

2013 Watershed Treatment Model



CENTER FOR WATERSHED PROTECTION
AUGUST, 2013

WTM - Agenda



1. Overview of the WTM
 - Terminology
 - Model Structure (Versions)
2. WTM Details (Assumptions)

What is the WTM?



- Simple Spreadsheet-Based Model
- Predicts Annual Rates of TN, TP, TSS, Fecal Coliform and Runoff Volume
- Four Major Components
 - Sources
 - Practices (Existing)
 - Practices (Future)
 - New Development

WTM Terminology

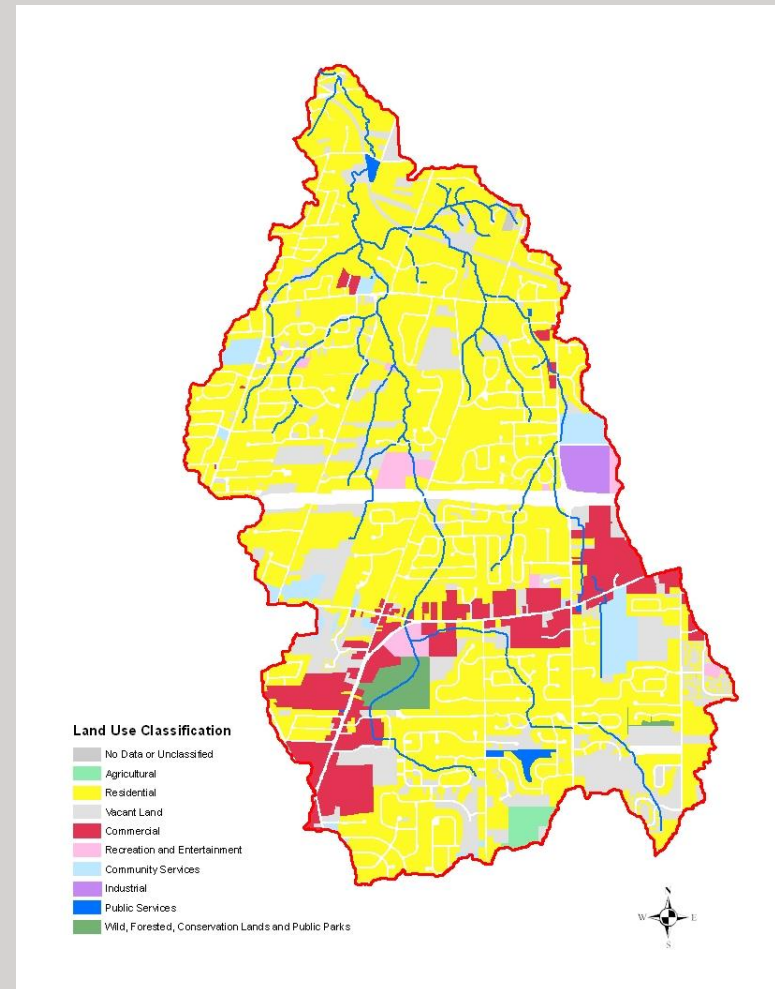


- Primary Sources
- Secondary Sources
- Management Practices
- Discount Factors



Primary Sources

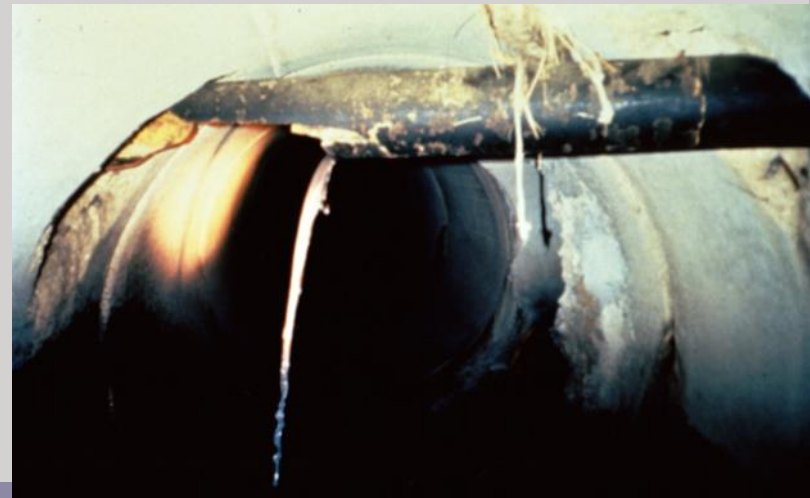
- Determined entirely from land use/cover
 - Residential
 - Commercial
 - Industrial
 - Forest
 - Rural



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.
- **Municipal:**
 - street sweeping, buffers, etc.
- **Educational:**
 - 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.



Example: Erosion and Sediment Control (ESC)

- **Base Conditions**
 - Load from “uncontrolled” construction is 1000 lb TSS/year
 - Practices can achieve 70% effectiveness (base efficiency), or 700 lb/year



ESC Discount Factors

BUT...

- Only 80% of Sites are Regulated...

Down to $0.8 * 700$, or **560 lbs/year**



- A combination of poor installation and maintenance reduces practice implementation/effectiveness by 25%

Down to $0.75 * 560$, or **420 lbs/year**

WTM Model Structure



Step 1. Calculate Pollutant Source Loads



Step 2. Calculate the benefits of Existing Management Practices



Step 3. Calculate the benefits of Future Management Practices



Step 4. Account for Future Growth



WTM 2013 Version – Two Versions



- WTM “Custom”

- Spreadsheet model
- Easily adapted, *but*
- Lots of information presented at one time, so
- Not easy to pick up and use

- WTM “Off the Shelf”

- Spreadsheet model
- Incorporates more features to make it more user friendly, *but*
- While we tried to make it adaptable, you **CANNOT ADD MORE ROWS**
- This might make it difficult to adapt for some applications

WTM Model Structure: Two Versions



- “Custom” Version has:

- 10 Total Worksheets
- 7 Input Worksheets
- 3 Output Worksheets

- “Off the Shelf” has:

- 8 Total Worksheets
- 4 Input Worksheets
- 2 Output Worksheets*
- 1 Model Default Worksheet
- 1 Calculations Worksheet

*1 is a Hidden Sheet

Blue text is for hidden sheets.

WTM “Off the Shelf” Worksheets



- **Input Sheets**

- Sources
- Existing Management Practices
- Future Management Practices
- New Development

- **Output Sheets**

- Results
- Results – Unlocked

- **Other Sheets**

- Defaults
- Calculations

WTM Details: Equations and Assumptions



- Some Example Calculations, for:
 - Urban Runoff
 - On-Site Sewage Treatment Systems (OSDSs)
 - Bioretention
 - Turf Management
 - Turf Education
 - Practices in Series



The (Tasmanian) Devil's
in the Details

Calculating Loads: Simple Method



$$\text{Annual Load} = 0.226 \cdot R \cdot C \cdot A$$

Runoff
Volume

Concentration

Drainage
Area

Simple Method - 2



$$R = P \cdot P_j \cdot R_v$$

Runoff
Volume

Fraction of
Storms
Producing
Runoff

Runoff
Coefficient.
Takes into
account
land cover
and soil
type.

Rainfall

Example Secondary Source: OSDSs



Load to Surface =

$$(L_{\text{OSDS delivery}}) \cdot SF \cdot D \cdot f$$

Load to
OSDSs

Failure Rate

Delivery/Decay
Ratios

OSDS: Failure Rate



- Determined as a Sliding Scale, from 5% to 25%
- Factors included are:
 - Operation and Maintenance
 - Separation Distance from Groundwater
 - Density (systems/acre)
- Alternative: Can override and replace with a known failure rate.

Example Management Practice: Structural BMPs



$$\text{Removal} = L_{\text{ulu}} \cdot T \cdot [E_{\text{RO}} + (1 - E_{\text{RO}}) \cdot E_{\text{P}}] \cdot D_1 \cdot D_2 \cdot D_3$$

Load from
Urban Land

Treatability
(fraction of
land
captured)

Runoff
Reduction
Efficiency

Filtering
Efficiency

Discount
Factors for
Capture
(Sizing),
Design, and
Maintenance

Example Management Practice: Turf Management

- Turf Management is a *Negative Reduction!*
- Key assumptions:
 - Turf has a higher nutrient loading rate than other pervious land.
 - Nutrient loss is equal to the “base” rate, plus a fraction of applied fertilizer.
 - Fertilizer application rate is dependant on several factors
 - Loss rate depends on fertilizer type



Some Factors Used to Estimate Fertilizer Application Rate

- Nitrogen Application Rate Influenced by:
 - Number of new homes
 - % of homes “highly managed”
 - Typical number of applications/year
- Alternative: Can override and enter annual application rate

- Fertilizer Type(s)
 - Organic
 - Soluble (Urea)
 - Slow Release
 - Phosphorus Free
- Each type has unique:
 - Nutrient Composition
 - Loss Rates

Example Practice: Turf Education

- Educate Citizens to do one/or more of the following:

- Reduce application rate
- Stop fertilizing
- Change fertilizer type
- Convert lawn to forest
- Use Soil Amendments

- Discount Factors include:

- Awareness Factor (how many people are aware of the message?)
- Implementation Factor (how many people will actually do this practice?)

- Reduction achieved by changing the turf area, fertilizer application rate, fertilizer type

Practices in Series (the Daisy Chain)



- Cannot indicate that one practice flows to another (like some CWP compliance tools).
- The WTM Assumes that pollution prevention practices (e.g., lawn care) occur in the landscape, and this influences loads to structural practices.



WTM Is on OWL



- Download files at:

http://www.cwp.org/online-watershed-library/cat_view/65-tools/91-watershed-treatment-model

