Watershed Treatment Model for Urban Watersheds

Neely L. Law
Watershed Analyst
Center for Watershed Protection

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Outline

- Background
- Primary Loads
- Secondary Loads
- Current Management Practices
- Future Development
- Future Management Practices
- Limitations/ Challenges

Watershed Treatment Model (WTM)- Need

There is no simple way to track the full range of management options in urban watersheds.

Choice of models

What is the goal of modeling?
What is the parameter of concern/issue?

Simple

Complex

Data requirements
Landscape representation
Model parameterization
Algorithms
Time step (event, daily, snapshot)
Calibration and validation

WTM Applications

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

Application:

- WTM can help answer the following questions:
  - What are key management decisions to meet target loads?
  - What load reduction can I expect from improved erosion and sediment control or stormwater programs?
  - Does the program effectively reduce the loads associated with new development?
  - Are municipal operations such as street sweeping and catch basin cleaning helping to meet my pollutant reduction goals?

Watershed Treatment Model (WTM)

What it is ?

- Simple excel based spreadsheet model
- Full suite of management options
- Examine source partitioning
  - What are the major sources of pollutants?
- Peer into the future
  - Land use change scenarios; and/or
  - Implementation options

What Does the WTM Do?

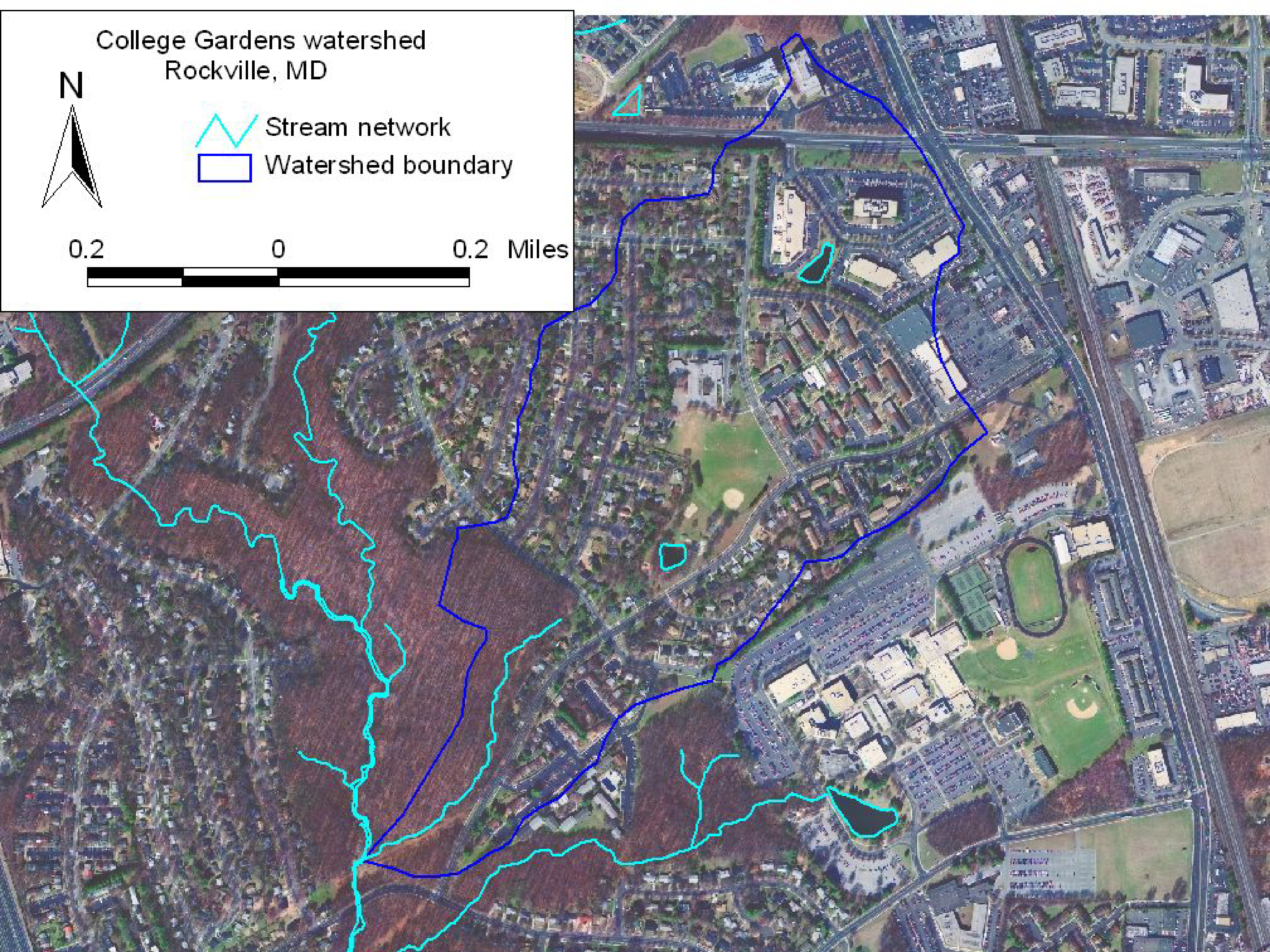
- Evaluates Nitrogen, Phosphorus, Total Suspended Solids, Bacteria
- Best applied on a small urban watershed scale
- Assess various management options:
  - Erosion and Sediment Control
  - Stormwater Treatment
  - Riparian buffers
- Assesses the impact of new development on pollutant loads.

Data Requirements

- Land Use/ Impervious Cover
- Programmatic information (e.g., street sweeping frequency, stormwater practice information, ESC program).
- Some infrastructure information, such as length of sewer.
- Model provides default values, but local watershed monitoring can be included
- Should take approximately 2-3 days from start to finish

Parameters

- Default values
- Field data
  - Survey
    - Upland Subwatershed and Site Reconnaissance (USSR, Manual 11)
    - Questionnaire
    - Unified Stream Assessment (USA, Manual 10)


College Gardens watershed
Rockville, MD
N
Stream network
Watershed boundary
0.2
0
0.2
Miles

College Gardens Low Impact Stormwater Management Techniques (LISW)

- Alternatives to structural controls
- Survey
  - USSR*, soil, stream survey
- WTM
  - existing
    - sources
  - Load reduction comparison

* completed

Nuts and Bolts

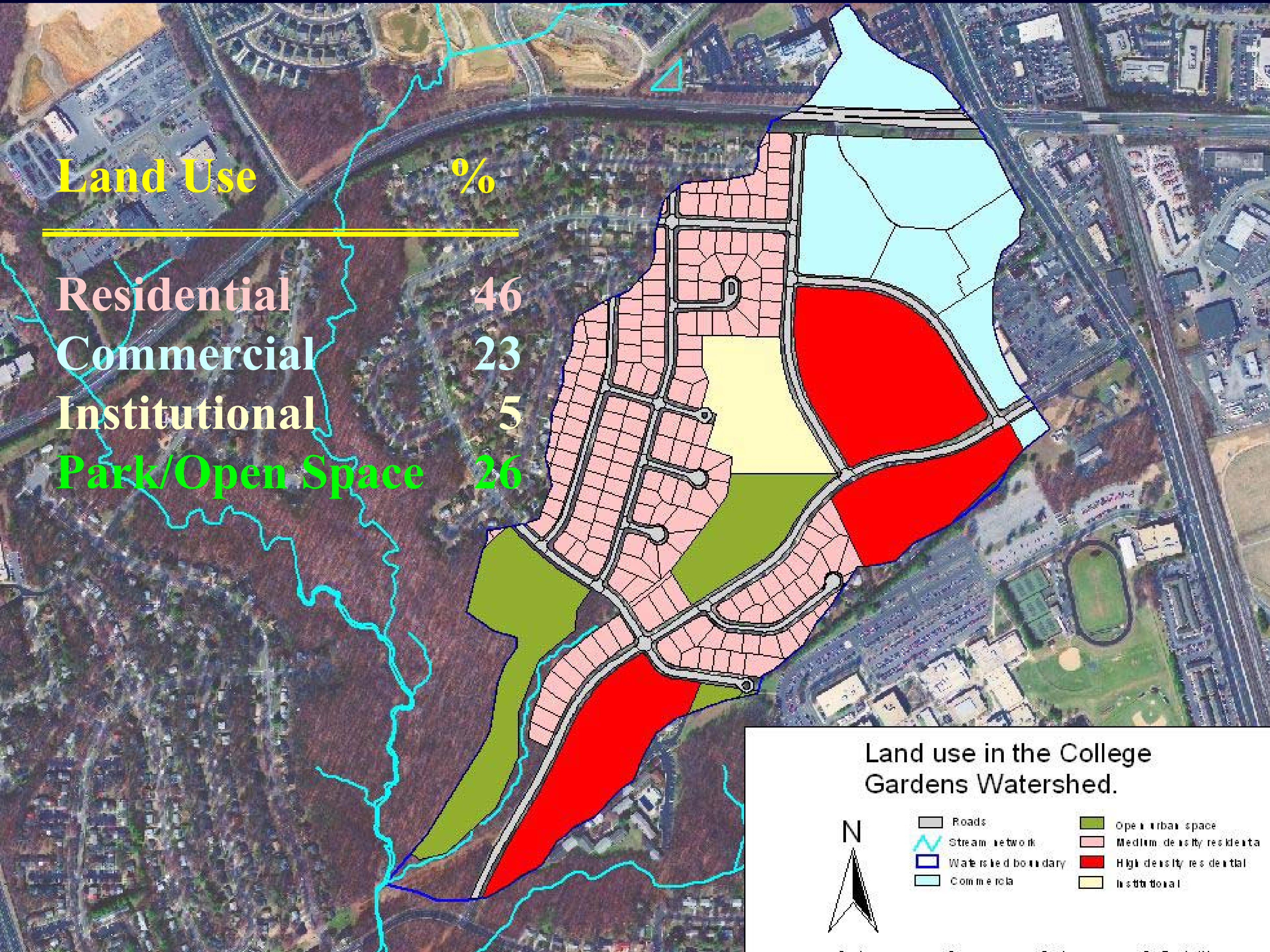
- Primary Loads
- Secondary Loads
- Management Practices
  - Structural, non-structural, behaviors
- Practice effectiveness
  - "discount" factors
- Future practices

Watershed Treatment Model

Primary Loads

- Simple method – Urban areas
  - load = f{rainfall, conc., area}
- Land use/Loading estimates for Ag and Forest

Land Use	%
Residential	46
Commercial	23
Institutional	5
Park/Open Space	26



Primary Loads

Green cells need to be completed by the user	
Blue cells have default or calculated values but may be substituted	
Grey cells should generally not be changed	
Purple Cells Reflect "Bottom Line" Loads or Load Reductions	

PRIMARY SOURCES - Land Use		Area (Acres)	Impervious Cover %	TN mg/l
Residential	LDR (<1du/acre)	0	12	2.2
	MDR (1-4 du/acre)	47.68	25	2.2
	HDR (>4 du/acre)	23.08	44	2.2
Commercial		36.16	72	2.0
Roadway		18.9	80	3.0
Institutional		4	45	2.5
Open urban space		39.91	5	
Rural		0		
Open Water		0.251		
Total		169.981	42.15465409	

Secondary Loads

- Active Construction
- SSOs
- CSOs
- Illicit Connections
- Lawn fertilizer
- Channel Erosion
- Road Sanding
- Point Sources - NPDES Dischargers

Total Annual Loads	
	N Load (lbs/year)
Septic Systems	0
Active Construction	0
SSOs	3
CSOs	0
Illicit Connections	61
Channel Erosion	0
Lawns (Subsurface Flow)	182
Hobby Farms/Livestock	0
Marinas	0.00
Road Sanding	0
NPDES Dischargers	0
Total Secondary Load	246

Management Practices

- Stormwater management
- Street Sweeping
- Erosion and Sediment Control
- Impervious cover disconnection
- Sanitary sewer upgrade
- Illicit discharge disconnection
- Riparian Buffers

Discount Factors

- Ideal load reductions can rarely be achieved
  - Lack of space
  - Imperfect practice application.
  - Inability of programs to be completely effective.

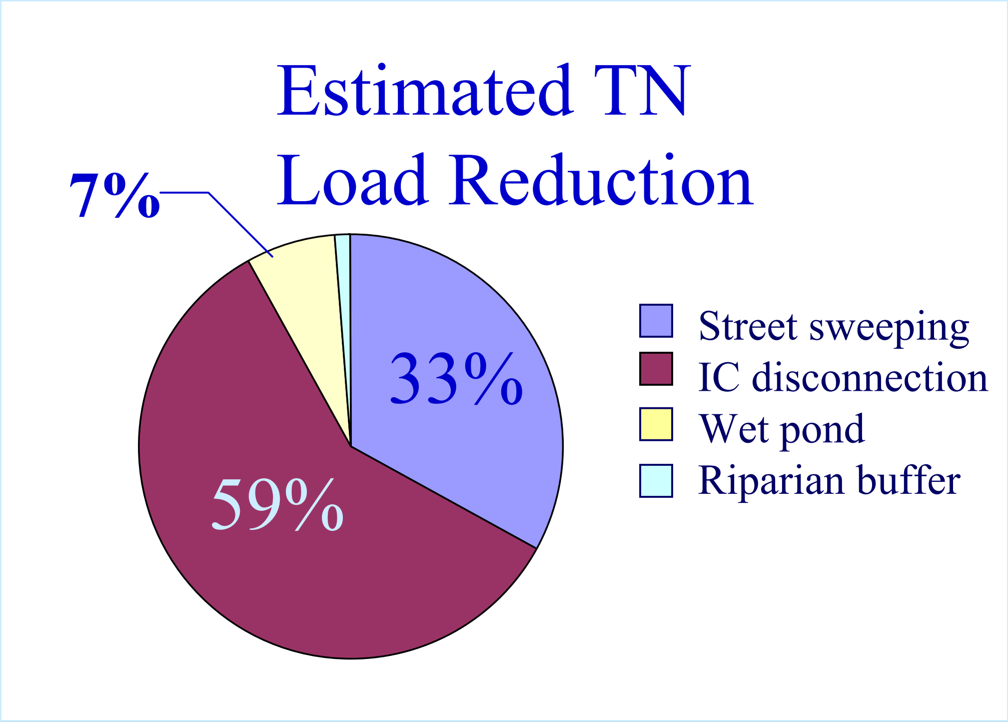
- Discount factors "discount" load reductions to account for less than perfect application of practices.

Example Discount Factors - Stormwater Retrofits

- Treatability
- Capture
- Design
- Maintenance

College Gardens Preliminary Results

- Programmatic
- Existing Load Reduction



Future Management Practices

- Stormwater management
- Erosion and Sediment Control
- Stormwater retrofits
- Sanitary sewer upgrade
- Illicit discharge disconnection
- Riparian buffers
- Stream restoration/stabilization

- Lawn care
- Pet waste management
- Street sweeping
- Impervious area disconnection

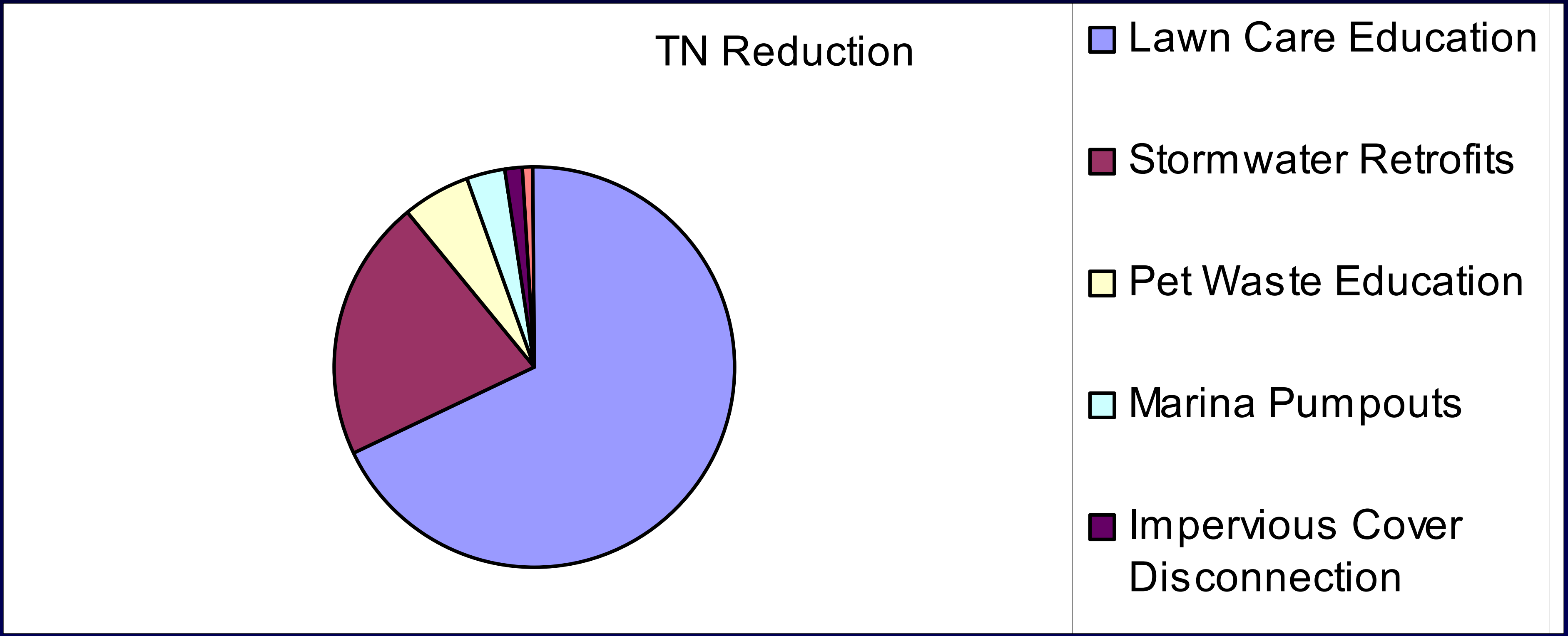
Limitations of the Model

- Few pollutants are currently incorporated
- The model is not predictive, and is intended as a planning tool
- Use of local data
  - Replace model default values
  - assess many Secondary Sources
- Judgment needs to be applied when assessing discount factors

Lessons Learned

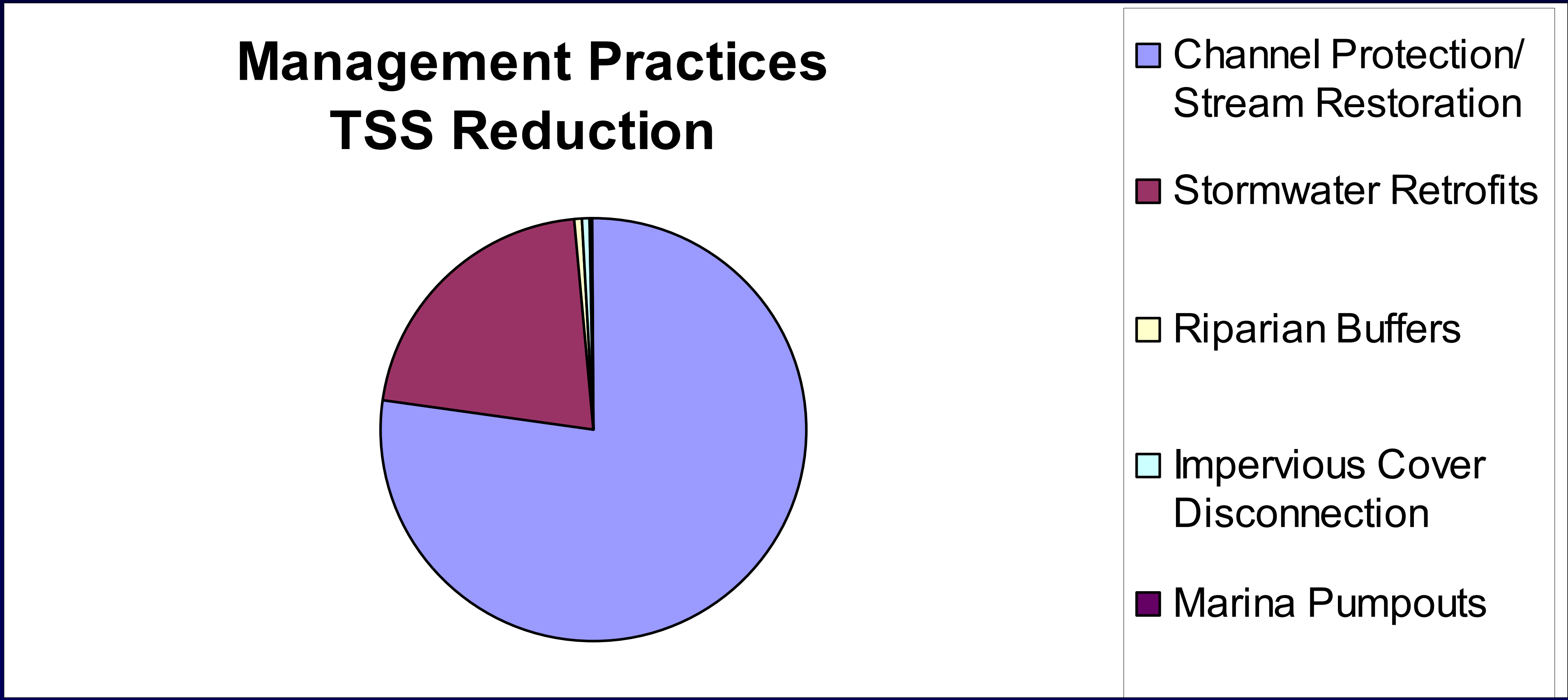
- Bush River
  - Harford County, MD
  - 120 sq. miles
  - Rapidly developing
  - Residential
- Model Results
  - Significance of lawns
  - Absence of riparian buffers
- Weems Creek
  - Annapolis, MD
  - 2 sq. miles
  - Mixed urban, ~29% impervious cover, ~50% land area turf
- Model Results
  - Stream restoration
  - Channel protection
    - Flow control

Projected TN Load Reduction Weems Creek



- Overall nitrogen loads could be reduced close to 15%

Projected TSS Load Reduction Weems Creek

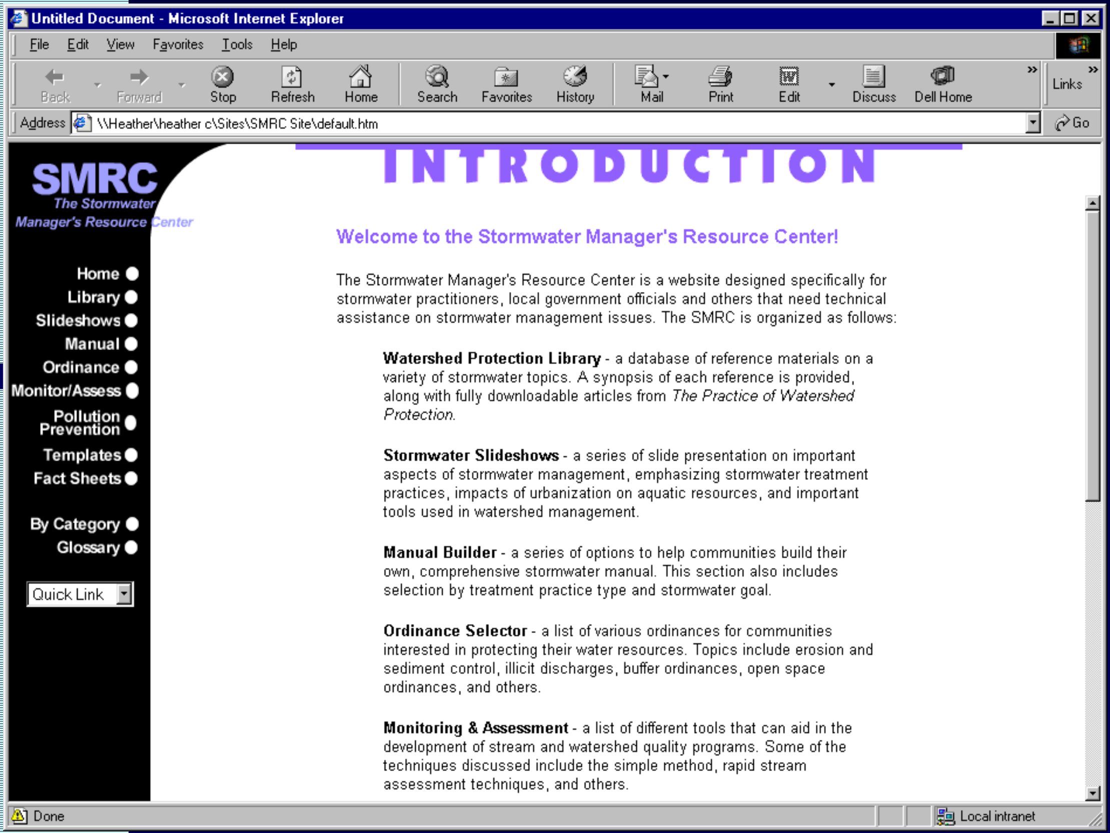


- TSS loads could be reduced by 1/3

Lessons Learned

- Stormwater retrofits provided some additional benefit
- Source partitioning
  - Load reduction from non-structural options
- Multi-faceted approach

www.stormwatercenter.net



Manual Builder

Model Ordinances

Slide Shows

Models & Protocols

Fact Sheets

Library Database

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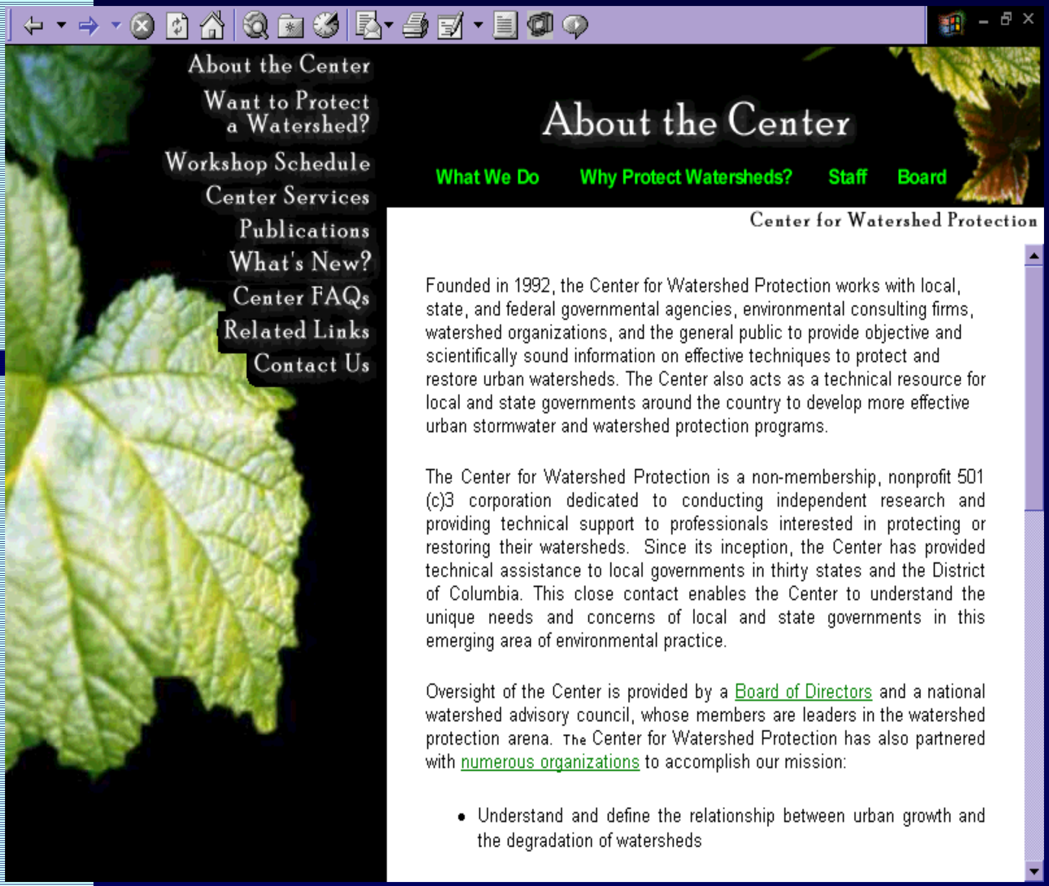

Techniques Articles

Links to Model Ordinances & Training

Current Publications List

Watershed Links