

## 4.11 Treatment Swale SCM

The following chapter from the NCDEQ Stormwater Design manual (Part C-11, last updated 11/20/2020) is accepted in the BMP Manual with the following exceptions:

MDC	Description
MDC 2: Shape	4:1 or flatter is required for side inflow by sheet flow
MDC 5: Conveyance of larger storms	Non-erosively pass SCM design storm. 100+1 flood study may be required if applicable. See the Open Channel Hydraulics chapter of the Storm Water Design Manual for additional information.
Recommendation 1:	6" freeboard for the 10- year storm is required.
<b>Additional Requirements:</b>	
Safety Features	Ponding depths for durations longer than 6 hours for all storm events must be limited to a maximum of 18 inches.
Drainage area limits	Maximum drainage area of 20 acres

## C-11. Treatment Swale



Montgomery County, MD

### Design Objective

Swales remove pollutants from stormwater by biofiltration, settling, and infiltration. Treatment swales filter pollutants as stormwater runoff moves through the leaves and roots of the grass. By reducing flow velocities and increasing a site's time of concentration, treatment swales contribute to reducing runoff peaks. Treatment swales that are designed with check dams or incorporate depression storage promote infiltration and can help contribute to satisfying a site runoff capture/storage requirement. Vegetated conveyances designed primarily to convey stormwater from a project rather than to remove pollutants are not subject to this Rule, but instead shall meet the minimum requirements of Rule .1003(2)(c).

### Design Volume

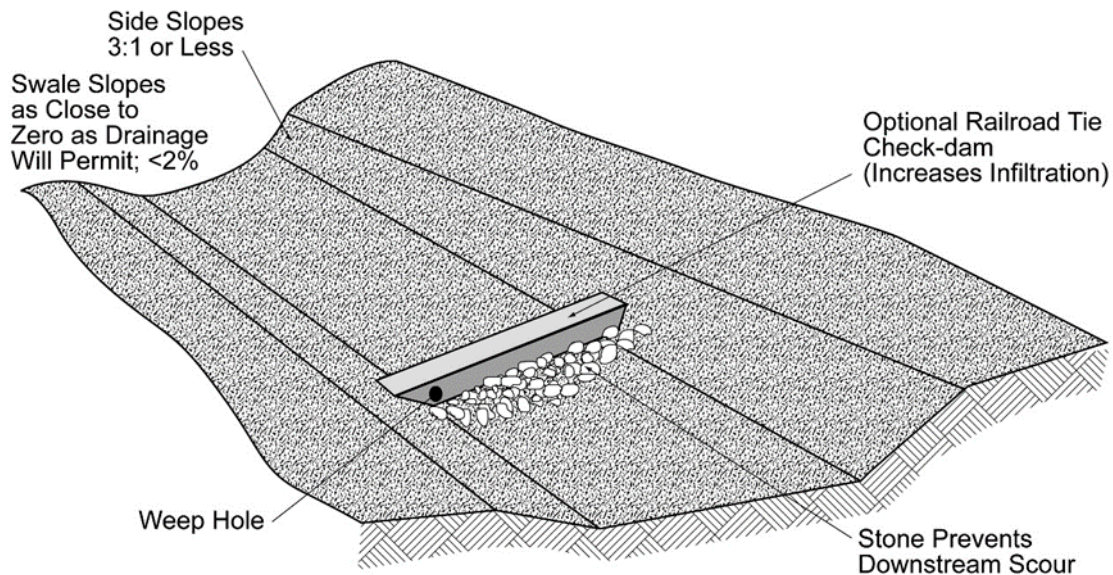
The design volume for a pollutant removal swale is the volume of runoff from a 0.75 inch/hour storm that results in a flow depth of six inches or less and hydraulic retention time of 4 minutes or greater in a trapezoidal swale with side slopes no steeper than 3:1.

### Important Links

Rule 15A NCAC 2H .1061. MDC for Treatment Swales

SCM Credit Document, C-11. Credit for Pollutant Removal Swales

**Figure 1: Basic Treatment Swale Elements**



## Guidance on the MDC

### **MDC 1. SHWT.**

Swales shall not be excavated below the seasonally high water table.

Swales with bottoms intersecting the SHWT may remain inundated with groundwater during portions of the year and have insufficient volume available to treat runoff from the design flow. They are also more prone to developing soggy bottoms and wetland vegetation.

### **MDC 2: SHAPE.**

Swales shall be trapezoidal in cross-section with a maximum bottom width of six feet. Side slopes stabilized with vegetative cover shall be no steeper than 3:1 (horizontal to vertical). Steeper vegetated slopes may be considered on a case-by-case basis provided that it is demonstrated that the soils and vegetation will remain stable in perpetuity.

The swale is typically parabolic or trapezoidal in cross section for ease of construction and maintenance and for reducing the potential for scour.

**MDC 3: SWALE SLOPE AND LENGTH.**

The longitudinal swale slope shall not exceed seven percent. The swale slope and length shall be designed to achieve a flow depth of six inches or less during the 0.75 inch per hour storm and a minimum hydraulic retention time of four minutes.

A treatment swale shall be designed such that the treatment volume has a HRT of at least four minutes and has a ponding depth of less than six inches (to ensure flow through grass vegetation) for a 0.75 in/hr storm intensity. Maximum longitudinal slope shall be 7%.

**MDC 4: GRASS SPECIFICATION.**

The grass species in the swale shall be:

- (a) non-clumping and deep-rooted;
- (b) able to withstand a velocity of four feet per second;
- (c) managed at an average of six inches; and
- (d) not be cut lower than four inches.

Standard turf grasses may be used if a lawn appearance is desired. The turf grasses include standard mixtures such as those recommended in the DEQ *Erosion and Sediment Control Planning and Design Manual* and the recommended vegetation tables in Section 6 of this document. The recommendation is to use taller growing grasses to improve the filtering capability of the swale. Bluegrass should be avoided for areas where salt loading is high.

**MDC 5: CONVEYANCE OF LARGER STORMS.**

Swales shall be designed to non-erosively pass the ten-year storm.

Non-erosive permissible velocity for pollutant removal swales with established grass lining is defined by the Table 1.

**Table 1: Maximum Permissible Velocities Based on Soils and Grass Species**

Type of Soil	Type of Grass	Permissible Velocity for Established Grass Lining (feet/sec)
Easily Erodible Non-Plastic (sands & silts)	Bermuda Grass	5.0
	Tall Fescue	4.5
	Bahiagrass	4.5
	Kentucky Bluegrass	4.5
	Grass-Legume Mixture	3.5
Erosion Resistant Plastic (clay mixes)	Bermuda Grass	6.0
	Tall Fescue	5.5
	Bahiagrass	5.5
	Kentucky Bluegrass	5.5
	Grass-Legume Mixture	4.5

Notes from Table 1:

- Permissible velocity is based on the 10-year storm peak runoff
- Soil erodibility is based on resistance to soil movement from concentrated water flow.
- Before establishment, permissible velocity is based on the type of liner used.

## Recommendations

### **RECOMMENDATION 1: FREEBOARD.**

A minimum freeboard of 6 inches for the 10-year storm is recommend.

Providing a 6-inch freeboard in the treatment swale for structural integrity as a good engineering practice.

## Design Variants

The designer may use check dams to retain a permanent pool of water within the treatment swale. This will result in a greater credit for nutrient removal as described in the SCM Credit Document's chapter C-11. Credit for Pollutant Removal Swales.

## Maintenance

Important operation and maintenance procedures:

1. The drainage area of the treatment swale will be carefully managed to reduce the sediment load to the treatment swale.
2. After the initial fertilization to establish the grass in the swale, fertilizer will not be applied to the treatment swale.

The treatment swale will be inspected **quarterly**. Records of inspection and maintenance will be kept in a known set location and will be available upon request.

Inspection activities shall be performed as follows. Any problems that are found shall be repaired immediately.



**Table 2: Sample Operation and Maintenance Provisions for Treatment Swales**

SCM element:	Potential problems:	How to remediate the problem:
The entire length of the swale	Trash/debris is present.	Remove the trash/debris.
	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, re-sod (or plant with other appropriate species) and water until established. Provide lime and a one-time fertilizer application.
	Sediment covers the grass at the bottom of the swale.	Remove sediment and dispose in an area that will not impact streams or SCMs. Re-sod if necessary.
	Vegetation is too short or too long.	Maintain vegetation at a height of approximately six inches.
	Grass is dead, diseased or dying.	Determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and

		replace plants. Provide a one-time fertilizer application to establish the ground cover if necessary.
	Trees and/or other woody vegetation are present in the treatment swale.	Remove the trees and woody vegetation from the treatment swale, regrade the treatment swale if necessary and re-establish grass as shown on the approved plans.
The receiving water	Erosion or other signs of damage have occurred at the outlet.	Repair the damage and improve the flow dissipation structure.
	Discharges from the treatment swale are causing erosion or sedimentation in the receiving water.	Contact the local NCDEQ Regional Office.