

# The Role & Purpose of Upland Stormwater BMPs

TAYLOR RUN & STRAWBERRY RUN CONSENSUS BUILDING WORKSHOP

SEPTEMBER 10, 2022

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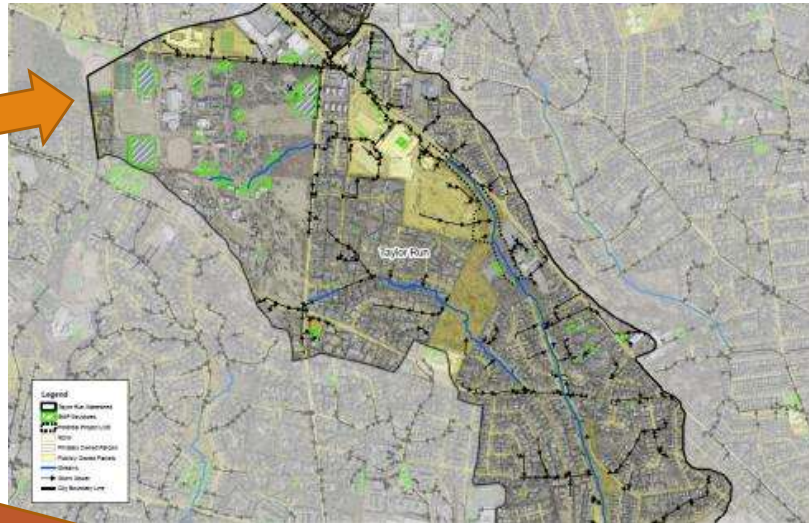
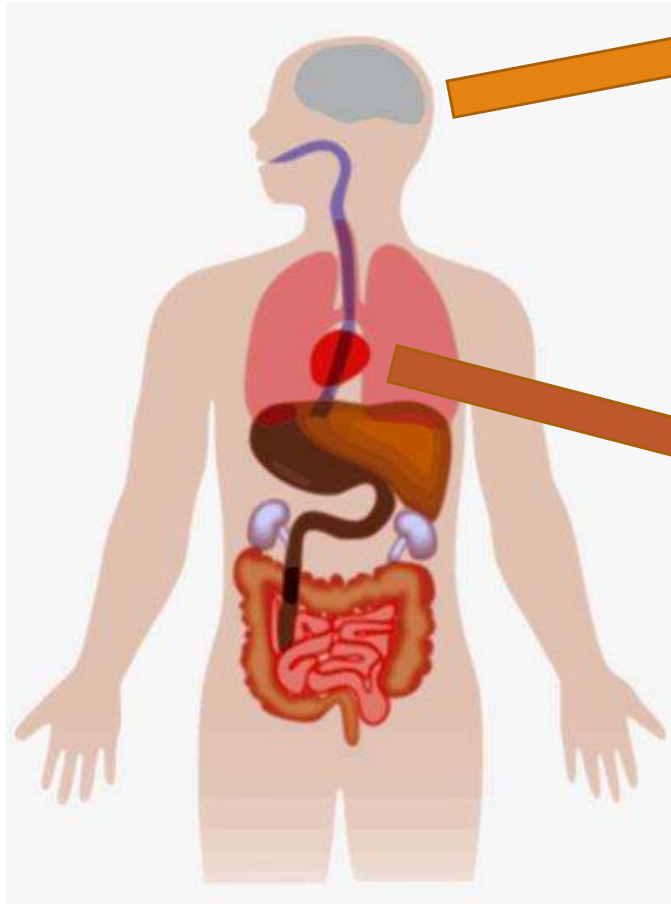
DAVID J. HIRSCHMAN, HIRSCHMAN WATER & ENVIRONMENT, LLC



# Role & Purpose of Upland Stormwater BMPs



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1. The Brain & Heart of Watersheds/Streams
2. BMP Credits (Pollutant Reductions) -- Drivers of Implementation
3. Upland Stormwater BMPs
  - Why We Do Them
  - Effectiveness at the watershed scale (water quantity and quality)
  - Costs



# Stormwater BMP Credits (Pollutant Reduction): Drivers of Implementation

**A Unified Guide for Crediting Stream and Floodplain  
Restoration Projects in the Chesapeake Bay Watershed**

<p style="text-align: center;"><b>CBP APPROVED MEMO</b></p> <p style="text-align: center;"><b>Recommended Methods to Verify Stream Restoration Practices Built for Pollutant Crediting in the Chesapeake Bay Watershed</b></p>  <p style="text-align: center;">Submitted By: Stream Restoration Group 1: Verification Joel Burch, Scott Cox, Sandra Davis, Meghan Fellows, Kathy Hoyerman, Neely Law, Kip Munson, Jennifer Ramhofer, Tim Schaefer and Rich Starr</p> <p style="text-align: center;">Approved by the Urban Stormwater Work Group of the Chesapeake Bay Program</p> <p style="text-align: center;">Date: June 18, 2019</p>	<p style="text-align: center;"><b>Final Memo</b></p> <p style="text-align: center;"><b>Water Quality Goal Implementation Team Approved: October 15, 2019</b></p> <p style="text-align: center;"><b>Recommendations for Crediting Outfall and Gully Stabilization Projects in the Chesapeake Bay Watershed</b></p>  <p style="text-align: center;">Stream Restoration Group 2: Ray Balz, Aaron Blair, Ted Brown, Karen Coffman, Ryan Cole, Tracey Harrison, Erik Michelson, Nick Noss, Elizabeth Ottinger, Brock Reggi, Stephen Reiling, Allison Santoro, Chris Stone, Carris Traver and Neil Weinstein</p> <p style="text-align: center;">Date: October 15, 2019</p>
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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

Good Recipes for the Bay Pollution Diet

**U-15 CONSERVATION LANDSCAPING**

PRACTICE AT A GLANCE

Recommendations of the Expert Panel  
to Define Removal Rates  
for **Urban Nutrient Management**

**CBP APPROVED FINAL REPORT**

Marc Aveni, Karl Berger, Jonathan Champion, Gary Felton, Mike Goatley,  
William Keeling, Neely Law and Stuart Schwartz

Recommendations of the Expert Panel to Define  
Removal Rates for the Elimination of Discovered  
**Nutrient Discharges from Grey Infrastructure**

**FINAL APPROVED REPORT**

Submitted by:

Marianne Walch, Megan Brosh, Lori Lilly, Jenny Tribo, June Whitehurst,  
Barbara Brumbaugh, Diana Handy, Mark Hoskins, Kevin Utt, Robert Pitt,  
Tanya Spano and Whitney Katchmark

Recommendations of the Expert Panel to Define  
BMP Effectiveness for **Urban Tree Canopy**  
Expansion

Karen Capiella, Sally Claggett, Keith Cline, Susan Day, Michael Galvin, Peter MacDonagh,  
Jessica Sanders, Thomas Whitlow, Qingfu Xiao

Recommendations of the Expert Panel  
to Define Removal Rates for  
**Street and Storm Drain Cleaning Practices**

Sebastian Donner, Bill Frost, Norm Goulet, Marty Hurd, Neely Law, Thomas Maguire,  
Bill Selbig, Justin Shafer, Steve Stewart and Jenny Tribo

# Stormwater BMPs in the Uplands: Why We Do Them



# Part of Development Approval



# Retrofits (C.B. TMDL)



Photo: Arlington County





# BMPs in the Uplands: Effectiveness at the Watershed Scale



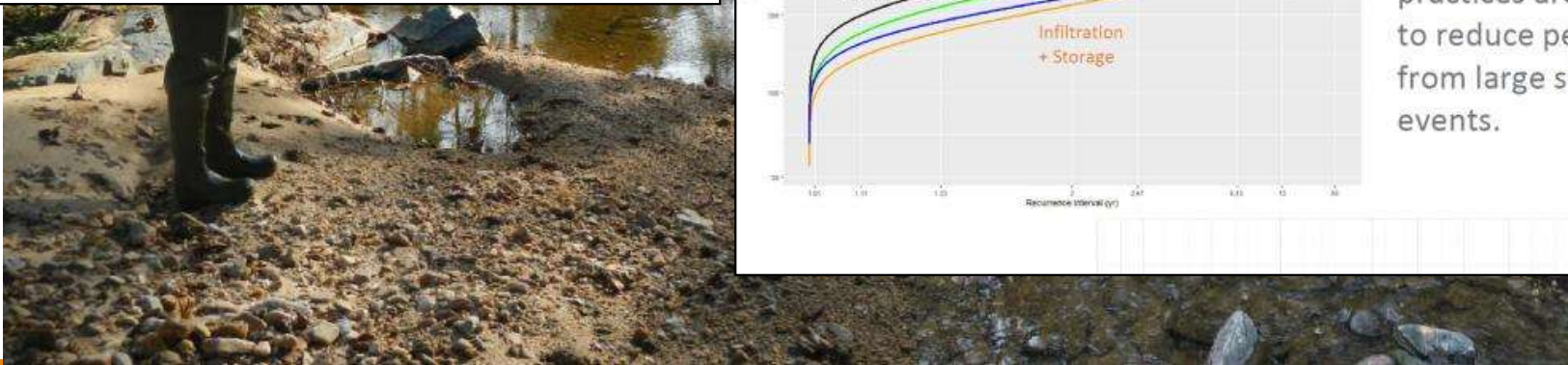
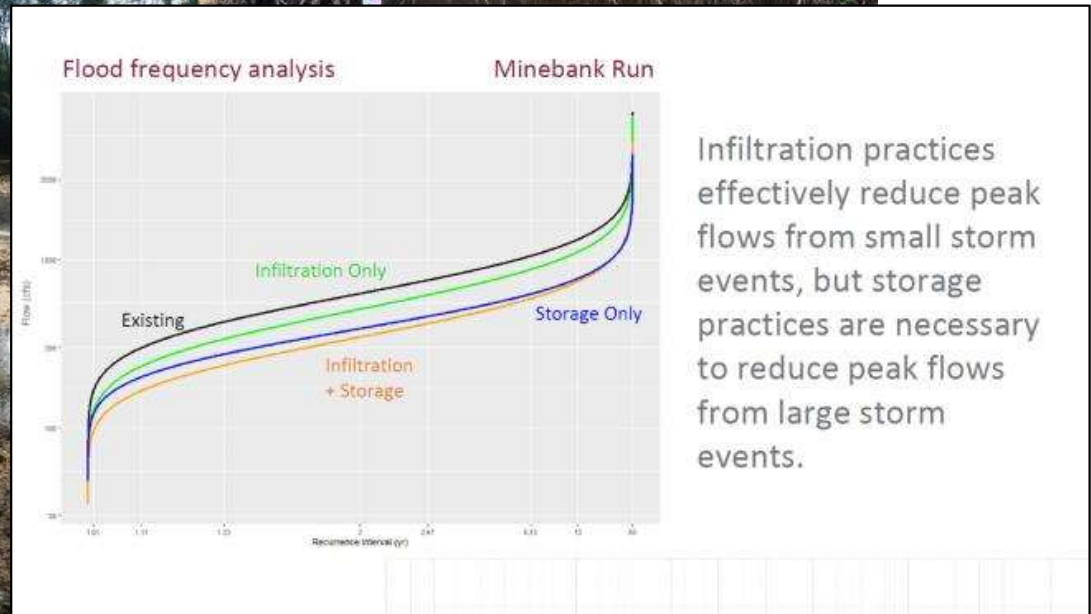
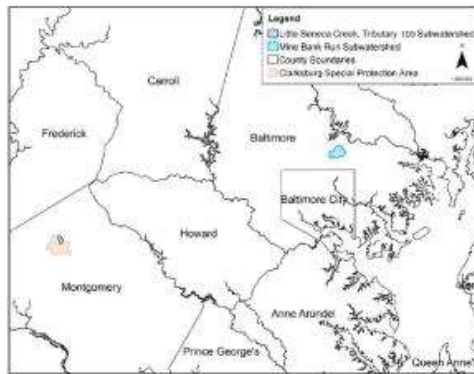
**Quantity: Storage**



**Quality: Treatment**

# Virginia Tech: Effectiveness of Stormwater BMPs in Protecting Stream Channel Stability (2022)

The overall study goal is to evaluate the impacts of different stormwater management practices on channel stability

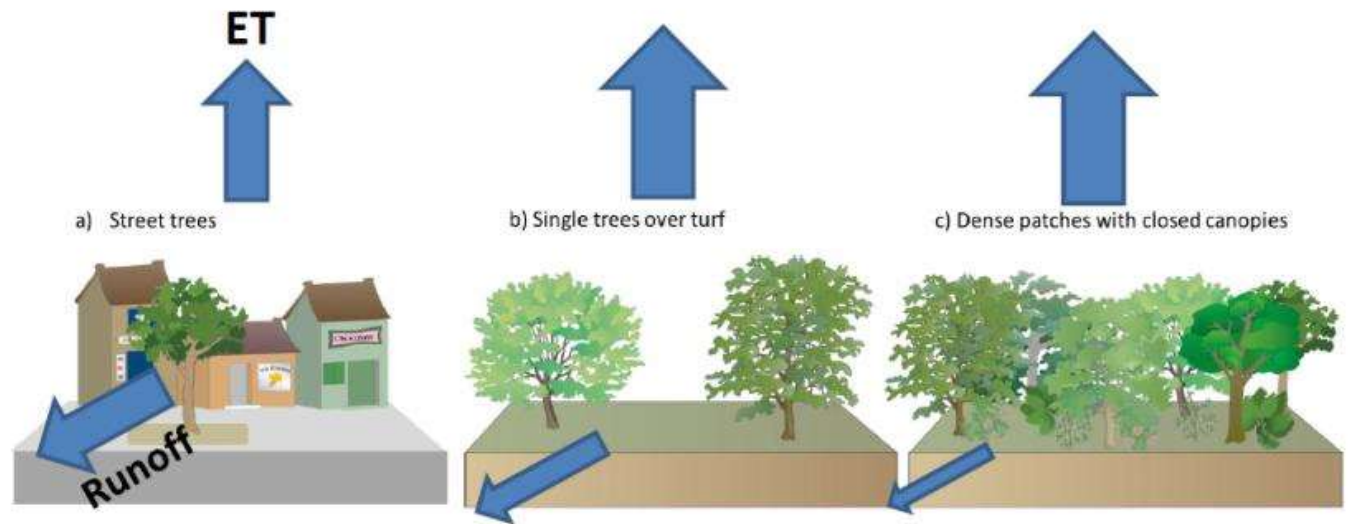




# A Novel Research Framework to Assess Water Quality Impacts of Urban Trees

Question B7, Water Quality of an Urban Tree

Neely L. Law, PhD  
Mitch Pavao-Zuck  
PhD  
Sarah Ponte Cabr  
Nancy Sonti, USFS



Examples of different urban tree typologies. (Images courtesy of the Integration and Application Network, UMD Center for Environmental Science)

# Page, et al., 2015 (NCSU)

*Retrofitting residential streets with stormwater control measures over sandy soils for water quality improvement at the catchment scale*



- Wilmington, NC
- Paired Catchment Areas: residential streets
- Retrofits: Street Bioretention, 4 PP Parking Stalls, Tree Box Filter
- Treatment Area = 1.3 ac.
- **91%** of DA treated; **94%** of directly-connected IC
- Good reductions: TKN, TP, TSS, Cu, Pb, Zn – particulate bound
- Dissolved did not change

## Quantifying the cumulative effects of stream restoration and environmental site design on nitrate loads in nested urban watersheds using a high-frequency sensor network

Restoration Research Question Addressed:

*What are the cumulative effects of watershed restoration activities within a watershed?*

Claire Welty, UMBC  
Andy Miller, UMBC  
Jon Duncan, Penn State

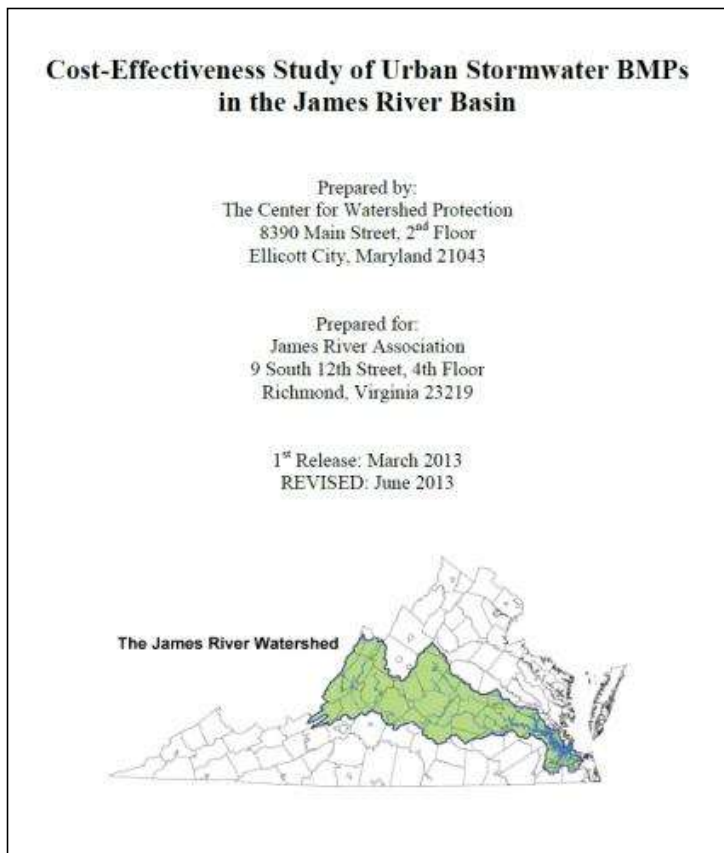


**3 urban watersheds near Baltimore (Dead Run):  
½ to ¾ square miles in size**

### Summary: Part 2, Stormwater

- Comparison of composite hydrographs shows no difference in rising limb of hydrograph and time of peak flow, slightly longer recession curve for watersheds with more SWM.
- Comparison of composite hydrographs before and after restoration shows no change.
- Analysis of trends in peak runoff response to storm-total rainfall shows no significant difference for watersheds with large differences in SWM coverage.
- Analysis of runoff depth as a function of storm-total precipitation shows differences that are not statistically significant, with more runoff for the watershed with the highest SWM coverage and highest impervious cover.

# BMPs in the Uplands: Cost



## Cost:

- Many ways to forecast costs
- Today: construction costs only
- \$ per Impervious Acre Treated
- Pre-COVID costs may be on low side

Retrofit an old pond or basin



**= \$15,500**



## Bioretention: typical or highly-urban



**= \$45,700**



**= \$160,000**

Photo: Arlington County

# Permeable Pavement



**= \$265,500**

# BMP Maintenance



# Summary

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Heart & Mind: urban watersheds & urban stream health

Chesapeake Bay TMDL crediting drives implementation (cost per pound metric)

Many different BMP types

Upland BMP effectiveness at catchment/watershed scale is (finally) being studied. Results are mixed.

Costs vary widely

Maintenance matters!

Hirschman Water & Environment, LLC.

[www.hirschmanwater.com](http://www.hirschmanwater.com).



