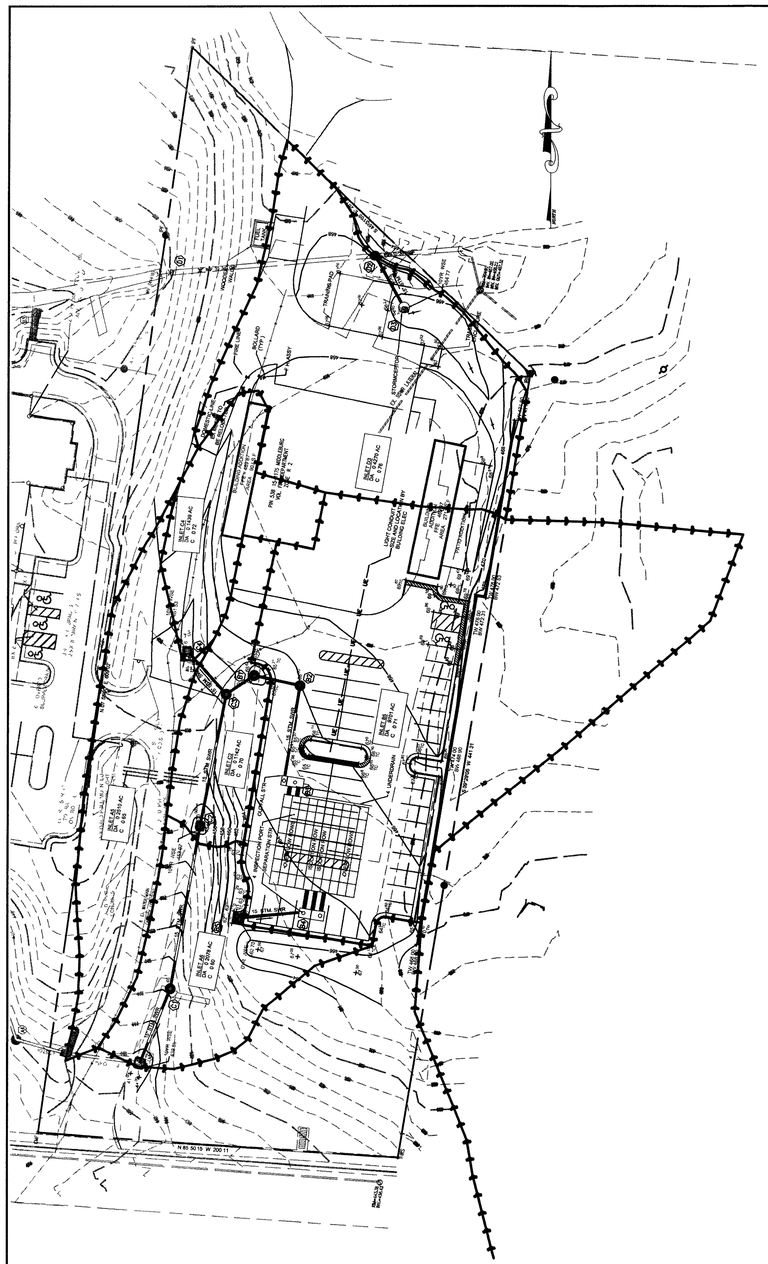

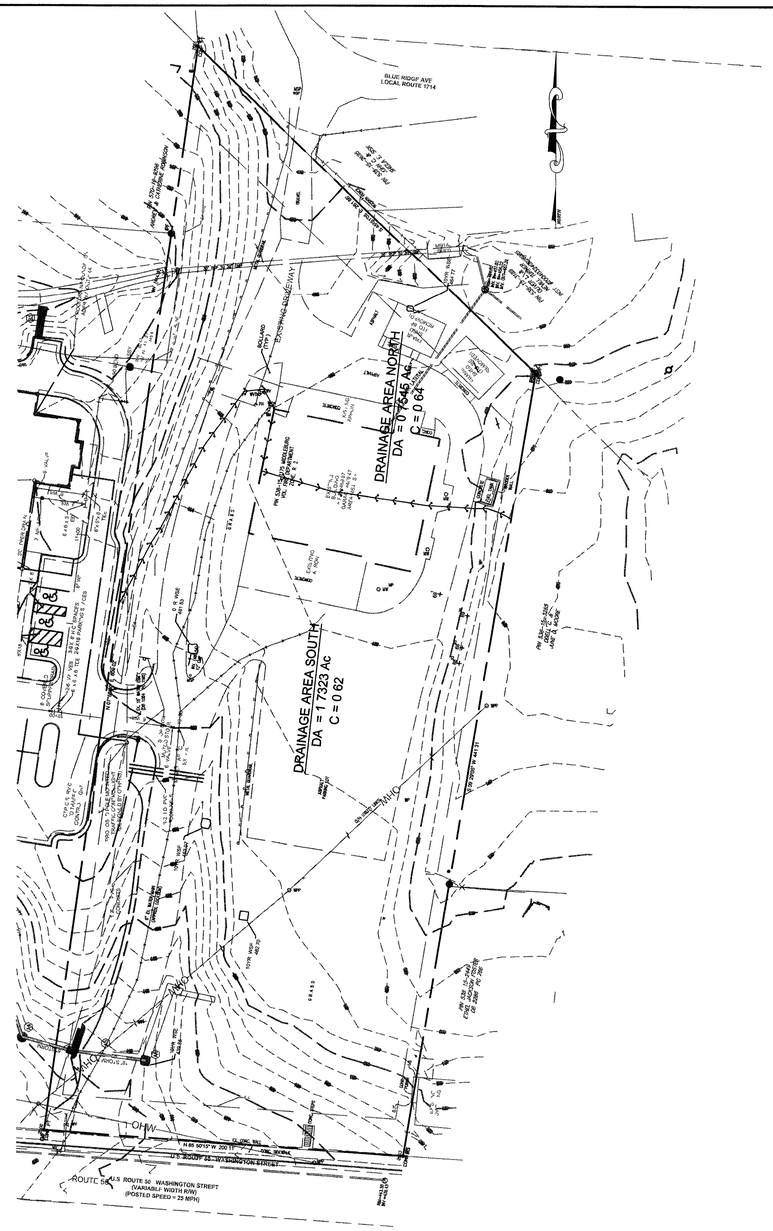

POST-DEVELOPMENT DRAINAGE DIVIDE

PRE-DEVELOPMENT DRAINAGE DIVIDE

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft

BMP Facility Design Calculations

1 - Watershed Information

List all the SubAreas and C Factors used in the BMP Computations

SubArea Designation/Description	C	Acres
(1) Impervious Developed Area to Stormtech	0 90	0 5685
(2) Pervous Developed Area to Stormtech	0 45	0 0717
(3) Offsite Pervous Area to Stormtech	0 45	0 3299
(4) Impervious Developed Area to Bioretention	0 90	0 3313
(5) Pervous Developed Area to Bioretention	0 45	0 3856
(6) Impervious Developed Area Bypassing BMP	0 90	0 0327
(7) Pervous Developed Area Bypassing BMP	0 45	0 6250
(8) Impervious Developed Area Stormceptor	0 90	0 3250
(9) Pervous Developed Area Stormceptor	0 45	0 1471

2 Phospohorous Removal - Chesapeake Bay Method

Calculate Existing Site Impervousness

Existing Impervious Area	0 9873	Ac
Total Area	2.487	Ac
Existing Conditions Imperviousness	**39.70**	**%**

Determine Average Watershed Impervousness

Average Watershed Imperviousness	**16**	**%**

Note Use 16% if the local jurisdiction does have watershed impervousness provided

Determine Existing Conditions Impervousness For Computation Purposes

Existing Conditions Impervousness <10%	29.70	%
Average Watershed Impervousness	16.00	%
Exisiting Impervousness Used	29.70	%

Calculate Post Developed Site Impervousness

Post Developed Impervous Area	1.26	Ac
Total Area	2.487	Ac
Post Developed Imperviousness	**50.56**	**%**

Calculate Phosphorous Loadings

Pre Developed Phosphorous Loading	1.80	Lbs /Year
Post Developed Phosphorous Loading	2.86	Lbs /Year

Calculate Phosphorous Removal Required

Removal Required	1.06	Lbs /Year
BMP Removal Required	**37.18**	**%**

Phosphorous Removal

BMP Facility	Removal Efficiency (%)	Imperv Coverage (%)	Drainage Area (ac)	Post Developed Loading (Lb s/Yr)	Load Removed (Lb s/Yr)
Stormtech	40	88 80	0 6402	1.24	0.50
Bioretention	65	46 21	0 7169	0.79	0.50
Stormceptor	15	68 84	0 4721	0.72	0.11
Total				**1 10 Lbs./Year**	

Phosphorous Removal OKAY

3 Storage

Compute the Weighted Average C Factor for the BMP Facility

List the Subareas to be controlled by the BMP Facility

Subarea Description	C	Acres	Product
(1) Impervious Developed Area to Stormtech	0.90	0.57	0.51
(2) Pervous Developed Area to Stormtech	0.45	0.07	0.03
(3) Offsite Pervious Area to Stormtech	0.45	0.33	0.15
	Total Area =	0.97	
	Total =	0.69	
	Weighted Average C Factor =	0.71	

Determine the Storage Required for the BMP Facility

(A) Extended Detention Dry Pond

Method 1 (4375 C) 875 =	2,247	cf/ac
Method 2 (31 25 IMP%) =	2,775	cf/ac
Design 1 (48 hour drawdown)		
BMP Volume Required =	2,692	cf
BMP Volume Provided =	**3 320**	**cf**

4 Outlet Computation

Determine the Required Orifice Size for the BMP Facility

(A) BMP storage requirement (s) from Part 8	(a)	3,320	cf
(B) Maximum Head (h) at the required BMP storage from the elevation storage curve for the facility	(b)	3 75	ft
(C) Peak outflow rate (Qp) at the maximum head for drawdown time of 48 hrs [Qp=s/(0 5 3600 48)]	(c)	0.0384	cfs
(D) Required orifice area (A) [A=Qp/(0 6 (64 4 h)^0 5]	= (d)	0.0041	sf
(E) Diameter of circular orifice	= (d)	1.00	in

PRE - DRAINAGE AREA		SOUTH	NORTH
Time Of Concentration			
Used	(min)	**5**	**5**
Rational Coefficient			
Use #1 Drainage Area	(ac)	1 09	0.44
Use #1 Rational Coefficient		0 45	0 45
Use #2 Drainage Area	(ac)	0 64	0 31
Use #2 Rational Coefficient		0 90	0 90
Total Area	**(ac)**	**1 73**	**0.75**
Weighted Rational Coefficient		**0.62**	**0.54**
2 Year Rational Peak			
Area	(ac)	1.73	0.75
Rational Coefficient		0.62	0.54
Intensity	(in /hr)	5 75	5 75
2 Year Flow	(cfs)	6.15	2.76
Total	**(cfs)**	**8.90**	
10 Year Rational Peak			
Area	(ac)	1.73	0.75
Rational Coefficient		0.62	0.54
Intensity	(in /hr)	7 27	7 27
10 Year Flow	(cfs)	7.78	3.48
Total	**(cfs)**	**11.25**	

POST DRAINAGE AREA		Facility	Bypass
Time Of Concentration			
Used	(min)	**5**	**5**
Rational Coefficient			
Use #1 - Drainage Area	(ac)		0 69
Use #1 Rational Coefficient			0 90
Use #2 Drainage Area	(ac)		1 16
Use #2 Rational Coefficient			0 45
Total Area	**(ac)**	**0 97**	**1.85**
Weighted Rational Coefficient		**0 71**	**0 62**
2 Year Rational Peak			
Area	(ac)		1.85
Rational Coefficient			0.62
Intensity	(in /hr)		5 75
2 Year Flow	(cfs)	0.49	6.56
Total	**(cfs)**	**7.05**	
10 Year Rational Peak			
Area	(ac)		1.85
Rational Coefficient			0.62
Intensity	(in /hr)		7 27
10 Year Flow	(cfs)	0 74	8.30
Total	**(cfs)**	**9.03**	

Post-Developed Weighted C Values

Site Struc	Onsite Impervious Area (Ac)	Onsite Pervous Area (Ac)	Offsite Impervious Area (Ac)	Offsite Pervous Area (Ac)	Total Area (Ac)	Weighted C Value
C Value	0.90	0.45	0.90	0.45		
B5	0 5685	0 0717	0 0000	0 3299	0.9701	0.71
C2	0 0822	0 0520	0 0000	0 0000	0.1142	0.70
C4	0 0866	0 0573	0 0000	0 0000	0.1439	0.72
D3	0 3250	0 1470	0 0000	0 0000	0.4720	0.76
A5	0 1125	0 1385	0 0000	0 0000	0.2510	0.65
A6	0 0700	0 1378	0 0000	0 0000	0.2078	0.60
BYPASS	0 0327	0 6250	0 0000	0 0000	0.6577	0.47

Channel ID		Channel A6
Runoff Analysis		
Drainage Area	(Ac)	0 21
Rational Coefficient		0 60
Time Of Concentration	(Min)	5
2 Year Intensity	(In /Hr)	5 75
10 Year Intensity	(In /Hr)	7 27
2 Year Runoff	(Cu Ft /Sec)	0.72
10 Year Runoff	(Cu Ft /Sec)	0.92
Channel Geometry		
Design Depth	(Ft)	0 50
Bottom Width	(Ft)	0 00
Side Slope Left	X H 1 V	2
Side Slope Right	X H 1 V	2
Channel Slope	(Ft /Ft)	0 110
Lining Material		Vegetative
Channel Lining - Vegetative		
Description of Vegetative Lining to be Utilized		Blue Gamma
Flow Retardance Classification		B
ASTM Soil Classification		CL
Permissible Shear Force on Soil Bed	(Lbs /Sq Ft)	0.07
Mean Boundary Shear Stress	(Lbs /Sq Ft)	1.38
Manning s coefficient		0.078
10 Year Flow depth	(Ft)	0.46
2 Year Flow Depth	(Ft)	0.42
2 Year Flow Velocity	(Ft /Sec)	0.86
Permissable Shear Stress on Channel Bottom	(Lbs /Sq Ft)	5.72
Actual Shear Stress on Channel Bottom	(Lbs /Sq Ft)	3.16

MIDDLEBURG VOLUNTEER FIRE DEPARTMENT BUILDING ADDITION
FINAL SITE PLAN
BLUE RIDGE DISTRICT
TOWN OF MIDDLEBURG, VIRGINIA

SWM/BMP Divides & Calculations

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Consulting Engineers and Surveyors
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NO	DATE	REVISION
1	5-2-08	REMOVED MEETING HALL
2	7-10-08	REV. 2ND REVIEW COMMENTS

COMMONWEALTH OF VIRGINIA
WILLIAM D HUME
No 0037880
7/10/08
PROFESSIONAL ENGINEER

SCALE	N/A
DATE	11-16-07
DRAWN BY	PJC/BP
DESIGNED BY	PJC
REVIEWED BY	MS
PROJ NO.	220550002

SHEET 8 OF 18