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Best Management Practice Fact Sheet 3:

Grass Channels

David J. Sample, Assistant Professor and Extension Specialist, Biological Systems Engineering, Virginia Tech
Stefani Barlow, Undergraduate Student, Biological Systems Engineering, Virginia Tech

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 a Grass Channel?

Grass channels (GCs) are wide, gently sloping, open channels with grass sides used as a *stormwater conveyance system* (see figure 1). Grass channels are similar to ditches; however, their side slopes are much more gradual. GCs provide treatment via filtering through vegetation. When compared with traditional curb and gutter, or inlets and pipes, which remove no pollutants, GCs may provide a modest amount of runoff reduction and pollutant removal. The extent of this reduction depends on the underlying soil characteristics, slope, and flow velocity. At higher velocities, *stormwater* is only conveyed and is not treated. Unlike *dry swales*, (VCE publication 426-129), GCs do not include a soil media and/or specific storage volume.

Figure 1. Photograph of typical grass channel.
Source: Fairfax County Department of Public Works and Environmental Services, 2011.

Where Can Grass Channels Be Used?

Residential, commercial, and industrial areas are all good candidates for GC implementation. GCs are limited to small drainage areas (smaller than 5 acres) with any type of underlying soil. However, a *soil amendment*, such as compost (see VCE publication 426-123), is recommended for *hydrologic soil group* (HSG) C or D to improve *infiltration*.

Highways and parking lots are well-suited for GCs, as are turf areas, such as golf courses, sports fields, and residential lawns. While the objective of both dry and *wet swales* (VCE publication 426-130) is retention and runoff reduction, the main purpose of a GC is to transport stormwater from one place to another.

How Do Grass Channels Work?

As an engineered *best management practice* (BMP), GCs mainly convey stormwater to a stormwater treatment runoff, but they can provide modest water quality improvement with a slight reduction in volume. Concentrated runoff is initially directed over a *check dam* that reduces flow velocity and maximizes vegetative filtering during conveyance. The grass lining protects the conveyance system from erosion by reducing velocities and provides minor filtering and infiltration. The GC then transports stormwater to another BMP for further treatment (see figure 2). In terms of water quality, the

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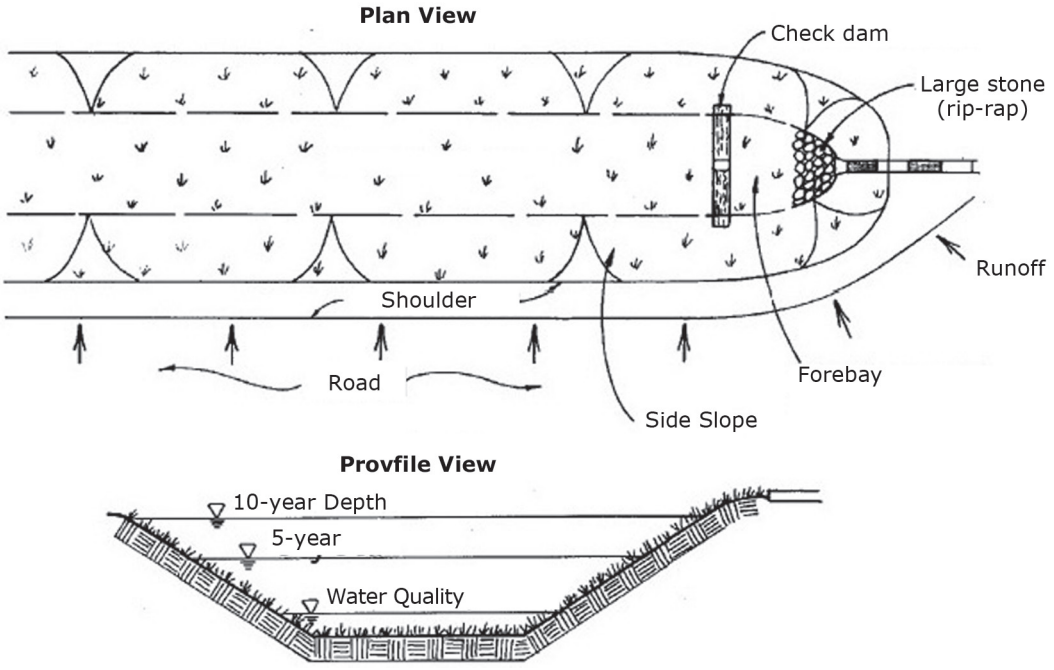

Figure 2. Plan and profile view of a grass channel *(VA-DCR 2011)*.

vegetation in the channel will also filter the stormwater and remove a small portion of *nutrients*, often those that are attached to *sediment*.

Selection of grass type may depend on local climate and tolerance for moist conditions. Creeping bentgrass is a reasonably water-tolerant species for cool-season grasses, as is bermudagrass for warm-season grasses. Both can be obtained from seed or sod throughout Virginia.

Limitations

- Not recommended for channels with greater than 4 percent slope; otherwise, *erosion* will likely occur in the channel.
- Not suitable for drainage areas of 5 acres or larger.
- High-density residential lands may concentrate runoff and result in excessive channel erosion.
- Channel must remain above the seasonally high *water table* to preclude *groundwater contamination* or design failure.

Maintenance

Routine Maintenance (annual)

- Remove trash, debris, and accumulated leaves, which can clog the channel.
- Monitor channel bottom for excessive erosion, *braiding*, ponding, or dead grass.
- Inspect side slopes for evidence of erosion.
- Replant to maintain 90 percent cover; reseed any dead vegetation.
- Look for bare soil patches or sediment sources in the contributing drainage area and repair.
- Mow regularly. GCs are typically mowed seasonally at a tall grass setting to prevent taller shrubs and trees from taking hold in the channel. Frequent, manicured mowing at low settings is not recommended and can lead to erosion of the channel.

Nonroutine Maintenance (as needed)

- Repair check dams, remove any accumulated sediment from behind dam structure.
- Remove sediment buildup within the channel.

Performance

Grass Channels are effective at removing small concentrations of pollutants from incoming water flow. A typical GC is expected to reduce total phosphorus (TP) by 25 percent and total nitrogen (TN) by 35 percent, including mass load reduction from runoff removal. More advanced designs can be achieved when using very long travel paths within a GC or soil amendments to enhance infiltration. These advanced designs may lead to higher runoff reductions (VA-DCR 2011).

Expected Cost

Grass channels are a relatively inexpensive *stormwater treatment practice* when compared to other alternatives. A preliminary estimate of the average construction cost of a GC that receives and treats stormwater from 5 acres is approximately $2,160, which includes construction and design costs (VA-DCR 2011). The value of land is not included in this analysis (VA-DCR 2011).

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 http://vwrrc.vt.edu/swc. The BMP Clearinghouse is jointly administered by the VA-DEQ and the Virginia Water Resources Research Center, which has an oversight committee called the Virginia Stormwater BMP Clearinghouse Committee. Committee members represent various stakeholder groups involved with stormwater management.

Online Resources

Chesapeake Stormwater Network – www.chesapeakestormwater.net/all-things-stormwater/grass-channel-design-specification.html

Hydrologic Soil Groups – http://kula.geol.wwu.edu/rjmitch/hydro_soil_groups.pdf

Knox County Stormwater Management Manual – www.knoxcounty.org/stormwater/pdfs/vol2/4-3-10%20Grass%20Channel.pdf

Virginia Stormwater BMP Clearinghouse – http://vwrrc.vt.edu/swc/

Wisconsin Department of Natural Resources – http://dnr.wi.gov/runoff/stormwater/post-constr/swales.pdf

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*, VCE Publication 430-350.

Gilland, T., L. Fox, M. Andruczyk, and L. Swanson. 2009. *Urban Water-Quality Management - What Is a Watershed?* VCE Publication 426-041.

Sample, D., et al. 2011-2012. Best Management Practices Fact Sheet Series 1-15, VCE Publications 426-120 through 426-134.

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Virginia Department of Conservation and Recreation (VA-DCR). 2011. *Virginia DCR Stormwater Design Specification No. 3: Grass Channels*, Version 1.8. http://vwrrc.vt.edu/swc/april_22_2010_update/DCR_BMP_Spec_No_3_GRASS_CHANNELS_Final_Draft_v1-8_04132010.htm.

Glossary of Terms

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

Braiding – A phenomenon when streams or channels incur bottom erosion to form smaller channels that intertwine.

Check dam – A small structure, either temporary or permanent, usually made of stones or logs and constructed across a ditch, swale, or channel to reduce concentrated flow velocity.

Dry swales – Shallow, gently sloping channels with broad, vegetated side slopes and low-velocity flows. They are always located above the water table to provide drainage capacity.

Erosion – A natural process by either physical processes, such as water or wind, or chemical means that moves soil or rock deposits. Excessive erosion is considered an environmental problem that is very difficult to reverse.

Grass channels – Wide, gently sloping, open channels with grass sides; used as part of a stormwater conveyance system.

Groundwater contamination – The presence of unwanted chemical compounds in groundwater. This could possibly include unwanted bacteria. In this case, we would normally be referring to dissolved nitrogen compounds, such as nitrates.

Hydrologic soil group (HSG) – Classes of soils (named either A, B, C, or D) that indicate the minimum rate of infiltration observed after prolonged wetting time.

Impervious surfaces – Hard surfaces that do not allow infiltration of rainfall into them; not *pervious*.

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

Nutrients – The substances required for growth of all biological organisms. When considering water qualities, the nutrients of greatest concern in stormwater are nitrogen and phosphorus, because they are often limiting in downstream waters. Excessive amounts of these substances are pollution and can cause algal blooms and dead zones to occur in downstream waters.

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

Sediment – Soil, rock, or biological material particles formed by weathering, decomposition, and erosion. In water environments, sediment is transported across a *watershed* via streams.

Soil amendment – Any material mixed into the soil; usually compost, to improve overall soil quality.

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.

Stormwater treatment practice – A type of best management practice that is structural and reduces pollution in the water that runs through it.

Watershed – A unit of land that drains to a single "pour point." Boundaries are determined by water flowing from higher elevations to the pour point. The pour point is the point of exit from the watershed, or where the water would flow out of the watershed if it were turned on end.

Water table – The depth at which soils are fully saturated with water.

Wet swales – Shallow, gently sloping channels with broad, vegetated side slopes constructed to slow runoff flows. They typically stay wet by intercepting the shallow groundwater table.