

3.6 Biofiltration Facility (no infiltration/limited infiltration)

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| Type of BMP | LID – Biofiltration |
| Priority Level | Priority 2 – Biofiltration without infiltration |
| Treatment Mechanisms | Evapotranspiration, Evaporation, Biofiltration |
| Infiltration Rate Range | Less than 0.1 in/hr (factored) or other feasibility criteria limits any amount of infiltration |
| Maximum Drainage Area | This BMP is intended to be integrated into a project’s landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 5 acres. For facilities treating larger drainage basins see Fact Sheet 3.7 for additional guidance on design of larger scale facilities. |

Description

Biofiltration Facilities are shallow, vegetated basins that filter water through vegetation and engineered soil media prior to discharge via underdrain or overflow to the downstream conveyance system. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil media and maximize plant uptake of pollutants and runoff. This can extend the time until the BMP clogs and allows more of the soil column to function as both a sponge (retaining water) and an effective biofilter.

Biofiltration Facilities are similar to Biofiltration with Partial Infiltration Facilities except Biofiltration Facilities are generally lined and include a shallower gravel underdrain layer. **This fact sheet is condensed to include only the design aspects and criteria that are different when designing biofiltration compared to biofiltration with partial infiltration.** The user should refer to the Biofiltration with Partial Infiltration Fact Sheet (3.5) and apply the criteria in that fact sheets with the exception of the differences below.

Differences from Biofiltration with Partial Infiltration

Infiltration constraints do not apply. There are no setbacks or considerations related to infiltration feasibility. Infiltration does not occur in appreciable amounts in these facilities.

Underdrain placement and gravel depth is similar to biofiltration with partial infiltration, but for different purposes. These systems should still include a gravel layer of 12 to 18 inches below the underdrain discharge elevation wherever the system discharges to a nutrient-impaired water body. (This applies to all projects in Santa Margarita Watershed). This sump serves to promote nitrogen removal. This can be achieved with an upturned elbow on the outlet. Alternative outlet configurations are acceptable at the discretion of the local jurisdiction.

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Planter box configuration is allowed. Biofiltration Facilities that do not include infiltration can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 12 inches. No side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Other general criteria for design are the same as biofiltration with partial infiltration.



Figure 1: Planter Box

Use of proprietary devices as biofiltration BMPs may be allowed. Approved proprietary biofiltration devices may be classified as Biofiltration facilities . Proprietary biofiltration facilities are small footprint, manufactured devices that have been designed to provide biofiltration treatment through the use of high filtration rate media. Proprietary biofiltration BMPs can be considered equivalent to standard biofiltration facilities for the “no infiltration” feasibility condition. See Section 2.3.7 of the 2018 WQMP for approval requirements. Separate sizing methods, maintenance requirements, and design criteria may apply to proprietary biofiltration BMPs.

Sizing calculations are similar, but do not include the infiltration compartment. Because there is no volume retained via infiltration in these facilities, sizing methods differ.

Biofiltration Sizing and Design Procedure

Biofiltration Facilities provide treatment through biofiltration and do not provide appreciable retention (though a minor amount is possible via evapotranspiration). The sizing and design procedure is presented below:

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- 1) Enter the area tributary, A_T , to the Bioretention Facility.
- 2) Enter the required Design Volume, V_{BMP} (also referred to as DCV) determined from Section 2.1 of this Handbook.
- 3) Enter the estimated footprint for the BMP (use available space or default of 3% of contributing impervious surface area). **This is the effective footprint of the BMP.** It is measured at the mid ponding depth of the BMP. For example, if the BMP has a ponding depth of 12 inches, then effective footprint is the wetted surface area when the BMP is holding 6 inches of ponded water. For systems with vertical walls, the effective area is the same as the total area.
- 4) Enter the depth of surface ponding layer, d_p . The minimum depth of surface ponding layer can be 6" so that the runoff is uniformly spread throughout the basin. The maximum depth can be 12".
- 5) Enter the depth of the engineered soil media, d_s . The recommended minimum depth is 24". A depth of 36" is preferred to provide an enhanced root zone. Engineered soil media deeper than 36" will only get credit for the pore space in the first 36".
- 6) Enter the design media filtration rate of the media (I_{design}) of 2.5 in/hr to be used for sizing. Actual installed filtration rate may be higher.
- 7) Enter the allowable routing period ($T_{routing}$) of 5 hours. Routing period is estimated based on the 15th percentile storm duration for storms similar to 85th percentile rainfall depth at the Temecula gage.
- 8) Calculate the effective biofiltration depth, d_{E_bio} . The effective depth of biofiltration is calculated as:

$$d_{E_bio} \text{ (ft)} = (d_p + (0.3 \times d_s) + (I_{design} \times T_{routing})) \text{ (ft)}$$

The internal gravel storage is permanently saturated in this design and should not be considered in this calculation. The effective biofiltration storage should only include the storage above the discharge elevation of the underdrain. The maximum allowable pore space of the soil media is 30%. This calculation accounts for water biofiltered during the event.

- 9) Calculate the effective static biofiltration depth, $d_{E_bio_static}$, within the Biofiltration with Facility. The effective depth of biofiltration storage is calculated as:

$$d_{E_bio_static} \text{ (ft)} = (d_p + (0.3 \times d_s)) \text{ (ft)}$$

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This is similar to the effective biofiltration depth above, but does not include the depth infiltrated during the storm event.

10) Calculate the amount of $V_{\text{biofiltered}}$ and $V_{\text{biofiltered_static}}$

$$V_{\text{biofiltered}} = d_{E_bio} \text{ (with routing)} \times A_{\text{effective}}$$

$$V_{\text{biofiltered_static}} = d_{E_bio_static} \times A_{\text{effective}}$$

11) Compare the results of above to the required biofiltration volume. There are two options for demonstrating conformance:

a) $V_{\text{biofiltered (with routing)}} > 150\% \text{ of } V_{\text{BMP}}$

OR

b) $V_{\text{biofiltered_static}} > 0.75 \times V_{\text{BMP}}$

Both calculations assume that no portion of the V_{BMP} is retained. This is slightly conservative as it does not account for soil soaking and drying. But soil pores are credited as biofiltration volume. This simplification has negligible effect.

12) If neither of these criteria are met, then return to Step 3, increase the footprint and rerun calculations. This calculation is inherently iterative.

13) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design. Demonstrate that the assumed effective area is provided at the mid ponding contour of the BMP.

14) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Biofiltration Facility. See Appendix B for specific information regarding perforated pipes.

15) Provide the slope within the Biofiltration with Partial Infiltration Facility, if used. The maximum slope is 3 percent for a standard design.

16) Provide the check dam spacing, the Biofiltration with Partial Infiltration Facility is sloped.

17) Describe the vegetation used within the Biofiltration Facility.