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Best Management Practice Fact Sheet 1:

Rooftop Disconnection

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This fact sheet is one of a 15-part series on urban stormwater management practices.

Please refer to definitions in the glossary at the end of this fact sheet.
Glossary terms are *italicized* on first mention in the text. For a comprehensive list, see Virginia Cooperative Extension (VCE) publication 426-119, "Urban Stormwater: Terms and Definitions."

What Is Rooftop Disconnection?

Rooftop disconnection (RD) is one of the simplest means of reducing *stormwater* from residential lots. RD takes roof runoff that has been collected in gutters and piped directly to streets, storm drains, and streams and redirects it away from *impervious surfaces* to landscaped areas (figure 1). Rooftop disconnection is a very *sustainable best management practice* (BMP) because it controls pollutants in runoff near their source. Redirected runoff from downspouts is *infiltrated*, filtered, treated, or reused prior to draining into a *stormwater conveyance system*.

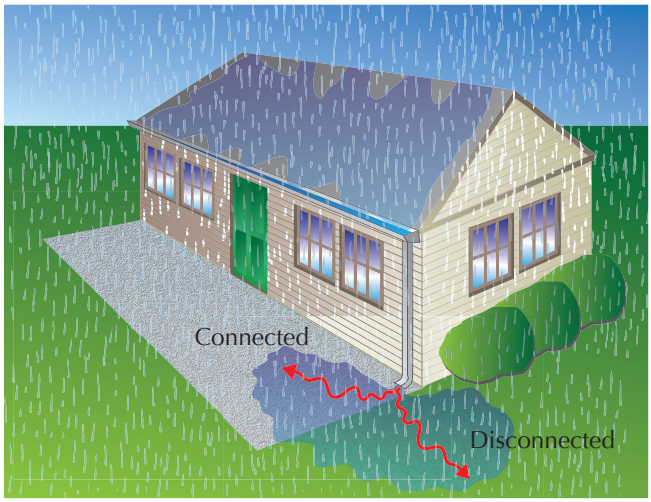

Figure 1. Diagram of water flow with simple rooftop disconnection.
Source: "Urban Nutrient Management Handbook," VCE publication 430-350.

Where Can Rooftop Disconnection Be Used?

Rooftop disconnection can be used in either commercial or residential areas with a lot size larger than 6,000 square feet. It can be used in any soil; however, caution should be applied to applications in poorly draining soils, such as *clays* and *silts*.

What Does Rooftop Disconnection Do?

A variety of different means of disconnecting runoff from impervious surfaces is used in RD. If sufficient land area with good soils is available, simply disconnect the rooftop runoff, creating a wide, shallow flow across the ground surface. The *flow path* can be amended with *compost* to encourage infiltration.

In other cases where space is limited, rooftop disconnection can be accomplished by diverting runoff into other best management practices, such as *bioretention*, a *cistern*, a *tree planter*, or a *dry well*.

The most common of these practices is simple disconnection. This easy method can often be accomplished by cutting the downspout and redirecting it horizontally onto a splash pad and to a *pervious* area (such as a lawn) to infiltrate.

Adding a *compost-amended filter path* involves tilling the soils in the flow path (about 10 feet wide) to a depth

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of 6 to 10 inches, and adding 2 to 4 inches of compost in the top layer while maintaining the low point of the channel. This provides enhanced infiltration of runoff through the flow path.

Adding a *rain garden* in series can reduce runoff and provide additional treatment, and it can effectively eliminate most of the rooftop runoff. Refer to "Best Management Practices Fact Sheet 9: Bioretention" (VCE publication 426-128) for further information on this practice. Best Management Practices Fact Sheet 8 (VCE publication 426-127) focuses on dry wells, which are also an option.

Limitations

Limitations for Simple RD

- Limit the contributing roof area (*roofshed*) to a maximum of 1,000 square feet per downspout.
- Establish the longest overland flow path after disconnection at 40 to 75 feet to allow infiltration.
- Limit applications to areas with slopes less than 2 feet in 100 feet to prevent *erosion*. However, if turf reinforcement is used, slopes can be as high as 5 feet in 100 feet.
- Locate downspout *outlets* at least 5 feet from any building.
- Use screens to prevent leaves and organic material from entering gutters, which can result in clogged gutters and flow paths.

Limitations for Compost-Amended Flow Path

- Set a minimum length of 20 feet and a minimum width of 10 feet.
- Maintain low elevation for the channel.
- Use pea gravel at the downspout outlet to spread the flow and prevent channeling.

Limitations for Rain Gardens/ Microbioretention

The same limitations as for simple RD apply, plus:

- Soil infiltration rate should be greater than 0.5 inches per hour, or use an *underdrain*.
- *Filter media* should be at least 18 inches.
- Elevation drop needs to be a minimum of 1 to 3 feet.
- Buildings downhill should be at least 25 feet away.

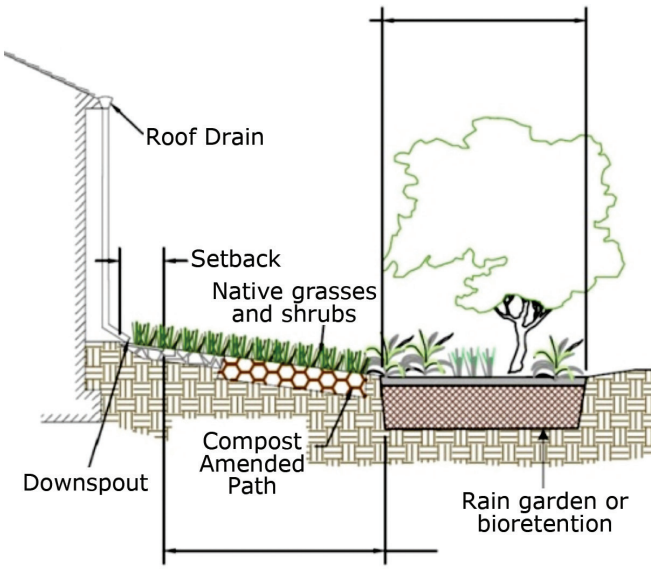

Figure 2. Diagram of rooftop disconnection with compost-amended filter path and bioretention.
Source: Virginia Department of Environmental Quality (VDEQ ; 2011).

Maintenance

- Maintenance is similar to other landscaping and may require periodic mowing.
- Inspect periodically for clogging (failure to drain).
- Remove any accumulated leaves, organic materials, and *sediment* as soon as practical if an inspection reveals clogging.

Performance

Rooftop disconnection is a small practice whose performance is difficult to measure. Most of the treatment expected is due to runoff reduction, which reduces the mass of pollutants.

Therefore, performance is directly affected by soils. In sandy soils, with high infiltration, an RD is expected to reduce total phosphorus and total nitrogen by 50 percent. In less infiltrative soils (such as clays or silts), this

is reduced to 25 percent for both total phosphorus and total nitrogen (VA-DEQ 2011).

Expected Costs

The cost of installation for RD can vary significantly. For simple RD, the costs of materials and labor are rather inexpensive and can be done for less than $100 per downspout. The addition of compost-amended flow paths and rain gardens will likely increases costs significantly. Costs must be estimated on a site-by-site basis. However, many of these practices are in use by homeowners and appear to be performing well. Maintenance for all RD practices is similar to other home landscaping tasks and can be performed by the homeowner.

Additional Information

The Virginia departments of Conservation and Recreation (VA-DCR) and Environmental Quality (VA-DEQ) are the two state agencies that address nonpoint source pollution. The VA-DCR oversees agricultural conservation; VA-DEQ regulates stormwater through the Virginia Stormwater Management Program.

Additional information on best management practices can be found at the Virginia Stormwater BMP Clearinghouse website at https://www.swbmp.vwrrc.vt.edu/ (Permanent link: https://perma.cc/WC5L-KCZ8) The BMP Clearinghouse is jointly administered by the VA-DEQ and the Virginia Water Resources Research Center.

Online Resources

Chesapeake Stormwater Network – http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2012/01/VA_BMP_Spec_No_1_DISCONNECTION_FINAL_Draft_v2-0_01012013.pdf

City of Philadelphia – http://scribd.com/doc/13322624/Stormwater-Management-Guidance-Manual-Ver-20

City of Portland, Ore. – http://portlandonline.com/bes/54651

Virginia Stormwater BMP Clearinghouse – https://www.swbmp.vwrrc.vt.edu/ (Permanent link: https://perma.cc/WC5L-KCZ8)

Companion Virginia Cooperative Extension Publications

Daniels, W., G. Evanylo, L. Fox, K. Haering, S. Hodges, R. Maguire, D. Sample, et al. 2011. *Urban Nutrient Management Handbook*. Edited by J. M. Goatley. VCE Publication 430-350.

Fox, L. and Andruczyk, M. 2018. *Urban Water Quality Management: What Is a Watershed?* VCE Publication 426-041.

Fox, L. J., Sample, D. J., Robinson, D. J., & Wolford, C. E. (2018). Stormwater Management for Homeowners Fact Sheet 1 Rooftop Redirection (disconnection). VCE Publication SPES-9P.

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City of Portland (Ore.). Bureau of Environmental Services. 2009. *Portland Stormwater Management Manual*. https://www.portlandoregon.gov/bes/64040

Virginia Department of Environmental Quality (VA DEQ). 2011. Draft of *Virginia DEQ Stormwater Design Specification No. 1: Rooftop (Impervious Surface) Disconnection*, Version 1.9. https://www.swbmp.vwrrc.vt.edu/wp-content/uploads/2017/11/BMP-Spec-No-1_DISCONNECTION_v1-9_03012011.pdf.

Glossary of Terms

Best management practice – Any treatment practice for urban lands that reduces pollution from stormwater. A BMP can be either a physical structure or a management practice. A similar but different set of BMPs is used to mitigate agricultural runoff.

Bioretention – A BMP that is a shallow, landscaped depression that receives and treats runoff with the goal

of discharging water of a quality and quantity similar to that of a forested watershed. Bioretention devices typically consist of vegetation, soils, and, optionally, an *underdrain*, and an outlet structure. Bioretention is sometimes called a rain garden; normally the term bioretention implies the practice was designed specifically for a site.

Cistern – A storage tank designed to store rainwater for later use.

Clay – Soils with a particle size smaller than 0.002 millimeter (mm), according to the U.S. Department of Agriculture's (USDA) soil classification system.

Compost – Vegetative or organic matter that has been allowed to fully decompose, leaving a rich, organic medium that can be mixed with soils.

Compost-amended flow path – The practice of restoring soils within the flow path (with redirected roof runoff from RD) using compost (see "*soil restoration"*).

Dry well – A small, underground structure that disposes of stormwater through infiltration. Usually consists of a hole lined with gravel.

Erosion – The movement of soils and rock through weathering from water and wind.

Flow path – The path water takes as it flows over land; in the case of RD, after it exits the downspout.

Impervious surface – A hard surface that does not allow infiltration of rainfall into it; not pervious.

Infiltrate, infiltrated – The act of water entering soils (see "infiltration").

Infiltration – The process by which water (surface water, rainfall, or runoff) enters the soil.

Media, filter media – The topsoil that supports plant growth. Bioretention media is used in dry swale and typically has a high *sand* and low clay content and a low phosphorus content.

Outlet – The point of exit of water from a downspout or other BMP, usually through a control such as an outlet structure.

Pervious – A ground surface that is porous and allows infiltration.

Rain garden – See *bioretention*. Often used interchangeably with bioretention, however it typically refers to a less formal design and installation process. Typically implemented in residential areas by homeowners.

Roofshed – The area of the roof that drains to a single downspout. The boundary is determined by the roof and the roof ridge lines.

Rooftop disconnection – RD redirects runoff from streets, storm drains, and streams onto landscaped areas and away from impervious surfaces.

Sand – Soils with a particle size larger than 0.05 mm, according to the USDA's soil classification system.

Sediment – The soil, rock, or biological material particles that are formed by weathering, decomposition, and erosion. In water environments, sediment is transferred across a watershed via streams..

Silt – Soils with a particle size between 0.002 and 0.05 mm, according to the USDA's soil classification system.

Soil restoration – The technique of using compost to amend soils to improve their porosity and nutrient retention. The restored soils are less compacted and can replicate runoff from forested areas.

Stormwater – Water that originates from impervious surfaces during rain events, often associated with urban areas. Also called "runoff."

Stormwater conveyance system – Means by which stormwater is transported in urban areas.

Sustainable – The ability of the system to endure and remain productive over a long time.

Tree planter – An ultra-urban, small BMP that is a bioretention system designed to exist inside a concrete box or tree planter (see "bioretention").

Underdrain – A perforated pipe in the bottom of a treatment process, such as bioretention or permeable pavement, designed to collect water that does not infiltrate native soils.