



WISCONSIN
CONSTRUCTION SITE
EROSION CONTROL
FIELD GUIDE



Montgomery Associates
Resource Solutions, LLC



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ACRONYMS

- **WDNR T.S.** Wisconsin Department of Natural Resources Stormwater Management Technical Standard
- **WisDOT PAL** Wisconsin Department of Transportation Product Acceptability List
- **BMP** Best Management Practice

CONTACTS

- **Montgomery Associates, Resource Solutions**
119 S. Main Street | Cottage Grove, WI 53527
(608) 839-4422 | <http://www.ma-rs.org>
- **Earth and Road**
101 Skyline Drive | Arlington, WI 53911
(608) 635-7755 | www.earthandroad.com

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- Wisconsin Department of Transportation (WisDOT)
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- Dane County Land and Water Resources Department
- Gil Layton, Layton Environmental
- U.S. Environmental Protection Agency (EPA)

This guide is current as of February 18, 2016.

Background



As our society has become more environmentally aware, federal, state and local regulatory agencies have recognized the impacts of sediment pollution on our lakes streams and wetlands and established rules to reduce those impacts.

Project owners and contractors are required to meet the standards prescribed in the rules during construction. Consequently, erosion control Best Management Practices (BMPs) have become a standard part of the construction process.

Erosion control BMPs are designed to limit off-site effects of erosion, aid in project construction while minimizing overall cost, and to comply with federal, state, and local laws and regulations.

BMPs can be generally classified into two categories, erosion control and sediment control.

- Erosion Control - Directly protect the disturbed soil surface from erosion. They are the best measure for preventing erosion.
- Sediment Control - Aid in removal of sediments from water after the erosion process has already begun. This is accomplished by using barriers, containments, or other devices to filter or reduce the velocity of the water so soil particles can no longer remain suspended.

There are many types and uses of temporary and permanent erosion control that may be used on a project. This guide is intended to aid contractors in selecting and correctly installing BMPs to reduce erosion.

WISCONSIN DEPARTMENT OF TRANSPORTATION PRODUCT ACCEPTABILITY LIST (PAL)

<http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrcs/tools/pal/default.aspx>

This list provides guidance in installation and proper use of erosion and sediment control products. The Product Acceptability List pages are for the guidance of design engineers, technicians, and inspection personnel, municipalities, counties, contractors, and suppliers engaged in bridge and highway design, plan preparation, and construction.

Categories include erosion mats, tackifiers, soil stabilizers, inlet protection, FF fabric, temporary ditch checks, sediment traps, and articulated concrete block revetment systems. Projects permitted by the State of Wisconsin shall utilize products listed on the PAL when appropriate.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES STORMWATER CONSTRUCTION AND POST-CONSTRUCTION TECHNICAL STANDARDS

<http://dnr.wi.gov/topic/stormwater/standards>

Stormwater Construction and Post-Construction Technical Standards are minimum requirements needed to plan, design, install and maintain a wide array of conservation practices aimed at preserving the land and water resources of Wisconsin. The WDNR recommends that these technical standards be used for erosion/sediment control or stormwater management as they have been determined to be adequate and effective to implement the performance standards of subch. III or IV of ch. NR 151 and Trans 401.06, WI Administrative Code.

BMP Matrix

WDNR T.S.	Best Management Practice	Construction		Site Features		
		Summer	Winter	Steep Slopes	Ditches or Channels	Sensitive Features
		May-September	October-April	Slopes > 10%	Concentrated Flow	Wetlands, Waterways, Streams
Erosion Control						
1050	Polyacrylamide (PAM)	OK	OK	OK	OK	OK
1052	Non-Channel Erosion Mat	OK	OK	OK	OK	OK
1053	Channel Erosion Mat	OK	OK	OK	OK	OK
1058	Mulch	OK	OK	OK	OK	OK
1059	Seeding	OK	OK	OK	OK	OK
1067	Temporary Grading Practices	OK	OK	OK	OK	OK
1068	Dust Control	OK	OK	OK	OK	OK

WDMR T.S.	Best Management Practice	Construction		Site Features			Sensitive Features Wetlands, Waterways, Streams
		Summer	Winter	Steep Slopes	Ditches or Channels	Concentrated Flow	
		May- September	October- April	Slopes >10%			
Sediment Control							
1051	Water Application of Polymers	OK	OK	OK	OK	OK	OK
1054	Vegetative Buffer	OK	OK	OK	OK	OK	OK
1055	Sediment Bale Barrier	OK	OK	OK	OK	OK	OK
1056	Silt Fence	OK	OK	OK	OK	OK	OK
1057	Tracking Pad and Tire Washing	OK	OK	OK	OK	OK	OK
1060	Storm Drain Inlet Protection	OK	OK	OK	OK	OK	OK
1061	Dewatering	OK	OK	OK	OK	OK	OK
1062	Temporary Ditch Check	OK	OK	OK	OK	OK	OK
1063	Sediment Trap	OK	OK	OK	OK	OK	OK
1064	Sediment Basin	OK	OK	OK	OK	OK	OK
1066	Construction Site Diversion	OK	OK	OK	OK	OK	OK
1069	Turbidity Barrier	OK	OK	OK	OK	OK	OK
1070	Silt Curtain	OK	OK	OK	OK	OK	OK
1071	Temporary Slope Breaks	OK	OK	OK	OK	OK	OK

Polyacrylamide (PAM) (WDNR T.S. 1050)



DEFINITION

The land application of products containing water soluble anionic polyacrylamide (PAM) as temporary soil binding agents to reduce erosion.

PURPOSE

To reduce erosion from wind and water on construction sites and agricultural lands.

CONDITIONS WHERE PRACTICE APPLIES

Intended for direct soil surface application to sites where the timely establishment of vegetation may not be feasible or where vegetative cover is absent or inadequate. Such areas may include agricultural lands where plant residues are inadequate to protect the soil surface and construction sites where land disturbing activities or winter shutdown prevent establishment or maintenance of a cover crop.

This practice is not intended for application to surface waters of the state as defined by WDNR ch. NR 102.

POLYACRYLAMIDE (PAM) INSTALLATION

Application

- Selected from the approved list in the WisDOT PAL. This product is defined as “Soil Stabilizer, Type B” on the WisDOT PAL.
- Apply PAM by the methods and at the rates specified by manufacturer.
- PAM may be used either alone as a temporary stabilization measure or in conjunction with seeding and mulching for permanent restoration.
- PAM is particularly applicable for temporary stabilization of disturbed areas that will receive intermittent periods of disturbance throughout a construction project.
- May be applied with conventional hydraulic seeding equipment or through dry spreading. Choose application method for uniform coverage and to minimize drift to non-target areas. Prevent over-spray from reaching pavement (pavement becomes slippery).

Restrictions

- Do not be use in areas within 30 feet of wetlands, waterways, or channels.
- Use of PAM shall be restricted to slopes 3 horizontal : 1 vertical or flatter.

Documentation

- Pin flags showing the location of PAM application and indicating the type applied, the rate of application, and the date of application should be placed immediately after application.
- Document and keep with the erosion control plan and inspection notes:
 - » Name of person performing the application;
 - » Date, location of application, and weather conditions;
 - » Type of PAM applied (manufacturer, product name, concentration);
 - » Application rate per acre, amount of material used, and method.

INSPECTION AND MAINTENANCE

Reapply after disturbance, large rain events, or where wind/rill erosion is apparent since the last application. May lose effectiveness in 2 months.

Water Application of Polymers (WDNR T.S. 1051)



DEFINITION

The application of products containing polymers to sediment control structures.

PURPOSE

To settle out or remove suspended sediment from water within sediment control structures.

CONDITIONS WHERE PRACTICE APPLIES

- Use to improve the sediment removal efficiency of self-contained sediment control structures (such as a detention basin), on a temporary basis for construction sites or, in an emergency, for post-construction sites.
- Do not apply polymers directly to surface waters of the state.
- If used in accordance with the use restriction, polymer must meet an acceptable level of risk such that it can be used without harm to organisms that inhabit or come in contact with the aquatic environment. Every attempt shall be made to eliminate any environmentally toxic chemicals within a polymer mixture, and must be non-combustible.
- Contact the WDNR Storm Water Coordinator at (608) 266-2621 to get the latest "List of Water Applied Polymers for Sediment Control Completing Toxicity Testing."

WATER APPLICATION OF POLYMERS INSTALLATION

Application

- Maximum application rates in pounds per acre-feet shall be the lesser of WDNR's use restriction multiplied by 1.35 or manufacturer's rate.
- Neither the manufacturer's written application rate recommendations, nor the application rate shall exceed the WDNR use restriction.
- The manufacturer or distributor shall provide for the applicator:
 - » Labels affixed to the polymer mixture containers that indicate the recommended application rate and the maximum application rate based on the use restriction;
 - » Product expiration date for the polymer mixture based on product expiration dates of the polymer and written application methods;
 - » Written instructions for safety, storage, and mixing of their product.
- The product must be applied uniformly and in one of the following ways:
 - » *Passive Applications:* Polymers applied by non-mechanically dosing the sediment laden inflow prior to it entering the impoundment area of the sediment control structure. Manufacturer must base passive application rates on the dissolution rate and/or the dead storage volume of the sediment control structure. Or;
 - » *Active or Mechanical Applications:* Polymer applied by mechanically or hydraulically mixing directly into a sediment control structure.

Documentation

- » Name of applicator, product type, and method of application;
- » Application rate in pounds per acre-feet of stormwater runoff;
- » Date applied and weather conditions during application;
- » Enter copies of this documentation into the contractor's monitoring log or a project diary at the time of application. Must be made available upon request.

INSPECTION AND MAINTENANCE

Monitor sediment levels on the bottom of the structure to measure the loss of storage capacity due to enhanced sedimentation by the polymer mixture.

Non-Channel Erosion Control Mat (WDNR T.S. 1052)



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. Rolled products are available in many varieties and combinations of material and with varying life spans.

PURPOSE

To protect the soil surface from the erosive effect of rainfall and prevent sheet erosion during the establishment of grass or other vegetation, and to reduce soil moisture loss due to evaporation. Applies to both Erosion Control Revegetative Mats (ECRM) and Turf-Reinforcement Mats (TRM).

CONDITIONS WHERE PRACTICE APPLIES

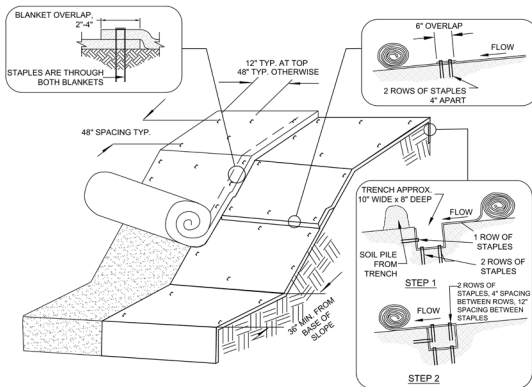
Erosion mats for use on erodible slopes. Not for channel erosion; for channel applications see WDNR T.S. Channel Erosion Mat (1053).

NON-CHANNEL EROSION CONTROL MAT INSTALLATION

- Use only products listed in the WisDOT PAL.
- Erosion mat shall be in firm and continuous contact with the soil and extend upslope one-foot from land disturbance.
- Where possible, use a single roll of EC mat to span the disturbed area.

NON-CANNEL EROSION CONTROL MAT INSTALLATION

- Staples used for erosion mats shall be 1-2 inch wide, U-shaped, made of No.11 (3.05mm) or larger diameter steel wire, and not less than 6 inches long for firm soils and 12 inches long for loose soils.
- In areas with mowed turf or where animal entrapment is possible use urban mats. Urban mats and associated anchoring devices shall be selected based upon the WisDOT Pal.
- Erosion mat shall be anchored, overlapped, staked and entrenched per the manufacturer's recommendations.
- This detail is an example of typical installation guidance.



INSPECTION AND MAINTENANCE

Install additional anchoring in areas of rilling and concentrated flow beneath the mat. If rilling is preventing vegetation establishment, remove erosion mat, regrade, compact, re-seed, and replace the section of mat.

Channel Erosion Mat (WDNR T.S. 1053)



DEFINITION

A protective soil cover 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. Rolled products are available in many varieties and combination of materials and with varying life spans.

PURPOSE

To protect the channel from erosion or act as turf reinforcement during and after the establishment of grass or other vegetation in a channel. Applies to erosion control revegetative mats (ECRM) and turf-reinforcement mats (TRM).

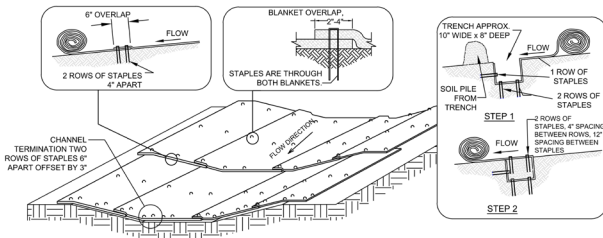
CONDITIONS WHERE PRACTICE APPLIES

Where runoff channelizes in intermittent flow and vegetation is to be established. Some products may have limited applicability in projects adjacent to navigable waters.

Product selection must be specified by the design engineer.

CHANNEL EROSION MAT INSTALLATION

- Must be prepared or reviewed by an engineer to determine correct product application for site conditions.
- Only products listed in the WisDOT PAL are acceptable for use.
- All products shall be installed per the manufacturer's recommendations, including required staple spacing and patterns.
- Staple materials shall be per the manufacturer's recommendations.
- Mats shall extend upslope 1-ft vertically from the ditch bottom or 6 inches higher than the design flow depth, whichever is greater.
- Mats shall be in firm and continuous contact with the soil.
- Avoid placing side-by-side lap joints in the bottom of channels.
- This detail is an example of typical installation guidance.



INSPECTION AND MAINTENANCE

Install additional anchoring in areas of rilling and concentrated flow beneath the mat. If rilling is preventing vegetation establishment, remove erosion mat, regrade, compact, re-seed, and replace the section of mat.

Vegetative Buffer (WDNR T.S. 1054)



DEFINITION

An area of dense vegetation intended to slow runoff and trap sediment. Vegetative buffers are commonly referred to as filter or buffer strips.

PURPOSE

To remove sediment in sheet flow by velocity reduction.

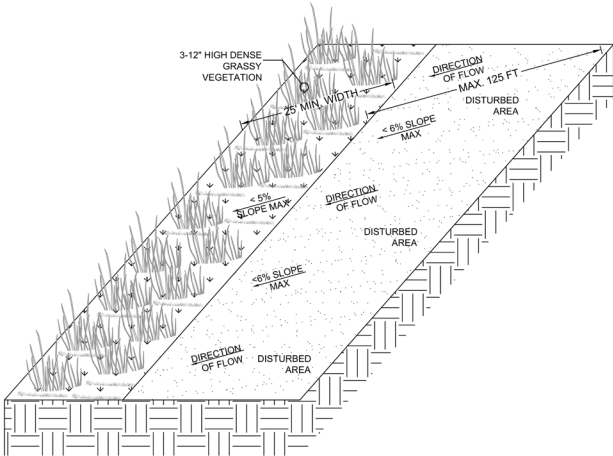
CONDITIONS WHERE PRACTICE APPLIES

Areas where sediment delivery is in the form of sheet and rill erosion from disturbed areas.

VEGETATIVE BUFFER INSTALLATION

- Shall consist of a dense stand of existing grassy vegetation or vegetation established during the project provided sufficient vegetative cover is established prior to land disturbing activities.
- Must be clearly marked as area of no disturbance, including vehicle traffic.
- Vegetative buffers are only effective if sheet flow conditions are present.

- This detail is an example of typical installation guidance.



INSPECTION AND MAINTENANCE

Look for improper distribution of flows, sediment accumulation, and rill erosion. If the vegetative buffer becomes sediment covered, shows rill erosion, or is ineffective, other practices must be implemented.

Sediment Bale Barrier (WDNR T.S. 1055)



DEFINITION

A temporary sediment barrier consisting of a row of entrenched and anchored straw bales, hay bales or equivalent material used to intercept sediment-laden sheet flow from small drainage areas of disturbed soil.

PURPOSE

To reduce slope length of the disturbed area and to intercept and retain transported sediment from disturbed areas.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to the following applications where:

- Erosion occurs in the form of sheet and rill erosion. There is no concentration of water flowing to the barrier (channel erosion).
- Where adjacent areas need protection from sediment-laden runoff.
- Effectiveness is required for less than 3 months.
- Conditions allow for the bales to be properly entrenched and staked as outlined in the Criteria Section V of WDNR T.S. Sediment Bale Barrier (1055).

Under no circumstance shall products be used in the following applications:

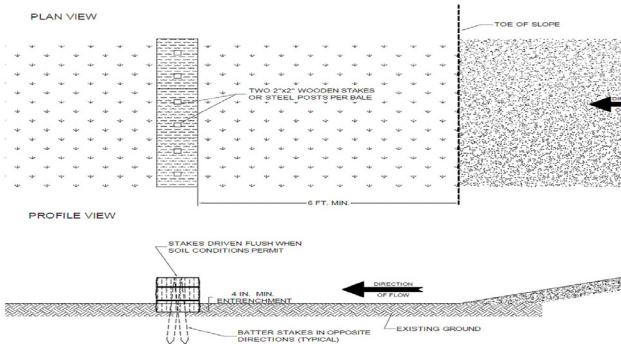
- Below the ordinary high watermark or placed perpendicular to flow in streams, swales, ditches or any place where flow is concentrated.
- Where the maximum gradient upslope of the fence is $>50\%$ (2:1).

SEDIMENT BALE BARRIER INSTALLATION

- Install materials per manufacturer's recommendations.
- When joints are necessary, overlap and secure to minimize potential for concentrated flow. Ends should tie into the slope to prevent erosion from concentrated flow around the ends.
- Should be used in conjunction with permanent restoration practices.
- When not used in conjunction with other practices, install spacing per:

Slope	Spacing
< 2 %	100 feet
2 - 5 %	75 feet
5 - 10 %	50 feet

- This detail is an example of typical installation guidance.



INSPECTION AND MAINTENANCE

Look for indicators that water is eroding around the ends, undercutting the barrier, or erosion is occurring downslope. Remove sediment from behind barrier when reaching 1/2 the height. Remove when permanent vegetation is established.

Silt Fence (WDNR T.S. 1056)



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 to create ponding.

PURPOSE

Reduce slope length and intercept and retain sediment from disturbed areas.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to the following applications where:

- Erosion occurs in the form of sheet and rill erosion. There is no concentration of water flowing to the barrier (channel erosion).
- Where adjacent areas need protection from sediment-laden runoff.
- Where effectiveness is required for one year or less.
- Where conditions allow for silt fence to be properly entrenched and staked as outlined in the Criteria Section V of WDNR T.S. Silt Fence (1056).

Under no circumstance shall products be used in the following applications:

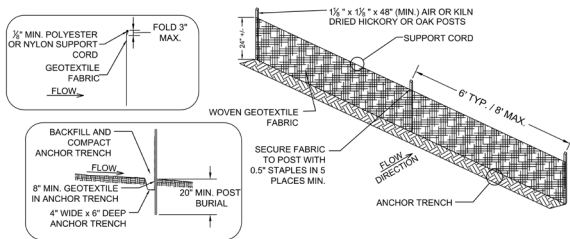
- Below the ordinary high watermark or placed perpendicular to flow in streams, swales, ditches or any place where flow is concentrated.
- Where the maximum gradient upslope of the fence is $>50\%$ (2:1).
- Lettering on the fence is not permissible on WisDOT projects.
- Must have support cord.

SILT FENCE INSTALLATION

- Construct in an arc with the ends pointing upslope to avoid erosion around ends of the fence. Best installation method is static slicing. Failure to properly anchor silt fence could result in water and sediment release beneath the silt fence. It is critical to backfill and compact the trench.
- Construct from a continuous roll of geotextile to avoid joints. Where joints are necessary, overlap to the next post or wrap adjoining fabrics together around the joint post and tightly fasten.
- When not used in conjunction with other practices and when using for slope interruption, install spacing per:

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

- This detail is an example of typical installation guidance.



INSPECTION AND MAINTENANCE

Look for indicators that water is eroding around the ends, undercutting the barrier, or erosion downslope. Remove sediment behind silt fence when reaching 1/2 the height. Remove when permanent vegetation is established.

Tracking Pad and Tire Washing (WDNR T.S. 1057)



DEFINITION

A stabilized pad of stone aggregate or tire washing station located at any point where traffic will egress a construction site.

PURPOSE

To reduce off-site sedimentation by eliminating the tracking of sediment from construction sites.

CONDITIONS WHERE PRACTICE APPLIES

- Either a stone tracking pad or tire washing station shall be used at all points of construction egress.
- This standard applies where construction traffic is likely to transport sediment off site into live traffic.

TRACKING PAD AND TIRE WASHING INSTALLATION

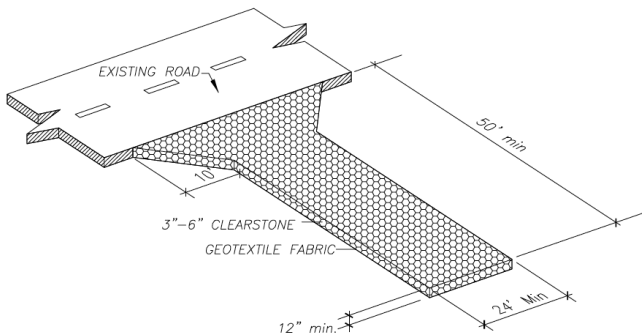
Tracking Pad

- » Install prior to any traffic leaving the site;
- » The aggregate shall be 3-6 inch clear or washed stone and placed in a layer >12 inches thick. If saturated conditions are expected, underlay stone tracking pads with a WisDOT Type R geotextile fabric. Must be the full width of the egress point;

- » Tracking pad must be >50 feet long;
- » Prevent surface water from passing through the tracking pad. Flows shall be diverted away from tracking pads or conveyed under and around by using culverts, water bars, or similar practices.

Tire Washing

- » If sediment is not adequately removed from vehicle tires by tracking pad, wash tires with pressurized water before entering a public road;
 - » Shall be located on site in an area that is stabilized and drains into suitable sediment trapping or settling device;
 - » The wash rack shall consist of a heavy grating over a lowered area. The rack must be strong enough to support crossing vehicles;
 - » Rocks lodged between the tires of dual wheel vehicles shall be removed prior to leaving the construction site.
- This detail is an example of typical tracking pad installation guidance.



INSPECTION AND MAINTENANCE

Maintain by scraping or top dressing with more aggregate.

Mulch (WDNR T.S. 1058)



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.

PURPOSE

To reduce soil erosion, aid in seed germination and establishment of plant cover or conserve soil moisture.

CONDITIONS WHERE PRACTICE APPLIES

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 not appropriate in areas of concentrated flow.

ACCEPTABLE MULCH TYPES

- Straw or hay in air-dry condition, wood excelsior fiber, or wood chips, or other suitable material of a similar nature that the engineer approves. Use of marsh hay will not be accepted. All mulch material shall be free of noxious weeds and objectionable foreign matter.
- Wood chips or wood bark should be used as for temporary stabilization only and should not be used in conjunction with seeding.

MULCH INSTALLATION

Prepare area to remove gullies/rills. If seeding, apply prior to mulch.

Wood Chips or Bark Mulch

- Apply at uniform rate of 9 tons/acre. Mulch should cover a minimum of 80% of the soil surface with an applied thickness of 0.5 - 1.5 inches.

Straw Mulch

- Apply at a uniform rate of 2 tons/acre. Mulch should cover a minimum of 70% of the soil surface with an applied thickness of 0.5 - 1.5 inches.
- If straw mulch is used without seeding, apply at a uniform rate of 3 tons/acre. Mulch should cover a minimum of 80% of the soil surface with an applied thickness of 1.5 - 3.0 inches.
- Anchor by crimping or with a tackifier.

Straw Mulch Crimping

- Just after spreading, anchor mulch using a crimper or equivalent device consisting of a series of dull flat discs with notched edges spaced approximately 8 inches apart to impress mulch in the soil to a depth of 1 - 3 inches.

Straw Mulch Tackifiers

- Selected from the approved list in the WisDOT PAL. Apply at a uniform rate.
- Spray tackifier at the same time as the mulch application or just after. Do not spray during conditions preventing proper placement of adhesive.
- Apply at rate per acre specified below or at manufacturer's recommended rate, whichever is greater:
 - » *Latex base*: mix 15 gallons adhesive and a minimum of 250 pounds recycled newsprint (pulp) as tracer with 375 gallons water;
 - » *Guar gum*: mix 50 pounds dry adhesive and a minimum of 250 pounds recycled newsprint (pulp) as tracer with 1,300 gallons water;
 - » *Other tackifiers*: mix 100 pounds dry adhesive and a minimum of 250 pounds recycled newsprint (pulp) as tracer with 1,300 gallons water.

INSPECTION AND MAINTENANCE

Reapply as needed.

Seeding (WDNR T.S. 1059)



DEFINITION

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

PURPOSE

Temporary Seeding reduces runoff and erosion until permanent vegetation or other erosion control practices can be established.

Permanent Seeding permanently stabilizes areas of exposed soil.

Nurse Crop is seeded with a permanent mix to provide fast-growing cover to protect the soil surface until permanent vegetation becomes established.

CONDITIONS WHERE PRACTICE APPLIES

Areas of exposed soil where the establishment of vegetation is desired.

- Temporary seeding: 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: where perennial vegetative cover is needed.

SEED

- Seed shall conform to WI statutes and WI Administrative Code ch. ATCP 20 regarding noxious weed seed content and labeling.
- Use seed within one year of test date appearing on the label.
- Store seed to protect it from damage by heat, moisture, rodents. Discard and replace previously tested and accepted seed that becomes damaged.

SEEDING INSTALLATION

Seedbed Preparation

- Permanent seeding needs a seedbed of at least 4 inches of loose topsoil.
- Necessity of fertilizer application should be based on soil testing results. Prior to seeding, work the area being seeded with appropriate equipment to prepare a tilled, fine, but firm seedbed. Remove rocks, twigs, foreign materials, and dirt clods >2 inches diameter that cannot be broken down.

Sowing

- Apply uniformly over the seedbed at the correct seeding rate. Appropriate seed mixes should be lightly incorporated into the seedbed.

DOT Seed Mixture	Sowing Rate [pounds/1,000 square feet]
10	1.5
20	3
30	2
40	2
60	equivalent seeding rate of 1.5
70 and 70A	0.4
75	0.7
80	0.8
Temporary Seeding	3
Nurse Crop Seeding	0.8

- Seed when soil temperatures remain consistently above 53° F. Avoid seeding during periods where seedlings could be damaged or killed by frost (usually late September to early November).
- Dormant seed after November 1. Do not sow seeds over snow cover.

Seed Protection

- Protect seed using mulch (WDNR T.S. 1058) or erosion mat (WDNR T.S. 1052). Limit vehicle traffic in areas that have been permanently seeded.

INSPECTION AND MAINTENANCE

Inspect per permit requirements. Verify seed germination and vegetation establishment. Maintenance includes reapplying mulch and matting, irrigating, regrading, and reseeded.

Storm Drain Inlet Protection (WDNR T.S. 1060)



DEFINITION

A temporary device installed in or around a storm drain inlet, drop inlet or curb inlet.

PURPOSE

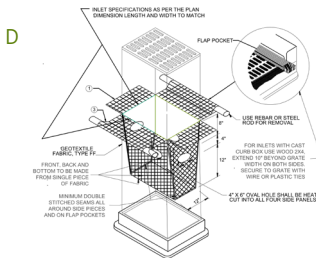
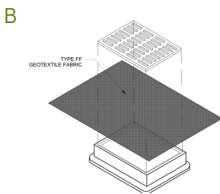
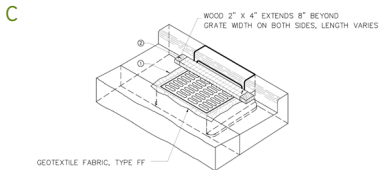
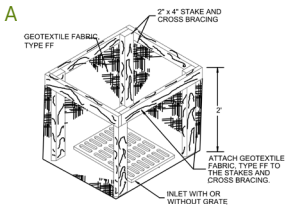
To minimize sediment from entering storm drains before stabilizing the contributing drainage area.

CONDITIONS WHERE PRACTICE APPLIES

- Where runoff from construction sites enters conveyance system structures such as drain inlets, drop inlets and curb inlets.
- Inlet protection devices are for drainage areas of one acre or less.
- Runoff from areas >1 acre should be routed through a properly designed sediment trapping or settling practice upstream of the inlet.

STORM DRAIN INLET PROTECTION INSTALLATION

- All fabrics used as part of an inlet protection device must meet WisDOT specifications for the selected fabric.
- Type FF geotextile fabric shall be used for Type A, B, C, or D devices. Replaceable interior fabric for Type D-M shall be selected based on exposed soil texture. Type D-HR shall have Type FF for the upper half and Type HR for the lower half of the device.
- Trim excess fabric in the flow line to within 2 inches of the grate.



TYPES B AND C

- Include a method of maintenance, using a sewn flap, hand holds, or other method to prevent sediment from entering the inlet.
- An additional 18 inches of fabric is wrapped around the wood and secured with staples. Wood shall not block the height of the curb box.

TYPE D

- Do not install in inlets shallower than 30 inches.
- Install >3 inch side clearance between the inlet walls and bag, measured at the bottom of the overflowing holes. Where necessary, cinch the bag to achieve the 3 inch clearance. Place ties <4 inches from bottom of the bag.

INSPECTION AND MAINTENANCE

When removing or maintaining inlet protection, trapped sediment must not fall into the inlet. Remove fallen sediment immediately. Maintain when device is no longer functioning and dispose of sediment properly.

Dewatering (WDNR T.S. 1061)



DEFINITION

A compartmented container, settling basin, filter, or other appropriate best management practice through which sediment-laden water is conveyed to trap and retain the sediment.

PURPOSE

To determine appropriate methods and means to remove sediment from water generated during dewatering activities prior to discharging off-site or to waters of the state. Practices meet the de-watering performance standard to the maximum extent practicable (MEP) as defined in NR 151.11(6)(c).

CONDITIONS WHERE PRACTICE APPLIES

Where sediment laden water needs to be removed for construction or maintenance activities. Dewatering practices shall meet criteria in the WDNR T.S. Dewatering (1061) Dewatering Practice Selection Matrix.

This practice does not apply to water being discharged directly to groundwater or karst features (see NR140) or well dewatering systems (see NR 812).

CONSIDERATIONS

- Municipal storm drainage system may need cleaning prior to/after discharging to prevent scouring solids from the drainage system.
- Do not use geotextile bags when discharging to ORW, ERW, waterbodies supporting cold water communities, trout streams, or susceptible wetlands.
- Pressurized filtration is most efficient for removing fine sediments.
- Portable sediment tanks may be appropriate when other sediment trapping practices cannot be installed.
- Filtration is not an efficient treatment of water with heavy sediment loads. Use a settling tank or sand filter as pretreatment when possible.
- Practices may need to be combined to achieve intended results.

DEWATERING INSTALLATION

- Select practices based on soil texture at the dewatering site with consideration of pumping or flow rates, volumes and device effectiveness.
- WDNR T.S. Dewatering (1061) Dewatering Practice Selection Matrix illustrates acceptable dewatering options and their effective ranges.
- Practices selected that are not on the matrix must provide an equivalent level of control, with justification provided to the reviewing authority.

INSPECTION AND MAINTENANCE

- If the dewatering effluent is discolored, has an odor, an oily sheen, or other toxins are present notify the DNR immediately:
 - » **24 Hours Spills Reporting Hotline 1-800-943-0003**
- Remove sediment from devices. Properly dispose of all sediment collected.
- Document test results on a daily log and keep on site:
 - » Discharge duration and specified pumping rate;
 - » Observed water table at time of dewatering;
 - » If used, type and amount of chemical used for pH adjustment;
 - » If used, type and amount of polymer used for treatment;
 - » Maintenance activities.

Dewatering Practice Selection Matrix

DEWATERING PRACTICE SELECTION MATRIX Type of Device	Soil and Particle Size Classification		
	Coarse to Medium Sand, Loamy Sands, and Sandy Loams	Medium to Fine Loams, Silt Loams, and Silts	Fine to Very Fine Clay Loams, Silty Clays, and Clay
Clay Geotextile Bags			
Type I	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective
Type II	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective
Gravity Based Settling			
Sediment Tank (Portable)	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective
Sediment Trap (Temporary)	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective
Sediment Basin (Temporary)	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective
Wet Detention Basin (Permanent)	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective
Passive Filtration			
Filter Tank (Portable)	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective
Filter Basin	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective
Vegetative Filter	Effective range of device	Device applicable, may not be cost effective	Device applicable, may not be cost effective








Effective range of device:

Device applicable, may not be cost effective:

Effective range with addition of polymer:



- (1) The effectiveness of many practices can be enhanced through the use of polymer mixture.
 (2) Soil classification shall be done in accordance to an accepted method (i.e. USDA, AASHTO)

DEWATERING PRACTICE SELECTION MATRIX	Soil and Particle Size Classification		
	Coarse to Medium	Medium to Fine	Fine to Very Fine
	Sand, Loamy Sands, and Sandy Loams	Loams, Silt Loams, and Silts	Clay Loams, Silty Clays, and Clay
Type of Device			
Pressurized Filtration			
Portable Sand Filter			
Wound Cartridge Units			
Membranes and Micro-filtration			
Other Practices			
Sanitary Sewer Discharge			
Pump Truck			
Alternative Method	Discuss with regulatory authority.		

Effective range of device:

Device applicable, may not be cost effective:

Effective range with addition of polymer:



- (1) The effectiveness of many practices can be enhanced through the use of polymer mixture.
- (2) Soil classification shall be done in accordance to an accepted method (i.e. USDA, AASHTO)

Temporary Ditch Check (WDNR T.S. 1062)



DEFINITION

A temporary dam constructed across a swale or drainage ditch to reduce the velocity of water flowing in the channel. Ditch checks can be constructed out of stone, a double row of straw bales or from manufactured products found on the WisDOT PAL.

PURPOSE

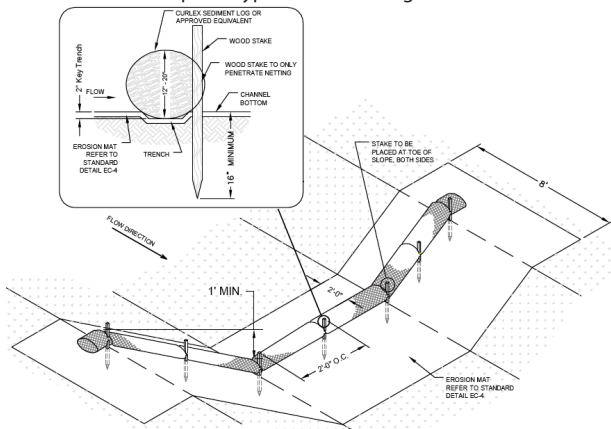
To reduce flow velocity and to pond water, thereby reducing active channel erosion and promoting settling of suspended solids behind the ditch check.

CONDITIONS WHERE PRACTICE 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.

TEMPORARY DITCH CHECK INSTALLATION

- Install proprietary ditch checks per manufacturer's recommendations.
- Install at least one ditch check for every two feet of drop in channel with spacing <100 feet.
- Ends should be higher than the center creating a stable overflow point, and should be at least 6" higher than the expected design water level.
- Place channel mat or other non-erodible materials at the base of a ditch check and extend >6 feet to prevent scour at the top of the ditch check.
- This detail is an example of typical installation guidance.



INSPECTION AND MAINTENANCE

Look for indicators that water is eroding around the ends, undercutting, or erosion is occurring downslope. Remove sediment from behind ditch check when reaching 1/2 the height. Remove when channel permanent vegetation is established, unless part of a permanent plan.

Sediment Trap (WDNR T.S. 1063)



DEFINITION

A temporary sediment control device formed by excavation and/or embankment to intercept sediment-laden runoff and to retain the sediment.

PURPOSE

To detain sediment-laden runoff from disturbed areas for sufficient time to allow the majority of the sediment to settle out.

CONDITIONS WHERE PRACTICE APPLIES

- Areas of concentrated flow or points of discharge during construction activities. Construct sediment traps at locations accessible for clean out.
- Sediment traps are designed to be in place until the contributory drainage area has been stabilized.
- The contributory drainage area shall be a maximum of five acres. For concentrated flow areas smaller than one acre, ditch checks may be installed; refer to WDNR T.S. Ditch Check (1062).
- For larger drainage areas and/or for sediment basins requiring an engineered outlet structure refer to WDNR T.S. Sediment Basin (1064) or Wet Detention Basin (1001).

SEDIMENT TRAP CRITERIA

Timing

- Constructed prior to disturbance of up-slope areas and placed so they function during all phases of construction, and placed in locations where runoff from disturbed areas can be diverted into the traps.
- Remove and stabilize the sediment trap after the disturbed area draining to sediment trap is stabilized.

Sizing Criteria

- Properly sized sediment traps are relatively effective at trapping medium and coarse-grained particles.
- To effectively trap fine-grained particles, the sediment trap must employ a large surface area or polymers.
- See WDNR T.S. Sediment Trap (1063) for specific design criteria. Based on:
 - » Surface area;
 - » Depth;
 - » Shape;
 - » Side slopes.

Embankments

- Not to exceed five feet in height measured from the downstream toe of the embankment to the top of the embankment. Construct with a minimum top width of four feet, and side slopes of 2:1 or flatter.
- Earthen embankments shall be compacted.
- Where sediment traps are employed as a perimeter control, the embankments shall have stabilization practices in place prior to receiving runoff.

Outlet

- Need both a principal outlet and emergency spillway and shall meet WDNR T.S. Sediment Trap (1063) design criteria.

INSPECTION AND MAINTENANCE

Remove and properly dispose of sediment to when they reach one foot depth. Clean outlet when clogged.

Sediment Basin (WDNR T.S. 1064)



DEFINITION

A device temporary or permanent constructed with an engineered outlet, formed by excavation or embankment to intercept sediment-laden runoff and retain sediment.

PURPOSE

Detain sediment-laden runoff from disturbed areas for sufficient time to allow the majority of the sediment to settle out.

CONDITIONS WHERE PRACTICE APPLIES

- Utilize in areas of concentrated flow or points of discharge during construction activities. Construct at locations accessible for clean out.
- Site conditions must allow for runoff to be directed into the basin.
- Sediment basins are designed to be in place until the contributory drainage area has been stabilized. Temporary sediment basins serve drainage areas <100 acres (other practices are often more economical).
- For drainage areas <5 acres sediment traps or ditch checks may be applicable; for design criteria refer to WDNR T.S. Sediment Trap (1063) or Ditch Check (1062). Design to WDNR T.S. Wet Detention Basin (1001) when a permanent stormwater basin is required.
- Minimum standards for design, installation and performance requirements are deemed 80% effective by design in trapping sediment.

SEDIMENT BASIN CRITERIA

Timing

- Construct prior to disturbance and place to function during all phases of construction, and in locations where runoff can be diverted into the basin.

Sizing Criteria

- Specific trapping efficiency varies based on the surface area and the particle size distribution of the sediment entering the device.
- Permanent sediment basins must be designed by an engineer.
- See WDNR T.S. Sediment Basin (1064) for specific design criteria. Based on:
 - » Treatment surface area and depth below treatment surface area;
 - » Active storage volume and shape.

Embankments

- Design earthen embankments to address potential risk and structural integrity issues such as seepage and saturation, and meet WDNR T.S. Sediment Basin (1064) design criteria.

Outlet

- Need both a principal outlet and an overflow spillway meeting WDNR T.S. Sediment Basin (1064) design criteria.

Inlet Protection

- Designed to prevent scour and reduce velocities during peak flows.
- Possible design options include flow diffusion, plunge pools, directional berms, baffles, or other energy dissipation structures.

Location

- Located to provide access for cleanout and disposal of trapped sediment.

Removal

- After the contributing drainage area has been stabilized, if temporary.
- Complete final grading and restoration according to the site plans. If standing water needs to be removed see WDNR T.S. Dewatering (1061).

INSPECTION AND MAINTENANCE

Remove and properly dispose of sediment to maintain three foot depth of the treatment surface area. Clean outlet when clogged.

Construction Site Diversion (WDNR T.S. 1066)



DEFINITION

A temporary berm or channel constructed across a slope to collect and divert runoff.

PURPOSE

To intercept, divert, and safely convey runoff at construction sites in order to divert clean water away from disturbed areas, or redirect sediment laden waters to an appropriate sediment control facility.

CONDITIONS WHERE PRACTICE APPLIES

- Where temporary surface water runoff control or management is needed.
- Locations and conditions include:
 - » Above disturbed areas, to limit runoff onto the site;
 - » Across slopes to reduce slope length;
 - » Below slopes to divert excess runoff to stabilized outlets;
 - » To divert sediment-laden water to sediment control facilities;
 - » At or near the perimeter of the construction area to keep sediment from leaving the site.
- Does not pertain to permanent diversions. Refer to appropriate design criteria and local regulations when designing permanent diversions.

CONSTRUCTION SITE DIVERSION INSTALLATION

- Shall have stable side slopes and shall not be overtopped during a 2-year frequency, 24-hour duration storm.
- The minimum berm cross section shall be as follows:
 - » Side slopes of 2:1 (horizontal:vertical) or flatter;
 - » Top width of two feet;
 - » Berm height of 1.5 feet.
- Sediment-laden runoff from disturbed areas shall be diverted into a sediment control practice. For typical sediment control practices see WDNR T.S. Sediment Trap (1063) or Sediment Basin (1065) for design criteria.
- When diverting clean water the diversion channel and its outfall shall be immediately stabilized for the 2-year frequency, 24-hour duration storm.
- Build and stabilize clean water diversions before initiating down slope land-disturbing activities.
- Diversions shall be protected from damage by construction activities.
- At all points where diversion berms or channels will be crossed by construction equipment, the diversion shall be stabilized or shaped appropriately.
- Temporary culverts of adequate capacity may be used.
- For diversions that are to serve longer than 30 days, the side slopes including the ridge, and down slope side of the diversion shall be stabilized as soon as they are constructed.
- For diversions serving less than 30 days, the down slope side of the diversion shall be stabilized as soon as constructed.
- The diversion channel should be stabilized (i.e. erosion mat) or an additive sediment control practice, such as ditch checks, shall be installed.

INSPECTION AND MAINTENANCE

Remove sediment from behind diversion berm when reaching 1/2 the height.

Temporary Grading Practices (WDNR T.S. 1067)



DEFINITION

Temporary grading practices used to minimize construction site erosion. These practices include, but are not limited to surface roughening (directional tracking and tillage) and temporary ditch sumps.

PURPOSE

To minimize erosion and sediment transport during grading operations on construction sites.

CONDITIONS WHERE PRACTICE APPLIES

Where land disturbing activities occur on construction sites, to be used in conjunction with other erosion control practices.

TEMPORARY GRADING PRACTICES INSTALLATION

- These interim practices may be employed in addition to the approved grading plan to reduce erosion and sediment transport.

Surface Roughening

- Abrading the soil surface with horizontal ridges and depressions across the slope to reduce runoff velocities.
 - » *Directional tracking*: the process of creating ridges with tracked vehicles by driving up and down unvegetated slopes, used for short durations on sites actively being graded. Use in conjunction with other practices, and place at the end of each workday;
 - » *Tillage*: utilizing conventional tillage equipment to create a series of ridges and furrows on the contour no more than 15 inches apart.

Temporary Ditch Sump

- » Temporary ditch sumps are ½ to 5 cubic yard excavations made in a drainageway during earthmoving operations. Their purpose is to slow and pond runoff during the time that drainageways are being graded;
- » Place sumps prior to anticipated rain events;
- » Construction involves excavating sumps (holes) in the rough ditch grade, and using the excavated material to form a dike on the downstream side of the sump;
- » Temporary ditch sumps are not effective perimeter controls. Utilize other sediment control practices prior to channels discharging into public waterways.

INSPECTION AND MAINTENANCE

Inspect and repair/reinstall after every runoff event.

Dust Control (WDNR T.S. 1068)



DEFINITION

Dust control includes practices used to reduce or prevent the surface and air transport of dust during construction. Includes minimization of soil disturbance, applying mulch and establishing vegetation, water spraying, surface roughening, applying polymers, spray-on tackifiers, chlorides, and barriers.

PURPOSE

- Reduce wind erosion and dust.
- Minimize deposition of dust and wind transported soils into water bodies through runoff or wind action.
- Reduce respiratory problems.
- Minimize low visibility conditions caused by airborne dust.

CONDITIONS WHERE PRACTICE APPLIES

At any construction site, but is particularly important for sites with dry exposed soils which may be exposed to wind or vehicular traffic.

DUST CONTROL INSTALLATION

- Implementation limits the area exposed for dust generation.
- Asphalt and petroleum based products cannot be used.

Mulch and Vegetation

- Mulch or seed and mulch may be applied to protect exposed soil from both wind and water erosion. Refer to WDNR T.S. Mulching (1058) and Seeding (1059) for criteria.

Water

- Water until the surface is wet and repeat as needed, applied at rates so that runoff does not occur. Treated soil surfaces that receive vehicle traffic require a stone tracking pad or tire washing at all point of egress. Refer to WDNR T.S. Tracking Pad and Tire Washing (1057) for criteria.

Tillage

- Performed with chisel type plows on exposed soils, beginning on the windward side of the site. Only applicable to flat areas.

Polymers

- Can be effective for areas that do not receive vehicle traffic. Dry applied polymers must be initially watered for activation to be effective for dust control. Refer to WDNR T.S. Land Application of Polymers (1050) for criteria.

Tackifiers and Soil Stabilizers Type A

- Products must be selected from and installed at rates conforming to the WisDOT PAL. Example products include Latex-based and Guar Gum.

Chlorides

- Apply according to the WisDOT Standard Specifications for Highway and Bridge Construction.

Barriers

- Place barriers at right angles to prevailing wind currents at intervals of about 15 times the barrier height. Solid board fences, snow fences, burlap fences, crate walls, bales of hay and similar material can be used to control air currents and blown soil.

INSPECTION AND MAINTENANCE

Inspect daily at a minimum.

Turbidity Barriers (WDNR T.S. 1069)



DEFINITION

A temporary fabric barrier with low permeability, installed parallel to the flow in or near the bed of a waterway of waterbody to minimize sediment transport.

PURPOSE

To provide sediment containment while construction activities are occurring in or directly adjacent to a waterway or waterbody.

CONDITIONS WHERE PRACTICE APPLIES

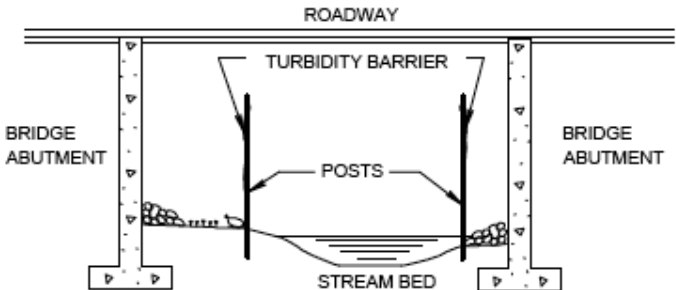
Where construction activities intrude or are directly adjacent to a waterway or waterbody. This includes but is not limited to bridge construction, rip rap placement, utility work, streambank restoration, boat launches and dredging. Use in conditions with fine soils and flow velocities not exceeding 5 feet per second, unless additional reinforcement is installed.

MATERIAL NOTES

- Reusable components of the turbidity barrier shall be clean and free of potential exotic species. Fabric cannot be reused.
- See WDNR T.S. Turbidity Barrier (1069) for detailed material specifications, per WisDOT Spec 628.2.10.

TURBIDITY BARRIERS INSTALLATION

- Refer to WDNR T.S. Turbidity Barriers (1069) for specific criteria.
- Install before construction activities are initiated in, or adjacent to the waterway or waterbody, as close to the construction as practical.
- The ends of the barrier shall be securely anchored and keyed into the shoreline to fully enclose the area where sediment may enter the water.
- Follow guidelines outlined in WDNR T.S. Turbidity Barriers (1069) regarding posts and spacing, flotation devices, height, anchorage, and danger buoys.
- Turbidity barriers shall be installed parallel to the direction of flow and shall not be installed across channels.
- Keep in place and maintain until the construction activity is completed and the disturbed area stabilized.
- This detail is an example of typical installation guidance.



INSPECTION AND MAINTENANCE

Inspect daily and repair if necessary. Do not remove until the water behind the barrier has equal or greater clarity than the waterbody (minimum of 24 hours). When removing the silt curtain, minimize the release or re-suspension of accumulated sediment.

Silt Curtain (WDNR T.S. 1070)



DEFINITION

A temporary permeable fabric installed in a waterway or waterbody to minimize sediment transport. A silt curtain does not extend to the bottom of the channel and is placed parallel or perpendicular to the direction of flow. Use in calm, slow-moving water conditions.

PURPOSE

To provide sediment containment while construction activities are occurring in or directly adjacent to a waterway or waterbody.

CONDITIONS WHERE PRACTICE APPLIES

- Calm water conditions, not subjected to wind, wave, or current.
- To settle out coarse and granular soils where water depth at the time of construction is greater than or equal to 4 feet.
- For applications in finer sediment or moving water see WDNR T.S. Turbidity Barrier (1069).

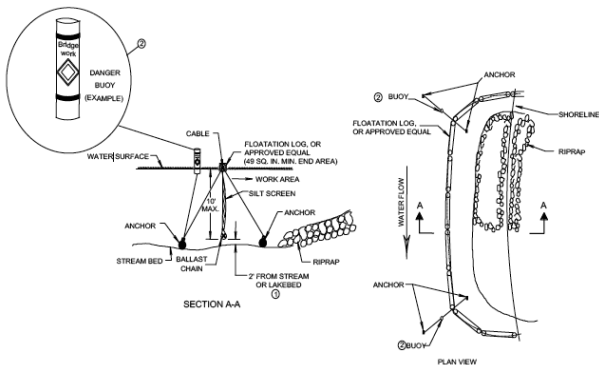
MATERIAL NOTES

- Reusable components of the silt curtain system shall be clean and free of potential exotic species. Fabric cannot be reused.
- See WDNR T.S. Silt Curtain (1070) for detailed material specifications.

SILT CURTAIN INSTALLATION

Installation

- Refer to WDNR T.S. Silt Curtain (1070) for specific criteria.
- Install in or adjacent to the waterway or waterbody before construction activities begin. Install as close to the construction as practical.
- Maintain a 2-foot gap between the weighted lower end of the curtain and the bottom of the waterway or waterbody.
- Follow guidelines outlined in WDNR T.S. Silt Curtain (1070) regarding anchorage and danger buoys.
- Must remain in place and be maintained until the construction activity is completed and the disturbed area is stabilized.
- This detail is an example of typical installation guidance.



INSPECTION AND MAINTENANCE

Inspect daily and repair if necessary. Do not remove until the water behind the curtain has equal or greater clarity than waterbody (minimum 24 hours). When removing the silt curtain, minimize the release or re-suspension of accumulated sediment.

Temporary Slope Breaks (WDNR T.S. 1071)



DEFINITION

Manufactured perimeter control and slope interruption products are designed to detain or slow the flow of sediment-laden sheet flow runoff from small areas of disturbed soil.

PURPOSE

To reduce uninterrupted slope length to slow the velocity of runoff so as to retain transported sediment from disturbed areas.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to the following:

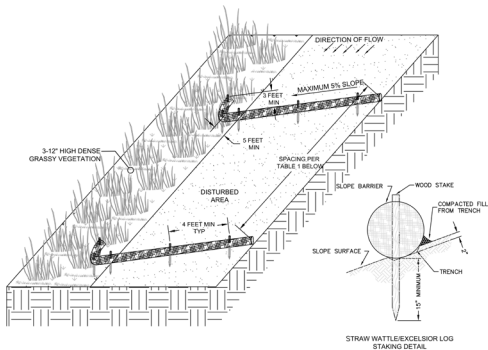
- Where only sheet and rill erosion occurs unless the product is approved for use in concentrated flow areas as a ditch check on WisDOT PAL and is designed/installed in accordance with WDNR T.S. Ditch Checks (1062).
- Products not approved for concentrated flow that are installed on slopes that terminate in a channel shall be installed no lower than 6 inches above the design flow depth of the channel, limited to 12 months.
- Proper installation (Criteria Section V) and maintenance (Criteria Section VIII) in WDNR T.S. Temporary Slope Break (1071) must be present.

Under no circumstance should products be used in the following:

- Below ordinary high watermark or placed perpendicular to flow in streams.
- Where the maximum gradient upslope of product is greater than 50% (2:1).

TEMPORARY SLOPE BREAKS INSTALLATION

- Proprietary products shall be installed per manufacturer's requirements.
- Installed to intercept sheet water flow and direct to an undisturbed area stabilized with grassy vegetation. Entrench 2 inches with the ends facing upslope. Configure lower end to provide sediment containment.
- The sediment barrier shall be secured with wooden stakes spaced every 4 lineal feet across the length of the barrier. The stakes shall be driven through the center of the barrier into the ground a minimum of 15 inches.
- This detail is an example of typical installation guidance.



Slope	Slope Break Spacing
< 2 %	100 feet
2 - 5 %	75 feet
5 - 10 %	50 feet
10 - 33 %	25 feet
33 - 50 %	20 feet
>50 %	Not Permitted

INSPECTION AND MAINTENANCE

Remove sediment from behind ditch check when reaching 1/2 the height.

Channel Erosion Control Matrix

CHANNEL EROSION CONTROL MATRIX Type of Device	Ditch Grade					
	4% - 6%		6% - 9%		9% - 12%	
	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]
Seed with properly anchored mulch	300	600	1200	300	600	1200
Sod ditch checks with seed and mulch						
Temporary ditch checks (hay bales or approved alternatives in WisDOT PAL)						
Sod ditch liner						
Double netted light duty (WisDOT Class I Type B) erosion mat						
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat						
Stone or rock ditch checks, or rock-filled filter bag						
Medium duty coconut erosion mat (WisDOT Class II Type B or C)						

Effective range of device for Sandy or Clayey Soil:

Device applicable, may not be cost effective:

Not applicable. Use in conjunction with other BMP's:



* For ditch grades over 9% special design considerations may be required.

*Use matrix in conjunction with notes on Page 57.

CHANNEL EROSION CONTROL MATRIX Type of Device	Permissible Shear [lbs/ square foot]	Ditch Grade					
		<2%			2% - 4%		
		Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]
		300	600	1200	300	600	1200
Seed with properly anchored mulch	0.6						
Sod ditch checks with seed and mulch	N/A					effective for clayey soil only	
Temporary ditch checks (hay bales or approved alternatives in WisDOT PAL)	N/A						
Sod ditch liner	1.0						
Double netted light duty (WisDOT Class I Type B) erosion mat	1.5						
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat	1.5						
Stone or rock ditch checks, or rock-filled filter bag	N/A						
Medium duty coconut erosion mat (WisDOT Class II Type B or C)	2.0						




Effective range of device for Sandy or Clayey Soil:
Device applicable, may not be cost effective:
Not applicable. Use in conjunction with other BMP's:






* For ditch grades over 9% special design considerations may be required.
 *Use matrix in conjunction with notes on Page 57.

Channel Erosion Control Matrix

CHANNEL EROSION CONTROL MATRIX Type of Device	Ditch Grade					
	4% - 6%		6% - 9%		9% - 12%	
	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]
Heavy duty synthetic (WisDOT Class III Type A) erosion mat or turf reinforcement mat (WisDOT Class III Type B)	300	1200	300	600	300	1200
	600	1200	300	600	300	1200
Heavy duty synthetic turf reinforcement (WisDOT Class III Type C) mat	300	1200	300	600	300	1200
	600	1200	300	600	300	1200
Riprap ditch checks	300	1200	300	600	300	1200
	600	1200	300	600	300	1200
Heavy duty synthetic turf reinforcement (Class III Type D) mat	300	1200	300	600	300	1200
	600	1200	300	600	300	1200
Light riprap	300	1200	300	600	300	1200
	600	1200	300	600	300	1200
Medium riprap	300	1200	300	600	300	1200
	600	1200	300	600	300	1200
Heavy riprap	300	1200	300	600	300	1200
	600	1200	300	600	300	1200
Grouted riprap	300	1200	300	600	300	1200
	600	1200	300	600	300	1200

Effective range of device for Sandy or Clayey Soil:   

Device applicable, may not be cost effective:  

Not applicable. Use in conjunction with other BMPs: 

* For ditch grades over 9% special design considerations may be required.
* Use matrix in conjunction with notes on Page 57.

CHANNEL EROSION CONTROL MATRIX Type of Device	Permissible Shear [lbs/ square foot]	Ditch Grade					
		<2%		2% - 4%			
		Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]
		300	600	1200	300	600	1200
Heavy duty synthetic (WisDOT Class III Type A) erosion mat or turf reinforcement mat (WisDOT Class III Type B)	2.0						
Heavy duty synthetic turf reinforcement (WisDOT Class III Type C) mat	3.5						
Riprap ditch checks	N/A						
Heavy duty synthetic turf reinforcement (Class III Type D) mat	5						
Light riprap	4						
Medium riprap	5						
Heavy riprap	8						
Gouted riprap	N/A						

Effective range of device for Sandy or Clayey Soil:
Device applicable, may not be cost effective:
Not applicable. Use in conjunction with other BMP's:



* For ditch grades over 9% special design considerations may be required.
 *Use matrix in conjunction with notes on Page 57.

Channel Erosion Control Matrix

CHANNEL EROSION CONTROL MATRIX Type of Device	Permissible Shear [lbs/ square foot]	Ditch Grade					
		< 6%		6% - 9%		9% - 12%	
		Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]	Max Length [feet]
Articulated Concrete Block Type A	5	300	600	1200	300	600	1200
		300	600	1200	300	600	1200
Articulated Concrete Block Type B	10	300	600	1200	300	600	1200
		300	600	1200	300	600	1200
Articulated Concrete Block Type C	15	300	600	1200	300	600	1200
		300	600	1200	300	600	1200
Articulated Concrete Block Type D	20	300	600	1200	300	600	1200
		300	600	1200	300	600	1200
Articulated Concrete Block Type E	30	300	600	1200	300	600	1200
		300	600	1200	300	600	1200

Effective range of device for Sandy or Clayey Soil:

Device applicable, may not be cost effective:

Not applicable. Use in conjunction with other BMP's:



* For ditch grades over 9% special design considerations may be required.

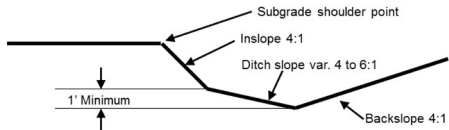
*Use matrix in conjunction with notes on Page 57.

NOTES FOR THE CHANNEL EROSION CONTROL MATRIX

- 1) Ditch flow rates used to develop bar chart are based on a 60 foot right of way (ROW) from pavement centerline and a 2-year rainfall event for temporary liners or a 25-year rainfall event for permanent (Class III mat or riprap) liners. If the drainage area extends outside the 60 foot ROW or unusual flows are expected, use the shear stress column values to determine the suitability of a liner. See FDM procedures in Chapter 10 and in Section 13-30-10.
- 2) Erosion mats shall extend upslope 1 foot minimum vertically from the ditch bottom or 6" higher than the design flow depth. There shall be no joints within 18" of the low point.
- 3) Cost shall be a consideration in the selection of these devices.
- 4) Add sediment traps at the bottom of channel slopes.
- 5) Refer to FDM Chapter 10 for any channels exceeding the limits shown.
- 6) Approved materials for erosion products are referenced from the WisDOT PAL: <http://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrcs/tools/pal/default.aspx>
- 7) On long or steep channels that require a higher class mat, use the appropriate lower class mat for the first 300-600 feet of the channel.
- 8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.

STANDARD DITCH SECTION

Erosion control for ditches not conforming to the typical at right, that complies with FDM procedures 11-15-1 Figures 6 & 7 should be designed according to FDM Chapter 13.



Slope Erosion Control Matrix

SLOPE EROSION CONTROL MATRIX Type of Device	Slope					
	2.5:1			2:1		
	Slope Length [feet]		Slope Length [feet]	Slope Length [feet]		Slope Length [feet]
Seed with properly anchored mulch	0-30	60-120	0-30	30-60	60-120	0-30
	30-60	60-120	0-30	30-60	60-120	30-60
Single netted light duty (WisDOT Class I Type A) erosion mat	0-30	60-120	0-30	30-60	60-120	0-30
	30-60	60-120	0-30	30-60	60-120	30-60
Light duty single netted 100% biodegradable (WisDOT Urban Type A) erosion mat	0-30	60-120	0-30	30-60	60-120	0-30
	30-60	60-120	0-30	30-60	60-120	30-60
Light duty double netted 100% biodegradable (WisDOT Urban Type B) erosion mat	0-30	60-120	0-30	30-60	60-120	0-30
	30-60	60-120	0-30	30-60	60-120	30-60
Bonded Mulch (WisDOT Type A Soil Stabilizer)	0-30	60-120	0-30	30-60	60-120	0-30
	30-60	60-120	0-30	30-60	60-120	30-60
Polymer (WisDOT Type B Soil Stabilizer)	0-30	60-120	0-30	30-60	60-120	0-30
	30-60	60-120	0-30	30-60	60-120	30-60
Double netted light duty (WisDOT Class I Type B) erosion mat	0-30	60-120	0-30	30-60	60-120	0-30
	30-60	60-120	0-30	30-60	60-120	30-60
Sod	0-30	60-120	0-30	30-60	60-120	0-30
	30-60	60-120	0-30	30-60	60-120	30-60

Used in conjunction with other BMP's effective up to a 2:1 slope. Not effective in sand. When used alone effective up to a 3:1 slope. Stand alone use appropriate for earthen stock piles, temporary, and late season applications.

Effective range of device for Sandy or Clayey Soil:



* For ditch grades over 9% special design considerations may be required.

Device applicable, may not be cost effective:



Not applicable. Use in conjunction with other BMP's:



*Use matrix in conjunction with notes on Page 62.

SLOPE EROSION CONTROL MATRIX Type of Device	Slope					
	6:1 or flatter		4:1		3:1	
	Slope Length [feet]	Slope Length [feet]	Slope Length [feet]	Slope Length [feet]	Slope Length [feet]	Slope Length [feet]
Seed with properly anchored mulch	0-30 30-60	60-120	0-30 30-60	60-120	0-30 30-60	60-120
Single netted light duty (WisDOT Class I/Type A) erosion mat						
Light duty single netted 100% biodegradable (WisDOT Urban Type A) erosion mat						
Light duty double netted 100% biodegradable (WisDOT Urban Type B) erosion mat						
Bonded Mulch (WisDOT Type A Soil Stabilizer)						
Polymer (WisDOT Type B Soil Stabilizer)						
Double netted light duty (WisDOT Class I/Type B) erosion mat						
Sod						

Used in conjunction with other BMP's effective up to a 2:1 slope. Not effective in sand. When used alone effective up to a 3:1 slope. Stand alone use appropriate for earthen stock piles, temporary, and late season applications.

Effective range of device for Sandy or Clayey Soil:  * For ditch grades over 9% special design considerations may be required.

Device applicable, may not be cost effective: 

Not applicable. Use in conjunction with other BMP's:  *Use matrix in conjunction with notes on Page 62.

Slope Erosion Control Matrix

SLOPE EROSION CONTROL MATRIX Type of Device	Slope					
	2.5:1		2:1		1:1	
	Slope Length [feet]	Slope Length [feet]	Slope Length [feet]	Slope Length [feet]	Slope Length [feet]	Slope Length [feet]
Medium duty coconut erosion mat (WisDOT Class II Type B or C)	0-30	60-120	0-30	30-60	0-30	60-120
	30-60		0-30	30-60	0-30	60-120
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat	0-30		0-30			
	30-60		0-30			
Heavy duty synthetic erosion control revegetation mat (WisDOT Class III Type A)	0-30		0-30			
	30-60		0-30			
Riprap	0-30		0-30			
	30-60		0-30			
Heavy duty synthetic turf reinforcement (WisDOT Class III Type B or C) mat	0-30		0-30			
	30-60		0-30			
Heavy duty synthetic turf reinforcement (WisDOT Class III Type D) mat	0-30		0-30			
	30-60		0-30			
Slope paving or grouted riprap	0-30		0-30			
	30-60		0-30			

Effective range of device for Sandy or Clayey Soil:

Device applicable, may not be cost effective:

Not applicable. Use in conjunction with other BMP's:



* For ditch grades over 9% special design considerations may be required.

*Use matrix in conjunction with notes on Page 62.

SLOPE EROSION CONTROL MATRIX Type of Device	Slope					
	6:1 or flatter		4:1		3:1	
	Slope Length [feet] 0-30	60-120	Slope Length [feet] 0-30	30-60	Slope Length [feet] 0-30	30-60
Medium duty coconut erosion mat (WisDOT Class II Type B or C)						
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat						
Heavy duty synthetic erosion control revegetation mat (WisDOT Class III Type A)						
Riprap						
Heavy duty synthetic turf reinforcement (WisDOT Class III Type B or C) mat						
Heavy duty synthetic turf reinforcement (WisDOT Class III Type D) mat						
Slope paving or grouted riprap						

Effective range of device for Sandy or Clayey Soil:

Device applicable, may not be cost effective:

Not applicable. Use in conjunction with other BMP's:



* For ditch grades over 9% special design considerations may be required.

*Use matrix in conjunction with notes on Page 62.

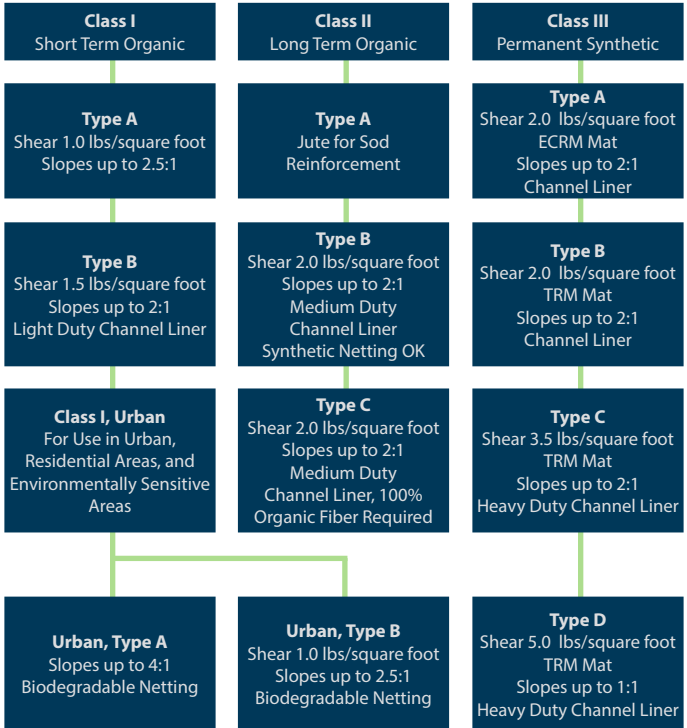
Slope Erosion Control Matrix

SLOPE EROSION CONTROL MATRIX		Erosion Control
Benches	Consider benches when cuts exceed 20'; bench at approximately 15' vertical intervals to collect and drain water. Treat benches as channels (ditches). Adjust elevations to provide drainage. Consider flumes at transitions.	
Intercepting embankments	Used to intercept runoff from abutting lands. Flumes may be necessary to direct runoff.	
Silt fence	Used at toe of slopes to intercept and detain small amounts of sediment. Use only WisDOT approved silt fence as listed in the PAL.	
Temporary ditch checks or erosion bales	Used at toe of slopes to intercept and detain small amounts of sediment.	
Slope drains/flumes	May be necessary on slopes (see channel matrix for design guidance).	
Sediment traps	Used to trap sediment laden runoff. Could be used at the inlet or outlet end of slope drain.	

NOTES FOR THE SLOPE EROSION CONTROL MATRIX

- 1) Cost shall be a consideration in the selection of these devices.
- 2) Designers should review FDM Chapter 10 prior to selection of erosion mats.
- 3) Install intercepting ditches to limit slope lengths to 15 foot vertical intervals (see FDM Chapter 10).
- 4) Refer to FDM Chapter 10 for any slopes exceeding the limits shown.
- 5) Approved materials for erosion products are referenced from the WisDOT PAL: <http://wisconsindot.gov/Pages/doing-bus-eng-consultants/cnsit-rsrces/tools/pal/default.aspx>
- 6) On steeper slopes that require a higher class mat, use the appropriate lower class mat or seed and mulch for the first 30-60 feet of the slope.
- 7) Unless project conditions require otherwise, seed and mulch all slopes that are flatter than a 5% grade, regardless of length. If practicable, bench the slopes.
- 8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.

WisDOT Erosion Mat Categories



General Inspection and Maintenance Guidance

- The environmental monitor will inspect erosion and sediment control practices a minimum of:
 - » Once a week;
 - » Within 24 hours following a rainfall of 0.5 inches or more.
- Take corrective action as soon as possible with consideration of site conditions, at the most within 24 hours of the inspection.
- Maintain written documentation of the inspection at the construction site describing:
 - » Date, time, and location of construction site inspection;
 - » Name of individual performing inspection;
 - » Assessment of the condition of erosion and sediment controls;
 - » Description of any corrective erosion and sediment control implementation or maintenance performed;
 - » Description of the current location and phase of land disturbing activity.
- For a sample construction site inspection report form:
<http://dnr.wi.gov/topic/Stormwater/construction/forms.html>

State of Wisconsin
 Department of Natural Resources (DNR)
 PO Box 7921, Madison WI 53707-7921
 dnr.wis.gov

CONSTRUCTION SITE INSPECTION REPORT
 Form 3400-197 (R 1/1/16)

Notice: This form was developed in accordance with s. NR 216.48 Wis. Adm. Code for WFOES permittees' convenience; however, use of this specific form is voluntary. Multiple copies of this form may be made to complete the inspection report. Inspections of the construction site and implemented erosion and sediment control best management practices (BMPs) must be performed weekly and within 24 hours after a rainfall event 0.5 inches or greater.

Construction Site Name and Location (Project, Municipality, and County): _____		Site/Facility ID No. (FIN): _____	
Onsite Contact/Contractor: _____		Onsite Phone/Cell: _____	
Note: Inspection reports, along with erosion control and storm water management plans, are required to be maintained on site in accordance with s. NR 216.48 (4) and made available upon request. PLEASE PRINT LEGIBLY.			
Date of inspection: _____	Time of inspection: Start: _____ End: _____	Type of inspection: <input type="radio"/> Weekly <input type="radio"/> Precipitation Event <input type="radio"/> Other (specify) _____	
Weather/Site Conditions: Temp. _____ °F Antecedent Soil Moisture _____ Last Rainfall Depth: _____ inches	<input type="radio"/> Dry <input type="radio"/> Variable <input type="radio"/> Frozen or snow covered <input type="radio"/> Frozen (Thaw predicted in next week) <input type="radio"/> Wet <input type="radio"/> Melting Snow/slush	Describe current phase of construction: _____	
Last Rainfall Date: _____		Scheduled Final Stabilization Date for Universal Soil Loss Equation (USLE) ¹ : _____	
Name(s) of individual(s) performing inspection: _____		Project on Schedule? <input type="radio"/> Yes <input type="radio"/> No Inspector Phone/Cell: _____	
I certify that the information contained on this form is an accurate assessment of site conditions at the time of inspection.			
Inspector Signature _____		Date: _____	
Inspection Questions:		Location/Comments:	
1. Is the erosion control plan accessible to operators? <input type="checkbox"/> Yes <input type="checkbox"/> No (Identify Actions Required): <input type="checkbox"/> Provide onsite copy		_____	
2. Is the permit certificate posted where visible? <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Post certificate	
3. Is the current phase of construction on sequence with the site-specific erosion and sediment control plan, including installation/stabilization of ponds and ditches? <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Add sediment control <input type="checkbox"/> Add missing ditch/pond <input type="checkbox"/> Stabilize bare soil	
4. Are all erosion and sediment control BMPs shown on plan properly installed and in functional condition? <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Repair <input type="checkbox"/> Modify <input type="checkbox"/> Install/replace	
5. Is inlet protection properly installed and functioning in all inlets likely to receive runoff from the site? <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Clean <input type="checkbox"/> Replace <input type="checkbox"/> Install	
6. Is the air free of fugitive dust resulting from construction activity and bare soil exposure? <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Apply water <input type="checkbox"/> Apply dust control product	
Actions Completed by Date & Initials _____		_____	

¹ The Universal Soil Loss Equation (USLE) model and the Construction Site Soil Loss and Sediment Discharge Guidance are available at: http://dnr.wis.gov/topic/stormwater/standards/const_standards.html

² If the project is not on schedule then the soil loss summary for the project should be reviewed and schedule, plan or practices modified accordingly.



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101 Skyline Drive | Arlington, WI 53911
(608) 635-7755 | www.earthandroad.com

EROSION CONTROL & GEOTEXTILES



119 S. Main Street | Cottage Grove, WI 53527
(608) 839-4422 | www.ma-rs.org

Montgomery Associates
Resource Solutions, LLC

