

# The Watershed Treatment Model

Chesapeake Bay Science and  
Technical Advisory  
Committee (STAC)  
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Protection  
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# About the Center for Watershed Protection

Non-profit 501(c)3, non-advocacy organization

Work with watershed groups, local, state, and federal governments

Provide tools communities need to protect streams, lakes, and rivers

Over 20 staff in MD, VA, NY

[www.cwp.org](http://www.cwp.org)

[www.awsp.org](http://www.awsp.org)



# Overview

- Description of the Watershed Treatment Model
  - Model Overview
  - Some Details
  - Recent Updates
- Integration of Local Watershed Planning Tools into the Chesapeake Bay Program

# What is the WTM?

- A simple, spreadsheet model for the rapid assessment of watershed treatment options
- Annual output
  - Pollutant loads (lbs/acre)
  - Bacteria Loads (MPN/yr)
  - Runoff Volume (acre-ft/yr)

The screenshot shows a Microsoft Excel spreadsheet titled "WTM\_scenario1WB37". The spreadsheet is divided into several sections:

- Subwatershed Segment:** Includes instructions on how to use the spreadsheet and a warning about data entry.
- PRIMARY SOURCES - Land Use:** A large table with columns for Area (Acres), Impervious Covers (%), Concentrations (mg/l), FC (MPN/100 ml), TN (lb/acre), TP (lb/acre), TSS (lb/acre), and Annual Load (lb/yr). The table lists various land use types such as Industrial, Forest (Deciduous, Evergreen, Mixed), Rural (Shrub, Grassland, Pasture, Cultivated Crops, Woody Wetlands, Emergent Herb. Wetland, Barren Land), Open Water, and Active Construction.
- Partitioning Coefficients for Rural and Forest Land:** A small table with columns for Fraction as Storm Load, FC, and TSS.
- Watershed Data:** A small table with columns for Annual Runoff (inches), Watershed Area (acres), and Storm Load Index.

The spreadsheet also shows a summary of the total annual loads for TN, TP, and TSS, and a search bar at the bottom right.

# WTM Applications

- Stormwater Program Assessment
- Stormwater Retrofit Ranking
- Source Water Assessment
- Determine Progress on Load Reductions\*
- TMDLs
- MS4 Accounting

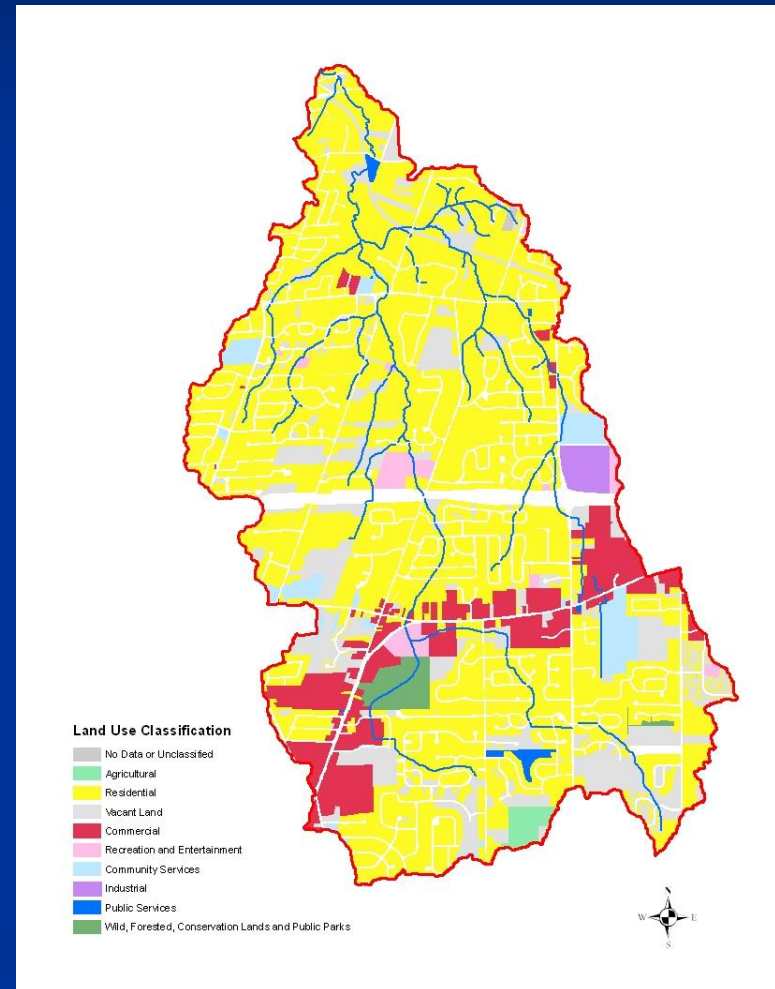
# WTM Terminology

- Primary Sources
- Secondary Sources
- Management Practices
- Discount Factors



# Primary Sources

- Determined entirely from land use/cover
  - Residential
  - Commercial
  - Industrial
  - Forest
  - Rural



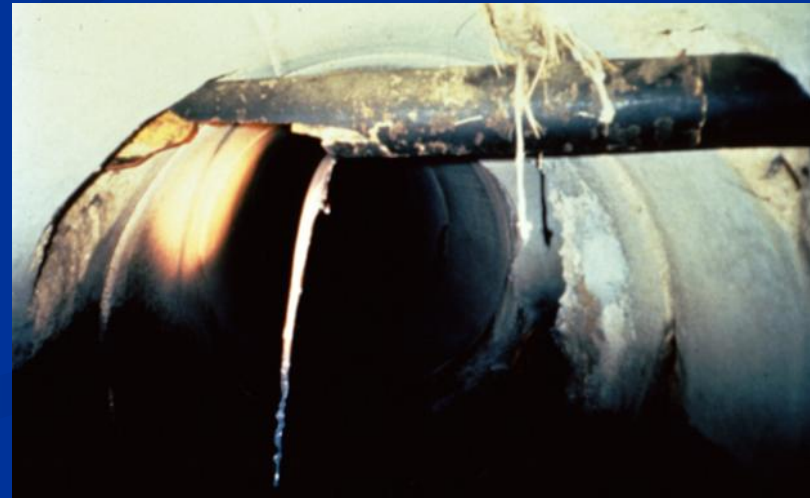
**PRIMARY SOURCES - Land Use**

Watershed		Area (Acres)	Impervious Cover (%)	Turf Cover (%)	TN (mg/			
Category	Detailed Description							
Residential	LDR (<1du/acre)		12%	70%	2			
	MDR (1-4 du/acre)		21%	63%	2			
	HDR (>4 du/acre)		33%	54%	2			
	Multifamily		44%	45%	2			
					0%			
				0%				
				0%				
				0%				
				0%				
				0%				
Commercial	Commercial		72%	22%	2			
				0%				
				0%				
				0%				
Roadway	Roadway		80%	16%	2			
				0%				
				0%				
				0%				
Industrial	Industrial		53%	38%	2	0.26	55	20000
				0%				
				0%				
				0%				
Forest	Forest							
Rural	Rural							
Open Water	Open Water							
Active Construction	Active Construction				1	0.2	680	0
Total		0	#DIV/0!					

- Primary Sources:**
- Residential Land
  - Commercial Land
  - Roadways
  - Industrial Land
  - Forest
  - Active Construction
  - Open Water

# Secondary Sources

- Cannot be calculated solely by land use
- Examples
  - CSOs, SSOs
  - Septic Systems
  - Channel Erosion



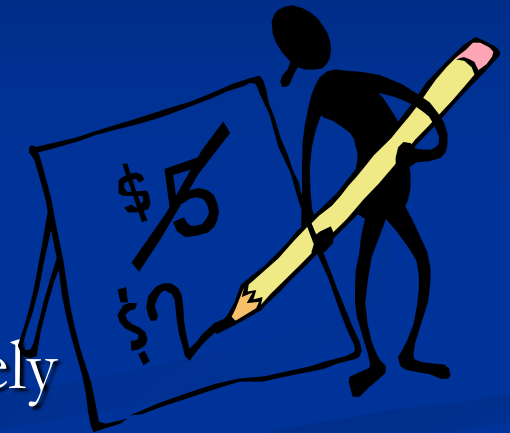
# Types of Management Practices

- Structural:
  - ponds, swale, LID etc.
- Non-Structural:
  - street sweeping, downspout disconnect, buffers
- Programmatic:
  - lawn and pet waste education, etc



# Discount Factors

- Ideal load reductions can rarely be achieved
  - Lack of space
  - Imperfect practice application
  - Inability of programs to be completely effective
- Discount factors "discount" load reductions to account for less than perfect application of practices.



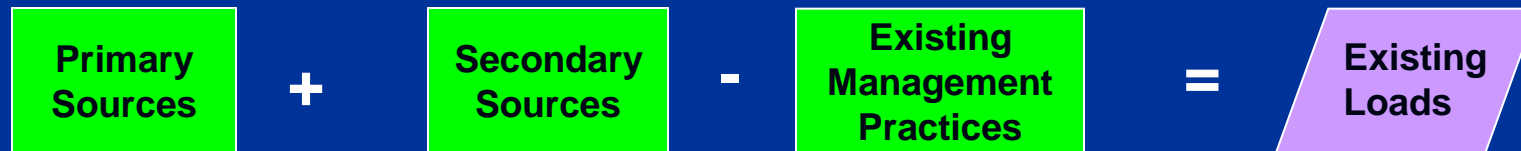
# A Few WTM Details

- Model Structure
- Some Data Entry Tips and Rules
- Ongoing WTM Updates

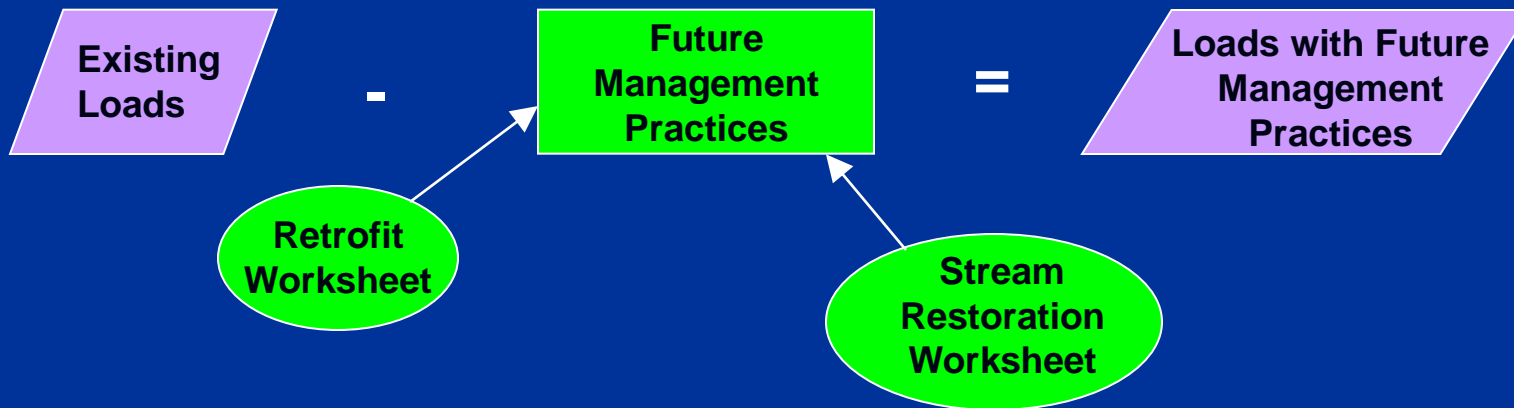


The (Tasmanian) Devil's  
in the Details

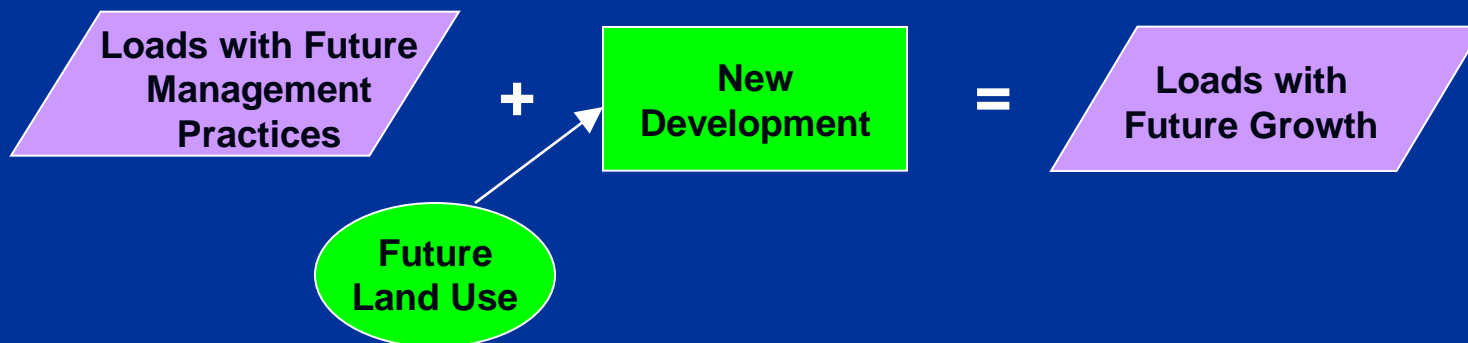
## Step 1. Calculate Existing Pollutant Loads



## Step 2. Apply "Future" Management Practices



## Step 3. Account for Future Growth



# Spreadsheet “Tabs”

## Step 1:

- 1a. Primary Sources
- 1b. Secondary Sources
- 1c. Existing Management Practices
- 1d. Existing Loads]

## Step 2:

- 2a. Future Management Practices
- 2b. Retrofit Worksheet
- 2c. Stream Restoration Worksheet
- 2d. Load with Future Management Practices

## Step 3:

- 3a. Future Land Use
- 3b. New Development
- 3c. Loads With Future Growth

# Data Entry:

## The WTM is Color-Coded.

Green (Cells and Tabs) require user input

Blue Cells are defaults the user can override

Grey Cells should not be modified

Purple (Cells and Tabs) represent Final Outputs

Pet Waste Education	
Program in Place?	yes
Both	
# of dwelling units	Enter Value
Fraction of Households with a Dog	40%
Owners who Walk their Dogs (fraction)	50%
Owners who Clean Up (fraction)	60%
Fraction willing to change behavior	60%
Awareness of Message (Fraction of Population)	Enter Value

Use Local  
Data if  
Available

# Data Entry: Pay Attention to “Pop Up” Guidance

Erosion and Sediment Control	
Program Efficiency	70%
Percentage of Building Permits Regulated	0%
Regulation/ Maintenance Discount	0.0
<b>Street Sweeping</b>	
	<b>Streets</b>
Sweeper Type	<b>Residential</b>
Mechanical	0
Regenerative Air	0

**Accounts for ESC Program**  
 Few inspectors, no pre-construction meeting! 0.3  
 Inspectors visit monthly; pre-construction for larger sites 0.6  
 Inspectors visit weekly, contractor education, pre-construction meeting for most sites 0.9

# Some Recent Updates

- Additions to the model.
- Some sources simplified
- Additional research to update some sources and practices.

# Example Addition: Runoff Reduction

- Incorporate runoff coefficients for various soil-land use combinations.

Soil Type Distribution		Runoff Coefficients				Land-Use Specific
		Impervious	Turf	Forest	Rural	Active Construction
A Soils		0.95	0.15	0.02	0.02	0.5
B Soils	100%	0.95	0.20	0.03	0.03	0.5
C Soils		0.95	0.22	0.04	0.04	0.5
D Soils		0.95	0.25	0.05	0.05	0.5
Weighted Rv		0.95	0.2	0.03	0.03	0.5

- Assign Runoff Reduction to various practices

Structural Stormwater Management Practices			Runoff
BMP Type	Total Area Captured (Acres)	Impervious Cover Captured (Acres)	Reduction (%)
Dry Water Quantity Pond			0%
Dry Extended Detention Pond			0%
Wet Pond			0%
Wetland			0%
Filters			0%
Green Roof			45%
Rooftop Disconnection			25%
Permeable Pavement			45%

# Example Simplification: Channel Erosion

- Problem:
  - Original WTM asked for data that we found was not readily available
  - Alternative was too simplified.
- Solution:
  - Offer alternatives to the user.
  - Allow use of other outside methods

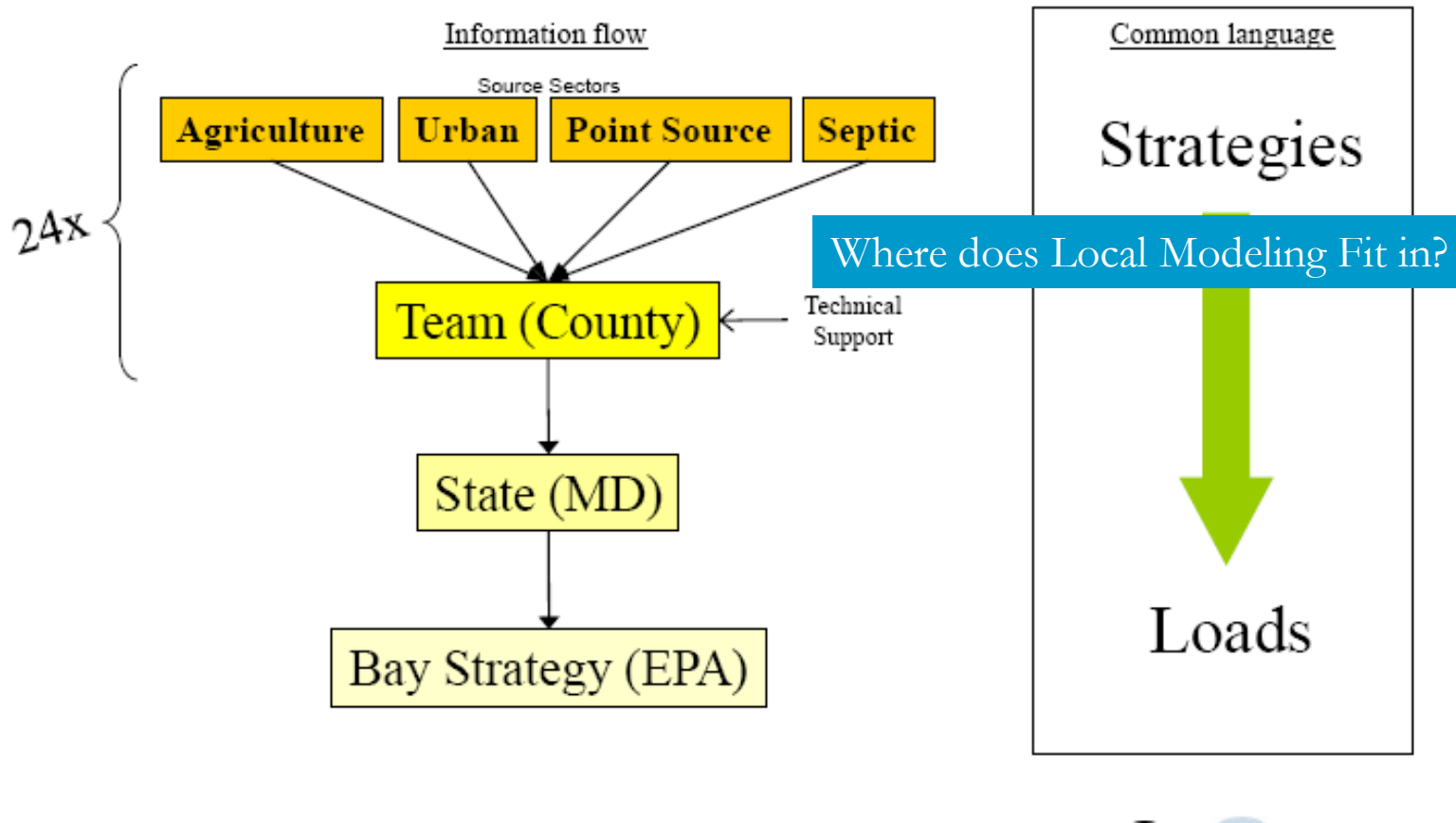


# New Research/Update: Turf Management

- Original Version:
  - Focuses “leachate” only.
  - Relies on a few studies.
  - Asks for some data that is not readily available.
- New Version:
  - Is backed by an extensive literature survey
  - Incorporates field observations from watershed assessments.



# Key Considerations for Integrating Local Watershed Planning



# Bay Program Needs

- List of practices for the Chesapeake Bay Watershed Model (the Bay Model) from local planning efforts.
- Local governments need an estimate of the “credit” given in the Bay Model.
- MAST, other tools help estimate this aggregation of practices.

# Some Concerns About Using “Local” Models (e.g., WTM)

- The numbers may or may not line up with Bay Program assumptions.
- Is the model “Bay Program Sanctioned”
- What if the model includes practices that aren’t in the Bay Model?
- Do the land use types line up with the Bay Model?

# Do the Numbers Line Up?

- Some key concerns
  - Are the assumed efficiencies the same?
  - Are the loading rates the same?
  - Do they need to be?



How much N and P did you say you got?

# WTM: Issues of Consistency

- Efficiencies of most practices are similar to Bay Program data (but account for “filtering” versus “runoff reduction” rather than an aggregate).
- Slightly different mechanism of calculating loading rates from some sources.

# To Ensure Consistency with the CBP Model

- Ensure that basic data (e.g., loading rates and efficiencies) are the same.
- Update WTM (or other local model) as Bay Program assumptions are updated.



# What do other local models offer?

- Other pollutants (beyond TN, TP, TSS)
- Broader range of practices\*
- Assessment of the *degree of implementation* (e.g., “discount factors”)
- Ability to predict benefits of educational, other practices.

# Can Local Efforts Identify New Practices?

- Example: Illicit Discharge Removal
  - Currently not accounted for in the Bay Model.
  - Local modeling efforts identify the *potential* removal.
  - Use monitoring data to actually measure pollutant removal.



# Can Local Models Quantify “Reasonable Assurances”

- Some key assurances:
  - Long term maintenance.
  - Proper practice sizing and implementation.
- Can we use the discount factors concept to quantify this?
- If so, how do we do this in a consistent manner?



# What About Educational/ Programmatic Practices?

- We encourage and require education and public education/ participation.
- How do we account for the actual results of the program?
- Local Models can predict the benefits based on assumed effectiveness.
- What follow-up is needed to ensure that the benefits are actually achieved?



# Summary

- The Watershed Treatment Model (WTM) is a simple, spreadsheet-based model that accounts for a wide range of practices.
- Some details need to be worked out for any local model to be consistent with the Bay Watershed Model.
- Local models can potentially inform the way practices are modeled in the Bay Watershed.

# Questions?

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