/Lb.	Seeds/Square Ft./Lb./Ac.
Native Grasses					
Big Bluestem ¹	Andropogon gerardii ¹	D, DM, M, WM	11	165,000	3.8
Canada Wild Rye	Elymus canadensis	DM, M, WM	12	83,200	1.9
Indian Grass ¹	Sorghastrum nutans ¹	D, DM, M, WM, W	10	192,000	4.4
Little Bluestem	Schizachyrium scoparium	D, DM, M	8	240,000	5.5
Prairie June Grass	Koeleria macrantha ^{1, 2}	D, DM, M	0.5	2,308,672	53
Sideoats Grama	Bouteloua curtipendula	D, DM, M	8	127,000	2.9
Switch Grass ¹	Panicum virgatum ¹	D, DM, M, WM, W	7	389,000	8.9
Virginia Wild Rye	Elymus virginicus	M, WM, W	17	67,200	1.5
Introduced Grasses					
Chewings Red Fescue ²	Festuca rubra L. ssp. fallax ²	D, DM, M	5	350,000	8
Creeping Red Fescue ^{1, 2}	Festuca rubra ^{1, 2}	DM, M, WM	5	350,000	8
Festulolium	Festuca x Lolium	DM, M, WM	10	227,000	5.2
Italian or Annual Ryegrass	Lolium perenne L. ssp. multiflorum	DM, M, WM	20	227,000	5.2
Kentucky Bluegrass ^{1, 2}	Poa pratensis ^{1, 2}	D, DM, M, WM, W	8	2,177,000	50
Orchard Grass	Dactylis glomerata L.	D, DM, M, WM	10	653,000	15
Perennial Ryegrass	Lolium perenne	DM, M, WM	20	227,000	5.2
Redtop ^{1, 2}	Agrostis gigantea ²	M, WM, W	4	4,990,000	114.5
Smooth Bromegrass ^{1, 2}	Bromus inermis ^{1, 2}	D, DM, M, WM	20	136,000	3.1
Tall Fescue	Schedonorus arundinaceus	D, DM, M, WM	12	227,000	5.2
Timothy	Phleum pratense	DM, M, WM, W	8	1,230,000	28.2
Legumes					
Alfalfa	Medicago sativa	D, DM, M	12	219,000	5.0
Alsike Clover	Trifolium hybridum	M, WM, W	3	680,000	15.6
Birdsfoot trefoil	Lotus corniculatus	DM, M, WM, W	7	375,000	8.6
Red Clover	Trifolium pratense	DM, M, WM	10	275,000	6.3
White Ladino Clover	Trifolium repens	DM, M, WM	3	871,650	20

¹ Species approved for seeding individually at the recommended Pure Stand Rates based on Pure Live Seeds (PLS) depending on the erosiveness of the site.

It is required that at least 50% of the seeds per square foot of mixtures planted to introduced and native species on critical areas are composed of grasses, and 25% of the seeds per square foot are sod-forming grasses for introduced species.

If more than 20% of the legume seed is hard seed, increase the seeding rate for legumes by the percent of hard seed.

Seeds per square foot for a particular specie can be calculated by multiplying the number of seeds per pound of the specie by the rate of the specie in pound(s) per acre divided by 43,560 square feet.

² Sod-forming grass plants.

Table 4
Seeding Chart for Native Grass Species

Common Name	Scientific Name	Percent of Mixture	Pure Stand Seeding Rate	Seeds per Square Foot
Big Bluestem	<i>Andropogon gerardii</i>	0-100	11 lbs/ac	42
Canada Wildrye	<i>Elymus canadensis</i>	0-20	12 lbs/ac	23
Indian grass	<i>Sorghastrum nutans</i>	0-100	10 lbs/ac	44
Little Bluestem	<i>Schizachyrium scoparium</i>	0-20	8 lbs./ac	44
Sideoats Grama	<i>Bouteloua curtipendula</i>	0-20	8 lbs/ac	23
Switchgrass	<i>Panicum virgatum</i>	0-100	7 lbs/ac	63
Virginia Wild Rye	<i>Elymus virginicus</i>	0-20	17 lbs/ac	26
Prairie June Grass	<i>Koeleria macrantha</i>	0-20	0.5 lbs/ac	26
Hairy Grama	<i>Bouteloua hirsuta</i>	0-25	1 lb/ac	26

Canada Wild Rye, Virginia Wild Rye and Sideoats Grama when combined will not comprise of more than 20% of the total grass seeds per square foot. Pure stand seeding rates for Big Bluestem and Indiangrass must be increased by 5 lbs/acre to meet the minimum seeds per square foot as required by this standard. Refer to Table 3 for suggested moisture regimes per specie.

Table 5
Seeding Mixtures Suitable for Critical Area Plantings

Seed Calculator Code*	Moisture Regimes	Common Name	Scientific Name	Seeding Rate in lb/ac PLS	Seeding Rate in Seeds/Ft ² PLS	Capacity Retardance	Type of Site**
342-1	Dry-Mesic and Mesic Sites	Smooth Brome grass	Bromus inermis	10	31	B	EB, WW, CSB
		Creeping Red Fescue	Festuca rubra	3	24		
		Alfalfa	Medicago sativa	3	15		
		Red Clover	Trifolium pratense	3	19		
		Kentucky bluegrass	Poa pratensis	1.5	75		
342-2	Dry-Mesic and Mesic Sites***	Smooth Brome grass	Bromus inermis	15	47	B	EB, WW
		Alfalfa	Medicago sativa	7	35		
		Timothy	Phleum pratense	3	85		
342-3	Dry-Mesic and Mesic Sites	Kentucky bluegrass	Poa pratensis	1	50	B	CSB, EB, WW
		Smooth Brome grass	Bromus inermis	10	31		
		Timothy	Phleum pratense	2	56		
		Tall Fescue	Schedonorus arundinacea	2	10		
		Perennial Ryegrass	Lolium perenne	5	26		
342-4	Dry-Mesic and Mesic Sites	Smooth Brome grass	Bromus inermis	20	62	B	EB, WW, CSB
		Creeping Red Fescue	Festuca rubra	5	40		
		Alfalfa	Medicago sativa	8	40		
		Red Clover	Trifolium pratense	4	25		
342-5	Dry-Mesic and Mesic Sites	Smooth Brome grass	Bromus inermis	30	93	B	EB, WW, CSB
		Alfalfa	Medicago sativa	14	70		
342-6	Dry-Mesic, Mesic, and Wet Mesic Sites	Smooth Brome grass	Bromus inermis	7	22	B	CSB, EB, WW
		Timothy	Phleum pratense	2	56		
		Creeping Red Fescue	Festuca rubra	1	8		
		Kentucky Bluegrass	Poa pratensis	1	50		
		Perennial Ryegrass	Lolium perenne	3	16		
		Red Clover	Trifolium pratense	3	19		
342-7	Mesic Sites***	Smooth Brome grass	Bromus inermis	7	22	B	EB, WW
		Creeping Red Fescue	Festuca rubra	2	16		
		Kentucky bluegrass	Poa pratensis	3	150		
		Birdsfoot trefoil	Lotus corniculatus	2	17		
342-8	Mesic Sites***	Smooth Brome grass	Bromus inermis	15	47	B	WW, EB
		Creeping Red Fescue	Festuca rubra	2	16		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-9	Mesic Sites***	Kentucky Bluegrass	Poa pratensis	3	150	C	WW, EB
		Creeping Red Fescue	Festuca rubra	4	32		
		Perennial Ryegrass	Lolium perenne	10	52		
342-10	Mesic Sites	Smooth Brome grass	Bromus inermis	14	43	B	EB, WW, CSB
		Timothy	Phleum pratense	3	85		
		Red Clover	Trifolium pratense	3	19		
		Perennial Ryegrass	Lolium perenne	4	21		
342-11	Mesic Sites	Smooth Brome grass	Bromus inermis	32	99	B	EB, WW
		Creeping Red Fescue	Festuca rubra	8	64		
342-12	Mesic Sites	Kentucky bluegrass	Poa pratensis	4	200	C	EB, WW
		Creeping Red Fescue	Festuca rubra	3	24		

Seed Calculator Code*	Moisture Regimes	Common Name	Scientific Name	Seeding Rate in lb/ac PLS	Seeding Rate in Seeds/Ft ² PLS	Capacity Retardance	Type of Site**
342-13	Mesic Sites	Smooth Brome	Bromus inermis	14	43	B	EB, WW, CSB
		Timothy	Phleum pratense	4	113		
		Red Clover	Trifolium pratense	3	19		
342-14	Mesic Sites	Smooth Brome	Bromus inermis	15	47	B	EB, WW, CSB
		Timothy	Phleum pratense	3.5	99		
		Alsike Clover	Trifolium hybridum	2	32		
342-15	Mesic Sites	Smooth Brome	Bromus inermis	15	47	B	EB, WW
		Timothy	Phleum pratense	3.5	99		
		Birdsfoot trefoil	Lotus corniculatus	3	26		
342-16	Wet Mesic Sites	Tall Fescue	Schedonorus arundinacea	5	26	B	CSB, EB, WW
		Timothy	Phleum pratense	3	85		
		Perennial Ryegrass	Lolium perenne	3	16		
		Red Clover	Trifolium pratense	3	19		
		Smooth Brome	Bromus inermis	6	19		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-17	Wet Mesic Sites	Redtop	Agrostis gigantea	1	115	C	WW, CSB, EB
		Timothy	Phleum pratense	3	85		
		Red Clover	Trifolium pratense	5	32		
342-18	Wet Mesic Sites	Timothy	Phleum pratense	3	85	B	WW, CSB, EB
		Perennial Ryegrass	Lolium perenne	3	16		
		Red Clover	Trifolium pratense	3	19		
		Smooth Brome	Bromus inermis	6	19		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-19	Wet Mesic Sites	Redtop	Agrostis gigantea	1	115	C	WW, CSB, EB
		Timothy	Phleum pratense	1	28		
		Red Clover	Trifolium pratense	4	25		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-20	Wet Sites***	Redtop	Agrostis gigantea	2	229	C	WW
		Alsike Clover	Trifolium hybridum	2	31		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-21	Wet Mesic Sites	Redtop	Agrostis gigantea	3	344	C	WW
		Alsike Clover	Trifolium hybridum	3	47		

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

**EB = Embankments; WW = Waterways; CSB = Channel and Streambanks

***Mixtures can be used on other site descriptions when not listed.

Section 630 Seeding

630.1 Description

- (1) This section describes preparing seed beds and furnishing and sowing the required seed on slopes, appurtenances, and other areas, and on borrow pits and material disposal sites.
- (2) This section also describes furnishing and sowing temporary seed mixture on the slopes and appurtenances of temporary embankments and roadways.

630.2 Materials

630.2.1 Seed

630.2.1.1 General Requirements

- (1) Conform to the Wisconsin statutes and Wisconsin administrative code chapter ATCP 20 regarding noxious weed seed content and labeling.

<http://docs.legis.wi.gov/statutes/statutes/>

http://docs.legis.wi.gov/code/admin_code/atcp/020/20.pdf

- (2) Use seed within one year of the test date appearing on the label.
- (3) Seed mixtures 70, 70A, 75, and 80 contain wild type forbs and grasses. Wild type is defined as seed that is derived directly from native, wild stock, including seed that was wild collected and placed into production or has been harvested directly from native stands.

630.2.1.2 Purity and Germination

- (1) Test seed according to the methods and procedures used for sampling and analyzing seed for purity, germination, and noxious weed seed content specified in the current edition of Rules for Testing Seed, published by the Association of Official Seed Analysts.

630.2.1.3 Inoculation

- (1) Inoculate legume seed (white clover, red clover, ladino clover, alsike clover, alfalfa, partridge pea, purple prairie clover, Canada tick-trefoil, and lupine) unless it has been pre-inoculated by the vendor. Follow the inoculation instructions that come with the culture purchases. If applying the seed according to method B, [630.3.3.2](#), treat seeds requiring inoculation with 5 times the amount of inoculant recommended in the instructions.
- (2) Avoid exposure of the culture or inoculated seed to the sunlight, and in no case shall any exposure exceed 1/2 hour.

630.2.1.4 Storing Seed

- (1) Store any seed delivered before use in a way that protects it from damage by heat, moisture, rodents, or other causes. Discard and replace any previously tested and accepted seed that becomes damaged.

630.2.1.5 Seed Mixtures

630.2.1.5.1 Right of Way

630.2.1.5.1.1 Permanent

630.2.1.5.1.1.1 Composition

- (1) Seed mixtures for use on the right of way and easements shall, unless specified otherwise, be composed of seeds of the purity, germination, and proportions, by weight, as given in the Table of Highway Seed Mixtures and the Table of Native Seed Mixtures.
- (2) Use seed of the species and varieties listed below. If no variety is listed, there will be no restriction on the variety furnished, except as follows:
 1. Species composed of pure live seed (PLS) shall contain no named or improved varieties. PLS shall be grown in Wisconsin or northern Illinois, northeastern Iowa, or eastern Minnesota. Seed produced out-of-state must be grown in one of the following counties:

1.1 From northern Illinois:

Boone	Bureau	Carroll	Cook	De Kalb	Du Page	Grundy
Henry	Jo Daviess	Kane	Kendall	Lake	La Salle	Lee
McHenry	Ogle	Putnam	Rock Island	Stevenson	Whiteside	Will
Winnebago						

1.2 From northeastern Iowa:

Allamakee	Benton	Black Hawk	Bremer	Buchanan	Cedar	Chickasaw
Clayton	Clinton	Delaware	Dubuque	Fayette	Floyd	Howard
Jackson	Johnson	Jones	Linn	Mitchell	Muscatine	Scott
Winneshiek						

1.3 From eastern Minnesota:

Aitkin	Anoka	Carlton	Carver	Chisago	Dakota	Dodge
Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	La Sueur
Mille Lacs	Mower	Olmsted	Pine	Ramsey	Rice	Scott
Sherburne	Steele	Wabasha	Washington	Winona	Wright	

2. PLS for seed mixtures 70, 70A, 75, and 80 shall be packaged separately by species and clearly labeled with the vendor's name, species common and botanical names, gross weight, percent PLS, year of harvest and any specialized treatments that have been applied to ensure or enhance germination. If PLS is not listed, determine PLS by multiplying the percent germination times the percent purity.

3. Minimum percent purity for native for species is 90 percent. If a listed species is not available, substitutions may be made with engineer's approval and must be documented.

(3) Mix native species at the project site. Clean and debeard seeds having awns or excessive hairs before mixing.

SPECIES COMMON NAME	SPECIES BOTANICAL NAME	ACCEPTABLE VARIETIES
Kentucky Bluegrass	Poa pratensis	Low Maintenance
Red Fescue	Festuca rubra	Creeping
Hard Fescue	Festuca ovina var. duriuscula	Improved
Tall Fescue	Festuca arundinacea	Improved turf type
Salt Grass	Puccinella distans Puccinella distans	Fult's Salty
Redtop	Agrostis alba	
Timothy	Phleum pratense	
Canada Wild Rye ^[1]	Elymus canadensis	
Perennial Ryegrass	Lolium perenne	
Perennial Ryegrass	Lolium perenne	Improved Fine
Annual Ryegrass	Lolium multiflorum	
Alsike Clover	Trifolium hybridum	
Red Clover	Trifolium pratense	
White Clover	Trifolium repens	
Japanese Millet	Echinochola crusgalli var. frumentacea	
Annual Oats	Avena sativa	
Alfalfa	Medicago sativa	
Bromegrass	Bromus inermis	
Orchardgrass	Dactylis glomerata	
Ladino Clover	Trifolium repens var. latum	Ladino
Agricultural Rye	Secale cereale	
Winter Wheat	Triticum aestivum	

^[1] Pure live seed

TABLE 630-1 HIGHWAY SEED MIXTURES

SPECIES	PURITY minimum %	GERMINATION minimum %	MIXTURE PROPORTIONS in percent				
			NO.10	NO.20	NO.30	NO.40	NO.60
Kentucky Bluegrass	98	85	40	6	10	35	
Red Fescue	97	85	25		30	20	
Hard Fescue	97	85		24	25	20	
Tall Fescue	98	85		40			
Salt Grass	98	85			15		
Redtop	92	85	5				
Timothy	98	90					12
Canada Wild Rye		PLS ^[1]					10
Perennial Ryegrass	97	90	20	30			
Improved Fine Perennial Ryegrass	96	85			20	25	
Annual Ryegrass	97	90					30
Alsike Clover	97	90					4
Red Clover	98	90					4
White Clover	95	90	10				
Japanese Millet	97	85					20
Annual Oats	98	90 ^[1]					20

^[1] Substitute winter wheat for annual oats in fall plantings started after September 1.

TABLE 630-2 NATIVE SEED MIXTURES

SPECIES	SPECIES BOTANICAL NAME	PURITY & GERMINATION minimum %	MIXTURE PROPORTIONS in percent			
			NO. 70	NO. 70A	NO. 75	NO. 80
FORBES	Canada Anemone	<i>Anemone canadensis</i>	PLS	2		
	Butterflyweed	<i>Asclepias tuberosa</i>	PLS		2	
	New England Aster	<i>Aster novae-angliae</i>	PLS	2	2	
	Partridge-pea	<i>Chamaecrista (Cassia) fasciculata</i>	PLS		2	
	Purple Prairie Clover	<i>Dalea (Petalostemum) purpurea</i>	PLS	2	2	4
	Canada Tick-trefoil	<i>Desmodium canadense</i>	PLS	2		
	Flowering Spurge	<i>Euphorbia corollata</i>	PLS		2	
	Wild Geranium	<i>Geranium maculatum</i>	PLS	2		
	Western Sunflower	<i>Helianthus occidentalis</i>	PLS	3	2	
	Rough Blazingstar	<i>Liatris aspera</i>	PLS		2	
	Prairie Blazingstar	<i>Liatris pycnostachya</i>	PLS	2		
	Lupine	<i>Lupinus perennis</i>	PLS		3	
	Wild Bergamot	<i>Monarda fistulosa</i>	PLS	2		
	Horse Mint	<i>Monarda punctata</i>	PLS		2	
	Yellow Coneflower	<i>Ratibida pinnata</i>	PLS	2	2	
	Blackeyed Susan	<i>Rudbeckia hirta</i>	PLS			1
	Showy Goldenrod	<i>Solidago speciosa</i>	PLS	2	2	
	Spiderwort	<i>Tradescantia ohiensis</i>	PLS	2	2	
	Golden Alexanders	<i>Zizia aurea</i>	PLS	2		
GRASSES	Big Bluestem	<i>Andropogon gerardi</i>	PLS	15	15	10
	Sideoats Grama	<i>Bouteloua curtipendula</i>	PLS	15	20	20
	Canada Wildrye	<i>Elymus Canadensis</i>	PLS	15	15	35
	Slender Wheatgrass	<i>Elymus trachycaulus</i>	PLS			20
	Junegrass	<i>Koeleria macrantha</i>	PLS		5	
	Annual Ryegrass	<i>Lolium multiflorum</i>	[1]		10	10
	Switchgrass	<i>Panicum virgatum</i>	PLS			10
	Salt Grass	<i>Puccinella distans</i>	[1]			2
	Little Bluestem	<i>Schizachyrium (Andropogon) scoparium</i>	PLS	15	20	10
	Indiangrass	<i>Sorghastrum nutans</i>	PLS	15		10
ALTERNATE FORBES	Sky Blue Aster	<i>Aster azureus</i>	PLS	[2]	[2]	
	White Wild Indigo	<i>Baptisia leucantha</i>	PLS	[2]	[2]	
	Pale Purple Coneflower	<i>Echinacea pallida</i>	PLS	[2]	[2]	
	White Prairie Clover	<i>Petalostemum candidum</i>	PLS	[2]	[2]	
	Stiff Goldenrod	<i>Solidago rigida</i>	PLS	[2]	[2]	
	Hoary Vervain	<i>Verbena stricta</i>	PLS	[2]	[2]	

[1] Provide the minimum purity and germination specified in 630.2.1.5.1.1.1(3) in the table of highway seed mixtures.

^[2] The contractor may, if the engineer approves, substitute an alternate forb for a required forb that is not available using the same percentage as specified for the required forb. Use a different alternate forb for each unavailable required forb. Provide documentation showing that a required forb is not available before using an alternate.

630.2.1.5.1.1.2 Mixture

- (1) The contractor shall select a seed mixture or mixtures that meet with the engineer's approval, and unless specified otherwise in the contract, shall conform to the following:
1. Use seed mixture No. 10 where average loam, heavy clay, or moist soils predominate.
 2. Use seed mixture No. 20 where light, dry, well-drained, sandy, or gravelly soils predominate and for all high cut and fill slopes generally exceeding 6 to 8 feet, except where using No. 70.
 3. Use seed mixture No. 10 or No. 20 on all ditches, inslopes, median areas, and low fills, except where using No. 30 or No. 70.
 4. Use seed mixture No. 30 for medians and on slopes or ditches generally within 15 feet of the shoulder where a salt-tolerant turf is preferred.
 5. Use seed mixture No. 40 in urban or other areas where a lawn type turf is preferred.
 6. Use seed mixture No. 60 only on areas the contract designates or the engineer specifies. Use it as a cover seeding for newly graded wet areas or as a nurse crop for specified wetland seed mixtures. The contractor shall not apply it to flooded areas.
 7. Use seed mixture Nos. 70 and 70A on slopes and upland areas the contract designates or the engineer specifies. Use seed mixture No. 70 on loamy soils and seed mixture No. 70A on sandy soils.
 8. Use seed mixture No. 75 where native grasses are desired for erosion control.
 9. Use seed mixture No. 80 on inslopes where a salt tolerant seed mix containing native grasses is desired.

630.2.1.5.1.2 Temporary

- (1) Under the Seeding Temporary bid item, use a temporary seed mixture conforming to [630.2.1.5.1.4](#). Use oats in spring and summer plantings. Use winter wheat or rye for fall plantings started after September 1.

630.2.1.5.1.3 Nurse Crop

- (1) If seeding bare soil with either mixture 70, 70A, 75, or 80, include the Seeding Nurse Crop bid item.

630.2.1.5.1.4 Borrow Pits and Material Disposal Sites

- (1) For seeding borrow pits and material disposal sites beyond the right of way, use seed mixtures conforming to seed mixture 10, 20, 70, 70A, or 75 of [630.2.1.5.1.1](#) or a borrow pit mixture composed of seeds of the species, purity, germination and proportions, by weight as given below:

PERMANENT		
SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Alfalfa	98	90
Bromegrass	85	85
Orchardgrass	80	85
Timothy	98	90
Red Clover	98	90
Alsike Clover	97	90
Ladino Clover	95	90
Kentucky Bluegrass	98	85

TEMPORARY		
SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Annual Oats	98	90
Agricultural Rye	97	85
Winter Wheat	95	90

NURSE CROP		
SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Annual Oats	98	90
Annual Ryegrass	97	90
Winter Wheat	95	90

- (2) For the borrow pit mixture use, by weight, 60 percent temporary species seeds and 40 percent permanent species seeds.
- (3) For the temporary component, use any combination of temporary seeds listed in the table above.
- (4) For the permanent component, use seeds from not more than 4 of the permanent species listed in the table above in any combination.
- (5) When nurse crop is required for spring seeding before June 15, use annual oats. For fall seeding after October 15, use winter wheat, or annual ryegrass.

630.3 Construction

630.3.1 General

- (1) If not protecting with a mulch cover, perform seeding, except Nos. 60, 70 and 70A mixtures at times of the year when temperature and moisture conditions are suitable for seeding, except during midsummer.
- (2) Perform seeding, except Nos. 60, 70 and 70A mixtures, in conjunction with mulching as specified in [627](#) at any time the engineer allows.
- (3) The contractor may perform seeding of Nos. 60, 70 and 70A mixtures at any time soil conditions are suitable, except between June 15 and October 15, unless the engineer allows otherwise.
- (4) Perform seeding with the selected seed mixture, sown at the specified rate.

630.3.2 Preparation of Seed Bed

- (1) Complete grading, shouldering, topsoiling, and fertilizing, if part of the work under contract, before permanent seeding, except the contractor may place the fertilizer and seed mixture in one operation if using equipment designed for the purpose.
- (2) Just before seeding, work the area being seeded with discs, harrows, or other appropriate equipment to obtain a reasonably even and loose seedbed. Place topsoil as specified in [625.3.3](#).

630.3.3 Sowing

- (1) Select the method of sowing from either method A, method B, method C, or an appropriate combination of methods A, B, and C. Obtain the engineer's approval for the sowing method and specific procedures used for each seed mixture used before sowing that mixture.

630.3.3.1 Method A

- (1) Sow the selected seed mixture using equipment adapted to the purpose, or by scattering it uniformly over the areas to be seeded. Lightly rake or drag to cover the seed with approximately 1/4 inch of soil. After seeding, lightly roll or compact the areas using suitable equipment, preferably the cultipacker type, when the engineer judges the seedbed too loose, or if the seedbed contains clods that might reduce seed germination. The contractor shall not roll slopes steeper than 1:3.
- (2) If scattering seed by hand, perform this work with satisfactory hand seeders and only when the air is calm enough to prevent seeds from blowing away.

630.3.3.2 Method B

- (1) Sow or spread the seed upon the prepared bed using a stream or spray of water under pressure and operated from an engineer-approved machine designed for that purpose. Place the selected seed mixture and water into a tank, provided within the machine, in sufficient quantities that when spraying the seed on a given area it is uniformly spread at the required application rate. During this process, keep the tank contents stirred or agitated to provide uniform distribution. Spread the tank contents within one hour after adding the seed to the tank. The engineer will reject seed that remains mixed with the water for longer than one hour. The engineer will not require dragging or rolling.

630.3.3.3 Method C

- (1) For spring seeding of seed mixtures 70 and 70A into existing ground cover, mow existing vegetation to 4 inches or less in height 2 to 4 weeks before seeding. Ten to 14 days after mowing, spray with vegetation control herbicide conforming to [632.2.12](#).
- (2) For fall seeding of seed mixtures 70 and 70A into existing ground cover, mow existing vegetation to 4 inches or less in height 4 to 6 weeks before seeding. Ten to 14 days after mowing, spray with vegetation control herbicide conforming to [632.2.12](#). Retreat with vegetation control herbicide 10 to 14 days after initial application if live vegetation persists.

- (3) Seed with a rangeland type drill with one or more seed boxes that can be calibrated independently to deliver different sized seeds uniformly at the required rate and equipped with a rear-mounted press wheel for each seed drop tube. If seeding into existing vegetation or thatch, use a rangeland type drill equipped with a no-till attachment that can cut through the vegetation or thatch in front of the V disc and seed drop tube. If the configuration of the area to be seeded allows, apply seed at 1/2 the specified seed rate and apply the second 1/2 in a perpendicular direction.

630.3.3.4 Borrow Pits and Material Disposal Sites

- (1) Seed borrow pits, and material disposal sites off the right of way, with the selected seed mixture specified in [630.2.1.5.1.4](#). Consult with the landowner or the landowner's agent when selecting the seed mixture.

630.3.3.5 Seeding Rates

630.3.3.5.1 Right of Way

- (1) Use the following sowing rate for seeds in pounds per 1000 square feet:

- Seed mixture No. 10 at 1.5 pounds
- Seed mixture No. 20 at 3 pounds
- Seed mixture No. 30 at 2 pounds
- Seed mixture No. 40 at 2 pounds
- Seed mixture No. 60 at an equivalent seeding rate of 1.5 pounds^[1]
- Seed mixture No. 70 or 70A at 0.4 pounds
- Seed mixture No. 75 at an equivalent seeding rate of 0.7 pounds^[1]
- Seed mixture No. 80 at an equivalent seeding rate of 0.8 pounds^[1]
- Temporary seeding at 3 pounds
- Nurse crop seeding at 0.8 pounds

^[1] Determine the actual seeding rate by multiplying the equivalent seeding rate by the sum of the unadjusted and adjusted percentages of the various species in the seed mixtures as sown.

- (2) The unadjusted percentage equals the minimum percent of purity and germination specified in the table of seed mixtures contained in [630.2.1.5.1.1.1](#) for the applicable species.
- (3) Obtain the adjusted percentage for each of the PLS species by dividing the specified percentage of the species by the product of the percent of purity and the percent of germination for each of the PLS species as delivered.

630.3.3.5.2 Borrow Pits and Material Disposal Areas

- (1) For seeding borrow pits and material disposal off the right of way, sow the seed mixtures specified in [630.2.1.5.1.4](#) at the following rates per pound per 1000 square feet:

- Seed mixture No. 10 at 0.75 pound
- Seed mixture No. 20 at 1 pound
- Seed mixture No. 70 or 70A at 0.4 pounds
- Seed mixture No 75 at 0.7 pounds
- Borrow pit mixture at 1.5 pounds

630.3.3.6 Establishment Period for Native Seeding

- (1) During the growing season after planting seed mixture 70 or 70A, mow all seeded areas twice as the engineer directs. Mow vegetation back to 6 inches when it has reached a height of at least 12 inches.
- (2) During the growing season after planting seed mixture 70 or 70A, eradicate the following species from the seeded areas as soon as they become evident:

SPECIES COMMON NAME**SPECIES BOTANICAL NAME**

Musk thistle

Carduus nutans

Spotted knapweed

Centaurea maculosa

Canada thistle

Cirsium arvense

Bull thistle

Cirsium vulgare

Field bindweed

Convolvulus arvensis

Leafy spurge

Euphorbia esula

Sweetclover

Melilotus species

Wild parsnip

Pastinaca sativa

- (3) Eradicate by hand pulling or by applying a vegetation control herbicide conforming to [632.2.12](#) to individual plants.

630.4 Measurement

- (1) The department will measure the Seeding bid items by the pound acceptably completed.
- (2) The department will measure quantities based on net weights of seed shipments, or on quantities weighed on department-approved scales the contractor furnishes.
- (3) The department will make deductions for all quantities wasted or not actually incorporated in the work according to the contract.
- (4) The department will determine the equivalent pounds of seed furnished and applied by dividing the actual pounds of seed applied by the sum of the unadjusted and adjusted percentages of the various species in the seed mixture sown.
- (5) The department will use the unadjusted and adjusted percentages determined in [630.3.3.5.1](#).

630.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
630.0100 - 0199	Seeding (mixture)	LB
630.0200	Seeding Temporary	LB
630.0300	Seeding Borrow Pit	LB
630.0400	Seeding Nurse Crop	LB

- (2) Payment for the Seeding bid items is full compensation for providing, handling, and storing all seed; for providing the required culture and inoculating seed as specified; and for preparing the seed bed, sowing, covering and firming the seed. If the landowner does not want the pit or material disposal site seeded, or seeded with any of the mixtures allowed, the department will not pay for fertilization or seeding of those areas.

Section 627 Mulching

627.1 Description

- (1) This section describes furnishing, placing, and anchoring a mulch cover, usually in connection with seeding the surfaces of the roadway.

627.2 Materials

- (1) Mulching material consists of straw or hay in an air-dry condition, wood excelsior fiber, wood chips, or other suitable material of a similar nature that the engineer approves, and is substantially free of noxious weed seeds and objectionable foreign matter.
- (2) If using tackifier, the department will prequalify it before use. Select tackifiers from the department's erosion control product acceptability list (PAL). The contractor may obtain a copy of the PAL and the prequalification procedure for products not on the PAL from the department.

627.3 Construction

627.3.1 General

- (1) Unless directed otherwise, place the mulch on the specified area within 2 days after completing the seeding.
- (2) The contractor shall not perform mulching during periods of excessively high winds that might preclude proper mulch placement.
- (3) Place the mulch loosely or open enough to allow some sunlight to penetrate and air to slowly circulate, but thick enough to shade the ground, conserve soil moisture, and prevent or reduce erosion.

Revise 627.3.1(4), the contractor is required to protect and maintain the work under part 1. This change was implemented in ASP 6 effective with the December 2013 letting.

- (4) Maintain the mulched areas and repair all areas damaged by wind, erosion, traffic, fire or other causes.

627.3.2 Placing

- (1) The contractor may perform the work as specified in one of the following ways: Method A, Method B, or Method C, or a combination of the 3, unless a specific method is specified in the contract.

627.3.2.1 Method A, Netting

- (1) Uniformly spread the mulching material over the designated areas to a loose depth of 1/2 to 1 1/2 inches. Use a specific rate of application; dependent on the character of the material, that results in a cover conforming to the requirements specified above in [627.3.1](#). Loosen or make fluffy the mulch material from compacted bales before spreading in place. Unless directed otherwise, begin mulching at the top of the slopes and proceed downward.
- (2) Securely anchor straw or hay mulch by using engineer-approved netting anchored to the ground with pegs or staples to prevent it from floating as the vegetation grows. Instead of this anchorage, the contractor may secure mulch by heavy biodegradable twine fastened by pegs or staples to form a grid with 6 to 10 feet spacing.
- (3) The contractor may use department-approved erosion control mats, listed in the PAL, instead of separately applying mulch and netting.

627.3.2.2 Method B, Tackifier

- (1) Treat straw or hay with a tackifier, blow from a machine, and uniformly deposit over designated areas in one operation. Place straw or hay uniformly over the area 1/2 to 1 inch deep, using 1/2 to 3 tons of mulch per acre. Mix and place tackifier according to the PAL. Within the above limits, the engineer will determine, on the job, the application rate of the mulch and the tackifier, and the engineer may vary the rates during mulching to produce the desired results. Use an engineer-approved machine to place the mulch that blows or ejects by constant air stream a controlled amount of mulch and applies a spray of tackifier to partially coat the straw or hay, sufficient to hold together and keep in place the deposited straw or hay. The contractor may apply the tackifier as an overspray in a separate operation after placing the straw or hay.
- (2) Apply wood fiber, wood chips, or similar material with engineer-approved blowing machines, or other engineer-approved methods, that place a controlled amount of mulch uniformly over the area 1/2 to 1 1/2 inches deep. Treat areas receiving wood chip mulch, with one pound of available nitrogen per 1000 square feet before or after applying the chips.

- (3) Throughout the process, feed the mulch material into the blowing machine to produce a constant and uniform ejection from the discharge spout, and operate in a position to produce mulch of uniform depth and coverage.

627.3.2.3 Method C, Crimping

- (1) Spread the straw or hay mulch uniformly over the designated areas to a loose depth of 1/2 to 1 1/2 inches, using 1/2 to 3 tons of mulch per acre, by blowing from a machine, as specified in Method B, or by other engineer-approved methods.
- (2) Immediately after spreading, anchor the mulch in the soil by using a mulch crimper consisting of a series of dull, flat discs with notched edges. Space the 20 inch diameter discs at about 8 inch centers. Equip the crimper with a ballast compartment to allow adjusting the weight for depth control.
- (3) Impress the mulch into the soil 1 1/2 to 2 1/2 inches deep in one pass of the crimper. The department will not allow mulch crimpers to operate on slopes so steep that damage to the mulch, seedbed, or soil occurs. Anchor the mulch on these areas by one of the following methods: Method A or Method B. Equip and operate tractors to minimize disturbing or displacing the soil. This process may require more than one pass of the crimper to ensure adequate anchoring of the mulch.
- (4) The contractor shall not use Method C if it cannot impress the mulch to a minimum of 1 1/2 inch.

627.4 Measurement

- (1) The department will measure Mulching acceptably completed by the square yard or by the ton, whichever the contract specifies.
- (2) If measured by the square yard, the measured quantity equals the number of square yards of surface area that the contractor applied the mulch.
- (3) If measured by the ton, the measured quantity equals the number of tons of mulch provided, placed, and acceptably completed.
- (4) Tackifiers or nitrogen used for treating mulch are incidental to the cost of the work.

627.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
627.0200	Mulching	SY
627.0205	Mulching	TON

- (2) Payment for Mulching is full compensation for providing all materials, including tackifiers or nitrogen; for all hauling, treating, placing, spreading, and anchoring of the mulch material; and for maintaining the work and repairing all damaged areas.
- (3) If the contractor opts to use department-approved erosion control mats instead of separately applying mulch and netting, the department will pay for it at the contract unit price for Mulching only.

-Existing

-Final

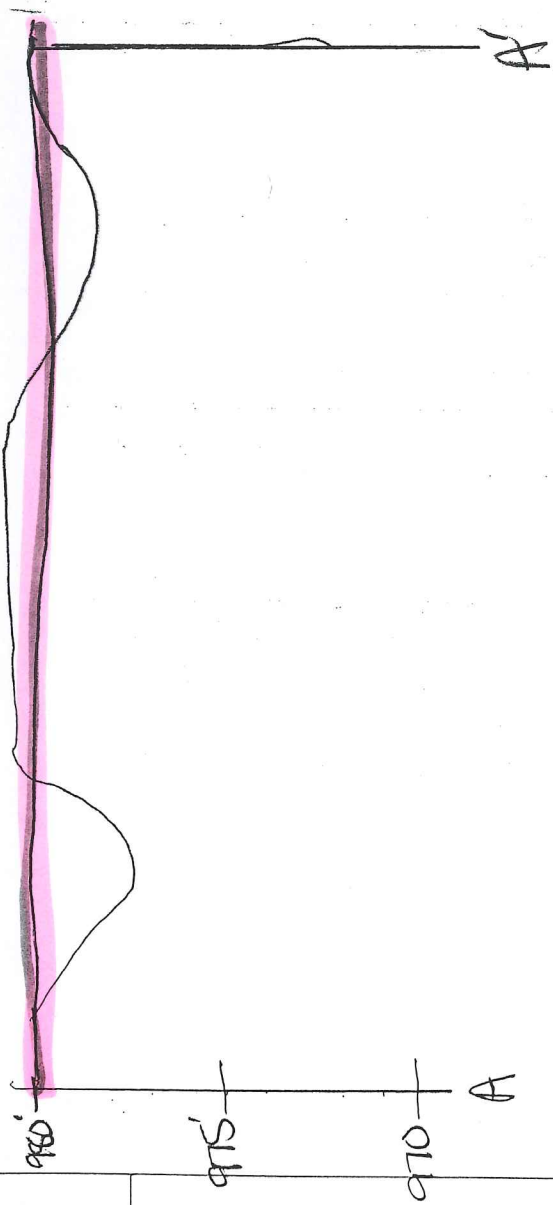


Figure A - Cross Sections



22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS