2.1 Impervious Surface Disconnection

Description

Impervious surface disconnection is the practice of directing stormwater runoff from a small roof or paved area through a receiving grass area, rain garden, or stormwater planter before it reaches drainage infrastructure. The receiving grass area provides an opportunity for runoff to infiltrate into the soil and for limited filtering of pollutants from stormwater passing through. Where there is insufficient pervious grass area to receive runoff a rain garden or stormwater planter can provide minor storage volume over a small area of filtering media. Rain gardens are shallow depressions built into the landscape. Stormwater planters are containers, above or at grade, in a mostly impervious setting.

Disconnecting impervious surfaces cannot be the exclusive or primary post-construction stormwater management practice. It can reduce the size of centralized stormwater controls by reducing the water quality volume (WQv) as well as increasing the time of concentration for the contributing drainage area. Disconnecting impervious surfaces throughout a development treats stormwater directly at the source which is a key part of low impact stormwater management strategies.

Planning and Feasibility

The decision to disconnect an impervious surface must happen early in the development process for the site layout, grading, and drainage infrastructure to accommodate a receiving grass area, rain garden, or stormwater planter.

Disconnect to receiving grass areas or rain gardens on medium to low density development where the practice will not contribute to flooding, erosion, drainage, or structural problems, both on site and down gradient. Lawn or green space, public or private, that meets the design criteria may serve as a receiving grass area if the area is not subject to compaction or excessive wear. A rain garden can be part of the landscaping of residential or institutional developments.

Impervious Surface Disconnection on Residential Lots

Disconnect residential lot impervious surfaces of medium to low density subdivisions or large single residence sites where it will be less likely to interfere with potential improvements (swimming pools, etc.), lead to nuisance wetness, or cause structural problems.

Plans to disconnect impervious surfaces on a residential lot must be communicated to the individual or homebuilder purchasing the lot. It is recommended that rain gardens or grass receiving areas on private residential lots be described and shown on final subdivision plats.

A residential receiving grass area or raingarden is often planned before the designer knows the exact position and dimensions of the dwelling unit. Disconnections may be sized on reasonable estimates of the structure; however, the general grading of an individual lot must be planned to locate and specify the disconnection practice(s) in the storm water pollution prevention plan (SWP3) and project documents.

Clearly delineate a receiving grass area or raingarden on the construction drawings and SWP3 for each lot impervious surface disconnection is applied to. Locate a practice where it can be reasonably expected to receive flow over the life of the development. Do not plan a receiving area or raingarden on or upgradient of household sewage treatment systems.

Maintaining lawn as a receiving grass area is straightforward but a rain garden requires a higher degree of upkeep that may be beyond the interest of the homeowner. Ensure the homeowner will routinely maintain a raingarden or allow an easement for maintenance by others.

Credits

Table 2.1.1 Credits for Impervious Surface Disconnection Meeting the Criteria Given in This Chapter

Objective	Credit
Runoff Reduction Volume (RRv)	0.04 ft^3 per square foot of receiving grass area on Hydrologic Soil Group A or B soil. 0.02 ft^3 per square foot of receiving grass area on Hydrologic Soil Group C or D soil. 0.04 ft^3 per square foot of receiving grass area restored by topsoil (see Chapter 1.4). The design surface storage volume of a rain garden or stormwater planter, up to 100 percent of the WQv for the practice's drainage area. RRv credits must be calculated using the Runoff Reduction Spreadsheet and may not exceed the WQv calculated for the practice.

Design Criteria – Receiving Grass Area

Receiving Grass Area

A grass receiving area can be all or a just a portion of an open space that accepts runoff directly from an impervious surface and conveys sheet flow without eroding or ponding. The space available may constrain the size of the grass receiving area, but it must have the minimum length of flow. Table 2.1.2 gives the dimensions for a grass receiving area eligible for RRv credits.

Table 2.1.2 Receiving Grass Area Dimensions

<table>
<tr><th rowspan="2">Disconnection Type</th><th colspan="2">Length in the Direction of Flow (L)</th><th rowspan="2">Width (W)</th></tr>
<tr><th>Minimum</th><th>Maximum</th></tr>
<tr><td>Full Edge of Pavement</td><td>10 feet</td><td rowspan="3">Up to 100 feet
and
within the property boundary</td><td>must equal the pavement width</td></tr>
<tr><td>Pavement with curb cuts</td><td>10 feet
or
0.04 x the contributing impervious area, whichever is greater</td><td>equals one-half of the length, up to a maximum width of 20 feet
or
twice the curb cut width</td></tr>
<tr><td>Roof downspout disconnection</td><td>10 feet or
0.04 x the contributing impervious area, whichever is greater</td><td>equals one-half of the length, up to a maximum width of 20 feet</td></tr>
</table>

Contributing Impervious Surface Area

The maximum impervious surface area discharging to a receiving grass area through a single roof downspout leader or single pavement curb cut opening is 1,000 square feet. Where the full edge of pavement discharges as sheet flow, the contributing length of pavement (L_{imp}) in the direction of flow shall be a maximum of 100 feet. Use a grass filter strip (Chapter 2.2) for larger impervious surface areas.

Disconnecting Pavement to a Receiving Grass Area

Disconnect the entire edge of pavement as illustrated in Figure 2.1.1.a by omitting curbing to promote sheet flow onto the full width of the receiving grass area. Raised wheel stops that do not obstruct sheet flow are an alternative to curbing. Keep the drop in elevation between pavement and the receiving grass area less than two inches. Consider a gravel verge (see Chapter 2.2) in all cases to absorb minor variations in pavement elevation that may concentrate flow as well as prevent damage to the receiving area from vehicles or snow plowing. In some cases, a concrete verge can create a level transition from pavement to grass while presenting a more familiar pavement border.

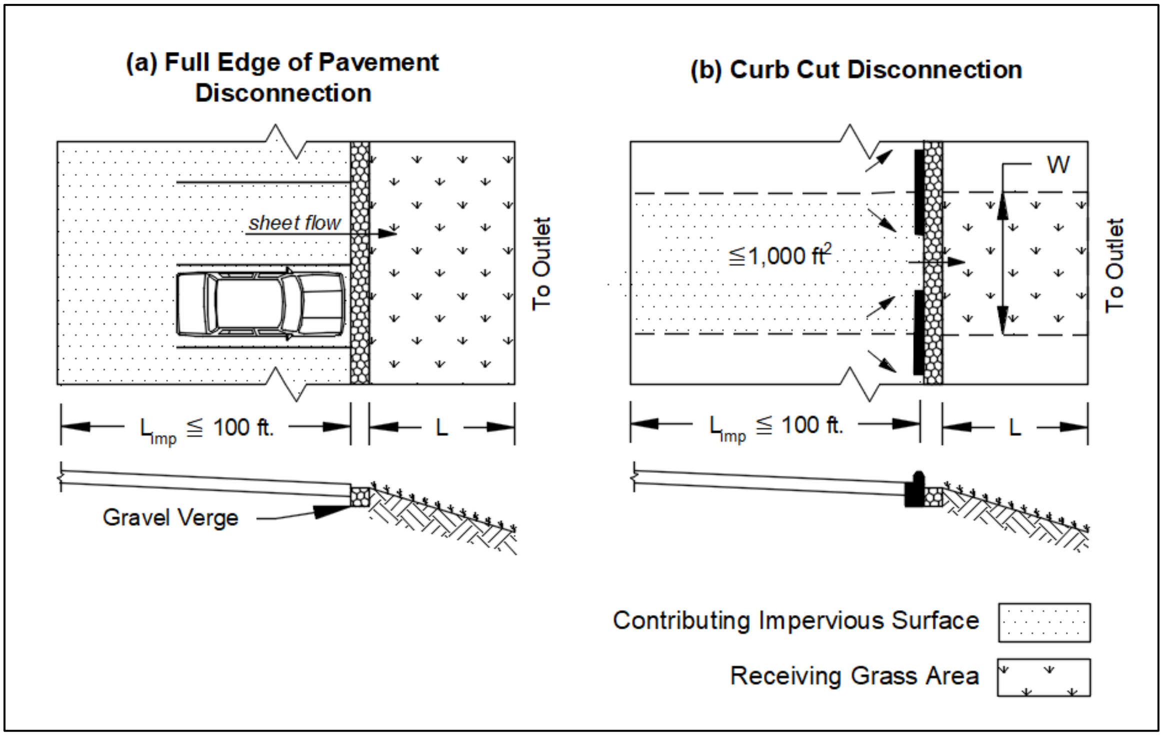

Figure 2.1.1 Illustrations of Pavement Disconnection to a Receiving Grass Area (not to scale)

Figure 2.1.2 a) Raised Wheel Stop and b) Pavement Disconnected with Multiple Curb Cuts

Where curbing is necessary, use curb cuts as illustrated in Figure 2.1.1.b to disconnect pavement to a receiving grass area. Design curb cuts at least 24 inches wide with a lip graded towards the receiving area. The opening must be level with the pavement and perpendicular to flow. Distribute multiple curb cuts along the edge of paved areas as shown in Figure 2.1.2.b according to the allowable contributing impervious area per curb cut and/or as necessary to make use of the full width of the grass area available.

Disconnecting Roof Downspouts to a Receiving Grass Area

The length (L) of a grass area receiving runoff from a roof downspout follows the path of flow exiting the downspout to the outlet (for example, catch basin, ditch bank, or upper edge of a conservation area). After determining the length available, the width (W) credited as receiving area will equal one-half of the length (W = L ÷ 2) up to a maximum width of 20 feet. This approximation of the area subject to flow eases the calculation. Runoff is likely to spread in an undefined manner along the flow path. This concept is illustrated in Figure 2.1.3 along with receiving grass area dimensions.

The receiving area of roof downspout disconnections should be set back a minimum of five feet from simple foundations and slope away from the structure to prevent structural damage or short-circuiting through footer drains. Structures with sump-pumps, basements, or in-ground finished floors may require added setback distance or structural measures as determined by the designer.

Disconnected roof downspouts should include a splash pad. Consider using a gravel spreader that could double as a landscaping border or feature.

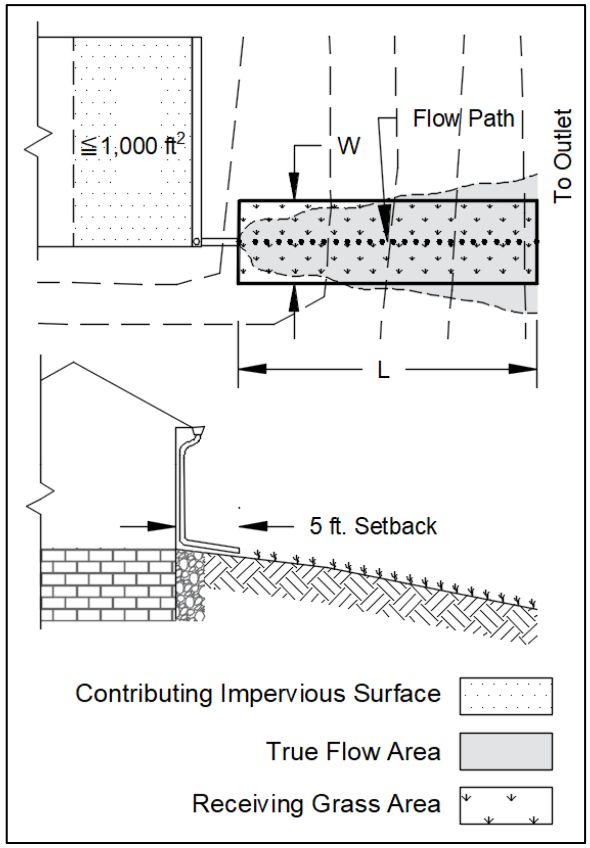

Figure 2.1.3 Illustration of a Roof Downspout Disconnection to a Receiving Grass Area (not to scale)

Receiving Area Slope

The receiving area must slowly disperse and convey stormwater runoff without prolonged ponding. For all receiving areas, the grade of the first 10 feet of flow length must be a minimum of two percent and maximum of five percent. The remaining length must be less than 25 percent grade.

Receiving Area Soil

A receiving grass area must consist of pervious area in good hydrologic condition (undisturbed soil protected from construction activity or disturbed soil that has been restored). Directing runoff onto compacted soil with insufficient tilth can lead to undesirable surface ponding or wetness. Soil restoration following the minimum specifications for topsoil replacement given in Chapter 1.4 is required to receive the higher RRv credit on HSG C or D soil (see Table 2.1.1).

Grass Cover

The receiving area shall be seeded to develop a cover of non-clumping, deep-rooted, turf-forming perennial grasses proper for the regional climate and local site conditions (for example, full sun, partial sun). Compatible legumes (for example, white clover) may be included in a seed mix to supply nitrogen. Refer to the permanent seeding specifications in Chapter 7. Allow time for a dense grass cover to grow prior to discharging stormwater runoff onto the receiving area.

Although sod may accelerate grass establishment, a high clay content in the sod's soil mass may impede infiltration. When necessary to use sod, place strips perpendicular to flow such that runoff cannot travel down the seams.

A receiving area is considered established when both (1) plants can no longer be pulled free from the soil by hand; and (2) 90 percent cover is achieved which may take multiple growing seasons.

Design Criteria - Rain Garden or Stormwater Planter

Rain gardens and stormwater planters are bioretention practices applied to small contributing drainage areas where the limited runoff volume requires a less rigorous design. Both practices pond stormwater over an engineered soil (filter) media prior to infiltrating to the in-situ soil, discharging through an underdrain, or both. The following criteria apply to disconnect impervious surface through a rain garden or stormwater planter.

Contributing Impervious Surface Area

A raingarden or stormwater planter may receive runoff from a roof downspout or pavement. The maximum impervious surface area discharging to a single rain garden or stormwater planter is 2,500 square feet. Use a bioretention practice (Chapter 2.9) for larger impervious surface areas.

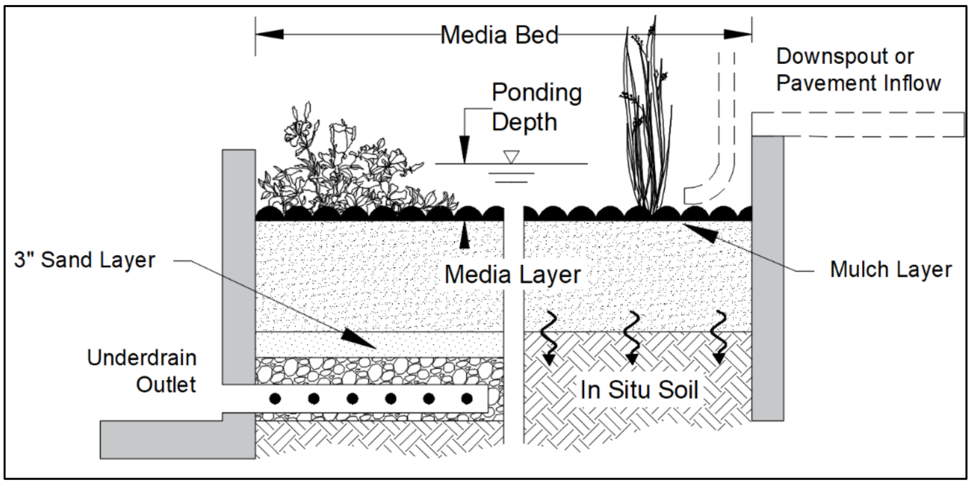

Figure 2.1.4 Joint Illustration of a Stormwater Planter or Rain Garden with Underdrain to the Left and with Infiltration to the Right (not to scale)

Surface Storage Volume

The RRv credit for a rain garden or stormwater planter equals the capacity of the storage reservoir above the media surface up to the WQv for the contributing drainage area. The surface storage capacity is determined by the design ponding depth and design media bed area. It will often be less than the WQv.

Ponding Depth

The ponding depth in the storage reservoir of a stormwater planter or raingarden may not exceed 18 inches. Safety and plant survival concerns typically limit the ponding depth to less than 12 inches. A design ponding depth of four to eight inches is recommended.

Media Bed Area

To prevent overloading of the media layer, the area of the media bed must be greater than three percent of the contributing impervious drainage area or

$$A_{practice} > 0.03^{*} A_{imp} \qquad \text{(Equation 2.1.1)}$$

where $A_{practice}$ = the filter bed area of the infiltration/filtration practice (ft^2), and

A_{imp} = contributing impervious drainage area (ft^2).

Media Layer

Engineered media (soil) facilitates treatment mechanisms in a healthy rooting environment for plants. The media depth must be a minimum of 18 inches. Refer to the bioretention media specification in Chapter 2.9 for composition of the engineered media.

Mulch Layer

A mulch layer protects the media from erosion, retains moisture for plant growth, helps develop organic matter within the media, and filters some pollutants. Maintain a two- to three-inch-thick layer of course hardwood mulch over the soil media.

Inflow and Outflow

A rain garden or stormwater planter that receives piped or concentrated inflow must include measures at the inlet to both dissipate energy and spread flow over the filter bed without eroding the media. The practice must safely convey flows exceeding the design runoff event without causing erosion or be placed in an off-line configuration.

Infiltration and Underdrain

Design a rain garden or stormwater planter to infiltrate stormwater runoff where the tested infiltration rate of the in-situ soil is at least 0.5 inches per hour. Otherwise place an underdrain below the media layer. Encase the perforated underdrain in pea gravel with a three-inch sand separation layer between the media layer and the gravel. Do not use geotextile fabrics that may clog for material separation. Refer to Chapter 2.9 for further design guidance.

Landscaping

Rain gardens and stormwater planters should be landscaped under the direction of a landscape architect, horticulturalist, or another qualified professional. Use hardy grasses, perennials, shrubs and/or trees compatible with the anticipated growing conditions including ponding and draughty conditions. Native, non-invasive plants are recommended. Where necessary, select species tolerant to de-icing salts.

Construction Considerations

A receiving area is best established early in the construction process to give time for a grass to grow prior to receiving stormwater runoff. Protect the receiving area from erosion, sediment, and compaction throughout construction by (1) diverting away construction runoff with silt fence or a diversion dike and (2) prohibiting construction traffic with fence or another barrier.

If construction activity cannot be averted, wait until the area is no longer at risk of being disturbed to replace and restore topsoil to the final elevations and grade. Use biodegradable erosion control matting/blankets to protect soil from erosion and accelerate grass growth. It may be necessary to advise the owner to temporarily divert stormwater away from the receiving area for some time after construction.

Do not install a raingarden or stormwater planter until the drainage area is stable and free from construction sediment.

Maintenance Considerations

The landowner or groundskeeping staff must be advised a rain garden or a stormwater planter serves stormwater management purposes that require it to be maintained different than traditional landscaping. For example, annually removing old mulch and replacing it with new mulch rather than simply replenishing mulch removes captured pollutants and sustains treatment. This is also an opportunity to evaluate the engineered media surface, replacing the surface if clogged.

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