
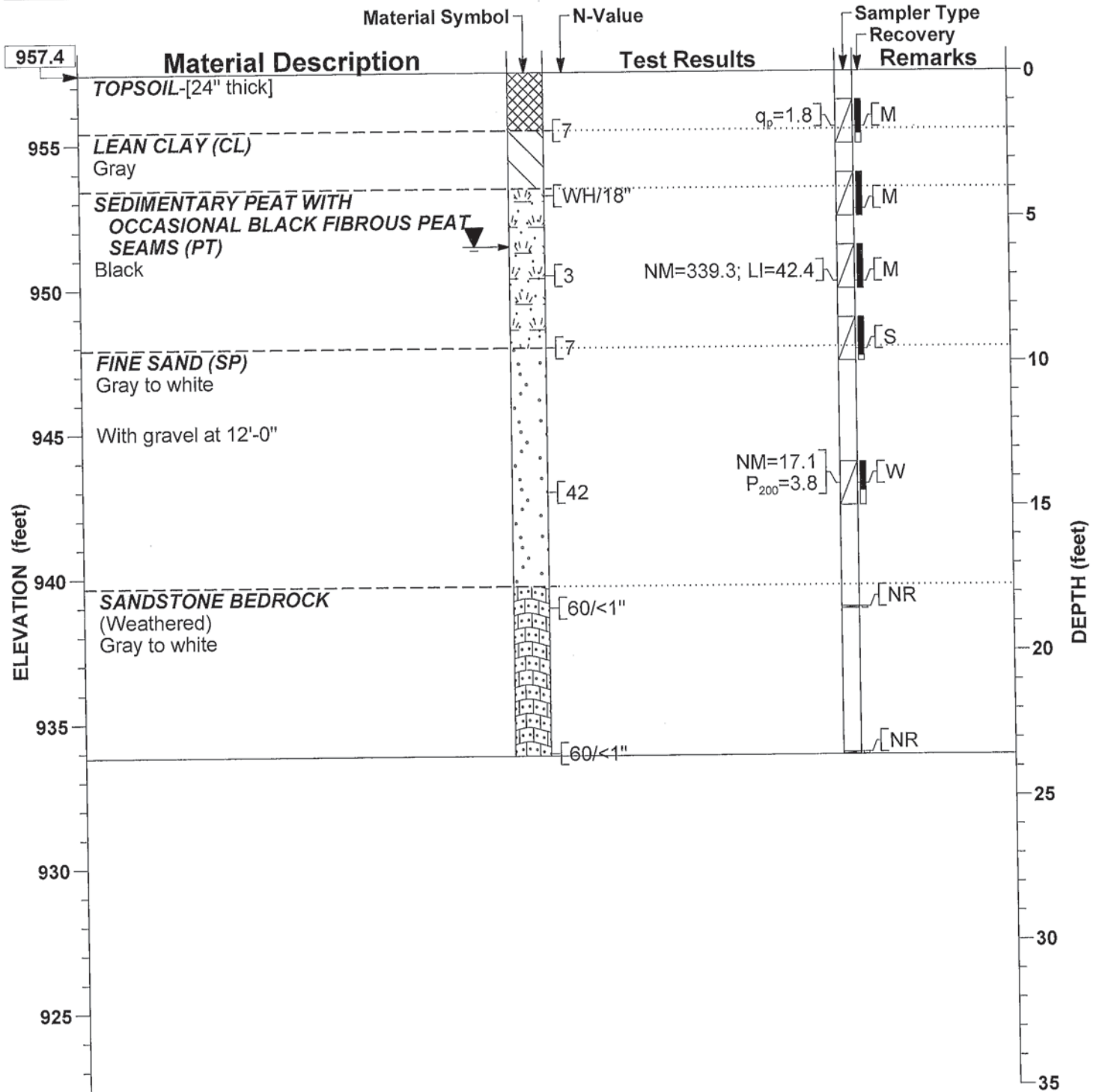


WATER LEVEL LEGEND		OTHER LEVEL LEGEND	
[M]	Moist 5'-2" at 5 days	[C]	(caved) 5'-2" at 5 days
[M]	Moist 6'-0" at completion	[C]	(caved) 6'-0" at completion

For Notes and Legend, see Drawing 12911-2.

<p>Soils & Engineering Services, Inc. 1102 STEWART STREET • MADISON, WISCONSIN Phone: 608-274-7600 • 888-866-SOIL (7645) Fax: 608-275-7511 • Email: soils@soils.ws CONSULTING CIVIL ENGINEERS SINCE 1966</p>	<p>SOIL BORING RECORD Smart Sand Town of Oakdale Monroe County, Wisconsin</p>	 DRAWING 12911-52
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WATER LEVEL LEGEND

▼ 6'-0" at completion

For Notes and Legend, see Drawing 12911-2.

Soils & Engineering Services, Inc.

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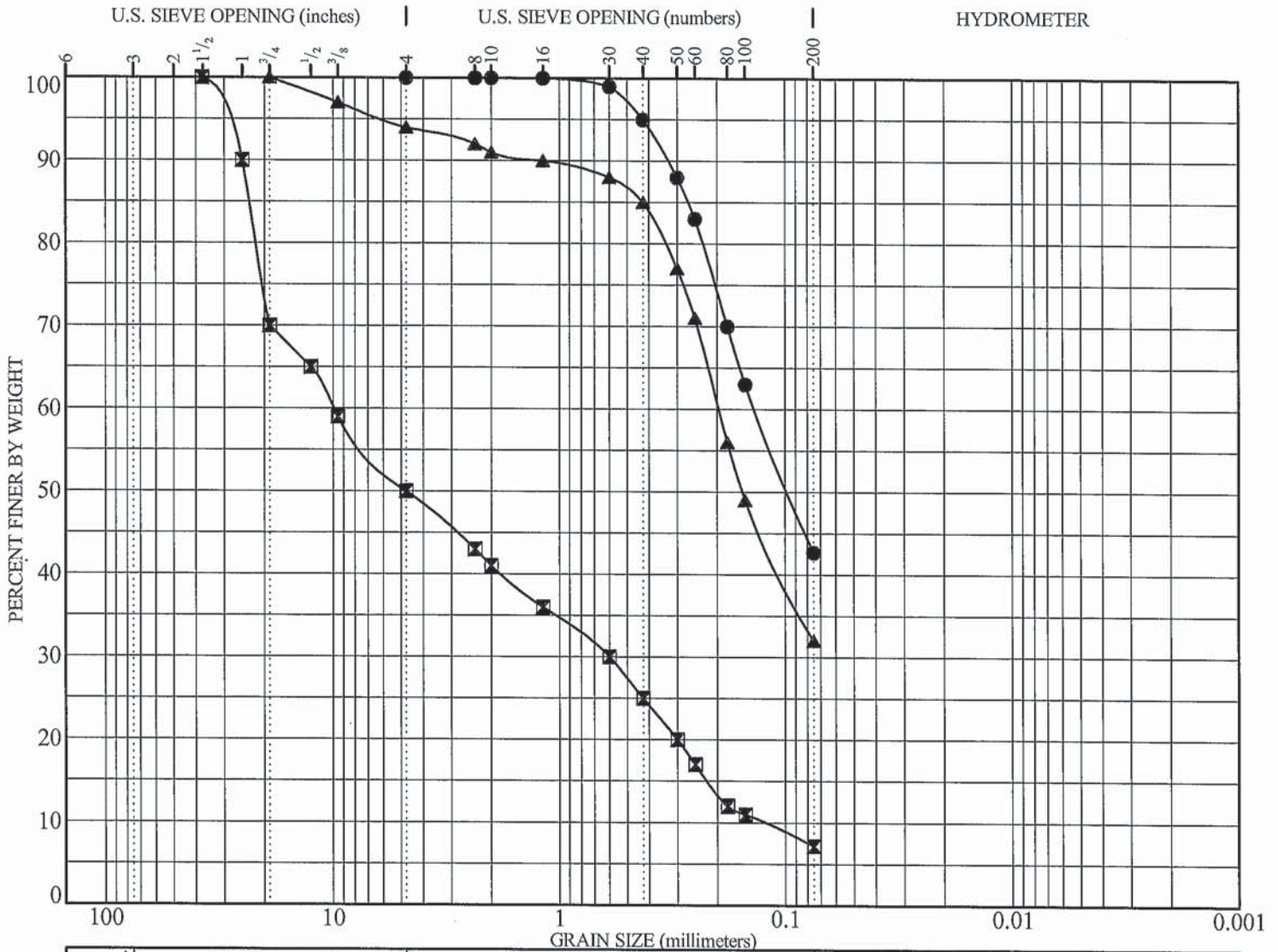
CONSULTING CIVIL ENGINEERS SINCE 1966

SOIL BORING RECORD
 Smart Sand
 Town of Oakdale
 Monroe County, Wisconsin



DRAWING
 12911-53

PARTICLE SIZE DISTRIBUTION ANALYSIS REPORT



COBBLES (%)	GRAVEL (%)		SAND (%)			SILT AND CLAY (%)
	coarse	fine	coarse	medium	fine	
● 0.0	0.0			57.3		42.7
◻ 0.0	49.8			43.0		7.2
▲ 0.0	6.2			61.8		32.0

Sieve Size	Percent Finer		
	●	◻	▲
1 1/2-inch		100	
1-inch		90	
3/4-inch		70	100
1/2-inch		65	
3/8-inch		59	97
#4	100	50	94
#8	100	43	92
#10	100	41	91
#16	100	36	90
#30	99	30	88
#40	95	25	85

Sieve Size	Percent Finer		
	●	◻	▲
#50	88	20	77
#60	83	17	71
#80	70	12	56
#100	63	11	49
#200	42.7	7.2	32.0

	Grain Size (mm)			Coefficients	
	D ₆₀	D ₃₀	D ₁₀	C _c	C _u
●	0.137				
◻	9.79	0.584	0.128	0.272	76.6
▲	0.197				

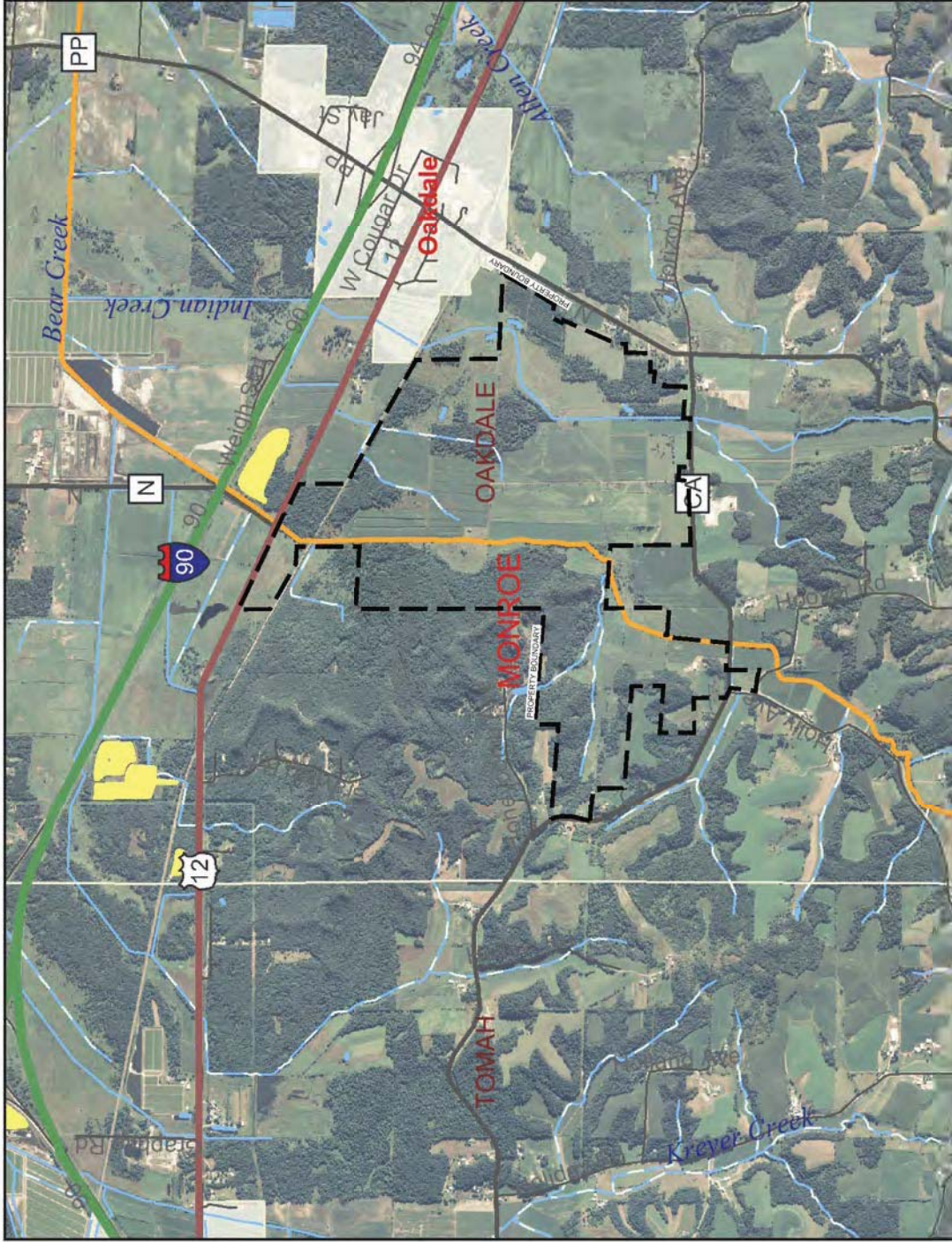
Sample Information	
●	Boring NW6-1, 7'-1" Depth: Silty Fine Sand (SM)
◻	Boring NW6-2, 9'-9" Depth: Fine to Coarse Gravel With Silt, much sand (GP-GM)
▲	Boring NW6-3, 19'-6" Depth: Silty Fine to Medium Sand, little gravel (SM)

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 Fax: 608-275-7511 • Email: soils@soils.ws
 CONSULTING CIVIL ENGINEERS SINCE 1966

LABORATORY TEST RESULT RECORD
 Mount Horeb - Madison
 Raymond Road to Seminole Highway
 USH 18
 Dane County, Wisconsin
 WisDOT State ID 1206-07-06

FIGURE
12901-M

Map Created on Feb 06, 2012



Scale: 1:42,683



Legend

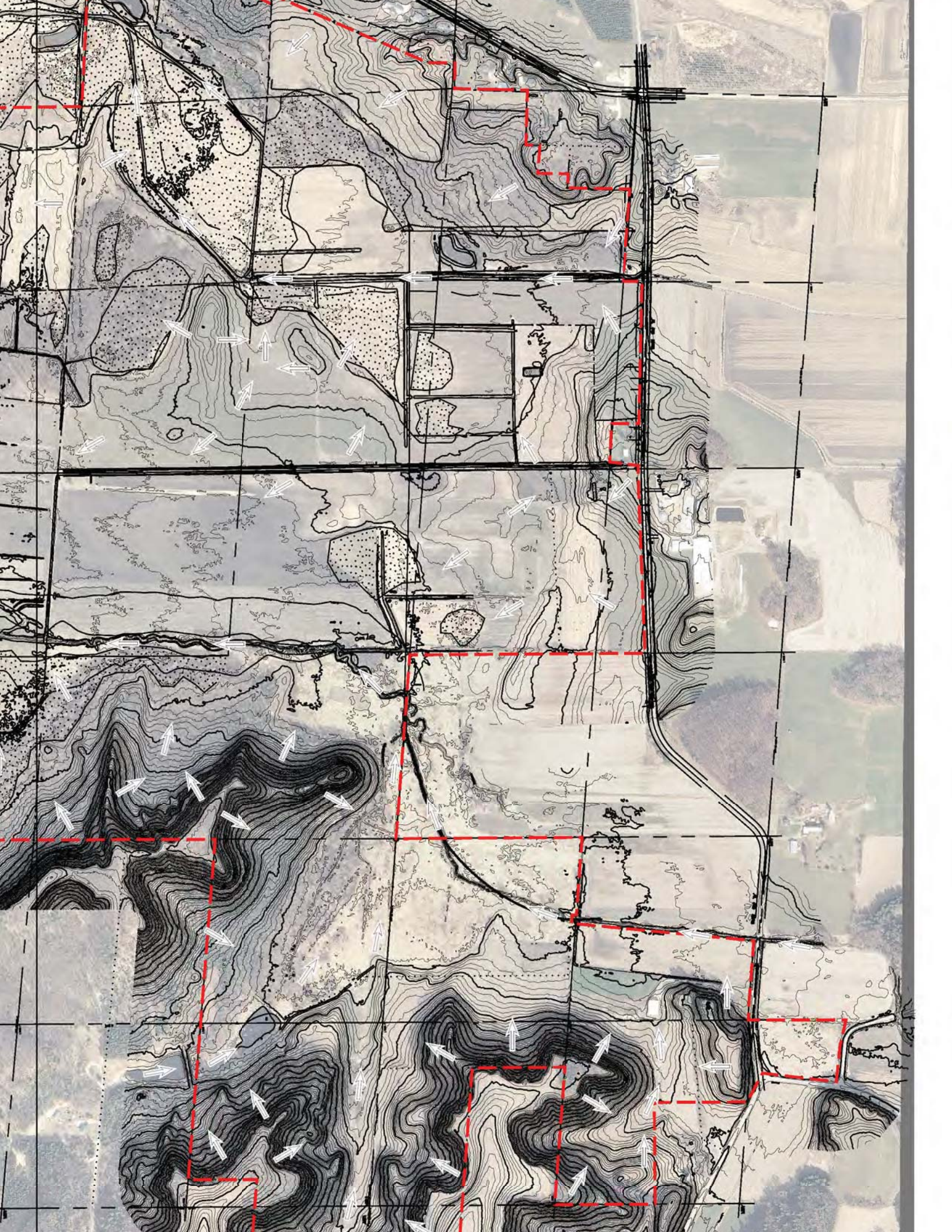
- Major Highways**
 - Interstate
 - State Highway
 - U.S. Highways
 - County Roads
 - Local Roads
- 24K County Boundaries**
- Civil Towns**
- Civil Town**
- PRF Other River Public Rights Features**
- PRF Sensitive Rivers**
- PRF Other Public Rights Features**
- PRF Sensitive Areas of Lakes**
- ASNRI Wild Rice Streams**
- ASNRI Outstanding and Exceptional Streams**
- ERW**
- ORW**
- ORW**
- ASNRI Wild and Scenic Rivers**
- ASNRI Trout Streams**
- Class I Trout**
- Class II Trout**
- Class III Trout**
- ASNRI Wild Rice Areas**
- ASNRI Outstanding and Exceptional Lakes**
- ERW**



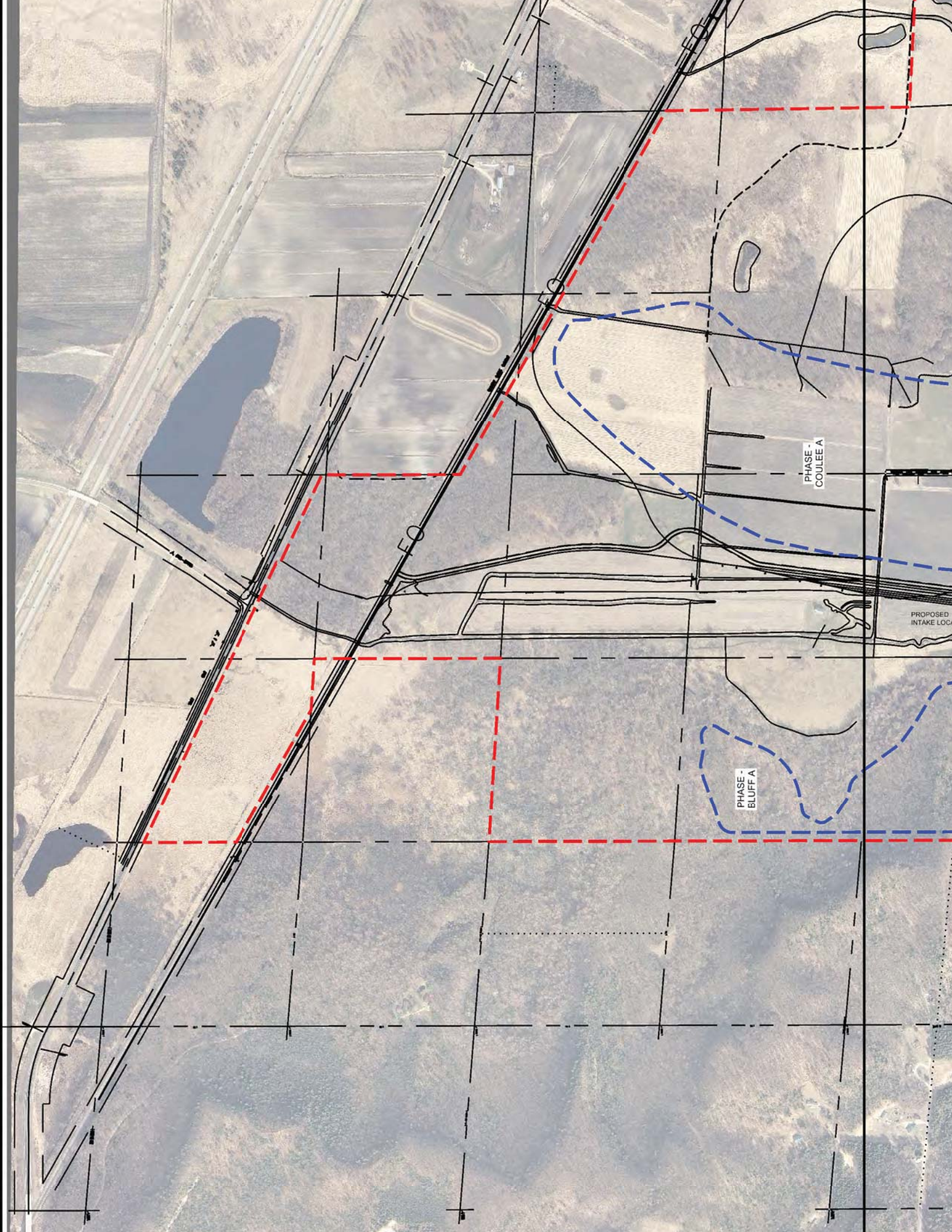
This map is a user generated static output from an internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.

Figure A12 - WDNR Surface Water Mapping





Appendix B
Non-Metallic Mining Operations

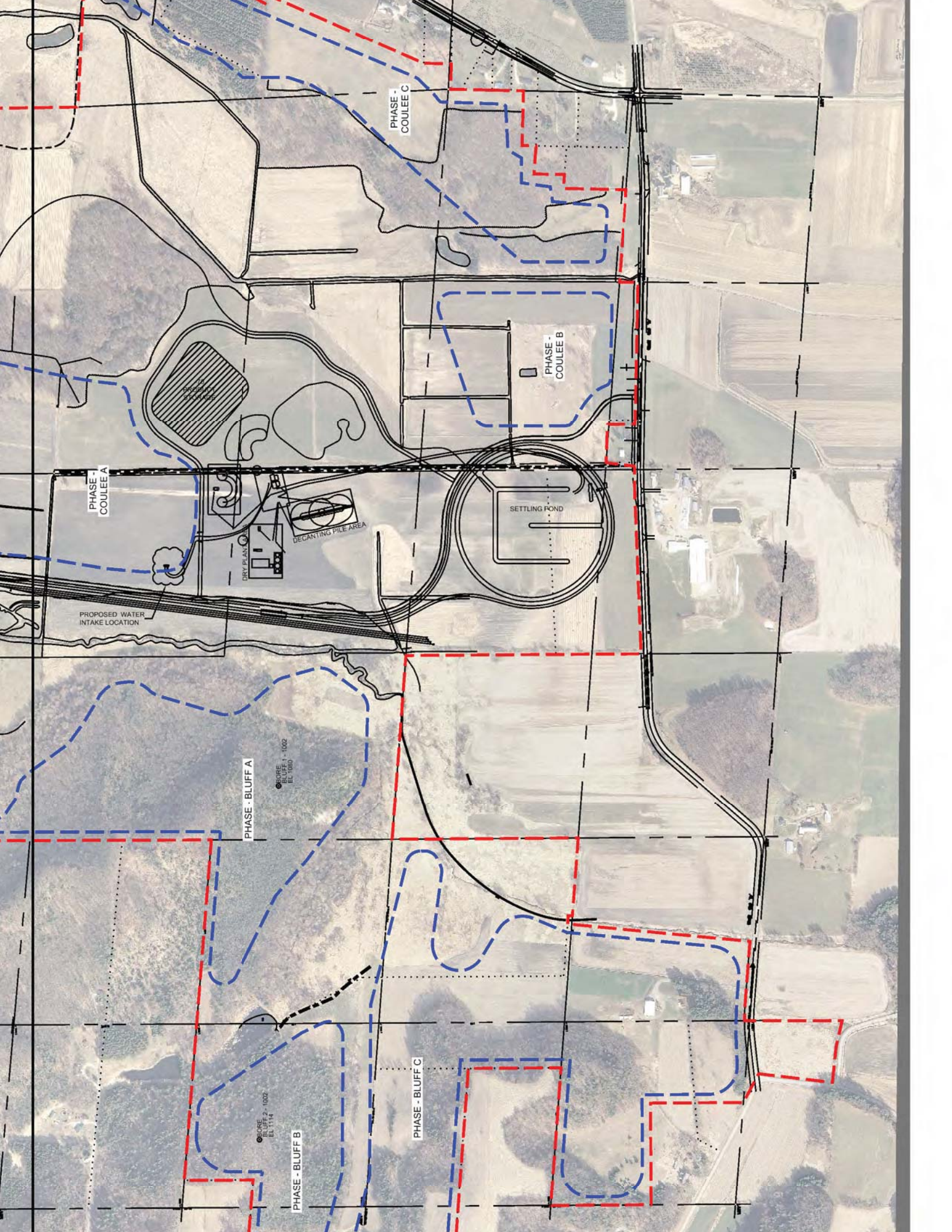


PHASE -
COULEE A

PHASE -
BLUFF A

PROPOSED
INTAKE LOC

41A



PHASE -
COULEE C

PHASE -
COULEE B

PHASE -
COULEE A

SETTLING POND

DECANTING PILE AREA

DRY PLANT

PROPOSED WATER
INTAKE LOCATION

PHASE - BLUFF A

BLUFF 1 - 1002
EL. 1080

PHASE - BLUFF B

BLUFF 2 - 1002
EL. 1114

PHASE - BLUFF C

Appendix C
Post Non-Metallic Mining Operations



NORTH



MATCHLINE



NORTH



SCALE IN FEET

HONEYCOMB AVE
(DEDICATED PUBLIC STREET)

COUNTY ROAD "CAP"
(DEDICATED PUBLIC STREET)



APPROXIMATE PERMANENT
SURFACE WATER
ELEVATION = 950



MATCHLINE

**APPROXIMATE PERMANENT
SURFACE WATER
ELEVATION = 950**



APPROXIMATE PERMANENT
SURFACE WATER
ELEVATION = 950

ROAD

COUNTY

INDIAN CREEK
WETLANDS

INDIAN CREEK
WETLANDS

DITCH

DITCH

WETLANDS

WETLANDS

WETLANDS

WETLANDS

COUNTY ROAD

CA

INDIAN CREEK

SECTION 628 EROSION CONTROL

628.1 Description

- (1) This section describes furnishing and installing, or constructing erosion control mats, bale checks or dikes, fences, screens, blankets, and other erosion control devices.
- (2) This section also describes cleaning sediment basins and mobilizations for erosion control.

628.2 Materials

628.2.1 General

628.2.1.1 Acronyms

- (1) Interpret acronyms used throughout this section as follows:

PAL The department's erosion control product acceptability list. The contractor may obtain a copy of the PAL and the prequalification procedure for products not on the PAL from the department.

ECRM Class I, II, and IIIA erosion control revegetative mats.

TRM Class III B, C, and D turf reinforcement mats.

628.2.1.2 Product Acceptability

- (1) The department prequalifies selected erosion control products in the PAL. If the contract specifies, furnish products of the class, type, and subject to the seasonal limitations the PAL designates. Before installing a PAL product, submit to the engineer a written copy of the manufacturer's specifications for installing that product on slopes, channels, shorelines, high wind locations, and next to live traffic lanes as applicable to the contract installation. Install PAL products conforming to those manufacturer's specifications. The department may specify modifications to the manufacturer's procedures for individual materials here within section 628.
- (2) The department may sample and test products supplied in the field to verify that they conform to the PAL prequalification requirements. Provide samples as the engineer directs.

628.2.2 Erosion Mat

- (1) The department must prequalify all erosion mat products before use. Furnish erosion mat products from the PAL.
- (2) The PAL identifies prequalified erosion mat products by class and type. Use the required class and type of erosion mat the plans show or the engineer specifies. The contractor may furnish any prequalified erosion mat product of the class and type the plans show or that the engineer specifies.
- (3) If using jute fabric for an erosion mat, use a woven fabric of a uniform open weave of single jute yarn. Use a jute yarn of loosely twisted construction with an average twist of not less than 1 1/2 turns per one inch. Ensure the average size of the warp and weft yarns are approximately the same. Furnish the woven fabric in rolled strips. Submit a certificate of compliance certifying that the jute fabric erosion mat conforms to the following:
 - Is a minimum 48 inches wide with a tolerance of minus one inch.
 - Has 78 warp ends, +/- one for each 48 inches of width. Has 45 weft yarns, +/- 2, per linear yard of length.
 - Weighs 92 pounds per 100 square yards +/- 10 percent, measured under average atmospheric conditions.
 - Is non-toxic to vegetation.

628.2.3 Staples

- (1) Furnish U-shaped staples, made of No. 11 or larger diameter steel wire, or other engineer-approved material, are one to 2 inches wide, and not less than 6 inches long for firm soils and not less than 12 inches for loose soils. The contractor may use anchors the staple gun manufacturer recommends, either lighter gage staples or equivalent, for engineer-approved staple gun systems.

628.2.4 Bales

- (1) For bales, use straw, hay, or other engineer-approved material, in good condition, of the dimensions the plans show.

628.2.5 Stakes

- (1) Furnish wood or metal stakes of the dimensions the plans show.

628.2.6 Silt Fence

628.2.6.1 Geotextile Fabric

- (1) Furnish one of the following geotextile fabrics: woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. For non-woven fabric the contractor may use needle punched, heat bonded, resin bonded, or combinations of all 3. Submit a certificate of compliance certifying that the geotextile conforms to the following:

TEST REQUIREMENT	METHOD	VALUE ^[1]
Minimum grab tensile strength (machine direction)	ASTM D 4632	120 lb
Minimum grab tensile strength (cross machine direction)	ASTM D 4632	100 lb
Maximum apparent opening size (equivalent standard sieve)	ASTM D 4751	No. 30
Minimum Permittivity	ASTM D 4491	0.05 s ⁻¹
Minimum ultraviolet stability	ASTM D 4355	70 %

(strength retained at 500 hrs of exposure)

^[1] All numerical values represent minimum or maximum average roll values. Average test results from all rolls in a lot must conform the tabulated values.

628.2.6.2 Fence Support System

- (1) Conform to plan requirements.

628.2.7 Silt Screen

- (1) Furnish fabric and submit a certificate of compliance certifying that the fabric conforms to the following:

Thickness	15 mils
Minimum grab tensile strength.....	120 lb
Minimum equivalent opening	No.170 sieve

- (2) Heat seal or sew all fabric seams.
- (3) For flotation, use an 8-inch diameter solid expanded polystyrene log, or engineer-approved equal, with a buoyancy of approximately 20 pounds per foot. Do not use polystyrene beads or chips.
- (4) For the main load line, use 5/16-inch cable. For ballast, use a 1/4-inch chain.

628.2.8 Sand Bags

- (1) Furnish bags made of canvas, burlap, nylon, or other engineer-approved material filled with concrete sand or other engineer-approved granular material.

628.2.9 Polyethylene Sheeting

- (1) Furnish 6 mil or thicker polyethylene sheeting conforming to ASTM D 4397.

628.2.10 Turbidity Barriers

- (1) Furnish barrier made of coated impervious fabric capable of containing all sediment at the location placed. It shall have a cable, with a 5/16 inch or larger diameter, capable of supporting the barrier at the required height above the water. It shall have a self-contained ballast that weighs at least 0.7 pound per foot. The ballast may be either chain or flexible cable. Barrier ends shall have grommets to lace together adjoining sections. For anchor posts use one of the following: steel fence posts, steel pipes, or steel channels.

- (2) Submit a certificate of compliance certifying that the turbidity barrier fabric conforms to the following:

TEST REQUIREMENT	METHOD	VALUE ^[1]
Minimum grab tensile strength	ASTM D 4632	200 lb
Minimum puncture strength	ASTM D 4833	90 lb
Maximum permeability	ASTM D 4491	1x10 ⁻⁷ cm/s
Minimum ultraviolet stability	ASTM D 4355	70 %

(strength retained at 500 hrs of exposure)

^[1] All numerical values represent minimum or maximum average roll values. Average test results from all rolls in a lot must conform the tabulated values.

628.2.11 Soil Stabilizer

- (1) Soil stabilizer type A is one of the following: a cementitious soil binder added to wood cellulose fiber mulch, or a bonded fiber matrix. Soil stabilizer type B is a polyacrylimide.
- (2) Furnish soil stabilizer products from the PAL.

628.2.12 Inlet Protection

- (1) Use a type FF geotextile fabric conforming to [645.2.1](#) except use a woven polypropylene fabric. Furnish type FF geotextile fabrics, or bags manufactured from type FF geotextile fabrics, from the PAL.

628.2.13 Rock Bags

- (1) Furnish rock bags made of a porous, ultraviolet resistant, high-density polyethylene or geotextile fabric that will retain 70% of its original strength after 500 hours of exposure according to ASTM D 4355 and a minimum in-place filled size of 24-inches long by 12-inches wide by 6-inches high. Ensure that the fabric conforms to the following:

TEST REQUIREMENT	METHOD	VALUE
Minimum Tensile	ASTM D4632	
Machine direction		70 lb minimum
Cross direction		40 lb minimum
Elongation	ASTM D4632	
Machine direction		20% minimum
Cross direction		10 % min
Puncture	ASTM 4833	65 lbs minimum
Minimum Apparent Opening		0.0234 inches (No. 30 sieve)
Maximum Apparent Opening		0.0787 inches (No. 10 sieve)

- (2) Fill the bags with a clean, sound, hard, durable, engineer-approved coarse aggregate conforming by visual inspection to the gradation specified for No. 2 coarse aggregate for concrete in [501.2.5.4.4](#).

628.2.14 Tracking Pads

- (1) Furnish tracking pad aggregate conforming to [312.2](#) for select crushed material except the material shall be substantially free of particles passing the No. 10 sieve. Furnish type R geotextile conforming to [645.2.6](#).

628.3 Construction

628.3.1 General

- (1) Arrange to have available a sufficient quantity of contract-required temporary erosion control materials to protect the project site from erosion at all times during construction. Include erosion mat, erosion bales, silt fence, manufactured alternative materials for temporary ditch checks, and other temporary erosion control materials the contract requires.
- (2) Ensure that erosion control products selected from the PAL are properly installed and maintained to remain in place and functioning as the contract specifies.

628.3.2 Erosion Mat

- (1) Furnish and install protective covering mats or soil retention mats for erosion control on prepared planting areas of slopes, ditches, channels, or shorelines, at locations the plans show or the engineer directs. Conform to the seasonal limitations designated in the PAL for photodegradable products.
- (2) Install as the manufacturer specifies except as follows:
 1. Do not use single roll material less than 6 feet wide in channels.
 2. Entrench mats approximately 3 inches deep along the edge facing traffic for all installations within 5 feet of active traffic lanes.
 3. Overlap mats by 3 inches or less and anchor with anchoring devices selected from the PAL for all mats the PAL designates as urban.
- (3) Cover TRM's immediately after installation with materials from the PAL as follows:
 1. On slopes use either an ECRM or a type A soil stabilizer. If using a soil stabilizer, apply at the manufacturer's recommended rate unless the contract or engineer specifies otherwise.
 2. In channels use an ECRM of a class and type the PAL allows for channel applications.

- (4) Remove all stones, clods, roots, sticks, or other foreign material that prevent the mat from bearing completely on the surface before placing the mat.
- (5) Reseed any seeded areas damaged or destroyed during placement of the erosion mat as specified for the original seeding.
- (6) Dispose of all surplus excavation or materials, and all stones, clods, or other foreign material removed in preparing for placing the mat.
- (7) Apply water uniformly after placing the mat over a seeded area to sufficiently moisten the seedbed to a depth of 2 inches and in a way that precludes washing or erosion.
- (8) Maintain the erosion mat and repair any damaged areas until the work is accepted.
- (9) The contractor shall not overlap type urban erosion mat with type urban or other type erosion mat.

628.3.3 Erosion Bales

- (1) Furnish bales of straw, hay, or other suitable baled material to form erosion control structures other than ditch checks. Install at locations the plans show or as the engineer directs.
- (2) Maintain the bales as required including removing and disposing of sediment deposits. Remove erosion bales after slopes and ditches are stable and turf develops enough to make future erosion unlikely. The engineer will determine when the contractor meets these criteria satisfactorily. The contractor may use bales as mulch. Dispose of bales not used as mulch in a manner acceptable to the engineer. Reshape ditches; fill sumps and trenches; dispose of excess eroded material; and topsoil, fertilize, and seed the affected area.

628.3.4 Silt Fence

628.3.4.1 Installation and Removal

- (1) Erect the silt fence before starting a construction operation that might cause sedimentation or siltation at the site of the proposed silt fence.
- (2) If possible, construct the silt fence in an arc or horseshoe shape with its ends pointing up slope. Construct the silt fence to the dimensions, and according to the details the plans show. Remove silt fences, as the engineer determines, after stabilizing the slopes and ditches and developing the turf to the extent that future erosion is unlikely. Clean up and restore the surface after removal. The contractor owns all materials remaining after removal and is responsible for their disposal off the right-of-way.

628.3.4.2 Inspection and Maintenance

- (1) Inspect all silt fences immediately after each rainfall and at least daily during prolonged rainfall. Correct any deficiencies immediately. Additionally, review the locations for silt fences and filter barriers in areas that construction activity changed the earth contour and drainage runoff on a daily basis to ensure that the silt fences are properly and effectively located. If deficiencies exist, install additional silt fences as the engineer directs or approves.
- (2) Remove sediment deposits when the build-up exceeds approximately 1/2 the volume capacity of the silt fence. The engineer may order the contractor to remove deposits if the engineer determines deposits exceed 1/2 the volume capacity of the silt fence. The contractor shall dress, to the existing grade, sediment deposits remaining in place after the silt fence is no longer required, this includes topsoiling, fertilizing, and seeding the affected area.

628.3.5 Silt Screen

- (1) Install the silt screen to prevent drift shoreward or downstream. Securely attach the flotation log to the fabric in both the horizontal and vertical direction.
- (2) Attach the 5/16-inch cable at the flotation members and extend along the entire length of each section of silt screen. Seal a 1/4-inch chain in the lower hem for ballast.
- (3) Use connectors to join the main load line and ballast chain to carry all tensile pressure. Join the fabric for its entire height with grommets and lacing rope.
- (4) Ensure the silt screen extends from the water surface to a maximum 10 foot depth.
- (5) Install anchorages or stakes on both shore and stream side to maintain stability. Use a post with deadman or engineer-approved equal for shore anchors. Ensure stream anchors are of sufficient size, type, and strength to stabilize the barrier beyond the construction area.

- (6) Buoy anchors to prevent pulling the barrier under water. Use Danforth-type anchors in sandy bottom and heavy kedge type or mushroom anchors on mud bottoms.
- (7) Maintain the barrier throughout construction operations.
- (8) After completing the work, remove the barrier in a way that prevents siltation of the river.

628.3.6 Cleaning Sediment Basins

- (1) Clean sediment basins when the engineer determines the sediment has accumulated to an extent that impairs the effectiveness of the sediment basin.
- (2) Dispose of the surplus material according to [205.3.12](#) for disposal of surplus or unsuitable material.

628.3.7 Mobilizations for Erosion Control

- (1) Move personnel, equipment, and materials to the project site for constructing erosion control items at the stages the contract indicates or the engineer directs.
- (2) Submit for approval an ECIP required in [107.20](#) for accomplishing temporary and permanent erosion control work. Stage the ECIP erosion control work to conform to the number of Mobilizations Erosion Control bid items the contract plans show. The department will not allow any deviation from approved staging without the engineer's written approval. The engineer will direct each of the mobilizations. Mobilize with sufficient personnel, equipment, supplies, and incidentals, within 72 hours of the engineer's written order.

628.3.8 Mobilizations Emergency Erosion Control

- (1) Move personnel, equipment, and materials to the project site to install temporary erosion control items on an emergency basis as the engineer directs.
- (2) Mobilize with sufficient personnel, equipment, materials, and incidentals on the job site within 8 hours the engineer's written order to install temporary erosion control items on an emergency basis.
- (3) An emergency is a sudden occurrence of a serious and urgent nature, beyond normal maintenance of erosion control items and mobilizations the ECIP includes. Under this definition, an emergency mobilization requires immediate action to move necessary personnel, equipment, and materials to the emergency site followed by immediate installation of temporary erosion control measures.
- (4) Unless the engineer directs otherwise, replenish stockpiled material delivered as specified for plan quantities in [628.3.1](#) and subsequently used for emergency erosion control to the pre-emergency totals of these stockpiles.

628.3.9 Polyethylene Sheeting

- (1) Install polyethylene sheeting at locations the plans show or as the engineer directs.
- (2) Secure the sheeting from wind and water dislocation. Before placing, remove stones, roots, sticks, and other materials that interfere with the sheeting bearing completely on the soil. Overlap adjacent sheets a minimum of 3 feet in the direction of flow; and seal the edges with waterproof tape or other engineer-approved method. Patch damaged areas with sheeting overlapped a minimum of 3 feet and seal the joints with waterproof tape or other engineer-approved method. Maintain the sheeting and make satisfactory repairs of damaged areas.
- (3) Upon completing the work, remove the polyethylene sheeting. The contractor shall assume ownership of all removed material.

628.3.10 Turbidity Barriers

- (1) Install turbidity barriers at locations the plans show or as the engineer directs.
- (2) Place all barriers, before beginning adjacent construction, in a way that causes minimum disturbance of the streambed and banks. Extend the barrier into the stream banks far enough to preclude washing out or erosion around the ends. Drive posts securely into the streambed at 10 foot intervals along the line of the barrier installation. Fasten the barrier to the posts and securely anchor the barrier load lines at the barrier ends and at 10 foot intervals between the barrier ends, unless the engineer directs otherwise. Provide additional anchoring if necessary to maintain the barrier location during construction operations. Install sand bags as the plans show to anchor the barrier to the streambed. The engineer may require additional sand bags to ensure adequate performance. The contractor, as required by permit under [107.19](#), shall provide and anchor both danger buoys and navigational markers.

- (3) Maintain the integrity of the barrier as necessary to contain erosion from adjacent construction operations. Promptly correct all deficiencies. Barrier maintenance includes removing and disposing of accumulations of soil and other detrimental material.
- (4) Remove the barrier after completing the adjacent work. Delay removal until removing and disposing of accumulated soils and other suspended materials, and all suspended materials settle. Minimize disturbing the streambed and banks during removal operations.
- (5) If the engineer approves, the contractor may substitute sheet pile installed as a part of their construction operation for all or part of the turbidity barrier the plans show.

628.3.11 (Vacant)

628.3.12 Soil Stabilizer

628.3.12.1 General

- (1) Provide soil stabilizer as a soil bonding agent to prevent or minimize erosion. Install on exposed soil surfaces of temporary or permanent slopes as the plans show or as the engineer directs.

628.3.12.2 Soil Stabilizer Type A

- (1) Apply soil stabilizer with conventional hydraulic seeding equipment. Ensure that surrounding surfaces, structures, signs, trees, and shrubs are not over-sprayed. The engineer will not accept the work until the contractor satisfactorily cleans over-sprayed surfaces. Provide a finished application 3/16 inch to 1/4 inch thick.
- (2) For permanent slope applications, sow seed separately, before applying the soil stabilizer, to ensure that the seed has direct contact with the soil.

628.3.12.3 Soil Stabilizer Type B

- (1) Apply soil stabilizer with conventional hydraulic seeding equipment or by dry spreading. Apply the material at the manufacturer's recommended rate unless the engineer directs otherwise.
- (2) For permanent slope applications, apply a department-approved mulch when applying the soil stabilizer or after applying it to protect the seed.

628.3.13 Inlet Protection

- (1) Furnish, install, maintain, and remove type FF geotextile fabric, and fabric hold down and support systems for inlet protection where the plans show or the engineer directs. The contractor may provide manufactured alternatives selected from the PAL.
- (2) For type A inlet protection, install around field inlets until establishing permanent soil stabilization; and around pavement inlets before placing curb, gutter, or curb & gutter.
- (3) For type B inlet protection, install on curb, gutter, curb & gutter, and pavement inlets after placing the surrounding pavement surfaces.
- (4) For type C inlet protection use a wooden 2 x 4, wrapped and secured in type FF geotextile fabric, installed in front of the curb head as the plans show. The wood shall not block the entire opening of the curb box.
- (5) For type D inlet protection, the contractor may make the bag from type FF geotextile fabric or choose a manufactured type FF bag from the PAL. Ensure that the device is designed to fit the size and shape of the inlet. At a minimum, inspect and maintain after every precipitation event.

628.3.14 Temporary Ditch Checks

- (1) Provide suitable ditch check materials, installed and maintained at locations the plans show or as the engineer directs.
- (2) Construct temporary ditch checks using a double row of erosion bales or a manufactured alternative from the PAL. Place temporary ditch checks across ditches at locations the plans show or as the engineer directs immediately after shaping the ditches or slopes. Excavate upstream sumps as the engineer directs.
- (3) Remove sediment deposits when the build-up exceeds approximately 1/2 the erosion bale structures volume capacity. The engineer may order the contractor to remove deposits if the engineer determines that sediment deposits exceed 1/2 the erosion bale structures volume capacity. Dispose of excess sediment as the engineer directs.

- (4) Remove ditch checks after the slopes and ditches are stable and the turf develops enough to make future erosion unlikely. The engineer will determine when the contractor meets these criteria. The contractor may use bales as mulch. Dispose of bales not used as mulch in a manner acceptable to the engineer. Reshape the ditch; fill sumps and trenches; dispose of excess eroded material; and topsoil, fertilize, and seed the affected area.

628.3.15 Culvert Pipe Checks

- (1) Install rock bag culvert pipe checks as the plans show and as the engineer directs. Place bags immediately after installing new culverts and before beginning earth disturbing activities in areas drained by existing culverts. Place rock bags on the inlet end of the culvert only. Leave rock bags in place until slopes and ditches are stable and turf develops enough to make future erosion unlikely. Periodically remove sediment to maintain effective function. Remove and dispose of the bags and rock filler when they are no longer needed to control erosion. Dispose of accumulated sediment and restore the site. The contractor may spread accumulated sediment to form a surface suitable for seeding.

628.3.16 Tracking Pads

- (1) Install tracking pads at the locations the plans show, locations consistent with an engineer-approved ECIP, or where the engineer directs before allowing construction traffic to leave the site. Ensure that the pad is wide enough to cover the full width of the egress point. Design the installation to divert surface water flow away from the pad and, if field conditions dictate, provide a culvert to channel flow under the pad.
- (2) Replace or rework material in the surface of the pad to ensure that the amount of material tracked onto public roads is minimized. Maintain the driving surface in a clean and safe operating condition. Remove the pad and restore the site upon completion of contract work.

628.3.17 Rock Bags

- (1) Install rock bags as the plans show or the engineer directs either in conjunction with work done under other contract bid items or as stand-alone erosion control devices. Periodically remove sediment to maintain effective function. Remove and dispose of the bags and rock filler when they are no longer needed to control erosion. Dispose of accumulated sediment and restore the site. The contractor may spread accumulated sediment to form a surface suitable for seeding.

628.4 Measurement

628.4.1 General

628.4.1.1 Borrow Sites and Material Disposal Sites

- (1) The department will measure work acceptably completed under selected bid items placed on borrow sites and material disposal sites if that work is consistent with an engineer-approved ECIP. The department will measure only the following bid items using the methods described in their respective measurement subsections:

Erosion Mat (type)	Soil Stabilizer (type)	Mulching
Erosion Bales	Culvert Pipe Checks	Seeding
Temporary Ditch Checks	Polyethylene Sheeting	Seeding Temporary
Silt Fence	Tracking Pads	Fertilizer Type (type)
Silt Fence Maintenance	Rock Bags	
Inlet Protection (type)	Mobilizations Emergency Erosion Control	

628.4.1.2 Sand Bags

- (1) The department will not measure sand bags. Sand bags are incidental to the bid items that use sand bags.

628.4.2 Erosion Mat

- (1) The department will measure the Erosion Mat bid items by the square yard acceptably completed. The department will not make allowance for portions of the mat that must be entrenched in the soil for any end or junction slot, or for required overlaps.

628.4.3 (Vacant)

628.4.4 Erosion Bales

- (1) The department will measure Erosion Bales as each individual bale acceptably completed.

628.4.5 (Vacant)

628.4.6 Silt Fence

- (1) The department will measure Silt Fence by the linear foot acceptably completed. The department will measure along the base of the fence, center-to-center of end post, for each section of fence.

628.4.7 (Vacant)

628.4.8 Silt Fence Maintenance

- (1) The department will measure Silt Fence Maintenance by the linear foot acceptably completed. The department will measure along the base of the fence, end-to-end of the section maintained, for each time a section of fence is cleaned and repaired.

628.4.9 Silt Screen

- (1) The department will measure Silt Screen by the linear foot acceptably completed.

628.4.10 Cleaning Sediment Basins

- (1) The department will measure Cleaning Sediment Basins by the cubic yard acceptably completed, measured in the vehicle.

628.4.11 Mobilizations Erosion Control

- (1) The department will measure Mobilizations Erosion Control by each individual mobilization acceptably completed. The department will not include the following:
 1. Delivering and installing materials provided for in specific contract bid items.
 2. Work specified under the Mobilizations Emergency Erosion Control bid item, or the work and operations necessary for normal contractor maintenance of erosion control items.
 3. The movement of personnel, equipment, and materials to the work site to accomplish installing additional erosion control items the engineer deems necessary to control erosion between the stages contained in the department-approved plan of operations, unless the engineer directs otherwise in writing.

628.4.12 Mobilizations Emergency Erosion Control

- (1) The department will measure Mobilizations Emergency Erosion Control by each individual mobilization acceptably completed. The department will not include delivering and installing temporary erosion control materials provided for in specific contract bid items.

628.4.13 Polyethylene Sheeting

- (1) The department will measure Polyethylene Sheeting by the square yard acceptably completed.

628.4.14 Turbidity Barriers

- (1) The department will measure Turbidity Barrier by the square yard acceptably completed. The department will make no allowance for portions of the turbidity barrier considered as part of the anchorages, required overlaps, or having a bottom flap greater than 48 inches.
- (2) If the contractor substitutes sheet pile for turbidity barrier as allowed in [628.3.10](#), the department will measure that turbidity barrier as the plan quantity in square yards of material replaced.

628.4.15 Soil Stabilizer

- (1) The department will measure the Soil Stabilizer bid items by the acre acceptably completed within the limits the contract designates or as the engineer directs.

628.4.16 Inlet Protection

- (1) The department will measure the Inlet Protection bid items as each individual location and type acceptably completed.

628.4.17 Temporary Ditch Checks

- (1) The department will measure Temporary Ditch Checks by the linear foot acceptably completed. If using erosion bales, the department will only measure the length across the ditch, not the length of each row of bales. The department will not measure ditch checks constructed with a single row of bales.

628.4.18 (Vacant)

628.4.19 Culvert Pipe Checks

- (1) The department will measure Culvert Pipe Checks as each as each individual bag acceptably completed.

628.4.20 Tracking Pads

- (1) The department will measure Tracking Pads as each individual location acceptably completed measured only at the locations the plans show, consistent with an engineer-approved ECIP, and where the engineer directs.

628.4.21 Rock Bags

- (1) The department will measure Rock Bags as each individual bag acceptably completed.

628.5 Payment

628.5.1 General

- (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>
628.1104	Erosion Bales	EACH
628.1504	Silt Fence	LF
628.1520	Silt Fence Maintenance	LF
628.1550	Silt Screen	LF
628.1905	Mobilizations Erosion Control	EACH
628.1910	Mobilizations Emergency Erosion Control	EACH
628.1920	Cleaning Sediment Basins	CY
628.2000 - 2099	Erosion Mat (class) (type)	SY
628.5505	Polyethylene Sheeting	SY
628.6005	Turbidity Barriers	SY
628.6500 - 6599	Soil Stabilizer (type)	ACRE
628.7000 - 7099	Inlet Protection (type)	EACH
628.7504	Temporary Ditch Checks	LF
628.7555	Culvert Pipe Checks	EACH
628.7560	Tracking Pads	EACH
628.7570	Rock Bags	EACH

- (2) The department will pay for measured quantities at the contract unit price under selected bid items placed on borrow sites and material disposal sites if that work is consistent with an engineer-approved ECIP. The department will pay for only the following bid items using the methods described in their respective payment subsections:

Erosion Mat (type)	Soil Stabilizer (type)	Mulching
Erosion Bales	Culvert Pipe Checks	Seeding
Temporary Ditch Checks	Polyethylene Sheeting	Seeding Temporary
Silt Fence	Tracking Pads	Fertilizer Type (type)
Silt Fence Maintenance	Rock Bags	
Inlet Protection (type)	Mobilizations Emergency Erosion Control	

628.5.2 Erosion Mat

- (1) Payment for the Erosion Mat bid items is full compensation for providing, protecting, and storing erosion mat materials on the project; for placing and anchoring the mat, including staples; for preparing the seeded areas; for installing end and junction slots; for repairing and reseeding damaged areas; for providing and applying water; and for disposing of all surplus and waste materials.
- (2) The department will pay separately for covering class III types B, C, and D mats with an ECRM under the applicable Erosion Mat bid item, or with type A soil stabilizer under the Soil Stabilizer Type A bid item.

628.5.3 (Vacant)

628.5.4 Erosion Bales

- (1) Payment for Erosion Bales is full compensation for providing, protecting, and storing erosion bales on the project; for placing all materials, including stakes; for anchoring the bales; for all excavating, including trenches and sumps; for removing excess sediment during construction; for removing and disposing of the bales and all waste or surplus materials, including eroded materials; and for shaping and restoring ditches.

- (2) The department will pay separately for any required topsoiling, fertilizing, or seeding under the applicable bid item.

628.5.5 (Vacant)

628.5.6 Silt Fence

- (1) Payment for Silt Fence is full compensation for providing, protecting, and storing silt fence on the project; for erecting fence, including all excavating, placing posts, backfilling, and attaching geotextile fabric; and for removing the fence at project completion.

628.5.7 (Vacant)

628.5.8 Silt Fence Maintenance

- (1) Payment for Silt Fence Maintenance is full compensation for all required cleaning and repairing; for removing or spreading the accumulated sediment to form a surface suitable for seeding; and for replacing silt fence and all damages caused by overloading sediment material or ponding water adjacent to the silt fence.

628.5.9 Silt Screen

- (1) Payment for Silt Screen is full compensation for providing, assembling, erecting, maintaining, and removing the silt screen barrier.

628.5.10 Cleaning Sediment Basins

- (1) Payment for Cleaning Sediment Basins is full compensation for all excavating; and for disposing of surplus material.

628.5.11 Mobilizations Erosion Control

- (1) Payment for Mobilizations Erosion Control is full compensation for the staged moving of personnel, moving equipment, and moving materials. The department will pay separately for delivery and installation of erosion control devices under the other bid items in this section.
- (2) Failure to mobilize within 72 hours of the engineer's written order will result in a \$300 per calendar day deduction from money due under the contract, for each calendar day of delay. The engineer may extend the 72-hour period for delays not the contractor's fault.

628.5.12 Mobilizations Emergency Erosion Control

- (1) Payment for Mobilizations Emergency Erosion Control is full compensation for the staged moving of personnel, moving equipment, and moving materials. The department will pay separately for delivery and installation of temporary erosion control devices under the other bid items in this section.
- (2) Failure to mobilize within 8 hours, will result in a \$300 per calendar day deduction from money due under the contract, for each calendar day of delay. The engineer may extend the 8-hour period for delays not the contractor's fault.

628.5.13 Polyethylene Sheeting

- (1) Payment for Polyethylene Sheeting is full compensation for furnishing and delivering the polyethylene sheeting to the project site; for storing on the project; for installing the sheeting; for all excavating and backfilling; for securing the sheeting and sealing the edges of the sheeting; and for removing and disposing of the sheeting and surplus materials.

628.5.14 Turbidity Barriers

- (1) Payment for Turbidity Barriers is full compensation for furnishing, assembling, installing, maintaining, and removing the turbidity barrier; and for sandbags, buoys, navigational markers, anchors, and anchor ropes.
- (2) If the contractor substitutes sheet pile for turbidity barrier as allowed in [628.3.10](#), the department will pay for the plan quantity of turbidity barrier replaced.

628.5.15 Soil Stabilizer

- (1) Payment for the Soil Stabilizer bid items is full compensation for furnishing, mixing, and applying soil stabilizer.

628.5.16 Inlet Protection

- (1) Payment for the Inlet Protection bid items is full compensation for furnishing, transporting, and installing all materials; and for maintaining and removing the inlet protection devices.

628.5.17 Temporary Ditch Checks

- (1) Payment for Temporary Ditch Checks is full compensation for providing, protecting, and storing ditch check materials on the project; for installing and removing ditch checks at project completion or as the engineer directs; for repairing and reseeding damaged areas; and for disposing of all surplus and waste material.
- (2) The department will not pay for installing ditch checks if constructed of a single row of erosion bales.

628.5.18 (Vacant)

628.5.19 Culvert Pipe Checks

- (1) Payment for Culvert Pipe Checks is full compensation for furnishing and installing rock bags;; for periodic sediment removal; for removing and disposing of rock bags and rock filler; for disposing of surplus eroded materials; and for restoring the site.

628.5.20 Tracking Pads

- (1) Payment for Tracking Pads is full compensation for providing tracking pads including aggregate and geotextile; for replacing or reworking material as required to maintain performance; and for removing the pad and restoring the site.

628.5.21 Rock Bags

- (1) Payment for Rock Bags is full compensation for providing rock bags; for periodic sediment removal; for removing and disposing of rock bags and rock filler; for disposing of surplus eroded materials; and for restoring the site.

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.
- (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, empire birdsfoot trefoil, 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	Fult's
	Puccinella distans	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	
Birdsfoot Trefoil	Lotus corniculatus	Empire
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 OF 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			10		
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			15	25	
Annual Ryegrass	97	90					30
Alsike Clover	97	90					4
Red Clover	98	90					4
White Clover	95	90	10				
Birdsfoot Trefoil	95	80			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 OF 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	25
	Canada Wildrye	<i>Elymus Canadensis</i>	PLS	15	15	35	23
	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	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 work under 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
Birdsfoot Trefoil	95	80
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 [section 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.

Seeding For Construction Site Erosion Control (1059)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

Planting seed to establish temporary or permanent vegetation for erosion control.

II. Purpose

The purpose of *temporary seeding*¹ is to reduce runoff and erosion until permanent vegetation or other erosion control practices can be established. The purpose of *permanent seeding* is to permanently stabilize areas of exposed soil.

III. Conditions Where Practice Applies

This practice applies to areas of exposed soil where the establishment of vegetation is desired. Temporary seeding applies to disturbed areas that will not be brought to final grade or on which land-disturbing activities will not be performed for a period greater than 30 days, and requires vegetative cover for less than one year. Permanent seeding applies to areas where perennial vegetative cover is needed.

IV. Federal, State and Local Laws

Users of this standard shall be aware of all applicable federal, state and local laws, rules, regulations or permit requirements governing seeding. This standard does not contain the text of federal, state or local laws.

V. Criteria

This section establishes the minimum standards for design, installation and performance requirements.

A. Site and Seedbed Preparation

Site preparation activities shall include:

1. Temporary Seeding

- a. Temporary seeding requires a seedbed of loose soil to a minimum depth of 2 inches.
- b. Fertilizer application is not generally required for temporary seeding. However, any application of fertilizer or lime shall be based on soil testing results.
- c. The soil shall have a pH range of 5.5 to 8.0.

2. Permanent Seeding

- a. *Topsoil* installation shall be completed prior to permanent seeding.
- b. Permanent seeding requires a seedbed of loose topsoil to a minimum depth of 4 inches with the ability to support a *dense* vegetative cover.
- c. Application rates of fertilizer or lime shall be based on soil testing results.
- d. Prepare a tilled, fine, but firm seedbed. Remove rocks, twigs foreign material and clods over two inches that cannot be broken down.
- e. The soil shall have a pH range of 5.5 to 8.0.

¹ Words 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.

B. Seeding

1. Seed Selection

- a. Seed mixtures that will produce dense vegetation shall be selected based on soil and site conditions and intended final use. Section IX References, lists sources containing suggested seed mixtures.
- b. All seed shall conform to the requirements of the Wisconsin Statutes and of the Administrative Code Chapter ATCP 20.01 regarding noxious weed seed content and labeling.
- c. Seed mixtures that contain potentially invasive species or species that may be harmful to native plant communities shall be avoided.
- d. Seed shall not be used later than one year after the test date that appears on the label.
- e. Seed shall be tested for purity, germination and noxious weed seed content and shall meet the minimum purity and germination requirements as prescribed in the current edition of Rules for Testing Seed, published by the Association of Official Seed Analysts.

2. Seed Rates

a. Temporary Seeding (Cover Crop)

Areas needing protection during periods when permanent seeding is not applied shall be seeded with annual species for temporary protection. See Table 1 for seeding rates of commonly used species. The residue from this crop may either be incorporated into the soil during seedbed preparation at the next permanent seeding period or left on the soil surface and the planting made as a no-till seeding.

Table 1 Temporary Seeding Species and Rates

Species	Lbs/Acre	Percent Purity
Oats	131 ¹	98
Cereal Rye	131 ²	97
Winter wheat	131 ²	95
Annual Ryegrass	80 ²	97

¹ Spring and summer seeding

² Fall seeding

b. Permanent Seeding

Rates shall be based on pounds or ounces of Pure Live Seed (PLS) per acre. Section IX contains some possible reference documents that provide seeding rates. Permanent seeding rates may be increased above the minimum rates shown in the reference documents to address land use and environmental conditions.

If a *nurse crop* is used in conjunction with permanent seeding, the nurse crop shall not hinder establishment of the permanent vegetation.

A nurse crop shall be applied at 50% its temporary seeding rate when applied with permanent seed.

3. Inoculation

Legume seed shall be inoculated in accordance with the manufacturer's recommendations. Inoculants shall not be mixed with liquid fertilizer.

4. Sowing

Seed grasses and legumes no more than ¼ inch deep. Distribute seed uniformly. Mixtures with low seeding rates require special care in sowing to achieve proper seed distribution.

Seed may be broadcast, drilled, or hydroseeded as appropriate for the site.

Seed when soil temperatures remain consistently above 53° F. *Dormant seed* when the soil temperature is consistently below 53° F (typically

Nov. 1st until snow cover). Seed shall not be applied on top of snow.

VI. Considerations

- A. Consider seeding at a lower rate and making two passes to ensure adequate coverage.
- B. Compacted soil areas may need special site preparation prior to seeding to mitigate compaction. This may be accomplished by chisel plowing to a depth of 12 inches along the contour after heavy equipment has left the site.
- C. Sod may be considered where adequate watering is available.
- D. When working in riparian areas refer to the NRCS Engineering Field Handbook, Chapter 16, Streambank and Shoreline Protection and Chapter 18, *Soil Bioengineering* for Upland Slope Protection and Erosion Reduction.
- E. A site assessment should be conducted to evaluate soil characteristics, topography, exposure to sunlight, proximity to natural plant communities, proximity to nuisance, noxious and/or invasive species, site history, moisture regime, climatic patterns, soil fertility, and previous herbicide applications.
- F. Use *introduced species* only in places where they will not spread into existing natural areas.
- G. Lightly roll or compact the area using suitable equipment when the seedbed is judged to be too loose, or if the seedbed contains clods that might reduce seed germination.
- H. See Section IX. References for suggested seed mixes (NRCS, WisDOT, UWEX) or use their equivalent.
- I. Turf seedlings should not be mowed until the stand is at least 6 inches tall. Do not mow closer than 3 inches during the first year of establishment.
- J. Seeding should not be done when the soil is too wet.

- K. Consider watering to help establish the seed. Water application rates shall be controlled to prevent runoff and erosion.
- L. Prairie plants may not effectively provide erosion control during their establishment period without a nurse crop.
- M. Topsoil originating from agricultural fields may contain residual chemicals. The seedbed should be free of residual herbicide or other contaminants that will prevent establishment and maintenance of vegetation. Testing for soil contaminants may be appropriate if there is doubt concerning the soil's quality.
- N. Consider using mulch or a nurse crop if selected species are not intended for quick germination. When mulching refer to WDNR Conservation Practice Standard Mulching for Construction Sites (1058).

VII. Plans and Specifications

Plans and specifications for seeding shall be in keeping with this standard and shall describe the requirements for applying this practice.

All plans, standard detail drawings, or specifications shall include schedule for installation, inspection, and maintenance. The responsible party shall be identified.

VIII. Operation and Maintenance

- A. During construction areas that have been seeded shall at a minimum be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period. Inspect weekly during the growing season until vegetation is densely established or permit expires. Repair and reseed areas that have erosion damage as necessary.
- B. Limit vehicle traffic and other forms of compaction in areas that are seeded.
- C. A fertilizer program should begin with a soil test. Soil tests provide specific fertilizer recommendations for the site and can help to avoid over-application of fertilizers.

IX. References

A. Seed Selection References

United States Department of Agriculture – Natural Resource Conservation Service Field Office Technical Guide Section IV, Standard 342, Critical Area Planting.

UWEX Publication A3434 Lawn and Establishment & Renovation.

WisDOT, 2003. State of Wisconsin Standard Specifications For Highway and Structure Construction. Section 630, Seeding.

B. General References

Association of Official Seed Analysts, 2003. Rules for Testing Seed. <http://www.aosaseed.com>.

Metropolitan Council, 2003. Urban Small Sites Best Management Practice Manual, Chapter 3, Vegetative Methods 3-85 – 3-91. Minneapolis.

The State of Wisconsin list of noxious weeds can be found in Statute 66.0407.

United States Department of Agriculture – Natural Resources Conservation Service. Engineering Field Handbook, Chapters 16 and 18.

UWEX Publication GWQ002 Lawn & Garden Fertilizers.

Nurse Crop (V.B.2.b): Also known as a companion crop; is the application of temporary (annual) seed with permanent seed.

Permanent seeding (II) Seeding designed to minimize erosion for an indefinite period after land disturbing construction activities have ceased on the site.

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

Temporary Seeding (II) Seeding designed to control erosion for a time period of one year or less that is generally removed in order to perform further construction activities or to permanently stabilize a construction site.

Topsoil (V.A.2.a) Consists of loam, sandy loam, silt loam, silty clay or clay loam humus-bearing soils adapted to sustain plant life with a pH range of 5.5 – 8.0. Manufactured topsoil shall through the addition of sand or organic humus material, peat, manure or compost meet the above criteria.

X. Definitions

Dense (V.A.2.b) A stand of 3-inch high grassy vegetation that uniformly covers at least 70% of a representative 1 square yard plot.

Dormant seed (V.B.4): Seed is applied after climatic conditions prevent germination until the following spring.

Introduced Species (VI.F) Plant species that historically would not have been found in North America until they were brought here by travelers from other parts of the world. This would include smooth brome grass and alfalfa. Some of these species may have a wide distribution such as Kentucky bluegrass.

Mulching For Construction Sites (1058)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

Mulching is the application of organic material to the soil surface to protect it from raindrop impact and overland flow. Mulch covers the soil and absorbs the erosive impact of rainfall and reduces the flow velocity of runoff.

II. Purpose

This practice may be used to:

- Reduce soil erosion
- Aid in seed germination and establishment of plant cover
- Conserve soil moisture

III. Conditions Where Practice Applies

This practice may be applied on exposed soils as a temporary control where soil grading or landscaping has taken place or in conjunction with temporary or permanent seeding. Mulching is generally not appropriate in areas of concentrated flow.

IV. Federal, State, and Local Laws

Users of this standard shall comply with applicable federal, state and local laws, rules, regulations or permit requirements governing mulching. This standard does not contain the text of federal, state, or local laws.

V. Criteria

This section establishes the minimum standards for design, installation and performance requirements.

A. Site Preparation:

Soil surface shall be prepared prior to the application of mulch in order to achieve the desired purpose and to ensure optimum contact between soil and mulch. All areas to be mulched shall be reasonably free of rills and gullies.

B. Materials:

Mulch shall consist of natural biodegradable material such as plant residue (including but not limited to straw, hay, wood chips, bark and wood cellulose fiber), or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended effect for the required time period.

Mulch shall be environmentally harmless to wildlife and plants. Materials such as gravel, plastic, fabric, sawdust, municipal solid waste, *solid waste byproducts*¹, shredded paper, and non-biodegradable products shall not be used.

Mulch shall be free of diseased plant residue (i.e. oak wilt), *noxious weed* seeds, harmful chemical residues, heavy metals, hydrocarbons and other known environmental toxicants.

Marsh hay shall not be used as mulch in lowland areas but may be used on upland sites to prevent the spread of invasive, non-native species (i.e. reed canary grass) commonly found in marsh hay.

Straw and hay mulch that will be crimped shall have a minimum fiber length of 6 inches.

¹ Words 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.

Wood chips or wood bark shall only be used for sites that are not seeded.

C. Application Rate:

1. Mulch shall cover a minimum of 80% of the soil surface for unseeded areas. For seeded areas, mulch shall be placed loose and open enough to allow some sunlight to penetrate and air to circulate but still cover a minimum of 70% of the soil surface.
2. Mulch shall be applied at a uniform rate of 1½ to 2 tons per acre for sites that are seeded, and 2 to 3 tons per acre for sites that are not seeded. This application results in a layer of ½ to 1½ inches thick for seeded sites, and 1½ to 3 inches thick for sites not seeded.
3. Wood chips or wood bark shall be applied at a rate of 6 to 9 tons per acre to achieve a minimum of 80% ground cover. This application should result in a layer of wood chips or wood bark ½ to 1½ inches thick.

D. Mulch Anchoring Methods

Anchoring of mulch shall be based on the type of mulch applied, site conditions, and accomplished by one of the following techniques:

1. Crimping

Immediately after spreading, the mulch shall be anchored by a mulch crimper or equivalent device consisting of a series of dull flat discs with notched edges spaced approximately 8 inches apart. The mulch shall be impressed in the soil to a depth of 1 to 3 inches.

2. Polypropylene Plastic, or Biodegradable Netting

Apply plastic netting over mulch application and staple according to manufacturer's recommendations.

3. Tackifier

Tackifier shall be sprayed in conjunction with mulch or immediately

after the mulch has been placed. Tackifiers must be selected from those that meet the WisDOT Erosion Control Product Acceptability List (PAL). Asphalt based products shall not be applied.

The tackifiers shall be applied at the following minimum application rates per acre:

- a. Latex-Base: mix 15 gallons of adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 375 gallons of water.
- b. Guar Gum: mix 50 pounds of dry adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as tracer with 1,300 gallons of water.
- e. Other Tackifiers: (Hydrophilic Polymers) mix 100 pounds of dry adhesive (or the manufacturer's recommended rate which ever is greater) and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 1,300 gallons of water.

VI. Considerations

- A. Wood products typically absorb available soil nitrogen as they degrade, thus making it unavailable for seed.
- B. The use of mulch behind curb and gutter may not be desirable unless anchored by netting, because air turbulence from nearby traffic can displace the mulch. Consider the use of erosion mat or sod as an alternative.
- C. In areas where lawn type turf will be established, the use of tackifiers is the preferred anchoring method. Crimping will tend to leave an uneven surface and plastic netting can become displaced and entangled in mowing equipment.

- D. A heavier application of mulch may be desired to prevent seedlings from being damaged by frost.
- E. It may be beneficial to apply polyacrylimide in addition to mulch. Refer to WDNR Conservation Practice Standard (1050) Erosion Control Land Application of Anionic Polyacrylamide for information about the advantages and proper use of polymers.
- F. Concentrated flows above the site where mulch is applied should be diverted.
- G. Mulch should be placed within 24 hours of seeding.
- H. Mulching operations should not be performed during periods of excessively high winds that would preclude the proper placement of mulch.
- I. Materials such as gravel may be effective for erosion control but are not considered mulches.

VII. Plans and Specifications

- A. Plans and specifications for mulching shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The plans and specifications shall address the following:
 - 1. Type of mulch used
 - 2. Application rate
 - 3. Timing of application
 - 4. Method of anchoring
- B. All plans, standard detail drawings, or specifications shall include schedules for installation, inspection, and maintenance. The responsible party shall be identified.

VIII. Operation and Maintenance

Mulch shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24 hour period.

Mulch that is displaced shall be reapplied and properly anchored. Maintenance shall be completed as soon as possible with consideration to site conditions.

IX. References

WisDOT’s Erosion Control Product Acceptability List (PAL) can be found on the WisDOT web site: <http://www.dot.wisconsin.gov/business/engrserv/pal.htm> Printed copies are no longer being distributed.

X. Definitions

Noxious weed (V.B): Any weed a governing body declares to be noxious within its respective boundaries. The State of Wisconsin list of noxious weeds can be found in Statute 66.0407.

Solid Waste Byproducts (V.B): Includes industrial, commercial, residential, and agricultural wastes that have been processed, incinerated, or composted and still contain inorganic wastes such as glass and metals and organic wastes including plastics, textiles, rubber, leather, and other miscellaneous organic wastes which may be toxic or hazardous in nature.

on Channel Erosion Mat (1052)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A protective soil cover made of straw, wood, coconut fiber or other suitable plant residue, or plastic fibers formed into a mat, usually with a plastic or biodegradable mesh on one or both sides. Erosion mats are rolled products available in many varieties and combinations of material and with varying life spans.

II. Purpose

The purpose of this practice is to protect the soil surface from the erosive effect of rainfall and prevent *sheet erosion*¹ during the establishment of grass or other vegetation, and to reduce soil moisture loss due to evaporation. This practice applies to both *Erosion Control Revegetative Mats (ECRM)* and *Turf-Reinforcement Mats (TRM)*.

III. Conditions Where Practice Applies

This standard applies to erosion mat selection for use on erodible slopes.

This standard is not for channel erosion; for channel applications reference WDNR Conservation Practice Standard (1053) Channel Erosion Mat.

IV. Federal, State, and Local Laws

Users of this standard shall be aware of applicable federal, state, and local laws, rules, regulations, or permit requirements governing the use and placement of erosion mat. This standard does not contain the text of federal, state, or local laws.

V. Criteria

This section establishes the minimum allowable standards for design, installation and performance requirements. Only Wisconsin Department of Transportation (WisDOT) Erosion Control Product Acceptability List (PAL) approved mats will be accepted for use in this standard.

Slope and slope length shall be taken into consideration. This information can be found in the Slope Erosion Control Matrix located in the PAL.

To differentiate applications Erosion mats are organized into three Classes of mats, which are further broken down into various Types.

- A. **Class I:** A short-term duration (minimum of 6 months), light duty, organic mat with photodegradable plastic or biodegradable netting.
 - 1. **Type A** – Use on erodible slopes 2.5:1 or flatter.
 - 2. **Type B** – Double netted product for use on erodible slopes 2:1 or flatter.
- B. **Class I, Urban:** A short-term duration (minimum of 6 months), light duty, organic erosion control mat for areas where mowing may be accomplished within two weeks after installation.
 - 1. **Urban, Type A** – Use on erodible soils with slopes 4:1 or flatter.
 - 2. **Urban, Type B** – A double netted product for use on slopes 2.5:1 or flatter.

Conservation Practice Standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your local WDNR office or the Standards Oversight Council office in Madison, WI at (608) 833-1833.

WDNR, WI
08/03

¹ Words 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.

C. **Class II:** A long-term duration (three years or greater), organic erosion control revegetative mat.

1. **Type A** – Jute fiber only for use on slopes 2:1 or flatter for sod reinforcement.
2. **Type B** – For use on slopes 2:1 or greater made with plastic or biodegradable net.
3. **Type C** – A woven mat of 100% organic fibers for use on slopes 2:1 or flatter and in environmentally and biologically sensitive areas where plastic netting is inappropriate.

D. **Class III:** A permanent 100% synthetic ECRM or TRM. Either a soil stabilizer Type A or Class I, Type A or B erosion mat must be placed over the soil filled TRM.

1. **Type A** – An ECRM for use on slopes 2:1 or flatter.
2. **Type B or C** – A TRM for use on slopes 2:1 or flatter.
3. **Type D** – A TRM for use on slopes 1:1 or flatter.

E. Material Selection

1. For mats that utilize netting, the netting shall be bonded to the parent material to prevent separation of the net for the life of the product.
2. For urban class mats the following material requirements shall be adhered to:
 - a. Only 100% organic biodegradable netted products are allowed, including parent material, stitching, and netting.
 - b. The netting shall be stitched with biodegradable thread/yarn to prevent separation of the net from parent material.
 - c. All materials and additive components used to manufacture

the anchoring devices shall be completely biodegradable as determined by ASTM D 5338.

d. Mats with photodegradable netting shall not be installed after September 1st.

F. Installation

1. ECRMs shall be installed after all topsoiling, fertilizing, liming and seeding is complete.
2. The mat shall be in firm and intimate contact with the soil. It shall be installed and anchored per the manufacturer's recommendation.
3. TRM shall be installed in conjunction with the topsoiling operation and shall be followed by ECRM installation.
4. At time of installation, document the manufacturer and mat type by retention of material labels and manufacturer's installation instructions. Retain this documentation until the site has been stabilized.

VI. Considerations

- A. Urban mats may be used in lieu of sod.
- B. Documentation of materials used, monitoring logs, project diary and weekly inspection forms, including erosion and stormwater management plans, should be turned over to the authority charged with long term maintenance of the site.

VII. Plans and Specifications

- A. Plans and specifications for installing erosion mat shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The plans and specifications shall address the following:
 1. Location of erosion mat
 2. Installation Sequence

3. Material specification conforming to standard

- B. All plans, standard detail drawings, or specifications shall include schedule for installation, inspection, and maintenance. The responsible party shall be identified.

VIII. Operation and Maintenance

- A. Erosion mat shall at a minimum be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period.
- B. If there are signs of rilling under the mat, install more staples or more frequent anchoring trenches. If rilling becomes severe enough to prevent establishment of vegetation, remove the section of mat where the damage has occurred. Fill the eroded area with topsoil, compact, reseed and replace the section of mat, trenching and overlapping ends per manufacturer's recommendations. Additional staking is recommended near where rilling was filled.
- C. If the reinforcing plastic netting has separated from the mat, remove the plastic and if necessary replace the mat.
- D. Maintenance shall be completed as soon as possible with consideration to site conditions.

IX. References

WisDOT "Erosion Control Product Acceptability List" is available online at <http://www.dot.wisconsin.gov/business/engrserv/pal.htm> Printed copies are no longer distributed.

X. Definitions

Sheet and Rill Erosion (II): Sheet and rill erosion is the removal of soil by the action of rainfall and shallow overland runoff. It is the first stage in water erosion. As flow becomes more concentrated rills occur. As soil detachment continues or flow increases, rills will become wider and deeper forming gullies.

Erosion Control Revegetative Mats (ECRM) (II): erosion control revegetative mats designed to be placed on the soil surface.

Turf-Reinforcement Mats (TRM) (II): turf-reinforcement mats are permanent devices constructed from various types of synthetic materials and buried below the surface to help stabilize the soil. TRMs must be used in conjunction with an ECRM or an approved Type A soil stabilizer.

Field Code Changed

Ditch Check (Channel) (1062)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A temporary dam constructed across a swale or drainage ditch to reduce the velocity of water flowing in the channel. *Ditch checks*¹ can be constructed out of stone, a double row of straw bales or from engineered products found on the Wisconsin Department of Transportation (WisDOT) Erosion Control Product Acceptability List (PAL).

II. Purpose

The purpose of this practice is to reduce flow velocity and to pond water, thereby reducing active channel erosion and promoting settling of suspended solids behind the ditch check.

III. Conditions Where Practice Applies

This Standard applies where grading activity occurs in areas of channelized flows and a temporary measure is needed to control erosion of the channel until permanent stabilization practices can be applied.

Under no circumstance shall ditch checks be placed in intermittent or perennial stream without permission from WDNR. This Practice may not be substituted for major perimeter trapping measures.

IV. Federal, State, and Local Laws

Users of this standard shall be aware of applicable federal, state, and local laws, rules, regulations, or permit requirements governing the use and placement of ditch checks. This standard does not contain the text of federal, state, or local laws.

V. Criteria

This section establishes the minimum standards for design, installation and performance requirements.

A. Height

1. Installed, the minimum height of ditch checks shall be 10 inches and shall not exceed a maximum height of 16 inches for manufactured or biodegradable materials and 36 inches for stone (or other inorganic materials).
2. Ditch checks must be installed with the center lower than the sides forming a weir. If this is not done stormwater flows are forced to the edge of the ditch check thus promoting scour, or out of the channel causing excessive erosion
3. Stone ditch checks shall have a minimum top width of 2-feet measured in the direction of flow with maximum slopes of 2:1 (2 horizontal to 1 vertical) on the upslope side and 2:1 on the down slope side.

B. Placement

1. At a minimum install one ditch check for every two feet of drop in the channel.
2. Ditch checks shall be placed such that the resultant ponding will not cause inconvenience or damage to adjacent areas.

¹ Words 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.

C. Material Specifications

1. Stone ditch checks shall be constructed of a well-graded angular stone, a D_{50} of 3 inch or greater, sometimes referred to as breaker run or shot rock.
2. Ditch checks may be constructed of other approved materials but must be capable of withstanding the flow velocities in the channel. Manufactured products listed in WisDOT's PAL are also acceptable for temporary ditch checks.

Note: Silt fence and single rows of straw bales are ineffective as ditch checks and are not permitted.

D. Construction - Refer to Figure 1 & 2

1. Ditch checks shall be utilized during rough grading and shall be removed once the final grading and channel stabilization is applied, unless intended to be part of a permanent stormwater management plan.
2. Channel erosion mat or other non-erodible materials shall be placed at the base of a ditch check, and extended a minimum of 6 feet, to prevent scour and washing out the toe of the ditch check. DNR Conservation Practice Channel Erosion Mat (1053) contains criteria for the placement of erosion mat in this location.
3. Chink or seal stone and rock ditch checks to minimize the flow through the ditch check.

VI. Considerations

- A. For added stability, the base of a stone or rock ditch check should be keyed into the soil to a depth of 6-inches.
- B. Stone ditch checks may be underlain by a nonwoven geotextile fabric to ease installation and removal. If the geotextile fabric is extended, it can serve purpose specified in section V.D.2

- C. Ditch checks installed in grass lined channels may kill the vegetation if water is ponded for extended periods or excessive siltation occurs. Proper maintenance is required to keep areas above and below the ditch check stabilized.
- D. The best way to prevent sediment from entering the storm sewer system is to stabilize the disturbed area of the site as quickly as possible, preventing erosion and stopping sediment transport at its source.
- E. When placing ditch checks in swales adjacent to roadways consider designating a 'clear zone' free of obstacles posing a threat to out of control vehicles.
- F. Mowing operations may throw stones from ditch checks causing a potential safety hazard.

VII. Plans and Specifications

- A. Plans and specifications for installing ditch checks shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The plans and specifications shall address the following:
 1. Location and spacing of ditch check
 2. Schedules and sequence of installation and removal
 3. Standard drawings and installation details
 4. Rock gradation
- B. All plans, standard detail drawings, or specifications shall include schedule for installation, inspection, and maintenance. The responsible party shall be identified.

VIII. Operation and Maintenance

- A. Ditch checks shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24 hour period.
- B. Unless incorporated into a permanent stormwater management system, ditch

checks shall be removed once the final grading and channel stabilization is applied.

- C. Sediment deposits shall be removed when deposits reach 0.5 the height of the barrier. Removal of sediment may require replacement of stone. Maintenance shall be completed as soon as possible with consideration to site conditions.

IX. References

WisDOT “Erosion Control Product Acceptability List” is available online at:

<http://www.dot.wisconsin.gov/business/engrserv/pal.htm> Printed copies are no longer distributed.

X. Definitions

D_{50} (V.C.1): The particle size for which 50% of the material by weight is smaller than that size.

Ditch Checks (I) Are commonly referred to as temporary check dams. Stone ditch checks refer to those made out of either stone or rock.

Silt Fence (1056)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

Silt fence is a temporary sediment barrier of entrenched permeable geotextile fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff from small areas of disturbed soil.

II. Purpose

The purpose of this practice is to reduce slope length of the disturbed area and to intercept and retain transported sediment from disturbed areas.

III. Conditions Where Practice Applies

- A. This standard applies to the following applications:
1. Erosion occurs in the form of *sheet and rill erosion*¹. There is no concentration of water flowing to the barrier (*channel erosion*).
 2. Where adjacent areas need protection from sediment-laden runoff.
 3. Where effectiveness is required for one year or less.
 4. Where conditions allow for silt fence to be properly entrenched and staked as outlined in the Criteria Section V.
- B. Under no circumstance shall silt fence be used in the following applications:
1. Below the ordinary high watermark or placed perpendicular to flow in streams, swales, ditches or any place where flow is concentrated.
 2. Where the maximum gradient upslope of the fence is greater than 50% (2:1).

IV. Federal, State, and Local Laws

Users of this standard shall be aware of applicable federal, state, and local laws, rules, regulations, or permit requirements governing the use and placement of silt fence. This standard does not contain the text of federal, state, or local laws.

V. Criteria

This section establishes the minimum standards for design, installation and performance requirements.

A. Placement

1. When installed as a stand-alone practice on a slope, silt fence shall be placed on the contour. The parallel spacing shall not exceed the maximum slope lengths for the appropriate slope as specified in Table 1.

Slope	Fence Spacing
< 2%	100 feet
2 to 5%	75 feet
5 to 10%	50 feet
10 to 33%	25 feet
> 33%	20 feet

2. Silt fences shall not be placed perpendicular to the contour.
3. The ends of the fence shall be extended upslope to prevent water from flowing around the ends of the fence.

- B. Height** – Installed silt fences shall be a minimum 14 inches high and shall not exceed 28 inches in height measured from the installed ground elevation.

¹ Words 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.

C. Support – Silt fences shall be supported by either steel or wood supports as specified below:

1. Wood supports
 - a. The full height of the silt fence shall be supported by 1 1/8 inches by 1 1/8 inches air or kiln dried posts of hickory or oak.
 - b. The silt fence fabric shall be stapled, using at least 0.5-inch staples, to the upslope side of the posts in at least 3 places.
 - c. The posts shall be a minimum of 3 feet long for 24-inch silt fence and a minimum of 4 feet for 36-inch silt fence fabric.

2. Steel supports
 - a. The full height of the silt fence shall be supported by steel posts at least 5 feet long with a strength of 1.33 pounds per foot and have projections for the attachment of fasteners.
 - b. The silt fence fabric shall be attached in at least three places on the upslope side with 50 pound plastic tie straps or wire fasteners. To prevent damage to the fabric from fastener, the protruding ends shall be pointed away from the fabric.
3. The maximum spacing of posts for non-woven silt fence shall be 3 feet and for woven fabric 8 feet.
4. Silt fence shall have a support cord.
5. Where joints are necessary, each end of the fabric shall be securely fastened to a post. The posts shall then be wrapped around each other to produce a stable, secure joint or shall be overlapped the distance between two posts.
6. A minimum of 20 inches of the post shall extend into the ground after installation.

D. Anchoring – Silt fence shall be anchored by spreading at least 8 inches of the fabric in a 4 inch wide by 6 inch deep trench, or 6 inch deep V-trench on the upslope side of the fence. The trench shall be backfilled and compacted. Trenches shall not be excavated wider and deeper than necessary for proper installation.

On the terminal ends of silt fence the fabric shall be wrapped around the post such that the staples are not visible.

E. Geotextile Fabric Specifications – The geotextile fabric consists of either woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. Non-woven fabric may be needle punched, heat bonded, resin bonded, or combinations thereof. All fabric shall meet the following requirements as specified in Table 2.

Test Requirement	Method	Value ¹
Minimum grab tensile strength in the machine direction	ASTM D 4632	120 lbs. (550 N)
Minimum grab tensile strength in the cross machine direction	ASTM D 4632	100 lbs. (450 N)
Maximum apparent opening size equivalent standard sieve	ASTM D 4751	No. 30 (600 μm)
Minimum permittivity	ASTM D 4491	0.05 scc ⁻¹
Minimum ultraviolet stability percent of strength retained after 500 hours of exposure	ASTM D 4355	70%

(WisDOT Standard Specifications for Road and Bridge Construction, 2001)

¹ All numerical values represent minimum / maximum average roll values. (For example, the average minimum test results on any roll in a lot should meet or exceed the minimum specified values.)

Silt fence shall have a maximum flow rate of 10-gallons/minute/square foot at 50mm constant head as determined by multiplying permittivity in 1/second as determined by ASTM D-4491 by a conversion factor of 74.

F. Removal – Silt fences shall be removed once the disturbed area is permanently stabilized and no longer susceptible to erosion.

VI. Considerations

- A. Improper placement as well as improper installation and maintenance of silt fences will significantly decrease the effectiveness of this practice.

Silt fences should be considered for trapping sediment where sheet and rill erosion may be expected to occur in small drainage areas. Silt fences should not be placed in areas of concentrated flow.

- B. Silt fences should be installed prior to disturbing the upslope area.
- C. Silt fences should not be used to define the boundaries of the entire project. Silt fence should be placed only in areas where it is applicable due to its cost and the fact that it is not biodegradable. For example, silt fence should not be placed in locations where the natural overland flow is from an undisturbed area into disturbed areas of the project. It should also not be used as a diversion.
- D. Silt fence should not be used in areas where the silt fence is at a higher elevation than the disturbed area.
- E. When placing silt fence near trees, care should be taken to minimize damage to the root system. Avoid compaction and root cutting within 1.5 feet multiplied by the inch diameter of the tree (for example: for 10-inch trees keep out a 15-foot radius from the trunk). Refer to UWEX publication Preserving Trees During Construction for more information.
- F. To protect silt fence from damage in areas of active construction or heavy traffic, silt fence should be flagged, marked, or highlighted to improve visibility.
- G. Silt fence effectiveness is generally increased when used in conjunction with other upslope erosion control practices. To further strengthen the silt fence, straw / hay bales can be placed on the down slope side.
- H. To help ensure effectiveness, silt fence should be inspected and repaired as necessary prior to forecasted rain events.

- I. Where installation with wood posts is difficult, such as when hard or frozen ground is encountered, the use of steel post is recommended.
- J. Silt fence can be mechanically installed with a plow type device provided that the silt fence is trenched in a manner such that equivalent performance is achieved to that specified in Section V.D.

VII. Plans and Specifications

- A. Plans and specifications for installing silt fence shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The plans and specifications shall address the following:
 1. Location of silt fence
 2. Contributory drainage area
 3. Schedules
 4. Material specification conforming to standard
 5. Standard drawings and installation details
 6. Restoration after removal
- B. All plans, standard detail drawings, or specifications shall include schedule for installation, inspection, and maintenance. The responsible party shall be identified.

VIII. Operation and Maintenance

- A. Silt fences shall at a minimum be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24 hour period.
- B. Damaged or decomposed fences, undercutting, or flow channels around the end of barriers shall be repaired or corrected.
- C. Sediment shall be properly disposed of once the deposits reach $\frac{1}{2}$ the height of the fence.

IX. References

X. Definitions

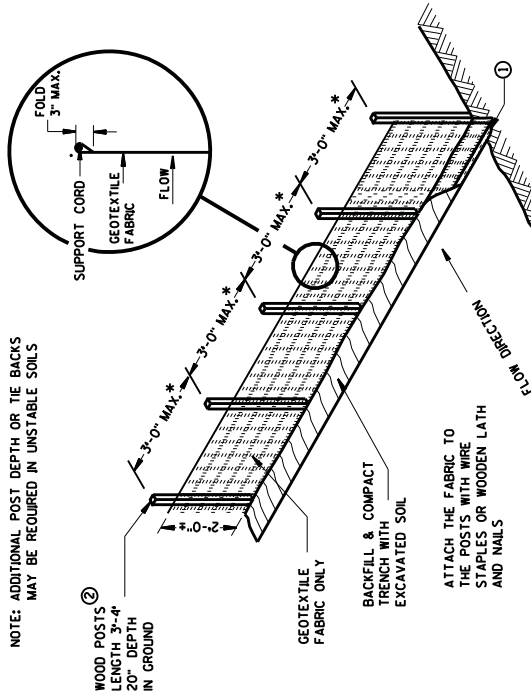
Channel Erosion (III.A.1): The deepening and widening of a channel due to soil loss caused by flowing water. As rills become larger and flows begin to concentrate, soil detachment occurs primarily as a result of shear.

Sheet and Rill Erosion (III.A.1): Sheet and rill erosion is the removal of soil by the action of rainfall and shallow overland runoff. It is the first stage in water erosion. As flow becomes more concentrated rills occur. As soil detachment continues or flow increases, rills will become wider and deeper forming gullies.

GENERAL NOTES

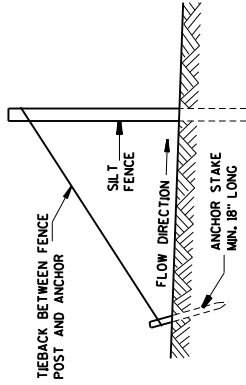
- ① TRENCH SHALL BE A MINIMUM OF 4" WIDE & 6" DEEP TO BURY AND ANCHOR THE GEOTEXTILE FABRIC. FOLD MATERIAL TO FIT TRENCH AND BACKFILL & COMPACT TRENCH WITH EXCAVATED SOIL.
- ② WOOD POSTS SHALL BE A MINIMUM SIZE OF 1/6" X 1/6" OF OAK OR HICKORY.
- ③ CONSTRUCT SILT FENCE FROM A CONTINUOUS ROLL IF POSSIBLE 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

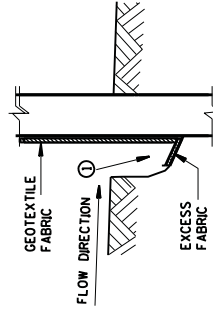


* NOTE: 8'-0" POST SPACING ALLOWED IF A WOVEN GEOTEXTILE FABRIC IS USED.

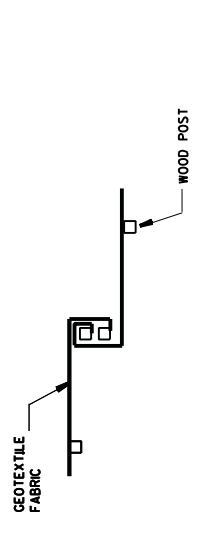
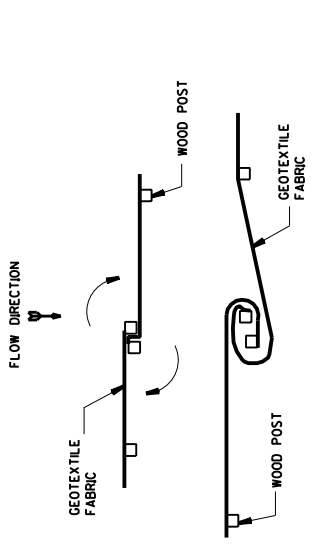
SILT FENCE



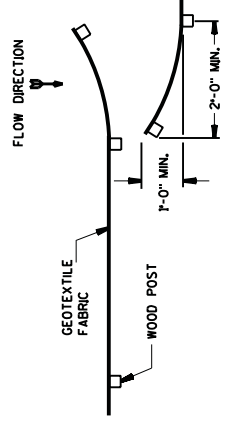
SILT FENCE TIE BACK
(WHEN ADDITIONAL SUPPORT REQUIRED)



TRENCH DETAIL



TWIST METHOD



HOOK METHOD
JOINING TWO LENGTHS OF SILT FENCE ④

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

SILT FENCE

Figure C9 - WDNR Tech Std 1056

Appendix D
Certification

CERTIFICATION:

Operator:

I, _____, as an authorized representative of _____, certify that the proposed reclamation of the site referenced in this document will be carried out in accordance with the proposed reclamation plan and any subsequent, approved changes.

Owner and/or Lessee:

I, _____, certify that I concur with the reclamation plan submitted and will allow its implementation.

(If the mine operator has submitted a reclamation plan for an existing mine in accordance with an automatic permit or if the operator has submitted a reclamation plan for a new or reopened mine which is located on land for which a lease agreement or memorandum of lease between the landowner and applicant was recorded prior to August 1, 2001, a certification is not required from the owner or lessee. However, the operator must provide written evidence that the landowner and lessee, if different from the operator, has been provided with a written copy of the reclamation plan)

<http://www.dnr.state.wi.us/org/aw/wm/publications/mining/NonmetRecPlan.pdf>