Recommendations of the Expert Panel to Define Removal Rates for Urban Filter Strips and Stream Buffer Upgrade Practices


Photo credit Ryan Winston

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Presentation to the Water Quality GIT
6/9/2014

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Center for Watershed Protection

Report approved 4/15/2014 by the Urban Stormwater Workgroup
Report approved 5/27 by the Watershed Technical Workgroup

Panel Membership

Name	Affiliation
Joe Battiata	Center for Watershed Protection, Inc.
Sally Claggett	USFS, Chesapeake Bay Program Forestry Work Group Coordinator
Scott Crafton	Virginia Department of Environmental Quality
David Follansbee, PhD	New York Department of Environmental Conservation
David Gasper	New York Department of Environmental Conservation
Randy Greer	Delaware Department of Natural Resources and Environmental Control
Curtis Hardman	West Virginia Department of Environmental Protection
Tom Jordan, PhD	Smithsonian Environmental Research Center
Steve Stewart	Baltimore County , Environmental Protection and Sustainability
Al Todd	Alliance for the Chesapeake Bay
Ryan Winston	North Carolina State University
Jennifer Zielinski	Biohabitats, Inc.
Non-panelists: Neely L. Law (Coordinator, CWP & CBP Sediment Stream Coordinoar), Hannah Martin (CRC), Gary Shenk (CBPO), Matt Johnston (CBPO), Jeff Sweeney (CBPO)	

Panel Charge

- Review all of the available science on the nutrient and sediment removal and runoff reduction performance associated with qualifying urban filter strips and/or stream buffer upgrade practices.

Key Elements of Panel Charge	
▪ Practice definition ▪ Qualifying conditions ▪ Model assumptions ▪ Reporting, tracking & verification provided to State and CBP	▪ Interim rate ▪ Conservation landscaping included as part of practice ▪ Unintended consequence ▪ Future research & management needs

Stream Buffer Upgrade

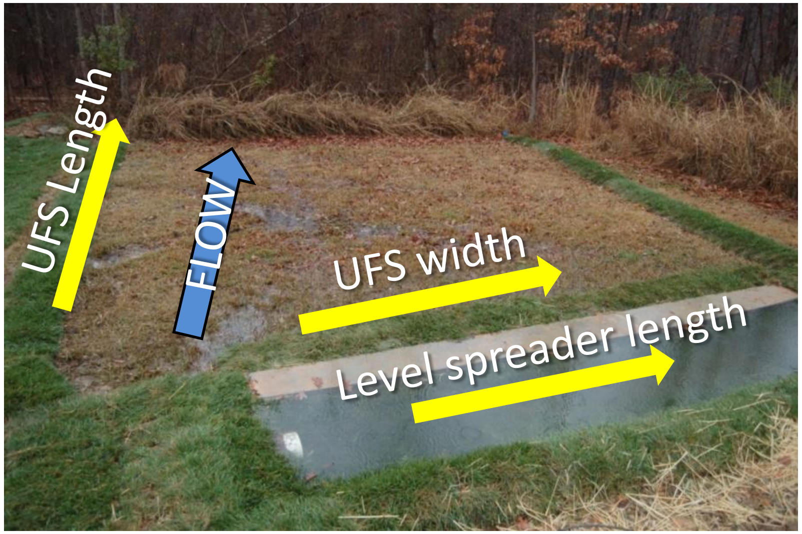
- No recommendations for stream buffer upgrade as a new BMP
- Insufficient data to differentiate from other urban BMPs (i.e., urban forest buffers, tree planting)
  - Very limited research on urban forest/stream buffers
    - Groffman et al (2003), Gift et al (2010), Bettez and Groffman (2012), Stewart et al (2005)
  - No research to explicitly evaluate more narrow buffers in urban context

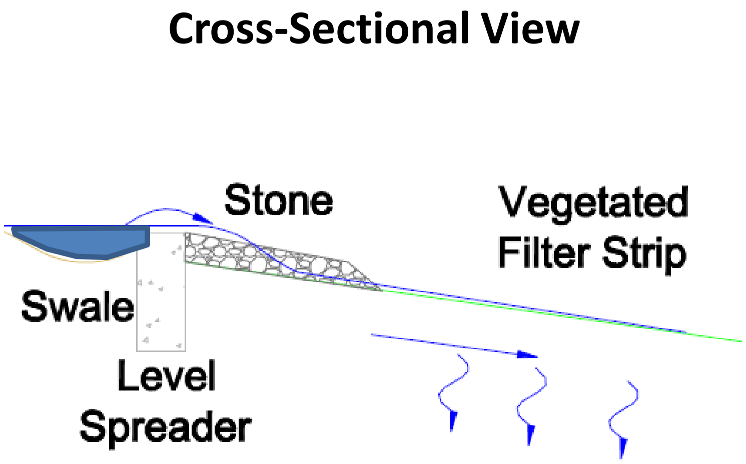
- No recommendations to include conservation landscaping as part of the definition in either practice

Note: The recommendations do not address or revise the current urban forest buffer BMP nitrogen, phosphorus or sediment removal efficiencies or definition defined by the Chesapeake Bay Program.

UFS Definition

- Runoff reduction (RR) and stormwater treatment (ST) BMP
- *Designed to manage stormwater runoff draining from urban lands. Water quality benefits from urban filter strips are derived from both load reduction through infiltration and recharge as well as removal of pollutants through settling and filtration. UFS are stable areas with vegetated cover on flat to gently sloping land. Runoff entering the UFS must be in the form of sheetflow and at a non-erosive rate for the site-specific soil conditions.*





Images courtesy of R. Winston, Winston et al. 2011a, Winston et al. 2011b www.bae.nscu.edu/stormwater

Summary of Key Recommendations for Urban Filter Strips (UFS)

- Runoff Reduction UFS

Table 9: Recommended pollutant removal rates for urban filter strips as a RR BMP.

	TN	TP	TS
0.5" Runoff depth captured	20%	54%	56%

- Stormwater Treatment UFS

Table 10. Recommended pollutant removal rate for UFS as a ST BMP.

	TN	TP	TS
0.5" Runoff depth captured	n/a	n/a	22%

Section 2.2 Qualifying Conditions

Stand-alone practice to treat relatively small impervious areas for new development, redevelopment or retrofit.

- Sheetflow must enter the UFS and be maintained across the entire flow length
- UFS that meet the maximum impervious flow length design criteria without use of a flow dispersion device to dissipate concentrated flow (see Appendix C).
  - A 0.4 design ratio of filter strip length: impervious flow length is recommended for runoff reduction urban filter strips (Section 6.1)
  - A 0.2 design ratio for stormwater treatment urban filter strips (Section 6.2).
- Soils must be classified as Hydrologic Soil Group A, B, or C. Soil amendments are required for D soils or compacted (disturbed) soils to make their permeability equivalent to A, B, or C soils.
- Vegetated cover must be in good condition with minimal bare spots
- Minimize use of fertilizer, application rate is based on a site specific soil test.

Qualifying Conditions

Additional conditions apply where concentrated flow conditions:

- Must enter a low flow diversion or forebay and into a combination channel and level spreader (or other approved configuration) prior to discharging into the filter strip.
- Level spreader length (or other flow dispersion device) is based on 10ft for every 1 cfs (of the concentrated flow) with a maximum 100 ft length.
- The maximum allowable drainage area to meet the above condition will vary depending on the percentage of imperviousness in the contributing drainage area and the volume of runoff requiring treatment by a particular jurisdiction.

- Manicured lawns, athletic fields and other managed turf or pervious areas cannot be used as UFS; other BMPs considered such as Urban Nutrient Management
- Not an applicable practice for hotspots or where there is a high groundwater table
- Consult state stormwater agency for state-specific design and hydraulic specifications

Urban Filter Strips

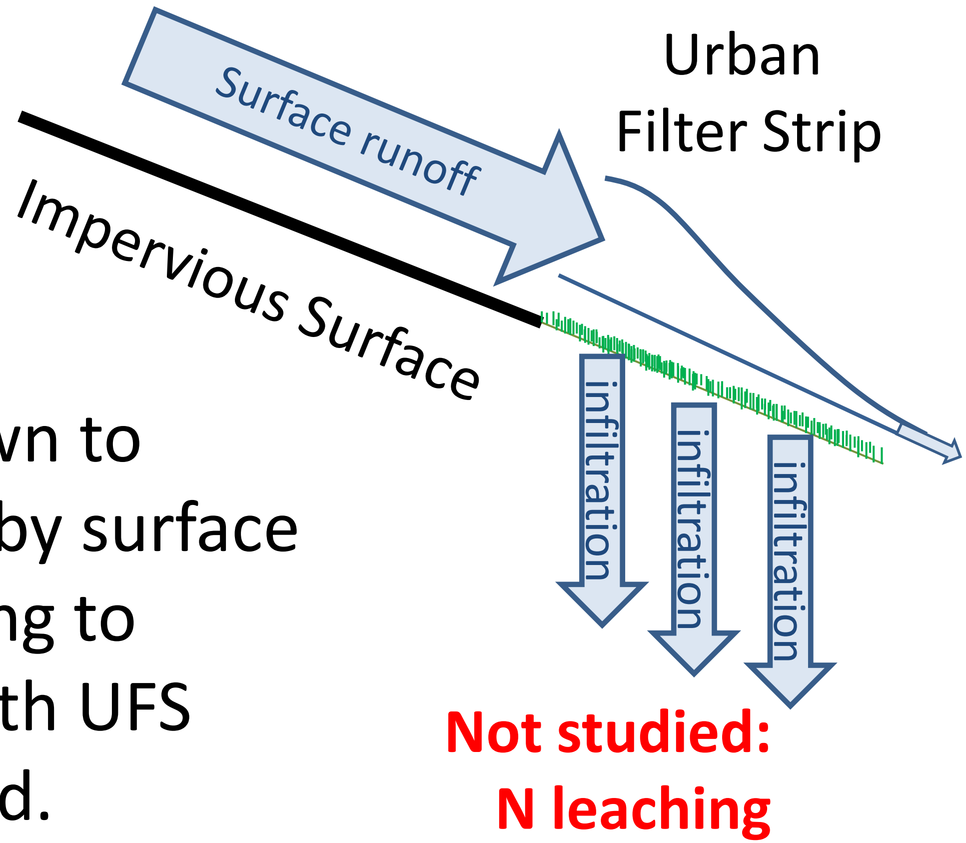
REVIEW OF THE SCIENCE

UFS Performance

- Runoff Reduction
  - Highly effective runoff reduction, from 36% to 85% total annual
  - Key factors: vegetative cover, soil characteristics, loading ratio (drainage area: filter strip area)
- Water Quality
  - Surface monitoring only studies
  - Sediment consistent and generally high
  - N and P variable

Statistic	TN	TP	TS
Average	51%	33%	86%
Range	38 - 69%	22 - 56%	73 - 94%

The case for zero nitrogen credit for urban filter strips (UFS)



UFS have been shown to reduce N transport by surface runoff, but N leaching to groundwater beneath UFS has not been studied.

TN Removal Conclusion

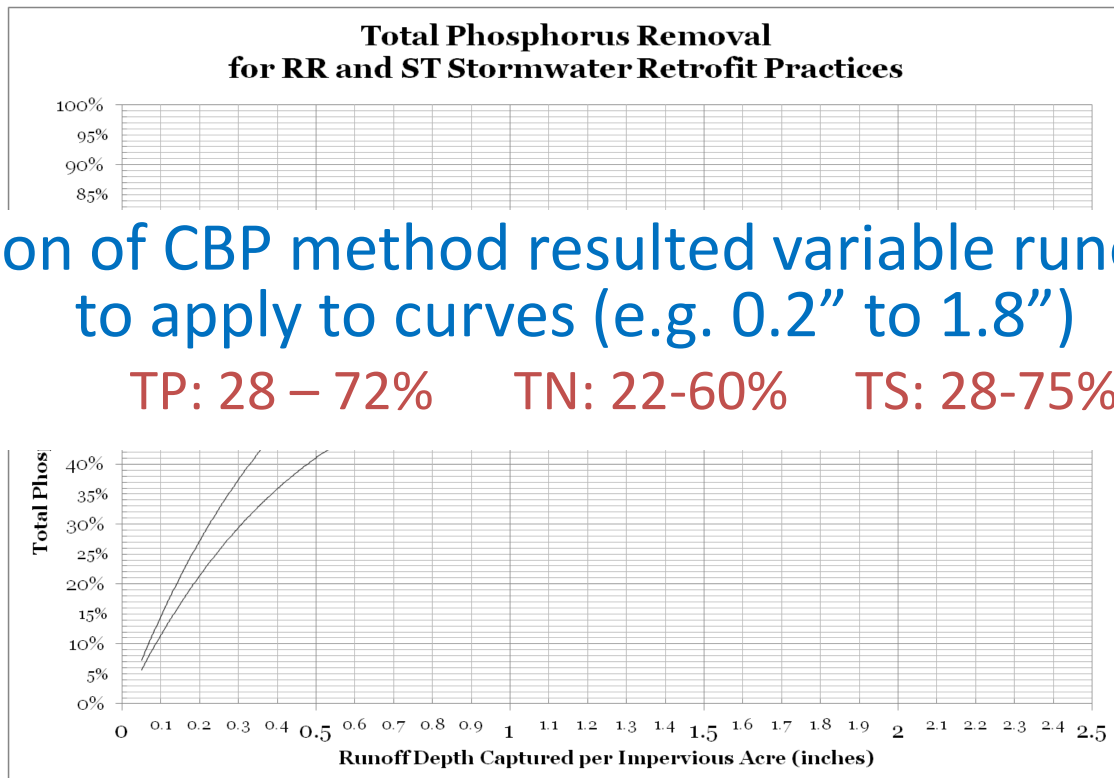
- Because N leaching has not been studied in UFS, estimates of N removal by UFS are best professional judgment given the available data

Urban Filter Strips

PROTOCOL DEVELOPMENT

Protocol to Define UFS Nutrient and Sediment Removal Rates

- Newly adopted CBP method to quantify pollutant removal rate based on *pollutant removal adjustor curves* for urban RR and ST BMPs



Application of CBP method resulted variable runoff depths to apply to curves (e.g. 0.2" to 1.8")

TP: 28 – 72% TN: 22-60% TS: 28-75%

Runoff Reduction
Urban Filter Strips (UFS)

- Runoff Reduction UFS

Table 9: Recommended pollutant removal rates for urban filter strips as a RR BMP.

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TN Removal by UFS

- Assumes only particulate N is reduced by UFS; *all* soluble N leaches to groundwater
- Derived new TN adjustor curve and applied the 0.5” runoff depth captured and discount factor to account for particulate N

⇨ Resulting 20% pollutant removal (Appendix E)

Stormwater Treatment UFS

- Apply only to sediment
- Discount factors (DF) applied to RR UFS
  - Smaller size (~ half length of current design standards). Apply 50% DF
  - coarse sediment trapped. Apply 80% DF

Table 10. Recommended pollutant removal rate for UFS as a ST BMP.

	TN	TP	TS
0.5" Runoff Reduction depth	n/a	n/a	22%

Reporting, Tracking & Verification

- Guidance provided in New State Stormwater Performance Standards and Retrofit Projects expert panel report recommendations
- USWG BMP Verification Guidance (1/23/2014)

Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards

Stewart Comstock, Scott Crafton, Randy Greer, Peter Hill, Dave Hirschman, Shoreh Karimpour, Ken Murin, Jennifer Orr, Fred Rose, Sherry Wilkins

Accepted by Urban Stormwater Work Group: **April 30, 2012**
Revised based on Watershed Technical Work Group feedback: **May 29, 2012**
Resubmitted to Watershed Technical Work Group: **July 15, 2012**
Conditionally Approved by Watershed Technical Work Group: **August 1, 2012**
Conditionally Approved by Water Quality Goal Implementation Team: **August 13, 2012**
Errata Correction Approved by USWG: **September 14, 2012**
Resubmitted to WQGIT **September 28, 2012**
Final Approval by WQGIT: **October 9, 2012**

Prepared by:
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Chesapeake Stormwater Network

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Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects

Ray Bahr, Ted Brown, LJ Hansen, Joe Kelly, Jason Papacosma, Virginia Snead, Bill Stack, Rebecca Stack and Steve Stewart

Accepted by Urban Stormwater Work Group: **April 30, 2012**
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Appendix K. Workgroups' BMP Verification Guidance

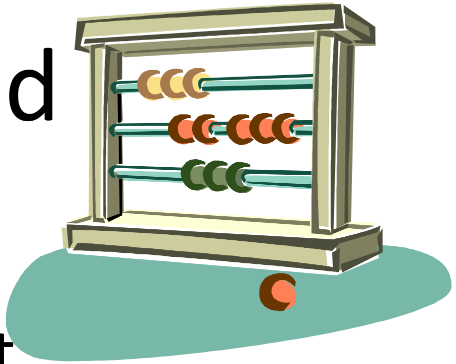
III. Urban Stormwater BMP Verification Guidance

Version: USWG Approved Guidance, January 21, 2014

This section describes guidance on how to verify the performance of urban BMPs in the Bay watershed, and is organized into 8 parts.

1. The Need for BMP Verification and the CBP Process to Define it.
2. Key Verification Definitions
3. Background on Urban BMP Verification
4. Verification Guidance for BMPs Located in MS4 areas
5. Verification Guidance for BMPs Located in non-MS4 areas
6. Verification Guidance for Non-Regulatory BMPs
7. Verification Guidance for Legacy BMPs
8. Process for Developing Urban BMP Verification Protocols

Un-Intended Consequences and Double-Counting



- Pollutant load reductions for Urban Nutrient Management (UNM) may not be applied to the area of an UFS,
- IF any pervious areas *draining to* the UFS may be eligible for UNM.
- A UFS may be credited as pretreatment to an urban forest buffer (to create sheetflow conditions)
  - In this circumstance, the area of the UFS may not be included as buffer area but must meet the qualifying conditions outlined in Section 2.2 to be eligible for credit.

Future Research & Management Needs

Urban Filter Strips

1. Monitoring studies to evaluate the fate of nitrogen and phosphorus treated by UFS (leaching and accumulation)
2. Monitoring studies to further evaluate the impact of concentrated flow through forested buffers.
3. Studies that review event mean concentration through various types of vegetated buffer may be helpful.

Stream Buffer Upgrades

4. Research to evaluate the function and pollutant removal capabilities of urban forested buffers less than 35ft along the flow path.
5. In forested stream buffers, investigate the effect of hydric soils or groundwater flow close to the soil surface on the nitrate removal capacity. Hydric soils of near-surface groundwater may decrease the flow path distance required for nitrate removal.

Thank you.

Comments & Questions?

Section 7. Accountability Mechanisms

- *Basic Reporting Unit*
- *Reporting to the State*
- *Initial Verification of BMP Installation*
- *New BMP Record-Keeping. Non-Conforming Projects*
- *Verification for Older UFS*
- *Periodic BMP Inspections*
- *Suggested Process for BMP Downgrades*
- *Special Procedures for BMPs Installed in Non-Regulated Areas**

* Recommended guidance to be provided by BMP Verification Principles