

**CHESAPEAKE REACH
STORMWATER MANAGEMENT REPORT**

Owner/Developer
Windward Investment, LLC

Design Professional
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Easton, Maryland 21601
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Date Prepared
November 3, 2008



11-3-08

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**CHESAPEAKE REACH
STORMWATER MANAGEMENT NARRATIVE
NOVEMBER, 2008**

1. INTRODUCTION

The following is an analysis of the stormwater management quality, quantity and 10% Rule requirements for the site, based on the criteria stated in Section 340-27.1.D for Intensely Developed Areas (IDA) within the Town of St. Michaels. The guidelines published by the Chesapeake Bay Critical Area Commission and the Town of St. Michaels Stormwater Management Plan have been utilized in meeting the requirements.

2. GENERAL SITE INFORMATION

The drainage area of the site is approximately 3.16 acres, located on the south side of Railroad Avenue and running to Canton Street. The proposed development is the construction of the remaining portion of Chesapeake Avenue to a cul-de-sac and residential lots. The proposed drainage area is divided into two sub areas, the majority of the site (P-1A) will flow through a proposed pocket pond and the remainder of the site (P-1B) will be made up of off-site drainage that will be conveyed by a wet swale and bypass the pond.

3. IMPERVIOUS COVER INFORMATION

The majority of the existing site is a meadow with portions of wetlands and/or woods. Proposed development includes a 29' closed road section along with residential houses and driveways.

4. QUANTITY STORMWATER MANAGEMENT

A waiver for quantitative stormwater management will be requested based on Section 281-7.B(2)(c) for direct discharge to tidally influenced receiving waters of San Domingo Creek. Calculations have been attached in Appendix A to calculate the flow and velocity for the outfall of the proposed pocket pond and swale.

5. QUALITY STORMWATER MANAGEMENT

A P-5 pocket pond and O-2 wet swales are proposed to address stormwater quality for the site. The attached calculations are in Appendix B to demonstrate the conformance to the criteria referenced in Section 281-11.A.(1). Two foot flat bottom swales will be constructed on the property lines to provide additional water quality treatment on each lot.

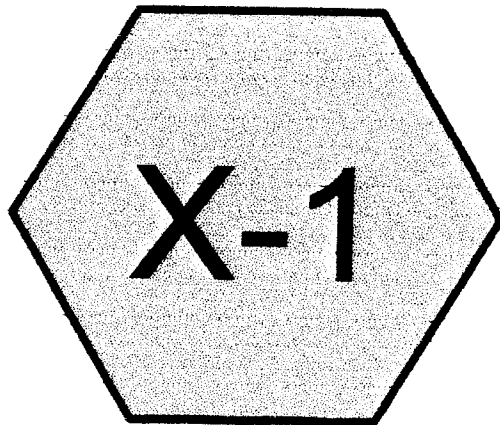
6. 10% RULE

Calculations have been attached for 10% Rule compliance in Appendix C. The proposed wet swales will treat 2.39 Ac. of the site which account for 76% of the 3.16 acres. Since 1.02 Ac. flow into the pocket pond after being conveyed by the wet swales, the removal efficiency for that 32% of the site is reduced to 25%. The remaining 0.72 acres which flows directly into the pocket pond utilized the full 50% efficiency of the pocket pond.

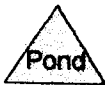
7. CONCLUSIONS AND RECOMMENDATIONS

The stormwater management analysis indicates the proposed design will successfully meet stormwater quantity, quality and 10% rule requirements.

APPENDIX A
STORMWATER MANAGEMENT QUANTITY CALCULATIONS



X-1



EXIST

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.900	71	Meadow, non-grazed, HSG C (X-1)
0.150	78	Meadow, non-grazed, HSG D (X-1)
0.110	98	Paved parking & roofs (X-1)
3.160		TOTAL AREA

EXIST

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.900	HSG C	X-1
0.150	HSG D	X-1
0.110	Other	X-1
3.160		TOTAL AREA

EXIST

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Type II 24-hr 1" Event Rainfall=1.00"

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Summary for Subcatchment X-1: X-1

Runoff = 0.00 cfs @ 18.14 hrs, Volume= 0.002 af, Depth> 0.01"

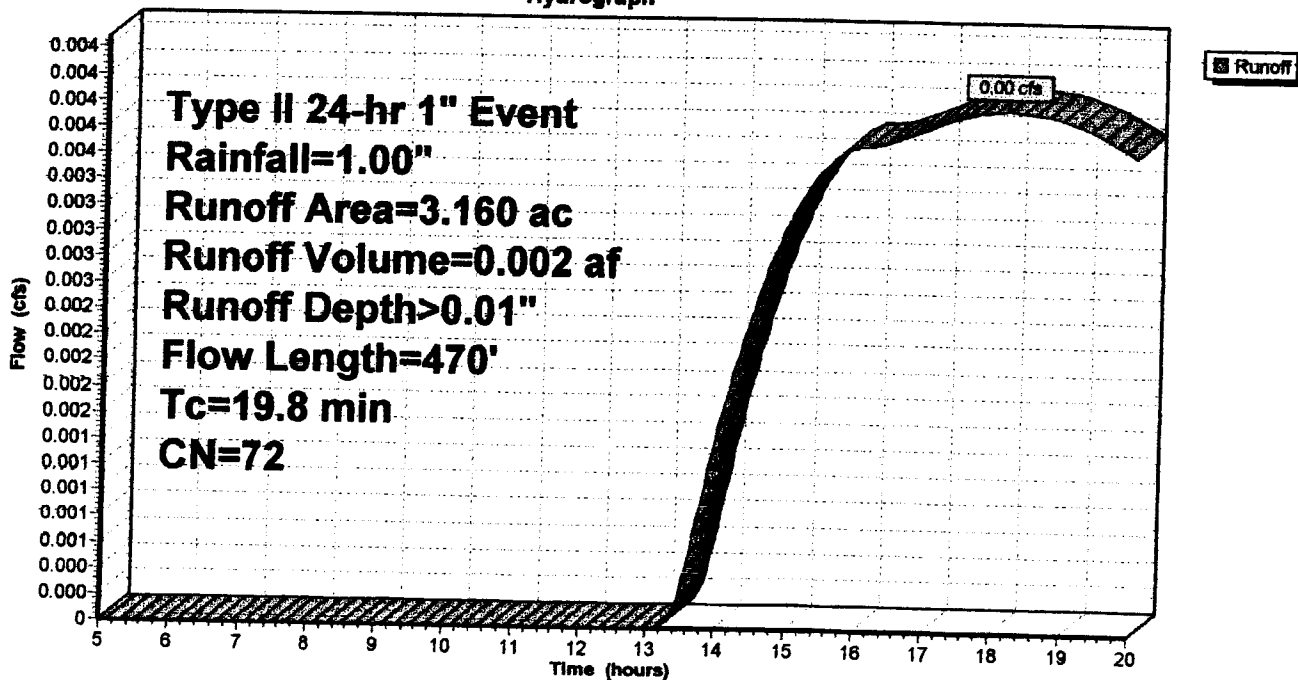
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1" Event Rainfall=1.00"

Area (ac)	CN	Description
0.110	98	Paved parking & roofs
2.900	71	Meadow, non-grazed, HSG C
0.150	78	Meadow, non-grazed, HSG D
3.160	72	Weighted Average
3.050		Pervious Area
0.110		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3	150	0.0100	0.14		Sheet Flow, A-B
2.5	320	0.0170	2.10		Grass: Short n= 0.150 P2= 3.40" Shallow Concentrated Flow, B-C
19.8	470				Unpaved Kv= 16.1 fps
					Total

Subcatchment X-1: X-1

Hydrograph



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Type II 24-hr 2-Year Event Rainfall=3.40"

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Summary for Subcatchment X-1: X-1

Runoff = 2.20 cfs @ 12.17 hrs, Volume= 0.247 af, Depth> 0.94"

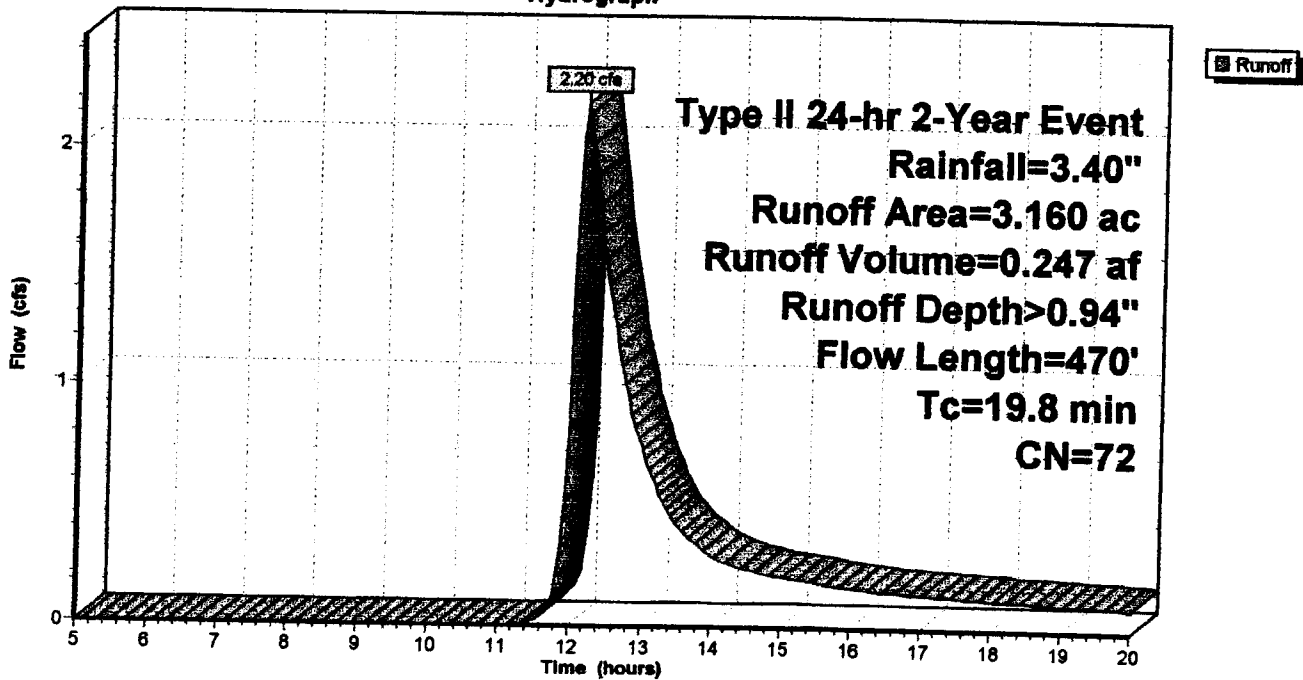
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type II 24-hr 2-Year Event Rainfall=3.40"

Area (ac)	CN	Description
0.110	98	Paved parking & roofs
2.900	71	Meadow, non-grazed, HSG C
0.150	78	Meadow, non-grazed, HSG D
3.160	72	Weighted Average
3.050		Pervious Area
0.110		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3	150	0.0100	0.14		Sheet Flow, A-B
2.5	320	0.0170	2.10		Grass: Short n= 0.150 P2= 3.40"
					Shallow Concentrated Flow, B-C
					Unpaved Kv= 16.1 fps
19.8	470	Total			

Subcatchment X-1: X-1

Hydrograph



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Type II 24-hr 10-Year Event Rainfall=5.30"

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Summary for Subcatchment X-1: X-1

Runoff = 5.49 cfs @ 12.15 hrs, Volume= 0.581 af, Depth> 2.21"

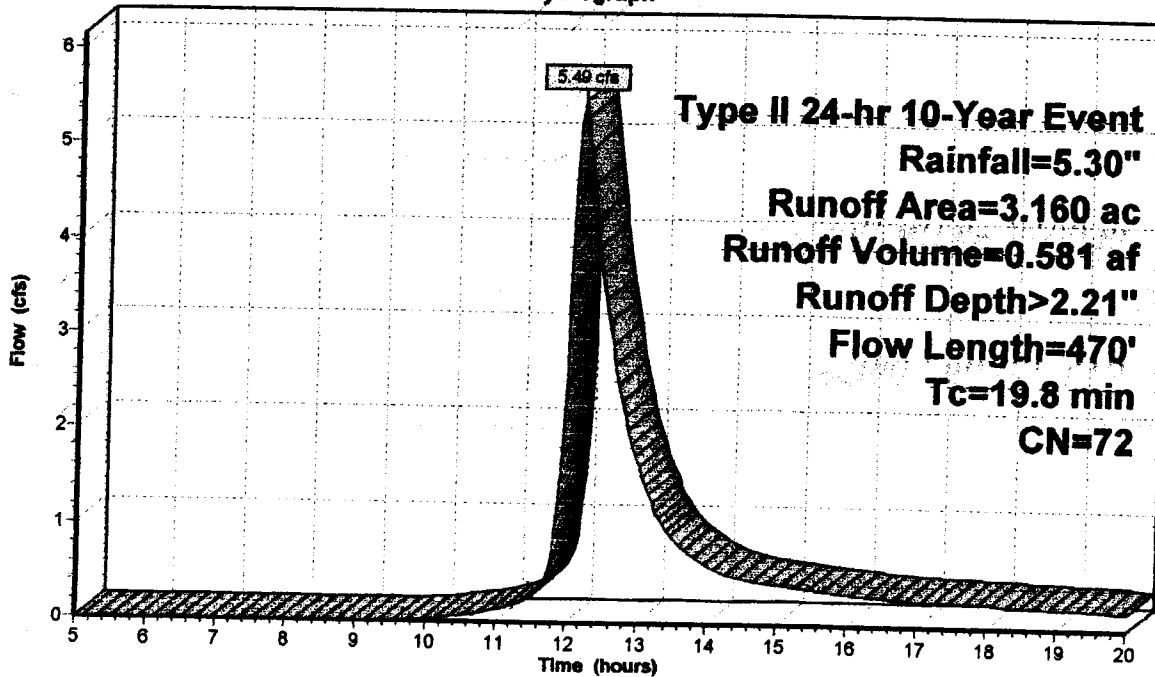
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Event Rainfall=5.30"

Area (ac)	CN	Description
0.110	98	Paved parking & roofs
2.900	71	Meadow, non-grazed, HSG C
0.150	78	Meadow, non-grazed, HSG D
3.160	72	Weighted Average
3.050		Pervious Area
0.110		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3	150	0.0100	0.14		Sheet Flow, A-B
2.5	320	0.0170	2.10		Grass: Short n= 0.150 P2= 3.40" Shallow Concentrated Flow, B-C
19.8	470				Unpaved Kv= 16.1 fps
					Total

Subcatchment X-1: X-1

Hydrograph



EXIST

Type II 24-hr 100-Year Event Rainfall=7.60"

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Summary for Subcatchment X-1: X-1

Runoff = 10.00 cfs @ 12.15 hrs, Volume= 1.050 af, Depth> 3.99"

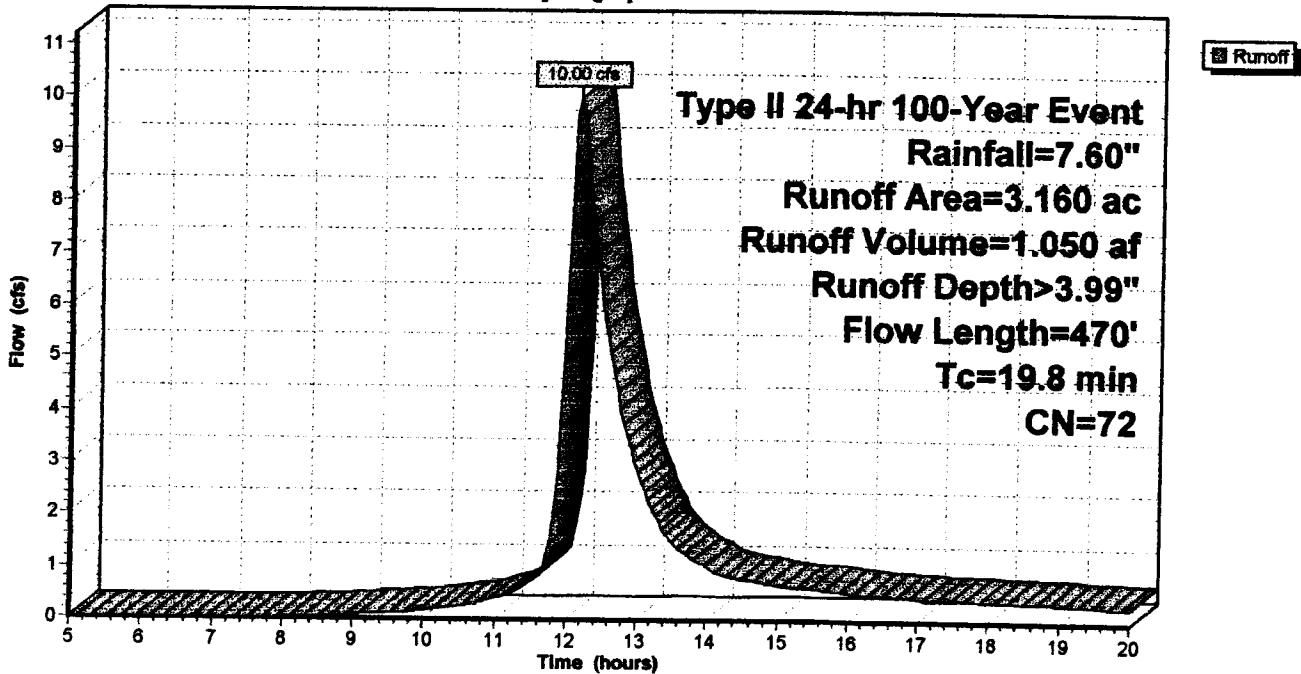
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Event Rainfall=7.60"

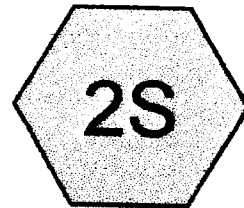
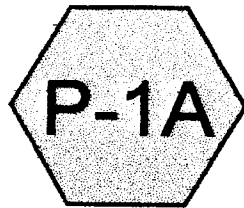
Area (ac)	CN	Description
0.110	98	Paved parking & roofs
2.900	71	Meadow, non-grazed, HSG C
0.150	78	Meadow, non-grazed, HSG D
3.160	72	Weighted Average
3.050		Pervious Area
0.110		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3	150	0.0100	0.14		Sheet Flow, A-B
2.5	320	0.0170	2.10		Grass: Short n= 0.150 P2= 3.40" Shallow Concentrated Flow, B-C Unpaved Kv= 16.1 fps
19.8	470	Total			

Subcatchment X-1: X-1

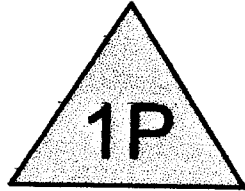
Hydrograph



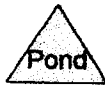


P-1A

P-1B



P-1A



Drainage Diagram for PROPOSED
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PROPOSED

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.140	74	>75% Grass cover, Good, HSG C (2S,P-1A)
0.090	80	>75% Grass cover, Good, HSG D (2S,P-1A)
0.890	98	Paved parking & roofs (2S,P-1A)
0.030	98	Water Surface (P-1A)
3.150		TOTAL AREA

PROPOSED

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.140	HSG C	2S, P-1A
0.090	HSG D	2S, P-1A
0.920	Other	2S, P-1A
3.150		TOTAL AREA

PROPOSED

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Type II 24-hr 1" Event Rainfall=1.00"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=Delmarva

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: P-1B

Runoff Area=1.370 ac 8.03% Impervious Runoff Depth>0.03"
Flow Length=550' Tc=39.7 min CN=76 Runoff=0.01 cfs 0.003 af

Subcatchment P-1A: P-1A

Runoff Area=1.780 ac 45.51% Impervious Runoff Depth>0.15"
Flow Length=485' Tc=12.1 min CN=85 Runoff=0.22 cfs 0.022 af

Pond 1P: P-1A

Peak Elev=2.02' Storage=39 cf Inflow=0.22 cfs 0.022 af
Outflow=0.21 cfs 0.022 af

Total Runoff Area = 3.150 ac Runoff Volume = 0.025 af Average Runoff Depth = 0.10"
70.79% Pervious = 2.230 ac 29.21% Impervious = 0.920 ac

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Type II 24-hr 1" Event Rainfall=1.00"

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Summary for Subcatchment 2S: P-1B

Runoff = 0.01 cfs @ 13.94 hrs, Volume= 0.003 af, Depth> 0.03"

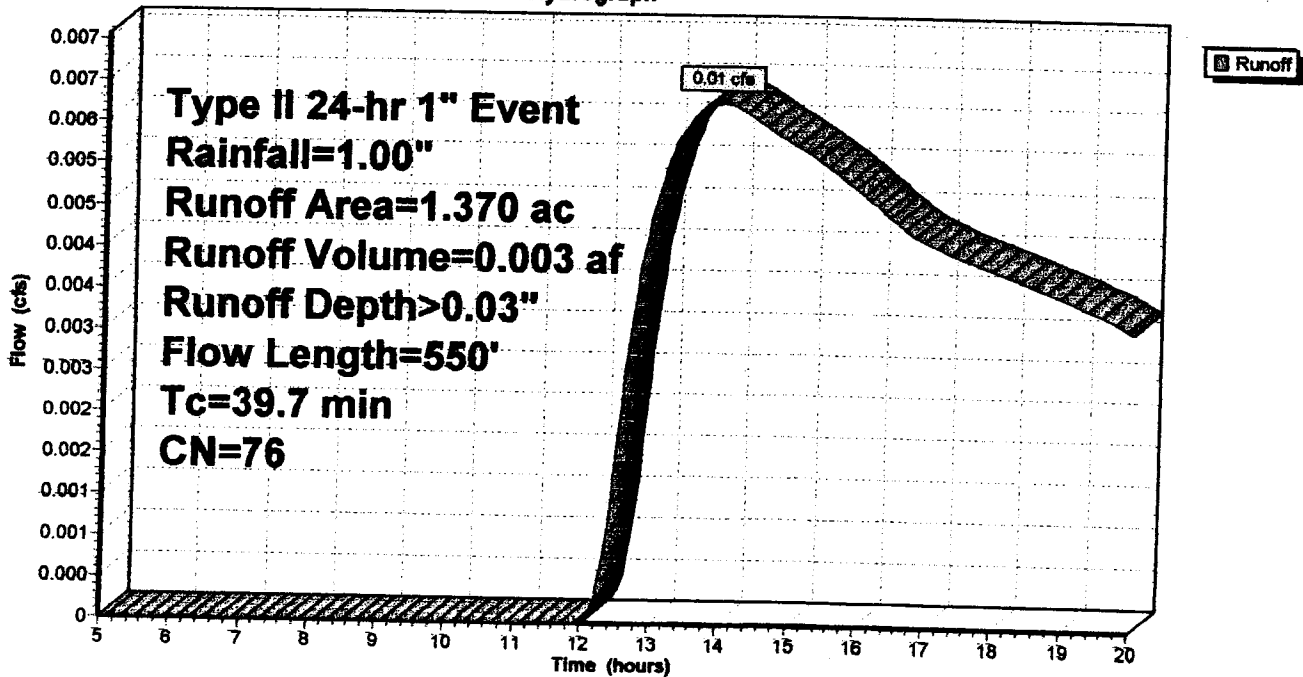
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1" Event Rainfall=1.00"

Area (ac)	CN	Description
0.110	98	Paved parking & roofs
1.250	74	>75% Grass cover, Good, HSG C
0.010	80	>75% Grass cover, Good, HSG D
1.370	76	Weighted Average
1.260		Pervious Area
0.110		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3	150	0.0100	0.14		Sheet Flow, A-B
22.4	400	0.0105	0.30	0.16	Grass: Short n=0.150 P2= 3.40" Trap/Vee/Rect Channel Flow, B-C Bot.W=2.00' D=0.20' Z= 3.0' Top.W=3.20' n= 0.150 Sheet flow over Short Grass
39.7	550	Total			

Subcatchment 2S: P-1B

Hydrograph



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Type II 24-hr 1" Event Rainfall=1.00"

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Summary for Subcatchment P-1A: P-1A

Runoff = 0.22 cfs @ 12.09 hrs, Volume= 0.022 af, Depth> 0.15"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1" Event Rainfall=1.00"

Area (ac)	CN	Description
0.030	98	Water Surface
0.780	98	Paved parking & roofs
0.890	74	>75% Grass cover, Good, HSG C
0.080	80	>75% Grass cover, Good, HSG D
1.780	85	Weighted Average
0.970		Pervious Area
0.810		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	30	0.0100	0.10		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.40"
5.8	115	0.0130	0.33	0.17	Trap/Vee/Rect Channel Flow, B-C Bot.W=2.00' D=0.20' Z= 3.0' Top.W=3.20' n= 0.150 Sheet flow over Short Grass
1.5	340	0.0173	3.75	6.21	Trap/Vee/Rect Channel Flow, C-D Bot.W=0.00' D=0.25' Z= 50.0 & 3.0' Top.W=13.25' n= 0.013 Concrete, trowel finish
12.1	485	Total			