

Fox Wolf Watershed Alliance
19th Annual Conference
March, 2018

WinSLAMM v 10.3 Update

Using WinSLAMM v10.3.4 to Meet Urban Stormwater Management Goals

John Voorhees

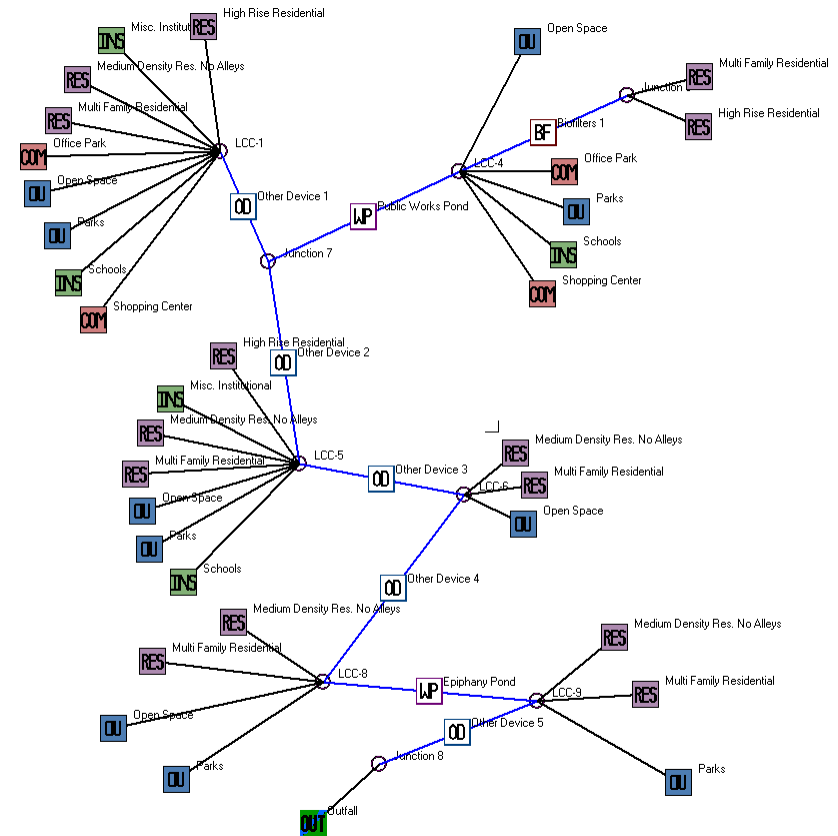
AECOM

Middleton, WI



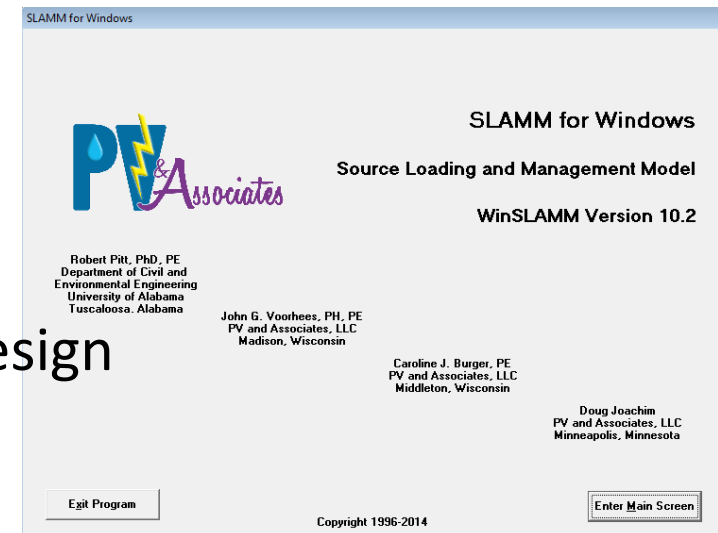
We will cover . . .

1. WinSLAMM Purpose and History
2. High Traffic Urban Highways
3. Particle Size Distribution Files
4. Importing Images
5. Other Device
6. Filtering and Settling Devices
7. Pipes
8. Command Line Model Runs
9. Modeling Considerations
10. Planned Modifications



WinSLAMM – What is it?

- Source Loading And Management Model for Windows
- Calculates Urban Stormwater Volumes and Pollutant Loads, and Quantifies their Reductions through the application of Stormwater Control Practices
- Applicable to:
 - Specific Control Practice Design
 - Site Development Analysis
 - Drainage Basin/MS4 Planning and Design
 - TMDL Reduction Determination

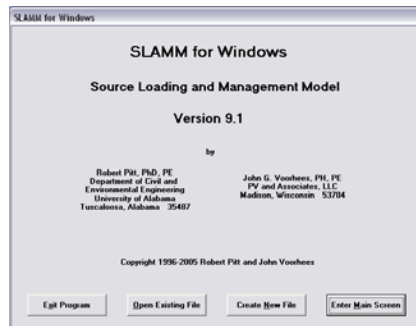


WinSLAMM Can Answer These Types of Policy Questions . . .

- What are the base level pollutant loadings for different land uses with no controls?
- What flow and pollutant levels result from different development scenarios?
- What are the critical sources of flows and pollutants?
- How effective and cost effective are treatment practices in controlling pollutants and reducing flows?
- What combinations of stormwater controls will best meet regulatory requirements?

Background & History

- Development Began in mid-1970's, with EPA Street Cleaning Projects in Southern California, by Dr. Robert Pitt
- Mid-1980's - Model used in Agency Programs (Interpreter Basic):
 - Toronto Area Watershed Management Strategy
 - Wis. Dept. of Natural Resources: Priority Watershed Program
- First Compiled Basic version released in late 80's
- First Windows Version Developed in 1995
- Version 10 released in 2012
- Continuously being updated based on user needs and new research
- PV & Associates
 - Bob Pitt
 - John Voorhees
 - Caroline Burger
 - Doug Joachim
 - and others



New Source Area in Freeway LU

High Traffic Urban Highways

- Accounts for high volume traffic corridors in Urban Areas
- Allows street cleaning for these corridors
- Data developed from USGS/DNR studies of highways
- Assumptions
 - ADT > 6,000 vpd
 - Speed Limit \geq 30 mph
 - No Parking
 - Curb and Gutter in Good Condition
 - Used with Vacuum-Assisted Street Cleaning Machines
- Preferred Source Area for Freeway Analysis

3. Source Area Particle Size Distributions

Particle Size Distribution by Source Area

Source Area Particle Size Distribution and Peak-To-Average Rainfall Ratio Standard Files

Select Source Area File (.csv) to Edit: C:\WinSLAMM Files\NURP Source Area PSD Files.csv

Browse to Particle Size Distribution (.cpz) File Path: C:\WinSLAMM Files\

Source Area Particle Size Distributions Peak to Average Flow Ratio - Light Rains Peak to Average Flow Ratio - Moderate Rains Peak to Average Flow Ratio - Heavy Rains

	Residential Land Use	Institutional Land Use	Commercial Land Use	Industrial Land Use	Other Urban Land Use	Freeway Land Use
Roofs	NURP	NURP	NURP	NURP	NURP	NURP
Paved Parking	NURP	NURP	NURP	NURP	NURP	NURP
Unpaved Parking	NURP	NURP	NURP	NURP	NURP	NURP
Driveways	NURP	NURP	NURP	NURP	NURP	NURP
Sidewalks	NURP	NURP	NURP	NURP	NURP	NURP
Streets	NURP	NURP	NURP	NURP	NURP	NURP
Sandy Pervious Areas	NURP	NURP	NURP	NURP	NURP	NURP
Silty Pervious Areas	NURP	NURP	NURP	NURP	NURP	NURP
Clayey Pervious Areas	NURP	NURP	NURP	NURP	NURP	NURP
Paved Playgrounds	NURP	NURP	NURP	NURP	NURP	NURP
Other Pervious Areas	NURP	NURP	NURP	NURP	NURP	NURP
Other Direct Con Imp	NURP	NURP	NURP	NURP	NURP	NURP
Other Part Con Imp Areas	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 1	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 2	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 3	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 4	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 5	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 6	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 7	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 8	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 9	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 10	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 11	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 12	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 13	NURP	NURP	NURP	NURP	NURP	NURP
Other Imp Area 14	NURP	NURP	NURP	NURP	NURP	NURP

Cancel Apply Default Values to All Source Areas Save .csv File and Exit

3. Source Area Particle Size Distributions

Particle Size Distribution by Source Area

Source Area Particle Size Distribution and Peak-To-Average Rainfall Ratio Standard Files

Select Source Area File (.csv) to Edit: C:\WinSLAMM Files\PSD source area SSC.csv

Browse to Particle Size Distribution (.cpz) File Path: C:\WinSLAMM Files\psd files\

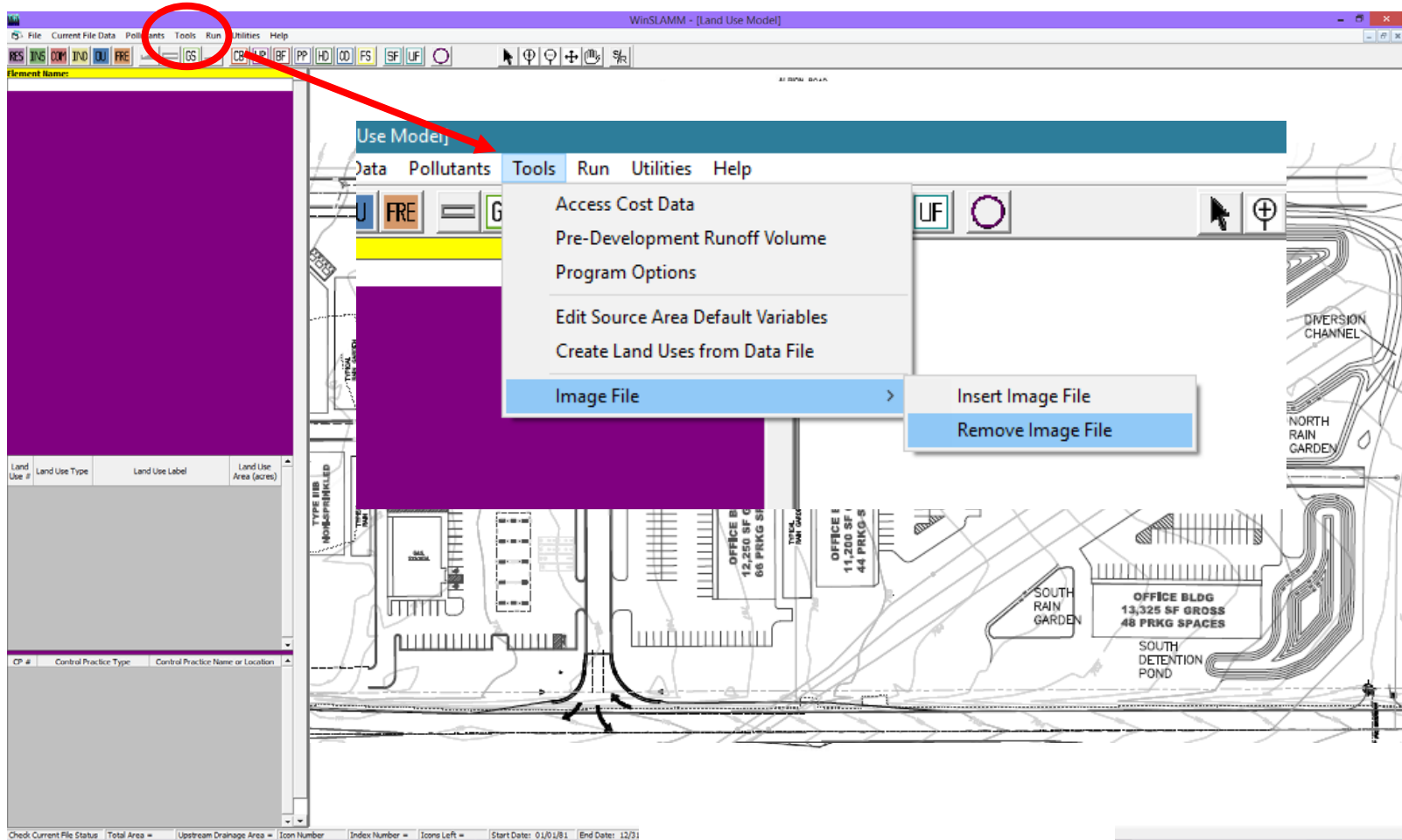
Source Area Particle Size Distributions Peak to Average Flow Ratio - Light Rains Peak to Average Flow Ratio - Moderate Rains Peak to Average Flow Ratio - Heavy Rains

	Residential Land Use	Institutional Land Use	Commercial Land Use	Industrial Land Use	Other Urban Land Use	Freeway Land Use
Roofs	SSC roof average	SSC roof average	SSC roof average	SSC roof average	SSC roof average	SSC roof average
Paved Parking	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Unpaved Parking	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average
Driveways	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average
Sidewalks	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Streets	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Sandy Pervious Areas	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average
Silty Pervious Areas	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average
Clayey Pervious Areas	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average
Paved Playgrounds	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Pervious Areas	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average	SSC landscaped average
Other Direct Con Imp	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Part Con Imp Areas	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 1	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 2	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 3	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 4	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 5	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 6	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 7	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 8	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 9	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 10	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 11	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 12	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 13	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average
Other Imp Area 14	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average	SSC pavement average

Cancel Apply Default Values to All Source Areas Save .csv File and Exit

4. Drainage System Map Images

To Add Drainage System Map Images



In 'Tools/Image File'

4. Drainage System Map Images

Add Images to the Drainage System Map

The screenshot displays the WinSLAMM software interface, titled "WinSLAMM - [Land Use Model]". The interface is divided into several sections:

- Top Menu and Toolbar:** Includes "File", "Current File Data", "Pollutants", "Tools", "Run", "Utilities", and "Help". The toolbar contains icons for various tools like "RES", "INS", "COM", "IND", "OU", "FRE", "GS", "CB", "WP", "BF", "PP", "HD", "OD", "FS", "SF", "UF", and a selection tool.
- Land Use Section:**
 - Strip Commercial Table:**

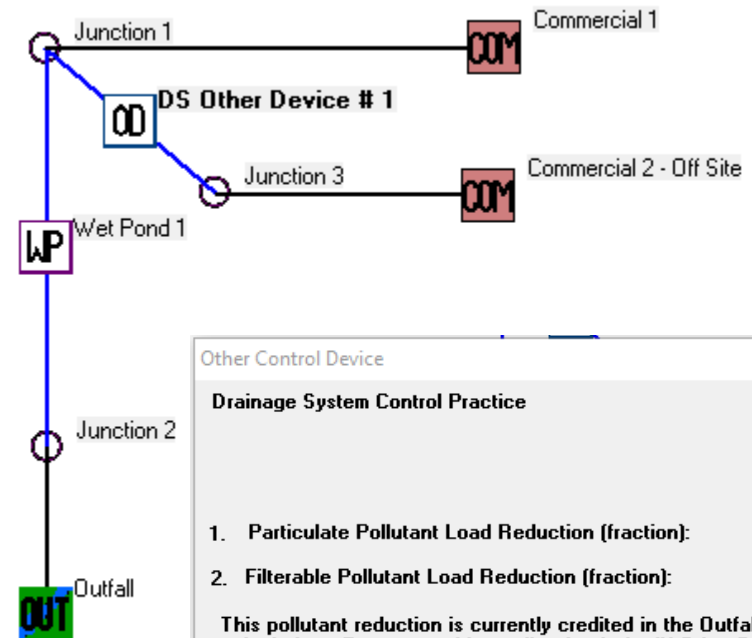
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
Roofs					
1	Roofs 1	0.586			
2	Roofs 2	0.493	Entered	--	--
3	Roofs 3	0.093	Entered	--	--
4	Roofs 4				
5	Roofs 5				
6	Roofs 6				
7	Roofs 7				
8	Roofs 8				
9	Roofs 9				
10	Roofs 10				
11	Roofs 11				
12	Roofs 12				
Parking					
13	Paved Parking 1	1.058			
14	Paved Parking 2	1.023	Entered	--	--
15	Paved Parking 3				
16	Paved Parking 4				
17	Paved Parking 5				
18	Paved Parking 6				
 - Land Use Table:**

Land Use #	Land Use Type	Land Use Label	Land Use Area (acres)
1	Commercial	Strip Commercial	12.000
2	Commercial	Strip Commercial	6.000
3	Commercial	Strip Commercial	2.503
 - Control Practices Table:**

CP #	Control Practice Type	Control Practice Name or Location
1	Biofilter	DS Biofilters # 1
2	Wet Detention Pond	DS Wet Pond # 1
3	Wet Detention Pond	DS Wet Pond # 2
4	Grass Swales	DS Grass Swales # 1
5	Biofilter	DS Biofilters # 2
- Main Map:** A detailed site plan showing buildings, parking lots, and drainage infrastructure. Buildings are labeled with details like "OFFICE BLDG 15,000 SF GROSS 74 PRKG SPACES". Drainage features include "Junction 1" through "Junction 6", "DS Wet Pond # 1", "DS Wet Pond # 2", "DS Biofilters # 1", "DS Biofilters # 2", "RAIN GARDEN", and "DS Grass Swales # 1". The map is overlaid with a network of lines representing the drainage system.
- Bottom Status Bar:** Displays "Check Current File Status", "Total Area = 20.500 acres", "No Upstream Source Areas", "LU# = 3", "Index Number = 3", "Remaining Icons = 251", "Start Date: 01/01/81", "End Date: 12/31/81", "X = 13920", "Y = 8130", and "Run Time =".

Using the 'Other Device' for Off-site Drainage

The Problem: Excluding the pollutant load from an analysis that includes off-site drainage can inflate the water quality performance of a drainage system because the No Control off-site pollutant load is included in the Percent Particulate Solids Reduction and other Pollutant calculations.



Other Control Device

Drainage System Control Practice

1. Particulate Pollutant Load Reduction (fraction):

2. Filterable Pollutant Load Reduction (fraction):

This pollutant reduction is currently credited in the Outfall Summary calculation. To remove this credit, check the 'If Other Device pollutant load reduction value is set to 1, remove off-site pollutant loads from pollutant load percent reduction calculation' checkbox in the Default Model Options tab of the Tool/Programs Options menu and set both pollutant load reduction values equal to 1.

3. Water Volume (flow) Reduction (fraction):

4. Drainage Area Fraction served by Other Control (0-1):

Press 'F1' for Additional Help

Control Practice #: 2 CP Index #: 2

Off-Site Drainage Setup

Other Control Device

Drainage System Control Practice

1. Particulate Pollutant Load Reduction (fraction):
2. Filterable Pollutant Load Reduction (fraction):

To credit this pollutant load reduction towards the overall drainage system reduction in the Outfall Summary calculation, uncheck the 'If Other Device pollutant load reduction values are set to 1, remove off-site pollutant loads from pollutant load percent reduction calculations' checkbox in the Default Model Options tab of the Tool/Programs Options menu.

3. Water Volume (flow) Reduction (fraction):
4. Drainage Area Fraction served by Other Control (0-1):

Press 'F1' for Additional Help

Control Practice #: 2 CP Index #: 2

Program Options

Detailed Output File Options **Default Model Options** Default Current File Data

- Turn 'Save File Upon Exit' Message Off
- Suppress the Wet Detention Pond Overflow Warning Message
- Save Backup File
- Save Outfall Runoff and Particulate Loading for WinDETPOUND Analysis
- If Other control device concentration reduction value is set to 1, remove off-site pollutant loads from pollutant load percent reduction calculations.

Default Peak Flow to Average Flow Ratio:

Standard Land Use File:

- Route Hydrographs and Particle Sizes Between Control Practices
 - Create Hydrograph and Particle Size Distribution .csv Files
- Use Default Time Increment for all Hydrograph Analyses (required for hydrograph routing between control practices)
 - Default Time Increment (min):

Default Monthly Stormwater Temperature (degrees F)

January	40
February	45
March	50
April	55
May	60
June	65
July	65
August	60
September	50
October	40
November	35
December	35

Soil Compaction Infiltration Factors

	Sandy	Silty	Clayey
Moderately Compacted	0.50	0.20	0.10
Severely Compacted	0.20	0.10	0.00

Output Comparison

Without 'Other Device' Adjustment

Outfall Output Summary							
	Runoff Volume (cu. ft.)	Percent Runoff Reduction	Runoff Coefficient (Rv)	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction	
Total of All Land Uses without Controls	435503		0.43	120.4	3274		
Outfall Total with Controls	436625	-0.26 %	0.43	29.72	810.1	75.26 %	
Current File Output: Annualized Total After Outfall Controls							
	437824		Years in Model Run: 1.00		812.3		

Pollutant	Concentration - No Controls	Concentration - With Controls	Concentration Units	Pollutant Yield - No Controls	Pollutant Yield - With Controls	Pollutant Yield Units	Percent Yield Reduction
Particulate Solids	120.4	29.72	mg/L	3274	810.1	lbs	75.26 %
Particulate Phosphorus	0.2491	0.06529	mg/L	6.774	1.780	lbs	73.73 %
Filterable Phosphorus	0.07756	0.06673	mg/L	2.109	1.819	lbs	13.74 %

With 'Other Device' Adjustment

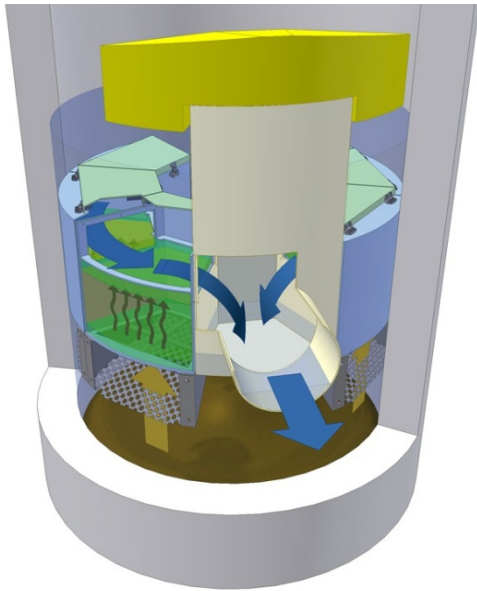
Outfall Output Summary							
	Runoff Volume (cu. ft.)	Percent Runoff Reduction	Runoff Coefficient (Rv)	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction	
Total of All Land Uses without Controls	435503		0.43	91.66 (1)	2492 (1)		
Outfall Total with Controls	436625	-0.26 %	0.43	29.72	810.1	67.49 %	
Current File Output: Annualized Total After Outfall Controls							
	437824		Years in Model Run: 1.00		812.3		

(1) Values reduced to remove off-site loadings due to setting Other Control Device Concentration Reduction values to 1.

Pollutant (1)	Concentration - No Controls	Concentration - With Controls	Concentration Units	Pollutant Yield - No Controls	Pollutant Yield - With Controls	Pollutant Yield Units	Percent Yield Reduction
Particulate Phosphorus	0.2491	0.06529	mg/L	5.373	1.780	lbs	66.88 %
Filterable Phosphorus	0.07756	0.06673	mg/L	1.816	1.819	lbs	-0.17 %
Total Phosphorus	0.3267	0.1320	mg/L	7.189	3.599	lbs	49.94 %

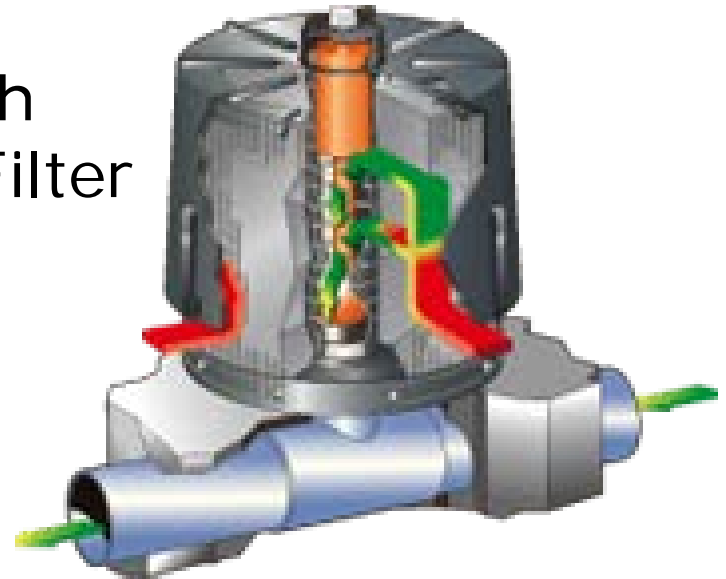
Proprietary Filtering Devices

- WinSLAMM v 10.2.1 will include two proprietary stormwater treatment filtering devices
 - StormFilter from Contech
 - Upflo Filter from Hydro International



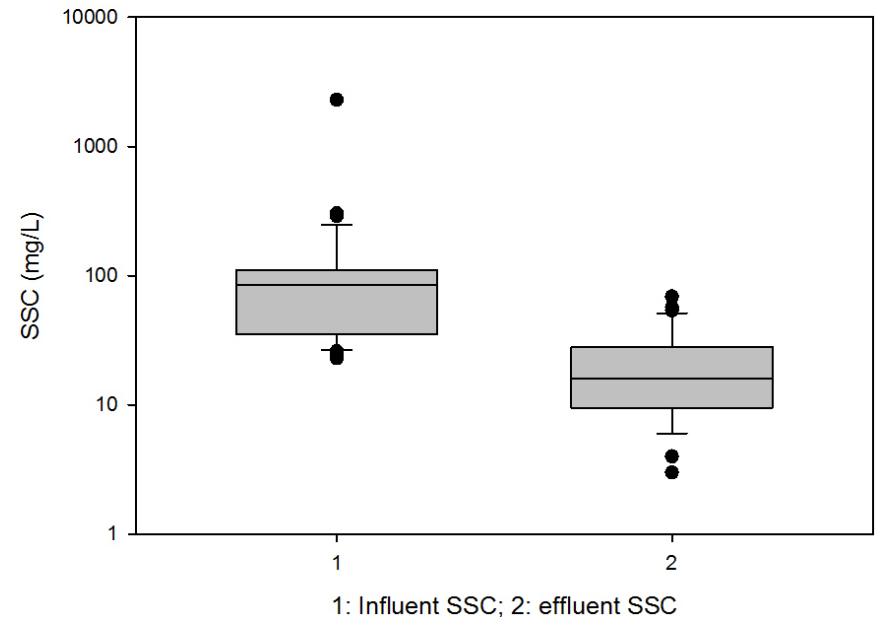
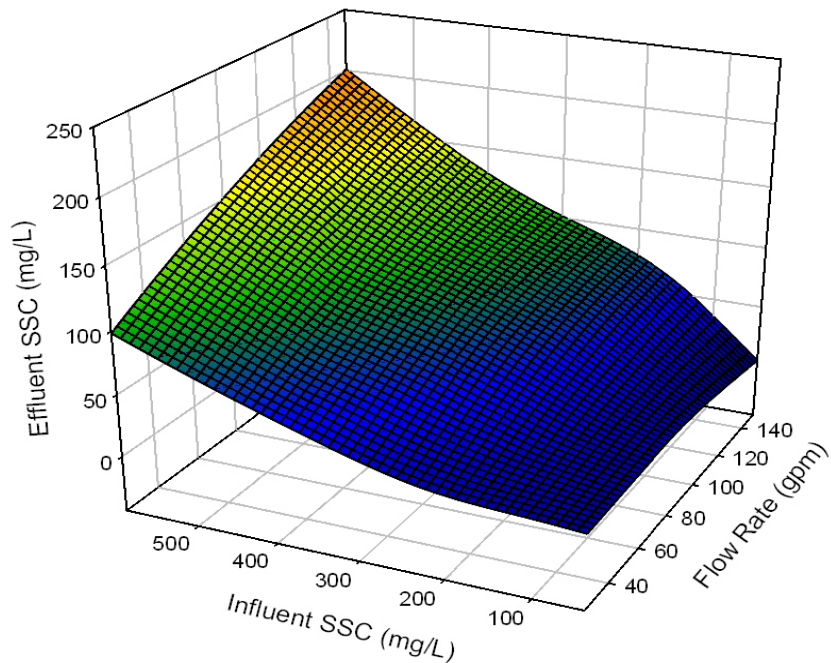
Hydro International
Up-Flo[®] Filter

Contech
StormFilter



SSC Influent and Effluent Concentrations during 40 Monitored Events at Full-Scale UpFlo[®] Filter Installation at BamaBelle Site, Tuscaloosa, AL

Up-Flo Filter Performance - CPZ Media



Up-flo[®] Filter incorporated into WinSLAMM version 10.2.1

Hydro International Up-Flo Filter

Drainage System Control Practice

Device Properties

Area Fraction Served by Up-Flo Filters (0-1)	1.000
A - Height from Outlet Invert to Structure Top (ft)	0.00
B - Sump Depth (ft)	3.80

Area Served by Upflow Filter (ac):

Filter Media: Select Media Type

Have Model Determine Cleaning/Replacement Frequency

Solve for Given Conditions

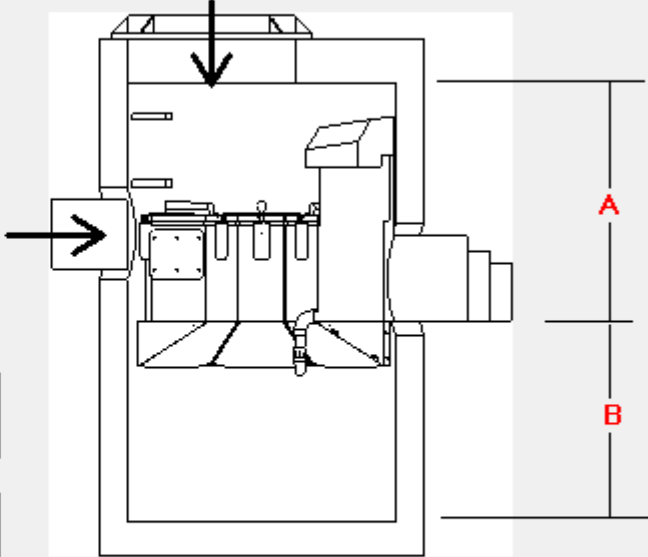
Number of Filter Modules Tank Area =

OR

Solve Iteratively for Desired Percent Reduction or Effluent Concentration

- Treatment Goal - Percent TSS (0.45-75 um) Removed
- Treatment Goal - Percent SSC (>0.45 um) Removed
- Treatment Goal - Effluent TSS Concentration (mg/L)
- Treatment Goal - Effluent SSC Concentration (mg/L)

Contact Hydro International Web Site



Copy Media Filter Data

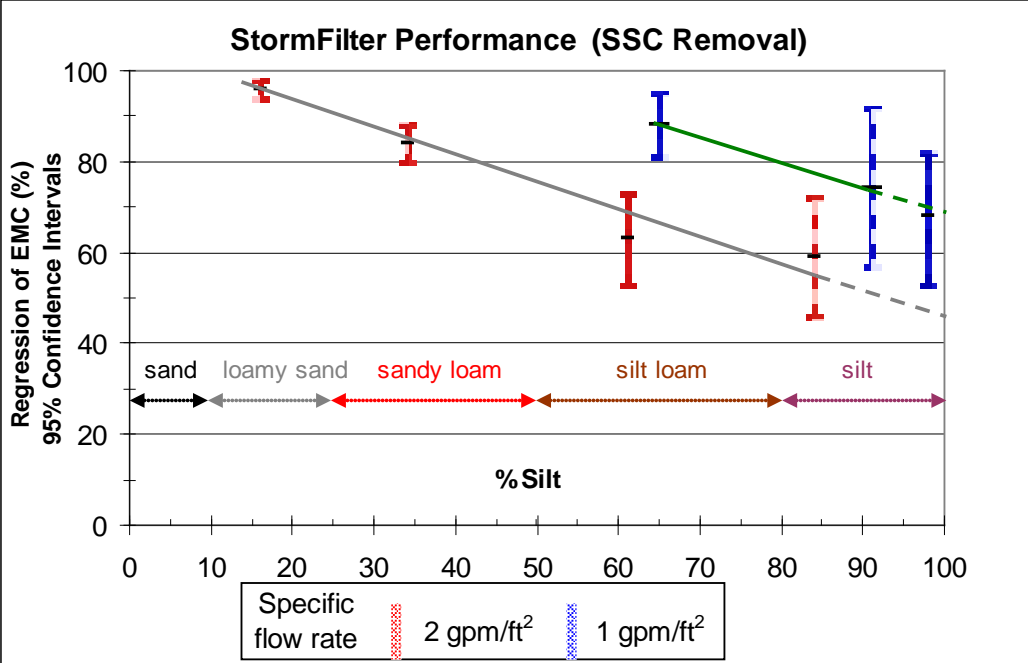
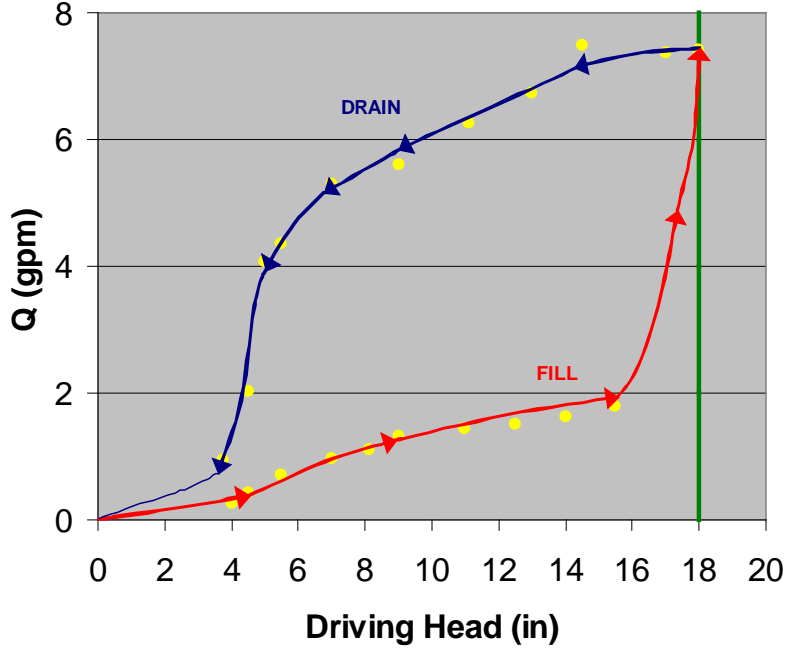
Paste Media Filter Data

Delete Cancel Continue

Control Practice #: 1 CP Index #: 1 Upstream Drainage Area = 0.000 acres

6. Filtering and Settling Devices

Contech StormFilter also has substantial performance information from both laboratory and field tests



6. Filtering and Settling Devices

The Contech StormFilter in WinSLAMM version 10.2.1

Stormwater Management StormFilter(R) (by Contech)

First Source Area Control Practice
Land Use: Residential 1
Source Area: Paved Parking 1

Media Type: **Perlite**

Cartridge Height
 12 inches 18 inches 27 inches

Cartridge Specific Flow Rate
 0.27 gpm/sf 1 gpm/sf 2 gpm/sf

Head Difference (ft) Between Inlet and Outlet Inverts. (Recommended Minimum Difference = 2.3')

Bypass Structure Location
 Online - Within cartridge chamber
 Offline - Upstream of cartridge chamber

Activate Upstream Storage Gallery

Volume Based Chamber Size
Runoff Depth (in)
Storage Chamber Depth (ft)

Pipe Storage
Storage Pipe Diameter (ft)
Storage Pipe Length (ft)
Chamber Sump Depth (ft)

Box Storage
Chamber Depth (ft)
Chamber Footprint Area (sf)
Chamber Sump Depth (ft)

Solve for Given Conditions
Number of Cartridges

OR

Solve Interatively for Desired Percent Reduction or Effluent Concentration

Treatment Goal - Percent TSS Removed

Treatment Goal - Percent SSC Removed

Treatment Goal - Effluent TSS Concentration (mg/L)

Treatment Goal - Effluent SSC Concentration (mg/L)

Minimum Time Between Maintenance Events (Months)

Select Particle Size Distribution File
C:\Program Files\WinSLAMM\NURP.CPZ

Copy Media Filter Data
Delete Control

Paste Media Filter Data
Cancel

Continue

Contact Contech Web Site

Cartridge Flow Rate = 7.5 gpm Total Flow Rate TBD

INLET PIPE

BYPASS FLOW

TO STORAGE

STORMFILTER CARTRIDGE

STORMGATE ADJUSTABLE WEIR

STORAGE GALLERY

INLET PIPE - 3.00'

18 in.

OUTLET PIPE

Control Practice #: 1 | Land Use #: 1 | Source Area #: 13

StormTech Isolator Row

The StormTech Isolator Row will be added to WinSLAMM v 10.4



ADS StormTech Isolator Row

Drainage System Control Practice: DS Isolator Row # 1

Total Available System Length (ft): 44
 Available Height from Chamber Base to Surface (ft): 5.00
 Native Soil Infiltration Rate (in/hr): 0.500
 Total Available System Width (ft): 33
 Number of Isolator Rows: 1
 Assumed Stone Porosity: 0.44

Select Either of These Sizing Options:
 Use All Available Area
 Enter Required Storage Volume
 Enter Number of Rows and Row Length

Buttons: Copy Data, Paste Data, Update Graphics, Show Cross Section Detail

Select Product

Chamber Segment Dimensions				Calculated System Size					
Product	Height (in)	Width (in)	Length (in)	Final Storage Volume (cf)	Number of Rows	Row Length (ft)	Total System Length (ft)	Total System Width (ft)	Number of Chambers
<input type="radio"/> SC-160LP	12	25	85.4						
<input type="radio"/> SC-310	16	34	85.4						
<input checked="" type="radio"/> SC-740	30	51	85.4	2463	6	35.6	213.5	28.5	30
<input type="radio"/> DC-780	30	51	85.4						
<input type="radio"/> MC-3500	45	77	86						
<input type="radio"/> MC-4500	60	100	48.3						

Cross Section		
Outlet	Invert Elevation (ft)	Orifice Diameter (ft)
Overflow Weir	1.50	N/A
Orifice 1	0.50	0.25
Orifice 2	0.25	0.25

Diagram: Top of Pavement, Min. Req. Cover of 18.0", 5.00', 8

Press 'F1' for Help

Approximate Pipe Configuration

Buttons: Cancel, Delete Control, Continue

Control Practice #: 1 CP Index #: 1

Entering Pipes in the Model

WinSLAMM v 10 Data File: [C:\Files\SLAMM\WinSLAMM\Current\Pipe2.mdb] - [Land Use Model]

File Current File Data **Control Practices** Tools Run Utilities Help

RES INS COM IND OU FR **CS** CB WP BF PP HD OD FS SF UF

Land Use:
Residential 1

Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	0.000			

Drainage System Pipe Geometry

Press 'F1' for Additional Help

Use Pipe as a Link, without Modifying Hydrograph Timing

1. Pipe Length (ft):

2. Pipe Diameter (ft):

3. Pipe Slope (ft/ft):

4. Mannings n:

Copy all values into next Pipe when you place it

Control Practice #: 1 CP Index #: 1

CP #	Control Practice Type	Control Practice Name or Location
1	Pipe	DS Pipe # 1
2	Pipe	DS Pipe # 3

Diagram labels: Residential 1, Residential 2, Residential 3, Junction 1, Junction 2, Junction 4, Outfall, DS Pipe # 1, DS Pipe # 3, RES, OUT

Data Entry Options

Options

1. Use Pipe as a Link, without Modifying Hydrograph Timing (Check the Checkbox)
2. Modifying the Hydrograph Timing by entering in Pipe Data
3. Copy all Four Variables from selected pipe to every pipe created after the selected pipe (some modifications may be needed)

Drainage System Pipe Geometry

Press 'F1' for Additional Help

Use Pipe as a Link, without Modifying Hydrograph Timing

1. Pipe Length (ft):	1000
2. Pipe Diameter (ft):	2.00
3. Pipe Slope (ft/ft)	0.010
4. Mannings n	0.012

Copy Pipe Geometry Data Paste Pipe Geometry Data

Copy all values into next Pipe when you place it

Clear Continue

Cancel

Control Practice #: 1 CP Index #: 1

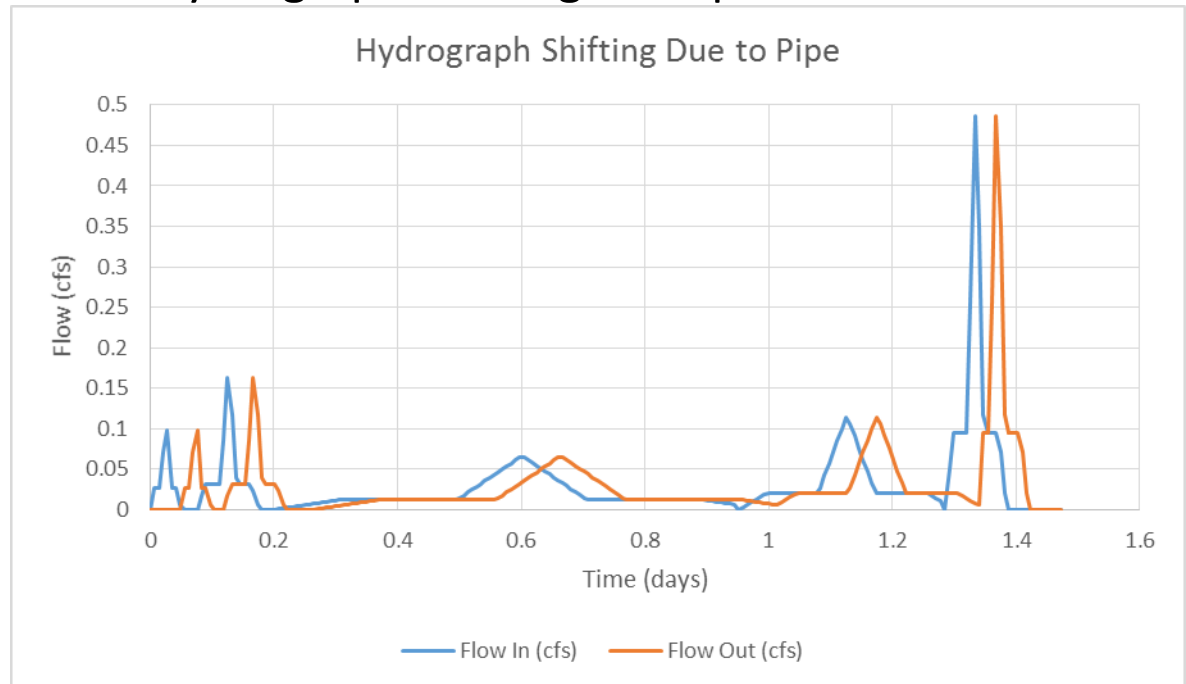
Pipe Output

Rain No.	Rainfall Depth (in)	Pipe No.	Avg Vel (ft/s)	Avg Depth (ft)	Travel Time (min)	Starting Increment No.	Ending Increment No.	Total No. of Incs.	Adj. No. of Increments	No. of Positive Flow Incs	No. of Incre. Shifts	Volume Shifted to Next Event (cf)	Max Flow (cfs)	Max Vel (ft/s)	Max Depth (ft)	Surcharged?
1	0.1	1	1.235059	6.71E-02	67.47315	0	10	10	0	7	7	1.562756	9.74E-02	1.619576	0.101573	#FALSE#
2	0.2	1	1.30847	7.33E-02	63.68759	11	28	17	0	14	6	0.624069	0.16368	1.89696	0.129636	#FALSE#
3	0.5	1	0.976864	4.70E-02	85.307	29	136	107	0	107	9	0.852409	6.51E-02	1.432696	8.42E-02	#FALSE#
4	0.4	1	1.16082	6.10E-02	71.78835	137	184	47	0	47	7	1.244993	0.114166	1.700002	0.10944	#FALSE#
5	0.5	1	1.823753	0.121976	45.69334	185	212	27	0	14	5	0	0.486276	2.636818	0.217113	#FALSE#

Detailed Output

1. Pipe Event Summary
2. Average Pipe Flow and Velocity
3. Maximum Pipe Flow and Velocity

Hydrograph Shifting Example



Command Line Processing

1. Run WinSLAMM from the command line using input and providing output not dependent upon the graphic user interface
2. Input file is a WinSLAMM program input file
3. Standard output is an event-by-event text file

Event Number	Rain Start Date	Rain Start Time	Julian Start Date & Time	Rain Duration (hrs)	Rain Interevent Period (days)	Runoff Duration (hrs)	Rain Depth (in)	Runoff Volume (cf)	R sub v	Average Flow (cfs)	Peak Flow (cfs)	Suspended Solids Conc. (mg/L)	Suspended Solids Mass (lbs)	Pre-Development Runoff Volume (cf)
15	03/25/81	21:00	13,598.88	4	3.04	4.8	0.07	107	0.42	0.01	0.02	130	0.8662	
16	03/29/81	02:00	13,602.08	3	0.25	3.6	0.05	68	0.37	0.01	0.02	130	0.5513	
17	03/29/81	11:00	13,602.46	2	0.29	2.4	0.06	87	0.4	0.01	0.04	130	0.702	
18	03/29/81	20:00	13,602.83	9	4.13	10.8	0.07	107	0.42	0	0.01	130	0.8662	
19	04/03/81	08:00	13,607.33	1	0.58	1.2	0.02	13	0.18	0	0.01	130	0.1048	
20	04/03/81	23:00	13,607.96	4	3.71	4.8	0.26	553	0.59	0.03	0.12	130	4.486	
21	04/07/81	20:00	13,611.83	12	0.29	14.4	0.71	1,841	0.71	0.04	0.13	130	14.94	
22	04/08/81	15:00	13,612.63	6	1.96	7.2	0.41	959	0.64	0.04	0.14	130	7.78	
23	04/10/81	20:00	13,614.83	3	1.17	3.6	1.06	3,022	0.79	0.23	0.89	130	24.53	
24	04/12/81	03:00	13,616.13	1	1.62	1.2	0.13	236	0.5	0.05	0.21	130	1.917	
25	04/13/81	19:00	13,617.79	6	2.54	7.2	0.32	709	0.61	0.03	0.1	130	5.751	
26	04/16/81	14:00	13,620.58	1	2.54	1.2	0.01	3	0.09	0	0	130	0.02619	
27	04/19/81	04:00	13,623.17	5	3.17	6	0.04	51	0.35	0	0.01	130	0.4141	

Modeling Considerations

Municipal Issues

1. Large networks may exceed WinSLAMM processing capabilities
2. Credit from private treatment practices allowable if municipalities have authority to require maintenance
3. DNR assessing Dry Pond modifications in WinSLAMM, with a reduction ratio calculated when the water surface elevation is less than three feet but above the lowest outlet invert, for each time step.
4. Large models

Modeling Considerations

Site Level Issues

1. Connected vs Disconnectedness. See DNR Post-Construction Modeling Guidance, Items 35-38: http://dnr.wi.gov/topic/stormwater/documents/Modeling_Post-Construction_Guidance_2011.pdf
2. Permanent pool of wet detention ponds must be included as a Water Body Area.
3. DNR assessing Dry Pond modifications in WinSLAMM, with a reduction ratio calculated when the water surface elevation is less than three feet but above the lowest outlet invert, for each time step.

Modeling Considerations

Site Level Issues

4. Hard copy submittals should include
 1. Input (use File/Print Input Data menu option)
 2. Output Summary (use Print Output Summary button on Outfall Output Summary tab)
 3. Drainage system diagram
5. Source area soil types: A: Sandy, B: Silty, C/D: Clayey.
6. Use Infiltration Rates from SOC Standard 1002, not default values in WinSLAMM.
7. Filter strips are for sheet flow, not concentrated flow.

Modeling Considerations

Site Level Issues

8. Enter Dynamic, not Static, Infiltration rates for swales and filter strips.
9. Always enter the wet pond initial elevation equal to the lowest outlet invert elevation.
10. Entering underdrain invert elevation above datum depth that exceeds the 72 hour drain time tech standard criteria for bioretention and permeable pavement systems.
11. Not entering “80” for the biofilter percent solids reduction due to engineered media
12. Not entering “65” for the permeable pavement underdrain discharge percent TSS reduction.

Planned Modifications

- Seasonal Phosphorus Reduction through Leaf Pickup
- Provide the ability to combine files
- Add inflow hydrograph option
- Add limited bypass routing
- Media filter performance update
- Green Roofs

Green Roof – v 10.5

Green Roof Control Device
✕

First Source Area Control Practice

Device Properties

Green Roof	
Green Roof Area (sf)	20000
Total Depth (ft)	1
Typical Width (ft) (Cost est. only)	100.00
Rock Filled Depth (ft)	0.10
Rock Fill Porosity (0-1)	0.400
Engineered Media Type	Media Data
Engineered Media Depth (ft)	0.80
Engineered Media Infiltration Rate (in/hr)	2.00
Engineered Media Porosity (0-1)	0.500
Percent solids reduction due to Engineered Media (0 -100)	N/A
Number of Devices in Source Area	1

Add <== Evaporation

Month	Evapotranspiration (in/day)	Evaporation (in/day)
Jan	0.00	
Feb	0.00	
Mar	0.00	
Apr	0.00	
May	0.50	
Jun	1.00	
Jul	0.50	
Aug	0.00	
Sep	0.00	
Oct	0.00	
Nov	0.00	
Dec	0.00	

Remove **Vertical Stand Pipe**

Pipe diameter (ft)	1.00
Height above datum (ft)	0.95

Add **Drain Tile/Underdrain**

Pipe Diameter (ft)	
Invert elevation above datum (ft)	
Number of pipes at invert elev.	

Bottom/Sides Sealed
 Bottom/Sides Drain

Remove **Evapotranspiration**

Soil porosity (saturation moisture content, 0-1)	0.500
Soil field moisture capacity (0-1)	0.400
Permanent wilting point (0-1)	0.300
Supplemental irrigation used?	<input type="checkbox"/>
Fraction of available capacity when irrigation starts (0-1)	0.000
Fraction of available capacity when irrigation stops (0-1)	0.000

Green Roof Geometry Schematic

Refresh Schematic

Plant Types

	1	2	3	4
Fraction of green roof that is vegetated	1.00	0.00	0.00	0.00
Plant type	Turfgras			
Root depth (ft)	1.0	0.0	0.0	0.0
ET Crop Adjustment Factor	0.80	0.00	0.00	0.00

Copy Green Roof Data

Paste Green Roof Data

Delete

Cancel

Continue

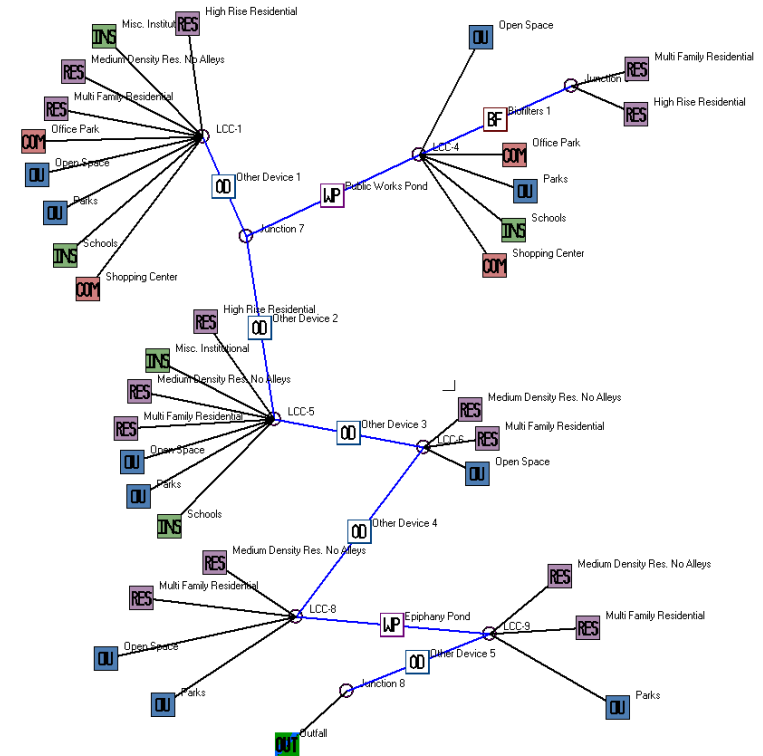
Control Practice #: 1 | Land Use #: 1 | Source Area #: 1 | Total Area: 1.000 acres | Land Use: Residential 1 | Source Area: Roofs 1

Planned Modifications

- Trash removal
- ✓ Credit Cards
- Linking files
- Opening two models at the same time
- Migrate to VB.net

We covered . . .

1. WinSLAMM Purpose and History
2. High Traffic Urban Highways
3. Particle Size Distribution Files
4. Importing Images
5. Other Device
6. Filtering and Settling Devices
7. Pipes
8. Command Line Model Runs
9. Modeling Considerations
10. Planned Modifications



Questions?



19th Annual Watershed Conference

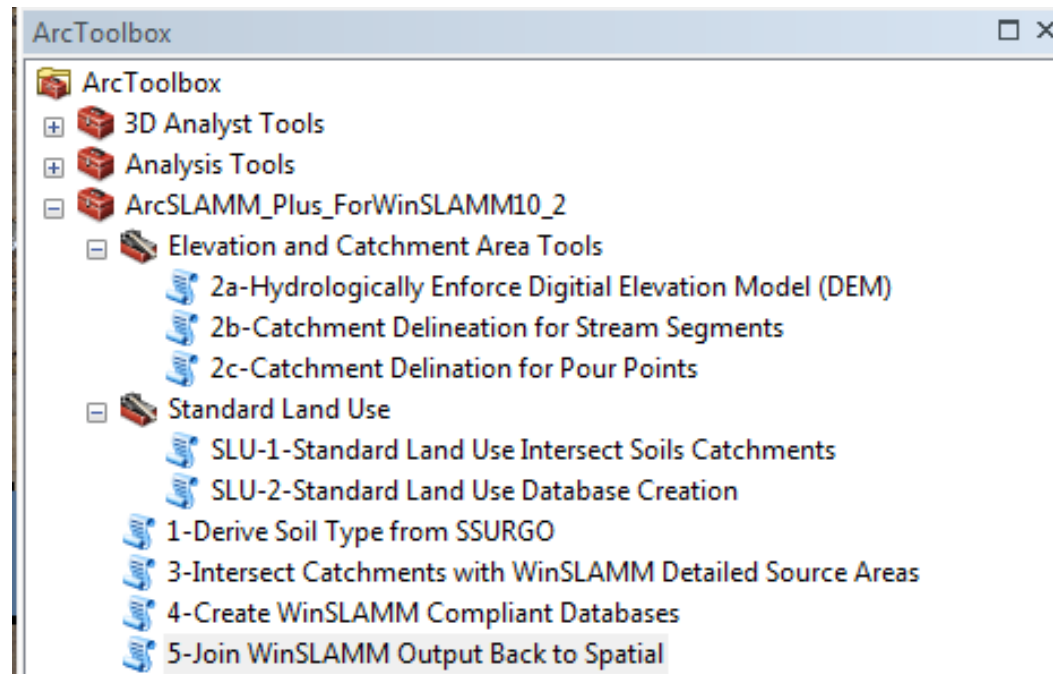
WinSLAMM Updates and Applications to WI Regulations

- ArcSLAMM Plus

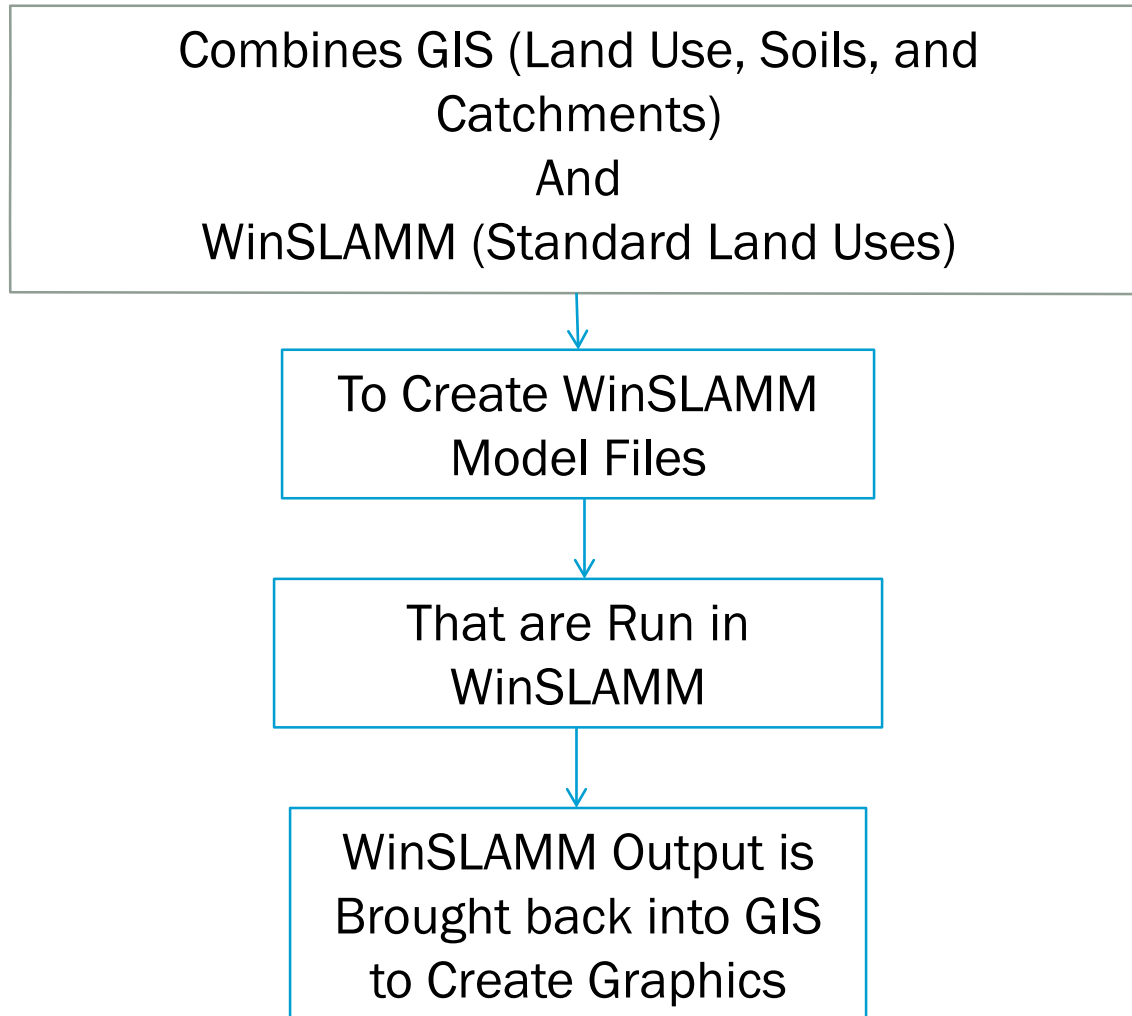
March 7, 2018

ArcSLAMM Plus

- An ArcGIS Extension developed by University of Northern Iowa GeoTREE Center
- <http://www.geotree.uni.edu/en/>

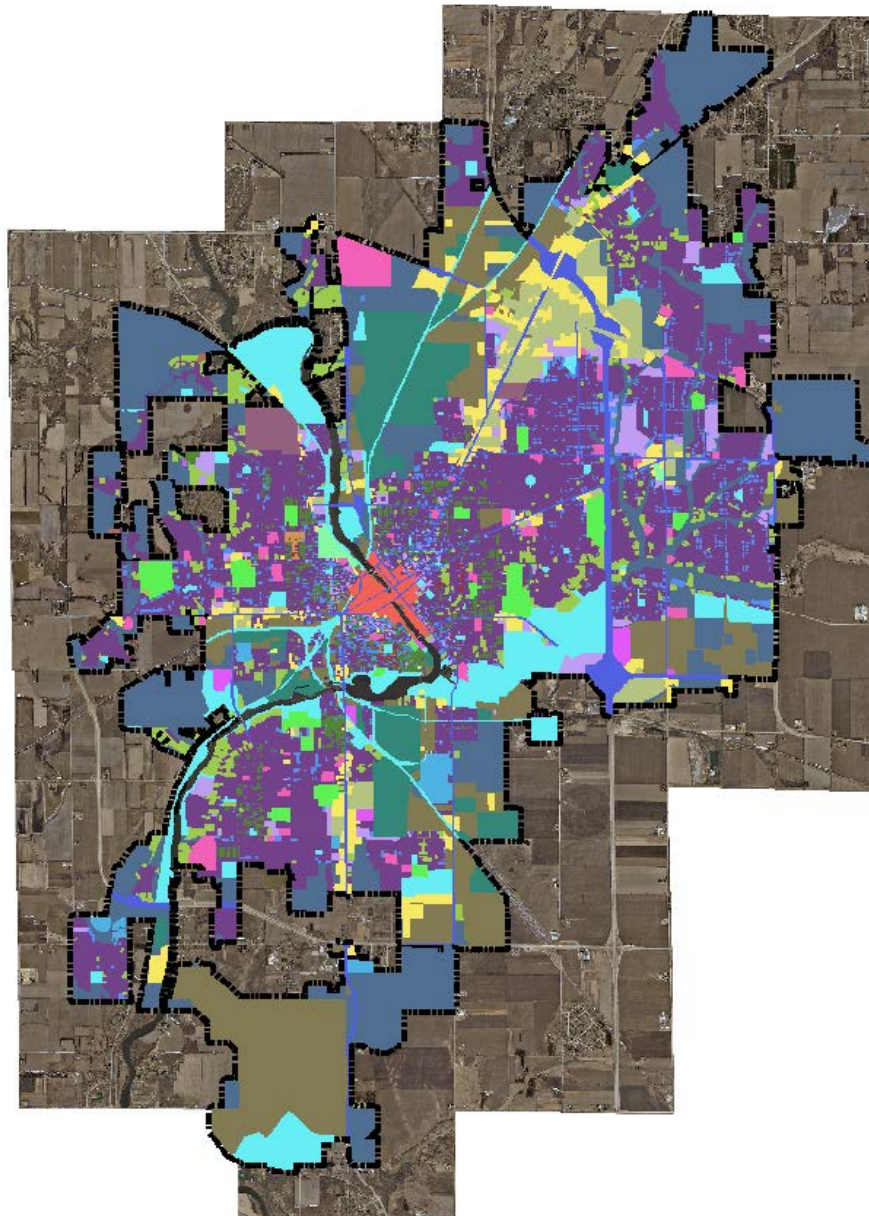


ArcSLAMM Plus

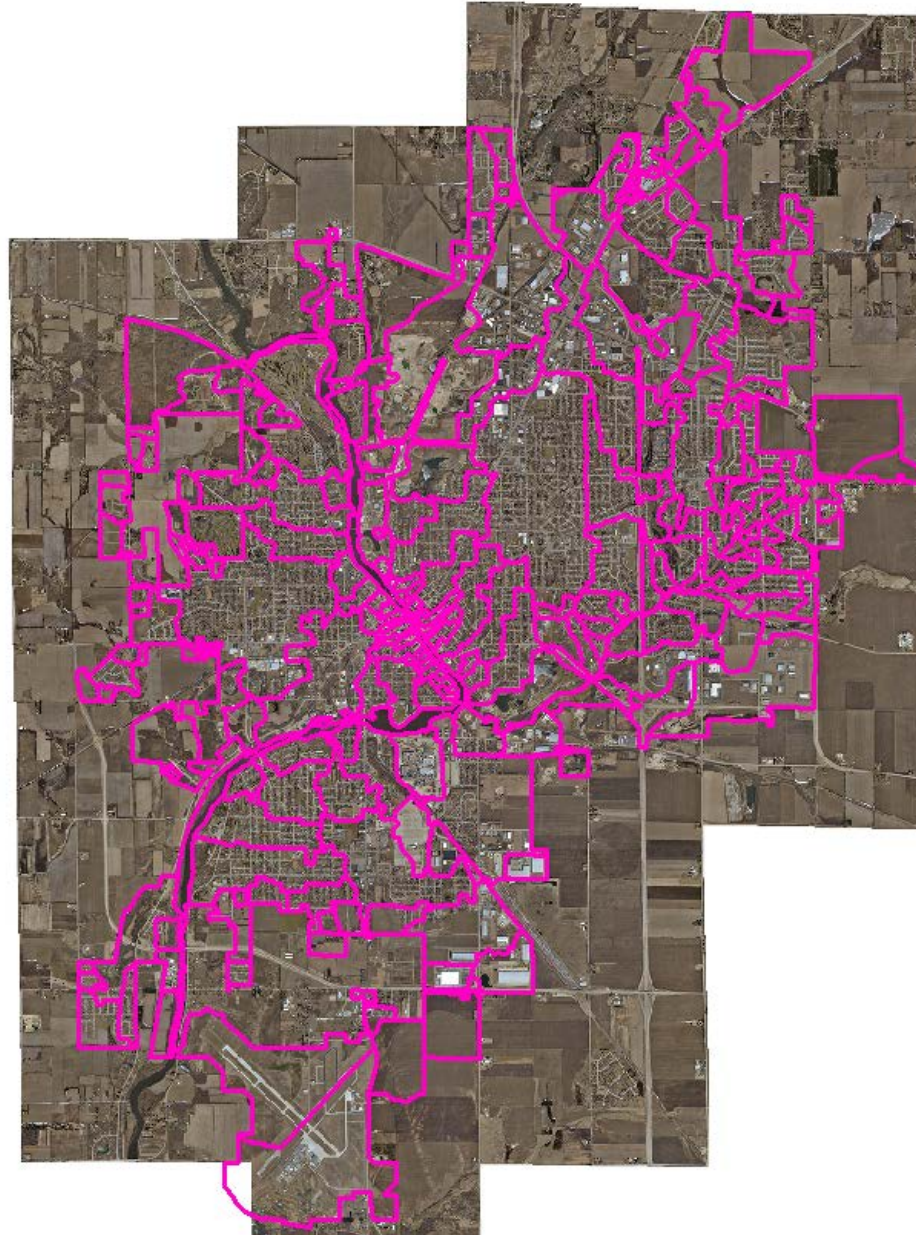


WinSLAMM Land Use

- ☐ SLAMM_Base_Catchment
- SLUDesc
- Cemetary
- Downtown Commercial
- Duplex
- HiTrafficUrban XS_Type 8 4 Lane Urb
- High Density Res. No Alleys
- High Density Res. with Alleys
- Hospital
- Light Industrial
- Low Density Residential
- Medium Density Res. No Alleys
- Medium Density Res. With Alleys
- Medium Industrial
- Misc. Institutional
- Mobile Homes
- Multi Family Residential
- Office Park
- Open Space
- Parks
- Schools
- Shopping Center
- Strip Commercial
- Suburban Residential



Catchments



Soils

- SSURGO -

<http://www.arcgis.com/apps/OnePane/basicviewer/index.html?appid=a23eb436f6ec4ad6982000dbaddea5ea>

SSURGO Downloader

Newer Data Available

A newer version of this application with data from the 2014 SSURGO snapshot is available. It includes new fields as well as updated data.

The new application is at:
[SSURGO Downloader 2014](#)

No longer do you have to spend time learning about the SSURGO database structure before you can use the data. No longer do you have to figure out how to import the data into the ArcGIS system to get your job done.

Use this web map to download map packages created from the Soil Survey Geographic Database (SSURGO) that the Esri Soils Team has extracted and prepared for immediate use in your maps and analyses.

The Esri Soils Team created a map with 130 of the most useful variables in SSURGO. The data are packaged by subbasin (HUC8 from the Watershed Boundary Dataset) and are available through this web map.

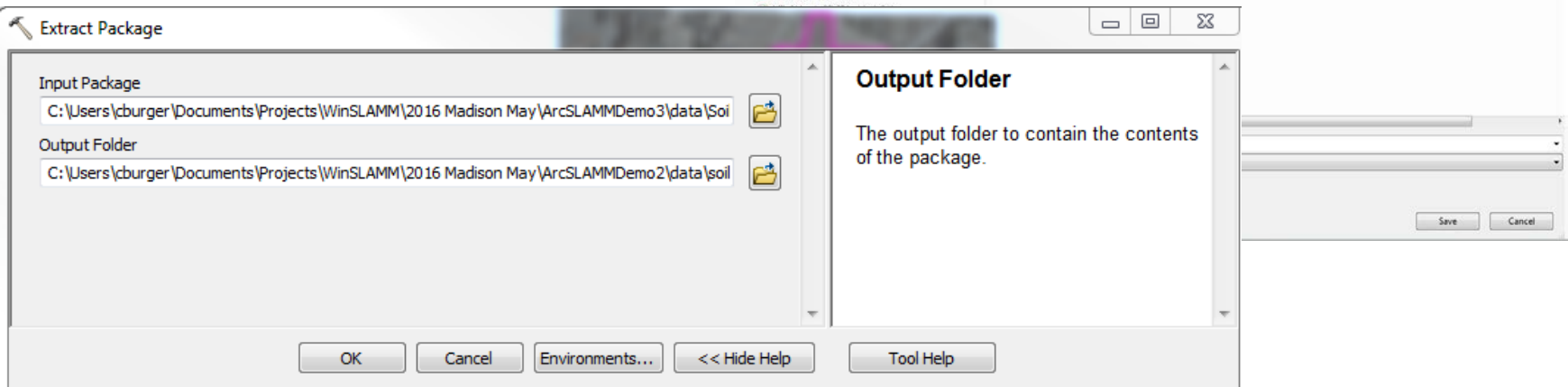
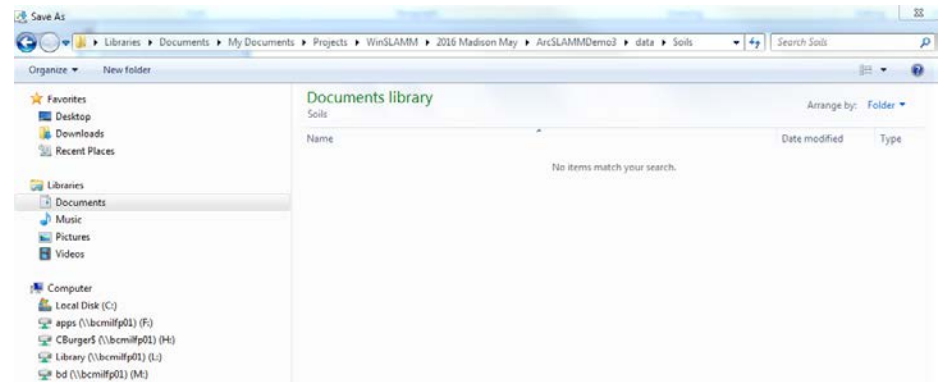
The SSURGO data selected for this application consist of basic descriptions of the data (from the Map Unit Feature Class and Map Unit tables), a collection of interpretations (from the MUJAGATT table), and aggregated information about the components of each map unit (Component table). We chose these data because they represent the most commonly used fields in SSURGO and many of these values serve as standard inputs to assessment and modeling processes.

Included in the map package is a zip folder containing 19 layer files

Sources: Esri, USGS, NOAA | WWF, USGS, EPA, Esri

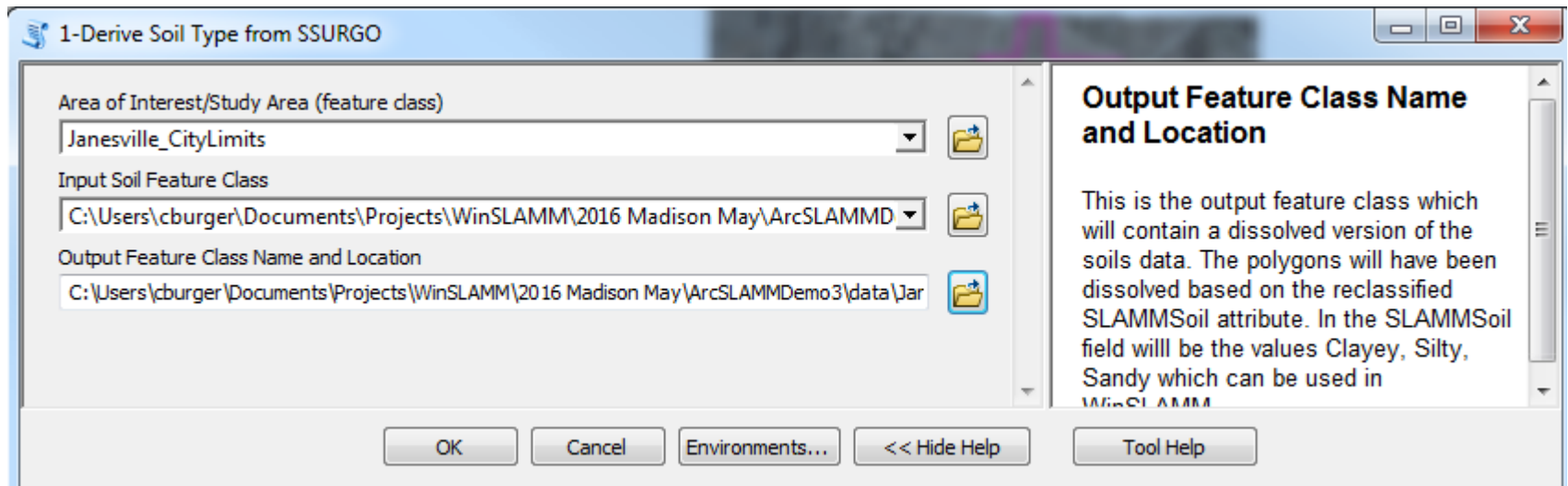
Soils

- Find your Project Area and Select Download
- Save the data in a folder specified in the user's guide
- Use ArcGIS toolbox to extract the map package



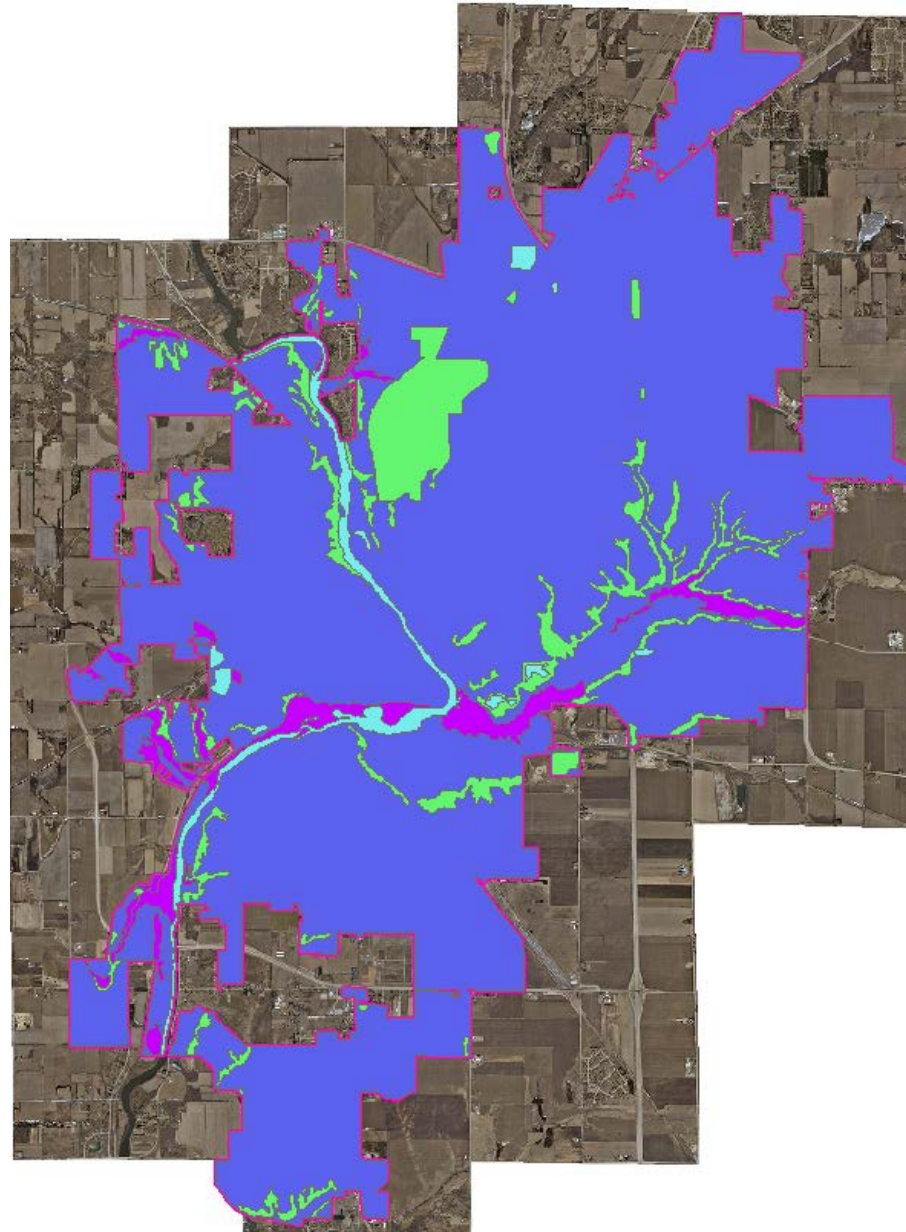
Create WinSLAMM Soils

- Use the ArcSLAMM Plus Extension to Create the WinSLAMM Soils



WinSLAMM Soils

- Janesville_Soils
- SLAMMsoil
 -
 - Clayey
 - Sandy
 - Silty



Land Use Database Format

Integer,
Matches
SLU

Table

SLAMM_Base_Catchment

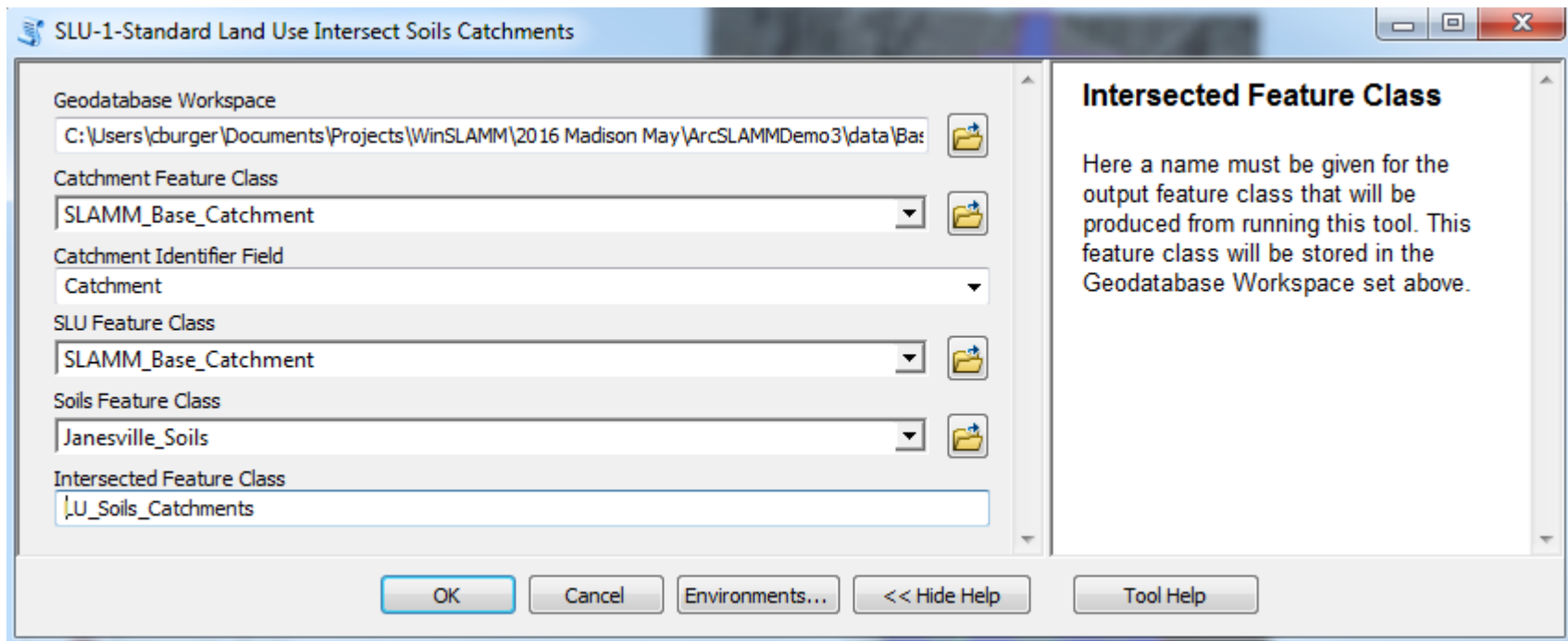
FID	Shape *	Shape_Leng	Shape_Area	LUType	SoilType	CatchID	AreaAcres	Catchment	SLUDesc	SLUType
0	Polygon	692.442263	120.799223	1			0	0	Low Density Residential	8
1	Polygon	6546.861197	0.078513	1			0	0	Medium Density Res. No Alleys	5
2	Polygon	939.043226	0.633319	4			0	0	Light Industrial	17
3	Polygon	574.716924	6.826793	1			0	0	Medium Density Res. No Alleys	5
4	Polygon	222.118541	0.032205	1			0	0	Medium Density Res. No Alleys	5
5	Polygon	437.257028	0.607203	1			0	0	Medium Density Res. No Alleys	5
6	Polygon	768.559356	41.945492	1			0	0	Medium Density Res. No Alleys	5
7	Polygon	1417.680302	34.478587	1			0	0	Medium Density Res. No Alleys	5
8	Polygon	779.564341	13.470759	1			0	0	Medium Density Res. No Alleys	5
9	Polygon	392.332605	0.156568	3			0	0	Strip Commercial	14
10	Polygon	1448.312173	0.372094	3			0	0	Strip Commercial	14
11	Polygon	413.834179	0.00065	3			0	0	Strip Commercial	14
12	Polygon	1786.523158	3.374489	3			0	0	Strip Commercial	14
13	Polygon	725.077274	5.039134	3			0	0	Strip Commercial	14
14	Polygon	461.936147	11.980507				0	0	Medium Density Res. No Alleys	5
15	Polygon	802.832748	7.278523				0	0	Open Space	19
16	Polygon	395.079134	1.88531				0	0	Medium Density Res. No Alleys	5
17	Polygon	1098.761659	0.0006				0	0	Parks	20
18	Polygon	6					0	0	Medium Density Res. No Alleys	5
19	Polygon	160					0	0	Open Space	19
20	Polygon	13					0	0	Medium Industrial	18
21	Polygon	387					0	0	Parks	20
22	Polygon	1572.544894	0.977722	5			0	0	Open Space	19
23	Polygon	771.520628	11.412915	4			0	0	Light Industrial	17
24	Polygon	1631.789881	7.566327	5			0	0	Open Space	19

Filled in by
ArcSLAMM Plus

1 (0 out of 49136 Selected)

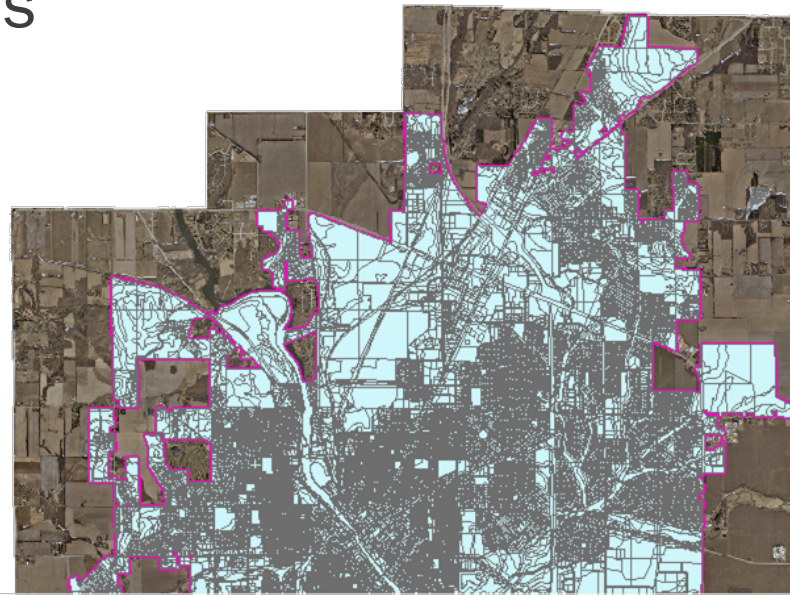
SLAMM_Base_Catchment

Combine Land Use, Soils, and Catchments



Feature Class Created

- A new Feature Class was Created with the Soils, Land Use, and Catchments
- Dataset cannot have blank cells



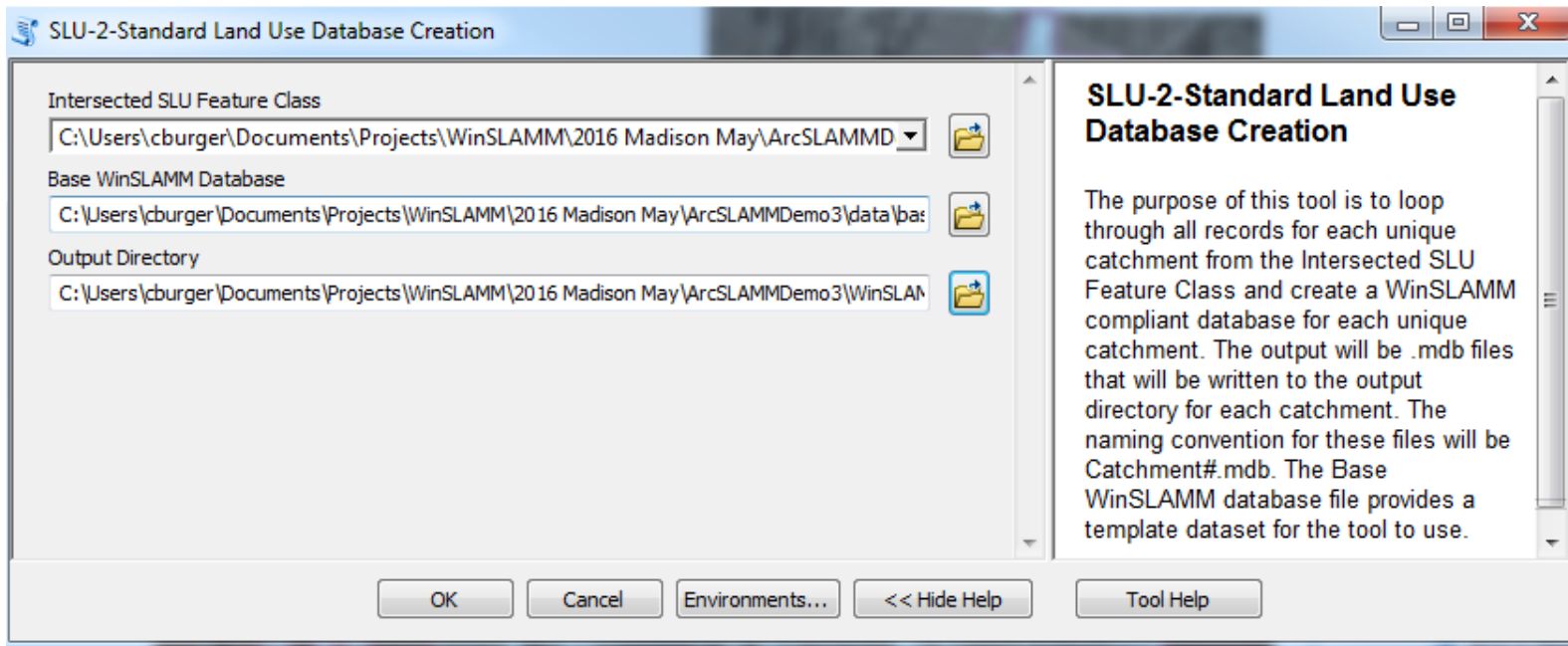
OBJECTID *	Shape *	LUType	SoilType	AreaAcres	SLUType	Shape_Length	Shape_Area	CatchID
90	Polygon		Sandy	0.000769	0	400.328879	33.483742	111
91	Polygon		Silty	0.014106	0	5432.026845	614.456729	111
92	Polygon		Sandy	0.000078	0	64.322382	3.38797	127
93	Polygon		Silty	0.00006	0	376.930274	2.633459	127
94	Polygon		Silty	0.003681	0	1532.669819	160.362046	127
95	Polygon		Silty	0.00635	0	3441.813392	276.61312	188
96	Polygon		Silty	0.017893	0	5581.771873	779.420547	184
97	Polygon		Silty	0.002442	0	1768.024172	106.368997	107
98	Polygon		Silty	0.001647	0	402.767059	71.745332	179
99	Polygon		Silty	0.006249	0	1898.881346	272.192225	180
100	Polygon		Silty	0.001568	0	1148.682792	68.288832	105
101	Polygon		Sandy	0.000445	0	461.107417	49.388336	127

ArcToolbox

- ArcToolbox
 - 3D Analyst Tools
 - Analysis Tools
 - ArcSLAMM_Plus_ForWinSLAMM10_2
 - Elevation and Catchment Area Tools
 - 2a-Hydrologically Enforce Digital Elevation Model (DEM)
 - 2b-Catchment Delineation for Stream Segments
 - 2c-Catchment Delineation for Pour Points
 - Standard Land Use
 - SLU-1-Standard Land Use Intersect Soils Catchments
 - SLU-2-Standard Land Use Database Creation
 - 1-Derive Soil Type from SSURGO
 - 3-Intersect Catchments with WinSLAMM Detailed Source Areas
 - 4-Create WinSLAMM Compliant Databases
 - 5-Join WinSLAMM Output Back to Spatial
 - Cartography Tools
 - Conversion Tools
 - Data Interoperability Tools
 - Data Management Tools
 - Archiving
 - Attachments
 - Data Comparison
 - Distributed Geodatabase
 - Domains
 - Feature Class
 - Features
 - Fields
 - File Geodatabase
 - General
 - Generalization
 - Geodatabase Administration
 - Geometric Network

Create Model Files

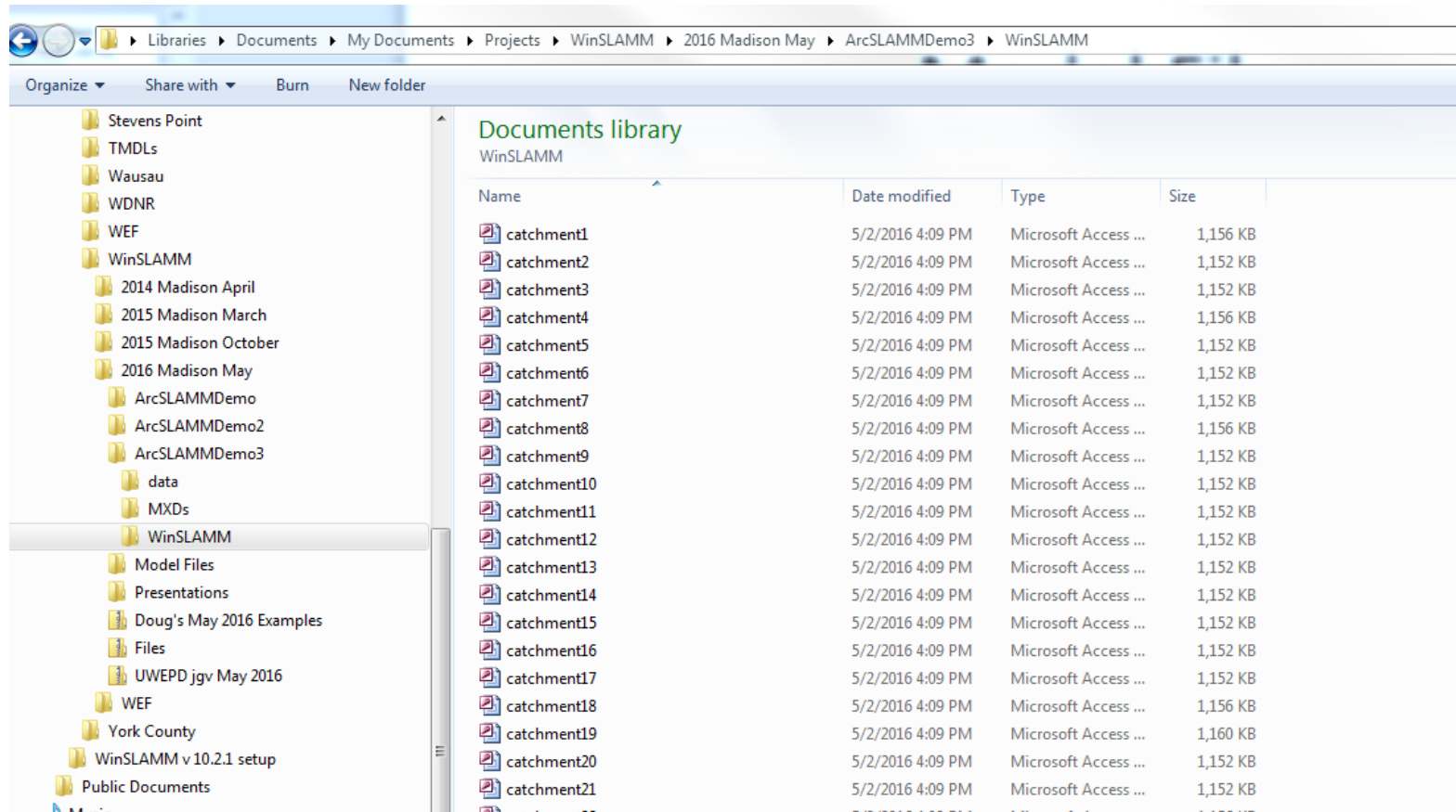
- Next Create the Model Files



- Depending upon the Database Size this may take hours

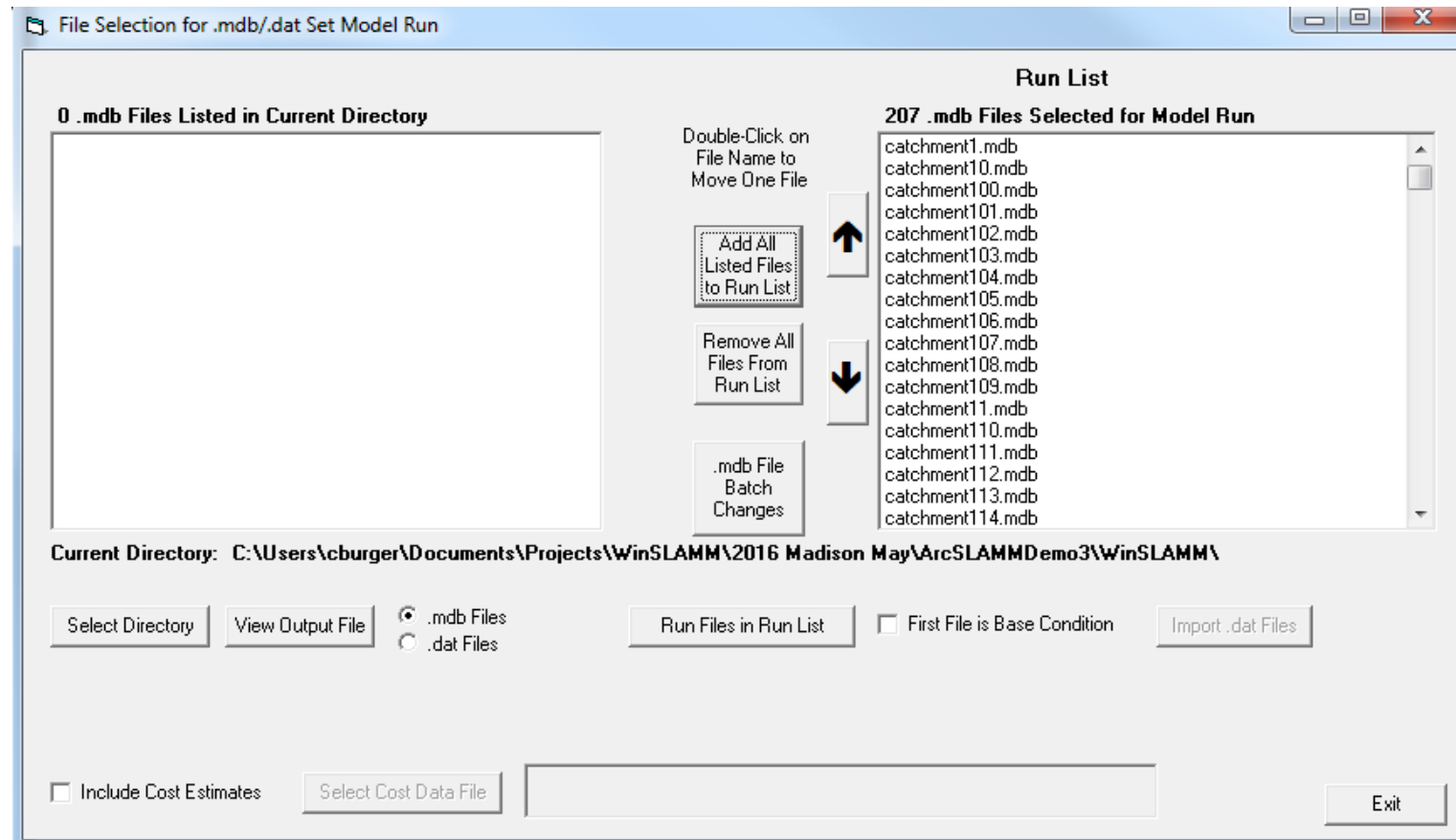
Model Files

- Model Files for each Catchment will be Created in the Specified Directory



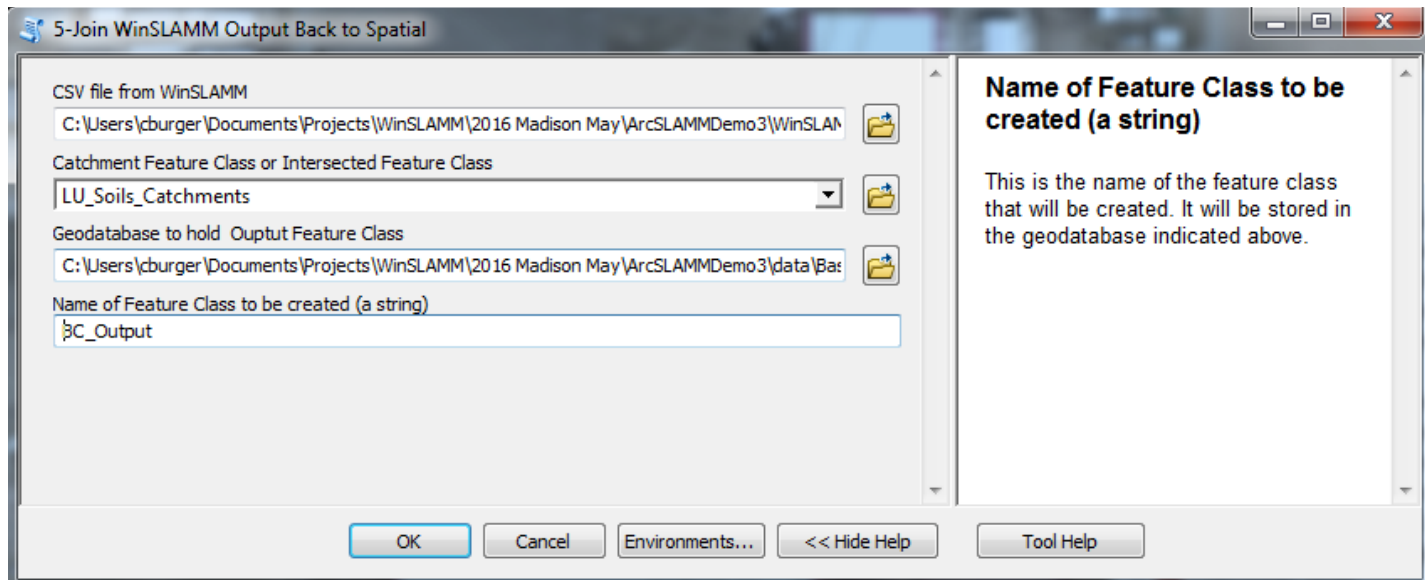
Run the Model Files

- Run the Files using the “Run” then “Set of Project Files”



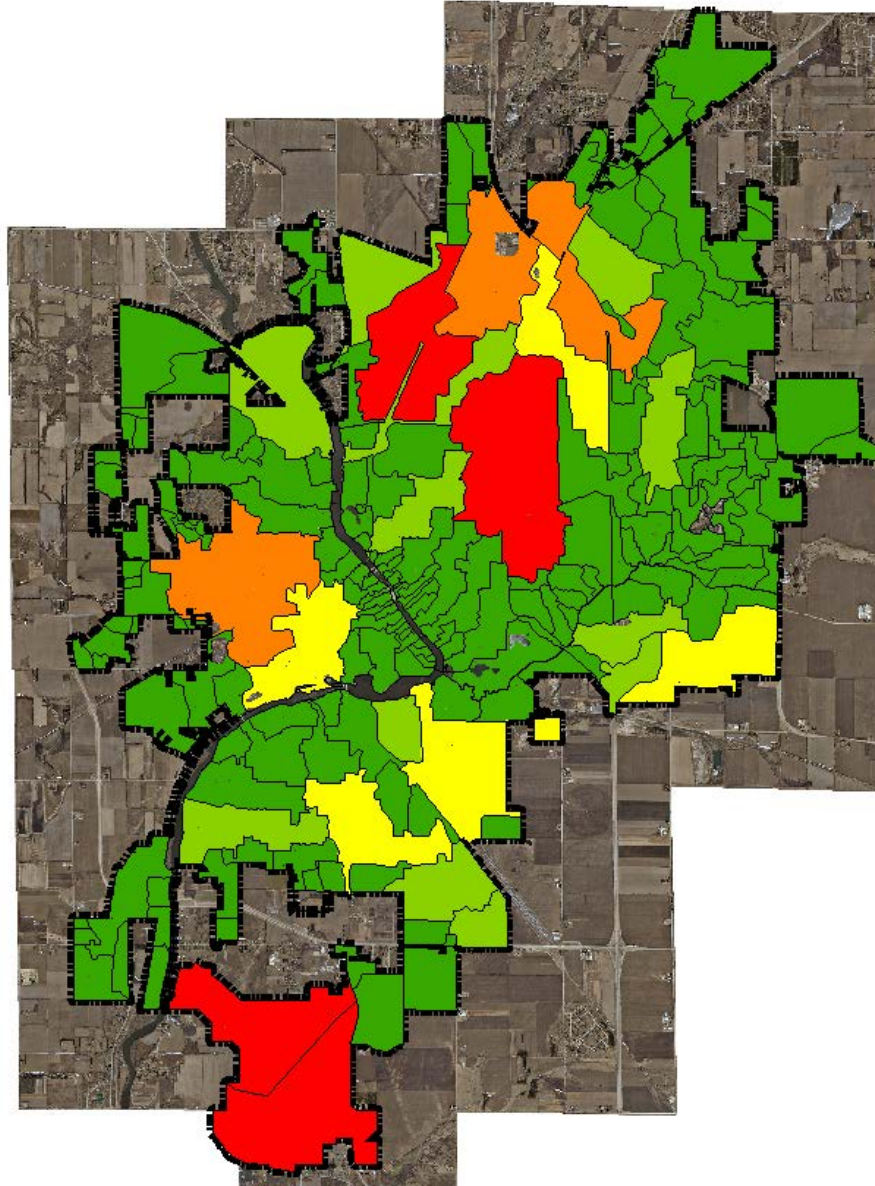
Add the Results to GIS

- After model is run, use ArcSLAMM to add the Output into GIS



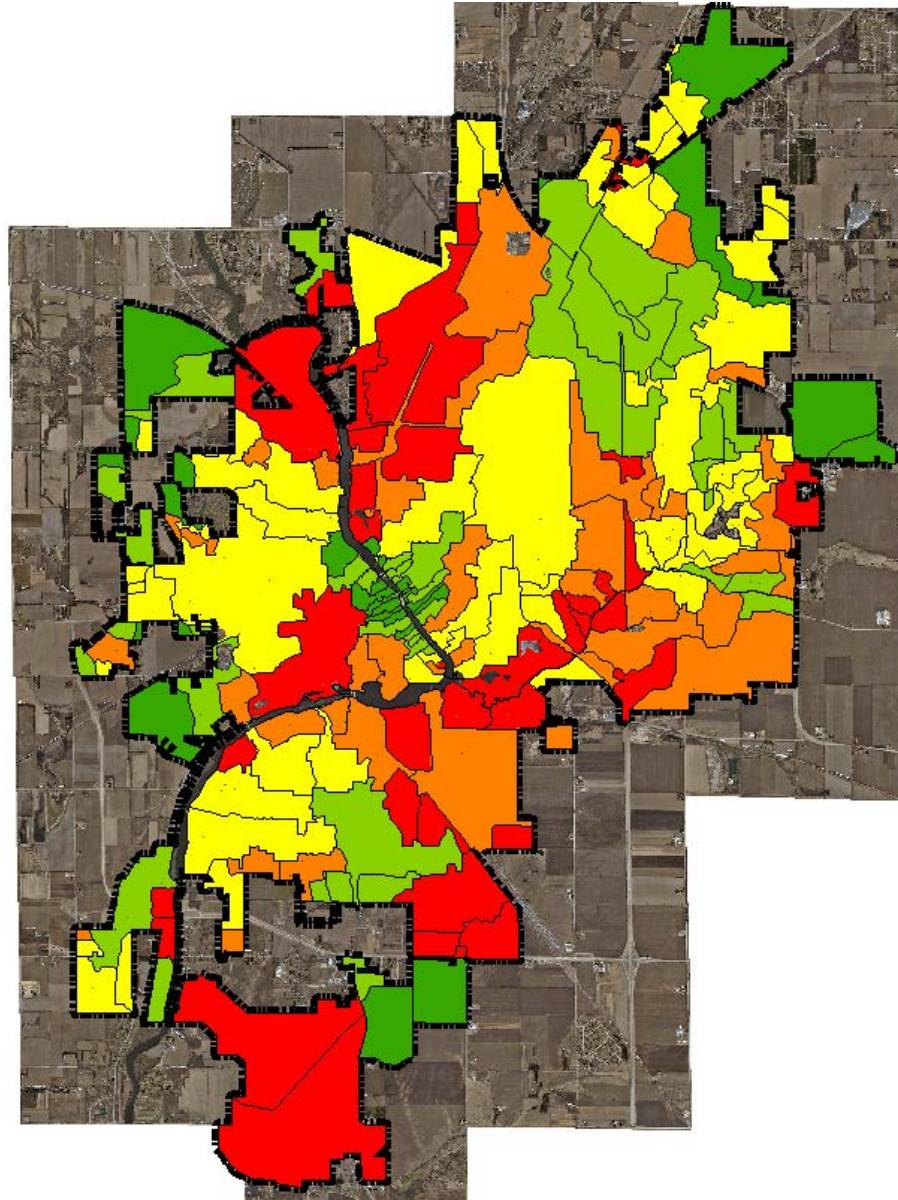
Generate Graphics

Base
Conditions TSS
Load per
Catchment

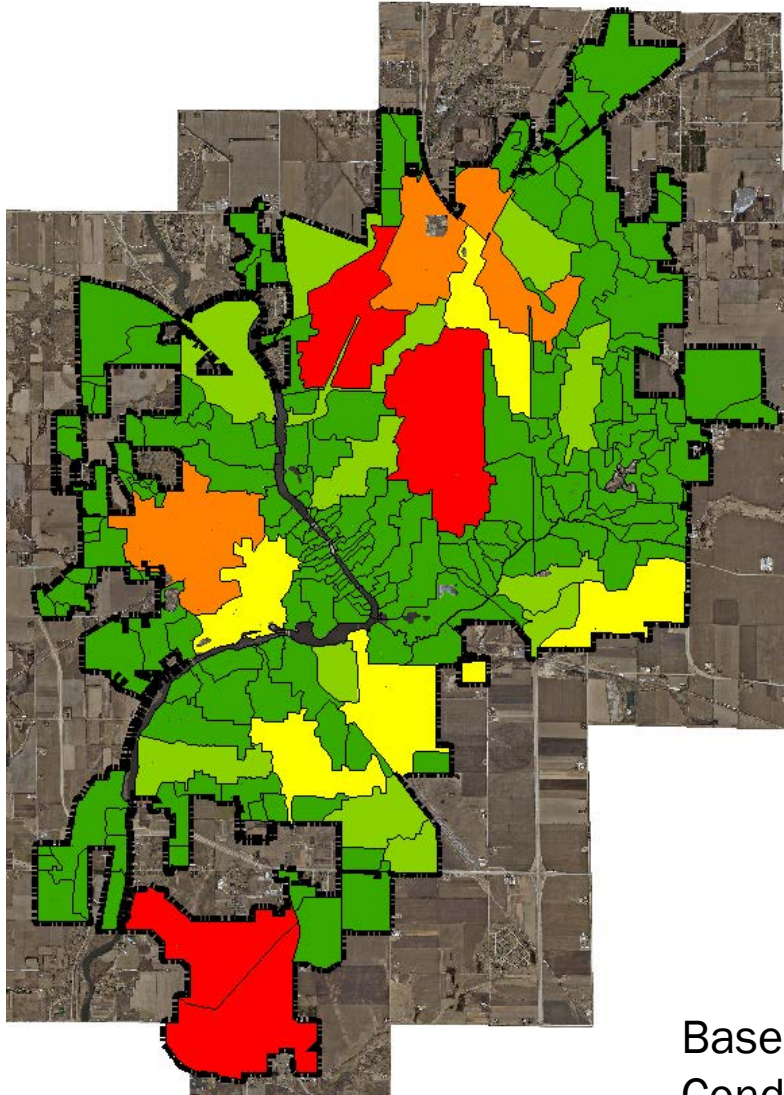


Generate Graphics

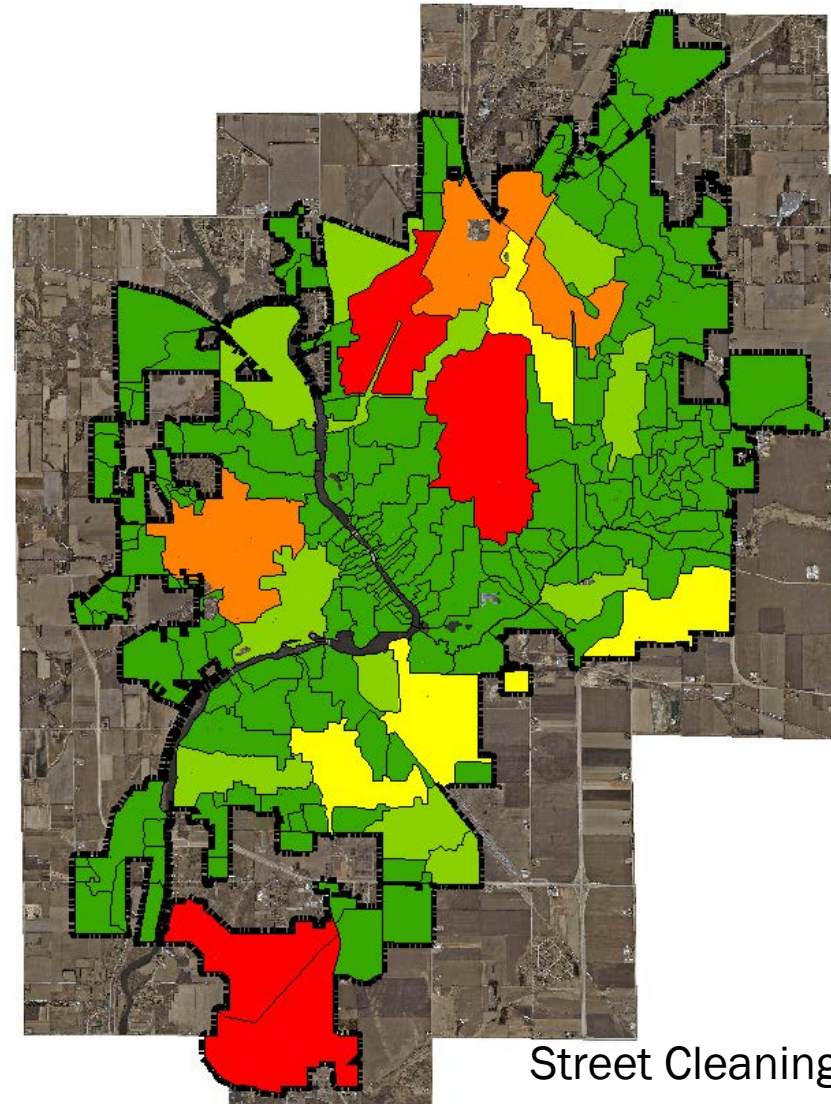
Base Conditions
TSS
Concentration
per Catchment



Add Control Practices

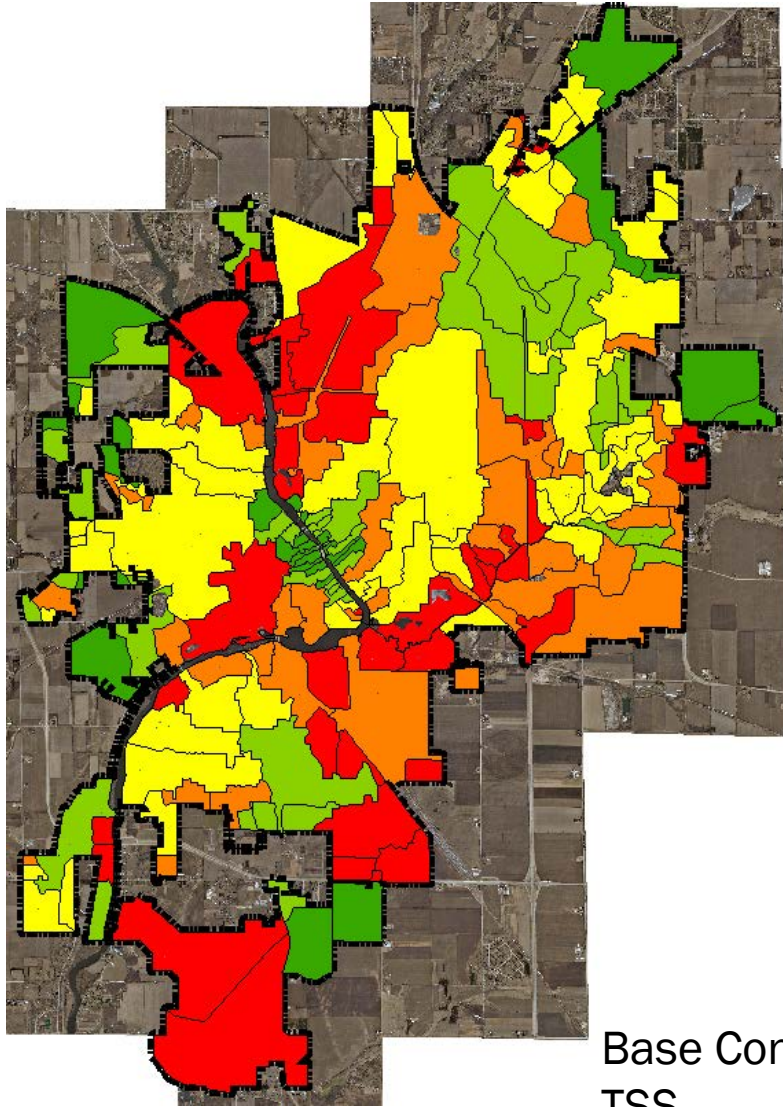


Base
Conditions TSS
Load per

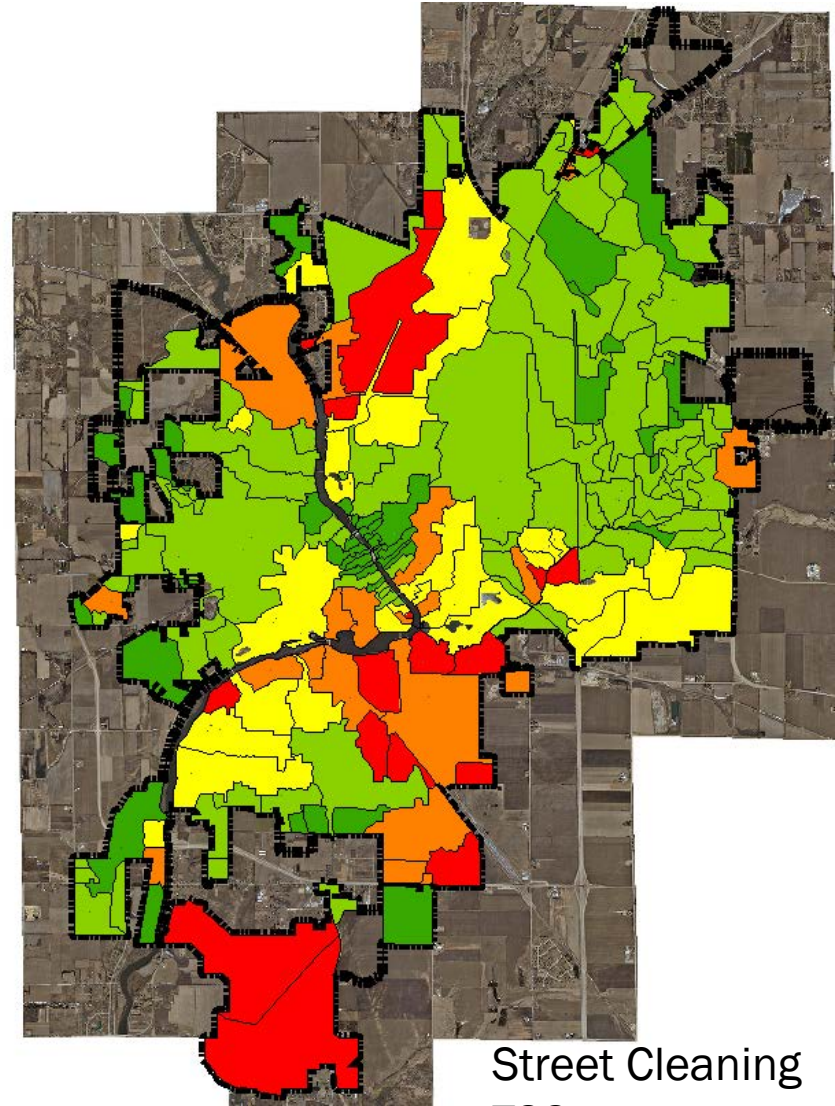


Street Cleaning
TSS Load per
Catchment

Add Control Practices



Base Conditions
TSS
Concentration



Street Cleaning
TSS
Concentration

How to Obtain

- ArcSLAMM
 - Source Area building blocks
 - Download from:
<http://www.geotree.uni.edu/en/extensions/arcslammpackages/>
- ArcSLAMM Plus
 - Standard Land Use building blocks
 - Cost: \$150
 - Order from: <http://www.winslamm.com/purchase.html>
 - Funds sent to GeoTREE for extension maintenance



Questions?