

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 1D

Alternate Stormwater Treatment Design

Exercise 1D Materials

In your participant guide:

- Exercise 1D Instructions
 - Use this sheet to jot down your results and notes

Exercise 1D: Instructions

ALTERNATE STORMWATER TREATMENT DESIGN

Follow the instructions below to evaluate if the alternate stormwater treatment design below meets water quality compliance. Use the site information and proposed treatment provided below. Assume "C" soils throughout and use the New Development Compliance spreadsheet.

Site Information

- Project area = 6.7 acres
- Post-development land cover:
 - Forest = 3 acres
 - Mixed open = 0.92 acres
 - Managed turf = 0.5 acres
 - Impervious cover = 1.95 acres
- Assume "C" soils throughout

Proposed treatment

- Treatment train of Dry Swale Level 2 (DS2) to Extended Detention Level 2 (ED2):
 - DS2 directly treats 0.60 acres of impervious area and all mixed open and managed turf.
 - DS2 has a surface area of 0.08 acres.
 - ED2 has a surface area of 0.25 acres.

EVALUATE FOR WATER QUALITY COMPLIANCE

Using the New Development Compliance spreadsheet, evaluate if the site meets water quality compliance requirements. Use the table below for the spreadsheet area inputs and results.

- Determine the total load reduction requirement and total load reduction achieved.
- Determine if the proposed treatment complies with the water quality compliance requirements.
- Enter the data into the spreadsheet.

		Site Information (no BMPs)	Site tab	DA tab
Site Data	Forest:	3 acres		
	Mixed Open	0.92 acres		
	Managed Turf:	0.5 acres		
	Impervious Cover:	1.95 acres		
Results	Total Phosphorus Load Reduction Achieved:			
	Total Phosphorus Load Reduction Requirement:			
	Water Quality Treatment Requirements Met?			

Exercise 1D Materials

In your participant guide:

- Module 4
 - Tables 4-2 and 4-4

FOREST

Land that will remain undisturbed¹:

- Portions of the site that will NOT be disturbed during construction.
- Portions of residential lots that will NOT be disturbed during construction, as approved by the VESMP authority. Portions of residential lots that will NOT be disturbed during construction, as approved by the VESMP authority.
- Surface area of stormwater post-construction (P-BMPs)² that are NOT wet ponds, have some type of vegetative cover, and that do not replace an otherwise impervious surface.³
 - P-BMPs in this category include bioretention, dry swale, grass channel, stormwater wetland, soil amended areas that are vegetated, and infiltration practices that have a vegetated cover.
- Other areas of existing forest, including wetlands, that will be protected during construction and that will remain undisturbed.
- Non-disturbed portions of the site that will be afforested (minimum of 400 woody stems per acre).

MIXED OPEN

Land that will remain undisturbed OR will be left in a natural vegetated state (bush hogged no more than four times per year):

- Portions of a development (residential lots, roadway rights-of-way, community open spaces areas, etc.) that were disturbed during construction and will not be mowed routinely but left in a natural vegetated state (can include areas bush hogged no more than four times per year or rotationally grazed) as approved by the VESMP authority.
- Community open space areas that will not be mowed routinely but left in a natural vegetated state (can include areas bush hogged no more than four times per year or rotationally grazed).
- Utility rights-of-way that will be left in a natural vegetated state (can include areas bush hogged no more than four times per year or rotationally grazed).
- Surface area of extended detention (ED) pond that is not mowed routinely.
- Other areas of existing mixed open that will be protected during construction and that will remain undisturbed.

Exercise 1D Materials

Virginia Runoff Reduction Method (VRRM) 4.1 New Development Spreadsheet

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

Project Name: CLEAR ALL (ctrl+q)

Date:

DEQ Design Specifications List 2024 State & Spec

Site Information

ENTER AREAS IN DATA INPUT CELLS FOR RESULTS

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 watershed area					0.00
Mixed Open (acres) - undisturbed/inherently maintained areas or Managed Turf (acres) - disturbed, graded for yards or other soft to be					0.00
Impervious Cover (acres)					0.00
					0.00

Post-Development Requirement for Site Area

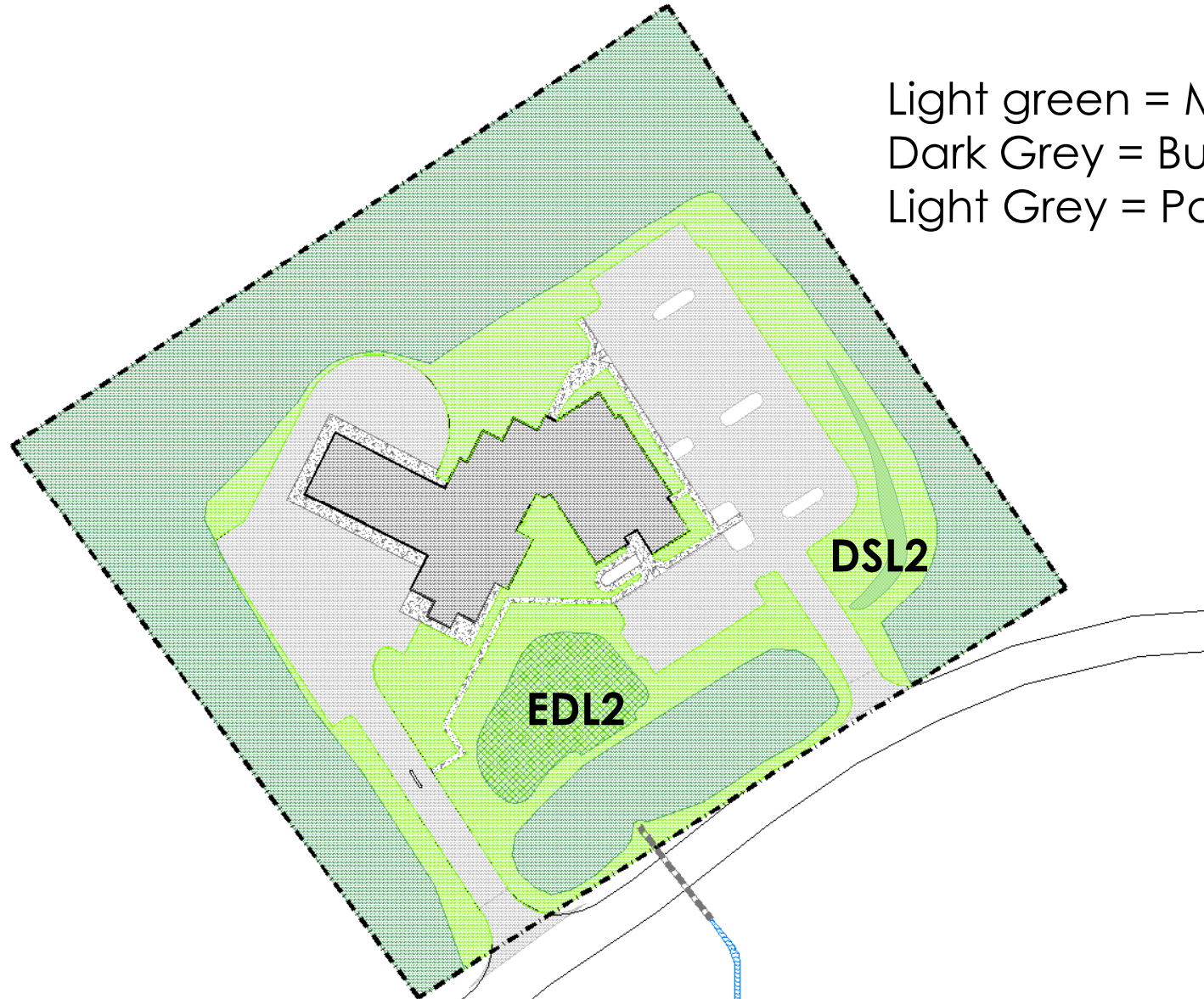
TP Load Reduction Required (lb/yr)

LAND COVER SUMMARY - POST DEVELOPMENT

Land Cover Summary		Treatment Volume and Nutrient Loads	
Forest Cover (acres)	0.00	Treatment Volume (acre-ft)	0.0000
Designated As Forest	0.00	Treatment Volume (cubic feet)	0
% Forest	0%	TP Load (lb/yr)	0.00
Mixed Open (acres)	0.00	TP Load (lb/yr)	0.00
Designated As mixed open	0.00		
% Mixed Open	0%		
Managed Turf Cover (acres)	0.00		
Designated As turf	0.00		
% Managed Turf	0%		
Impervious Cover (acres)	0.00		
As impervious	0.00		
% Impervious	0%		
Site Area (acres)	0.00		
Site As	0.00		

Treatment Train

Dry Swale Level 2 (DSL2) to
Extended Detention Level 2 (EDL2)



Light green = Managed Turf
Dark Grey = Building
Light Grey = Parking & Sidewalks

Exercise 1D

Alternative Stormwater Treatment Design

Initial Site Information:

Project Area = 6.7 acres

Forest*	3 ac
Mixed open*	0.5 ac
Managed turf*	1.25 ac
Impervious cover	1.95 ac

*Assume all "C" soils

Proposed Treatment:

Dry Swale Level 2 (DS2) to
Extended Detention Level 2 (ED2)

Treated area via treatment train:

- 1.0 acres impervious area, 0.30 acres mixed open, and 0.50 acres managed turf areas
- P-BMP surface areas = 0.12 ac (DS2) and 0.25 ac (ED2)

Determine for proposed treatment:

- | | |
|---|--|
| <input type="checkbox"/> Total phosphorus load reduction achieved: | |
| <input type="checkbox"/> Total phosphorus load reduction requirement: | |
| <input type="checkbox"/> Water quality treatment requirements met? | |

Exercise 1D

Alternative Stormwater Treatment Design

Not Including P-BMPs		Including P-BMP Surface Areas	
Site Information		Site tab	Drainage Area tab
Forest:	3 acres		
Mixed Open	0.5 acres		
Managed Turf:	1.25 acres		
Impervious Cover:	1.95 acres		

Determine for proposed treatment:

- | | |
|---|--|
| <input type="checkbox"/> Total phosphorus load reduction achieved: | |
| <input type="checkbox"/> Total phosphorus load reduction requirement: | |
| <input type="checkbox"/> Water quality treatment requirements met? | |

Solution

DEFINITION: FOREST

Land that will remain undisturbed¹:

- Portions of the site that will NOT be disturbed during construction.
- Portions of residential lots that will NOT be disturbed during construction, as approved by the VESMP authority. Portions of residential lots that will NOT be disturbed during construction, as approved by the VESMP authority.
- Surface area of stormwater post-construction (P-BMPs)² that are NOT wet ponds, have some type of vegetative cover, and that do not replace an otherwise impervious surface.³

- P-BMPs in this category include bioretention, **dry swale**, grass channel, stormwater wetland, soil amended areas that are vegetated, and infiltration practices that have a vegetated cover.

- Other areas of existing forest, including wetlands, that will be protected during construction and that will remain undisturbed.
- Non-disturbed portions of the site that will be afforested (minimum of 400 woody stems per acre).

DEFINITION: MIXED OPEN

Land that will remain undisturbed OR will be left in a natural vegetated state (bush hogged no more than four times per year):

- Portions of a development (residential lots, roadway rights-of-way, community open spaces areas, etc.) that were disturbed during construction and will not be mowed routinely but left in a natural vegetated state (can include areas bush hogged no more than four times per year or rotationally grazed) as approved by the VESMP authority.
- Community open space areas that will not be mowed routinely but left in a natural vegetated state (can include areas bush hogged no more than four times per year or rotationally grazed).
- Utility rights-of-way that will be left in a natural vegetated state (can include areas bush hogged no more than four times per year or rotationally grazed).
- Surface area of extended detention (ED) pond that is not mowed routinely.
- Other areas of existing mixed open that will be protected during construction and that will remain undisturbed.

Exercise 1D

Alternative Stormwater Treatment Design

Not including P-BMPs		Including P-BMP surface areas	
Site Information		Site tab	DA Tab
Forest:	3 acres	$3 + 0.12 = 3.12 \text{ acres}$	<i>3.12 acres</i>
Mixed Open	0.50 acres	$0.50 + 0.25 = 0.75 \text{ acres}$	<i>0.75 acres</i>
Managed Turf:	1.25 acres	$1.25 - 0.12 - 0.25 = 0.88 \text{ acres}$	<i>0.88 acres</i>
Impervious Cover:	1.95 acres	<i>1.95 acres</i>	<i>1.95 acres</i>

Determine for proposed treatment:

- | | |
|---|--|
| <input type="checkbox"/> Total phosphorus load reduction achieved: | |
| <input type="checkbox"/> Total phosphorus load reduction requirement: | |
| <input type="checkbox"/> Water quality treatment requirements met? | |

Exercise 1D

P-BMP Credit Areas in DA Tab

Treated Area via Treatment Train		DS2 Credit Area	ED2 Credit Area
Mixed Open	0.30 acres	<i>0.30 acres</i>	<i>0.25 acres</i>
Managed Turf:	0.50 acres	<i>0.50 acres</i>	-
Impervious Cover:	1.0 acres	<i>1.0 acres</i>	-

Determine for proposed treatment:

<input type="checkbox"/> Total phosphorus load reduction achieved:	
<input type="checkbox"/> Total phosphorus load reduction requirement:	
<input type="checkbox"/> Water quality treatment requirements met?	

Dry Swale (L2) to Extended Detention (L2)

1

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

Project Name:

Date:

BMP Design Specifications List: 2024 Stds & Specs

CLEAR ALL
(Ctrl+Shift+R)

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			3.12		3.12
Mixed Open (acres) -- undisturbed/infrequently maintained grass or shrub land			0.75		0.75
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed			0.88		0.88
Impervious Cover (acres)			1.95		1.95
					6.70

* Forest and Mixed Open areas must be protected in accordance with the Virginia Runoff Reduction Method

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

Dry Swale (L2) to Extended Detention (L2)

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)			3.12		3.12	0.04	0.08
Mixed Open (acres)			0.75		0.75	0.13	0.39
Managed Turf (acres)			0.88		0.88	0.22	0.75
Impervious Cover (acres)			1.95		1.95	0.95	0.86
Total					6.70		

3

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

Dry Swale (L2) to Extended Detention (L2)

4 Enter area treated by DS2 (upstream practice)

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)			3.12		3.12	0.04	0.08
Mixed Open (acres)			0.75		0.75	0.13	0.39
Managed Turf (acres)			0.88		0.88	0.22	0.75
Impervious Cover (acres)			1.95		1.95	0.95	0.86
Total					6.70		

Stormwater Best Management Practices (RR = Runoff Reduction)

Practice	Runoff Reduction Credit (%)	Mixed Open Credit Area (acres)	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	Volume from Upstream Practice (ft ³)	Runoff Reduction (ft ³)	Remaining Runoff Volume (ft ³)
5.b. Dry Swale #2 (P-CNV-02)	60	0.30	0.50	1.00	0	2,394	1,596

Site

D.A. A

D.A. B

D.A. C

D.A. D

D.A. E

Water Quality Compliance

Runoff Volume and CN

Summary

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Dry Swale (L2) to Extended Detention (L2)

5 Add downstream ED L2 practice via drop down menu

Drainage Area A

VRRM 4.1, 2024

Drainage Area A Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv	Composite Loading P
Forest (acres)			3.12		3.12	0.04	0.08
Mixed Open (acres)			0.75		0.75	0.13	0.39
Managed Turf (acres)			0.88		0.88	0.22	0.75
Impervious Cover (acres)			1.95		1.95	0.95	0.86
Total					6.70		

Downstream Practice

Total Phosphorus Available for Removal in D.A. A (lb/yr) 2.62

Post Development Treatment Volume in D.A. A (ft³) 7,781

Stormwater Best Management Practices (RR = Runoff Reduction)

--Select from dropdown lists--

Practice	Runoff Reduction Credit (%)	Mixed Open Credit Area (acres)	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	Volume from Upstream Practice (ft ³)	Runoff Reduction (ft ³)	Remaining Runoff Volume (ft ³)	Total BMP Treatment Volume (ft ³)	Phosphorus Removal Efficiency (%)	Phosphorus Load from Upstream Practices (lb)	Untreated Phosphorus Load to Practice (lb)	Phosphorus Removed By Practice (lb)	Remaining Phosphorus Load (lb)	Downstream Practice to be Employed
5.b. Dry Swale #2 (P-CNV-02)	60	0.30	0.50	1.00	0	2,394	1,596	3,989	40	0.00	1.35	1.02	0.32	8.b. ED #2

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

Dry Swale (L2) to Extended Detention (L2)

Do not enter acreage more than once in P-BMP credit areas

Image Area A VRRM 4.1, 2024

Image Area A Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv	Composite Loading P
Forest (acres)			3.12		3.12	0.04	0.08
Mixed Open (acres)			0.75		0.75	0.13	0.39
Managed Turf (acres)			0.88		0.88	0.22	0.75
Impervious Cover (acres)			1.95		1.95	0.95	0.86
Total					6.70		

CLEAR BMP AREAS

Downstream Practice

Post Development Treatment Volume in D.A. A (ft³) 7,781

Stormwater Best Management Practices (RR = Runoff Reduction)

Practice	Runoff Reduction Credit (%)	Mixed Open Credit Area (acres)	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	Volume from Upstream Practice (ft ³)	Runoff Reduction (ft ³)	Remaining Runoff Volume (ft ³)	Total BMP Treatment Volume (ft ³)	Phosphorus Removal Efficiency (%)	Phosphorus Load from Upstream Practices (lb)	Untreated Phosphorus Load to Practice (lb)	Phosphorus Removed By Practice (lb)	Remaining Phosphorus Load (lb)	Select from dropdown
5.b. Dry Swale #2 (P-CNV-02)	60	0.30	0.50	1.00	0	2,394	1,596	3,989	40	0.00	1.35	1.02	0.32	8.b. ED #2
Bioretention (RR)														
Bioretention #1 or Micro-Bioretention #1 or Urban Bioretention (P-FIL-05)	40				0	0	0	0	25	0.00	0.00	0.00	0.00	
6.b. Bioretention #2 or Micro-Bioretention #2 (P-FIL-05)	80				0	0	0	0	50	0.00	0.00	0.00	0.00	
Filtration (RR)														
7.a. Infiltration #1 (P-FIL-04)	50								25	0.00	0.00	0.00	0.00	
7.b. Infiltration #2 (P-FIL-04)	90								25	0.00	0.00	0.00	0.00	
Extended Detention Pond (RR)														
8.a. ED #1 (P-BAS-03)	0				0	0	0	0	15	0.00	0.00	0.00	0.00	

Do not enter here – will double drainage area

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**

Dry Swale (L2) to Extended Detention (L2)

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)			3.12		3.12	0.04	0.08
Mixed Open (acres)			0.75		0.75	0.13	0.39
Managed Turf (acres)			0.88		0.88	0.22	0.75
Impervious Cover (acres)			1.95		1.95	0.95	0.86
Total					6.70		

Total Phosphorus
Post Development

Stormwater Best Management Practices (RR = Runoff Reduction)

Practice	Runoff Reduction Credit (%)	Mixed Open Credit Area (acres)	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	Volume from Upstream Practice (ft ³)	Runoff Reduction (ft ³)	Remaining Runoff Volume (ft ³)	Total BMP Treatment Volume (ft ³)	Phosphorus Removal Efficiency (%)
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TOTAL IMPERVIOUS COVER TREATED (ac) 1.00 AREA CHECK: OK.
 TOTAL MIXED OPEN TREATED (ac) 0.55 AREA CHECK: OK.
 TOTAL MANAGED TURF AREA TREATED (ac) 0.50 AREA CHECK: OK.

TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr) 1.13

TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr) 2.62
 TOTAL PHOSPHORUS REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr) 0.00
 TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr) 1.14
 TOTAL PHOSPHORUS LOAD REDUCTION ACHIEVED IN D.A. A (lb/yr) 1.14
 TOTAL PHOSPHORUS REMAINING AFTER APPLYING BMP LOAD REDUCTIONS IN D.A. A (lb/yr) 1.48

TP Load Reduction Requirement = 1.13 lb/yr
TP Load Reduction = 1.14 lb/yr

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

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Dry Swale (L2) to Extended Detention (L2)

Site Results (Water Quality Compliance) VRRM 4.1, 2024

Area Checks	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	AREA CHECK
FOREST (ac)	3.12	0.00	0.00	0.00	0.00	OK.
MIXED OPEN AREA (ac)	0.75	0.00	0.00	0.00	0.00	OK.
MIXED OPEN AREA TREATED (ac)	0.55	0.00	0.00	0.00	0.00	OK.
MANAGED TURF AREA (ac)	0.88	0.00	0.00	0.00	0.00	OK.
MANAGED TURF AREA TREATED (ac)	0.50	0.00	0.00	0.00	0.00	OK.
IMPERVIOUS COVER (ac)	1.95	0.00	0.00	0.00	0.00	OK.
IMPERVIOUS COVER TREATED (ac)	1.00	0.00	0.00	0.00	0.00	OK.
AREA CHECK	OK.	OK.	OK.	OK.	OK.	

Site Treatment Volume (ft³) 8,234

TP Load Reduction = 1.14 lb/yr

Runoff Reduction Volume and TP By Drainage Area

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	TOTAL
RUNOFF REDUCTION VOLUME ACHIEVED (ft ³)	2,651	0	0	0	0	2,651
TP LOAD AVAILABLE FOR REMOVAL (lb/yr)	2.62	0.00	0.00	0.00	0.00	2.62
TP LOAD REDUCTION ACHIEVED (lb/yr)	1.14	0.00	0.00	0.00	0.00	1.14
TP LOAD REMAINING (lb/yr)	1.48	0.00	0.00	0.00	0.00	1.48

NITROGEN LOAD REDUCTION ACHIEVED (lb/yr)	13.58	0.00	0.00	0.00	0.00	13.58
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Total Phosphorus

FINAL POST-DEVELOPMENT TP LOAD (lb/yr)	2.88
TP LOAD REDUCTION REQUIRED (lb/yr)	1.13
TP LOAD REDUCTION ACHIEVED (lb/yr)	1.14
TP LOAD REMAINING (lb/yr)	1.74
REMAINING TP LOAD REDUCTION REQUIRED (lb/yr)	0.00



Meets Water Quality Treatment Requirements

Save Results As: EX1D.xlsm

Questions?

