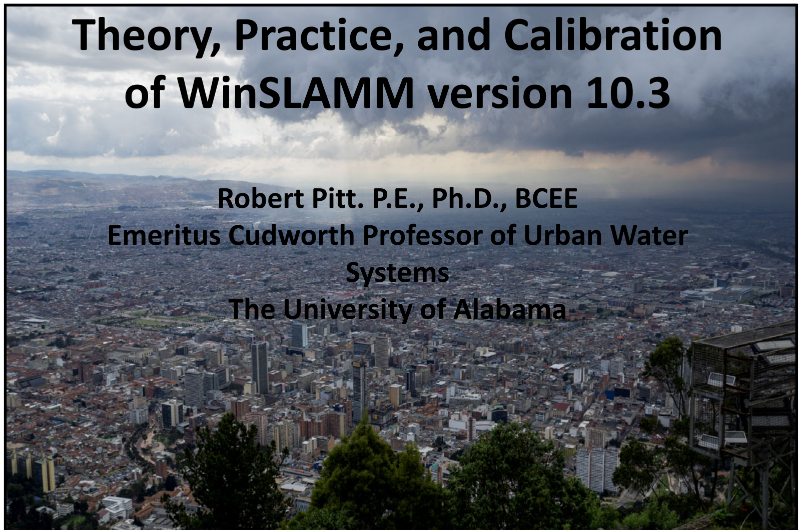


Theory, Practice, and Calibration of WinSLAMM version 10.3

Robert Pitt. P.E., Ph.D., BCEE
Emeritus Cudworth Professor of Urban Water Systems
The University of Alabama

Bogota getting washed… Universidad de los Andes recently completed stormwater planning and demonstrations using WinSLAMM

1

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?

2

Background & History

- **Development Began in mid-1970's**
  - Early EPA street cleaning projects
  - San Jose and Coyote Creek (CA)
  - Castro Valley and other NURP projects
- **Mid-1980's - Model used in Agency Programs:**
  - Ottawa bacteria stormwater management program
  - Toronto Area Watershed Management Strategy
  - Wis. Dept. of Natural Resources: Priority Watershed Program
- **Intensive data collection started in WI in early 1990s.**
- **First Windows version developed in 1995.**
- **Current graphical interface released, after three years of work, in 2012.**
- **Continuously being updated based on user needs and new research results.**

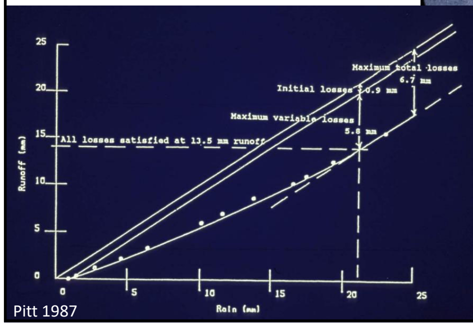
3

Unique Features of WinSLAMM (and why it was developed!)

- WinSLAMM based on actual monitoring results at many scales and conditions.
- Early research project results in the 1970s did not conform to typical stormwater assumptions about rainfall-runoff relationships and sources of pollutants.
- Initial versions of the model therefore focused on site hydrology and particulate sources and transport, and on public works practices.
- Other control practices added as data becomes available.

4

Controlled tests in small areas were used in conjunction with long-term rainfall/runoff monitoring at larger parking lot areas to develop actual hydrological relationships for paved areas, the most significant source of runoff for most urban areas during small to intermediate-sized rains.

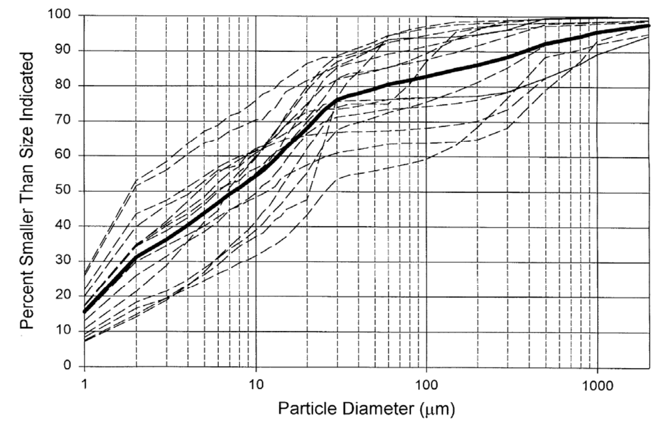


Pitt 1987

This is an example of a rainfall-runoff plot from one of many controlled street washoff and runoff tests. About 1/3 of the rainfall is infiltrated through the street pavement for many of these events (up to 20 mm rains in this plot). No further infiltration was observed for larger events, resulting in classical pavement Rv values of 0.8 to 0.95 for large rains of interest for drainage design.

5

Measured Particle Sizes, Including Bed Load Component, at influent to the Monroe St. Detention Pond, Madison, WI



Very few of the large particles that enter the drainage systems are transported to the outfalls in typical urban drainage systems. Most (about 85% in this typical example) of the outfall particulates discharged are less than 100 µm in size.

6

Mass balance measurements in the drainage system and at the outfall used to determine the fate and transport of the urban particulates. Much of the larger particulates that are not washed off are lost from the paved surfaces by fugitive dust by winds and traffic turbulence.

Measured fugitive dust losses from traffic (San Jose, Pitt 1979)

Keyes, good asphalt	0.33 grams/vehicle-mi
Keyes, oil and screens asphalt	18 grams/vehicle-mi
Tropicana, good asphalt	2.5 grams/vehicle-mi

7

Model Applications

Model Can Be Applied on Multiple Levels –

- Large Scale, City-wide Analysis
- Site Development Analysis (Apartment Complex, Shopping Center, Hospital Complex, Residential Development)
- Analysis of Single Practice

8

Model Applications

Large Scale, City-wide Analysis

Analysis Procedure -

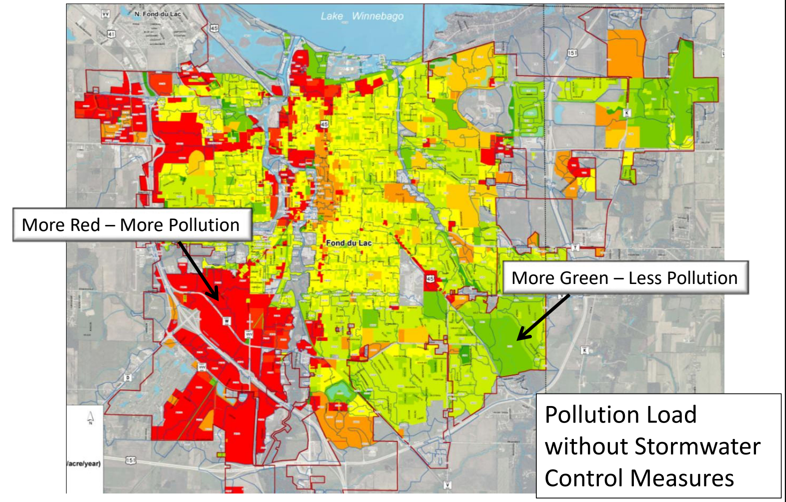
- Inventory drainage basins and land uses
- Evaluate existing pollutant loads and runoff volumes (base condition).
- Adjust base condition with existing stormwater control practices.
- Evaluate additional practices to cost-effectively achieve pollutant reduction goals.

9

9

Model Applications

Large Scale, Regional Analysis



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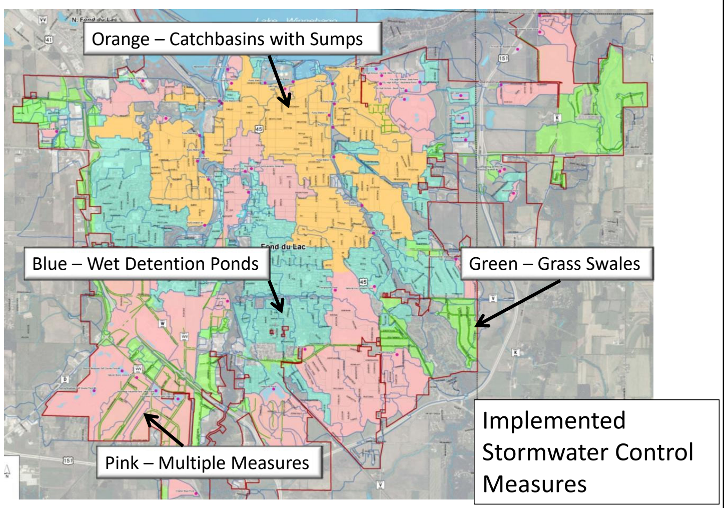
Model Applications

Large Scale, Regional Analysis



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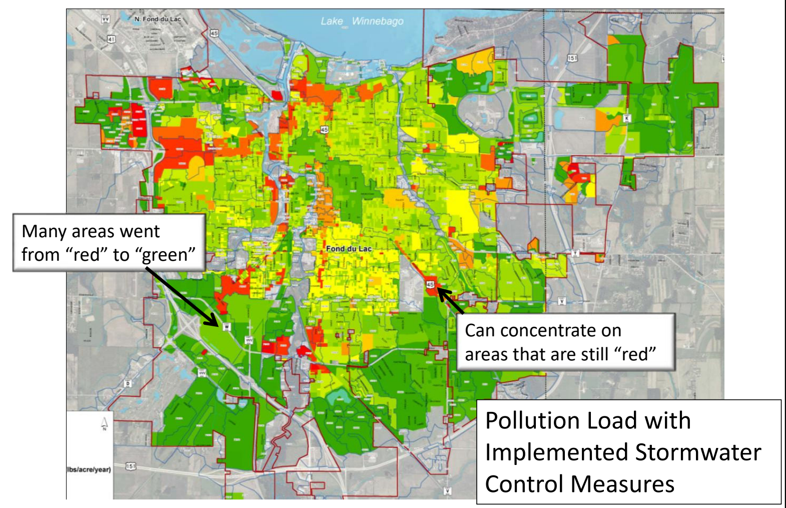
Model Applications

Large Scale, Regional Analysis



12

Model Applications

Site Development Analysis

Analysis Procedure -

- Inventory site characteristics (soil type, percent imperviousness, etc.)
- Locate selected stormwater controls throughout the site
- Determine volume and pollutant reduction achieved with selected stormwater control practices.

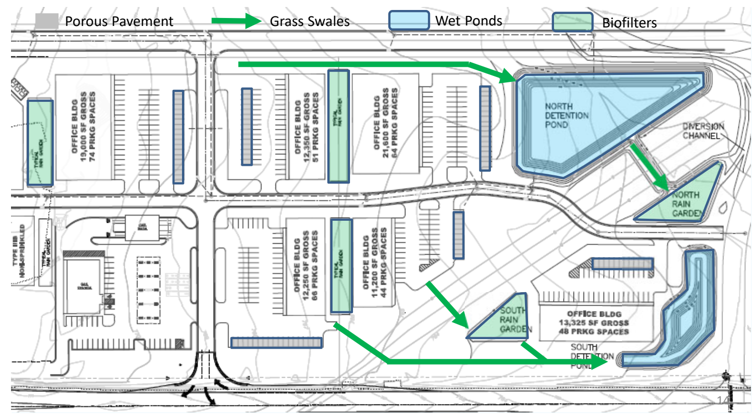
13

13

Model Applications

Site Development Analysis

Enter all the practices for a site and link them to determine the overall runoff and pollutant reductions



14

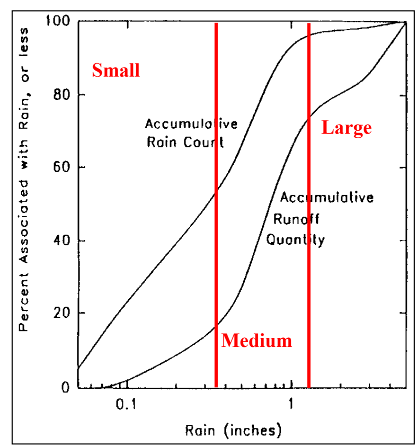
Knowing the Runoff Volume is the Key to Estimating Pollutant Mass

- There is usually a simple relationship between rain depth and runoff depth in urban systems.
- Changes in rain depth affects the relative contributions of runoff and pollutant mass discharges:
  - Directly connected impervious areas contribute most of the flows during relatively small rains
  - Disturbed urban soils may dominate during larger rains

15

15

Monitored Milwaukee Rainfall and Runoff Distributions



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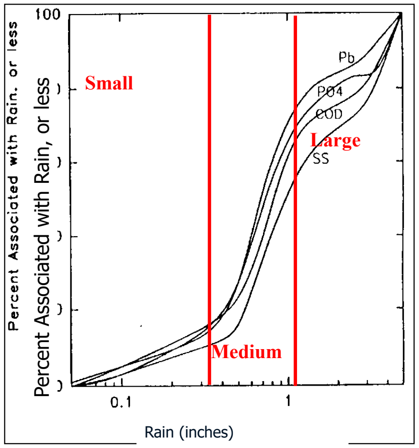
Monitored Milwaukee Pollutant Distribution



17

17

Rainfall Sorts into Three Distinct Categories

- Small Rains – Accounts for most events, by number
  - Typically can be easily captured for infiltration or on-site beneficial uses
  - Relatively low pollutant loadings, but frequent discharges
  - Key rains associated with water quality violations, e.g. bacteria and total recoverable heavy metals
  - "Every" time it rains, some numeric discharge concentration objectives may be exceeded. Therefore, try to eliminate the small events

18

18

Rainfall Sorts into Three Distinct Categories

- Medium Rains – Responsible for most pollutant mass discharges
  - Smaller events in this category can be easily captured and infiltrated or re-used
  - Larger events in this category need to be treated.
  - Typically responsible for about 75% of pollutant discharges

19

19

Rainfall Sorts into Three Distinct Categories

- Large Rains – Infrequent Large Events
  - Not cost effective to treat all runoff
  - Typically cause flooding and significant erosion
  - Treatment practices designed for smaller storms will mitigate impacts of larger events to some extent

20

20

Basic Program Structure

WinSLAMM Calculation Process

Calculate Runoff Volumes and Particulate Loadings for each Source Area

↓

Apply Appropriate Source Area Treatment Practices

↓

Sum Resulting Source Area Outputs

↓

Route Totals to the Drainage System

→

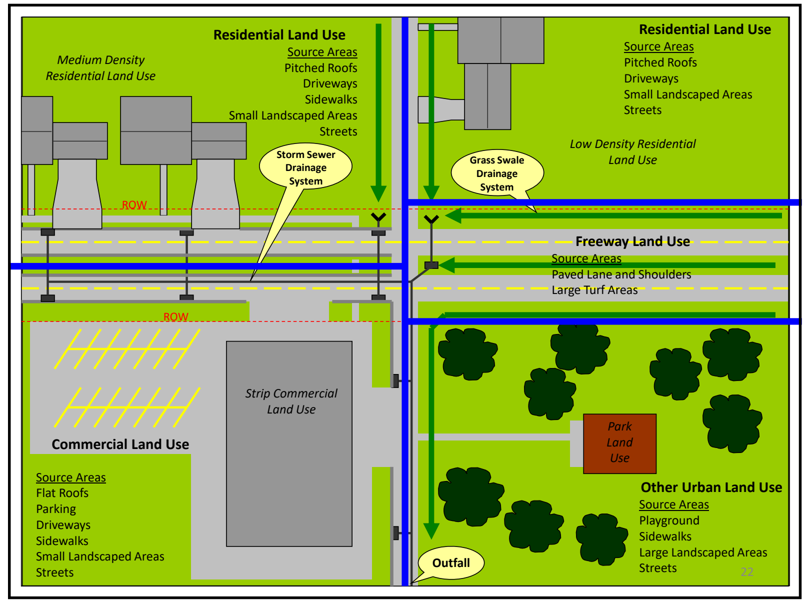
Apply Appropriate Drainage System Treatment Practices

↓

Route Totals to the Outfall for Volume and Pollutant Discharge to Receiving Waters

21

21



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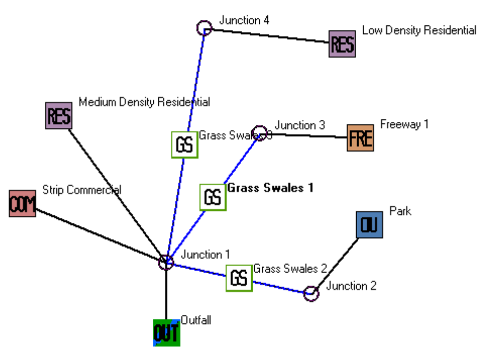
Modeled Drainage System from Previous Slide



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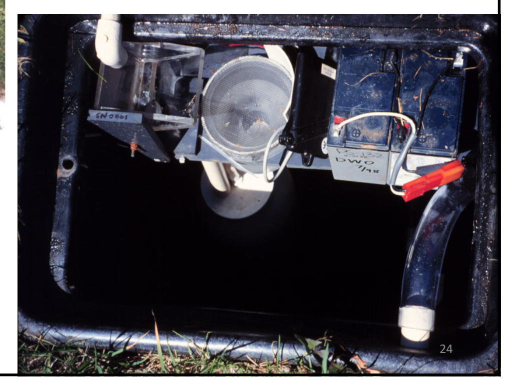
23

Model Strength – Based on Extensive Field Monitoring Data:

- Source Areas – Roofs, Streets, etc.
- End of Pipe – Many Land uses
- Stormwater Control Practices



Lawn Sheet Flow Sampler: Tipping Bucket for Flow and Cone Splitter for Water Sample

24

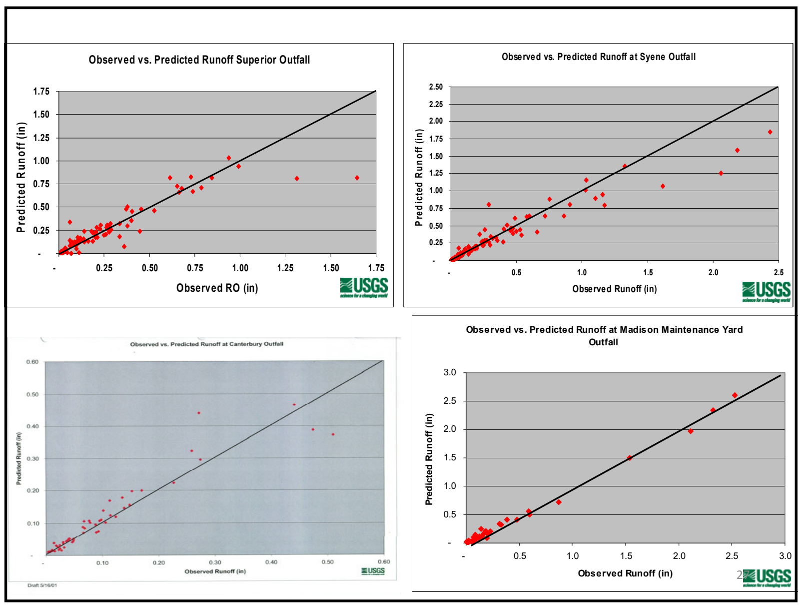
24


End of Pipe
Monitoring :Mass
Balance
25

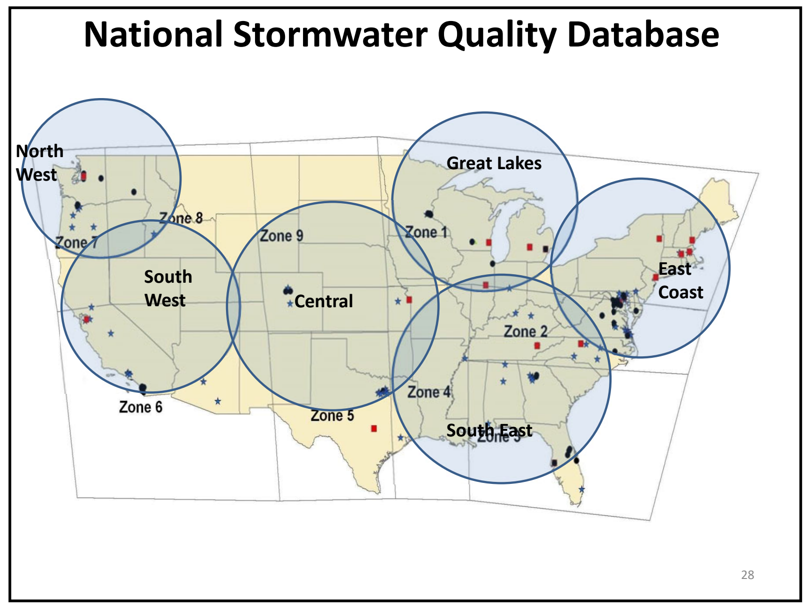
25


Monitored Full-Scale Setup in Tuscaloosa, AL
26

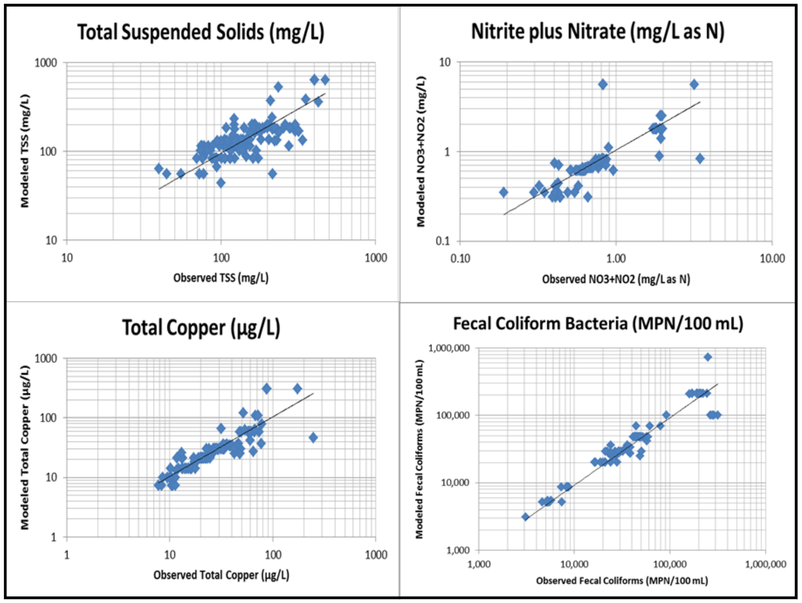
26


Observed vs. Predicted Runoff Superior Outfall
Predicted Runoff (in)
Observed RO (in)
USGS
Observed vs. Predicted Runoff at Syene Outfall
Predicted Runoff (in)
Observed Runoff (in)
USGS
Observed vs. Predicted Runoff at Canterbury Outfall
Observed vs. Predicted Runoff at Madison Maintenance Yard Outfall
Predicted Runoff (in)
Observed Runoff (in)
USGS

27


National Stormwater Quality Database
North West
Great Lakes
Zone 8
Zone 7
Zone 9
Zone 1
South West
Central
East Coast
Zone 2
Zone 6
Zone 5
Zone 4
South East
28

28



29

Stormwater Control Practices Included in WinSLAMM ver 10.3

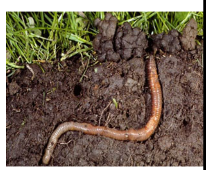
	wet ponds	hydro-dynamic separator	biofilter	cistern	beneficial uses	grass filter strip	disconnect pavement	porous pavement	compacted soil restoration	catch-basin	storm-water filter	upflow filter	grass swale	street cleaning
Roofs	x	x	x	x	x	x	x				x	x	x	
Paved parking/storage	x	x	x	x	x	x	x	x		x	x	x	x	
Unpaved parking/storage	x	x	x	x	x	x	x			x	x	x	x	
Driveways	x	x	x	x	x	x	x	x			x	x	x	
Sidewalks	x	x	x	x	x	x	x	x			x	x	x	
Streets		x	x			x		x		x	x	x	x	x
Large landscaped areas	x	x	x	x	x	x			x				x	
Small landscaped areas	x	x	x	x	x	x			x				x	
Undeveloped areas	x	x	x	x	x	x			x				x	
Paved playgrounds	x	x	x	x	x	x	x	x			x	x	x	
Other impervious areas	x	x	x	x	x	x	x	x		x	x	x	x	
Other non-paved areas	x	x	x	x	x	x	x	x	x	x	x	x	x	
Paved lane/shoulders	x	x	x			x	x	x		x	x	x	x	x
High traffic urban highways	x	x	x			x	x	x		x	x	x	x	x
High traffic urban pervious	x	x	x			x	x	x		x	x	x	x	x
Drainage system	x	x	x			x				x			x	
Outfall	x	x	x											

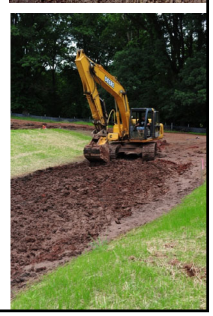
30

Land Development Characteristics: Disconnection of Impervious Areas and Restoration of Compacted Soil in WinSLAMM

Disconnections of Paved Areas and Roofs and Restoring Compacted Soil in WinSLAMM:

- Compacted soil can dramatically decrease infiltration capacity of urban soils; field research results used to quantify effects of different compactions, and how amendments can improve soil characteristics.
- Disconnecting “impervious” areas can decrease runoff volume as shown in field investigations.





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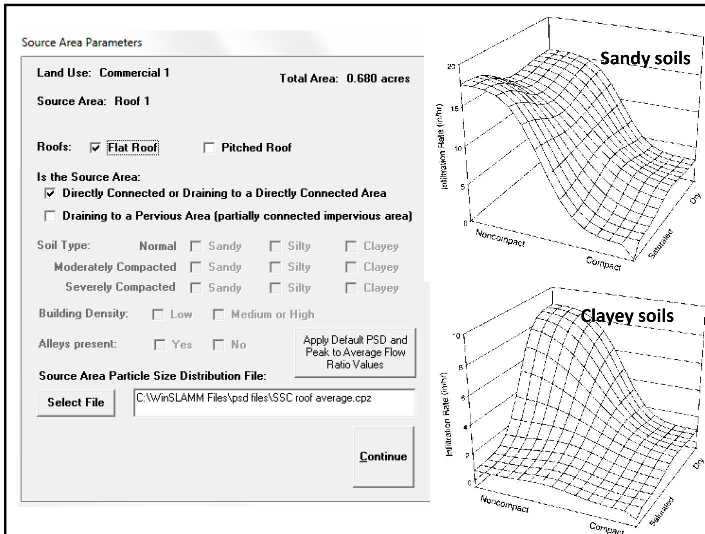

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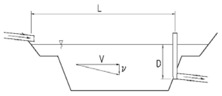
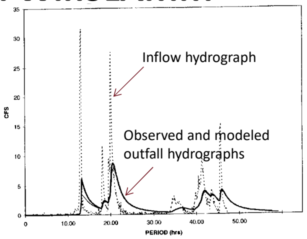
30

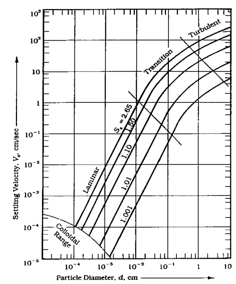
Wet Detention Ponds in WinSLAMM





Main Features of Wet Detention Pond Calculations in WinSLAMM:

- Full hydraulic routing using modified PULS.
- Also uses surface overflow rate (SOR)/upflow velocity to route particle size categories using Stoke's and Newton's settling equations.
- Automatically selects the best routing parameters to maximize program stability.
- Hydraulic and water quality performance verified from many field studies.



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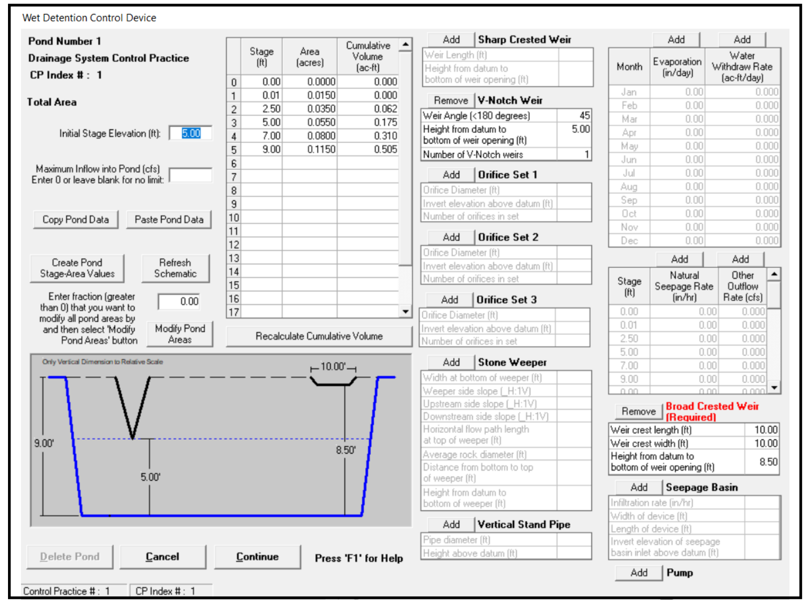
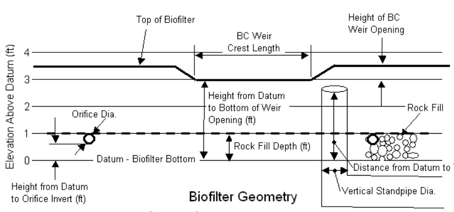
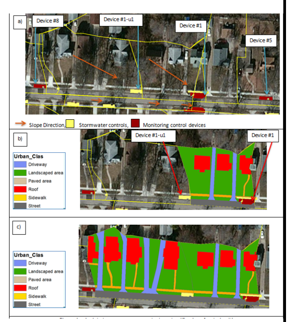


34

Biofilters in WinSLAMM

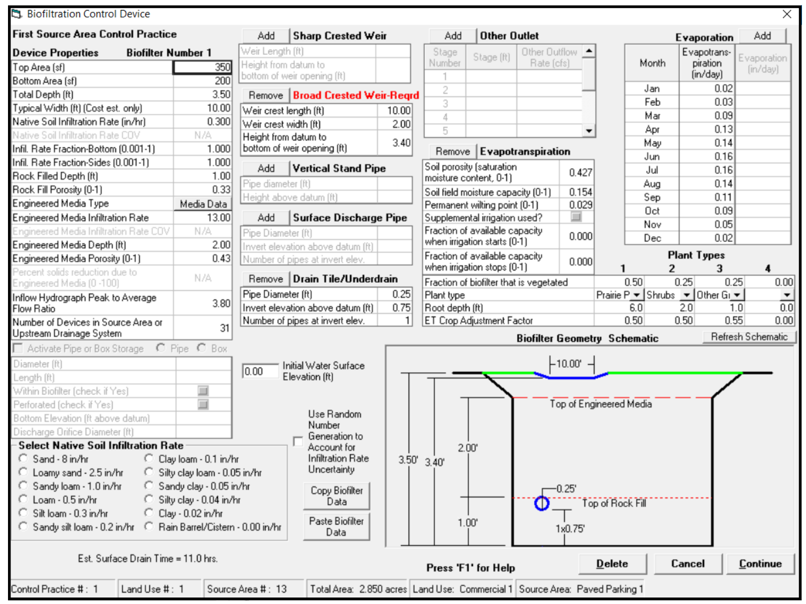




Main Features of Biofilter Calculations in WinSLAMM:

- Full hydraulic routing using modified PULS using total storage components.
- Detailed media performance data (hydraulic and water quality effects(based on lab and field studies.
- Evapotranspiration calculations based on soil and plant selections.
- Hydraulic and water quality performance verified from many field studies at many scales.

35

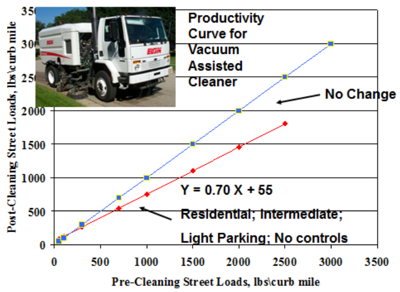


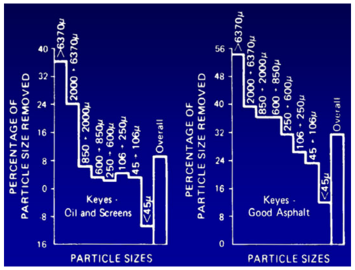
36

Street Cleaning in WinSLAMM

Main Features of Street Cleaning Performance Calculations in WinSLAMM:

- Detailed performance measurements and confirmations available from a very large number of research projects throughout the US.
- Factors affecting street cleaning performance (street texture, parking conditions, equipment type, frequency of cleaning, etc.) are all incorporated in the model.
- Street dirt deposition and accumulation rates, along with washoff, have all been extensively monitored for different particle size categories.





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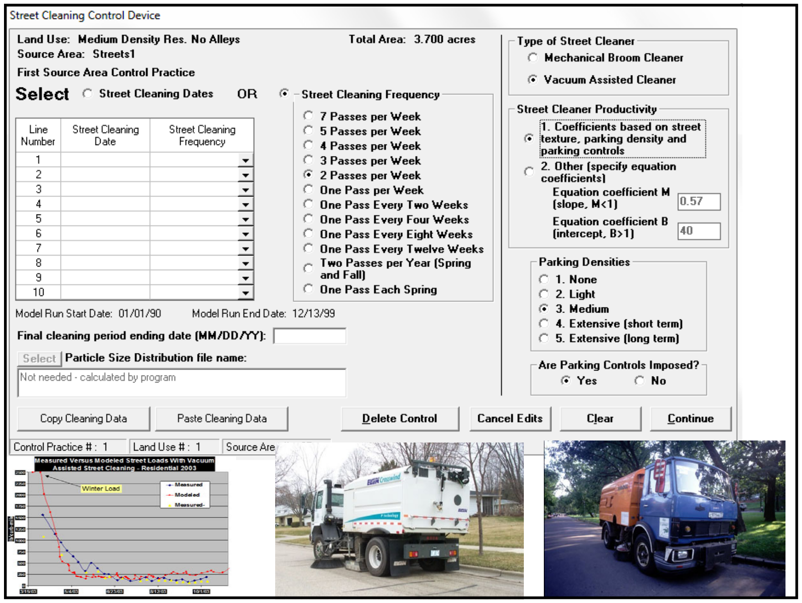
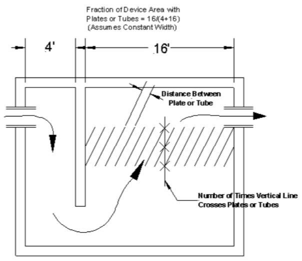


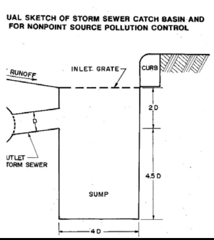
38

Catchbasins and Hydrodynamic Separators in WinSLAMM

Main Features of Catchbasin Cleaning and Hydrodynamic Device Performance Calculations in WinSLAMM:

- Long-term monitoring described performance and removal mechanisms (deposition vs. scour for different geometries and sizes of units).
- Enhanced performance available through lamella plates or inclined tubes.
- Detailed monitoring and CFD modeling to quantify scour.





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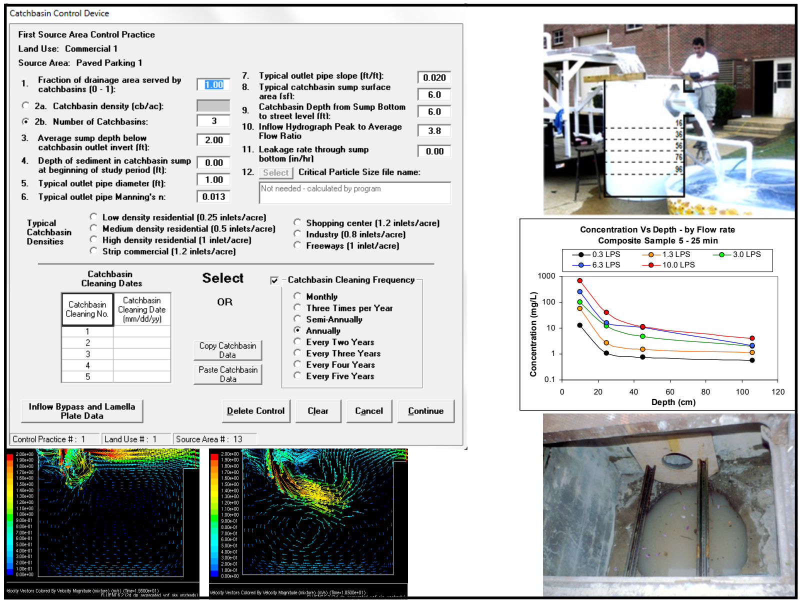

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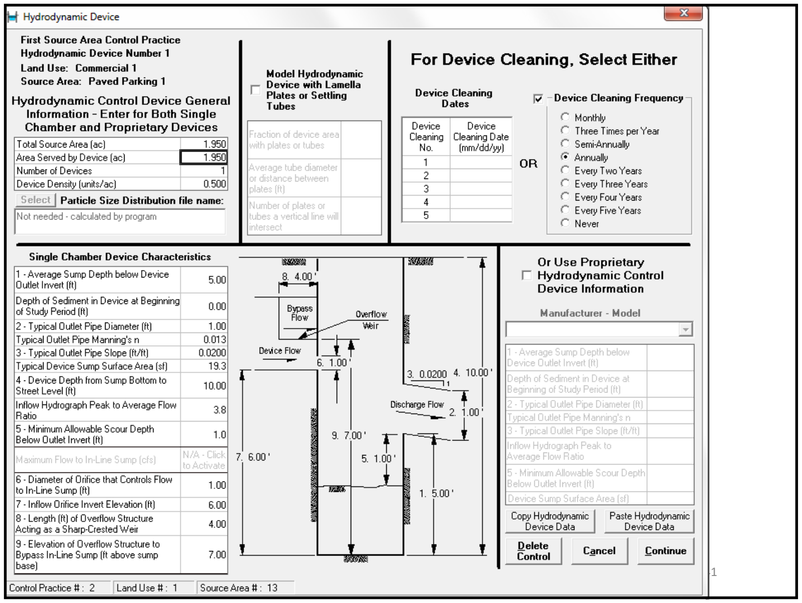
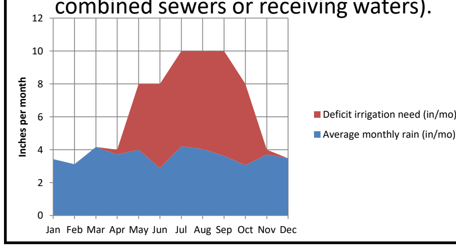


41

Cisterns and Beneficial Uses in WinSLAMM

Main Features of Cisterns/Water Tank Storage and Beneficial Use Calculations in WinSLAMM:

- Mass balance calculations for demand series compared to long-term rainfall data.
- Calculations for different tank volumes and source areas.
- Geographical location affects water needs (conservation approach to meet evapotranspiration (ET) requirements or maximum use to minimize discharges to combined sewers or receiving waters).

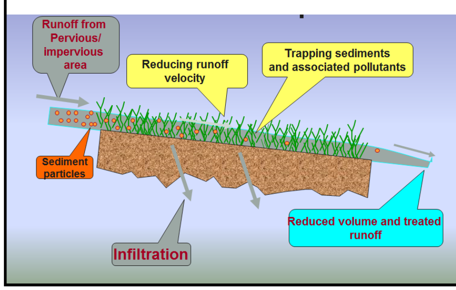


42

Grass Swales and Grass Filters in WinSLAMM

Main Features of Grass Swale and Grass Filter Calculations in WinSLAMM:

- Unique hydraulic calculations considering shallow flows in grass.
- Settling by particle size and infiltration as stormwater flows over grass.
- Developed calculation procedures in controlled laboratory experiments and verified with field measurements.



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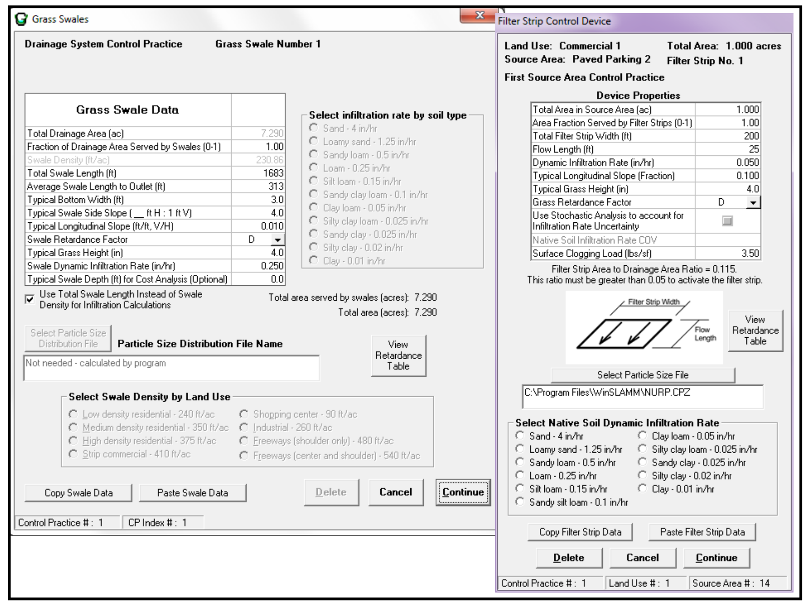
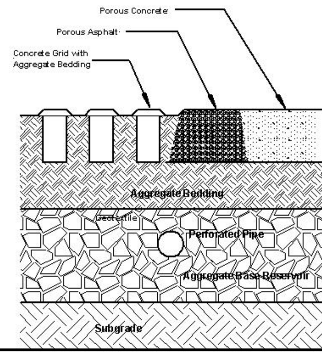


44

Porous Pavement in WinSLAMM

Main Features of Porous Pavement Performance Calculations in WinSLAMM:

- Particulate retention and clogging continuously calculated along with hydraulic effects.
- Processes modeled in each layer.
- Pavement restorative cleaning modeled.



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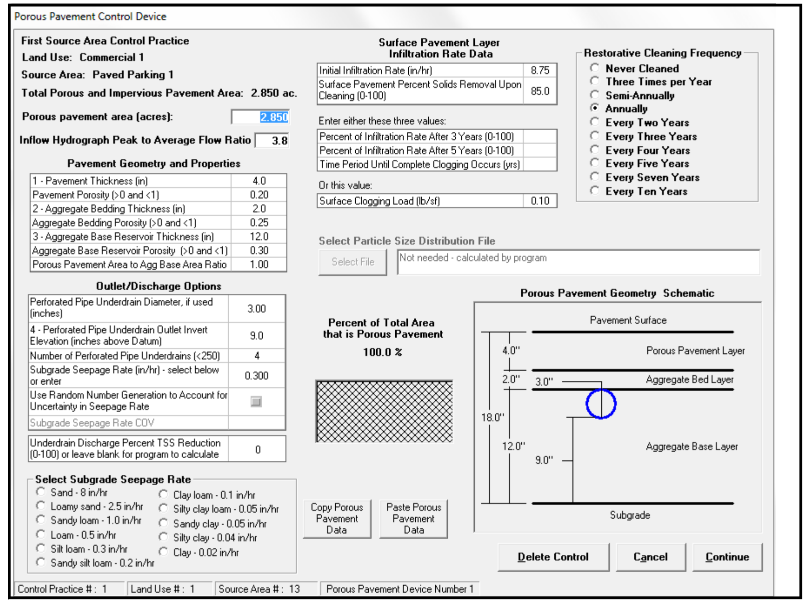


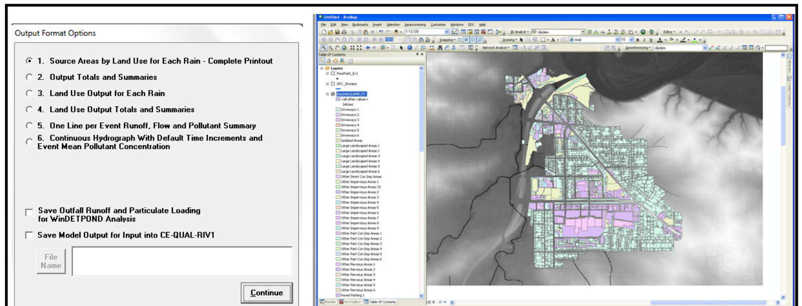
46

Model Output

1. Output Summary
2. Receiving Water Impacts
3. Land Uses and Source Area Detail
4. Control Device Detail
5. Analyzed as a single file or in batch mode
6. Many output options
   i. Control Device Detailed Output
   ii. Hydrograph and Particle Size Distribution at each Control Practice, Land Use and Junction

47

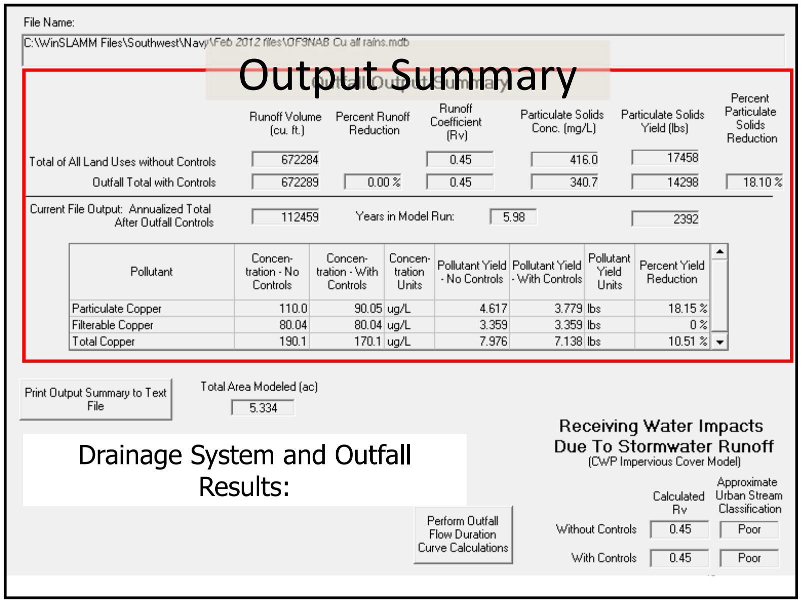
47



Output options include specially formatted files that can be used as inputs to receiving water models (CE-QUAL-RIV1) or detailed system models (SWMM and HSPF). Recently completed ArcSLAMM allows relatively seamless integration with ArcGIS for both input files and to graphically display output information.

48

48



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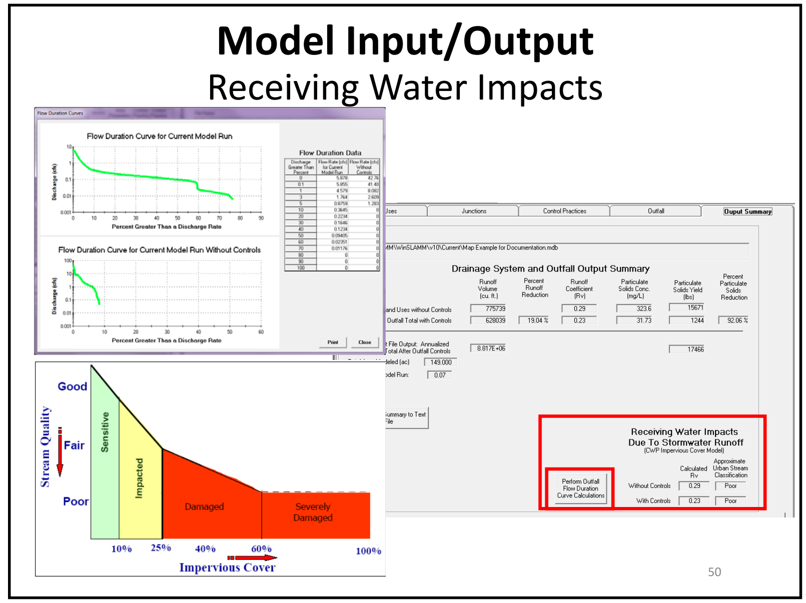

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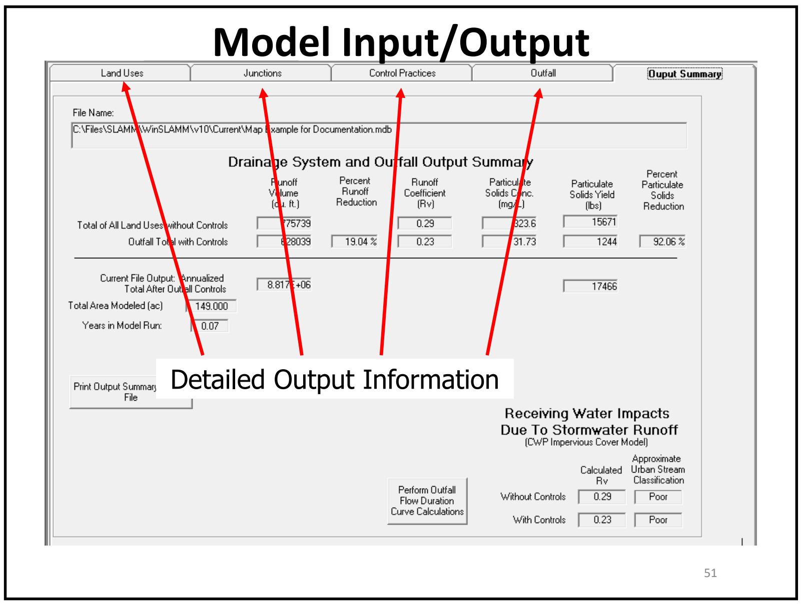

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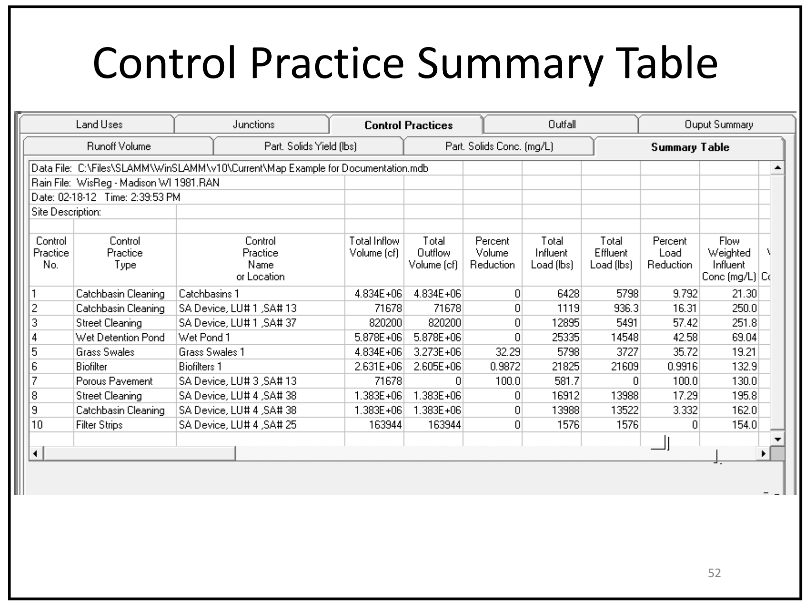

Control Practice Summary Table

Land Uses | Junctions | Control Practices | Outfall | Ouput Summary

Runoff Volume | Part. Solids Yield (lbs) | Part. Solids Conc. (mg/L) | Summary Table

Data File: C:\Files\SLAMM\WinSLAMM\v10\Current\Map Example for Documentation.mdb
Rain File: WisReg - Madison WI 1981.RAN
Date: 02-18-12 Time: 2:39:53 PM
Site Description:

Control Practice No.	Control Practice Type	Control Practice Name or Location	Total Inflow Volume (cf)	Total Outflow Volume (cf)	Percent Volume Reduction	Total Influent Load (lbs)	Total Effluent Load (lbs)	Percent Load Reduction	Flow Weighted Influent Conc (mg/L)
1	Catchbasin Cleaning	Catchbasins 1	4.834E+06	4.834E+06	0	6428	5798	9.792	21.30
2	Catchbasin Cleaning	SA Device, LU# 1 ,SA# 13	71678	71678	0	1119	936.3	16.31	250.0
3	Street Cleaning	SA Device, LU# 1 ,SA# 37	820200	820200	0	12895	5491	57.42	251.8
4	Wet Detention Pond	Wet Pond 1	5.878E+06	5.878E+06	0	25335	14548	42.58	69.04
5	Grass Swales	Grass Swales 1	4.834E+06	3.273E+06	32.29	5798	3727	35.72	19.21
6	Biofilter	Biofilters 1	2.631E+06	2.605E+06	0.9872	21825	21609	0.9916	132.9
7	Porous Pavement	SA Device, LU# 3 ,SA# 13	71678	0	100.0	581.7	0	100.0	130.0
8	Street Cleaning	SA Device, LU# 4 ,SA# 38	1.383E+06	1.383E+06	0	16912	13988	17.29	195.8
9	Catchbasin Cleaning	SA Device, LU# 4 ,SA# 38	1.383E+06	1.383E+06	0	13988	13522	3.332	162.0
10	Filter Strips	SA Device, LU# 4 ,SA# 25	163944	163944	0	1576	1576	0	154.0

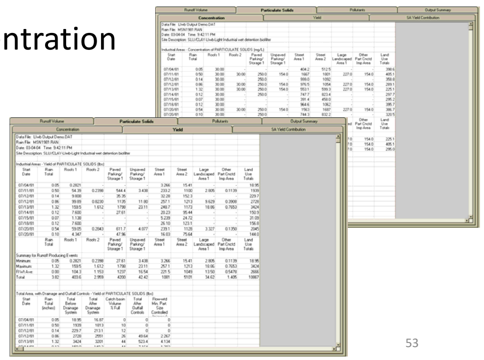
52

52

Model Input/Output

Similar Output for -

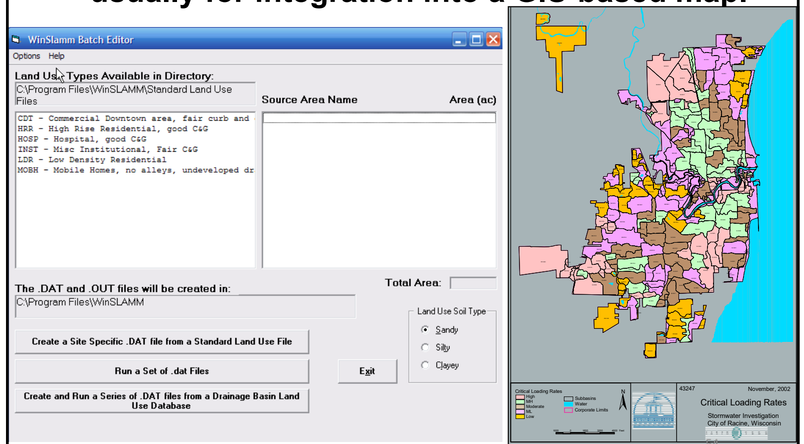
- Particulate Solids Concentration
- Particulate Solids Yield
- Pollutant Concentration
- Pollutant Yield



53

53

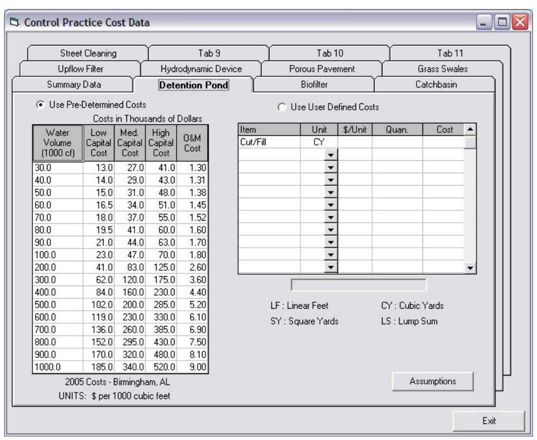
The WinSLAMM batch editor can be used to automatically run a large number of files, usually for integration into a GIS-based map.



54

Model Applications

Cost Analysis



Costs in Thousands of Dollars

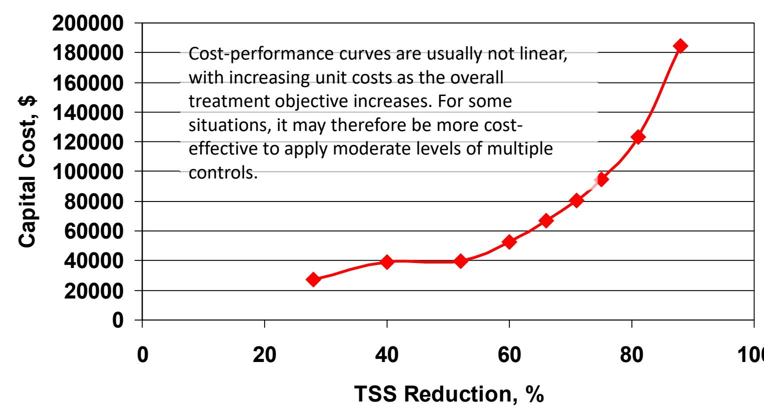
Water Volume (1000 cf)	Low Capital Cost	Med. Capital Cost	High Capital Cost	O&M Cost
30.0	13.0	27.0	41.0	1.30
40.0	14.0	29.0	43.0	1.31
50.0	15.0	31.0	48.0	1.38
60.0	16.5	34.0	51.0	1.45
70.0	18.0	37.0	55.0	1.52
80.0	19.5	41.0	60.0	1.60
90.0	21.0	44.0	63.0	1.70
100.0	23.0	47.0	70.0	1.80
200.0	41.0	83.0	125.0	2.60
300.0	62.0	120.0	175.0	3.60
400.0	84.0	160.0	230.0	4.40
500.0	102.0	200.0	285.0	5.20
600.0	119.0	230.0	330.0	6.10
700.0	136.0	260.0	385.0	6.90
800.0	152.0	295.0	430.0	7.50
900.0	170.0	320.0	480.0	8.10
1000.0	185.0	340.0	520.0	9.00

2005 Costs - Birmingham, AL
UNITS: $ per 1000 cubic feet

55

55

Capital Cost of Pond Achieving Different TSS Reductions at 100 Acre Mix of 40% Shopping Center and 60% Medium Residential

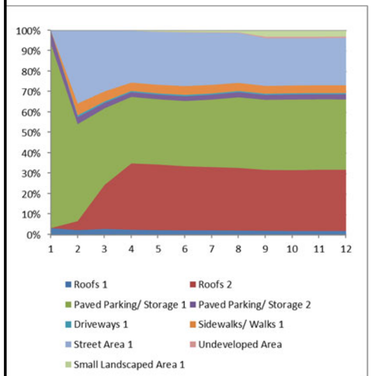


WinSLAMM can also calculate life-cycle costs that include land costs, capital costs, and operational and maintenance costs, all adjusted for financing costs and inflation factors, and expected life of project.

56

56

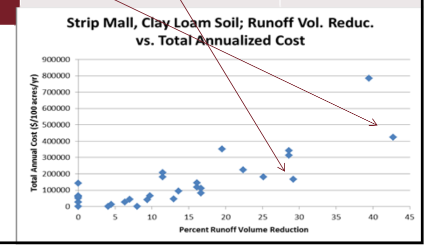
Lincoln, NE, WinSLAMM project to identify sources and controls for bacteria (runoff volume was the critical tool)



Commercial Areas Flow Contributions
Rains: 1: 0.01”; 2: 0.05”; 3: 0.1”; 4: 0.25”; 5: 0.5”; 6: 0.75”; 7: 1”; 8: 1.5”; 9: 2”; 10: 2.5”; 11: 3”; 12: 4”

57

Control Program for Commercial Strip Mall Land Use	Volume Reduction (% reduction compared to base conditions for clay loam conditions in the biofilters)	Total Annual Costs ($/100 acres/yr)
Porous pavement (in half of the parking areas)	25%	$180,400
Curb-cut biofilters (along 80% of the curbs)	29	$166,500
Biofilters in parking areas (10 percent of the source area)	29	$314,000
Small wet pond plus biofilters in parking areas (10 percent of the source area)	29	$341,800
Biofilters in parking areas (25 percent of the source area)	40	$785,000
Small wet pond plus biofilters in parking areas (10 percent of the source area) and curb-cut biofilters (along 40% of the curbs)	43	$424,600



58

Conclusions

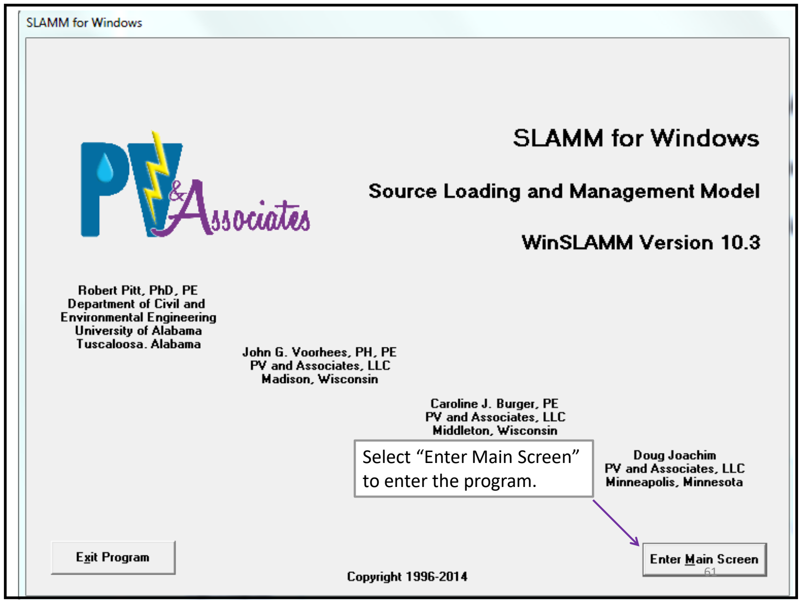
- WinSLAMM is based on theoretical approaches that have been confirmed during actual field monitoring as much as possible.
- Many of the assumptions associated with urban stormwater quality are too broad, and while there are usually some support for these assumptions, there are many exceptions.
- WinSLAMM models site characteristics and actual designs of stormwater controls and does not apply simple percentage control factors, for example.

59

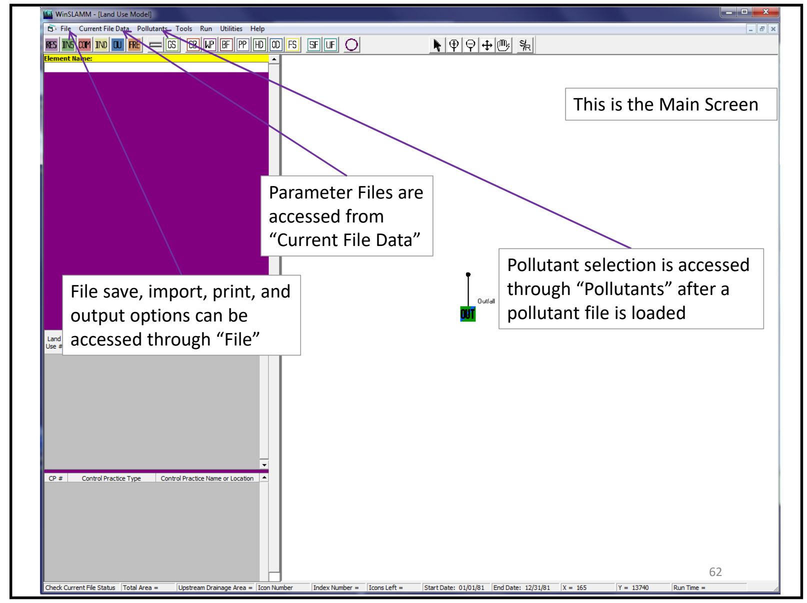
59

WinSLAMM Model Features and Navigation

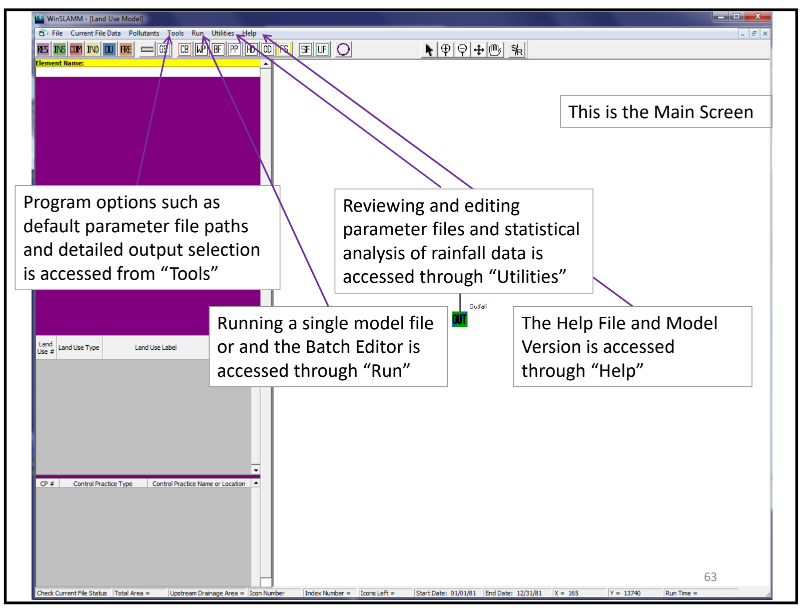
60


SLAMM for Windows
PV & Associates
SLAMM for Windows
Source Loading and Management Model
WinSLAMM Version 10.3
Robert Pitt, PhD, PE
Department of Civil and Environmental Engineering
University of Alabama
Tuscaloosa, Alabama
John G. Voorhees, PH, PE
PV and Associates, LLC
Madison, Wisconsin
Caroline J. Burger, PE
PV and Associates, LLC
Middleton, Wisconsin
Doug Joachim
PV and Associates, LLC
Minneapolis, Minnesota
Select "Enter Main Screen" to enter the program.
Exit Program
Copyright 1996-2014
Enter Main Screen

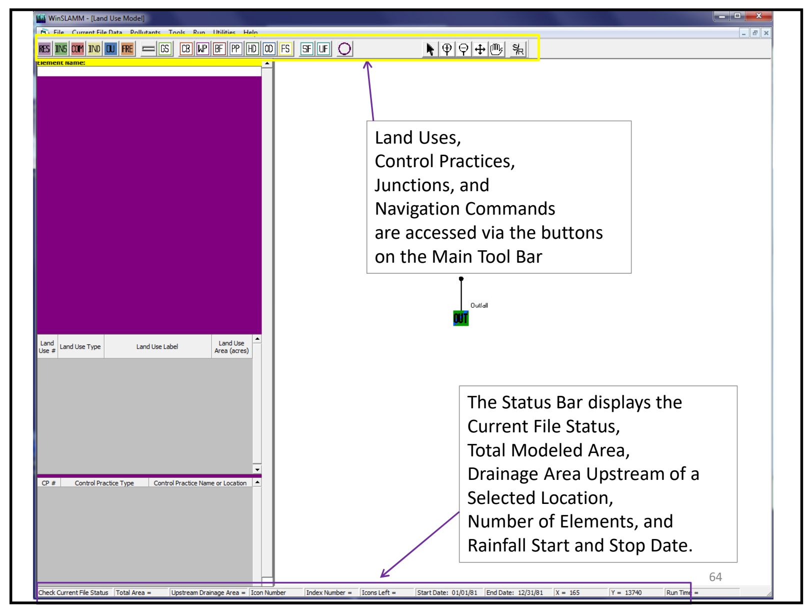
61


This is the Main Screen
Parameter Files are accessed from "Current File Data"
Pollutant selection is accessed through "Pollutants" after a pollutant file is loaded
File save, import, print, and output options can be accessed through "File"

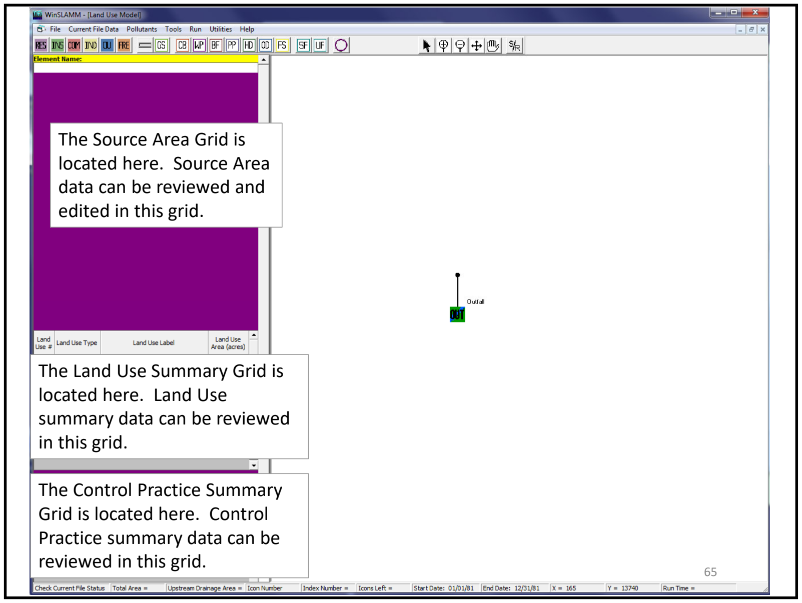
62


This is the Main Screen
Program options such as default parameter file paths and detailed output selection is accessed from "Tools"
Reviewing and editing parameter files and statistical analysis of rainfall data is accessed through "Utilities"
Running a single model file or and the Batch Editor is accessed through "Run"
The Help File and Model Version is accessed through "Help"

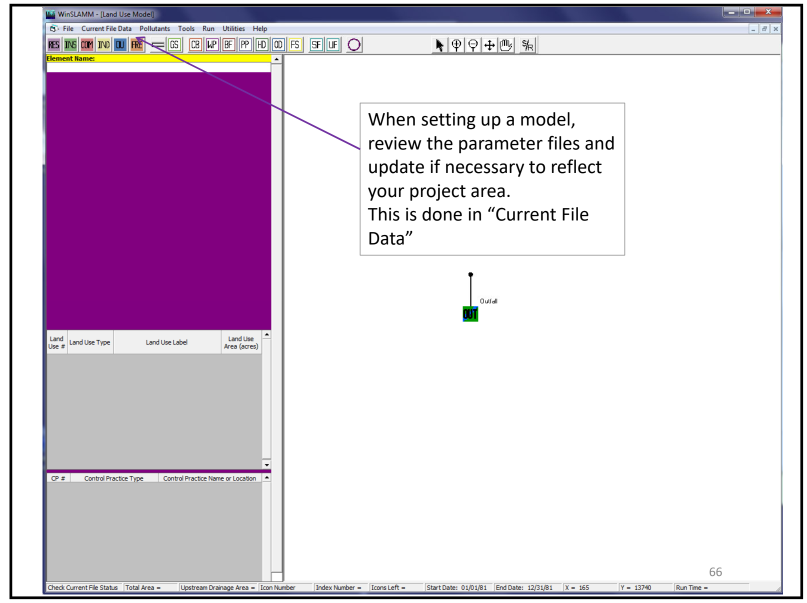
63


Land Uses,
Control Practices,
Junctions, and
Navigation Commands
are accessed via the buttons on the Main Tool Bar
The Status Bar displays the
Current File Status,
Total Modeled Area,
Drainage Area Upstream of a Selected Location,
Number of Elements, and
Rainfall Start and Stop Date.

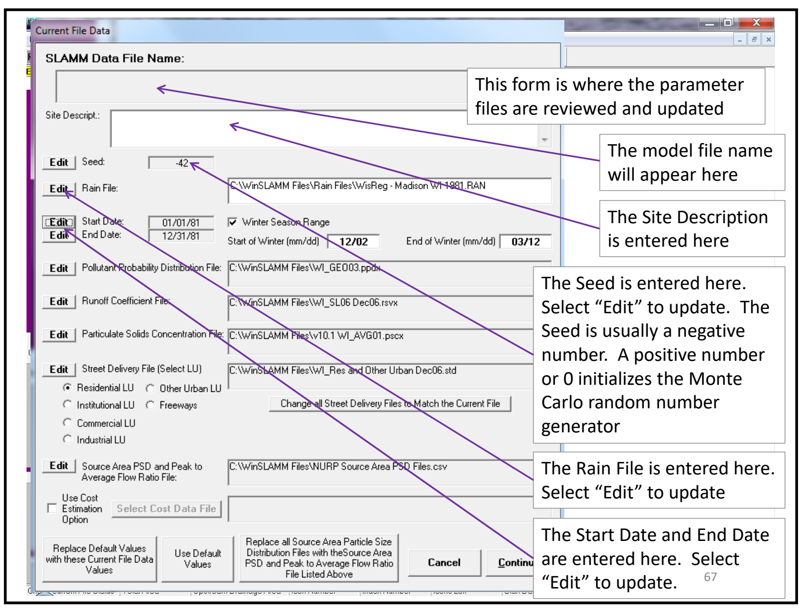
64


The Source Area Grid is located here. Source Area data can be reviewed and edited in this grid.
The Land Use Summary Grid is located here. Land Use summary data can be reviewed in this grid.
The Control Practice Summary Grid is located here. Control Practice summary data can be reviewed in this grid.
65

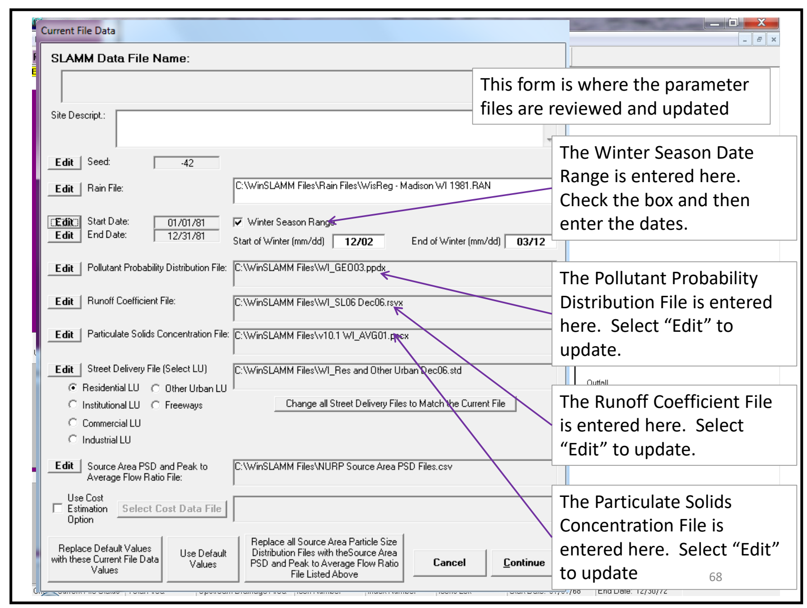
65


When setting up a model, review the parameter files and update if necessary to reflect your project area.
This is done in "Current File Data"
66

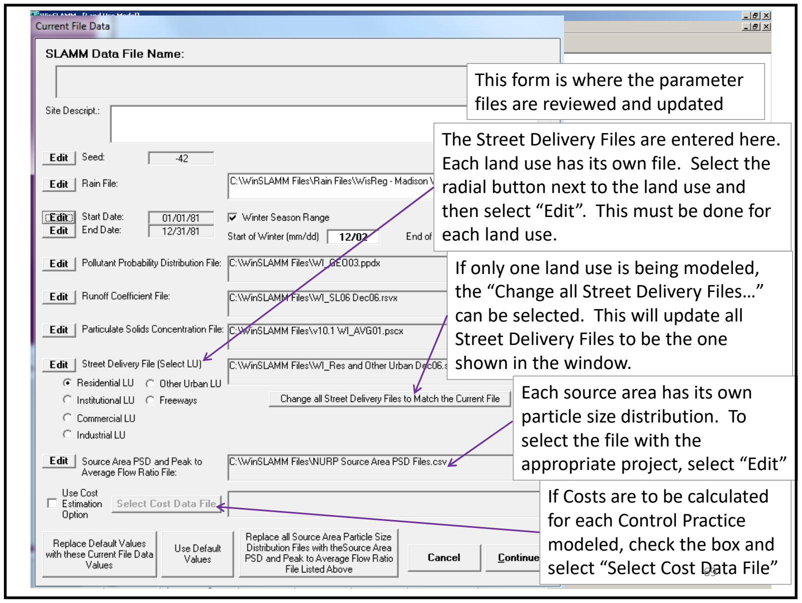
66


This form is where the parameter files are reviewed and updated
The model file name will appear here
The Site Description is entered here
The Seed is entered here. Select "Edit" to update. The Seed is usually a negative number. A positive number or 0 initializes the Monte Carlo random number generator
The Rain File is entered here. Select "Edit" to update
The Start Date and End Date are entered here. Select "Edit" to update.
67

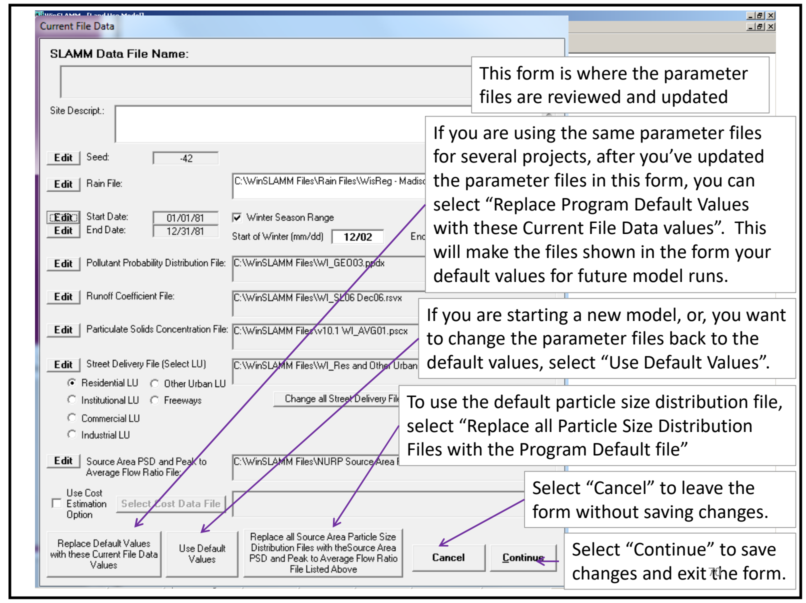
67


This form is where the parameter files are reviewed and updated
The Winter Season Date Range is entered here. Check the box and then enter the dates.
The Pollutant Probability Distribution File is entered here. Select "Edit" to update.
The Runoff Coefficient File is entered here. Select "Edit" to update.
The Particulate Solids Concentration File is entered here. Select "Edit" to update
68

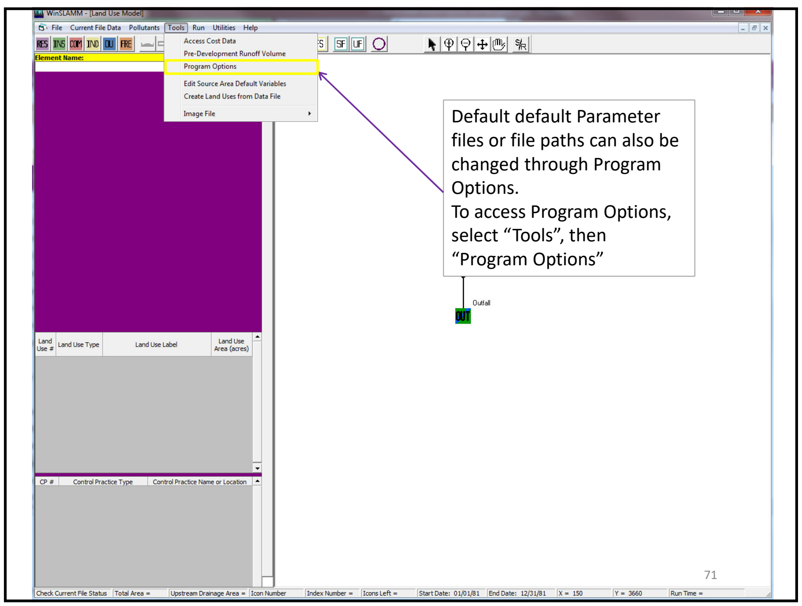
68


Current File Data
SLAMM Data File Name:
This form is where the parameter files are reviewed and updated
The Street Delivery Files are entered here. Each land use has its own file. Select the radial button next to the land use and then select "Edit". This must be done for each land use.
If only one land use is being modeled, the "Change all Street Delivery Files…" can be selected. This will update all Street Delivery Files to be the one shown in the window.
Each source area has its own particle size distribution. To select the file with the appropriate project, select "Edit"
If Costs are to be calculated for each Control Practice modeled, check the box and select "Select Cost Data File"
Replace Default Values with these Current File Data Values
Use Default Values
Replace all Source Area Particle Size Distribution Files with theSource Area PSD and Peak to Average Flow Ratio File Listed Above
Cancel
Continue

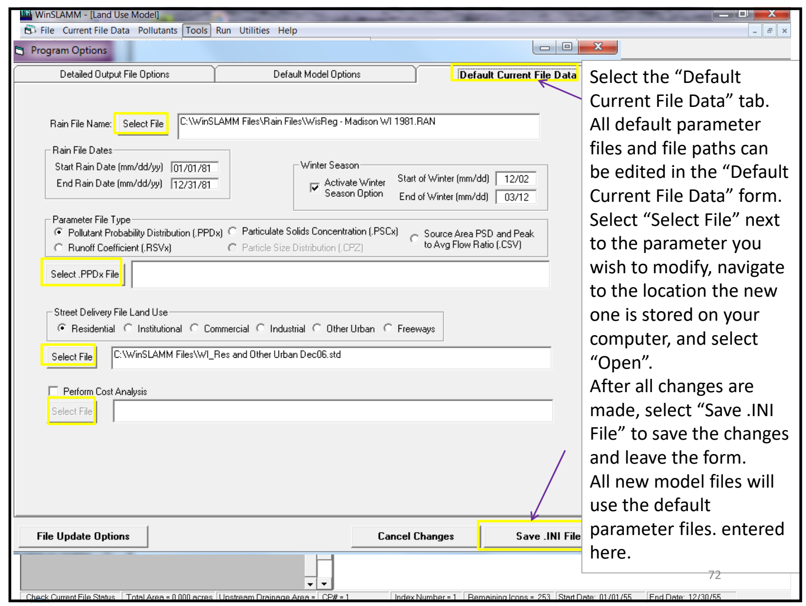
69


Current File Data
SLAMM Data File Name:
This form is where the parameter files are reviewed and updated
If you are using the same parameter files for several projects, after you've updated the parameter files in this form, you can select "Replace Program Default Values with these Current File Data values". This will make the files shown in the form your default values for future model runs.
If you are starting a new model, or, you want to change the parameter files back to the default values, select "Use Default Values".
To use the default particle size distribution file, select "Replace all Particle Size Distribution Files with the Program Default file"
Select "Cancel" to leave the form without saving changes.
Select "Continue" to save changes and exit the form.
Replace Default Values with these Current File Data Values
Use Default Values
Cancel
Continue

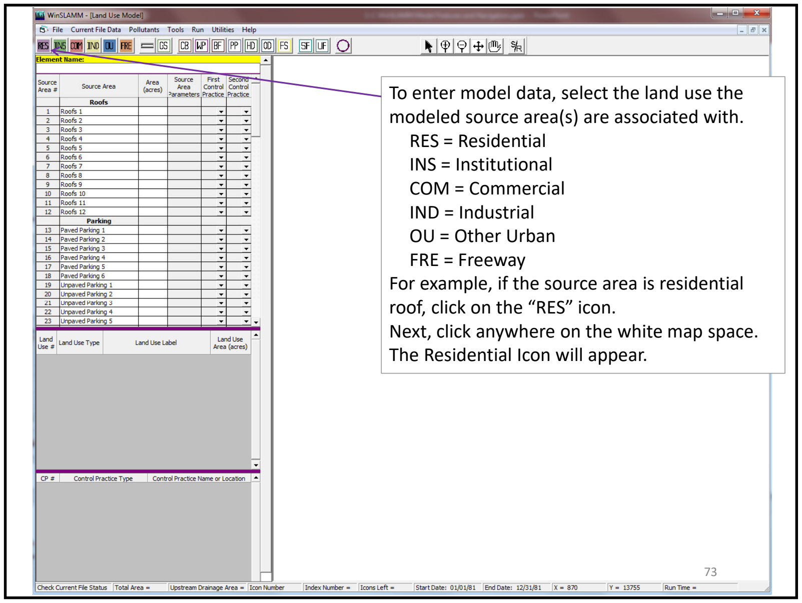
70


Default default Parameter files or file paths can also be changed through Program Options.
To access Program Options, select "Tools", then "Program Options"
Access Cost Data
Pre-Development Runoff Volume
Program Options
Edit Source Area Default Variables
Create Land Uses from Data File
Image File

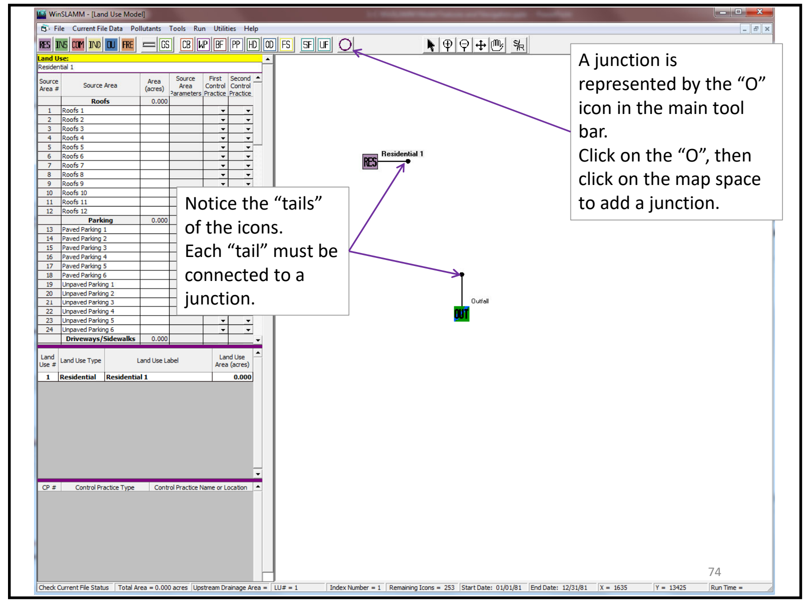
71


Program Options
Detailed Output File Options
Default Model Options
Default Current File Data
Select the "Default Current File Data" tab.
All default parameter files and file paths can be edited in the "Default Current File Data" form.
Select "Select File" next to the parameter you wish to modify, navigate to the location the new one is stored on your computer, and select "Open".
After all changes are made, select "Save .INI File" to save the changes and leave the form.
All new model files will use the default parameter files. entered here.
File Update Options
Cancel Changes
Save .INI File

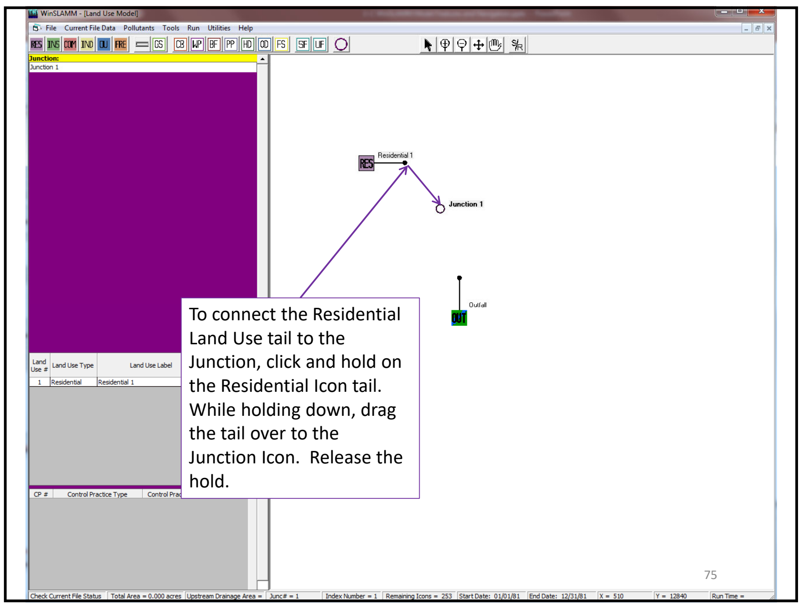
72


To enter model data, select the land use the modeled source area(s) are associated with.
RES = Residential
INS = Institutional
COM = Commercial
IND = Industrial
OU = Other Urban
FRE = Freeway
For example, if the source area is residential roof, click on the "RES" icon.
Next, click anywhere on the white map space. The Residential Icon will appear.

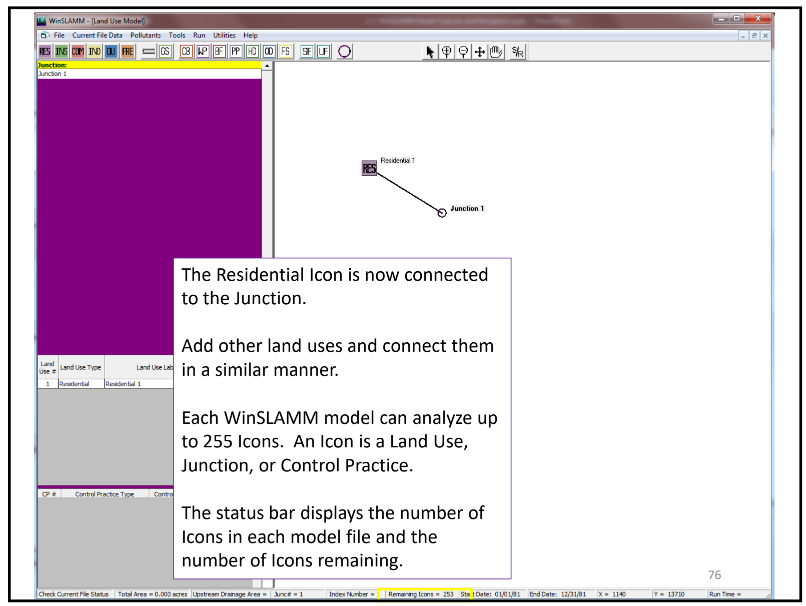
73


A junction is represented by the "O" icon in the main tool bar.
Click on the "O", then click on the map space to add a junction.
Notice the "tails" of the icons.
Each "tail" must be connected to a junction.

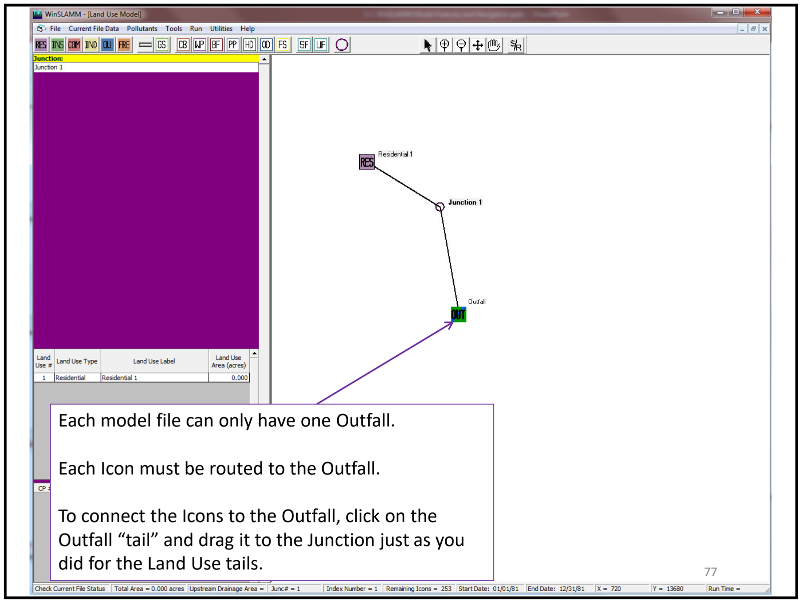
74


To connect the Residential Land Use tail to the Junction, click and hold on the Residential Icon tail. While holding down, drag the tail over to the Junction Icon. Release the hold.

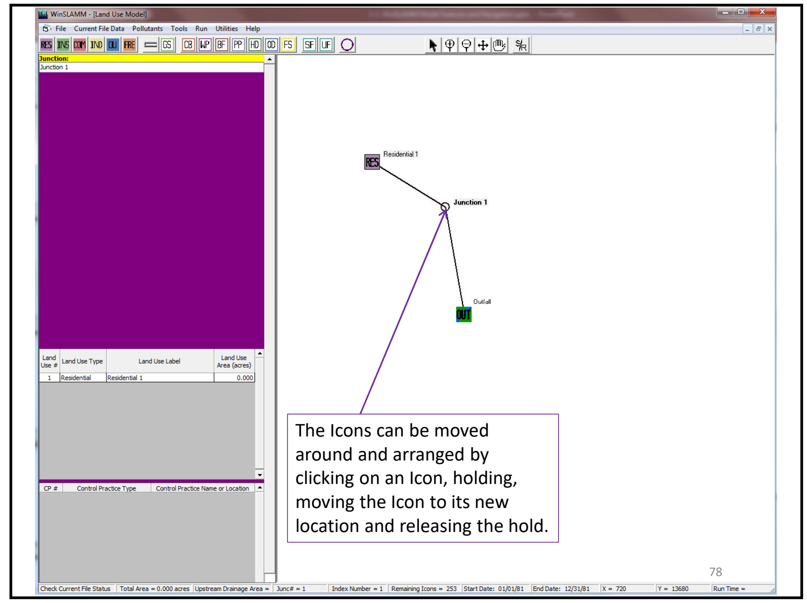
75


The Residential Icon is now connected to the Junction.
Add other land uses and connect them in a similar manner.
Each WinSLAMM model can analyze up to 255 Icons. An Icon is a Land Use, Junction, or Control Practice.
The status bar displays the number of Icons in each model file and the number of Icons remaining.

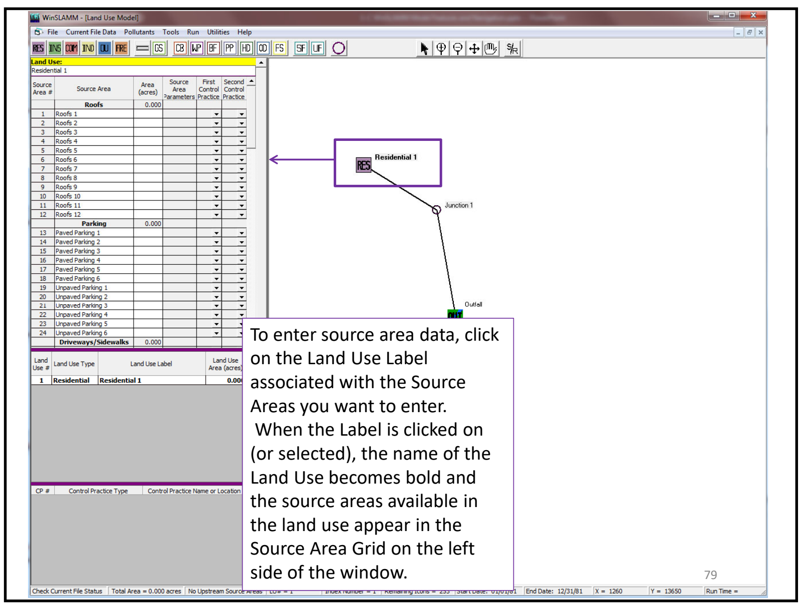
76


Residential 1
Junction 1
Outfall
Each model file can only have one Outfall.
Each Icon must be routed to the Outfall.
To connect the Icons to the Outfall, click on the Outfall "tail" and drag it to the Junction just as you did for the Land Use tails.

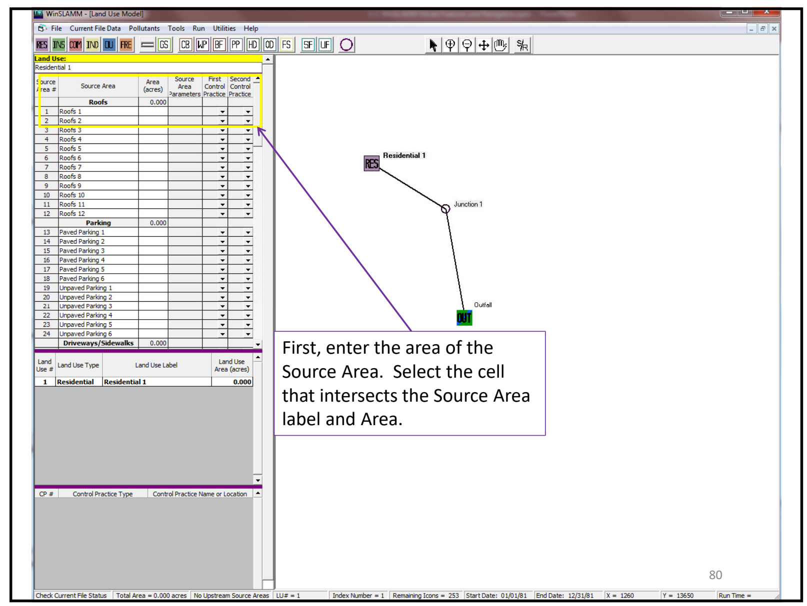
77


Residential 1
Junction 1
Outfall
The Icons can be moved around and arranged by clicking on an Icon, holding, moving the Icon to its new location and releasing the hold.

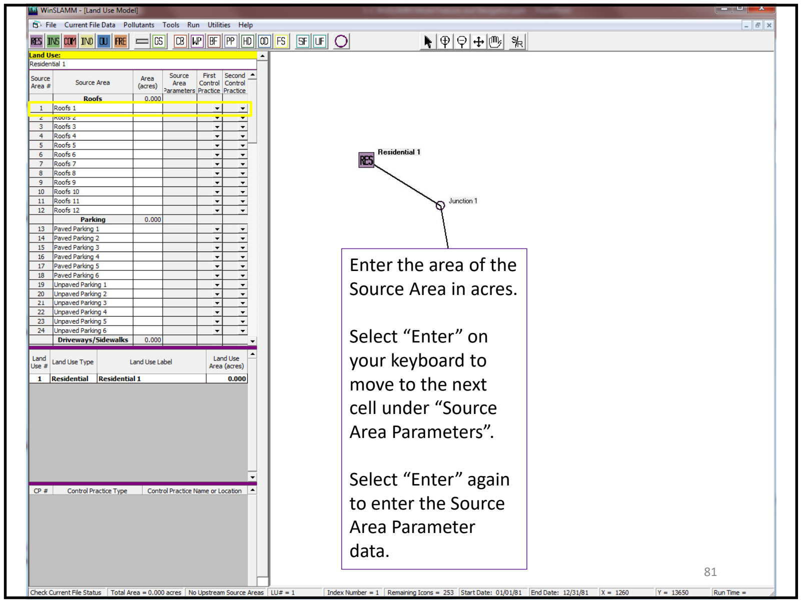
78


Residential 1
Junction 1
Outfall
To enter source area data, click on the Land Use Label associated with the Source Areas you want to enter. When the Label is clicked on (or selected), the name of the Land Use becomes bold and the source areas available in the land use appear in the Source Area Grid on the left side of the window.

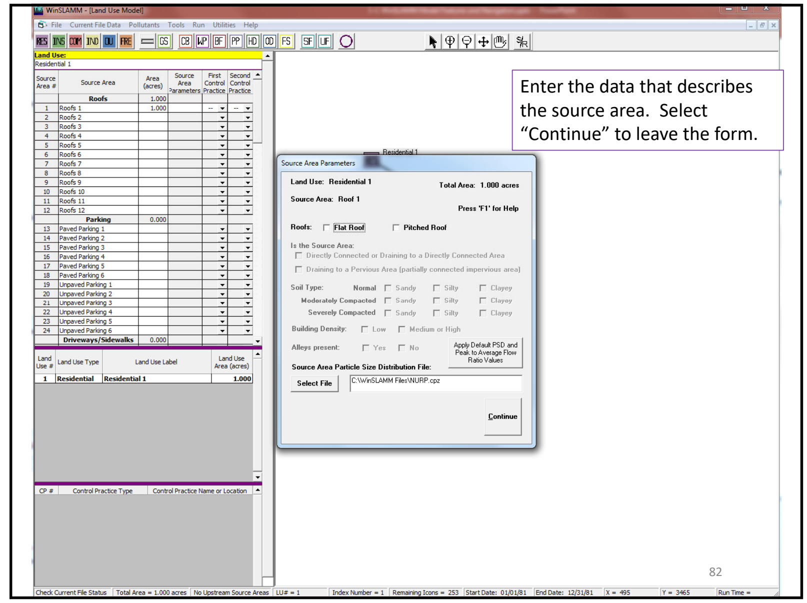
79


Residential 1
Junction 1
Outfall
First, enter the area of the Source Area. Select the cell that intersects the Source Area label and Area.

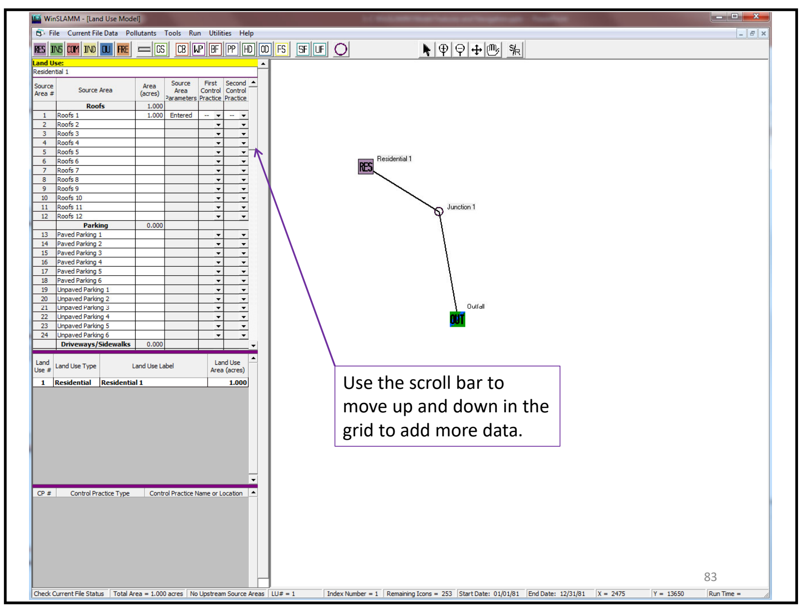
80


Enter the area of the Source Area in acres.
Select "Enter" on your keyboard to move to the next cell under "Source Area Parameters".
Select "Enter" again to enter the Source Area Parameter data.

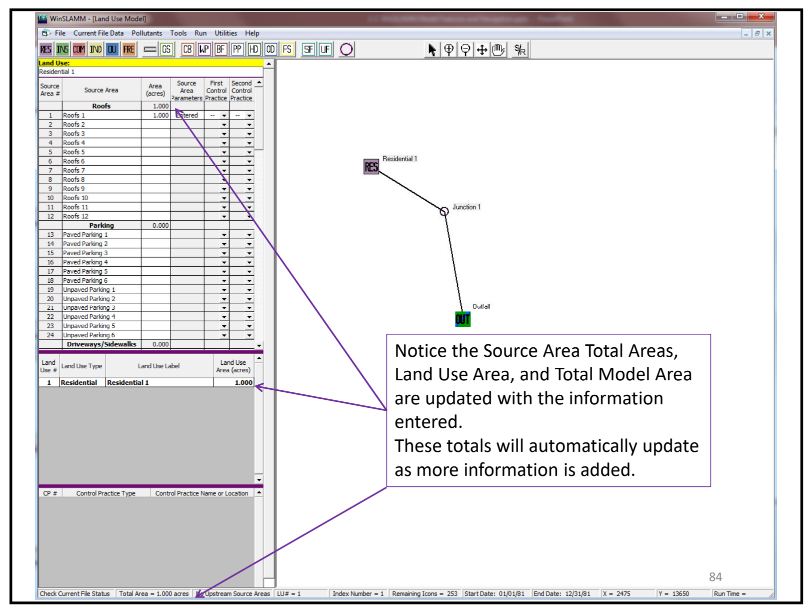
81


Enter the data that describes the source area. Select "Continue" to leave the form.

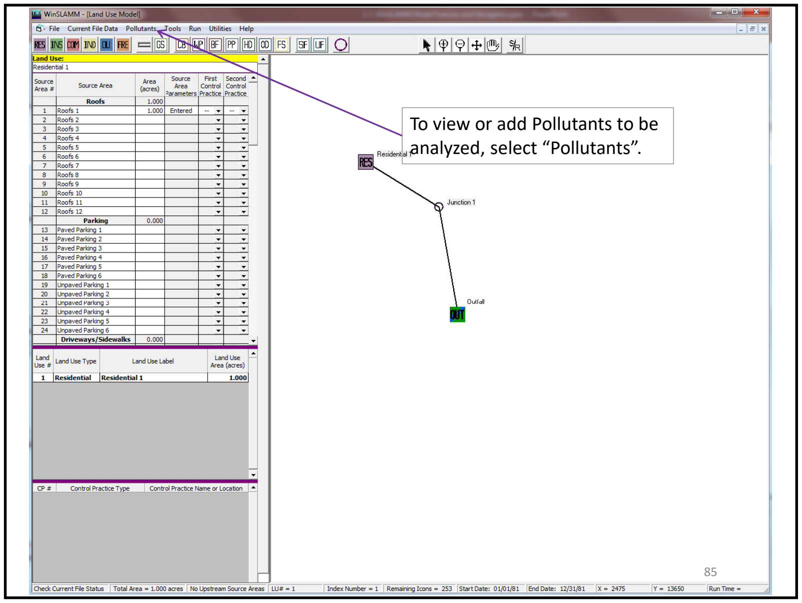
82


Use the scroll bar to move up and down in the grid to add more data.

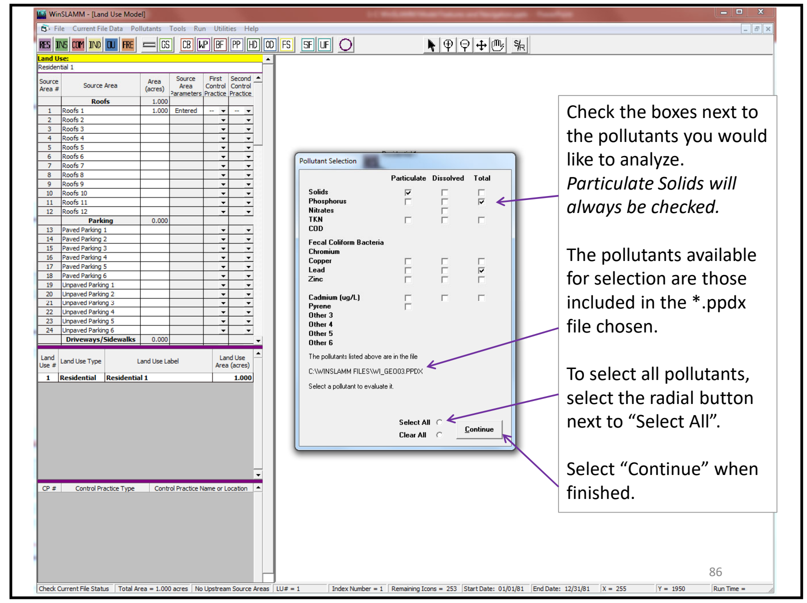
83


Notice the Source Area Total Areas, Land Use Area, and Total Model Area are updated with the information entered.
These totals will automatically update as more information is added.

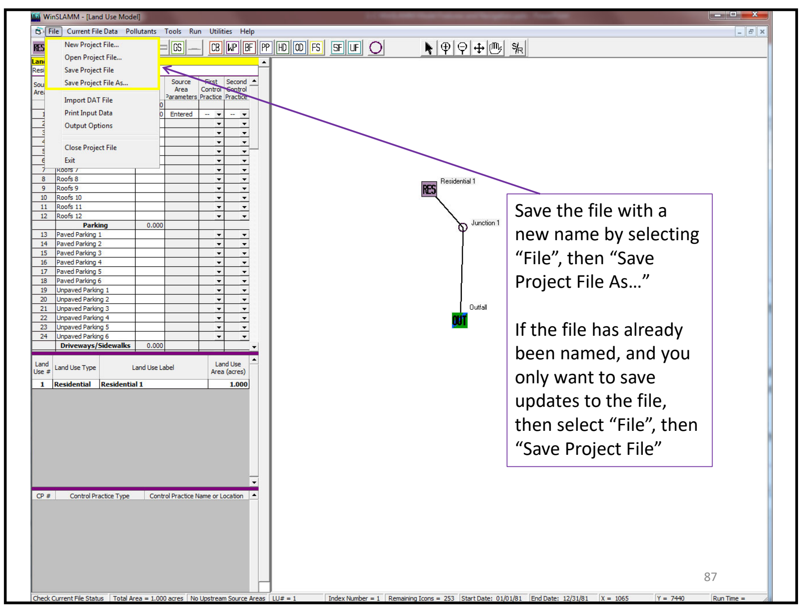
84


To view or add Pollutants to be analyzed, select "Pollutants".

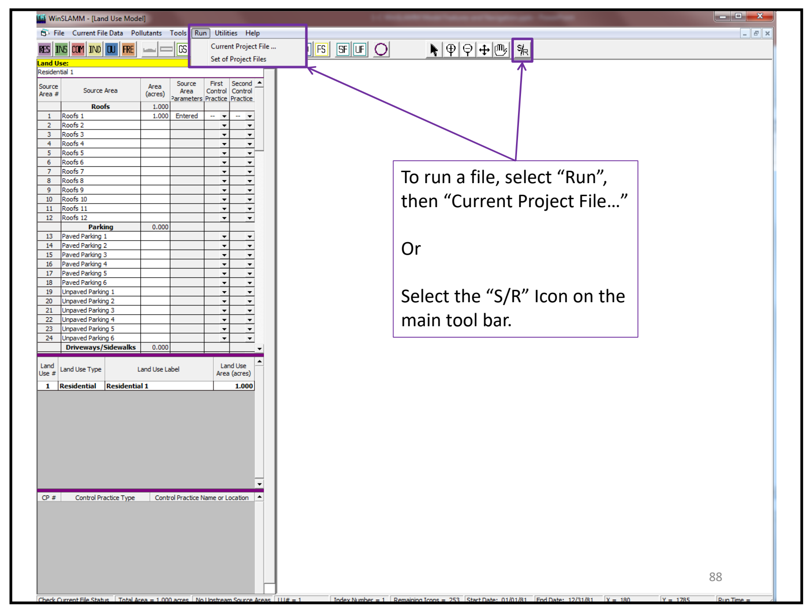
85


Check the boxes next to the pollutants you would like to analyze. *Particulate Solids will always be checked.*
The pollutants available for selection are those included in the *.ppdx file chosen.
To select all pollutants, select the radial button next to "Select All".
Select "Continue" when finished.

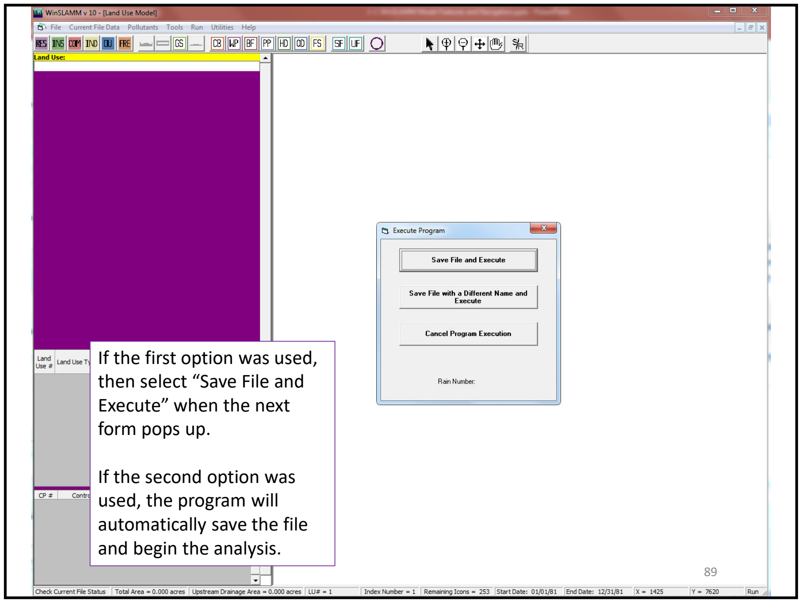
86


Save the file with a new name by selecting "File", then "Save Project File As…"
If the file has already been named, and you only want to save updates to the file, then select "File", then "Save Project File"

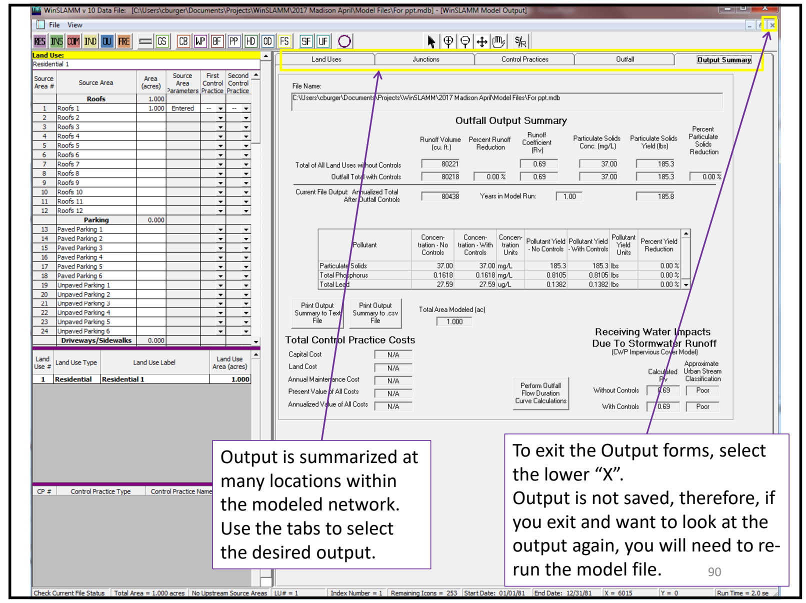
87


To run a file, select "Run", then "Current Project File…"
Or
Select the "S/R" Icon on the main tool bar.

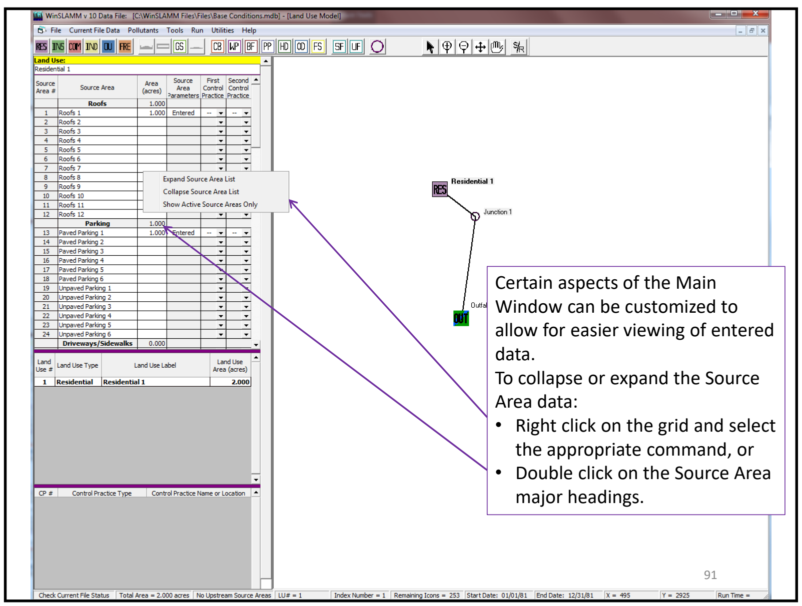
88


Execute Program
Save File and Execute
Save File with a Different Name and Execute
Cancel Program Execution
If the first option was used, then select “Save File and Execute” when the next form pops up.
If the second option was used, the program will automatically save the file and begin the analysis.
89

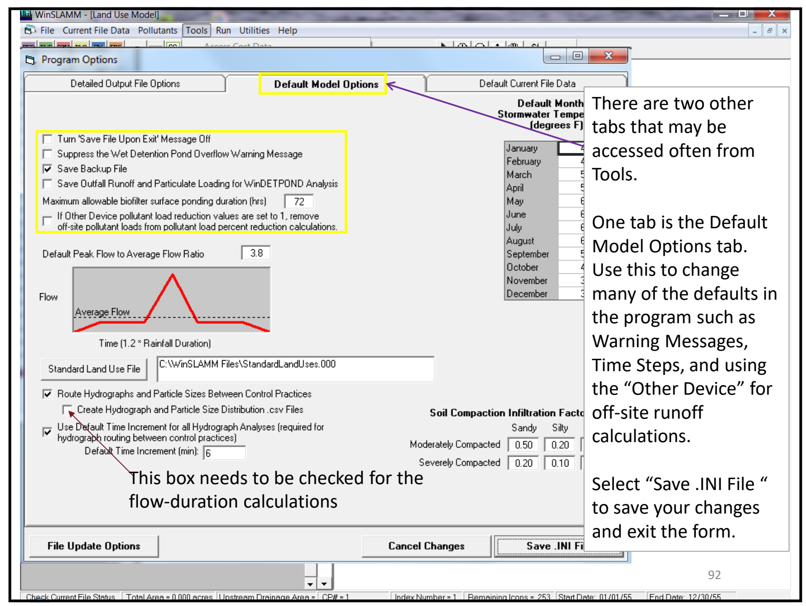
89


Outfall Output Summary
Total Control Practice Costs
Receiving Water Impacts Due To Stormwater Runoff
Output is summarized at many locations within the modeled network. Use the tabs to select the desired output.
To exit the Output forms, select the lower “X”.
Output is not saved, therefore, if you exit and want to look at the output again, you will need to re-run the model file.
90

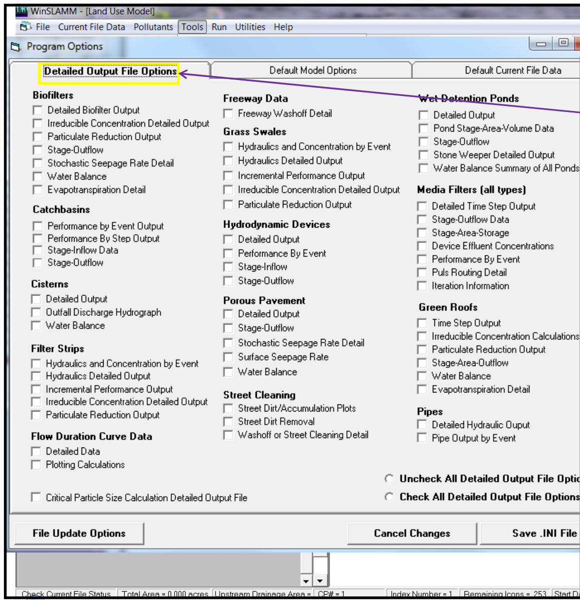
90


Expand Source Area List
Collapse Source Area List
Show Active Source Areas Only
Residential 1
Junction 1
Certain aspects of the Main Window can be customized to allow for easier viewing of entered data.
To collapse or expand the Source Area data:
• Right click on the grid and select the appropriate command, or
• Double click on the Source Area major headings.
91

91


Program Options
Detailed Output File Options
Default Model Options
Default Current File Data
There are two other tabs that may be accessed often from Tools.
One tab is the Default Model Options tab. Use this to change many of the defaults in the program such as Warning Messages, Time Steps, and using the “Other Device” for off-site runoff calculations.
Select “Save .INI File ” to save your changes and exit the form.
This box needs to be checked for the flow-duration calculations
File Update Options
Cancel Changes
92

92



Another tab is the "Detailed Output File Options" Tab.

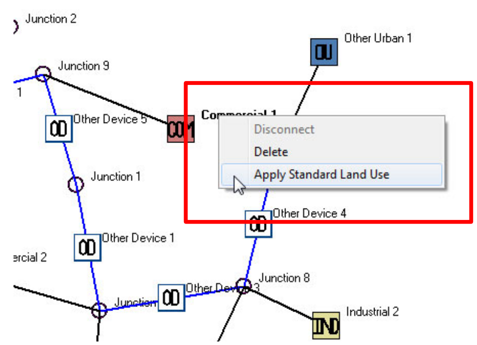
There may be times where more detailed output is needed. Select the detailed output desired.

Then select "Save .INI File " to save your changes and exit the form.

A *.csv file with the output will be generated when the model file is run. It will be saved in the same project directory as the WinSLAMM model file.

93

Standard Land Uses

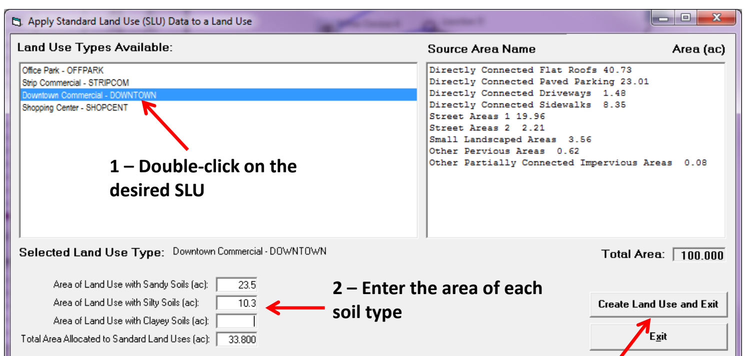


To Access a Standard Land Use, select an Icons' Land Use Label, right-mouse click to get the pop-up menu, and then select the 'Apply Standard Land Use' option

94

94

Applying Standard Land Use data to a Land Use

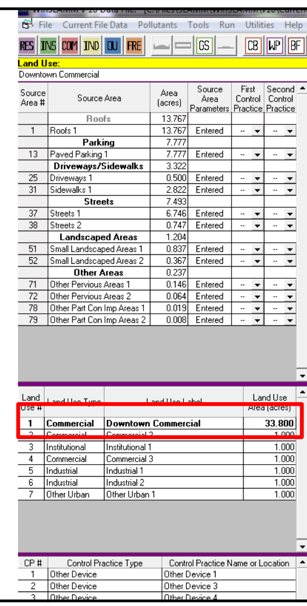


3 – Press the 'Create Land Use and Exit' button

95

95

Standard Land Use Source Areas applied to the Downtown Commercial Land Use



96

96

All Standard Land Uses are stored in an Access Database

Microsoft Access - [NonFreewayLandUses : Table]

File Edit View Insert Format Records Tools Window Help

LandUseType	Streets1_Texture	LandUseTypeNumber	StandardLandUseCode	StandardLandUseDescription	Roof_FlatDirectlyConnected	Roof_Fla
Residential	Smooth	1	SUBR	Suburban Residential	0	
Residential	Smooth	1	HDRWA	High Density Res. with Alleys	0	
Residential	Smooth	1	HDRNA	High Density Res. No Alleys	0	
Residential	Smooth	1	MOBH	Mobile Homes	16.9	
Residential	Intermediate	1	DUPLEX	Duplex	0	
Residential	Smooth	1	MDRNA	Medium Density Res. No Alleys	0	
Residential	Intermediate	1	MDRWA	Medium Density Res. With Alleys	0	
Residential	Smooth	1	MFR	Multi Family Residential	3.4	
Residential	Smooth	1	LDR	Low Density Residential	0	
Residential	Smooth	1	HRR	High Rise Residential	19	
Institutional	Smooth	2	INST	Misc. Institutional	5.39	
Institutional	Smooth	2	SCH	Schools	15	
Institutional	Smooth	2	HOSP	Hospital	31.8	
Commercial	Smooth	3	OFFPARK	Office Park	13.17	
Commercial	Smooth	3	STRIPCOM	Strip Commercial	19.7	
Commercial	Smooth	3	DOWNTOWN	Downtown Commercial	40.73	
Commercial	Smooth	3	SHOPCENT	Shopping Center	21.61	
Industrial	Smooth	4	LI	Light Industrial	20.51	
Industrial	Smooth	4	MI	Medium Industrial	16.8	
OpenSpace	Smooth	5	CEM	Cemetary	0.55	
OpenSpace	Smooth	5	OPEN	Open Space	0.55	
OpenSpace	Smooth	5	PARK	Parks	0.1	

Record: 1 of 22

Datasheet View

97

97

Remember to Press the "F1" to access the Help File

98