F.15 Media Filters

F.15.1 Media Filter Plan Standards

1. Verify that the plans include an appropriate sequence of construction that is specific to the construction of the media filter. Refer to Section 4.9.5 for guidance. [Section 2.3.1]
2. Verify that the plans include an appropriate cross-sectional detail for the media filter. [Section 2.3.1]

F.15.2 Media Filter Design Standards

1. Verify that the following information is submitted for each proposed media filter as part of the applicant's Post-Construction Stormwater Management Plan (PCSMP) Review Phase Submission Package: [Section 4.9.3, 1]
    a. Inflow and outflow event mean concentrations and percent removals for Total Suspended Solids (TSS) for sand/media filters (Designs must demonstrate a maximum effluent event mean concentration (EMC) of 15 milligrams per liter for TSS at a point of analysis (POA) downstream of the SMP);
    b. Third-party certifications for proprietary media filters;
    c. Hydrologic and hydraulic model files, if applicable;
    d. Product specifications for proprietary media filters;
    e. Manufacturer's guidelines for installation for proprietary media filters;
    f. Construction sequence; and
    g. Maintenance requirements, including product life and replacement schedule, if applicable.
2. For proprietary media filters, verify the following:
    a. Verify that the manufacturer's design guidance for appropriate pretreatment is followed. [Section 4.9.3, 7]
    b. Verify that the manufacturer's design guidance for inlet control configuration is followed. [Section 4.9.3, 9]
    c. Verify that the manufacturer's design guidance for filter sizing is followed. [Section 4.9.3, 11]
    d. Verify that the manufacturer's design guidance for outlet control configuration is followed. [Section 4.9.3, 22]
    e. Verify that the manufacturer's design guidance for inspection and maintenance access is followed [Section 4.9.3, 27]
3. Verify that the SMP drains within the acceptable 72-hour period after the 24-hour storm event. [Section 4.9.3, 2]
4. Verify that the filter footprint is sized pursuant to the filter media flow-through rate. [Section 4.9.3, 3]

5. Verify that positive overflow is provided for large storm events, up to and including the 100-year, 24-hour storm event, or, if the project is exempt from Flood Control, the ten-year, 24-hour storm. [Section 4.9.3, 4]
6. Verify that overflow structures and pipes are designed to convey at least the ten-year, 24-hour storm event. [Section 4.9.3, 4]
7. Verify that proposed filters without detention are able to convey the ten-year, 24-hour storm event. [Section 4.9.3, 5]
8. Verify that proposed filters with detention are designed to safely store and/or convey the 100-year, 24-hour storm event. [Section 4.9.3, 6]
9. Verify that pretreatment is provided for all runoff entering the media filter, including pretreatment of runoff from all inlets. At a minimum, this can be achieved through the use of sumps and traps. [Section 4.9.3, 8]
10. Verify that the filter system provides enough storage to allow the Water Quality storm to flow through the filter media. Upstream SMPs can be used to store this flow. [Section 4.9.3, 12]
11. Verify that, when SMPs are used in series, the storage areas for all SMPs provide cumulative static storage for the Water Quality Volume (WQv). [Section 4.9.3, 13]
12. Verify that the porosity values used for storage volume calculations are as follows: [Section 4.9.3, 15]
    a. Soil media: 0.20
    b. Sand: 0.30
    c. Stone: 0.40
    d. Porosity values of any proprietary rapid media should be obtained from the appropriate manufacturer.
13. Verify that filters have a minimum surface area as computed by the following equation: [Section 4.9.3, 16a]

$$A_f = \frac{(WQv \; x \; 0.8)}{k}$$

Where:
Af = surface area of the filter (square feet);
WQv = Water Quality Volume, the 1.5-inch Water Quality Volume over directly connected impervious area (DCIA) (cubic feet); and
k = saturated hydraulic conductivity of the filter media (feet per day)

14. Verify that a filtration rate of two inches per hour for sand and soil is used when computing surface area (accounting for the reduction in filtration rates for sand over time due to build-up of fine material). [Section 4.9.3, 16b]
15. Verify that the determination of filtration rate for proprietary or mixed media is obtained from manufacturers or from evaluation of similar applications. High filtration rates at installation associated with some media types may yield small required surface area values. Verify that the assumed infiltration rate accounts for the potential for filter systems to clog over time. [Section 4.9.3, 16c]
16. Verify that the filter media depth is a minimum of 18 inches (greater depths may be used but do not alter filter sizing requirements). [Section 4.9.3, 17]

17. Verify that stone is not used as filter media. It can be used within filter systems to provide additional storage. [Section 4.9.3, 18]
18. Verify that pipe, vault, grid, and chamber storage areas are adequately bedded with stone to prevent settling or subsidence. [Section 4.9.3, 19a]
19. Verify that bedding thickness is not less than six inches. [Section 4.9.3, 19b]
20. Verify that foundations/footers are provided as warranted by system loading, geotechnical conditions, and manufacturer's recommendations. Foundation designs must be performed by an appropriate design professional. [Section 4.9.3, 19d]
21. Verify that the storage design accounts for potential loading from vehicles, as appropriate, based on expected maximum active loading, including consideration for emergency vehicles. [Section 4.9.3, 20]
22. Verify that the system has a level bottom and uses a terraced system, if installed along a slope. [Section 4.9.3, 21]
23. Verify that impervious liners are provided for all filter systems not contained in impermeable structures. [Section 4.9.3, 23]
24. Verify that any impervious liner, if necessary, is not interrupted by structures within the filter footprint. The plans must indicate that the impervious liner is to be continuous and extend completely up the sides of any structures that are located within the lined filter footprint to the ground surface. If additional liner material must be added to extend up the structures, the additional liner sections are to be joined to the rest of the liner with an impervious seam per the manufacturers' recommendations. [Section 4.9.3, 23]
25. Verify that an underdrain is provided for any non-infiltrating system and that it meets the following requirements:
    a. Underdrains must be surrounded by a sand layer or stone to filter sediment and facilitate drainage. [Section 4.9.3, 24a]
    b. The minimum allowable depth of a sand or stone filter layer above and beneath the underdrain is six inches. [Section 4.9.3, 24b]
    c. Underdrains must be surrounded by a geotextile fabric if sand is used. [Section 4.9.3, 24c]
    d. The outlet pipe of an outlet control structure must have an invert at or below the invert of the underdrain. Setting the outlet pipe invert at a minimum of 7.5 inches below that of the underdrain is recommended. [Section 4.9.3, 24d]
26. For filters located in the separate sewer area, where infiltration is infeasible, flow through the underdrain may be modeled as exfiltration at a rate of two inches per hour for sand media and at an appropriate rate for other filter media, then routed through the underdrain system. Verify that this exfiltration flow is routed through the primary outlet of the filter, not discarded from the stormwater model. Determination of filtration rate for proprietary or mixed media must be obtained from the manufacturer or from evaluation of similar applications. [Section 4.9.3, 25]
27. Verify that an adequate number of appropriately placed manholes, access panels and other access features are provided to allow unobstructed and safe access to the media filter for routine maintenance and inspection of inflow, outflow, underdrains, and storage systems. [Section 4.9.3, 28]
28. Verify that access features are provided for underground storage SMPs within which filters are contained and that are not stone storage beds. [Section 4.9.3, 29a]

29. Verify that a sufficient number of access points in the SMP are provided to efficiently inspect and maintain the storage area. [Section 4.9.3, 29b]
30. For cast-in-place vault systems within which filters are contained, verify that access features consist of manholes or grated access panels or doors. Grated access panels are preferred to maintain airflow. [Section 4.9.3, 29c]
31. Verify that ladder access is proposed for vaults, within which filters are contained, greater than four feet in height. [Section 4.9.3, 29f]

F.15.3 Media Filter Material Standards

1. Verify that stone, if proposed, designed for stormwater storage is specified on the plans as being uniformly graded, crushed, clean-washed stone and that it is noted that PWD defines “clean-washed” as having less than 0.5% wash loss, by mass, when tested per the AASHTO T-11 wash loss test. AASHTO No. 3 and No. 57 stone can meet this specification. [Section 4.9.4, 3a]
2. Verify that stone, if proposed, is separated from filter media by a geotextile or a pea gravel filter. [Section 4.9.4, 3b]
3. Verify that sand used as filter media, if proposed, is specified on the plans to be clean, medium to fine sand, and to have organic material meeting the specifications of AASHTO M-6 or ASTM C-33 sand and a grain size of 0.02 inches to 0.04 inches. [Section 4.9.4, 4a]
4. Verify that sand used as filter media, if proposed, is capable of generating a maximum effluent EMC of 15 milligrams per liter for TSS accumulated at a POA downstream of the SMP. [Section 4.9.4, 4b]
5. Verify that peat, if proposed, has an ash content of less than 15%, a pH range of 3.3 to 5.2, and a loose bulk density range of 0.12 g/cc to 0.14 g/cc. [Section 4.9.4, 5b]
6. Verify that any filter media other than sand or peat is capable of generating a maximum effluent EMC of 15 milligrams per liter for TSS accumulated at a POA downstream of the SMP, meets all other filter design and water quality specifications set forth in Section 4.9, and has a demonstrated record of high performance within urban settings. [Section 4.9.4, 5c]
7. Verify that geotextile, if proposed, is specified on the plans to consist of polypropylene fibers and to meet the following specifications (AASHTO Class 1 or Class 2 geotextile is recommended): [Section 4.9.4, 6]
    a. Grab Tensile Strength (ASTM-D4632): ≥ 120 lbs
    b. Mullen Burst Strength (ASTM-D3786): ≥ 225 psi
    c. Flow Rate (ASTM-D4491): ≥ 95 gal/min/ft^2
    d. UV Resistance after 500 hrs (ASTM-D4355): ≥ 70%
    e. Heat-set or heat-calendared fabrics are not permitted
8. Verify that underdrains, if proposed, are made of continuously perforated HDPE plastic piping with a smooth interior and a minimum inner diameter of four inches. HDPE pipe must be specified on the plans to meet the specifications of AASHTO M252, Type S or AASHTO M294, Type S. [Section 4.9.4, 7]