

Non-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.

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.

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.

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.

Field Code Changed

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.

Channel Erosion Mat

(1053)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. 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. Erosion mats are rolled products available in many varieties and combination of materials and with varying life spans.

II. Purpose

The purpose of this practice is to protect the channel from erosion or act as turf reinforcement during and after the establishment of grass or other vegetation in a channel. This practice applies to both *Erosion Control Revegetative Mats (ECRM¹)* and *Turf-Reinforcement Mats (TRM)*.

III. Conditions Where Practice Applies

This standard 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.

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 standards for design, installation and performance requirements. To complete the shear calculations, a 2 year, 24 hour storm event shall be used to calculate depth of flows for an ECRM. For sizing a TRM, use the depth of flow corresponding to the maximum design capacity of the channel.

Only mats listed in the Wisconsin Department of Transportation (WisDOT) Erosion Control Product Acceptability List (PAL) will be accepted for use in this standard.

To differentiate applications WisDOT organizes erosion mats 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 ECRM with plastic or biodegradable netting.
 - 1. **Type A** – Only suitable for slope applications, not channel applications.
 - 2. **Type B** – Double netted product for use in channels where the calculated (design) shear stress is 1.5 lbs/ft² or less.
- B. **Class II:** A long-term duration (three years or greater), organic ECRM.
 - 1. **Type A** – Jute fiber only for use in channels to reinforce sod.
 - 2. **Type B** – For use in channels where the calculated (design) shear stress is 2.0 lbs/ft² or less. Made with plastic or biodegradable mat.
 - 3. **Type C** – A woven mat of 100% organic material for use in channels where the calculated (design) shear stress is 2.0 lbs/ft² or less. Applicable

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.

for use in environmentally sensitive areas where plastic netting is inappropriate.

- C. **Class III:** A permanent 100% synthetic ECRM or TRM. Class I, Type B erosion mat or Class II, Type B or C erosion mat must be placed over a soil filled TRM.
1. **Type A** – An ECRM for use in channels where the calculated (design) shear stress of 2.0 lbs/ft² or less.
 2. **Type B** – A TRM for use in channels where the calculated (design) shear stress of 2.0 lbs/ft² or less.
 3. **Type C** – A TRM for use in channels where the calculated (design) shear stress of 3.5 lbs/ft² or less.
 4. **Type D** – A TRM for use in channels where the calculated (design) shear stress of 5.0 lbs/ft² or less.

D. **Installation**

1. ECRM shall be installed after all topsoiling, fertilizing, liming, and seeding is complete.
2. Erosion mats shall extend for whichever is greater: upslope one-foot minimum vertically from the ditch bottom or 6 inches higher than the design flow depth.
3. The mat shall be in firm and continuous contact with the soil. It shall be anchored, overlapped, staked and entrenched per the manufacturer's recommendations.
4. TRM shall be installed in conjunction with the topsoiling operation and shall be followed by ECRM installation.
5. At time of installation, document the manufacturer and mat type by saving material labels and manufacturer's installation instructions. Retain this documentation until the site is stabilized.

VI. **Considerations**

- A. Erosion mats shall be selected so that they last long enough for the grass or other vegetation to become densely established.
- B. Consider using Class II, Type C mats adjacent to waterways where trapping small animals is to be avoided.
- C. Class III TRM may be appropriate as a replacement for riprap as a channel liner. Check the shear stress criteria for the channel to determine mat applicability.
- D. Once a gully has formed in a channel, it is difficult to stabilize due to loss of soil structure. Even when the gully is filled with topsoil and reseeded, the soil has a tendency to dislodge in the same pattern. If gully formation continues to be a problem the design should be reevaluated, including other mat classes or riprap.
- E. It may be difficult to establish permanent vegetation and adequate erosion protection in a channel with continuous flow. Consider riprap or planting wetland species with an ECRM.
- F. Documentation of materials used, monitoring logs, project diary, and weekly inspection forms including erosion and stormwater management plans, should be provided to the authority charged with long term maintenance of the site.
- G. Channel cross sections may be parabolic, v-shaped or trapezoidal. The use of "V" channels is generally discouraged due to erosion problems experienced.
- H. To help determine the appropriate channel liner, designers can refer to the design matrix in the back of the WisDOT PAL. However, for channels not conforming to the typical section shown in the channel matrix or having a depth of flow greater than 6 inches (150 mm), the designer will need to design

for an appropriate channel liner. One way to do this is to use the "tractive force" method presented in FHWA's Hydraulic Engineering Circular (HEC) No. 15. This method requires that the calculated maximum shear stress of a channel is not to exceed the permissible shear stress of the channel liner. To use this method, permissible shear stress values are stated next to each device listed in the channel matrix.

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 mats 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>.

X. Definitions

Channel Erosion: 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.

Erosion Control Revegetative Mats (ECRM) (II): Erosion control revegetative mats are designed to be placed on top of soil.

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 soil stabilizer Type A (as classified in the WisDOT PAL)

Sediment Bale Barrier (Non-Channel) (1055)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. 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.

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 where:

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. Effectiveness is required for less than 3 months.
4. Conditions allow for the bales to be properly entrenched and staked as outlined in the Criteria Section V.

B. Under no circumstance shall sediment bale barriers 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 sediment bale barriers 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 the sediment bale barrier. 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. At a minimum, sediment bale barriers shall be placed in a single row, lengthwise on the contour, with the ends of adjacent sediment bale barriers tightly abutting one another. The holes between bales shall be chinked (filled by wedging) with straw, hay or equivalent material to prevent water from escaping between the bales.
2. The maximum allowable slope lengths contributing runoff to a sediment bale barrier are specified in Table 1.

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

around the end of the sediment bale barriers shall be repaired.

- C. Sediment shall be properly disposed of once the deposits reach 1/2 the height of the sediment bale barrier.
- D. Sediment bale barriers and anchoring devices shall be removed and properly disposed of when they have served their usefulness, but not before the upslope areas have been permanently stabilized.
- E. Any sediment deposits remaining in place after the sediment bale barrier is no longer required shall be dressed to conform to the existing grade, prepared and seeded.

IX. 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. The transport capacity of the flow in a channel is based on the availability of sediment and is a monatomic function of velocity.

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.

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.

Stone Tracking Pad and Tire Washing (1057)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

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

II. Purpose

The purpose of this standard is to reduce off-site sedimentation by eliminating the tracking of sediment from construction sites.

III. 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.

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 this practice. 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. Tracking Pad:

1. The tracking pad shall be installed prior to any traffic leaving the site
2. The aggregate for tracking pads shall be 3 to 6 inch clear or washed stone. All material to be retained on a 3-inch sieve.

3. The aggregate shall be placed in a layer at least 12 inches thick. On sites with a high water table, or where saturated conditions are expected during the life of the practice, stone tracking pads shall be underlain with a WisDOT Type R geotextile fabric to prevent migration of underlying soil into the stone.

4. The tracking pad shall be the full width of the egress point. The tracking pad shall be at a minimum 50 feet long.

5. Surface water must be prevented from passing through the tracking pad. Flows shall be diverted away from tracking pads or conveyed under and around them by using a variety of practices, such as culverts, *water bars*¹, or other similar practices.

- B. Tire washing: If conditions on the site are such that the sediment is not removed from vehicle tires by the tracking pad, then tires shall be washed utilizing pressurized water before entering a public road.

1. The washing station shall be located on-site in an area that is stabilized and drains into suitable sediment trapping or settling device.

2. The wash rack shall consist of a heavy grating over a lowered area. The rack shall be strong enough to support the vehicles that will cross it.

- C. Rocks lodged between the tires of dual wheel vehicles shall be removed prior to leaving the construction site.

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

VI. Considerations

- A. Vehicles traveling across the tracking pad should maintain a slow constant speed.
- B. The best approach to preventing off-site tracking is to restrict vehicles to stabilized areas.
- C. It is always preferable to prevent sediment from being deposited upon the road than cleaning the road later. Sediment on a road can create a safety hazard as well as a pollution problem.
- D. Any sediment tracked onto a public or private road should be removed by street cleaning, not flushing, before the end of each working day.

VII. Plans and Specifications

- A. Plans and specifications for installing tracking pads 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 all points of egress with tracking pad locations shown
 - 2. Material specifications conforming to standard
 - 3. Schedule for installation and removal
 - 4. Standard drawings and installation details
 - 5. Stabilization 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. Tracking pads and tire washing stations 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. The tracking pad performance shall be maintained by scraping or top-dressing with additional aggregate.
- C. A minimum 12-inch thick pad shall be maintained.

IX. Definitions

Water bar (V.A.5): A shallow trench or diversion dam that diverts surface water runoff into a dispersion area.

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.

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.

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.

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

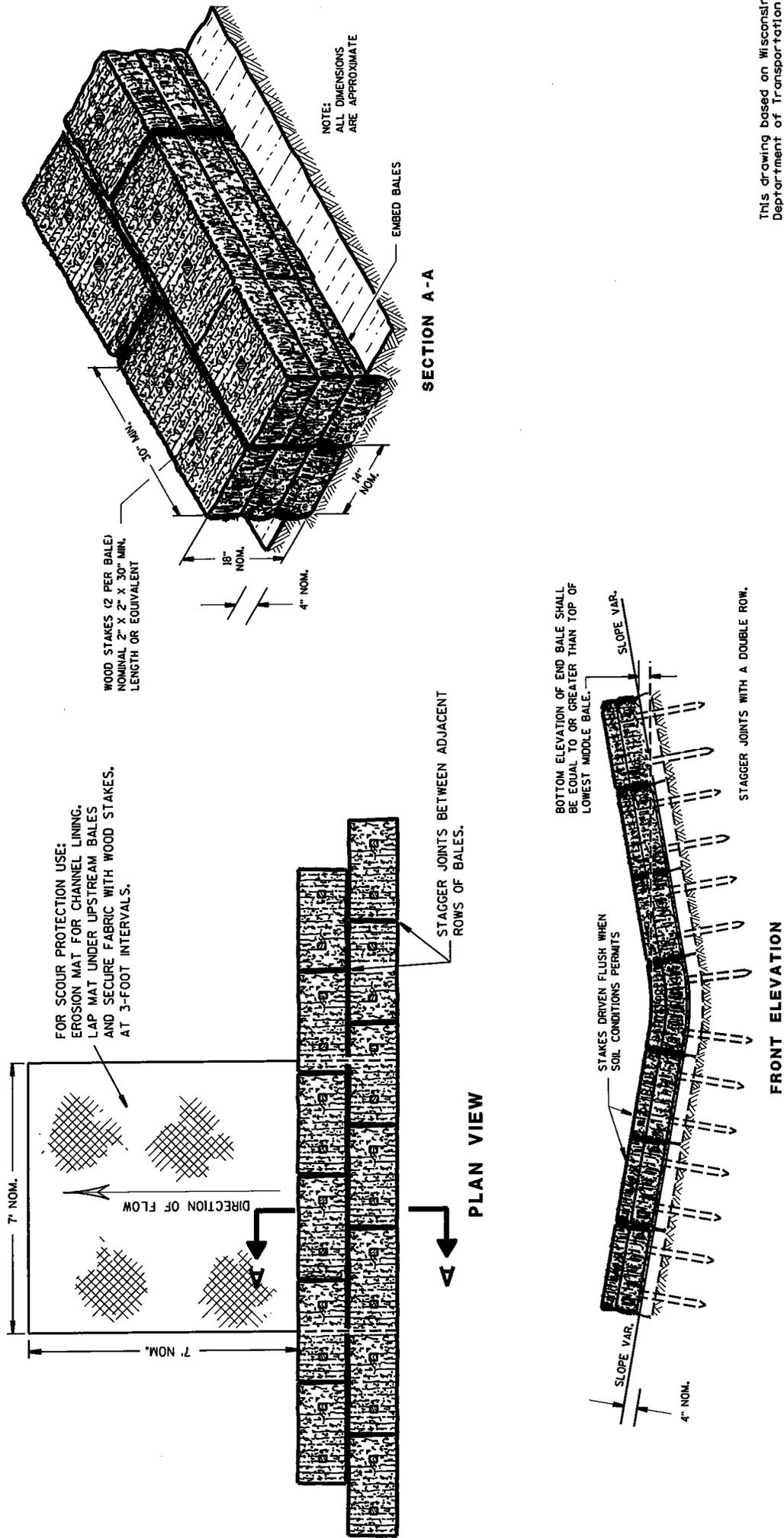
WisDOT "Erosion Control Product Acceptability List" is available online at:
<http://www.dot.wisconsin.gov/business/engrserv/pal.htm> Printed copies are no longer distributed.

X. Definitions

D₅₀ (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.

Figure 1

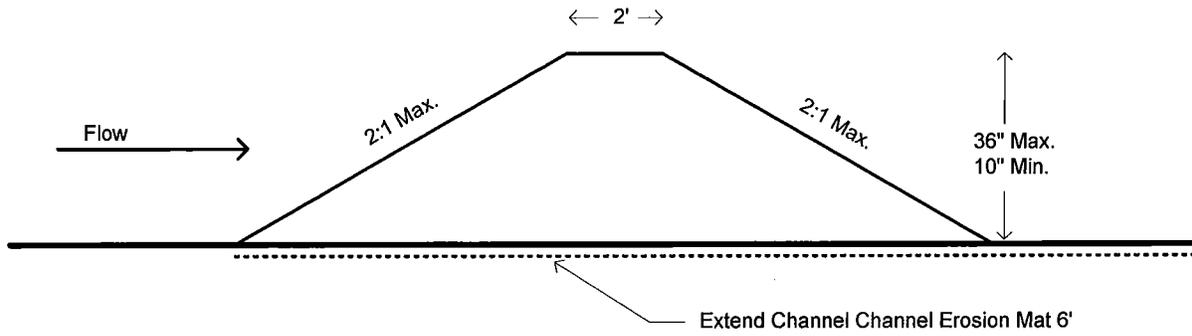


This drawing based on Wisconsin
Department of Transportation
Standard Detail Drawing 8 E 8-3.

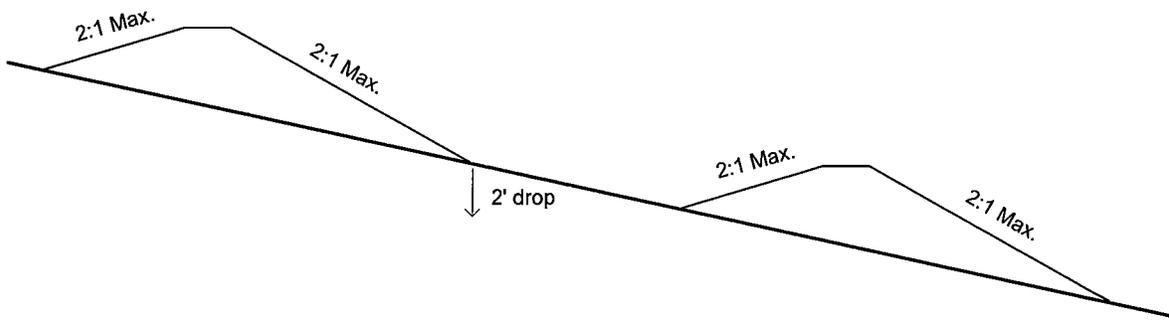
**TYPICAL INSTALLATIONS OF
EROSION BALES / TEMPORARY
DITCH CHECKS**

TEMPORARY DITCH CHECK USING EROSION BALES ①

Figure 2. Stone Ditch Check



Side View



Side View

Not to Scale

WDNR

CHANNEL EROSION CONTROL MATRIX (Concentrated Flow Application)

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

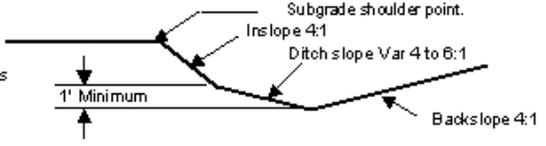
Riprap measures apply to all ditch types. Use of these measure requires engineering judgement and design.

CHANNEL EROSION CONTROL MATRIX (Concentrated Flow Application)

TYPE OF EROSION CONTROL DEVICE	PERMISSIBLE SHEAR LEG.F.	DITCH GRADE															REMARKS		
		< 2%			2% - 4%			4% - 6%			6% - 9%*			9% - 12%*					
		Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)			Max. Length (ft.)					
		300	600	1200	300	600	1200	300	600	1200	300	600	1200	300	600	1200			
Grouted rip rap	N/A	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	Address outfalling, overtopping and scour. Line with Geotextile fabric Type "HR", (see Chap. 10, Const. Detail and special provision). Use 2' minimum ditch depth. ACBs apply to all ditch types. Use of these measures requires engineering judgement and design.	
Articulated Concrete Block Type A	5	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Articulated Concrete Block Type B	10	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Articulated Concrete Block Type C	15	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Articulated Concrete Block Type D	20	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Articulated Concrete Block Type E	30	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			

Standard Ditch Section

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



Subgrade shoulder point.
Inslope 4:1
Ditch slope Var 4 to 6:1
Backslope 4:1
1' Minimum

KEY
 Effective range of device for Sandy or Clayey Soil:
 Device applicable, may not be cost effective:
 " C " effective for clayey soil only
 Not applicable. Use in conjunction with other BMPs: X

ECRM - Erosion control revegetation mat. All Class I and II mats are ECRMs.
 TRM - Turf reinforcement mat.
 FDM - WisDOT Facilities Development Manual
 BMP - Best Management Practice
 PAL - See Note 6

* For ditch grades over 9% special design considerations may be required.
 ** Soils that are not sandy should be treated as clay soils.

NOTES

- 1) Ditch flow rates used to develop bar chart are based on a 60 ft. right of way from pavement centerline and a 2-Yr. rainfall event for temporary liners or a 25-Yr. rainfall event for permanent (Class III mat or riprap) liners. If the drainage area extends outside the 60 ft of right of way or unusual flows are expected, use the shear stress column values to determine the suitability of a liner. See FDM procedures in Chapter 10 and in Section 13-30-10.
- 2) Erosion mats shall extend upslope 1.0 ft. min. vertically from the ditch bottom or 8' higher than the design flow depth. There shall be no joints within 18' of the low point.
- 3) Cost shall be a consideration in the selection of these devices.
- 4) Add sediment traps at the bottom of channel slopes.
- 5) Refer to FDM Chapter 10 for any channels exceeding the limits shown.
- 6) Approved materials for erosion products are referenced from the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL), found at the web site: <http://www.dot.wisconsin.gov/business/engsenv/pal.htm>
- 7) On long or steep channels that require a higher class mat, use the appropriate lower class mat for the first 300 ft to 600 ft of the channel.
- 8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.

SLOPE EROSION CONTROL MATRIX

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.

KEY:

Not applicable. Use in conjunction with other BMPs:



Effective range of device for Sandy or Clayey Soil:
Device applicable, may not be cost effective:



* Soils that are not sandy should be treated as clay soils.

ECRM - Erosion control revegetation mat. All Class I and II mats are ECRMs.

TRM - Turf reinforcement mat.

FDM - WisDOT Facilities Development Manual

PAL - See Note 5

NOTES

- 1) Cost shall be a consideration in the selection of these devices.
- 2) Designers should review FDM Chapter 10 prior to selection of erosion mats.
- 3) Install intercepting ditches to limit slope lengths to 15' vertical intervals. (See FDM Chapter 10)
- 4) Refer to FDM Chapter 10 for any slopes exceeding the limits shown.
- 5) Approved materials for erosion products are referenced from the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL), found at the web site: <http://www.dot.wisconsin.gov/business/engrserv/pal.htm>
- 6) On steeper slopes that require a higher class mat, use the appropriate lower class mat or seed and mulch for the first 30 ft to 60 ft of the slope.
- 7) Unless project conditions require otherwise, seed and mulch all slopes that are flatter than a 5% grade, regardless of length. If practicable, bench the slopes.
- 8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.