4.7 Impervious Surface Disconnection

Introduction

In this practice, runoff from a rooftop or other small impervious surface is directed to a pervious surface or small practice to provide infiltration, filtering, or reuse (Figure 4.7-1 and Figure 4.7-2). Disconnection practices can be used to reduce the volume of runoff created by impervious surfaces. Applicable practices include:

- ✧ Simple disconnection to managed turf areas
- ✧ Simple disconnection to forest cover or preserved open space
- ✧ Simple disconnection to a soil compost amended filter path

Disconnection to alternative practices, such as infiltration (dry wells) or bioretention (rain gardens) are covered in other specifications in this manual. Disconnection practices reduce a portion of the water quality volume. In order to meet requirements for larger storm events, disconnection practices must be combined with additional practices.

Figure 4.7-1. Simple Rooftop Disconnection (Photo: Center for Watershed Protection)

KEY CONSIDERATIONS: IMPERVIOUS SURFACE DISCONNECTION

DESIGN CRITERIA:

- Disconnection area should be at least 15 feet long and 10 feet wide.
- Disconnections should convey stormwater away from buildings to prevent damage to foundations.

BENEFITS:

- Helps restore pre-development hydrology on development sites and reduces post-construction stormwater runoff rates, volumes and pollutant loads.
- Practices have relatively low construction cost and long-term maintenance burden.

LIMITATIONS:

- Only applicable to very small drainage areas.
- Simple disconnections provides greater stormwater management benefits on A and B soils.
- This practice is difficult to use in series with other practices (treatment train) as the runoff gets dispersed over a wide area.

SITE APPLICABILITY:

♦ Rural use ♦ Suburban use	♦ Construction Cost: Low ♦ Maintenance: Low ♦ Area Required: Low

STORMWATER MANAGEMENT PRACTICE PERFORMANCE

Runoff Reduction Credit Approach
(applies to Shellfish Bed, SMS4, and infiltration credit approaches)

▶ 25% - 50% credit for disconnected impervious areas.

Coastal Zone Credit Approach

▶ 25% - 50% credit for disconnected impervious areas.

Statewide Water Quality Requirement Credit Approach

▶ Runoff Reduction credit applies to infiltration requirement.

Pollutant Removal[1]
80% - Total Suspended Solids
25% - 50% - Total Phosphorus
25% - 50% - Total Nitrogen
25% - 50% - Metals
N/A - Pathogens

[1] expected annual pollutant load removal

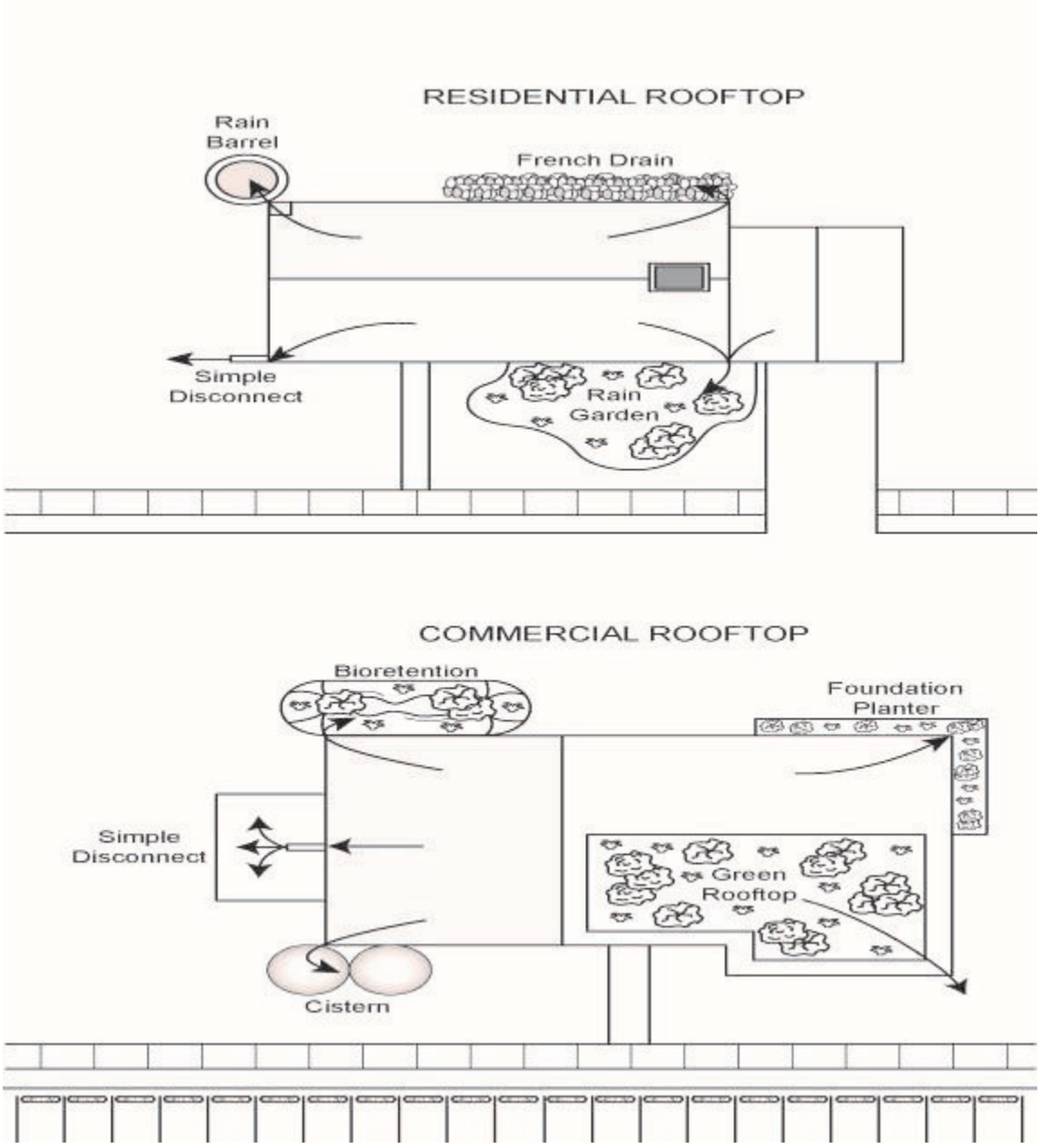

Figure 4.7-2. Roof Disconnection and Alternative BMPs.

Impervious Surface Disconnection Feasibility Criteria

Impervious surface disconnections are ideal for use on commercial, institutional, municipal, multi-family residential and single-family residential buildings. Key constraints with impervious surface disconnections include available space, soil permeability, and soil compaction.

For simple disconnection to turf areas or forest cover/open space the following feasibility criteria exist (Table 4.7-1).

Table 4.7-1. Feasibility criteria for simple disconnection

Design Factor	Disconnection Design
Impervious Area Treated	1,000 ft^2 per rooftop disconnection. For non-rooftop impervious areas, the longest contributing impervious area flow path cannot exceed 75 feet.
Required Space	Minimum 150 feet of disconnection area.
Sizing	The available disconnection area must be at least 10 feet wide and 15 feet long. Maximum disconnection width is 25 feet unless the contributing runoff is conveyed via sheetflow or a level spreader. Maximum disconnection length is 100 feet.
Site Topography	Grade of the receiving pervious area is less than 2%, or less than 5% with turf reinforcement. The slope of the receiving areas must be graded away from any building foundations.
Building Setbacks	5 ft. away from building if the grade of the receiving area is less than 1%.

Required Space. The available disconnection area must be at least 10 feet wide and 15 feet long. The disconnection width is limited to 25 feet unless the contributing runoff is conveyed via sheet flow or a level spreader. The disconnection length can be extended up to 100 feet to increase the volume treated.

Site Topography. Simple disconnection is best applied when the grade of the receiving pervious area is less than 2%, or less than 5% with turf reinforcement. The slope of the receiving areas must be graded away from any building foundations. Turf reinforcement may include erosion control matting or other appropriate reinforcing materials that are confirmed by the designer to be non-erosive for the specific characteristics and flow rates anticipated at each individual application, and acceptable to the plan approving authority.

Soils. Impervious surface disconnection can be used on any post-construction Hydrologic Soil Group. The disconnection area must be kept well-vegetated with minimal bare spots.

Contributing Drainage Area (CDA). For rooftop impervious areas, the maximum impervious area treated cannot exceed 1,000 sq. ft. per disconnection. For non-rooftop impervious areas, the longest contributing impervious area flow path cannot exceed 75 feet. If inflow is conveyed via level spreader, the maximum flow path length is 150 feet and the level spreader should be designed with an appropriate width as specified in section 6.5.

Setbacks. If the grade of the disconnection area is less than 1%, downspouts must be extended 5 ft. away from building. Note that the downspout extension of 5 feet is intended for simple foundations.

Discharge Across Property Lines. Disconnection areas must be designed such that runoff is not directed across property lines toward other sites.

Economic Considerations. Disconnection is one of the least expensive LID practices available.

Impervious Surface Disconnection Conveyance Criteria

Simple disconnection practices must safely convey the 2-year and 10-year storm events over the receiving area without causing erosion. In some applications, erosion control matting or other appropriate reinforcing materials may be needed to control flow rates anticipated for larger design storms.

Impervious Surface Disconnection Pretreatment Criteria

Pretreatment is not needed for simple impervious surface disconnection.

Impervious Surface Disconnection Design Criteria

The following design criteria apply to each disconnection practice:

Simple Disconnection to a managed turf area. Disconnection to pervious areas with the compacted cover designation is required to meet the feasibility criteria presented above in *Impervious Surface Disconnection Feasibility Criteria*.

During site construction, care must be taken not to compact the receiving pervious area. To prevent soil compaction, heavy vehicular and foot traffic must be kept out of the receiving pervious area both during and after construction. This can be accomplished by clearly delineating the receiving pervious areas on all development plans and protecting them with temporary fencing prior to the start of land disturbing activities (If compaction occurs, soil amendments or post-construction aeration will be required. See Appendix C for information regarding soil amendments).

Simple Disconnection to a forest cover/open space. Disconnection to forest cover/open space is required to meet the feasibility criteria presented in Impervious Surface Disconnection Feasibility Criteria, with the following additions/exceptions:

- ✧ Minimum disconnection length: 40 feet.
- ✧ Maximum slope of the receiving area: 6% (2% for the first 10 feet).
- ✧ Inflow must be conveyed via sheet flow or via a level spreader.
- ✧ If inflow conveyed via level spreader, the maximum flow path length is 150 feet and the level spreader must be designed with an appropriate width as specified below.

Simple Disconnection to a Soil Compost-Amended Filter Path. Consult *Soil Compost Amendment Requirements* in *Appendix C*, for detailed information on the design and function of soil compost amendments. The incorporation of compost amendments must meet the design criteria in the specification and include the following design elements:

- ✧ Flow from the downspout must spread over a 10-foot wide strip extending downgradient along the flow path from the building to the street or conveyance system.

- ✧ The filter path must be a minimum 15 feet in length.
- ✧ Installation of a pea gravel or river stone diaphragm, or other accepted flow spreading device is required at the downspout outlet to distribute flows evenly across the filter path.
- ✧ The strip requires adequate "freeboard" so that flow remains within the strip and is not diverted away from the strip. In general, this means that the strip should be lower than the surrounding land area in order to keep flow in the filter path. Similarly, the flow area of the filter strip should be level to discourage concentrating the flow down the middle of the filter path.
- ✧ Use 2 to 4 inches of compost and till to a depth of 6 to 10 inches within the filter path.

Level Spreaders. A level spreader can be used to disperse or "spread" concentrated flow thinly over a vegetated or forested area to promote greater runoff infiltration in the receiving area. A level spreader consists of a permanent linear structure constructed at a 0% grade that transects the slope. The influent concentrated runoff must be spread over an area wide enough to prevent erosion of the receiving area. Detailed information on the design and function of level spreaders can be found in Hathaway and Hunt, 2006 and Van Der Wiele, 2007. The minimum recommended width of the level spreader is:

- ✧ 13 linear feet per each 1 cubic foot/second of inflow if the receiving conservation area has 90% ground cover;
- ✧ 40 linear feet per 1 cubic foot/second of inflow if the receiving conservation area is forested.

Storage Volume. While disconnection practices do not have a discreet storage volume in the same sense as other LID practices, for calculation purposes, the storage volume, *Sv*, may be calculated using Equation 4.7-1:

Equation 4.7-1. Storage Volume for Disconnection Practices

$$Sv = \frac{1}{12} \times SA_{disconnection}$$

where:

Sv	=	storage volume of the disconnection practice (ft^3)
$SA_{disconnection}$	=	surface area of the disconnection area (ft^2)

In the LID Compliance Calculator, the Sv for disconnection is given varying percentage credit toward the water quality volume requirements depending on the design:

- ✧ Simple disconnection to managed turf areas on A/B soils: 50% credit
- ✧ Simple disconnection to managed turf areas on C/D soils: 25% credit
- ✧ Simple disconnection to forest cover or preserved open space: 75% credit
- ✧ Simple disconnection to a soil compost amended filter path: 50% credit

Impervious Surface Disconnection Landscaping Criteria

All receiving disconnection areas must be stabilized to prevent erosion or transport of sediment to receiving practices or drainage systems. Several types of grasses appropriate for coastal South Carolina area listed in Table 4.7-2. Designers should ensure that selected grass species are suited to the specific conditions on the site, including flow rate, slope, and aesthetic considerations. For more information on stabilization seeding, see the Charleston County Stabilization Specifications.

Table 4.7-2. Recommended vegetation for pervious disconnection areas.

Common Name	Botanical Name
Common Bermudagrass	*Cynodon dactylon*
Common Carpetgrass	*Axonopus affinis*
Bahiagrass	*Paspalum notatum*
Coastal Panicgrass	*Panicum amarum*
Weeping Lovegrass	*Eragrostis curvula*
White Clover	*Trifolium repens*
Indiangrass	*Sorghastrum nutans*
Virginia Wildrye	*Elymus virginicus*
Crimson Clover	*Trifolium incarnatum*
Bowntop Millet	*Panicum ramosum*
Sweet Sorghum	*Sorghum bicolor*
Perennial Ryegrass	*Lolium perenne*
Source: Charleston County Stabilization Specifications, December 2011	

Impervious Surface Disconnection Construction Sequence

Construction Sequence for Disconnection to Pervious Areas. For simple disconnection to a pervious area, the pervious area can be within the limits of disturbance during construction. The following procedures should be followed during construction:

- ✧ Before site work begins, the receiving pervious disconnection area boundaries should be clearly marked.
- ✧ Construction traffic in the disconnection area should be limited to avoid compaction. The material stockpile area shall not be located in the disconnection area.
- ✧ Construction runoff should be directed away from the proposed disconnection area, using perimeter silt fence, or, preferably, a diversion dike.
- ✧ If existing topsoil is stripped during grading, it shall be stockpiled for later use.
- ✧ The disconnection area may require light grading to achieve desired elevations and slopes. This should be done with tracked vehicles to prevent compaction.
- ✧ Topsoil and or compost amendments should be incorporated evenly across the disconnection area, stabilized with seed, and protected by biodegradable erosion control matting or blankets.

- ✧ Stormwater should not be diverted into any compost amended areas until the turf cover is dense and well established.

Construction Sequence for Disconnection to Conservation Areas. For simple disconnection to a conservation area, the conservation area must be fully protected during the construction stage of development and kept outside the limits of disturbance on the Erosion and Sediment (E&S) Control Plan.

- ✧ No clearing, grading or heavy equipment access is allowed in the conservation area except temporary disturbances associated with incidental utility construction, restoration operations or management of nuisance vegetation.
- ✧ Any conservation areas shall be protected by super silt fence, chain link fence, orange safety fence, or other measures to prevent sediment discharge.
- ✧ The limits of disturbance should be clearly shown on all construction drawings and identified and protected in the field by acceptable signage, silt fence, snow fence or other protective barrier.
- ✧ If a level spreader is to be used in the design, construction of the level spreader shall not commence until the contributing drainage area has been stabilized and perimeter E&S controls have been removed and cleaned out. Further, stormwater should not be diverted into the disconnection area until the level spreader is installed and stabilized.

Construction Supervision. Construction supervision is recommended to ensure compliance with design standards. Inspectors should evaluate the performance of the disconnection after the first big storm to look for evidence of gullies, outflanking, undercutting, or sparse vegetative cover. Spot repairs should be made, as needed.

Impervious Surface Disconnection Maintenance Criteria

Maintenance of disconnected downspouts usually involves the regular lawn or landscaping maintenance in the filter path from the roof to the street. In some cases, runoff from a simple disconnection may be directed to a more natural, undisturbed setting (i.e., where lot grading and clearing is "fingerprinted" and the proposed filter path is protected).

An example maintenance checklist for impervious surface disconnection is included in *Appendix F*.

Impervious Surface Disconnection References and Additional Resources

1. Atlanta Regional Commission (ARC). 2001. "Bioretention Areas." Georgia Stormwater Management Manual. Volume 2. Technical Handbook. Section 3.2.3. Atlanta Regional Commission. Atlanta, GA. Available Online: http://www.georgia stormwater.com/
2. Charleston County. 2011. Charleston County Stabilization Specifications. Charleston County, South Carolina.
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5. United States Department of Agriculture (USDA). 1954. Handbook of channel design for soil and water conservation. SCS-TP-61. Washington, DC. Available online: http://www.wsi.nrcs.usda.gov/products/w2q/h&h/docs/TRs_TPs/TP_61.pdf
6. Van Der Wiele, C.F. 2007. Level Spreader Design Guidelines. North Carolina Division of Water Quality. Raleigh, NC. Available online: http://h2o.enr.state.nc.us/su/documents/LevelSpreaderGuidance_Final_-3.pdf
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