Clean Water Optimization Tool for Maryland's Eastern Shore

Karen Cappiella
Program Director
Center for Watershed Protection

Upper Eastern Shore WIP Workshop

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- Distill research into practical tools
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Clean Water Optimization Tool for Eastern Shore

Overview

Purpose: To help Eastern Shore municipalities develop more realistic and cost-effective scenarios to meet the Chesapeake Bay TMDL and other local water quality goals

- Excel spreadsheet-based tool
- Quickly and easily develop BMP scenarios based on cost-effectiveness
- Compare scenarios
- Considers practical limitations on BMP implementation
- Tailored to the Eastern Shore
- Focuses on pollutant reductions from the stormwater sector

How Does it Relate to the Maryland Assessment and Scenario Tool?

- Consistent land use pollutant loading rates
- Includes cost adjustments for Eastern Shore counties
- Includes BMPs not yet available in MAST
- Allows user to optimize BMP selection based on cost-effectiveness for a particular pollutant
- Requires assumptions about practicality of installing each BMP type
- Results can be used to inform MAST scenario development for reporting/crediting

Tool Inputs

Required:

- County
- Timeframe (2017 or 2025)
- NPDES regulatory status
- Pollutant on which to optimize (N, P, TSS or N & P)
- Maximum practical number of units treated by each BMP
- For certain BMPs, % impervious cover in the drainage area

Optional:

- User-defined pollutant load reduction requirements
- Priority BMPs to receive higher weight in the optimization process
- Portion of load reductions to be met through trading
- Load reductions from BMPs installed between 2009 and the present

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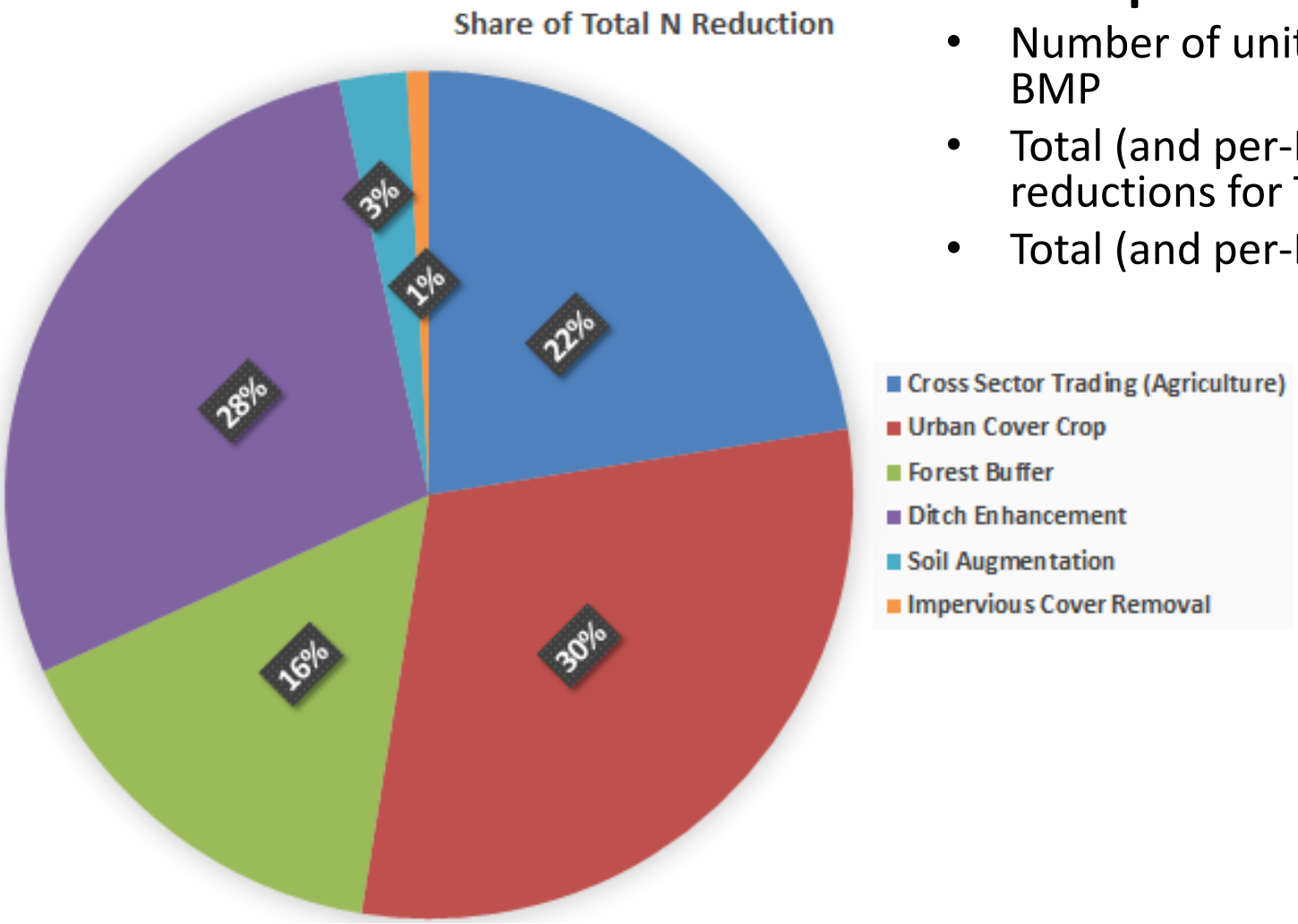
Overview



Tool outputs:

- Number of units treated by each BMP
- Total (and per-BMP) annual load reductions for TN, TP and TSS
- Total (and per-BMP) annual cost

BMPs in the Tool: Stormwater Retrofits**

- Permeable pavement
- Permeable pavers
- Rainwater harvesting
- Stormwater planter
- Green roof
- Downspout disconnection
- Bioretention
- Rain garden
- Green streets
- Vegetated filter strips
- Hydrodynamic structures
- Filtering practices
- Infiltration practices
- Tree pits/structural soils
- Sand filters
- Dry swales
- Wet swales
- Vegetated open channels
- Bioswales
- Regenerative Stormwater Conveyance
- Wet ponds
- Constructed wetlands
- Extended detention ponds
- Ditch enhancement*
- Conversion of dry pond to wet pond

* Not currently credited by CBP

** More on the way

BMPs in the Tool

Land Use Change BMPs:

- Forest buffers
- Urban tree planting
- Impervious cover removal
- Urban cover crops*
- Soil augmentation*

Municipal Programs and Other Practices:

- Pet waste programs*
- Street sweeping
- Outfall netting systems*
- IDDE*
- Living shorelines
- Stream restoration
- User-defined BMP*

* Not currently credited by CBP

Cost Components

- Initial Costs - design, construction, land costs
- Operation and Maintenance – annual routine maintenance, intermittent maintenance, county implementation cost (inspection and enforcement)
- Annualized life cycle costs are estimated as the annual bond payment required to finance the initial cost of the BMP (20-year bond at 3%) plus average annual routine and intermittent maintenance costs.
- Primary data sources: King and Hagan (2011); Schueler et al (2007)

BMP Effectiveness

- Stormwater retrofit BMPs based on Expert Panel recommendations
  - To date, these have not been implemented in MAST
- Land use change BMPs based on differences in land use pollutant loading rates from MAST
  - These are specific to Eastern Shore counties
- Programmatic and other practices based on various sources
  - Expert Panel recommendations on stream restoration, living shorelines, IDDE
  - Research studies and available literature on outfall netting systems, pet waste programs, etc.

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Steps

- Step 1: Scenario Setup
  - Enter County of interest, NPDES status and timeframe of interest (2017 or 2025)
  - *Optional: enter user-defined reduction goal*
  - Enter maximum practical units treated for each applicable BMP
  - *Optional: give more weight to high priority practices*
    - *Account for externalities (i.e. established rain garden program)*

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Steps

Required Pollutant Load Reductions:

Pollutant	Total County Load (lbs/yr)	County Reduction Goal (lbs/yr)	Reduction Goal (lbs/yr) for scale other than county
TN	215,208	61,014	
TP	13,946	6,117	
TSS	5,757,469	#N/A	

2. Best Management Practices:

BMP Key: BMPs that receive Chesapeake Bay Program credit | BMPs that do not currently receive Chesapeake Bay Program credit

Stormwater Retrofits		Units	Maximum Practical Units Treated	Estimated Impervious Cover % in Drainage Area
Pavement/Impervious Cover BMPs				
	Permeable Pavement	Acres		100%
	Permeable Pavers	Acres		100%
Rooftop BMPs				
	Rainwater Harvesting	Acres		100%

Instructions | Scenario Setup | BMP Costs | Optimization Results | Cost Result Chart | Nitrogen Result Chart | Phosphorus Result Chart

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Steps to Use the Tool

- Maximum Practical Units treated example
  - 100 home owners have expressed interest in rainwater harvesting
    - It's likely another 900 would be interested if approached
  - Assuming 1500 square feet of roof per home being treated
  - 1000 participating homes would treat ~34 acres of impervious

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Steps to Use the Tool

- Maximum Practical Units treated example
  - Use GIS to calculate acres of land within 100 feet of stream = 2,834 acres
  - Of this, 1,497 acres is forest and 229 acres is impervious cover
  - Remaining 1,106 can potentially be reforested
  - 25% (276 acres) is on public land
  - Assume that 10% (83 acres) of the privately owned acres can be reforested (willing landowner)

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Steps

- Step 2: BMP Costs
  - Review BMP cost data
  - *Optional: Replace with local values*
  - *Optional: Review and replace other variables used to calculate cost*

Variable	Value
Opportunity cost of developable land ($/acre)	$100,000
Typical proportion of land that is developable (%)	50%
Interest rate associated with bond payment to finance construction (%)	3%
Number of years over which to project costs	20

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Steps

- Step 3: Optimization Results
  - *Optional: Enter reductions from installed BMPs*
  - *Optional: Enter cross sector trading limits*
  - Select BMP on which to optimize (TN, TP, TSS, or TN&TP)

4. Results: Update Table

Practice	TN (lbs reduced)	TP (lbs reduced)	TSS (lbs reduced)	Total Cost ($)	Units Treated
Cross Sector Trading (Agriculture)	1,000.0	0.0	0.0	$5,000	0
Urban Cover Crop	1,334.7	38.9	6,442.8	$50,648	200
Forest Buffer	694.1	48.3	12,437.3	$236,222	200
Ditch Enhancement	1,262.2	102.4	47,873.0	$577,632	250
Soil Augmentation	115.2	8.6	2,584.6	$457,003	200
Impervious Cover Removal	37.0	32.3	27,234.3	$536,158	50
Total:	4,443.2	230.6	96,572.0	$1,862,663	
Percent of Required Reductions Met:	**2.9%**	**3.7%**			
Remaining Reductions Needed to Meet Targets	**147,750.6**	**5,956.7**	**0.0**		

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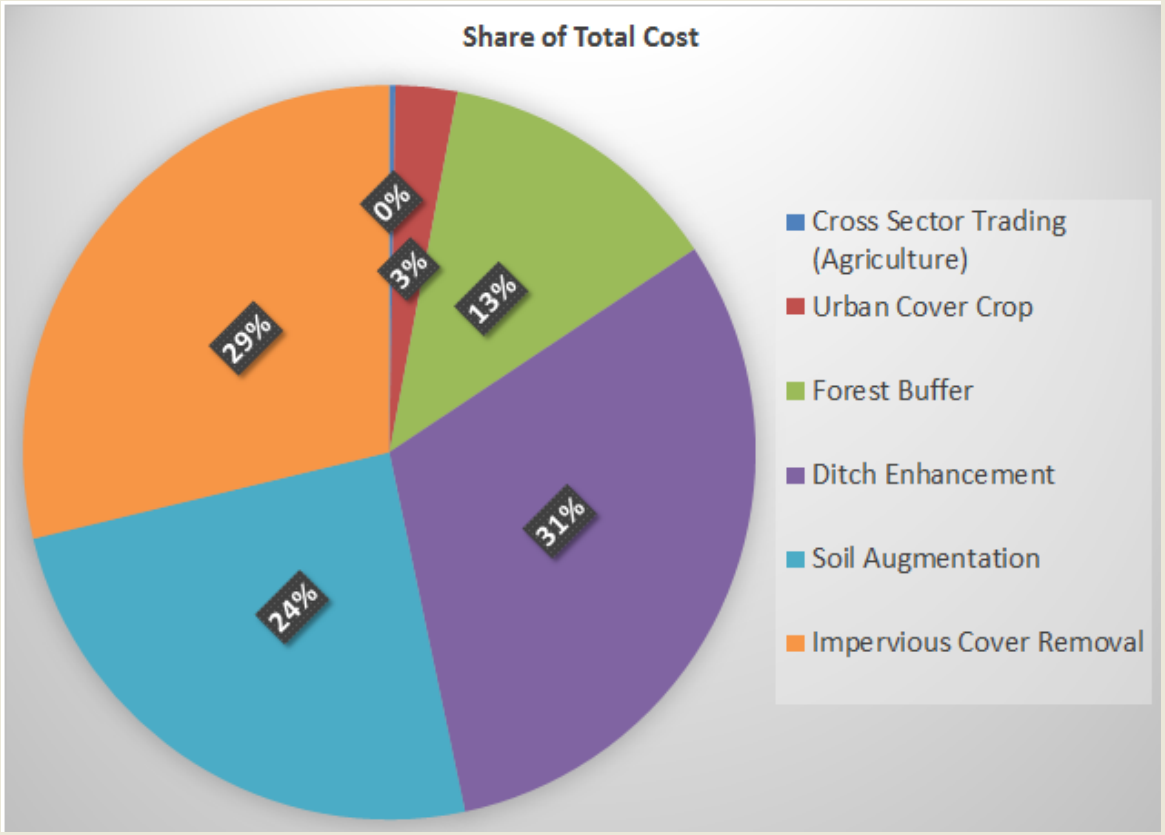
Steps

- Use results to re-evaluate feasibility of more cost-effective BMPs
- Help determine where to focus efforts (and when)
- Communicate & report results



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Next Steps

- Pilot the Tool in Queen Anne's, Talbot, Wicomico and Kent Counties
- Revise and disseminate the Tool to all Counties
- Provide training and a user guide
- Future updates to include new BMPs, a revised interface and expansion to all of Maryland

Questions?

Karen Cappiella

kc@cwp.org

410-461-8323 ext. 3203