Chapter 7.0
Filtration BMPS

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Filtration BMPs, particularly vegetated organic soil filter media BMPs, have been shown to be very effective at removing a wide range of pollutants from stormwater runoff. Soil filters can be designed and constructed using common materials; however, some manufacturers have developed proprietary filter media and structures that may also be used with DEP approval. This chapter discusses the design and construction of underdrained soil filters.

Underdrained soil filters provide quality treatment and channel protection as the underdrain piping system slowly releases the discharge of runoff. This prevents downgradient channel erosion associated with more frequent increased flow volumes. It also cools the runoff, reducing thermal impacts to receiving streams.

Underdrained soil filter structures must detain a runoff volume equal to 1.0 inch times the subcatchment's impervious area plus 0.4 inch times the subcatchment's landscaped developed area. Upgradient areas should be directed away from the filter basin. This surface area of a grass filter bed should represent no less than the sum of 5% of the impervious area and 2% of the landscaped area draining into it. For a bioretention cell, the surface area needs to be at least 8% of the impervious area and 3% of the landscaped area. When used to meet phosphorus allocation in lake watersheds, the sizing of the underdrain filter structures need to be adjusted in accordance with Volume II of this BMP manual.

DEP strongly encourages the use of Low Impact Development (LID) techniques and recommends the use of small underdrained soil filter basins dispersed throughout a site with a maximum drainage area of 0.75 to 1.0 acre for each individual filter.

The soil filter should be designed to drain the channel protection or water quality volume within 24 to 48 hours. If flood control is also required, detention within the structure or in parallel must be provided.

The peak storage depth within the filter structure may not exceed 18 inches if grassed and 6 inches if planted with landscaping plants. Storage and detention for flooding conditions and to meet the 2, 10 and 25-year peak control is allowed within the structure and over the channel protection volume provided that it will drain within 12 hours.

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Filter basins may be constructed as infiltration or underdrained soil filters depending on site soils; however, the design standards and requirements for infiltration provided in Chapter 6 of Volume III of the Maine BMP Manual must be followed. Soils must be able to infiltrate the pooled water within 12 hours, requiring an infiltration rate of greater than 0.5 to 1.5 inch per hour depending on the depth of water. In very permeable soils that have a permeability rate of 2.41 inch per hour or greater and where the groundwater table is deeper than the bottom of the basin, an impermeable liner will be required to protect the groundwater from contamination.

Underdrained soil filter basins must be planted with plant species that are tolerant of draught conditions with frequent inundation. Mulching is required. See Appendix B of Volume I for appropriate plant species for Maine. A landscape designer or architect should be involved to select the appropriate plants for conditions at the site.

7.0.1 Description of an Underdrain Soil Filter BMP

Vegetated underdrained soil filters control stormwater quality by capturing and retaining runoff and passing it through a filter bed comprised of a specific soil media. Soil filters having a mixture of silty sand and organic matter achieve the highest removal rates and therefore are the focus of this Chapter. These filters can remove a wide range of pollutants from stormwater, including suspended sediment, phosphorus, nitrogen, metals, hydrocarbons and some dissolved pollutants.

Once through the soil media, the runoff is collected in a perforated underdrain pipe and discharged to the receiving water. The filter and underdrain provides for slow release of smaller storm events, minimizing stream channel erosion and cooling of the discharge. There are several types of filters and these will be discussed individually and in more details in the following sections.

Vegetated soil filters are usually located in close proximity to the origin of the stormwater runoff and it is anticipated that these facilities would most often be scattered throughout a residential area or along the downhill edge of smaller parking areas.

7.0.2 Site Suitability Criteria

Drainage Area: The size of the underdrained soil filter and storage capacity over the filter is based on the size and land use within the area draining to the structure.
Depth to Groundwater: In most instances, the bottom of the underdrained soil filter should be above the seasonal high groundwater table and should always be below the invert of the underdrain pipe.
Bedrock: Bedrock close to the surface may require blasting or an impermeable liner to prevent fast infiltration and the potential of contaminating the deep groundwater table.
Test Pits: One test pit shall be excavated for filter bed area to identify the depth to groundwater and bedrock
Infiltration: Vegetated soil filters can be designed to infiltrate water into the groundwater below or to filter the water through the bioretention soil media and collect it in an underdrain located beneath the soil media. In Maine, the most typical use of vegetated soil filters will be with an underdrained soil filter structure because natural soils are rarely suitable for infiltration