Draft Urban Nutrient Management Recommendations

Presented to the
Agricultural Workgroup
November 29, 2012

Next Steps

- Solicit informal feedback today
- Revise draft of both panel reports
- Joint USWG/WTWG/Invited Interests meeting on December 17 (including ag)
- 30 day comment period
- Final Draft submitted for USWG/WTWG/WQGIT approval in early 2013

The Expert Panel

Panelist	***Affiliation***
Jonathan Champion	District Department of the Environment
Karl Berger	Metropolitan Washington Council of Governments
Dr. Stu Schwartz	University of Maryland, Baltimore County
William Keeling	Virginia Department of Conservation and Recreation
Dr. Gary Felton	University of Maryland, College Park
Dr. Neely Law	Center for Watershed Protection
Marc Aveni	Prince William County Department of Public Works
Dr. Mike Goatley	Virginia Tech
Tom Schueler	Chesapeake Stormwater Network (panel facilitator)

Technical support by Jeremy Hanson (CRC), Molly Harrington (CRC), Gary Shenk (EPA CBPO, Jeff Sweeney (EPA CBPO) and Mark Sievers (TetraTech) is gratefully appreciated

Panel Charge

- Current CBWM 5.3.2 land use data for urban pervious areas and recommend the most probable splits for turf management status (i.e., fertilized, un-fertilized, and over-fertilized)

- Available literature on the nutrient and sediment loading rates associated with fertilized, un-fertilized and over-fertilized turf, accounting for regional and terrain differences.

- Specific definitions for each class of UNM practices and the qualifying conditions and rationale under which a locality can receive a nutrient reduction credit.

- Whether the 2003 CBP-approved nutrient removal rates for UNM practices developed in 2003 is still reliable.

The Charge

- What, if any, nutrient credits can be provided by outreach campaigns to change homeowner fertilization behavior.
- The proper units to report UNM implementation to receive credit in the Chesapeake Bay Watershed Model
- Critically analyze any unintended consequence associated with the removal rates and any potential for double or over-counting of the load reduction achieved.

Definitions

- Pervious Land vs. Turf
- High Risk Export Factors
- Urban Nutrient Management
- Core UNM Practices
- P Fertilizer Restrictions
- UNM Planning Agency
- Qualifying UNM Plan
- Trained UNM Expert
- Passive, Active, and Alternative Outreach

High Risk Export Factors

Pervious areas subject to one or more of the following risk factors:

- Currently over-fertilized beyond state or extension recommendations
- P-saturated soils as determined by a soil P test
- Newly established turf (i.e., less than three years old)
- Steep slopes
- Exposed soil
- High water table
- Over-irrigated lawns
- Soils that are sandy, shallow, compacted or have low water holding capacity
- High use areas (e.g., athletic fields, golf courses)
- Adjacent to stream, river or Bay
- Karst terrain

More specific "operational definitions" provided for each risk factor

Core UNM Practices for the Chesapeake Bay

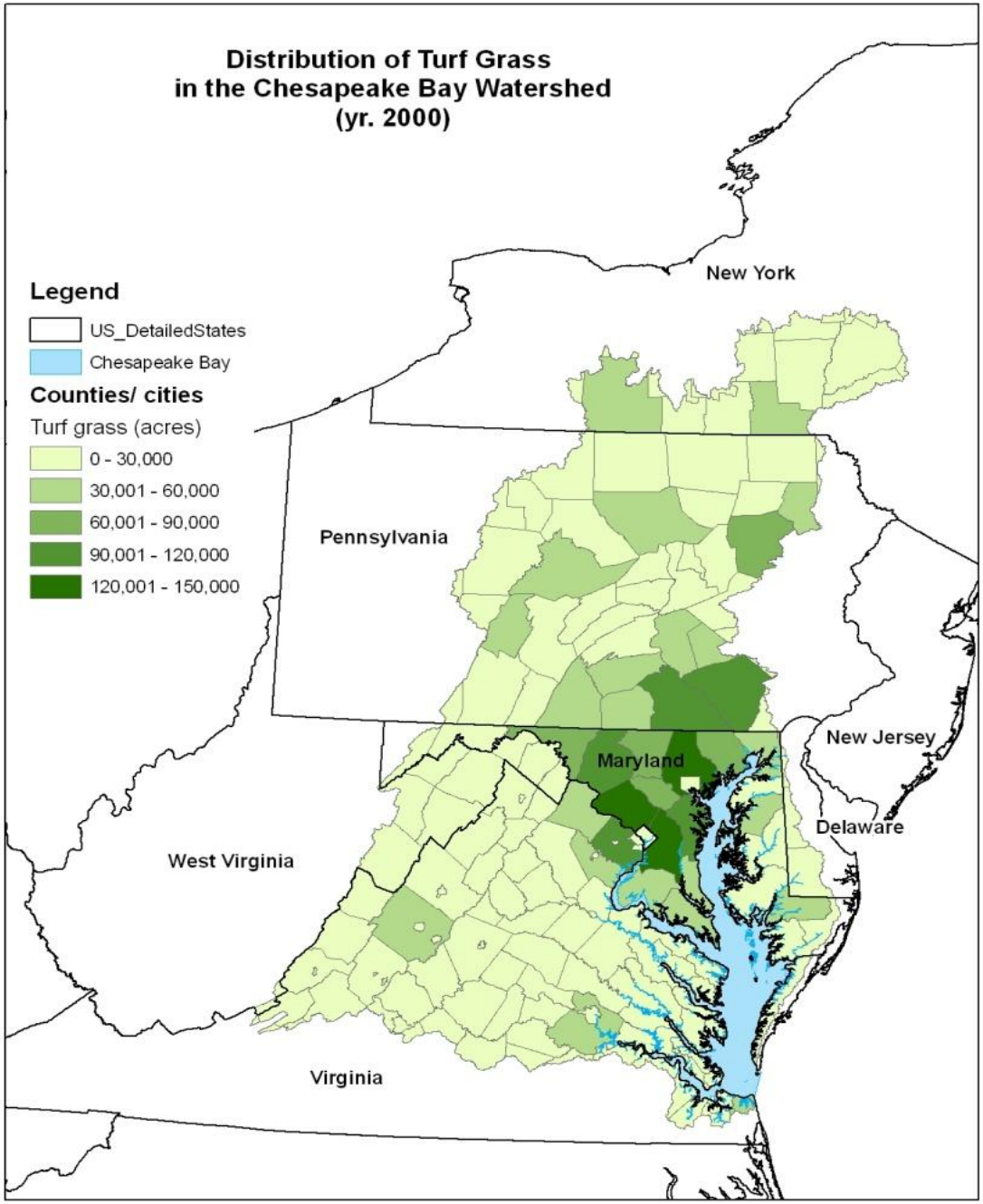
1. Get *technical assistance* to develop an effective UNM plan for the property
2. Maintain a **dense** vegetative cover of turf grass or conservation landscaping
3. Choose not to fertilize, **OR** adopt a reduce rate/monitor approach **OR** the use the small fertilizer dose approach
4. Retain clippings and mulched leaves on the yard and keep them out of streets and storm drains
5. Do not apply fertilizer before spring green up or after Halloween*

Core UNM Practices for the Chesapeake Bay

6. Maximize use of slow release N fertilizer during the active growing season
7. Set mower height at 3 inches or taller
8. Immediately sweep off any fertilizer that lands on a paved surface
9. Do not apply fertilizer within 20 feet of a water feature and manage this zone as a perennial planting, a tall grass buffer or a forested buffer
10. Employ lawn practices to increase soil porosity and infiltration capability and use the lawn to treat stormwater runoff.

Review of Turf and Fertilization in the Chesapeake Bay

- Estimates of turf/pervious cover in watershed.
- Differences in State P fertilizer legislation
- Trends in non-farm fertilizer sales
- Derivation of existing CBP rate
- CBWM simulation of nutrients on pervious land


Distribution of Turf Grass
in the Chesapeake Bay Watershed
(yr. 2000)
Legend
US_DetailedStates
Chesapeake Bay
Counties/ cities
Turf grass (acres)
0 - 30,000
30,001 - 60,000
60,001 - 90,000
90,001 - 120,000
120,001 - 150,000
New York
Pennsylvania
New Jersey
Maryland
Delaware
West Virginia
Virginia

Comparison of Acres of Urban Pervious Areas and Anticipated Acres Under Urban Nutrient Management by 2025, For Each Bay State

State	Urban Pervious Area [1]	Urban Nutrient Management [2]
	Acres	
Delaware	36,481	34,584
District of Columbia	17,206	42,240
Maryland	990,291	555,575
New York	170,716	170,654
Pennsylvania	1,052,558	311,154
Virginia	1,195,567	517,058
West Virginia	88,218	347
TOTAL	3,551,037	1,631,612

[1] Acres of Urban Pervious Area in Version 5.3.2 of Chesapeake Bay Watershed Model

[2] Acres under urban nutrient management in each state by 2025 as reported in the Phase 2 Watershed Implementation Plan submissions to EPA in 2012, as summarized in spreadsheet by Jeff Sweeney, EPA CBPO

[3]

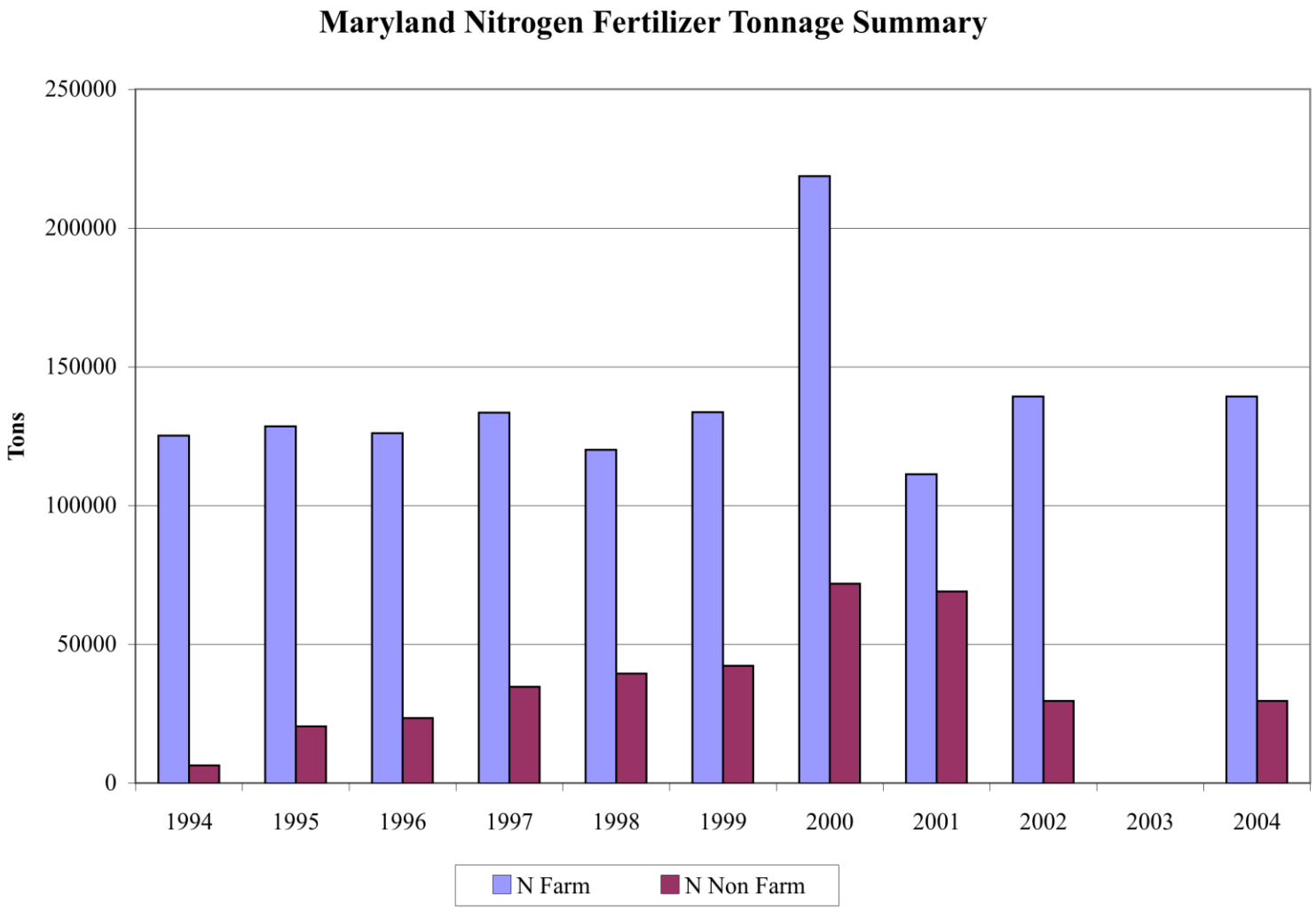
State P fertilizer legislation

- 3 States have done so (MD,NY, VA)
- Each legislation is different, and is not equivalent to a P-ban in fertilizer products
- States that not passed laws still benefit form industry phase-out of fertilizer products

The Panel and the Old CBP-Approved UNM Rate

... urban nutrient management leads to a reduction in urban fertilizer applied. Urban nutrient management involves public education (targeting urban/suburban residents and business) to encourage reduction of excessive fertilizer use. The CBP Nutrient Subcommittee Tributary Strategy Workgroup has estimated that urban nutrient management ***reduces nitrogen loads by 17% and phosphorus loads by 22%***

- **No scientific or modeling analysis could be found to support or document the above cited rates.**
- **UNM definition was extremely ambiguous and could not be accurately measured, tracked or verified.**
- **Panel concluded the existing CBP-approved UNM practice could not be technically justified.**



Non-farm fertilizer sales statistics show trends but have some real data quality issues

Industry Reported Change in P Fertilizer Sales in the Bay States, 2006 to 2010 [1]

State [2]	2006	2010	Percent reduction
	Millions of Pounds	Millions of Pounds	
Pennsylvania	1.41	0.26	82 %
Maryland	0.68	0.10	85 %
Virginia	0.60	0.22	63 %
Delaware	0.09	0.04	55 %
West Virginia	0.07	0.02	71 %
Total	**2.85**	**0.655**	**77%**

[1] annual sales data reported by Scotts (2011) for non-farm fertilizer sales by state. Scott's currently has a 60% market share, and has committed to a full phase out of P in its fertilizer products by January 1, 2013. Analysis performed by Gary Felton, 2012.

2 Note that the statistics on P sales are provided for each state as a whole, and NOT the fraction of the state located within the Bay watershed

Urban Nutrient Research Review

1. P Dynamics on Urban Lawns
2. N Dynamics on Urban Lawns
3. High Risk Factors for Nutrient Export
4. Justification for Core UNM Practices
5. Impact of P Fertilizer Restrictions
6. Homeowner Fertilizer Behavior
7. Effect of Outreach on Fertilizer Behavior

Panel reviewed more than 150 papers and has met 7 times

Recommended Credits

- Automatic State-wide P Reduction Credit for UNM Legislation
- Contingent State-wide N Reduction Credit based on Sales
- N and P Reductions for Qualifying UNM Plans
- Programmatic Credit for Alternative Outreach Option

Automatic TP Load Reduction Credit from Pervious Lands for States that HAVE adopted urban nutrient management legislation

Bay State	TP Reduction (million pounds)	% Change in Pervious Load	% Change in Urban Load
MD	0.060	- 25.1	- 8.6
NY	0.012	- 26.5	- 11.6
PA [2]	0.053	- 23.3	- 10.4
VA	0.125	- 26.7	- 10.2

[1] 2010 Delivered Loads

[2] PA UNM legislation is still under consideration, no credit is allowed until it has passed

Source: Gary Shenk, CBPO, April 10, 2012 spreadsheet of CBWM 5.3.2. model runs assuming 0% P application rates

Assumed 70% Reduction in TP fertilizer Inputs to CBWM

Automatic P Reduction Credit from Pervious Lands in States that influenced by fertilizer industry phase-out

Bay State	TP Reduction (million pounds)	% Change in Pervious Load	% Change in Urban Load
DE	0.0018	- 19.0	- 7.8
DC	0.0006	- 21.2	- 3.6
PA [2]	0.046	-20.0	-8.9
WV	0.0048	-21.1	- 4.4

[1] 2010 Delivered Loads
[2] In the event UNM legislation is not passed
Source: Gary Shenk, CBPO, April 10, 2012 spreadsheet of CBWM 5.3.2. model runs assuming 0% P application rates

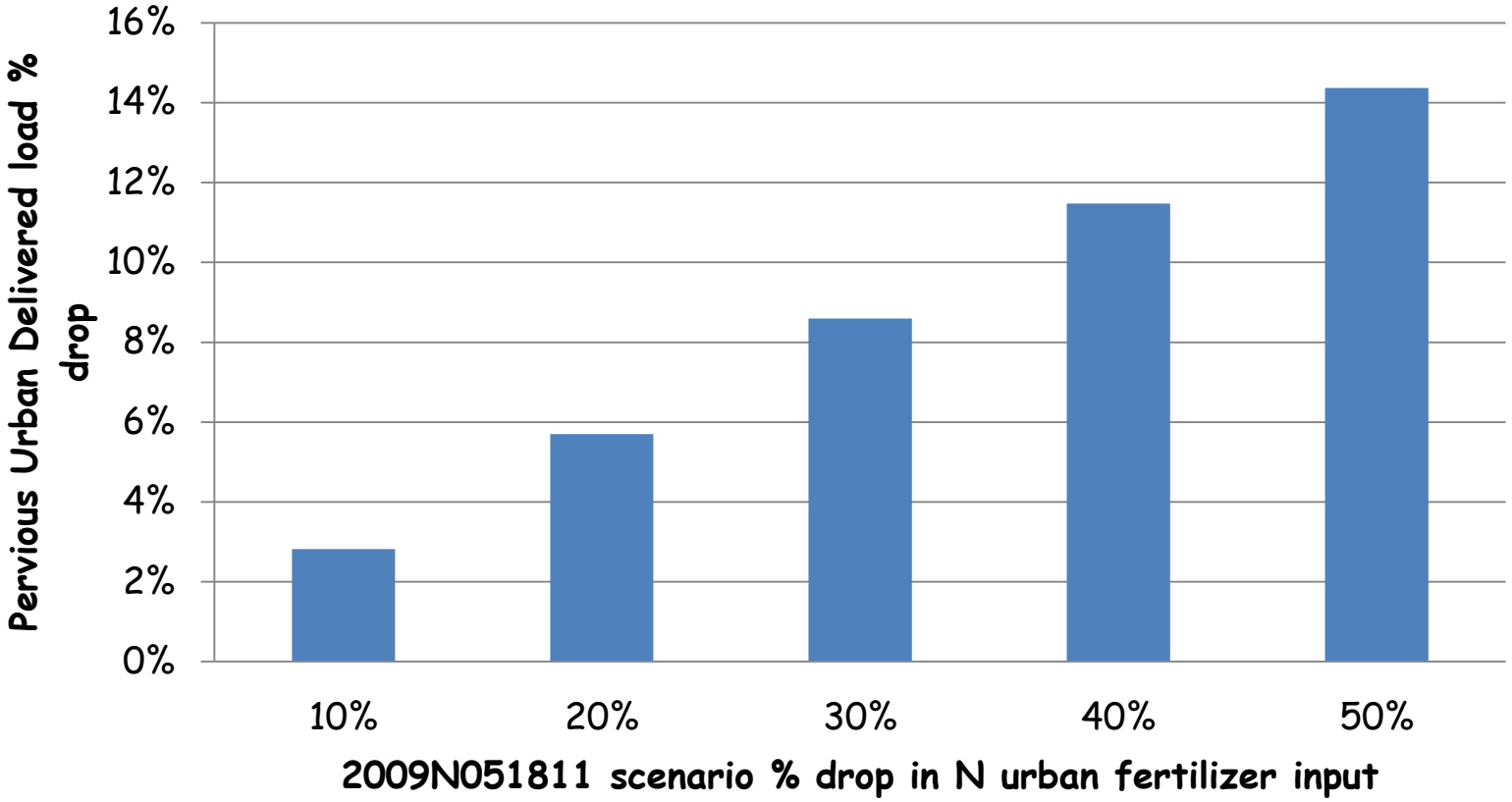
Assumed 60% Reduction in TP fertilizer Inputs to CBWM

Meaningless Photo to Break up Monotonous Word Slides

Statewide Nitrogen Reduction Credit for Pervious Land

- Load reduction credit contingent on the expected decline in N fertilizer sales over time.
- Credit is based on each state's 2014 N fertilizer inputs, relative to the current CBWM assumption of 43 lbs/ac/year for pervious land.
- Only granted when states can document a downward trend in the N content of non-farm fertilizer sales data.
- The magnitude of the credit will be determined by changing N fertilization inputs in the CBWM.
- Subject to biannual verification

3% Decline in N Load for each 10% decline in N fertilizer sales



Nitrogen Reduction Credits for Qualifying UNM Plans Per Acre of Residential, Commercial, Institutional or Public Land

Turf Nitrogen Management Category	Annual Nitrogen Reduction Rate
Low Risk Lawns [1]	**6 % reduction of pervious load**
Hi Risk Lawns [1]	**20% reduction of pervious load**
Blended Rate [2]	**9% reduction of pervious load**
[1] regardless of fertilization regime (including non-fertilized lawns [2] state-wide credit, assuming 80% of lawn acreage falls into the low category and 20% is high risk	

While rates were based on best professional judgment, they are reinforced by a CBWM loading mass balance analysis

Phosphorus Reduction Credits for Qualifying UNM Plans Per Acre of Residential, Commercial, Institutional or Public Land

Turf Management Category [1]	Annual TP Reduction Rate [1]
Low Risk Lawns	**3 % reduction of pervious load**
Hi Risk Lawns	**10 % reduction of pervious load**
Blended Rate	**4.5% reduction of pervious land**

[1] regardless of fertilization regime (including non-fertilized lawns
[2] state-wide credit, assuming 80% of lawn acreage falls into the low category and 20% is high risk

Alternative Outreach Option

Communities can create programs that motivate property owners to implement the core UNM practices, such as:

- Local or regional social media/marketing campaigns to deliver the core message to a geographically defined target population, and funnel them to a UNM planning agency.

- Mapping of high risk export factors within a community to target outreach efforts to develop more UNM plans.

- Targeted training to commercial applicators, lawn care companies, landscape contractors and property managers.

- Distribution of point of sale outreach materials at retail sales outlets (e.g., information kiosks at home and garden stores)

- Other alternative outreach efforts, as approved by state and/or extension service.

Credit for Alternative Outreach Option

- Communities that utilize them are eligible for a one-time, three year N reduction credit equivalent to **3% of the N load** generated from the total pervious land area in the geographical area that is targeted.

- Credit is contingent upon before and after surveys, monitoring or other research that can scientifically evaluate the quantitative outcome of the outreach program, in terms of actual changes in fertilization behavior or increased delivery of UNM plans.

- After the three years, the alternative outreach program credit will expire, and the acreage of UNM plans/pledges will become the metric by which credit is determined

- Acknowledged that some alternative outreach efforts may fail or may not meet their original expectations, but new data collected will improve future UNM delivery.

Accountability

Different for each credit, although all must meet specific reporting, tracking and verification requirements

After 2015, however, the automatic state credit will lapse and be replaced with state-reported estimates of P fertilizer applications to pervious land using the methods and verification procedures

Step 1: Multiply the state acreage in pervious land by the 1.3 lbs P/acre/year average application rate assumed in the current version of CBWM to establish the state P application benchmark.

Step 2: Determine the P content of reported non-farm fertilizer sales for two consecutive years, accounting for the differential P content in the various lawn and garden fertilizer products that are represented in the sales statistics.

Convert to total pounds of P, and adjust downward to account for non-Bay watershed area in the state on a pro-rata basis.

The mass of estimated P sold is then divided by the state acres of pervious land determine the new state average P application rate in lbs/ac/year

Step 3: Divide the new state P application rate by the state application benchmark and then multiply by 100 to get the percentage reduction in P application from the CBWM benchmark.

Step 4: The state-specific unit area P application rate is then entered into the CBWM directly to compute the revised P load generated from pervious lands for the state.

The Panel acknowledges that most current state non-farm fertilizer sales statistics are not detailed enough to characterize urban nutrient content, but feel that such data is critical to verify the substantial reductions provided.

Qualifying Conditions for UNM

- Each UNM plan must be prepared by a trained expert (e.g., certified plan writer)
- Plan must be consistent with the applicable UNM core lawn care practices or existing state requirements (e.g., Virginia)
- Each UNM plan must clearly document the:
  - Start and end dates for the plan
  - Name, contact information and locator data for the owner, applicator and UNM planner
  - Acreage of turf and landscaping covered by the plan
  - Annual N and P fertilization rate
  - Whether the turf is classified as high or low risk of nutrient export or is an unfertilized lawn (optional)

Q & A

Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects

DRAFT

Expert Panel on Urban Stream Restoration

Panelist	***Affiliation***
Deb Cappuccitti	Maryland Department of Environment
Bob Kerr	Kerr Environmental Services (VA)
Matthew Meyers, PE	Fairfax County (VA) Dept of Public Works and Environmental Services
Daniel E. Medina, PE	Atkins (MD)
Joe Berg	Biohabitats (MD)
Lisa Fraley-McNeal	Center for Watershed Protection (MD)
Steve Stewart	Baltimore County Dept of Env. Protection and Sustainability (MD)
Dave Goerman	Pennsylvania Department of Environmental Protection
Natalie Hartman	West Virginia Department of Environmental Protection
Josh Burch	District Department of Environment
Dr. Robert C. Walter	Franklin and Marshall College
Dr. Sujay Kaushal	University of Maryland
Dr. Solange Filoso	University of Maryland
Julie Winters	US Environmental Protection Agency CBPO
Bettina Sullivan	Virginia Department of Environmental Quality
Panel Support	
Tom Schueler	Chesapeake Stormwater Network (facilitator)
Bill Stack	Center for Watershed Protection (co-facilitator)
Other Panel Support: Russ Dudley – Tetra Tech, Debra Hopkins – Fish and Wildlife Service, Molly Harrington, CBP CRC, Norm Goulet, Chair Urban Stormwater Work Group, Gary Shenk, EPA CBPO, Jeff Sweeney, EPA CBPO	

Stream Restoration is expected to increase substantially to meet the WIP targets

Urban Stream Restoration Expected by 2025 in Bay State Phase 2 Watershed Implementation Plans		
State	Urban Stream Restoration	**Non-Urban Stream Restoration**
	Linear Feet (Miles)	
Delaware	200 (0.02)	63,202 (12)
District of Columbia	42,240 (8)	0
Maryland	19,354,449 (3666)	73,975 (14)
New York	26,500 (5)	337,999 (64)
Pennsylvania	55,000 (10)	529,435 (100)
Virginia	116,399 (22)	104,528 (20)
West Virginia	0	19,618 (3.7)
TOTAL	3711 miles	214 miles

[1] Acres under urban and non urban stream restoration in each state by 2025 as reported in the Phase 2 Watershed Implementation Plan submissions to EPA in 2012, as summarized in May and July 2012 spreadsheets provided by Jeff Sweeney, EPA CBPO

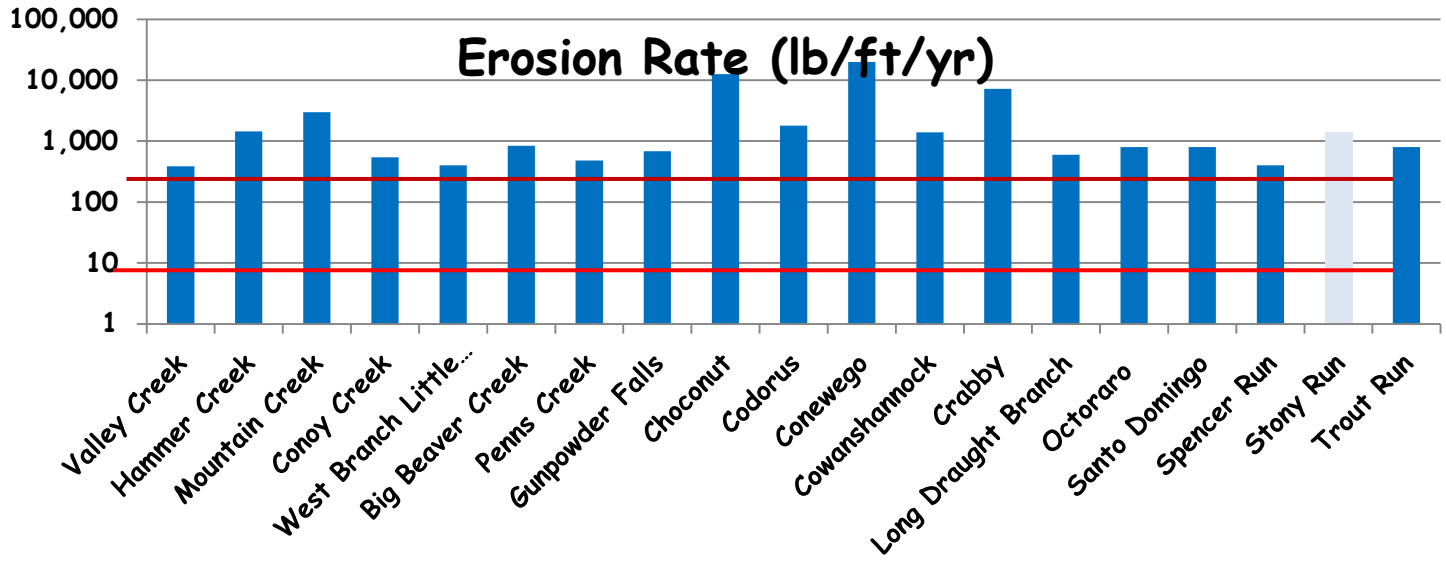
Initial CBP-Approved Stream Restoration Credit (2003)

Removal Rate per Linear foot (lf) of Qualifying Stream Restoration			
Source	TN	TP	TSS
Spring Branch N=1	0.02 lbs	0.0035	2.55 lbs
AT SOME POINT, APPLIED TO NON-URBAN STREAM RESTORATION PROJECTS			

Revised Removal Rate per Linear foot (lf) for Spring Branch, Based on Four Additional Years of Sampling and Data Re-Analysis			
Source	TN	TP	TSS
Spring Branch N=1	0.227 lbs	0.0090	3.69 lbs [1]
% Removal in Reach	42%	43%	83%
Source: Stewart et al (2008) and Steve Stewart presentation to expert panel 1/25/2012 [1] the project did not directly measure nutrient and sediment removal due to prevented streambank erosion, so these numbers are still considered very conservative			

2012 Interim Approved Removal Rate

Interim Approved removal rate per Linear foot of Qualifying Stream Restoration			
Source	**TN**	**TP**	**TSS**
New Interim CBP Rate	0.20 lbs	0.068 lbs	310 lbs
Derived from six stream restoration monitoring studies: Spring Branch, Stony Run, Powder Mill Branch, Moore's Run, Beaver Run and Beaver Dam Creek located in MD or PA			



Categories of Stream Restoration

- Natural Channel Design (e.g., Rosgen approach)
- Regenerative Stormwater Conveyance (wet and dry channel)
- Legacy Sediment Removal (PA)
- Others
- Panel agnostic as to which approach is superior, but devised four project specific protocols based on project design factors

Stream Restoration Credits

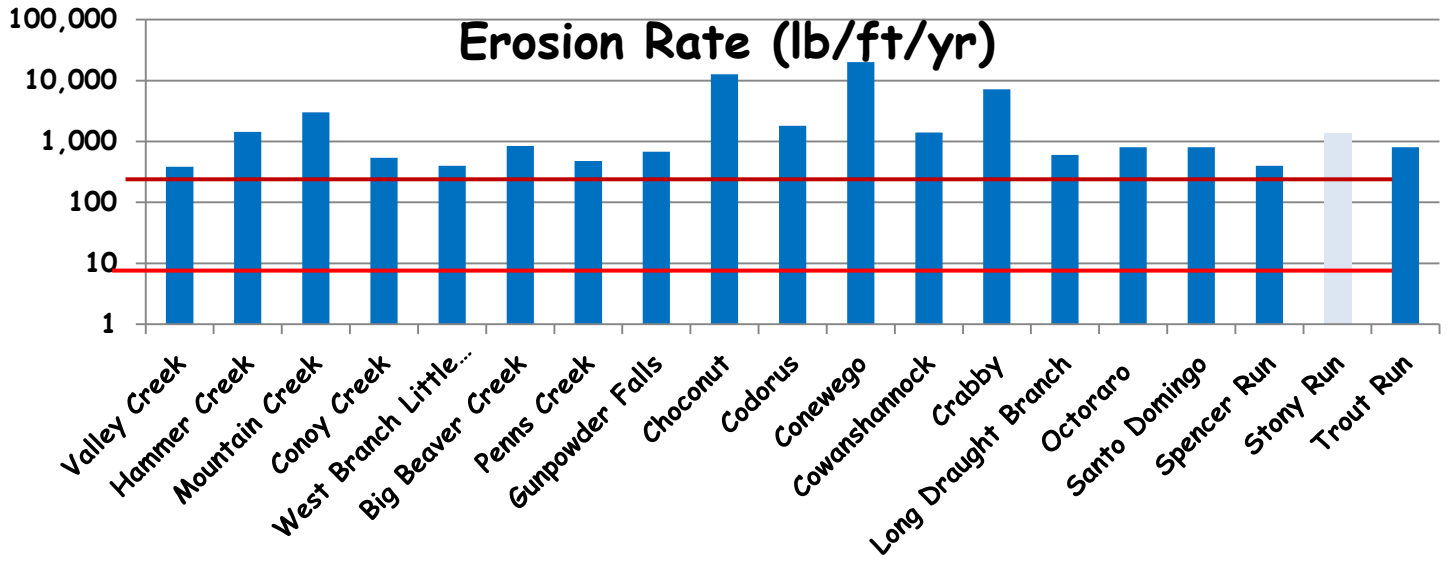
Prevented Bank Erosion

Instream denitrification

Stormflow Reconnection to Floodplain

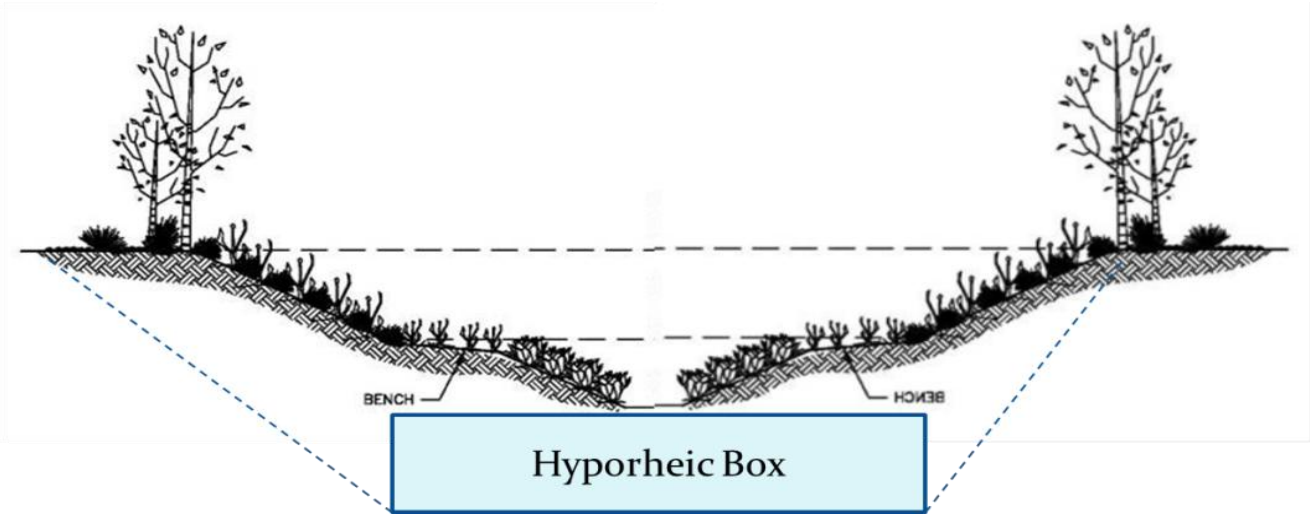
3 Stream Restoration Protocols

- *Protocol 1: Credit for Prevented Sediment During Storm Flow* -- This protocol provides an annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that would otherwise be delivered downstream from an actively enlarging or incising urban stream.



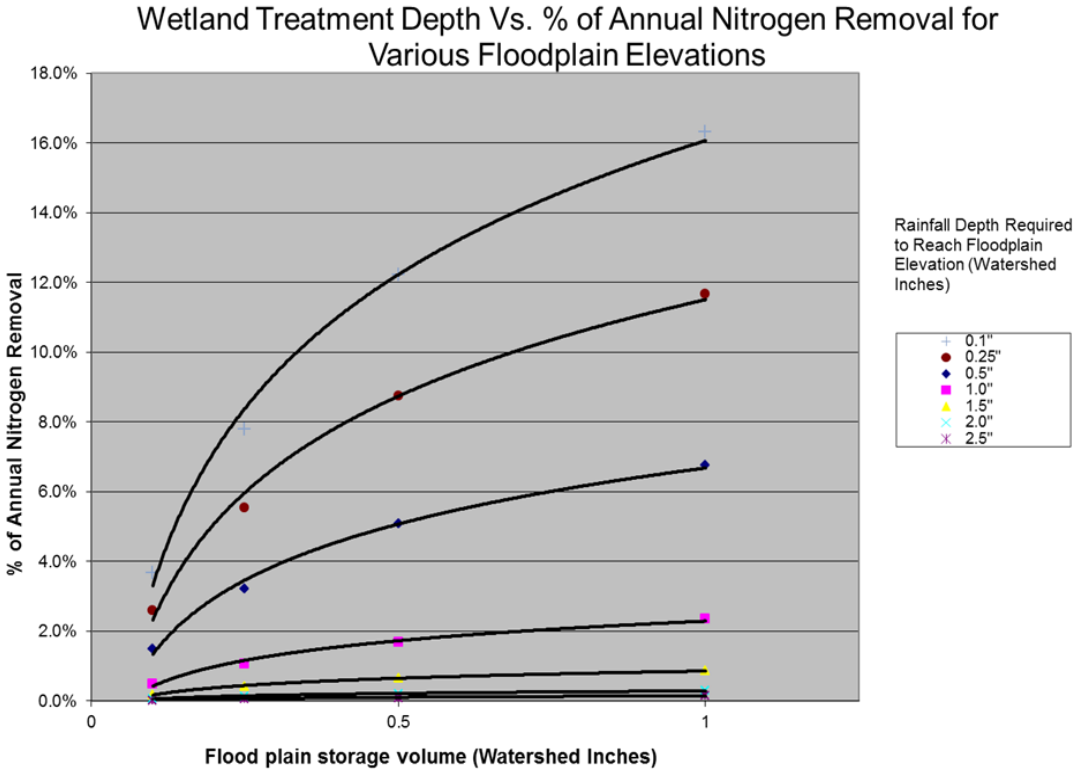
Stream Restoration Protocols

- *Protocol 2: Credit for Denitrification in the Hyporheic Zone During Base Flow* -- This protocol provides an annual mass nitrogen reduction credit for qualifying projects using empirical measurements of denitrification during base flow within a stream's hyporheic zone (stream, riparian and floodplain)



Stream Restoration Protocols

Protocol 3: Credit for Floodplain Reconnection Volumes During Storm Flow- Annual mass nutrient reduction credit for projects that reconnect stream channels to their floodplain over a wide range of storm events



Issues with Applying Urban Protocols to Non-Urban Stream Restoration Projects

- Urban and non-urban streams do differ with respect to their hydrologic stressors, nutrient loadings and geomorphic response.
- Both are subject to the pervasive impact of legacy sediments observed in rural and agricultural watersheds
- The new urban stream protocols should work well in rural situations, depending on project design parameters (e.g., severity of bank erosion, floodplain reconnection volume, etc.)

Panel recommends that the urban protocols can be applied to non-urban stream restoration projects, if they:

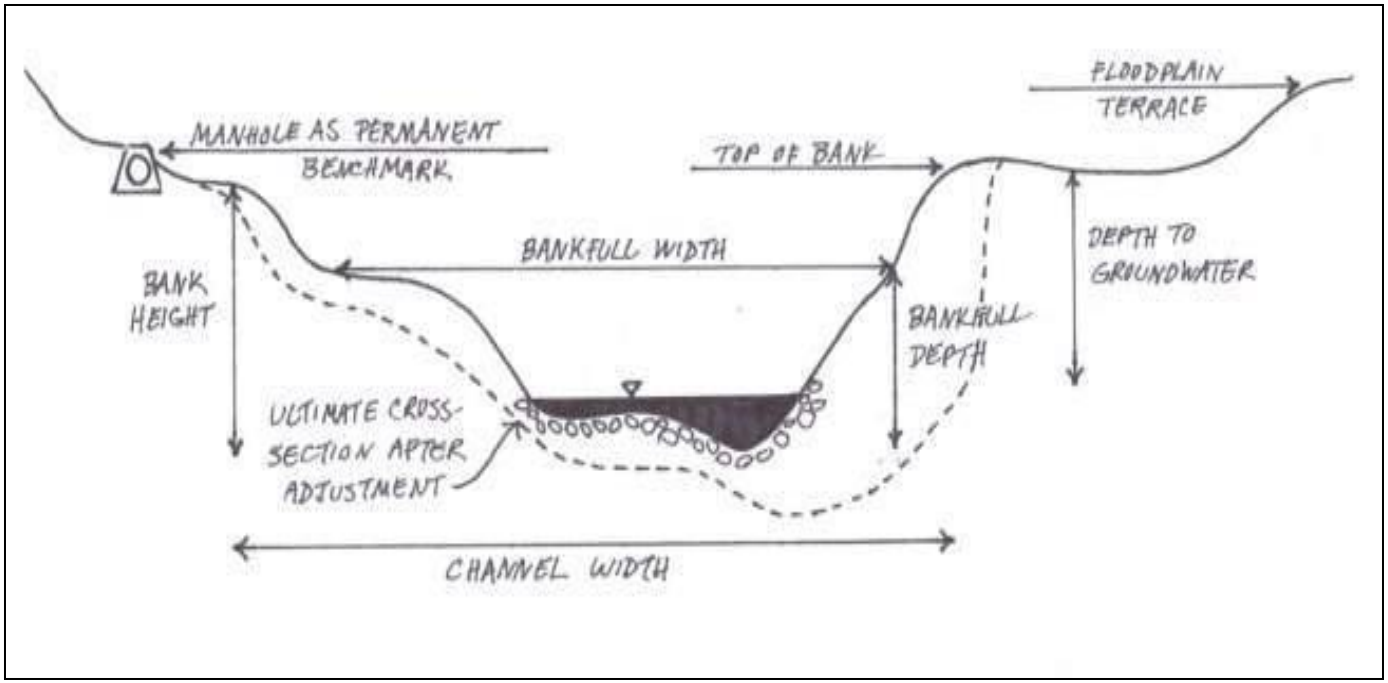
- Are designed using the NCD, LSR or RSC approaches,
- Meet the relevant qualifying conditions, environmental review and verification requirements for urban projects.
- Are adjusted to reflect the actual non-urban load being delivered to the rural project *

*The appropriate unit area loading rate for each non-urban land use can be directly determined directly from local CAST outputs for the geographic area in which the project is located.

Some kinds of non-urban stream restoration projects will not qualify for sediment or nutrient credit including:

- Enhancement projects where the stream is in fair to good condition, but habitat features are added to increase fish production (e.g., trout stream habitat, brook trout restoration, removal of fish barriers, etc.).
- Projects that seek to restore streams damaged by acid mine drainage
- Riparian fencing projects to keep livestock out of streams
- Stream mitigation projects

Q & A


FLOODPLAIN
TERRACE
MANHOLE AS PERMANENT
BENCHMARK
TOP OF BANK
BANKFULL WIDTH
DEPTH TO
GROUNDWATER
BANK
HEIGHT
BANKFULL
DEPTH
ULTIMATE CROSS-
SECTION AFTER
ADJUSTMENT
CHANNEL WIDTH