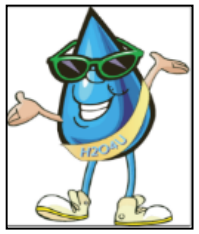
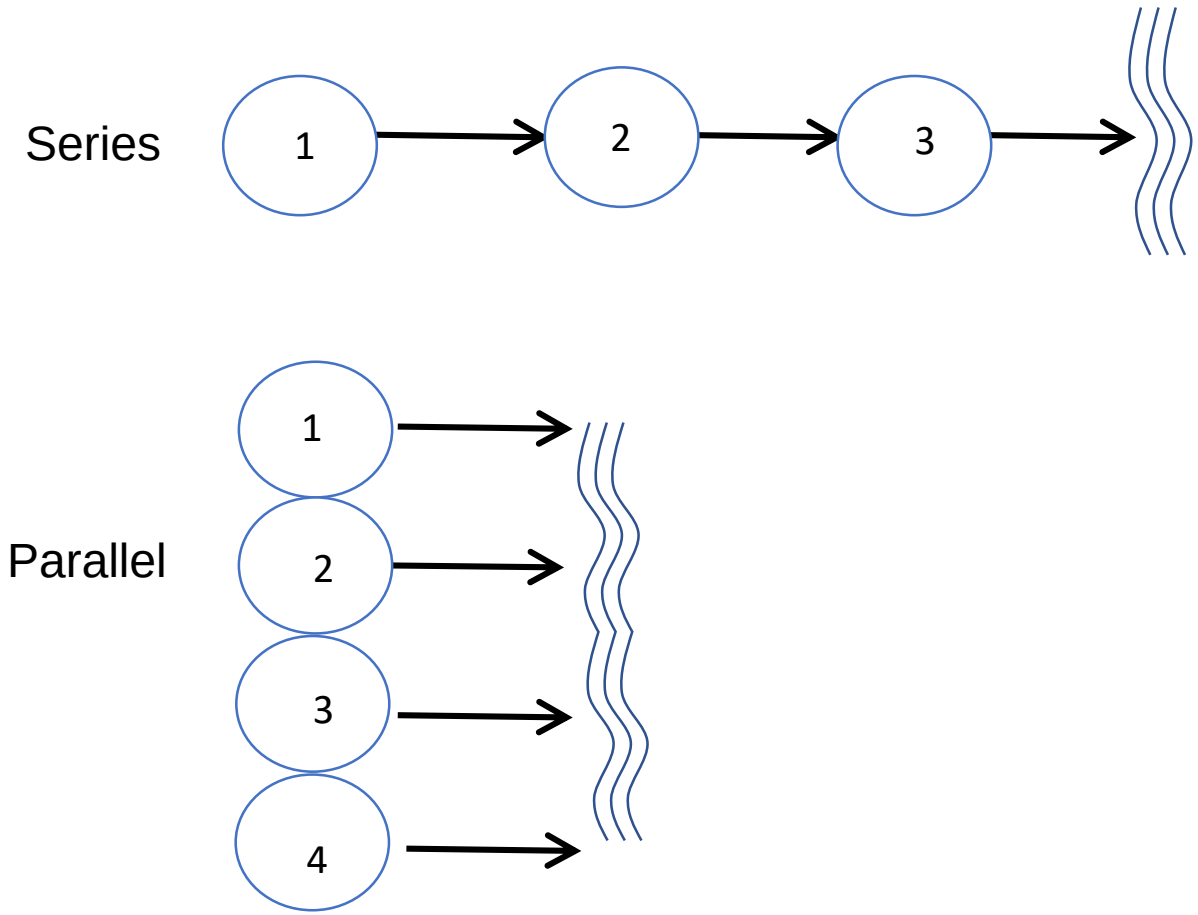
BMP Trains 2020
Model Capabilities

Disconnecting Areas BMP Trains 2020 Model

By: Marty Wanielista



CATCHMENTS Dis-connecting Areas



A catchment is defined by an area that contributes runoff water and there is a potential for a BMP. It is frequently called a contributing area.

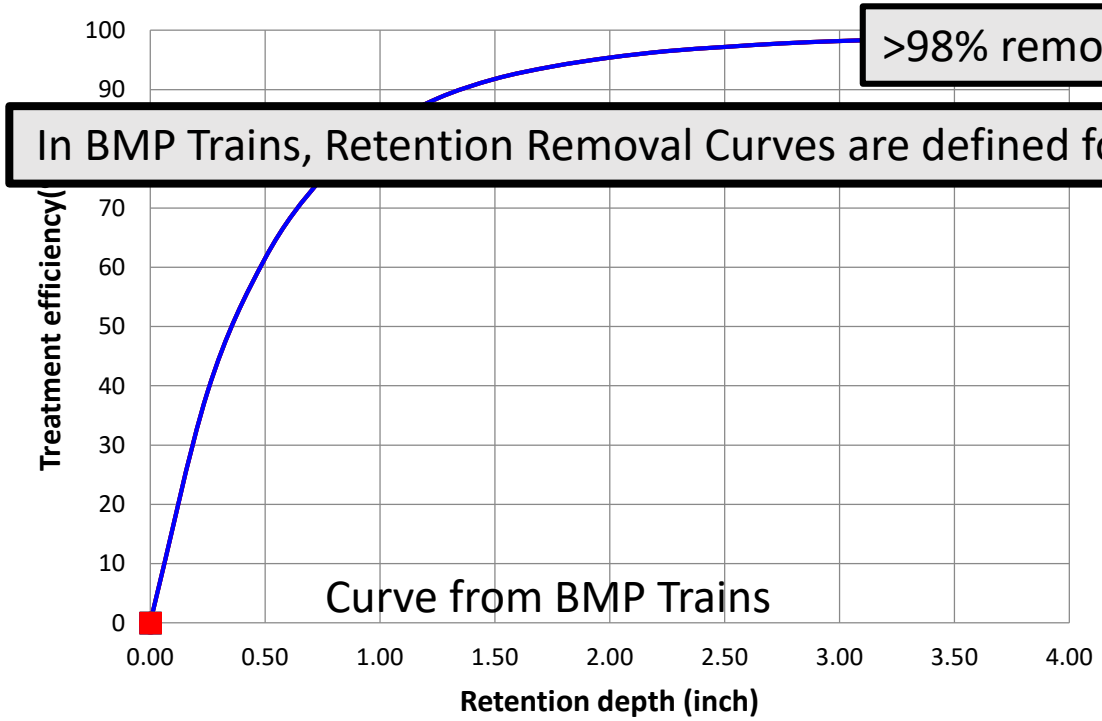
A dis-connected area is one from which there is no annual runoff for 4 inches of rain.

Why 4 inches? Marginal increases in annual mass loadings for rainfall over 4 inches. AND near 99% removal.

A depression area with 4-inch storage

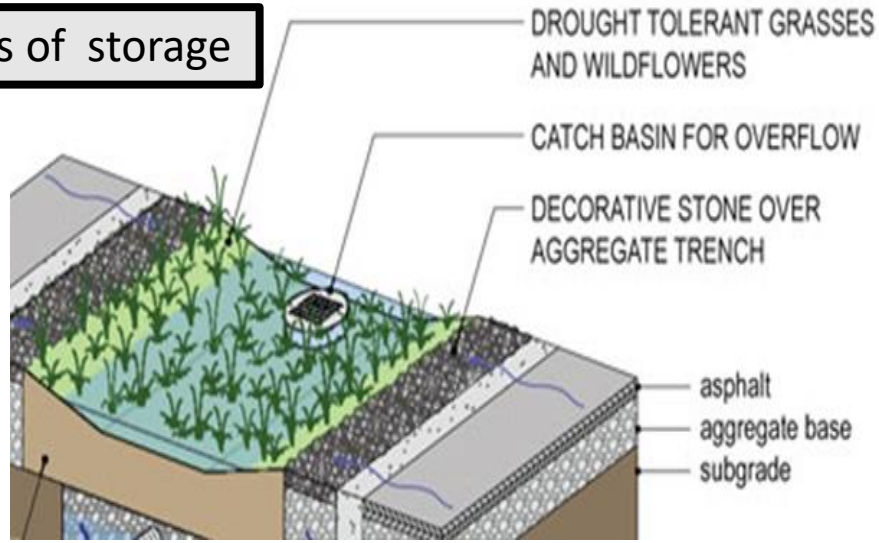
over the catchment area (CA)

(AVG annual Treatment efficiency = AVG annual capture volume)



>98% removal @ 4.0 inch over the CA, usually

In BMP Trains, Retention Removal Curves are defined for up to 4 inches of storage



Water infiltrates into ground in 3 days or less

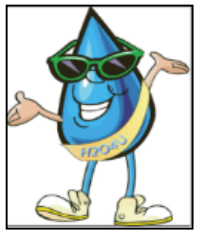
ALSO: If Storage is = or > 4 inches, the CN number is the lowest or 30, which implies that the annual capture volume ~ 99%

The CA for depression storage can be removed from the total area if treat depth = or >4.0“

BMP Trains 2020 Model

Single catchment with more than one BMP in the same catchment

By: Marty Wanielista

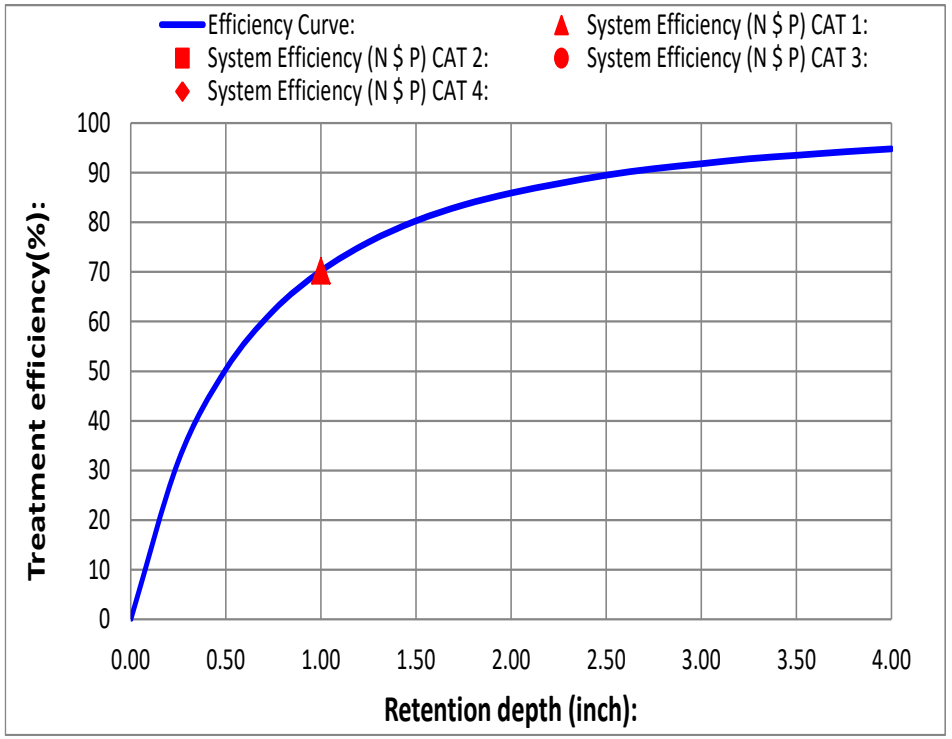


Retention BMPs Treating Runoff from the Same Catchment Area

BMP Efficiency Determination

- For multiple retention BMPs used within a single catchment the overall efficiency is determined by adding up the total volume retained to obtain the associated treatment efficiency

Retention Efficiency Plot

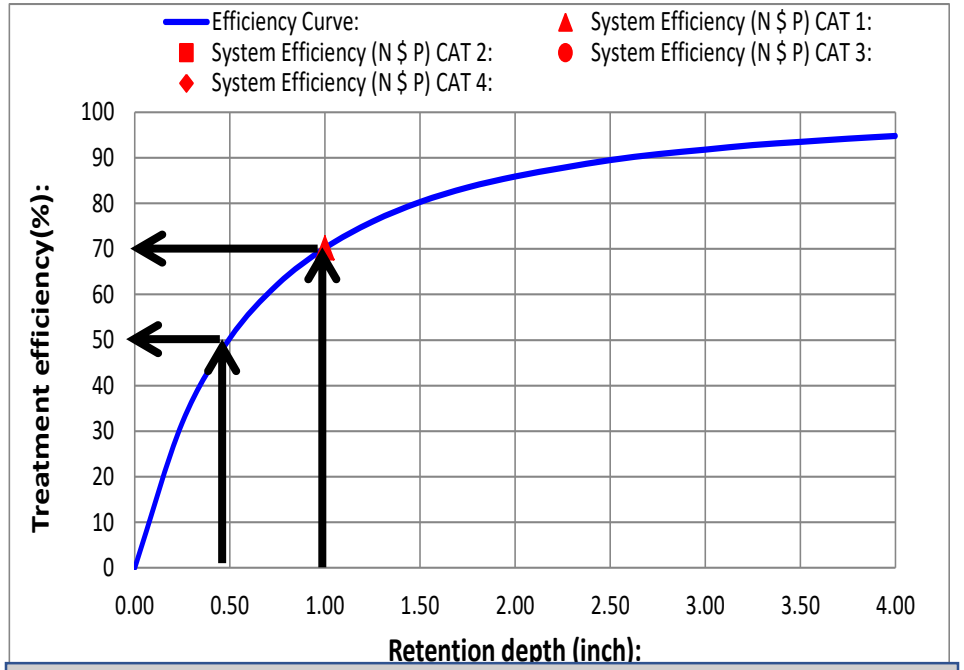


Example for Two Retention BMPs in Series

BMP Efficiency Determination

- Assume two retention BMPs in series – first captures 0.5 in and the second captures 0.5 in
- 50% + 50% = 100% X
- **Add the volume retained**
- 0.5in + 0.5in = 1in
  - **70%** ✓

Retention Efficiency Plot



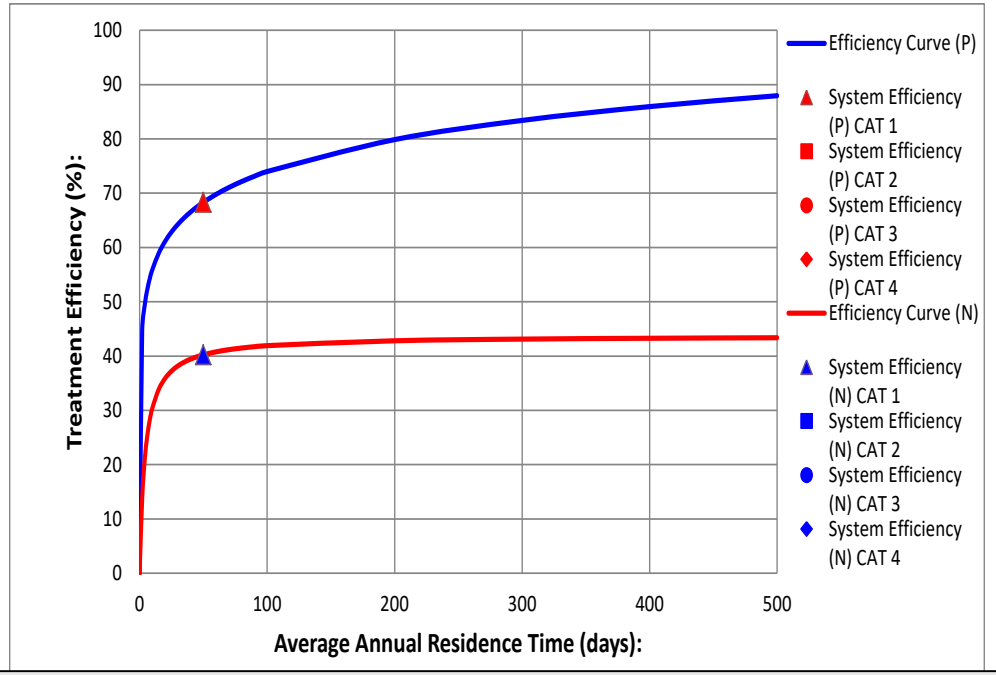
The avg annual cumulative rainfall for a given retention depth or rainfall volume.

Detention BMPs Treating Runoff from the Same Catchment Area

BMP Efficiency Determination

- Based on the residence time a treatment efficiency can be determined and note Different removals for N & P
- At 50 days residence time, N removal is 40%, P removal is 70%.

Detention Efficiency Plot



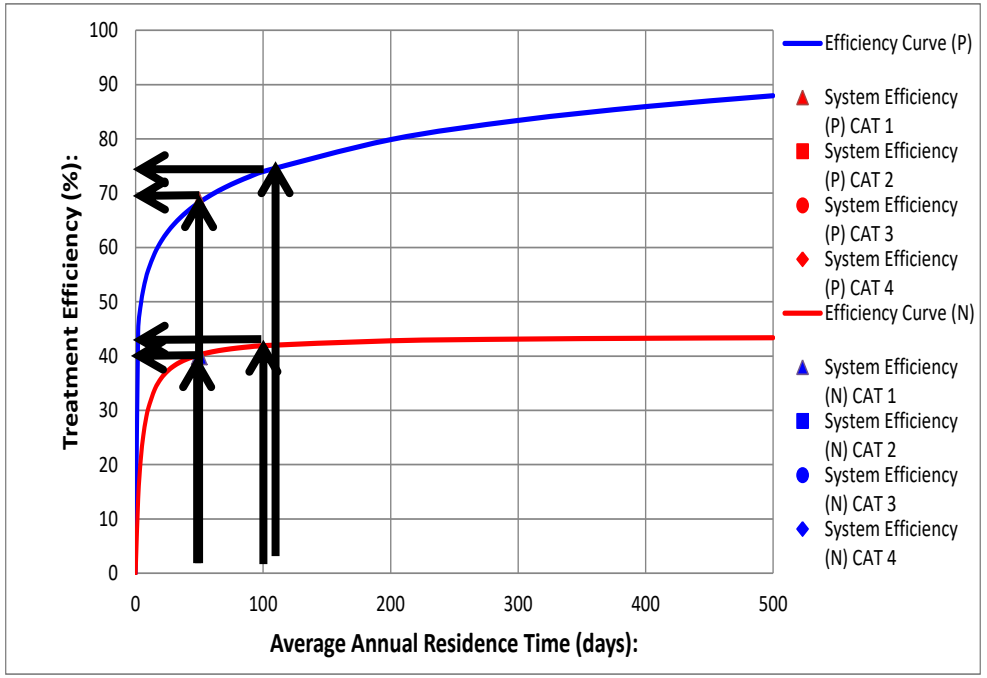
Average Annual Residence Time = [Perm Pool Vol / Annual Runoff] x days/year

Example for Detention BMPs in Series

BMP Efficiency Determination

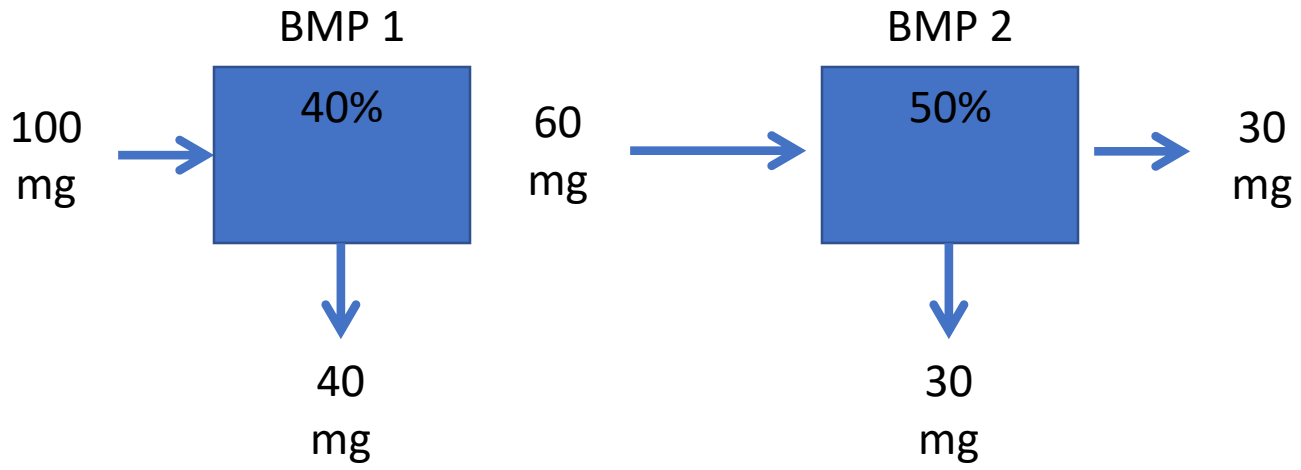
- Assume two detention BMPs in series – each have a 50 day retention time N=40%; P=70%
  - N – 40% + 40% = 80% **X**
  - P – 70% + 70% = 140% **X**
  - N – 50d + 50d = 100d ~ 43% ✓
  - P – 50d + 50d = 100d ~ 74% ✓

Detention Efficiency Plot



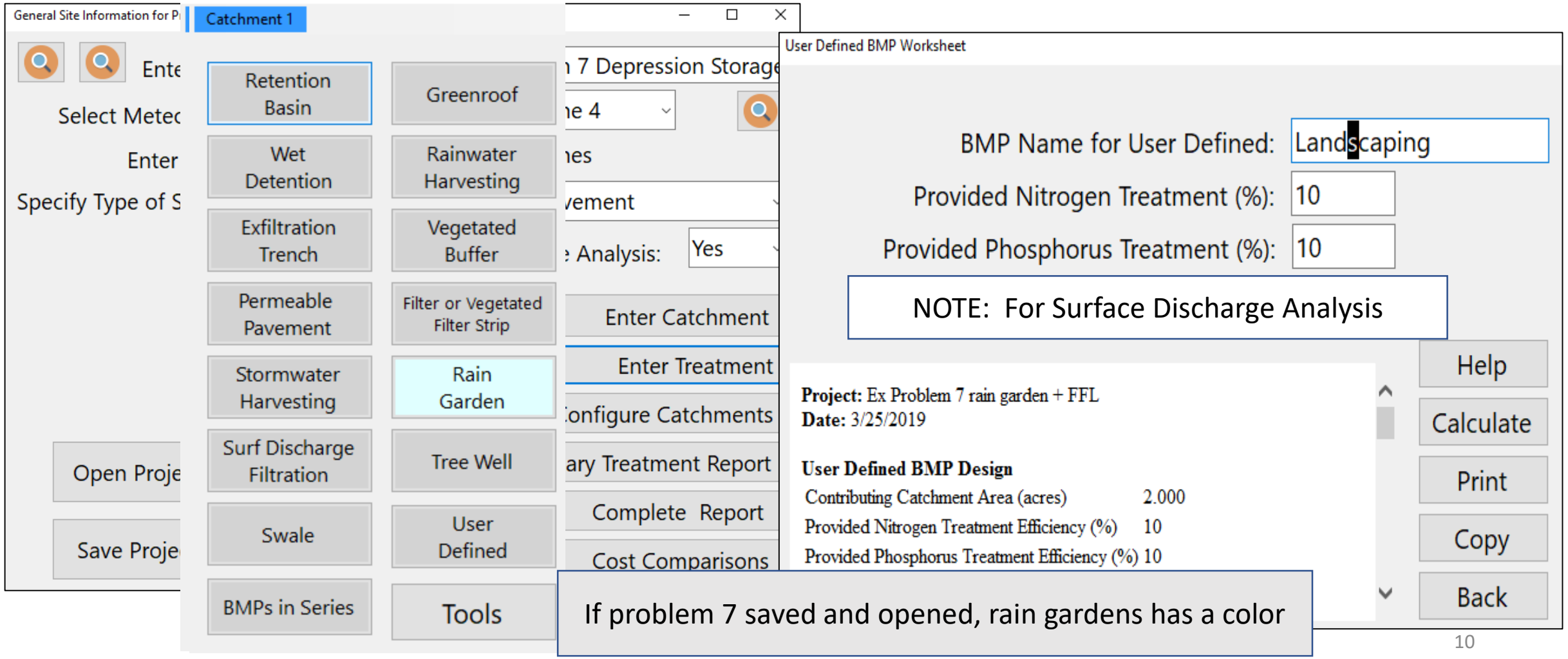
BMPs not Related

- Example: Wet detention followed by filtration



- Note this results in a 70% removal efficiency
  - Not 90%, and never can have over 100% removal

Example: Two BMPs in one catchment
Also an example of a BMP that is user defined
some user defined are: Pre-Treat, Street Sweeping & FFL

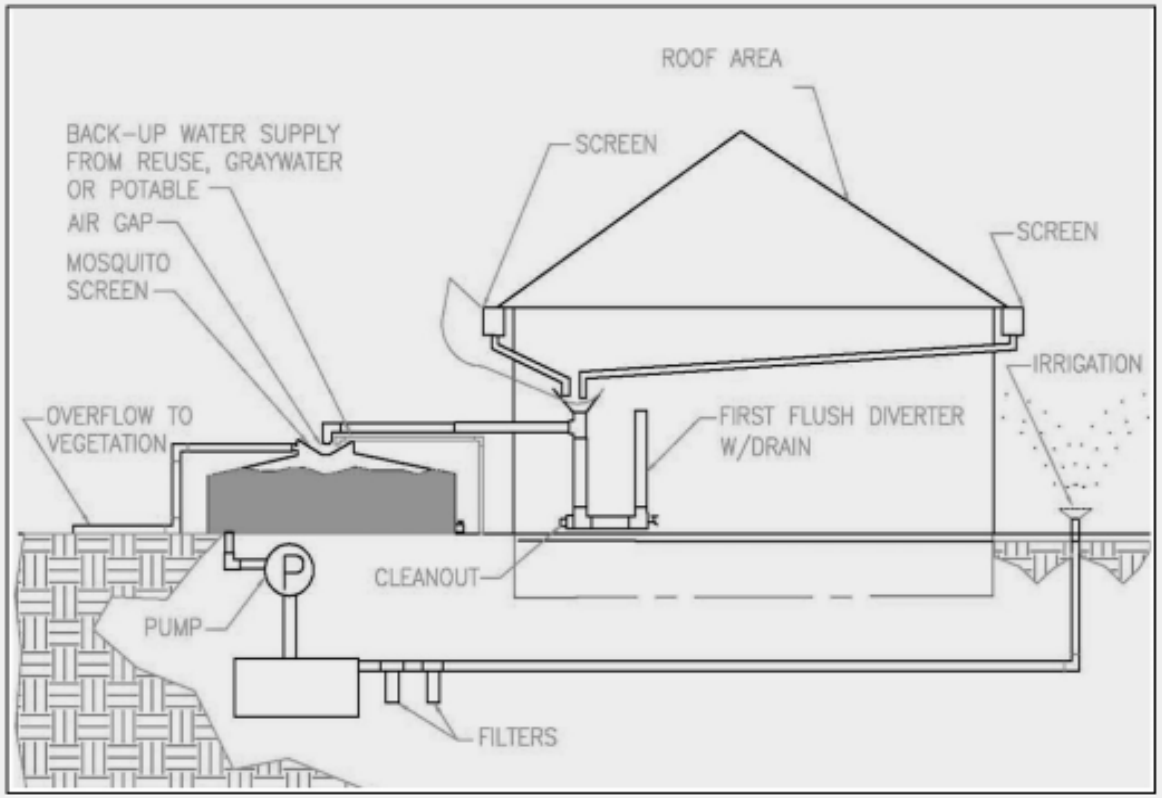


Select Treatment Options for individual performance, not in series or in multiple catchments. Analysis: BMP Analysis

Catchment 1

Treatment Options

Retention Basin	Greenroof
Wet Detention	Rainwater Harvesting
Exfiltration Trench	Vegetated Buffer
Permeable Pavement	Filter or Vegetated Filter Strip
Stormwater Harvesting	Rain Garden
Surf Discharge Filtration	Tree Well
Swale	User Defined
BMPs in Series	



Tools | Reset All

Catchments | Cost Report | Back

Multiple BMP Worksheet for Catchment 1

Add up to 4 BMP's to each catchment in order of routing

BMP 1: User Defined BMP — Open

BMP 2: Rain Garden — Open

BMP 3: None

BMP 4: None

Calculate

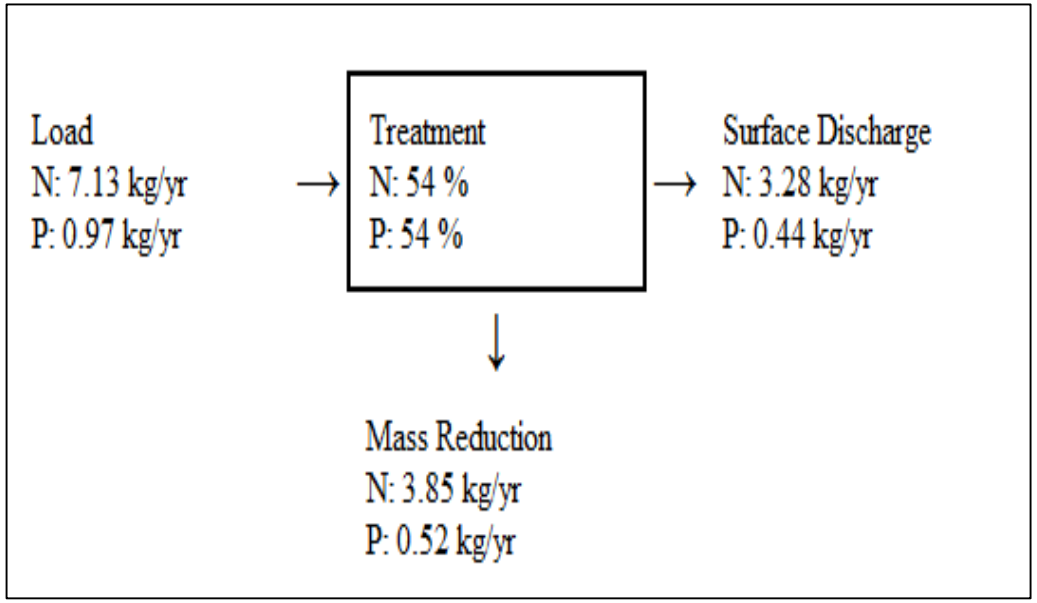
Print

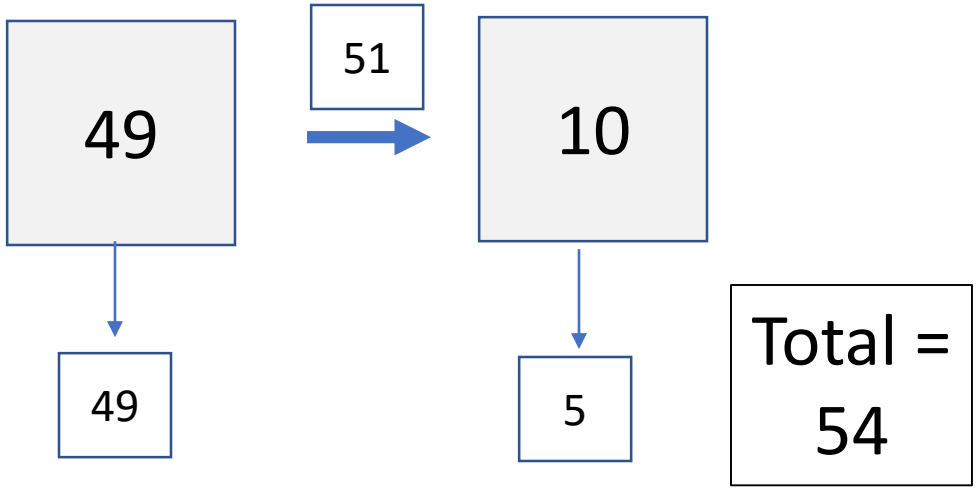
Copy

Back

Combined Report of all BMP's

Catchment Area (acres)	2.00
Watershed Non-DCIA Curve Number	78.00
Watershed DCIA Percent	65.00
Rainfall Zone	Florida Zone 4
Calculated Annual Coefficient (0-1)	0.58
Total (accumulated) Retention Depth (in over watershed)	0.452
Overall Provided Nitrogen Treatment Efficiency (%)	54
Overall Provided Phosphorus Treatment Efficiency (%)	54

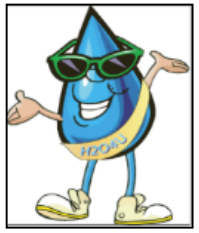


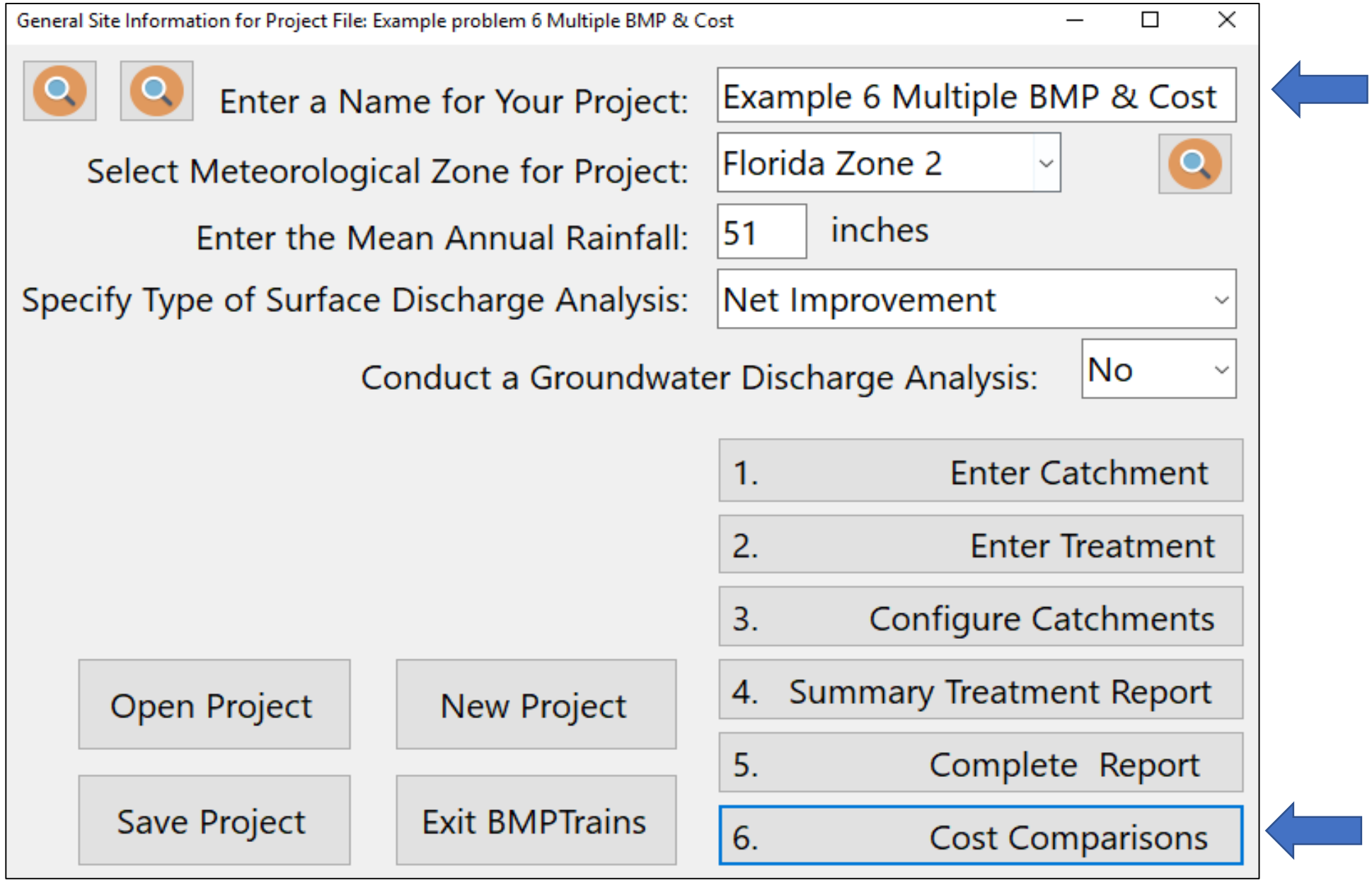


BMP Trains 2020 Model

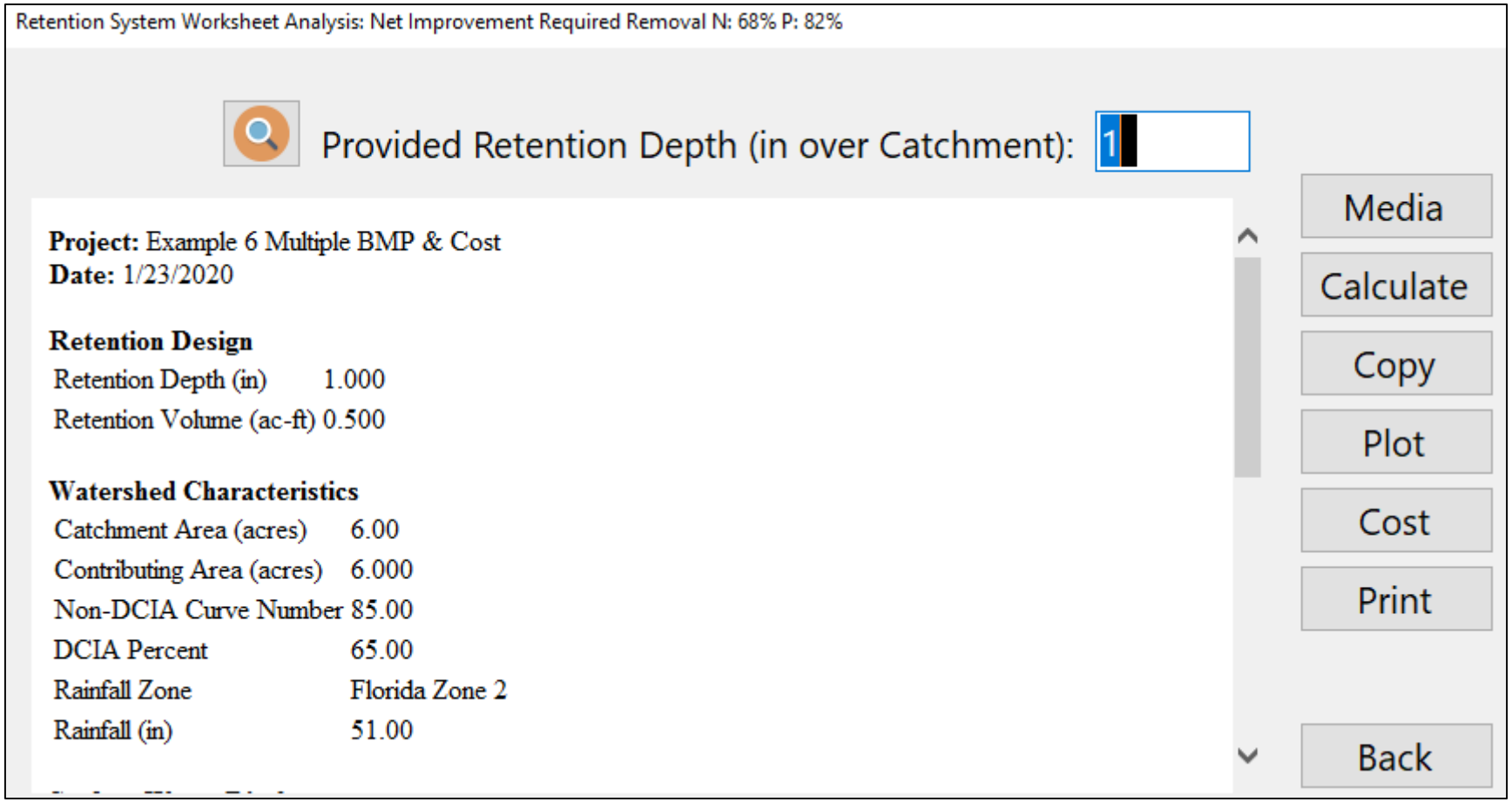
Cost Example Single Catchment Example Problem 6

By: Marty Wanielista

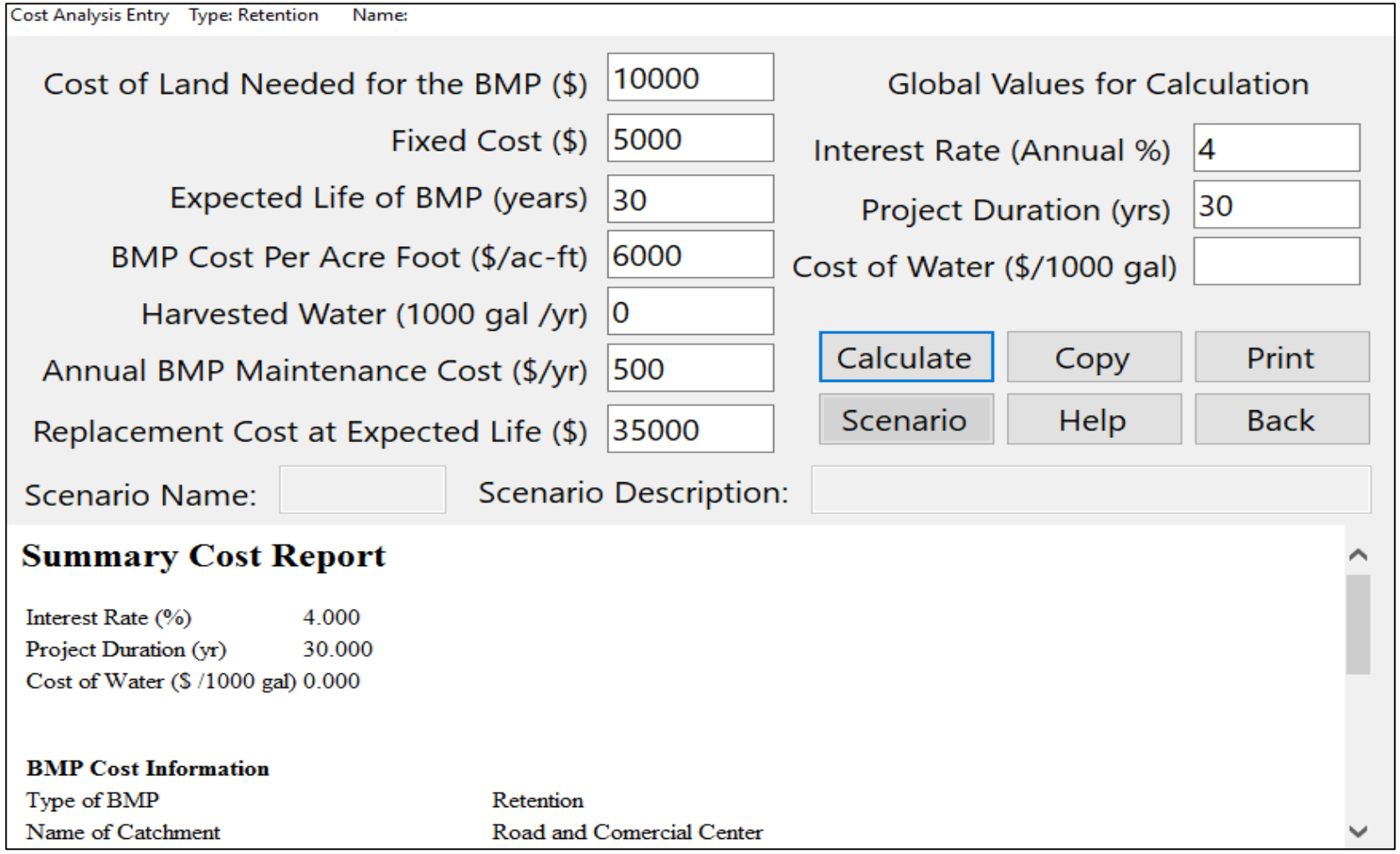



General Site Information for Project File: Example problem 6 Multiple BMP & Cost
Enter a Name for Your Project:
Example 6 Multiple BMP & Cost
Select Meteorological Zone for Project:
Florida Zone 2
Enter the Mean Annual Rainfall:
51
inches
Specify Type of Surface Discharge Analysis:
Net Improvement
Conduct a Groundwater Discharge Analysis:
No
1. Enter Catchment
2. Enter Treatment
3. Configure Catchments
4. Summary Treatment Report
5. Complete Report
6. Cost Comparisons
Open Project
New Project
Save Project
Exit BMPTrains

Enter cost data from the treatment worksheet



Example Input Cost Data for a Retention Basin



Example Output Cost Analysis

Project: Example 6 Multiple BMP & Cost

Date: 01/06/2019

Summary Cost Report

Interest Rate (%)	4.000
Project Duration (yr)	30.000
Cost of Water ($ /1000 gal)	0.000

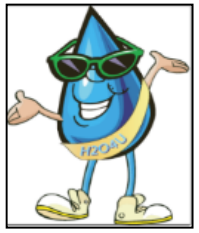
Road and Commercial Center (Catchment #1)

BMP Type	Treatment Volume (ac-ft)	Land Cost ($)	Expected Life (yr)	Fixed Cost ($)	BMP Cost ($/ac-ft)	Initial BMP Cost ($)	BMP Maintenance ($/yr)	Annual Recovery ($/yr)	Total Annual Cost ($/yr)	Future Replace Cost ($)	Present Value to Replace ($)	Present Value/Life Cycle Cost ($)	Nitrogen Mass Reduction (lb/yr)	Phosphorus Mass Reduction (lb/yr)	PV Cost per Pound N Removed ($/lb)	PV Cost per Pound P Removed ($/lb)
Retention	0.50	10,000	30	5,000	6,000	18,000		0	500	35,000	10,791	26,646	34.61	5.76	25.67	154.27
Exfiltration	0.07	0	30	2,000	265,000	20,311	800	0	800	0	0	34,145	8.49	1.41	134.00	805.41
Tree Well	0.07	0	30	2,000	95,000	8,543	800	0	800	0	0	22,376	8.47	1.41	88.11	529.57
Multiple BMP	0.64	10,000	0	9,000	0	46,854	2,100	0	2,100	0	10,791	83,167	37.54	6.25	73.85	443.86

BMP Trains 2020 Model

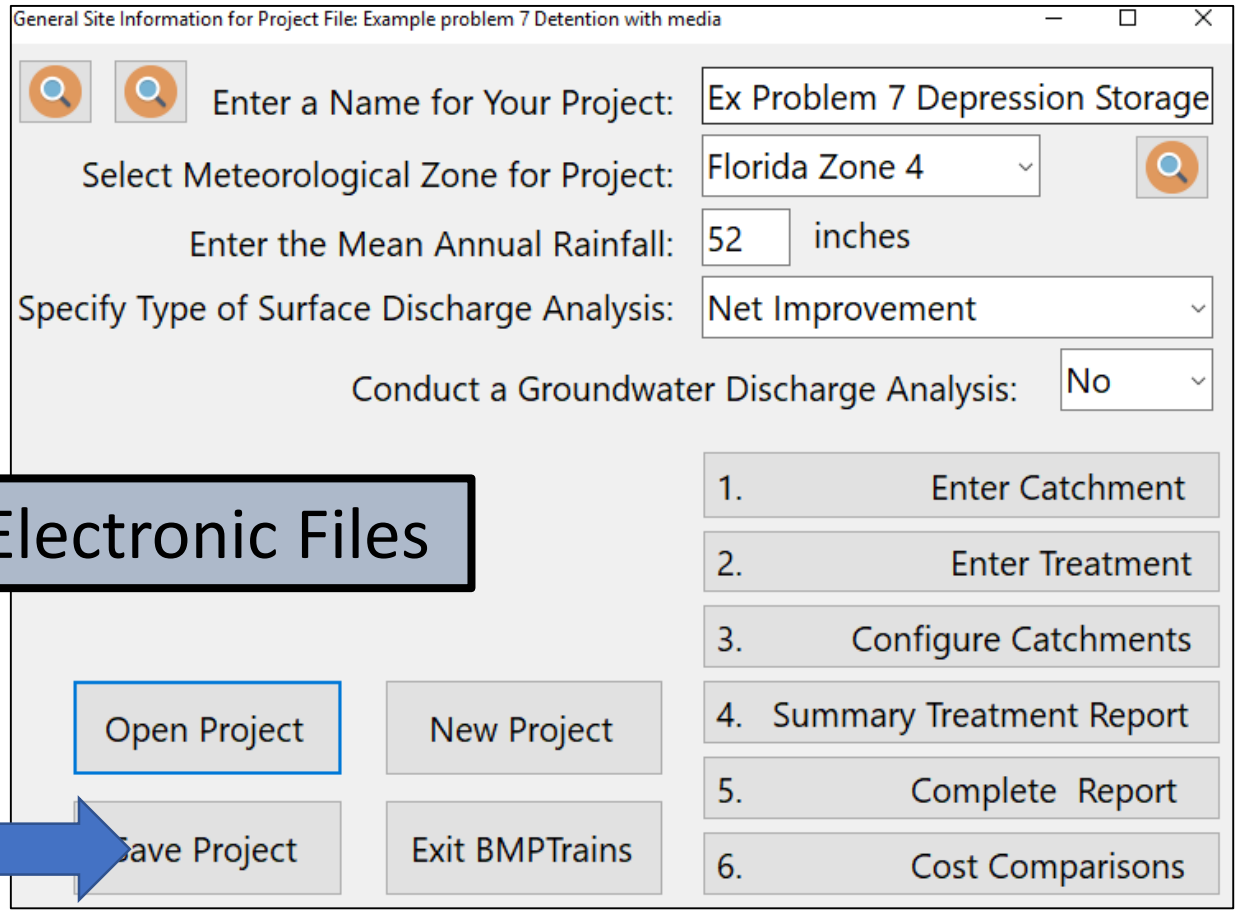
Reports, Copy, Print and Save

By: Marty Wanielista



REPORT GENERATION and DATA for REVIEW

Many options to print, copy or create electronic files



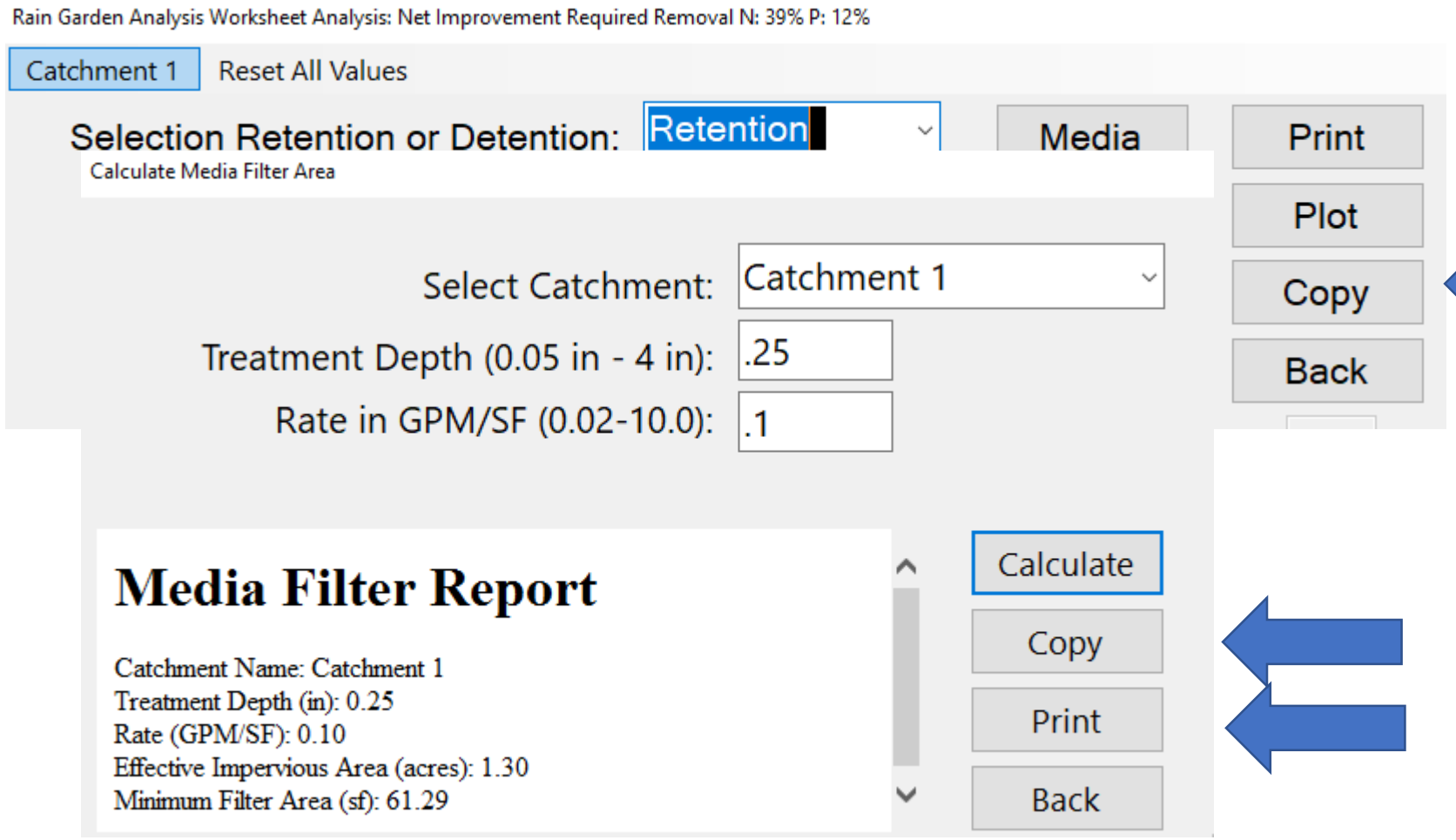
Electronic Files

Bragging point: Was able to secure the extender

Namely .BMPT

Example problem 10 5 catchments	10/28/2018 1:08 PM	BMPT File	372 KB
Example problem 11 user define BMP	10/29/2018 3:25 PM	BMPT File	75 KB
Example problem 11 user define with filter	10/29/2018 8:05 PM	BMPT File	75 KB
Example Problem 12, wet detention and s...	10/31/2018 10:18 ...	BMPT File	71 KB
hi intensity comm 100% imper	8/12/2018 10:20 AM	BMPT File	65 KB
I 95 Net Improvement	11/1/2018 3:05 PM	BMPT File	210 KB
Lake Silver current condition	11/11/2018 11:09 ...	BMPT File	141 KB

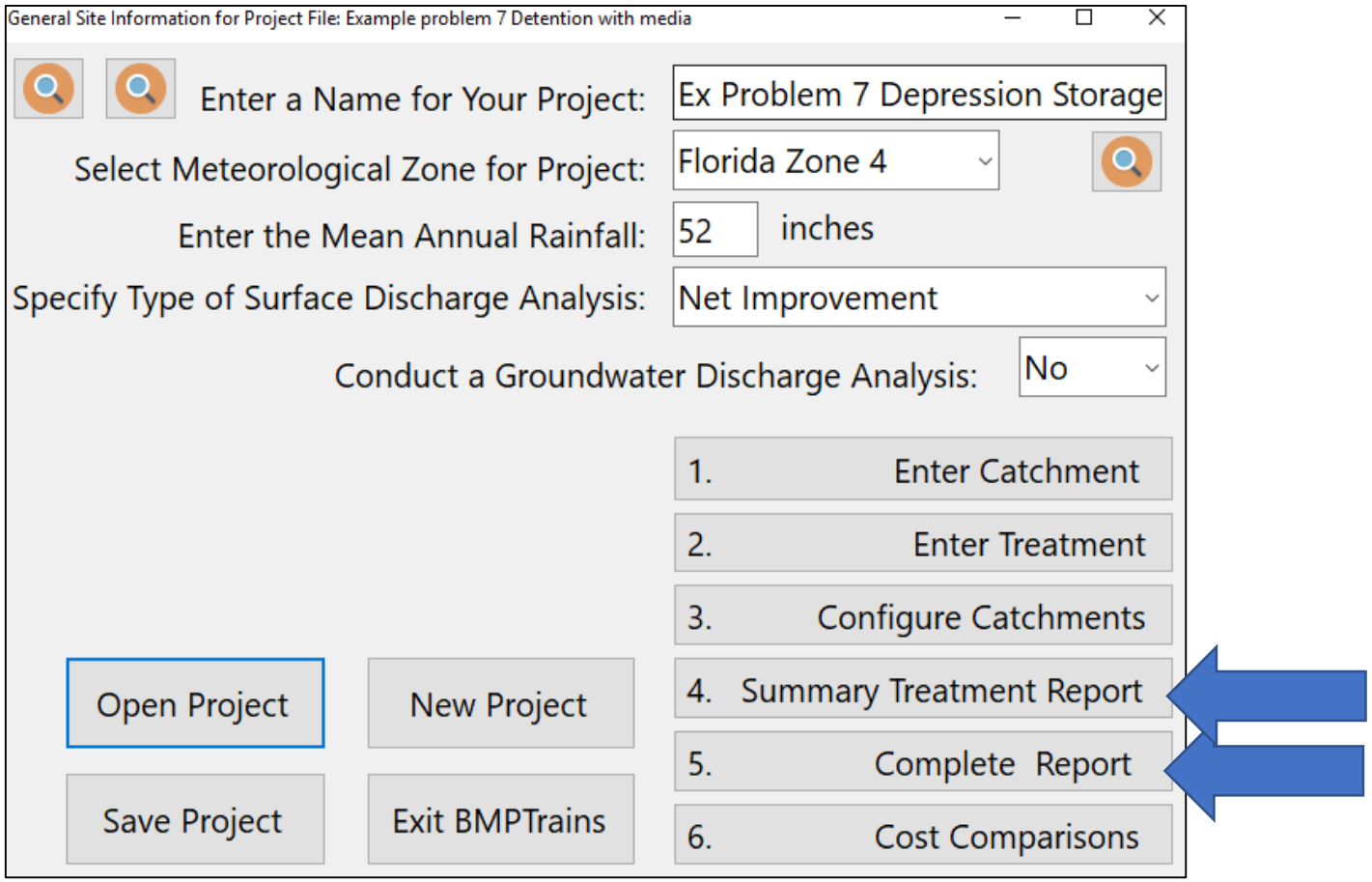
REVIEW PROCESS: USE COPIES OR PRINT OUTS



Note: 2020 Key Stroke Convention for Print Ctrl P is an option To print the report

REPORT GENERATION and DATA for REVIEW

Many options to print, copy or create electronic files



BMP Trains Reports

Copy Back

Complete Repo

Project: Ex Problem 7 Depression
Date: 3/25/2019 8:55:23 AM

Site and Catchment

Analysis: Net Improvement

Catchment Name
Rainfall Zone
Annual Mean Rainfall

Pre-Condition Land

Landuse
Area (acres)
Rational Coefficient (0-1)
Non DCIA Curve Number
DCIA Percent (0-100)
Nitrogen EMC (mg/l)
Phosphorus EMC (mg/l)
Runoff Volume (ac-ft/yr)
Nitrogen Loading (kg/yr)
Phosphorus Loading (kg/yr)

Post-Condition Landuse Information

Landuse
Area (acres)
Rational Coefficient (0-1)
Non DCIA Curve Number
DCIA Percent (0-100)
Nitrogen EMC (mg/l)
Phosphorus EMC (mg/l)
Runoff Volume (ac-ft/yr)
Nitrogen Loading (kg/yr)
Phosphorus Loading (kg/yr)

Catchment Number: 1 Name: Venice

Project: Ex Problem 7 Depression Storage
Date: 3/25/2019

Rain Garden detention with media Design

Type of System	Detention
Type of Media Mix	B&G CTS 24
Sustainable Void Fraction (0-1)	0.250
Media Volume (Cubic Feet)	5,800.000
Water Above Media (cubic feet)	2,080.000

BMP Trains Reports

Copy Back

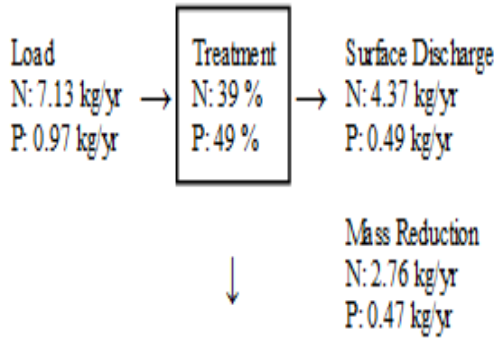
Watershed Characterist
Catchment Area (acres)
Contributing Area (acres)
Non-DCIA Curve Numbe
DCIA Percent
Rainfall Zone
Rainfall (in)

Surface Water Analysis
Required TN Treatment E
Provided TN Treatment E
Required TP Treatment E
Provided TP Treatment E

Media Mix Information
Type of Media Mix
Media N Reduction (%) 7
Media P Reduction (%) 9

Ground Water Analysis
Recharge Rate (MG/yr)
TN Mass Load (kg/yr)
TN Concentration (mg/L)
TP Mass Load (kg/yr)
TP Concentration (mg/L)

Load Diagram for Rain Garden detention with media (stand-alone)



Summary Treatment Report Version: 1.2.6

Project: Ex Problem 7 Depression Storage

Analysis Type: Net Improvement
BMP Types:
Catchment 1 - Rain Garden detention with media

Routing Summary
Catchment 1 Routed to Outlet

Total nitrogen target removal met? YES
Total phosphorus target removal met? YES

Summary Report

Nitrogen

Summary Reports and Information

Summary Treatment Report

Project: Ex Problem 7 Depression Storage

Analysis Type: Net Improvement
BMP Types:
Catchment 1 - Rain Garden retention with media

Routing Summary
Catchment 1 Routed to Outlet

Total nitrogen target removal met? YES
Total phosphorus target removal met? YES

Summary Report for Outlet:
Nitrogen Loading

Surface Water Analysis

Total N pre load	4.37 kg/yr	
Total N post load	7.13 kg/yr	
Target N load reduction	39 %	
Target N discharge load	4.37 kg/yr	
Percent N load reduction	49 %	
Provided N discharge load	3.65 kg/yr	8.05 lb/yr
Provided N load removed	3.48 kg/yr	7.68 lb/yr

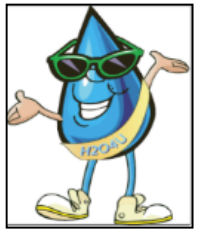
Groundwater Analysis

Average Annual Recharge	.793 MG/yr	
Provided N recharge load	.87 kg/yr	1.92 lb/yr
Provided N Concentration	.29 mg/l	

BMP Trains 2020 Model

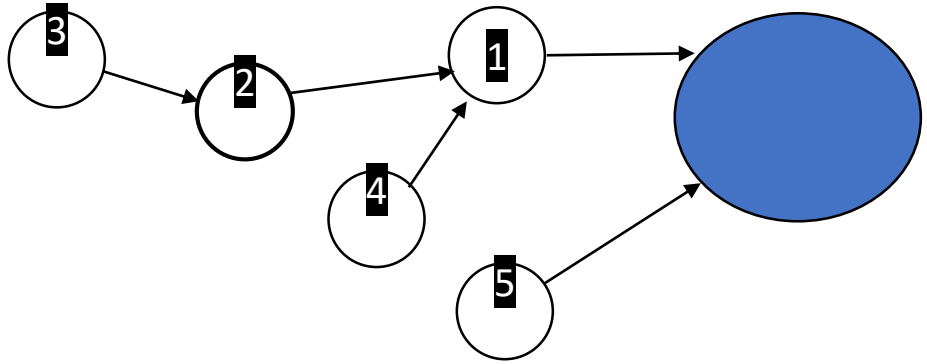
Multiple Configuration of Catchments

By: Marty Wanielista

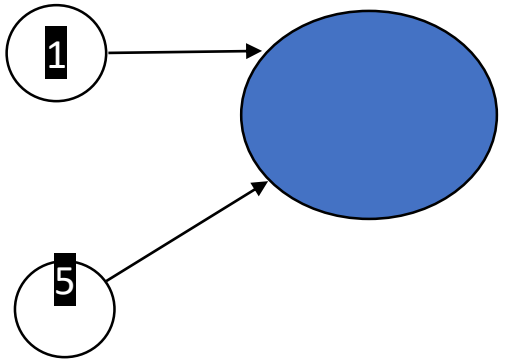


BMP Trains 2020 can model many catchments in any configuration

Previously limited to 4 catchments:



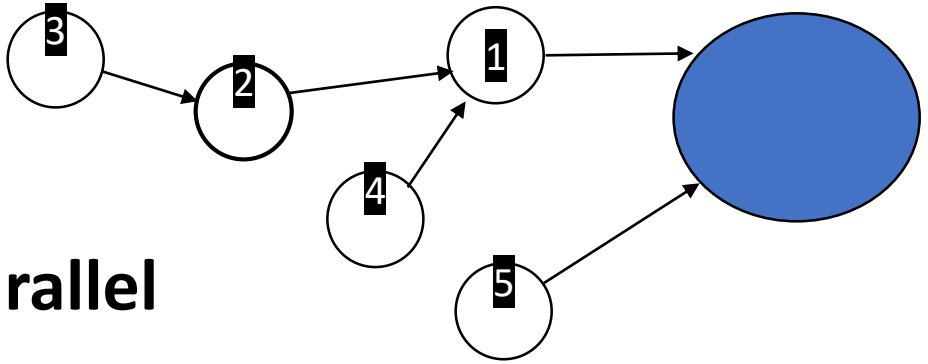
User Define



Previously had to run the model twice (4 catchments and two catchment). Then by repetitive solving of two models to achieve a target removal.

With BMP Trains 2020 run the model once to determine the average annual removal or target levels.

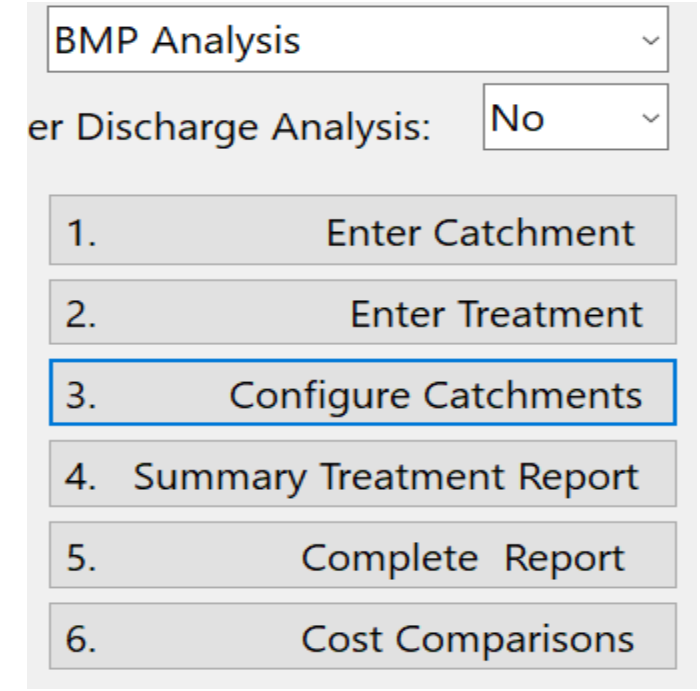
Many catchments in any configuration

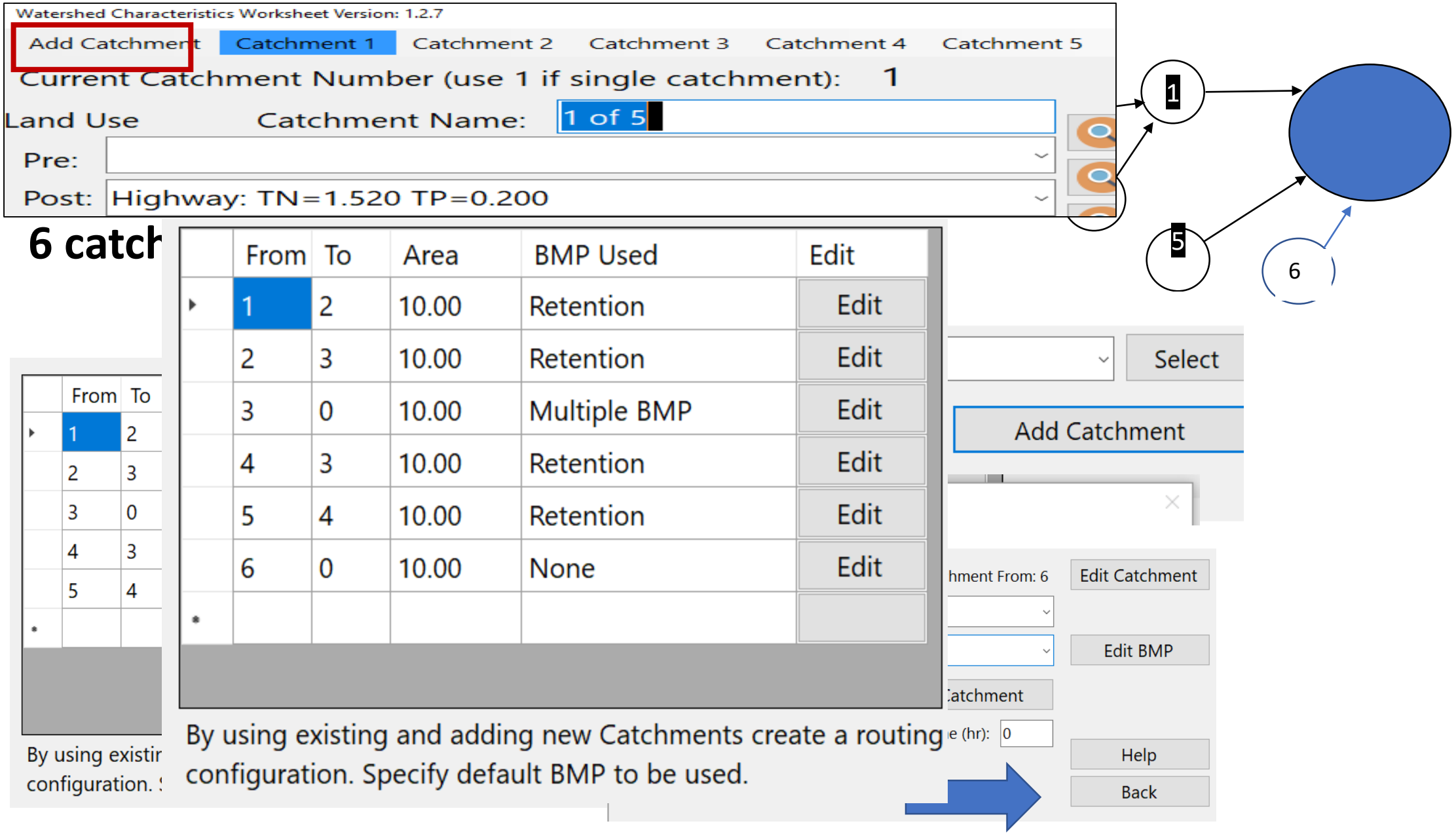


5 catchment configuration, series and parallel

	From	To	Area	BMP Used	Edit
▸	1	0	40.00	Retention	Edit
	2	1	40.00	Exfiltration	Edit
	3	2	40.00	None	Edit
	4	1	40.00	Retention	Edit
	5	0	40.00	WetDetention	Edit
*					

Catchment and treatment data must be added




Watershed Characteristics Worksheet Version: 1.2.7
Add Catchment
Catchment 1
Catchment 2
Catchment 3
Catchment 4
Catchment 5
Current Catchment Number (use 1 if single catchment): 1
Land Use
Catchment Name:
1 of 5
Pre:
Post: Highway: TN=1.520 TP=0.200
6 catch
From To Area BMP Used Edit
1 2 10.00 Retention Edit
2 3 10.00 Retention Edit
3 0 10.00 Multiple BMP Edit
4 3 10.00 Retention Edit
5 4 10.00 Retention Edit
6 0 10.00 None Edit
From To
1 2
2 3
3 0
4 3
5 4
By using existir
configuration.
By using existing and adding new Catchments create a routing configuration. Specify default BMP to be used.
Select
Add Catchment
hment From: 6
Edit Catchment
Edit BMP
atchment
e (hr): 0
Help
Back
1
5
6

BMP Trains 2020 Model

Model Capabilities
Questions and Discussion

By: Marty Wanielista