DPS | Montgomery County
Department of Permitting Services

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MONTGOMERY COUNTY SAND FILTER (MCSF)

January 2009

A. Facility Description

Montgomery County DPS staff has developed a simple surface sand filtration system for providing water quality control which is applicable to drainage areas of 5 acres or less. The Montgomery County Sand Filter (MCSF) is essentially a shallow, dry stormwater management facility which incorporates a sand filter with an underdrain. The MCSF system does not employ a pre-treatment sediment basin. Instead, pretreatment is provided via a grass filter strip or by structural means.

B. Design Considerations

1. Applicability

The MCSF may be considered for catchment areas up to 5 acres, except as noted below. Where high particulate pollutant loads and/or trash-debris levels are expected, multiple BMP's, and/or increased pretreatment must be used. In Special Protection Areas, the maximum catchment area is 3 acres. The MCSF must be located a minimum of 20-feet from any building foundation, as measured from the 10-year water surface elevation within the facility. It may not be located in the bottom of a detention pond. Retaining walls will not be allowed as part of the facility design or anywhere within the stormwater management easement for the facility.

2. Design Storm

The facility must be sized to provide storage for the required water quality volume. Peak flows from the 10-year frequency storm must be safely conveyed around the facility whenever possible.

3. Soil Suitability

It is important that the facility is placed in an area that will be conducive to its long term effectiveness. Shallow bedrock, uncontrolled fill and high groundwater can all inhibit the installation or function of a sand filter.

Field Investigation

a. To be performed by boring or open excavation.

b. Soil description to include all soil horizons.

c. Soil textures to be identified according to USDA and Unified Soil Classification.

d. Soil boring depth shall extend at least 4 feet below the bottom of the proposed trench in order to ensure the facility is separated from seasonal high groundwater by at least 2 feet.

e. Groundwater elevations are to be recorded at the time of boring and after 24 hours. Based on this information, along with appropriate soil analysis, the seasonal high groundwater table shall be determined. Measured groundwater elevation alone is not sufficient to estimate seasonal high groundwater elevation.

C. Specifications and Details

1. Embankment Criteria

These criteria are for shallow facilities only. For MD-378 pond facilities, those criteria and DPS pond requirements must apply.

The MCSF utilizes an embankment with a minimum top width of four feet, maximum 3:1 side slopes and a core trench. Appropriate pond construction specifications must also be used. It is imperative that the appropriate underdrain excavation, core trench, and all backfill and embankment requirements are met, since these are permanent facilities. Refer to "Construction Specifications for Shallow Facilities" and “Water Resources Technical Policy: Height of Embankments for Water Quality Structures (WRTP-3)”. For facilities that meet the pond standard as defined in MD-378, those criteria and DPS pond requirements must fully apply. However, the sand and underdrain criteria described herein must be utilized in either case.

2. Overflow Weir Sizing Criteria

All facilities must be designed without overflow weirs wherever possible. Flows in excess of the water quality volume must be conveyed away from the facility via a flow splitter. Design of the overflow weir or structure, if required, is largely dependent upon the way flows are delivered to the facility. Refer to “Montgomery County Flow Splitting Criteria”. Generally, the overflow weir design is as follows:

a. An overflow weir or structure may not be required where a minimum of one foot of freeboard is provided above the 10-year water surface elevation in the facility.

b. If an overflow weir or structure is necessary, it must be concrete. Grassed overflow weirs are not acceptable. If the facility is not fed by a flow-splitter, size the weir to safely pass the full 10-year storm.

   If the facility is fed by a flow-splitter, outlet weir sizes may be reduced, with the outlet weir sized to safely pass whatever portion of the 10-year storm is delivered to the facility.

   Specific designs to safely pass either a flow-split Q or the 10-year storm, both with one foot of freeboard, are necessary. Provide a safe non-erosive outlet below the outfall.

3. Water Quality Storage Criteria

Storage volume is determined from the top of the sand to the crest of the outlet weir (if provided) or invert of the flow splitter overflow pipe, whichever is lower. Storage within the sand/gravel layers shall not be considered toward required storage volume. When the design storage depth in the facility exceeds 24-inches, “Pond Safety” signage must be installed. Storage depths may not exceed 4-feet. Contact the Montgomery County Department of Environmental Protection (240-777-7700) for signage.

4. Sand Filter Layer

Clean, washed silica sand meeting the sieve requirements of ASTM C33 Fine Aggregate Concrete Sand is utilized for applications in Montgomery County. DPS requires a minimum sand depth of 18-inches above the underdrain gravel. Limestone based products, manufactured sand and stone dust are not acceptable. Natural sand deposits may not be used, as they may contain impurities.

Minimum filter area is determined by multiplying the WQV by 10%, with a minimum surface area of 200 square feet. For example, if the WQV is 3,500 cubic feet, the required sand filter surface area is 350 square feet, as illustrated by the formula below:

$A_f = WQV\ (0.1)$

If WQV (0.1) < 200, use 200 square feet as the minimum surface area.

If the storage amount provided is in excess of the required WQV, the surface area will be computed based on the provided volume. Do not design the facility to store more than 110% of the WQV.

A 4-inch layer of washed pea gravel must be placed on top of the sand layer. The gravel must be washed, uncrushed natural pea gravel, size no. 8. The top of the gravel must be level with the surrounding ground surface. No geotextile or filter fabric will be allowed between the pea gravel and the sand.

5. Gravel Bed Around Collector Pipe(s)

The gravel layer surrounding the underdrain pipe(s) must meet MSHA size #7 (Table 901A), and must provide a minimum of 6 inches cover over the pipe(s). No geotextile or filter fabric is allowed anywhere within the filter media (stone and sand). The gravel must extend across the entire bottom of the facility, with a minimum of 3-inches below the perforated underdrain pipe.

6. Underdrain Pipe

The underdrain pipe consists of 6-inch diameter schedule 40 or stronger perforated PVC pipe at 0.00% slope. Perforations must be 3/8 inch in diameter and must be located 4 inches on center, every 90 degrees around the pipe. Perforated pipe must begin at least 5' inside the filter media.

Access for cleaning all underdrain piping is needed. Clean-outs for each pipe should extend 6 inches above the top of the sand and have a removable waterproof cap.

The required number of underdrain pipes is proportional to the surface area of the sand filter. To determine the maximum number of underdrain pipes required, multiply the surface area square footage by 0.05. This determines the linear feet of piping required. Use a minimum of two pipes whenever possible. For example, if the surface area of the sand filter is 450 square feet, then:

450 (0.05) = 22.5 LF (This should be rounded to the nearest foot.)

Thus, the requirement will be for two underdrain pipes, each 11 feet long.

7. Pre-Treatment Grass Filter

As previously stated, stormwater runoff entering the MCSF system must outfall onto a rip-rap or surge stone apron which discharges into a grass filter strip or swale. For entry points conveying runoff from less than 2 acres of vehicular imperviousness, the required grass filter length shall be determined by multiplying the sand filter surface area by 0.1. In no case shall the grass filter strip be less than 20 LF. For example, if the surface area of the sand filter is 450 square feet, then:

450 (0.1) = 45 LF grass pre-treatment required

For entry points conveying runoff from more than 2 acres of vehicular imperviousness, structural pre-treatment will be required. Pretreatment shall be sized for full water quality for the contributing drainage area. Pretreatment does not reduce the sizing requirement of the MCSF.

All incoming runoff shall be treated in this manner prior to its entry onto the sand surface layer. In subdivisions with open section roadways, the road ditches may be considered as pretreatment. DPS does not employ pretreatment sediment basins.

8. Internal Basin Geometry

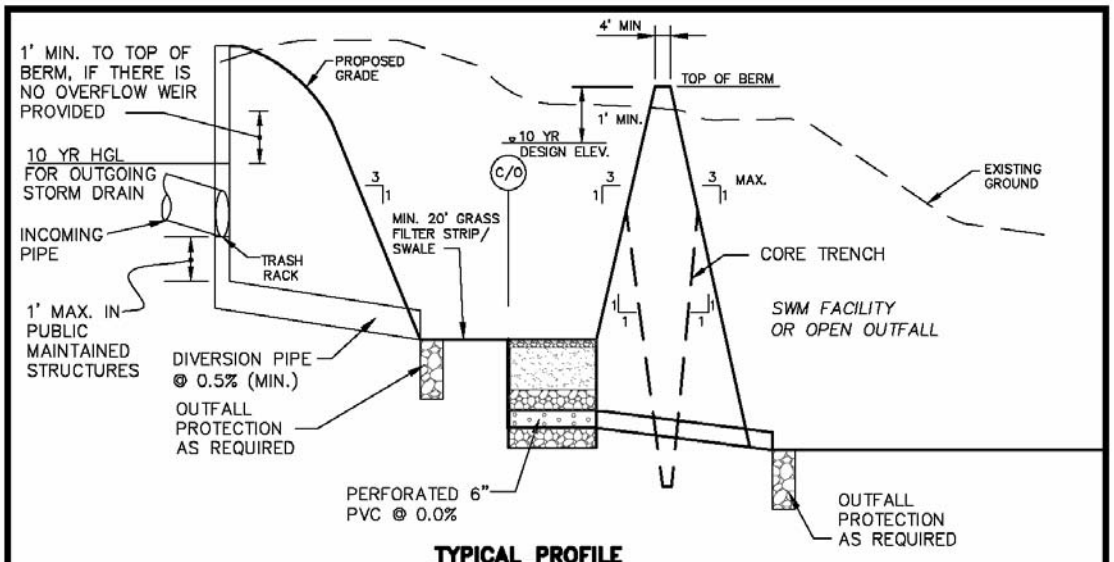
Inflow points and the underdrain pipe(s) should be located as far away from one another as possible to maximize the length of the pollutant removal pathway. Within the grass swale system, low height earthen berms may be employed to increase the length of the pollutant removal pathway.

9. Outfall Protection

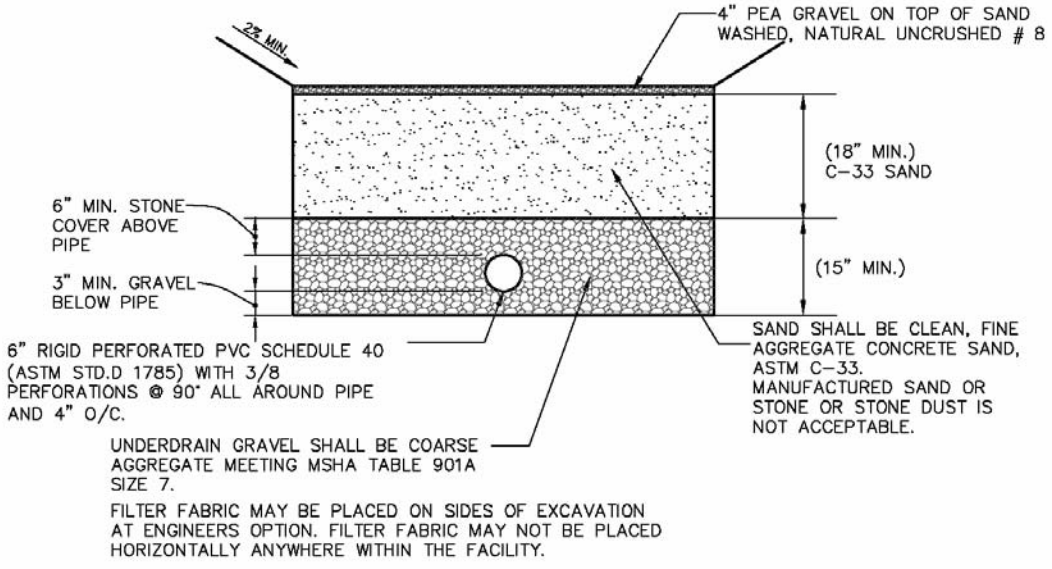
Any pipe outfall from a MCSF must be onto a rip-rap or surge stone apron. A concrete endwall is required for pipe support.

10. Concrete

Concrete design shall meet the requirements of ACI 350, Environmental Engineering Concrete Structures, with freezing and thawing exposures. Concrete shall be a type II or IIA cement, with a 28 day compressive strength of 4500 psi for cast in place and 5000 psi for pre-cast structures. Concrete shall also meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 420, Mix No. 6.



TYPICAL PROFILE



TYPICAL SECTION

MONTGOMERY COUNTY 1776 MARYLAND	MONTGOMERY COUNTY DEPARTMENT OF PERMITTING SERVICES WATER RESOURCES	MONTGOMERY COUNTY SAND FILTER (MCSF) DETAIL	DATE: 01/05
			SCALE: NONE