

Flow Transition Mats



Source: ScourStop, 2006

<u>BENEFITS</u>				
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Flow Control	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 15px; background-color: black;"></td> <td style="width: 20px; height: 15px;"></td> <td style="width: 20px; height: 15px;"></td> </tr> </table>			
Erosion Control	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 15px; background-color: black;"></td> <td style="width: 20px; height: 15px; background-color: black;"></td> <td style="width: 20px; height: 15px; background-color: black;"></td> </tr> </table>			
Sediment Control	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 15px;"></td> <td style="width: 20px; height: 15px;"></td> <td style="width: 20px; height: 15px;"></td> </tr> </table>			
Runoff Reduction	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 15px;"></td> <td style="width: 20px; height: 15px;"></td> <td style="width: 20px; height: 15px;"></td> </tr> </table>			
Flow Diversion	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 15px;"></td> <td style="width: 20px; height: 15px;"></td> <td style="width: 20px; height: 15px;"></td> </tr> </table>			

Description: Transition mats are a synthetic alternative to using rip rap.

Typical Uses: Used to dissipate energy and prevent scour at the transition from highly concentrate flow outlets to channel flow.

Advantages:

- Vegetated condition is more aesthetically pleasing than rip rap.
- Installation can be mowed with conventional equipment.
- May be utilized as a temporary measure.
- May be more economical than other “hard-armor” methods.
- Installation does not require any heavy equipment.

Limitations:

- Continuous flow channels may not support vegetation.
- Not appropriate for high velocity discharges (>16 fps).

Longevity: Permanent

SUDAS Specifications: Refer to [Section 9040, 2.19](#) and [3.25](#)

A. Description/Uses

A transition mat is a HDPE, UV stabilized, plastic sheet approximately 4 feet by 4 feet by 1/2 inch thick, comprised of multiple voids which allow vegetation to grow through, or small gravel and pebbles to accumulate and stabilize the area. The mat protects the area at pipe outlets from scour until the water spreading out in the channel diminishes the turbulent forces. The channel downstream of the outlet, where flow becomes uniform, must still be evaluated to ensure that the channel lining can withstand the anticipated shear stress.

B. Design Considerations

Generally, vegetation alone and a vegetated turf reinforcement mat (TRM) ([Section 7E-18](#)) can carry significant storm water shear, but cannot withstand the turbulence and concentrated flow generated by a hard surface such as storm sewers, culverts, or parking lots. At these locations, additional measures are usually required to prevent scour. Transition mats are one option for protecting that critical area.

Transition mats can be installed in several different configurations to meet the particular site requirements.

Transition mats installed over sod are good applications for parking lot outlets or pipe outlets conveying storm water through residential developments. The installation can be mowed with standard equipment and unsightly rock rip rap is avoided.

Installing sod and a Type 1 TRM under the transition mat adds a strong supporting element to the system. Vegetated TRMs already have proven shear force resistance of 12 pounds per feet. The sod eliminates the germination issue of a plain TRM installation, even though it adds a slight cost of material and labor, as well as potential short-term irrigation needs. Appropriate uses for a transition mat over a Type 1 TRM and sod would be 24 to 48 inch storm water pipes.

Transition mats may also be used without sod. A transition mat with a Type 1 TRMs over bare soil might be used in situations where turfgrass is not desired, such as a rural area, or as a temporary installation. When used without sod, the flows should be slow and the area fairly flat to encourage sediment accumulation in the voids, where vegetation could also start. Pipe sizes should be limited to 24 inches.

Higher flow installations without sod can be accommodated using a higher class, Type 3 TRM over the bare soil. This type of installation may be applicable for temporary, pre-vegetation erosion control use (temporary meaning remove and reinstall when vegetation can be established), or as a permanent installation requiring substantial soil protection and vegetation growth over time. This installation could also be used in a streambed, where the mats would collect small gravel and sediment in the voids and appear naturally stabilized.

Installations with continuous low flows, such as irrigation over charge, should utilize a sub-surface drainage system directly downstream of the outlet to drain that low flow from the surface, thus allowing vegetation to properly establish. Of course, adequate slope is required for a subdrain system. In some instances, marsh plants could be planted into a transition mat and TRM combination as another solution.

For installations where the slope of the discharge area or channel is greater than the outlet, but not a waterfall situation, transition mats should perform as specified. When the slope of the discharge area or channel is flatter than the outlet, and the grade break between the two exceeds 8%, the flow velocities and vector forces directed into the transition mat should be considered to determine if a flow transition mat is appropriate for the situation.

A temporary installation, for example the outlet of a temporary slope drain, can be readily achieved with a transition mat and TRM combination. Vegetation would generally not be necessary or desired, but scour protection would be quickly achieved, and the materials could be easily picked up and moved to another area on demand.

Transition mats do not dissipate energy by impact like rip rap, but generally rely on the expansion area downstream to dissipate scour forces. The expansion area should be as wide and flat as possible. Channel side slopes that restrict expansion require protection with either a TRM or other means.

In addition to the potential scour area at the outlet, the channel downstream of the transition mat should be evaluated to ensure that it can carry the anticipated flows without eroding the streambank. Additional information on evaluating channel linings can be found in [Section 7E-23 - Grass Channel](#) and [7E-18 - Turf Reinforcement Mats](#).

C. Application

Outlet protection should be designed to withstand the 10 year storm event. The following table lists the recommended dimensions for transition mat and TRM (if used) installations based upon pipe diameter.

Table 7E-21.01: Flow Transition Mat Application

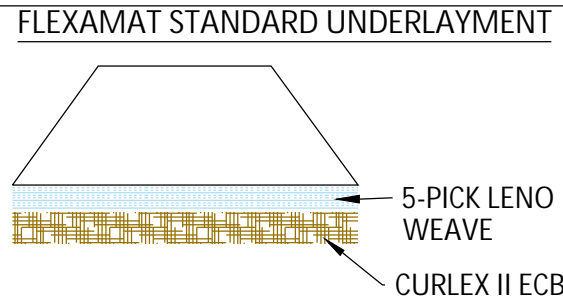
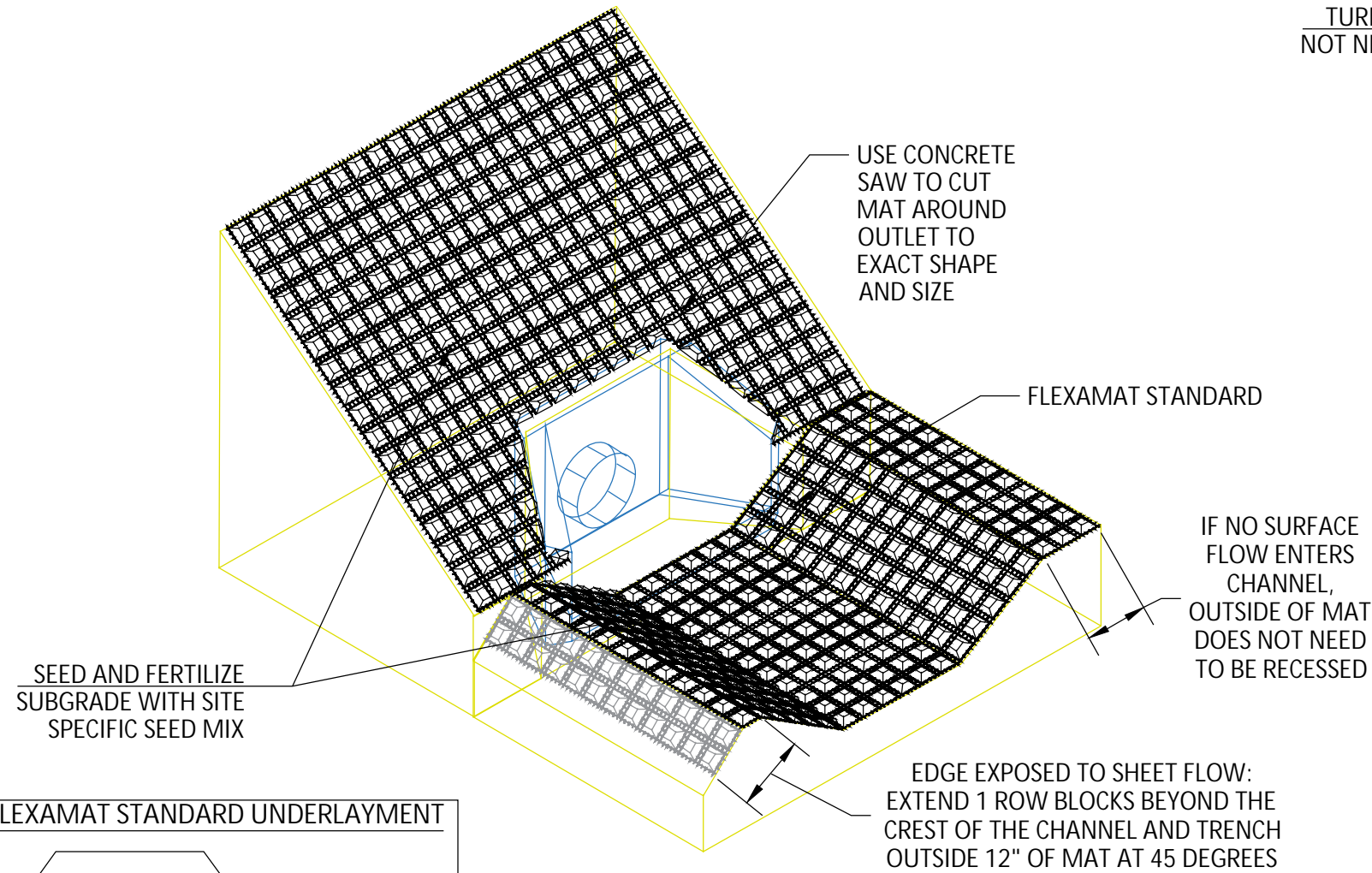
Pipe Diameter (inches)	Discharge ¹ (cfs)	Transition Mats		TRM
		Width (ft) x Length (ft)	Quantity	Width (ft) x Length (ft)
12	8	4 x 4	1	6 x 8
24	30	4 x 8	2	11 x 12
36	75	8 x 12	6	17 x 16
48	100	12 x 16	12	23 x 20

¹ If the design discharge exceeds that for the diameter shown, alternative methods of outlet protection should be provided.

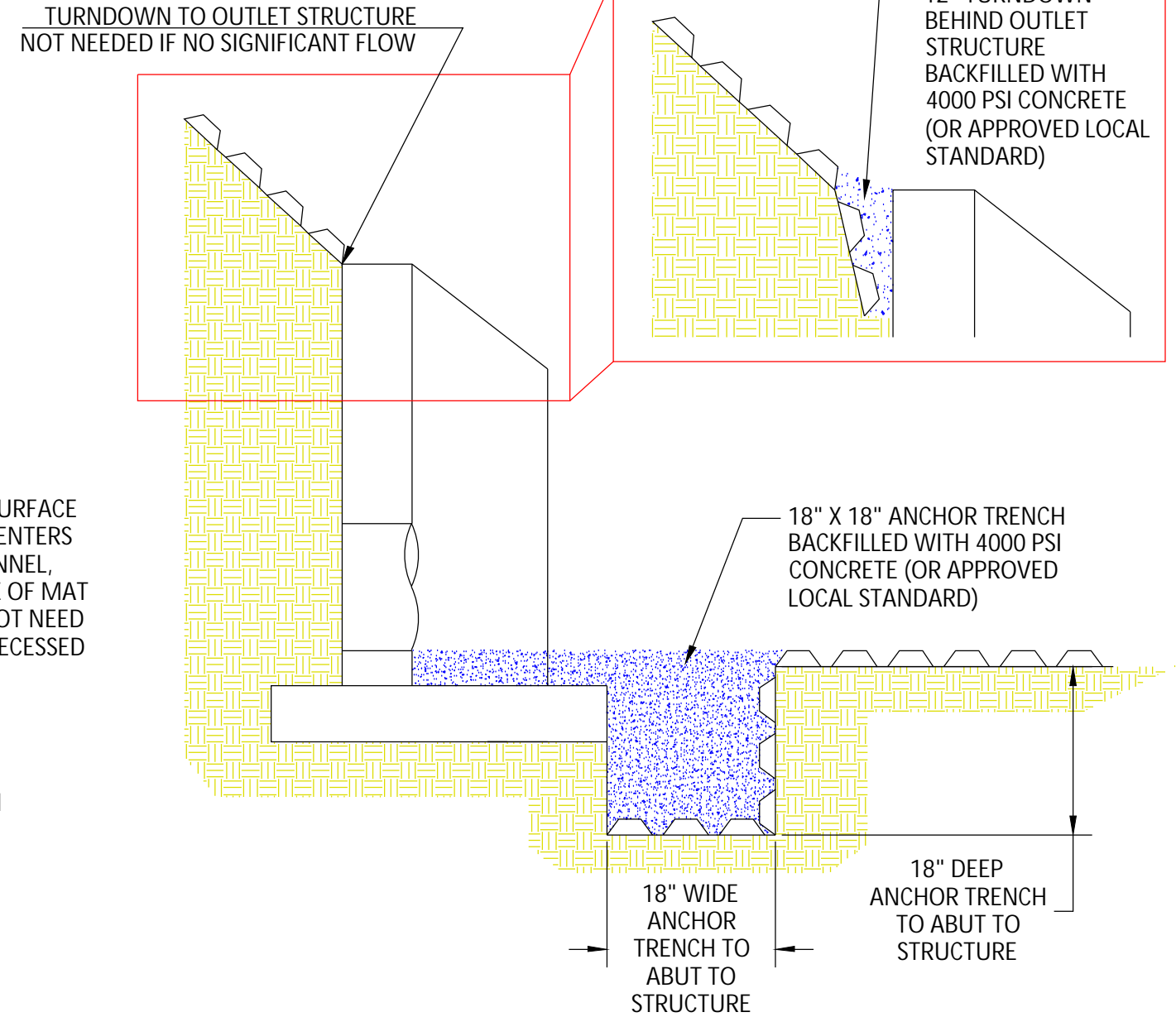
D. Maintenance

Transition mats are generally permanent installations, and maintenance should not be necessary. Utilized in a temporary installation, the transition mats and TRMs can be picked up and moved when appropriate.

ISOMETRIC VIEW OF OUTLET AND SLOPE PROTECTION



PROFILE VIEW OF ANCHOR TRENCHES



FLEXAMAT STANDARD - OUTLET ARMORING

CONSTRUCTION NOTES:

- GRADE CHANNEL SO THAT WATER WILL FLOW DOWN CENTER OF THE CHANNEL AND BE CONTAINED TO THE CHANNEL. ALL SUBGRADE SURFACES PREPARED FOR PLACEMENT OF MATS SHALL BE SMOOTH AND FREE OF ALL ROCKS, STICKS, ROOTS, OTHER PROTRUSIONS, OR DEBRIS OF ANY KIND. THE PREPARED SURFACE SHALL PROVIDE A FIRM UNYIELDING FOUNDATION FOR THE MATS.
- PRIOR TO FLEXAMAT STANDARD INSTALLATION, SEED AND FERTILIZER SUBGRADE WITH SITE SPECIFIC SEED MIX IN ACCORDANCE WITH THE PROJECT PLANS AND SPECIFICATIONS.
- INSTALL FLEXAMAT ROLLS. AVAILABLE WIDTHS ARE 4', 5.5', 8', 10', 12', AND 16' AVAILABLE IN CUSTOM LENGTHS. FOR WIDTHS WIDER THAN 16', INSTALL 15.5' WIDE MAT WITH 12" GEOGRID EXTENSION AND 6" UNDERLAYMENT EXTENSION.
 - WHERE POSSIBLE AVOID LONGITUDINAL ABUTMENT SEAMS IN CHANNEL BOTTOM.
 - FOR OUTLET PROTECTION WIDER THAN 16' SEE CHANNEL PARALLEL TO FLOW INSTALLATION DETAIL.
 - FOR OUTLET PROTECTION THAT REQUIRES MORE THAN 1 MAT IN LENGTH TO COVER CHANNEL SEE CHANNEL PARALLEL TO FLOW INSTALLATION DETAIL.
- AT THE BEGINNING OF CHANNEL, THE INITIAL LEADING EDGE OF FLEXAMAT EXPOSED TO CONCENTRATED FLOW SHALL BE EMBEDDED 18" VERTICALLY INTO ANCHOR TRENCH. THE TRENCH SHALL BE FILLED WITH 4,000 PSI CONCRETE.
- AT THE END OF THE ARMORED CHANNEL, EMBED THE MAT 18" IN A TERMINATION TRENCH. FILL AND COMPACT TERMINATION TRENCH WITH A COHESIVE FILL.

GUIDANCE TABLE FOR STORMWATER OUTFALL PROTECTION

PIPE DIAMETER		FLEXAMAT WIDTH	FLEXAMAT LENGTH (*MIN)
12"	8 CFS	5.5'	5'
18"	20 CFS	8'	8'
24"	30 CFS	8'	10'
36"	75 CFS	12'	16'
48"	100 CFS	16'	20'
60"	150 CFS	20'	25'

*CONSULT MANUFACTURER FOR GUIDANCE IF DESIGN DISCHARGE VARIES SIGNIFICANTLY FROM VALUES LISTED IN TABLE.
 *LENGTH OF PROTECTION WILL VARY ON THE LENGTH OF THE SLOPE, DEGREE OF SLOPE, OR IF IT IS DISCHARGING ONTO A FLAT AREA. OUTFALLS DISCHARGING ONTO SLOPES, IT IS RECOMMENDED TO EXTEND FLEXAMAT PLUS THE LENGTH OF THE SLOPE AND 3' PAST THE TOE.

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