WinSLAMM Analysis of Treatment Practices September 29, 2009

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Outline

> WinSLAMM Purpose Model Applications Model Strengths and Limitations Small Storm Hydrology Basic Program Structure Treatment Practices Bio-filters > Upcoming Features



Purpose of the Source Loading and Management Model (SLAMM)

Developed to evaluate the benefits of stormwater treatment practices for both runoff quality and quantity in existing and developing urban areas.

Model Applications

Model Can Be Applied on Multiple Levels –

- Large Scale, City-wide Analysis
- Single Land Use
- Single Source Areas







Model Applications

Stormwater Control Practices Can Be Applied on Multiple Levels –

- Source Area
- Conveyance System
- End of Pipe







Infiltration Basin – End of Pipe

Bioretention in Residential Right-of-way = 34% Reduction in Annual Runoff

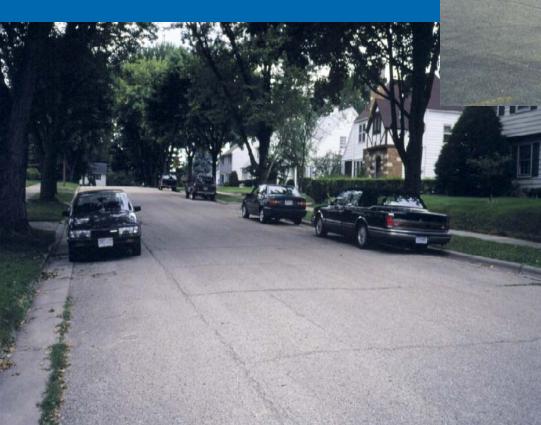
These concepts are incorporated into SLAMM

Soil Type Runoff Landuse Area Volume and **SLAMM** Pollutant Rainfall Load Development Characteristics **Control Practices**

Model Strengths

- Based upon actual field monitoring and data
- Analyzes pollutants at the source area level
- Considers many stormwater controls together, for a long series of rains
- Input data relatively easy to acquire
- Predicts runoff volumes and pollutant loads for long periods

Calibrate SLAMM with Source Area Concentrations







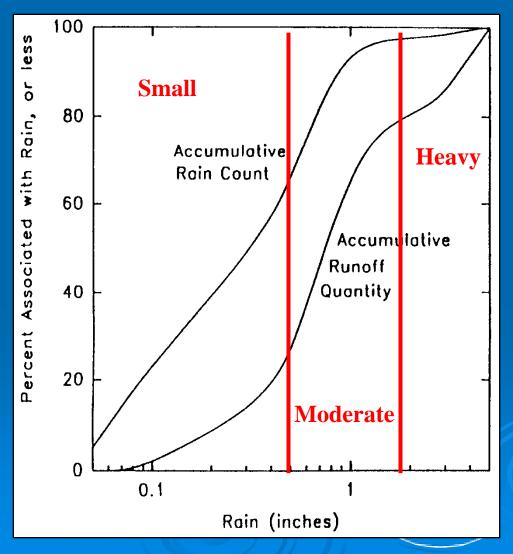
Source Area Sampler for Streets, Parking Lots, Driveways, and Roofs



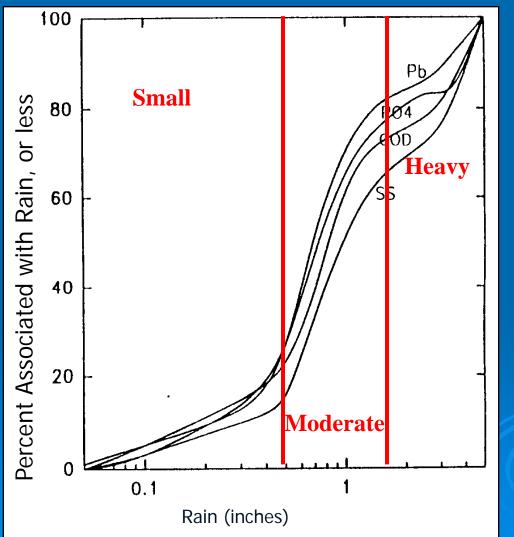
Source Area Sampler for Lawns

U.S. Geological Survey Monitoring Station at End of the Pipe For Urban Stormwater Quality, WinSLAMM bases it's analysis on the concept of Small Storm Hydrology

Milwaukee Rainfall and Runoff Distributions



Milwaukee Pollutant Distribution

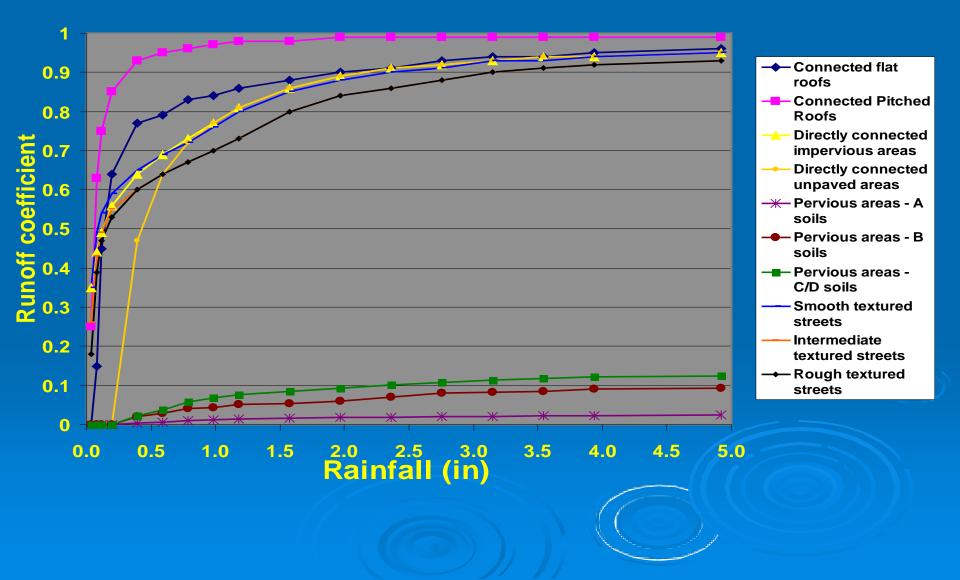




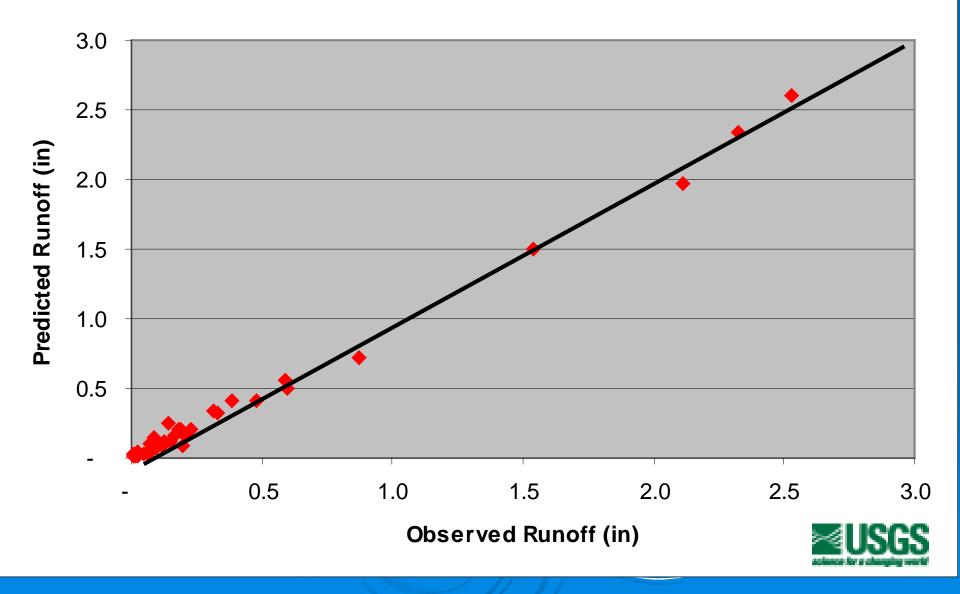
Annual Runoff for Commercial Using SLAMM and TR55

Type of Hydrology	Runoff for < 0.5 in. Rain	Runoff for > 0.5 in. Rain	Total Runoff, inches	Rain Depth, inches
TR55	3.01	14.77	17.99	28.81
SLAMM	4.48	14.81	19.29	28.81

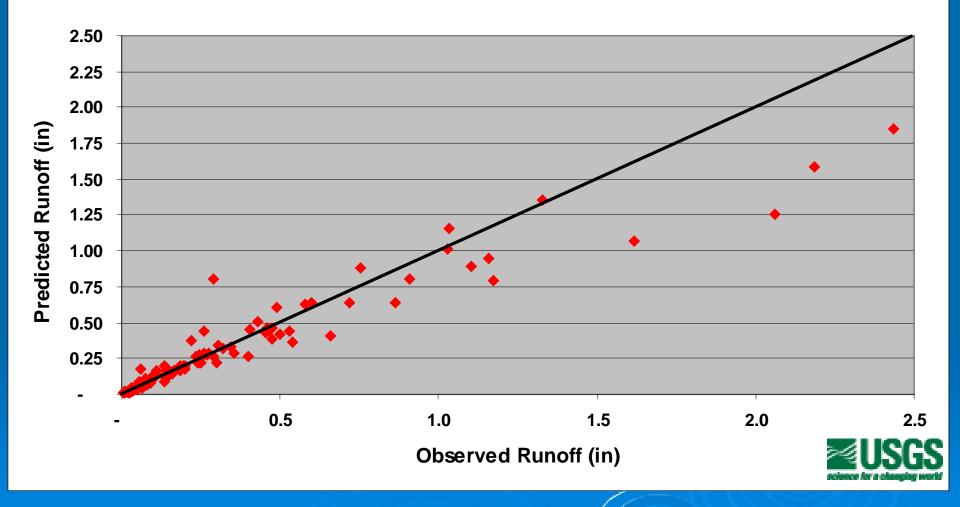
SLAMM runoff coefficient file - .rsv



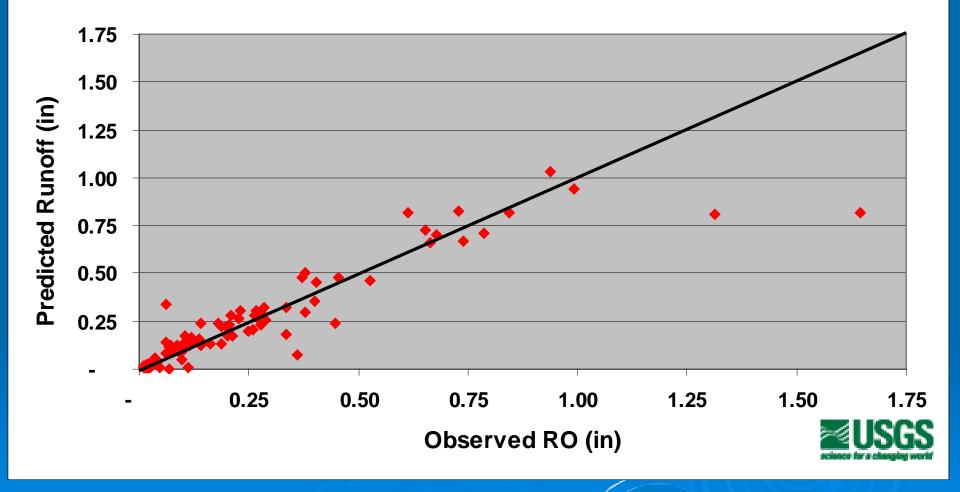
Observed vs. Predicted Runoff at Madison Maintenance Yard Outfall



Observed vs. Predicted Runoff at Syene Outfall



Observed vs. Predicted Runoff Superior Outfall



Measured versus Modeled Runoff, inches

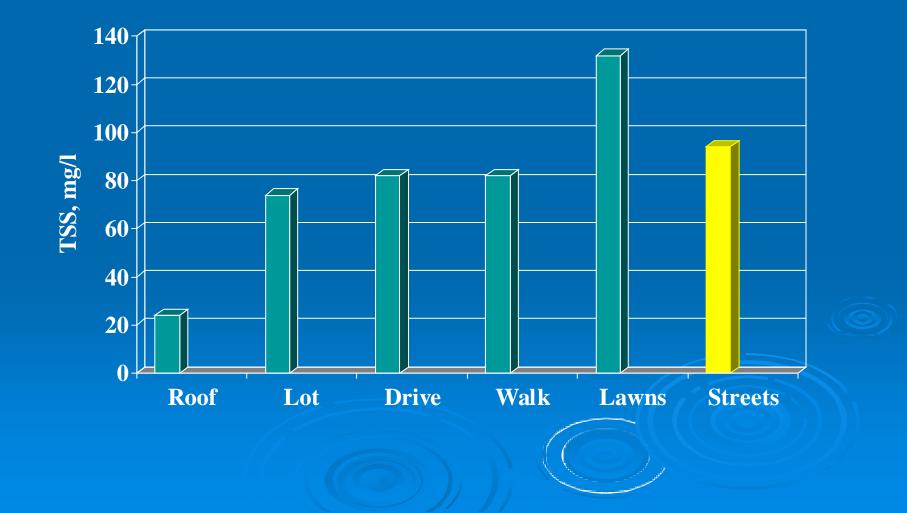
SITE	Total Rain	Measured Runoff	Modeled Runoff	Difference, %
Harper	27.9	7.3	5.3	-27%
Monroe	46.4	8.2	8.8	7%
Canterbury	14.5	5.4	5.9	10%
Marquette	22.1	3.8	4.5	19%
Superior	41.8	22.8	21.8	-4%
Syene	70.5	36.2	33.4	-8%
Badger	17.2	14.9	14.3	-4%

Type of Pollutants

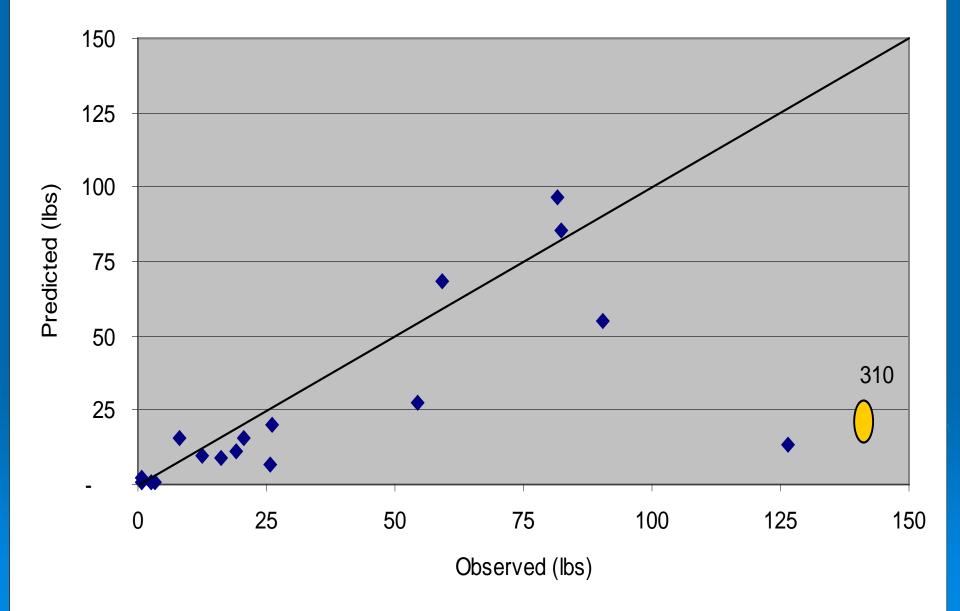
Suspended Solids
Total Solids
Total Phosphorus
Total Lead
Total Zinc
Total Copper

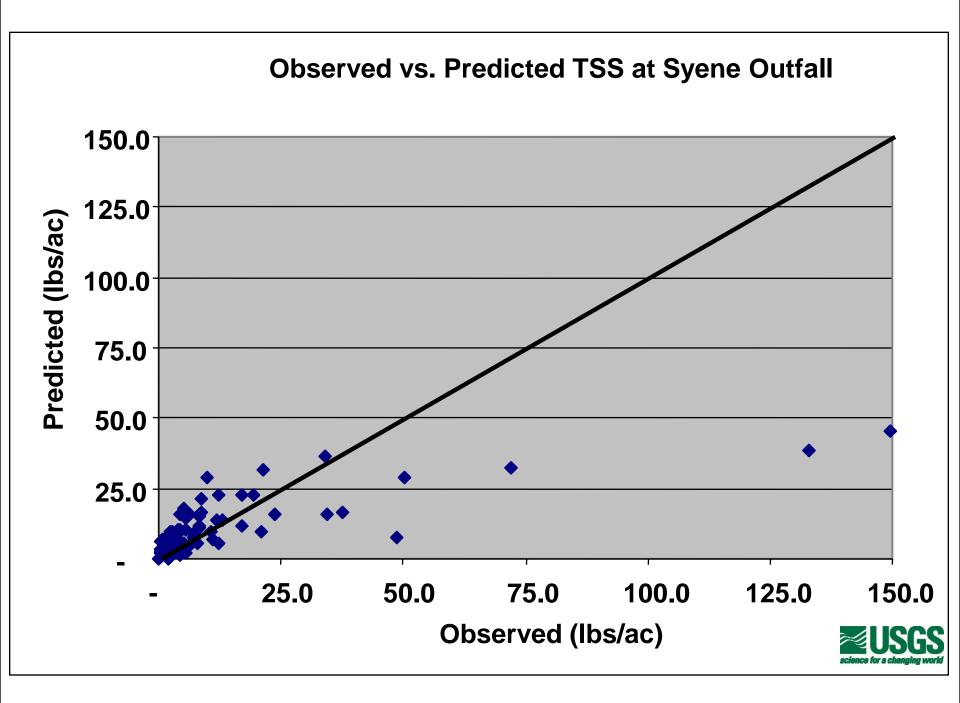
- Dissolved Phosphorus
- Dissolved Lead
- Dissolved Zinc
- > Dissolved Copper

TSS Concentrations Used in SLAMM

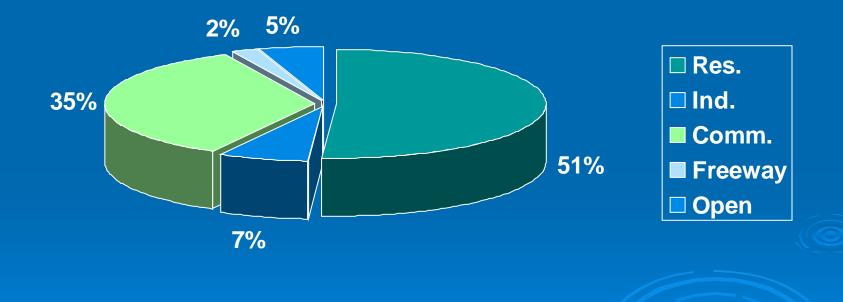


Observed vs. Predicted TSS at Maintenance Yard Outfall

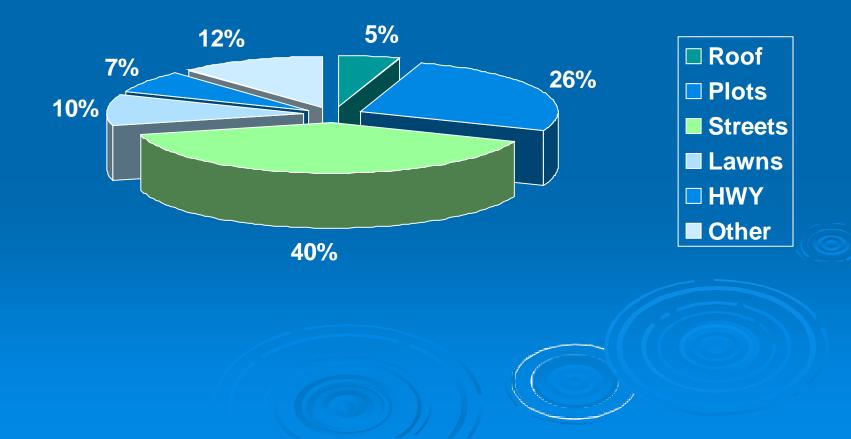




% Suspended Solids Load by Landuse for 4 Subwatersheds



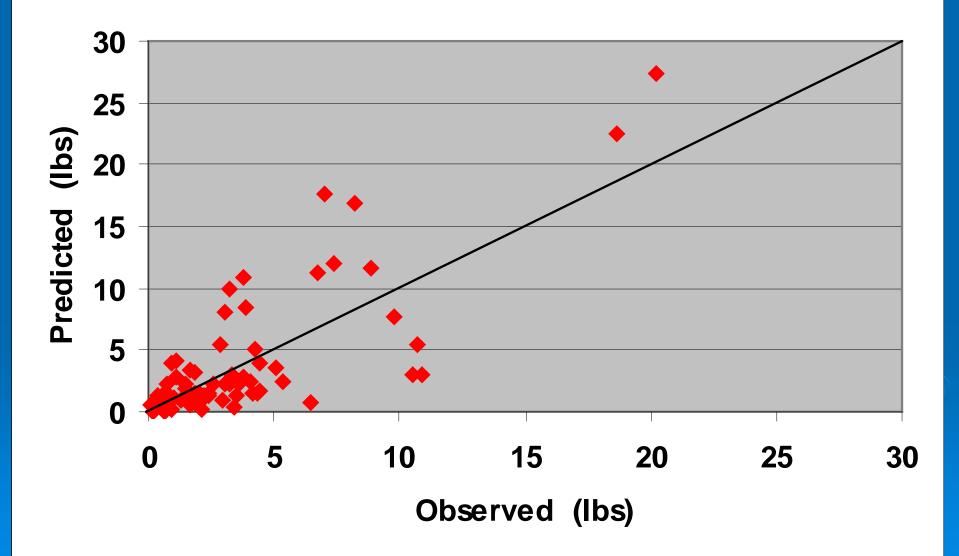
% Suspended Solids Loads from Source Areas in 4 Subwatersheds



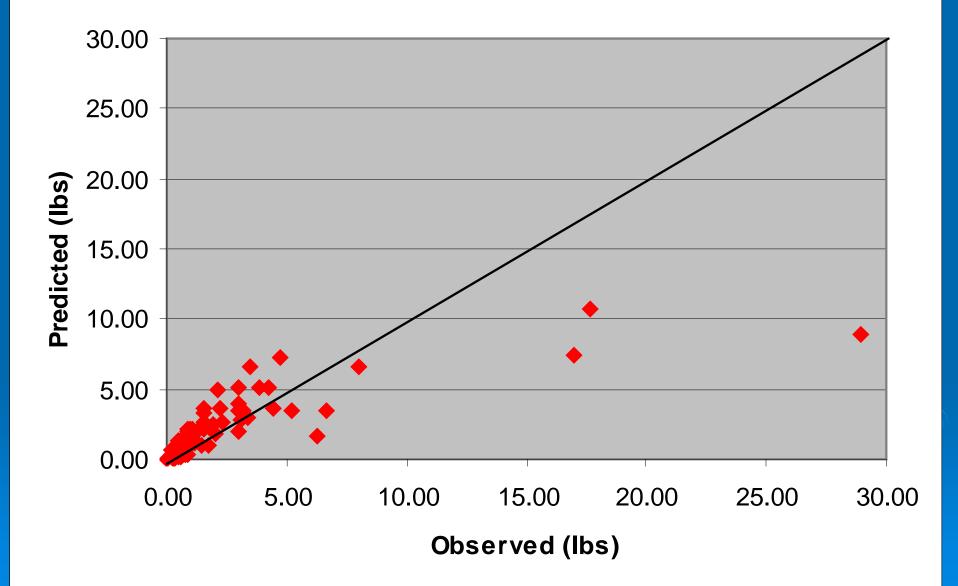
Residential Particulate P Values Used in SLAMM - .ppd



Observed vs. predicted total phosphorus Monroe St. Outfall



Observed vs. predicted total phosphorus Syene Outfall



These concepts are incorporated into SLAMM

Soil Type Runoff Landuse Area Volume and **SLAMM** Pollutant Rainfall Load **Development Characteristics Control Practices**

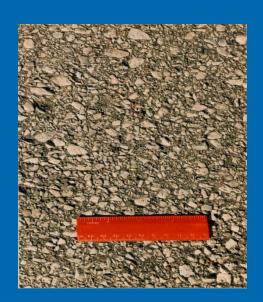
Development Characteristics for Each Source Area

<u>Roofs</u>

Area
% Connected
Pitched or not
Paved Parking

> Area

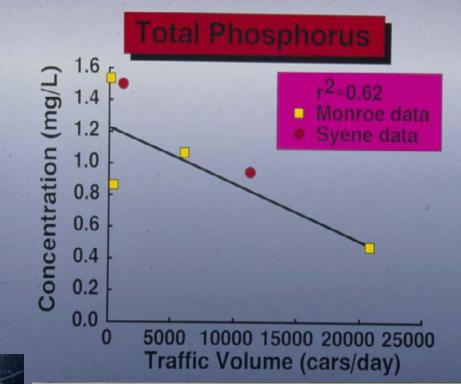
- % Connected Driveways
- > Area
- > % Connected

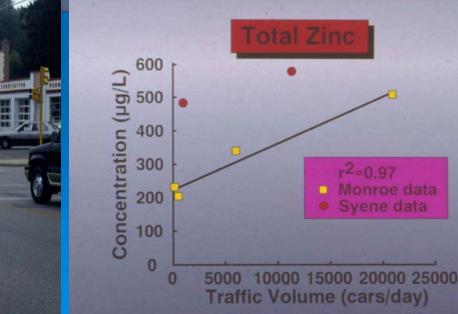


Streets

- Length
- Pavement Texture
- > Area
- > Alleys
- Small Landscape
- > Area
- Soil type

Impact of Traffic Volume on Street Runoff Concentrations





Model Limitations

- No snowmelt or baseflow conditions
- Does not consider in-stream processes (but links into receiving water models)
- Has complete routing analyses only for controls and components where hydrograph effects are important
- Does not model construction site erosion losses
- Not intended for design storm or rural analysis

These concepts are incorporated into SLAMM

Soil Type Runoff Landuse Area Volume and **SLAMM** Pollutant Rainfall Load Development Characteristics **Control Practices**

Treatment Practices

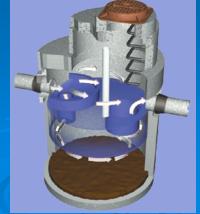






Hydrodynamic Devices > Catchbasin Cleaning
 Wet Detention > Grass Swales
 Porous Pavement > Biofiltration/Infiltration
 Street Cleaning > Other Device







Evapotranspiration

11

Datalogger

Soil Moisture

Volume In

2

Pond Depth

8 T

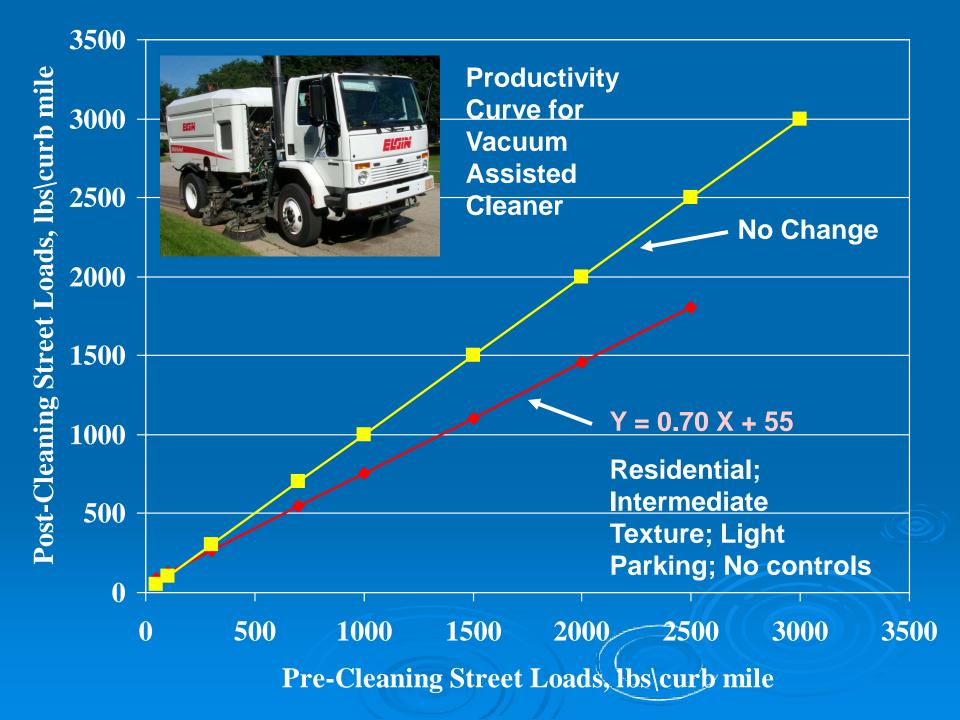
Volume Out

11/3/2003

Comparison of Measured and Modeled TSS Reductions

	Measured TSS Reductions	SLAMM / DETPOND Estimates with Measured PSD and Rainfall
Stormceptor	5%	12%
Vortechs	19%	-19%

Monroe St. Detention Pond



Inputs to WinSLAMM for Biofiltration analysis

Adam St. Inlets to Rain Gardens

Biofiltration Control Device					
Land Use: Residential	To	tal Area: 5 acres	Source Areas from Land	Use that Contribute Runo	ff to Biofiltration Control Device(s)
Source Area: Roofs 1	Bio	ofilter Number 1			
Device Propertie	\$		Rooftop 1 Rooftop 2	Playground 1 Playground 2	🔲 Large Landscaped Area 1
Top Area (sf)					developed Area
Bottom Area (sf)		Add Outlet/ Biofilf	ration Devi	ce(s)	all Landscaped Area 1
Total Depth (ft)		- Outlet/Disch			all Landscaped Area 2
Typical Width (ft) (Cost est. only)	10.00	C 1. Sharp Cre physic	cal characte	eristics	all Landscaped Area 3
Native Soil Infiltration Rate (in/hr)		C 2. Broad Cre			ner Pervious Area
Native Soil Infiltration Rate COV	N/A	C 3. Vertical Stand Pipe	Paved Parking/Storag		🔲 Other Dir Cnotd Imp Area
Infil. Rate Fraction-Bottom (0-1)	1.00	C 4. Evaporation	Unpaved Prkng/Stora		🔲 Other Part Cnotd Imp Area
Infil. Rate Fraction-Sides (0-1)	1.00	C 5. Rain Barrel/Cistern	🔲 Unpaved Prkng/Stora	ge 2 🛛 🔲 Street Area 3	
Rock Filled Depth (ft)		C 6. Underdrain Outlet			
Rock Fill Void Ratio (0-1)			Ine	values wil	l appear
Engineered Soil Type	-				
Engineered Soil Infiltration Rate (in/hr)		Edit Existing Outlet	in ti	he diagram	
Engineered Soil Depth (ft)		Selected Outlets			
Engineered Soil Void Ratio (0-1)					
Percent solids reduction due to Engineered Soil (0 -100)				Biofilter Geometry Sch	ematic
Inflow Hydrograph Peak to Average Flow Ratio	3.80				
Number of Devices in Source Area or Land Use	1	Change Geometry			
Copy Biofilter Data	Paste Biofilter D	Pata Route Through			
Select Native Soil Infiltration	n Rate Clay Ioam - 0.1 in/hi Silty clay Ioam - 0.05 Sandy clay - 0.05 in Silty clay - 0.04 in/h Clay - 0.02 in/hr Rain Barrel/Cistern	To in/hr /hr //hr //hr //hr //hr //hr //hr /			
Size File			Refresh Schematic	Delete	e Cancel <u>C</u> ontinue

Land Use: Residential Source Area: Roofs 1		ital Area: 5 acres ofilter Number 1	Source Areas from Land Use that Contribu	ute Runoff to Biofiltration Control Device(s)
Device Propertie			Rooftop 1 Playgrou Rooftop 2 Playgrou	
Top Area (sf) Bottom Area (sf) Total Depth (ft) Typical Width (ft) (Cost est. only) Native Soil Infiltration Rate (in/hr) Native Soil Infiltration Rate COV Infil. Rate Fraction-Bottom (0-1) Infil. Rate Fraction-Sides (0-1) Rock Filled Depth (ft) Rock Filled Depth (ft) Engineered Soil Type Engineered Soil Type Engineered Soil Depth (ft) Engineered Soil Depth (ft) Engineered Soil Depth (ft)	10.00 N/A 1.00 1.00	Add Outlet/ Discharge Outlet/Discharge Options 1. Sharp Crested Weir 2. Broad Crested Weir 3. Vertical Stand Pipe 4. Evaporation 5. Rain Barrel/Cistem 6. Underdrain Outlet Edit Existing Outlet Selected Outlets	Rooftop 3 Driveway Rooftop 4 Driveway Rooftop 5 Driveway Paved Parking/Storage 1 Sidewalk Paved Parking/Storage 2 Sidewalk Paved Parking/Storage 3 Street Ar Unpaved Prkng/Storage 1 Street Ar Unpaved Prkng/Storage 2 Street Ar Paved Land and Shoulder Paved Land and Shoulder Paved Land and Shoulder Paved Land and Shoulder Paved Land and Shoulder Paved Land and Shoulder	ys 2 Small Landscaped Area 1 ys 3 Small Landscaped Area 2 (s/Walks 1 Small Landscaped Area 3 (s/Walks 2 Other Pervious Area rea 1 Other Dir Chotd Imp Area rea 2 Other Part Chotd Imp Area rea 3 1 Large Turf Areas 2 Undeveloped Areas 3 Other Pervious Areas 4 Other Directly Conotd Imp
Percent solids reduction due to Engineered Soil (0 -100)			Biofilter Geom	netry Schematic
Inflow Hydrograph Peak to Average Flow Ratio	3.80			
Number of Devices in Source Area or Land Use	1	Change Geometry		
Copy Biofilter Data	Paste Biofilter D	Route Through		
Select Native Soil Infiltration Sand - 8 in/hr C Loamy sand - 2.5 in/hr C Sandy Ioam - 1.0 in/hr C Loam - 0.5 in/hr C Silt Ioam - 0.3 in/hr C Sandy silt Ioam - 0.2 in/hr C Select Particle Size File	n Rate Clay Ioam - 0.1 in/hi Silty clay Ioam - 0.05 Sandy clay - 0.05 in Silty clay - 0.04 in/h Clay - 0.02 in/hr Rain Barrel/Cistern	5 in/hr Use Random Numbe Genera Accept	nknown, select the epage Rate from th ues	

Land Use: Outfall Biofilter Number 1		Source Areas from Land Use that Co	ontribute Runoff to	Biofiltration Control Device(s)	
		ofilter Number 1			Large Landscaped Area 1
Device Propertie				ayground 2	
Top Area (sf)	500	Add Outlet/ Discharge			Undeveloped Area
Bottom Area (sf)	400				Small Landscaped Area 1
Total Depth (ft)	5.00	Outlet/Discharge Options			Small Landscaped Area 2
Typical Width (ft) (Cost est. only)	10.00	C 1. Sharp Crested Weir			Small Landscaped Area 3 Other Pervious Area
Native Soil Infiltration Rate (in/hr)	0.02	C 2. Broad Crested Weir			
Native Soil Infiltration Rate COV	N/A	C 3. Vertical Stand Pipe			Other Dir Cnotd Imp Area
Infil. Rate Fraction-Bottom (0-1)	1.00	C 4. Evaporation		reet Area 2 🛛 📔	Other Part Cnotd Imp Area
Infil. Rate Fraction-Sides (0-1)	1.00	C 5. Rain Barrel/Cistern			Leves Test Areas
Rock Filled Depth (ft)	1.00	C 6. Underdrain Outlet	Paved Land and Sho Paved Land and Sho		Large Turf Areas
Rock Fill Void Ratio (0-1)	0.30				Undeveloped Areas
Engineered Soil Type	Fine Filter Sand 💌		Paved Land and Sho		Other Pervious Areas
Engineered Soil Infiltration Rate (in/hr)	1.00	Edit Existing Outlet	Paved Land and Sho Paved Land and Sho	-	Other Directly Conctd Imp Other Partially Conctd Imp
Engineered Soil Depth (ft)	3	Selected Outlets			
Engineered Soil Void Ratio (0-1)	0.30		Fraction of Runoff from Outfall R	louted to Uutfall Biohite	ers (U - 1)
Percent solids reduction due to Engineered Soil (0 -100)	N/A		Biofilter 6	Geometry Schema	tic
Inflow Hydrograph Peak to Average Flow Ratio	3.80		Fa	D.00' -	
Select Native Soil Infiltratio		/hr Use Random Number Generation to Account for	5.00' 3.00'	op of Engineered Soil Top of Rock Fill	
Select Particle Size File	iles\WinSLAMM\NUF	IP.CPZ	Refresh Schematic	<u>D</u> elete	Cancel <u>C</u> ontinue

Land Use: Outfall			Source Areas from Land Use that Contribute Runoff to Biofiltration Control Device(s)		
	Biofilter Number 1			Plauground 1	Large Landscaped Area 1
Device Propertie	es		Enter the	outlet stru	
Top Area (sf)	500	Add Outlet/ Discharge		oullet stit	
Bottom Area (sf)	400		informatio	n	aped Area 1
Total Depth (ft)	5.00	Outlet/Discharge Options	intornatio		aped Area 2
Typical Width (ft) (Cost est. only)	10.00	C 1. Sharp Crested Weir	Payed Parking/Storage 1		Onlar Condecaped Area 3
Native Soil Infiltration Rate (in/hr)	0.02	C 2. Broad Crested Weir	Paved Parking/Storage 2	Sidewalks/Walks 2	Dther Pervious Area
Native Soil Infiltration Rate COV	N/A	C 3. Vertical Stand Pipe	Paved Parking/Storage 3	Street Area 1	Dither Dir Crictid Imp Area
Infil. Rate Fraction-Bottom (0-1)	1.00	C 4. Evaporation	Unpaved Prkng/Storage 1 Unpaved Prkng/Storage 2	Street Area 2	🔲 Other Part Cnotd Imp Area
Infil. Rate Fraction-Sides (0-1)	1.00	C 5. Rain Barrel/Cistern			
Rock Filled Depth (ft)	1.00	C 6. Underdrain Outlet		id and Shoulder 1	Large Turf Areas
Rock Fill Void Ratio (0-1)	0.30			id and Shoulder 2	Undeveloped Areas
Engineered Soil Type	Fine Filter Sand 💌			id and Shoulder 3	C Other Pervious Areas
Engineered Soil Infiltration Rate (in/hr)	1.00	Edit E <u>x</u> isting Outlet		id and Shoulder 4 id and Shoulder 5	 Other Directly Conctd Imp Other Partially Conctd Imp
Engineered Soil Depth (ft)	3	Selected Outlets			
Engineered Soil Void Ratio (0-1)	0.30	1 - Underdrain Outlet	Fraction of Runoff from	n Outfall Routed to Outfall Bi	ohiters (U - 1)
Percent solids reduction due to Engineered Soil (0 -100)	N/A	2 - Broad Crested Weir		Biofilter Geometry Sche	ematic
Inflow Hydrograph Peak to Average Flow Ratio	3.80			-10.00' -	
Data descri structures v reflected in Sandy Ioam - 1.0 in/hr Sandy Ioam - 0.3 in/hr Silt Ioam - 0.3 in/hr Sandy silt Ioam - 0.2 in/hr	will also	be ematic. /hr 0.00 in/hr	5.00' 4.50' 3.00'	Top of Engineered S	
Size File			Refresh Schematic	<u>D</u> elete	Cancel <u>C</u> ontinue

Land Use: Outfall Biofilter Number 1		Source Areas from Land Use t	hat Contribute Runoff	to Biofiltration Control Device(s	
Device Properties	Device Properties			 Playground 1 Playground 2 	Large Landscaped Area 1
Top Area (sf)	500	Add Outlet/ Discharge	Rooftop 3	Driveways 1	Undeveloped Area
Bottom Area (sf)	400		Rooftop 4	Driveways 2	Small Landscaped Area 1
Total Depth (ft)	5.00	Outlet/Discharge Options	Rooftop 5	Driveways 3	Small Landscaped Area 2
Typical Width (ft) (Cost est. only)	10.00	C 1. Sharp Crested Weir	Paved Parking/Storage 1	Sidewalks/Walks 1 Sidewalks/Walks 2	Small Landscaped Area 3
Native Soil Infiltration Rate (in/hr)	0.02	C 2. Broad Crested Weir	Paved Parking/Storage 2	Street Area 1	Other Pervious Area
Native Soil Infiltration Rate COV	N/A	C 3. Vertical Stand Pipe	Paved Parking/Storage 3	Street Area 2	Other Dir Cnotd Imp Area
Infil. Rate Fraction-Bottom (0-1)	1.00	C 4. Evaporation	Unpaved Prkng/Storage 1	Street Area 2	Other Part Crictid Imp Area
Infil. Rate Fraction-Sides (0-1)	1.00	C 5. Rain Barrel/Cistern	Paved Land a	-	Large Turf Areas
Rock Filled Depth (ft)	1.00	🔿 6. Underdrain Outlet		and Shoulder 1 and Shoulder 2	
Rock Fill Void Ratio (0-1)	0.30				Undeveloped Areas
3	Fine Filter Sand 💌			and Shoulder 3	Conter Pervious Areas
Engineered Soil Infiltration Rate (in/hr)	1.00	Edit Existing Outlet	Paved Land a	and Shoulder 4 and Shoulder 5	 Other Directly Conctd Imp Other Partially Conctd Imp
Engineered Soil Depth (ft)	3	Selected Outlets			(h) (h) (h)
Engineered Soil Void Ratio (0-1)	0.30	1 - Underdrain Outlet	1 Fraction of Runoff from U	or all Routed to Outfall Bi	ohiters (U - 1)
Percent solids reduction due to Engineered Soil (0 -100)	N/A	2 - Broad Crested Weir	Bio	of Iter Geometry Sche	matic
Inflow Hydrograph Peak to Average Flow Ratio	3.80			-10.00' -	
Number of Devices in Source Area or Land Use	5	Change Geometry			
Copy Biofilter Data	Paste Biofilter D	ata I		+	<u> </u>
- Select Native Soil Infiltration	Rate	If the Biofiltra	tion Device is	s entered	at the Land
⊂ Sand-8in/hr ⊂	Clay loam - 0.1 in				
	Silty clay loam - C	Use, the abov	e area will ha	ve Sourc	e Areas
	Sandu clau - 0.05				
C Loam 0.5 in/hr C	Silty clay - 0.04 in	hiahliahted th	hat can be sel	ected if tl	nev are
	Clay - 0.02 in/hr				
○ Sandy silt loam - 0.2 in/hr ○	Rain Barrel/Ciste	draining to th	e Biofiltration	Device.	
CAD a second Fil		ID CD7		0.50	
Size File	es\WinSLAMM\NUR	IF.UF2	Refresh Schematic	<u>D</u> elete	Cancel <u>C</u> ontinue

Land Use: Residential Source Area: Roofs 1	Total Area: 5 acres Biofilter Number 1	Source Areas from Land Use	that Contribute Runoff	to Biofiltration Control Device(s)
	Biofilter Number 1	Rooftop 1	Playground 1	🔲 Large Landscaped Area 1
Device Properties		Rooftop 2	Playground 2	
Top Area (sf)	<u>A</u> dd Outlet/ Discharge	Rooftop 3	Driveways 1	Undeveloped Area Small Landscaped Area 1
Bottom Area (sf)		Rooftop 4	Driveways 2 Driveways 3	Small Landscaped Area 1
Total Depth (ft)	Outlet/Discharge Options	Paved Parking/Storage 1	Sidewalks/Walks 1	Small Landscaped Area 3
Typical Width (ft) (Cost est. only)	10.00 C 1. Sharp Crested Weir	Paved Parking/Storage 2	Sidewalks/Walks 2	Other Pervious Area
Native Soil Infiltration Rate (in/hr) Native Soil Infiltration Rate COV N/			Área 1	Other Dir Croctd Imp Area
Native Soil Infiltration Rate COV N/. Infil. Rate Fraction-Bottom (0-1)	In version 9.4.0), the model v	VII Area 2	Other Part Cnotd Imp Area
Infil. Bate Fraction-Sides (0-1)			Area 3	
Rock Filled Depth (ft)	route the hydro	ograph and	er 1	Large Turf Areas
Rock Fill Void Ratio (0-1)		· ·	er 2	Undeveloped Areas
Engineered Soil Type	particle size di	stribution fro	ma er 3	Other Pervious Areas
Engineered Soil Infiltration Bate			er 4	Other Directly Conctd Imp
(in/hr)	wet detention	nond to a	er 5	Other Partially Conctd Imp
Engineered Soil Depth (ft)				
Engineered Soil Void Ratio (0-1)	biofilter. This	routing can o	nlv	
Percent solids reduction due to				
Engineered Soil (0 -100)	be done at the	Outfall in	metry Sche	matic
Inflow Hydrograph Peak to Average Flow Ratio	be defie at the	Carran III		
Number of Devices in Source	version 9.4.0.			
Area or Land Use				
Copy Biofilter Data Paste	e Biofilter Data Route Through	Select "R	oute Thro	ugh Wet
Select Native Soil Infiltration Rate	Wet Detention Pond First	Detention	Pond Fir	C 4 77
🔿 Sand - 8 in/hr 💦 🔿 Clay Ioam	- 0.1 in/hr	Detention		SL
C Loamy sand - 2.5 in/hr C Silty clay	loam - 0.05 in/hr			
	ay-0.05 in/hr Use Random Number			
	- 0.04 in/hr 🛛 🚽 Generation to			
Silt Ioam - 0.3 in/hr Clay - 0.0				
Sandy silt loam - 0.2 in/hr O Rain Barr	el/Cistern - 0.00 in/hr Infiltration Rate Uncertainty			
	Oncertainty			
Select Particle Size File		Refresh Schematic	<u>D</u> elete	Cancel <u>C</u> ontinue

Upcoming Features Sneak Peak

Evapotranspiration
Cisterns
Filter Strips
Green Roofs
Version 10



Edgewood College Bioretention Systems - Evapotranspiration

Evapotranspiration

> Added as outlet for Biofiltration/Infiltration Devices

Currently undergoing testing through the USGS, WDNR, and City of Madison
 Will be available in

version 9.4.1 or 10.0



Monteverde Cloud Forest, Costa Rica

Cisterns

Cistern Control Device

Land Use: Institutional Source Area: Paved Parking/Storage 3

Device Properties

Cistern Area (sf)	
Cistern Depth (ft)	
Rock Filled Depth (ft)	
Rock Fill Porosity (0-1)	
Inflow Hydrograph Peak to Average Flow Ratio	
Number of Devices in Source Area or Land Use	

Copy Cistern Data

Paste Cistern Data

Total Area: 3 acres Cistern Number = 1

Water Use Rate

Month	Water Use Rate (gal/day)
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

Cancel

<u>D</u>elete

<u>C</u>ontinue



Grass Filter Strips

Filter Strip Control Device

Land Use: Commercial Source Area: Roofs 3

Device Properties

Total Area in Source Area (ac)	
Area Served by Filter Strips (ac)	
Total Filter Strip Length (ft)	
Effective Width (ft)	
Native Soil Infiltration Rate (in/hr)	
Native Soil Infiltration Rate COV	
Typical Longitudinal Slope (0-1)	
Typical Grass Height (in)	
Grass Retardance Factor	-
Rock Fill Porosity (0-1)	
Grass Retardance Factor	
Number of Devices in Source Area or Land Use	

Select Particle Size File

С

Cancel

Select Native Soil Infiltration Rate

0	Sand - 8 in	n/hr
---	-------------	------

- Loamy sand 2.5 in/hr
- Sandy loam 1.0 in/hr
- Loam 0.5 in/hr
- Silt loam 0.3 in/hr
- Sandy silt loam 0.2 in/hr
 - Copy Filter Strip Data

Delete

Paste Filter Strip Data

Continue

Clay loam - 0.1 in/hr

Clay - 0.02 in/hr

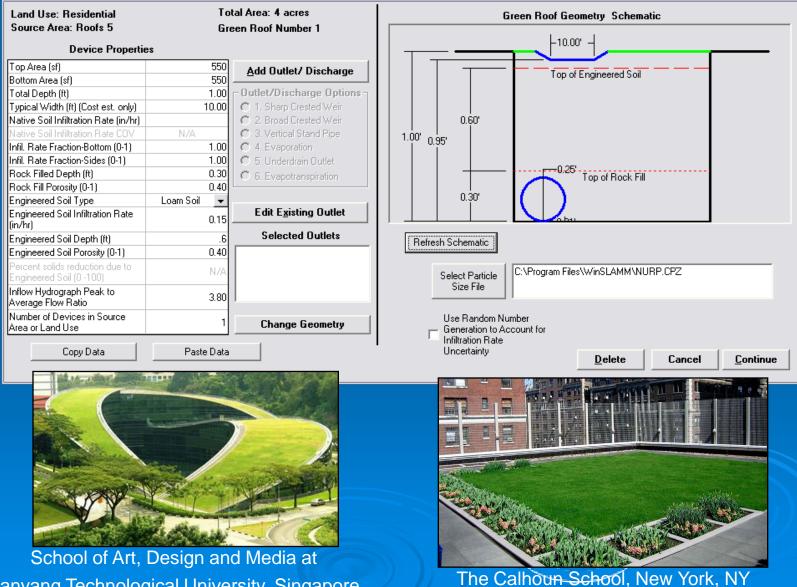
Silty clay loam - 0.05 in/hr Sandy clay - 0.05 in/hr Silty clay - 0.04 in/hr Rain Barrel/Cistern - 0.00 in/hr



Ledgebrook Lane in Southbury, CT

Green Roofs

Green Roof Control Device



Nanyang Technological University, Singapore

Version 10

	inSLAMM - [Land l		-				_ 7 ×
	e Pollutants Tools	(I		<u> </u>			
RESI	NS 9991 IND DUI		G -	- 🔁 '	₩I		
Land Us	se:						
Indust	rial 1						
Source		Area	Control	Source	-		
Area #		(acres)	Practice	Area			
	Roofs	12.300	0	Parameters	5	Institutional 1	
1	Roofs 1		•		-	Besidential 1	
2	Roofs 2	12.300	DHD 👻	Entered	-	RES	
3	Roofs 3		-				
4	Roofs 4		-		- 1	Junction 1	
5	Roofs 5		•		-	T T	
6	Roofs 6 Roofs 7		• •		-	Residential 2	
8	Roofs 8				-	Swale 1	
9	Roofs 9						
10	Roofs 10		-		-		
11	Roofs 11		-			Junction 2	
12	Roofs 12		-				
	Parking	2.200			_		
	Paved Parking 1		-		_	Industrial 1 1 Wet Pond 1	
14	Paved Parking 2	2.200		E 1 1	-	TND Wet Fond T	
	Paved Parking 3 Paved Parking 4	2.200	0 •	Entered	-		
17	Paved Parking 5		• •		-	distinction 3	
18	Paved Parking 6		-		-		
19	Unpaved Parking 1		-		-	Biofilter 1	
20	Unpaved Parking 2		-			Biotite 1	
21	Unpaved Parking 3		-			4	
22	Unpaved Parking 4		-		_	Junction 4	
	Unpaved Parking 5		-		-	1	
24	Unpaved Parking 6 Driveways/Sidew	valks 0.000	•		-		
25	Driveways 1				-		
26	Driveways 2		-		-	Outfall 1	
Land	Lendlin T	1		Land Use	•		
Use #	Land Use Type	Land Use L	abel	Area (acres)			
1	Residential	Residential 1		8.70	D		
		Residential 2		14.200	ō		
		Institutional 1		101.50			
		Industrial 1		14.500			
5	Freeway	Freeway 1		0.000	<u>U</u>		
					Ŧ		
CP #	Control Practice T		trol Practic	e Name	-		
	Wet Pond	Wet Pon Biofilter 1			-		
2.	Biofilter						

Questions

Ken B. and Roger B. in Milwaukee ~1981