

DEQ Certification Class Presentations

Class presentations are provided for study/review purposes only. Printouts of these PowerPoint slides will not be allowed into the exam testing centers.

August 2024



Exercise 2A

Post-Development Curve Number

Exercise 2A Materials

In your participant guide:

- Exercise 2A Instructions
 - Use this sheet to jot down your results and notes

Exercise 2A: Instructions

SIMPLE SITE DESIGN (EXERCISE 1A SPREADSHEET)

Using the saved spreadsheet from Exercise 1A, follow the instructions below to determine the post-development runoff volume and curve number (CN). Use the site drainage area information given below.

Site Drainage Area Information (Given)

- Drainage area = 6.7 acres
- Post-development land cover (from Exercise 1A):
 - Managed turf = 4.75 acres
 - Impervious cover = 1.95 acres
 - Assume "C" soils throughout
- One-year rainfall = 2.6 inches

DETERMINE POST-DEVELOPMENT RUNOFF VOLUME AND CN

- Determine the post-development curve number for the one-year 24-hour storm computed from the spreadsheet.
- Determine the post-development one-year **runoff depth** (in inches) computed from the spreadsheet.]

Instructions

1. Start with the same Site tab information as in Exercise 1A.
2. Copy the land cover summary on the Site tab to the Drainage Area A tab.
3. Go to the Runoff Volume and Curve Number tab.
4. Enter the rainfall amount.
5. Review the Drainage Area A summary information.
6. Save the spreadsheet for further use as "EX2A.xls" or similar.

Helpful Hints: Make sure to copy the site data to the Drainage Area tab.

Exercise 2A Materials

VRRM 4.1 New Development Spreadsheet

- Open Exercise 1A spreadsheet

DEQ Virginia Runoff Reduction Method New Development Compliance Spreadsheet - Version 4.1

Project Name:

Date:

CLEAR ALL
(Ctrl+Shift+R)

BMP Design Specifications List: 2024 Stds & Specs

data input cells

constant values

calculation cells

final results

Site Information

Post-Development Project (Treatment Volume and Loads)

Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest (acres) -- undisturbed, protected forest or reforested land					0.00
Mixed Open (acres) -- undisturbed/inrequently maintained grass or					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			4.75		4.75
Impervious Cover (acres)			1.95		1.95
					6.70

Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary		Treatment Volume and Nutrient Loads	
Forest Cover (acres)	0.00	Treatment Volume (acre-ft)	0.2415
Weighted Rv (forest)	0.00	Treatment Volume (cubic feet)	10,518
% Forest	0%	TP Load (lb/yr)	5.21
Mixed Open (acres)	0.00	TN Load (lb/yr)	61.71
Weighted Rv (mixed open)	0.00		
% Mixed Open	0%		
Managed Turf Cover (acres)	4.75		
Weighted Rv (turf)	0.22		
% Managed Turf	71%		
Impervious Cover (acres)	1.95		
Rv (impervious)	0.95		
% Impervious	29%		
Site Area (acres)	6.70		
Site Rv	0.43		

Exercise 2A

Post-Development Curve Number

Site Information:

- Drainage area = 6.7 acres
- Post-development land cover
 - Managed turf = **4.75 acres**
 - Impervious cover = **1.95 acres**
 - Assume “C” soils
- One-year rainfall = 2.6 inches

Determine:

- ❑ Approximate curve number for one-year storm
- ❑ Post-development one-year runoff volume (watershed inches)

Solution

Exercise 2A (Post-Development Curve Number)

Site Information

1 From Exercise 1A

Post-Development Project (Treatment Volume and Loads)

Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest (acres) -- undisturbed, protected forest or reforested land					0.00
Mixed Open (acres) -- undisturbed/infrequently maintained grass or shrub land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			4.75		4.75
Impervious Cover (acres)			1.95		1.95

Site
D.A. A
D.A. B
D.A. C
D.A. D
D.A. E
Water Quality Compliance
Runoff Volume and CN
Summary
Constants
Notes

Site tab



Light green = Managed turf
 Dark gray = Building
 Light gray = Parking and sidewalks

Exercise 2A (Post-Development Curve Number)

2 Enter areas on Drainage Area A tab

Drainage Area A

Drainage Area A Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv	Composite Loading P
Forest (acres)					0.00	0.00	0.00
Mixed Open (acres)					0.00	0.00	0.00
Managed Turf (acres)			4.75		4.75	0.22	0.75
Impervious Cover (acres)			1.95		1.95	0.95	0.86
				Total	6.70		

Site **D.A. A** D.A. B D.A. C D.A. D D.A. E Water Quality Compliance Runoff Volume and CN Summary Constants Notes

Drainage Area tab

Exercise 2A (Post-Development Curve Number)

Runoff Volume and Curve Number Calculations, VRRM 4.1, 2024

Enter design storm rainfall depths (in):

1-year storm

2-year storm

10-year storm

2.60

Use NOAA Atlas 14 (<http://hdsc.nws.noaa.gov/hdsc/pfds/>)

Site

D.A. A

D.A. B

D.A. C

D.A. D

D.A. E

Water Quality Compliance

Runoff Volume and CN

Summary

Constants

Notes

Runoff Volume and CN

3

Enter 2.60 inches for one-year storm on Runoff Volume and Curve Number tab

Exercise 2A (Post-Development Curve Number)

4

Review Drainage Area A summary information

Drainage Area A		A Soils	B Soils	C Soils	D Soils	Total Area (acres):	6.70
Forest -- undisturbed, protected forest or reforested land	Area (acres)	0.00	0.00	0.00	0.00	Runoff Reduction Volume (ft ³):	0
	CN	30	55	70	77		
Mixed Open -- undisturbed/inrequently maintained grass or shrub land	Area (acres)	0.00	0.00	0.00	0.00		
	CN	34	59	72	79		
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.00	4.75	0.00		
	CN	39	61	74	80		
Impervious Cover	Area (acres)	0.00	0.00	1.95	0.00		
	CN	98	98	98	98		
		CN _(D.A. A)					
		81					
RV _{Developed} (watershed-inch) with no Runoff Reduction*	1-year storm	1.01	0.00	0.00			
RV _{Developed} (watershed-inch) with Runoff Reduction*	1-year storm	1.01	0.00	0.00			
Adjusted CN*	1-year storm	81	100	100			

*See Notes above

Weighted or composite curve number (CN) = 81

- No CN adjustment
- P-BMPs not yet added—no runoff reduction

5

Determine post-development one-year runoff volume in watershed inches = 1.01 inches

$RV_{\text{Developed}}$ (watershed-inch) with no Runoff Reduction*

$RV_{\text{Developed}}$ (watershed-inch) with Runoff Reduction*

Adjusted CN*

1-year storm	2-year storm	10-year storm
2.60	0.00	0.00

Use NOAA Atlas 14 (<http://hdsc.nws.noaa.gov/hdsc/pfds/>)

1-year storm	2-year storm	10-year storm
1.01	0.00	0.00
1.01	0.00	0.00
81	100	100

*See Notes above

Adjusted CN of 81 is unchanged

TR-55 Runoff Equations 2-3 and 2-4 Module 5

$$S = \frac{1000}{CN} - 10 = \frac{1000}{81} - 10 = 2.35 \text{ in}$$

S = potential maximum retention after runoff begins, inches

5

Determine post-development one-year runoff volume in watershed inches = 1.01 inches

$RV_{\text{Developed}}$ (watershed-inch) with no Runoff Reduction*

$RV_{\text{Developed}}$ (watershed-inch) with Runoff Reduction*

Adjusted CN*

1-year storm	2-year storm	10-year storm
2.60	0.00	0.00

Use NOAA Atlas 14 (<http://hdsc.nws.noaa.gov/hdsc/pfds/>)

1-year storm	2-year storm	10-year storm
1.01	0.00	0.00
1.01	0.00	0.00
81	100	100

*See Notes above

Adjusted CN of 81 is unchanged

Q calculated using P and S

TR-55 Runoff Equations 2-3 and 2-4 Module 5

$$S = \frac{1000}{CN} - 10 = \frac{1000}{81} - 10 = 2.35 \text{ in}$$

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{[2.6 - (0.2 \times 2.35)]^2}{2.6 + (0.8 \times 2.35)} = 1.01 \text{ in}$$

Q = runoff depth, inches

(Runoff volume also expressed as runoff depth)

5

Determine post-development one-year runoff volume in watershed inches = 1.01 inches

1-year storm	2-year storm	10-year storm
2.60	0.00	0.00

Use NOAA Atlas 14 (<http://hdsc.nws.noaa.gov/hdsc/pfds/>)

1-year storm	2-year storm	10-year storm
1.01	0.00	0.00
1.01	0.00	0.00
81	100	100

RV_{Developed} (watershed-inch) with no Runoff Reduction*

RV_{Developed} (watershed-inch) with Runoff Reduction*

Adjusted CN*

*See Notes above

*RV in VRRM CN adjustment is the same as Q in TR-55 Runoff Equation

TR-55 Runoff Equations 2-3 and 2-4 Module 5

$$S = \frac{1000}{CN} - 10 = \frac{1000}{81} - 10 = 2.35 \text{ in}$$

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{[2.6 - (0.2 \times 2.35)]^2}{2.6 + (0.8 \times 2.35)} = 1.01 \text{ in}$$

Q = runoff depth, inches

(Runoff volume also expressed as runoff depth)

Questions?

