

ATTACHMENT B

Stormwater Flow Culvert Sizing Calculations

Black Nubble Wind Farm Project
MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
LOWER BLACK NUBBLE EXISTING LOGGING ROAD								
culvert p stream	9.50		9.500	6.4	9.728	12.160	24	1.00
culvert o stream	23.67		23.670	6.4	24.238	30.298	36	0.90
culvert n	1.05		1.050	6.4	1.075	1.344	12	0.75
culvert m	2.46		2.460	6.4	2.519	3.149	15	0.90
culvert l	3.97		3.970	6.4	4.065	5.082	18	0.85
culvert k	20.96		20.960	6.4	21.463	26.829	36	0.85
culvert j	50.11	1.26	53.420	6.4	54.702	68.378	Dual 36	<1.00
culvert i	0.71	5.43	15.670	6.4	16.046	20.058	30	0.95
culvert h	5.43	7.95	14.960	6.4	15.319	19.149	30	0.90
culvert g	0.44		0.440	6.4	0.451	0.563	12	<0.58
culvert f	0.44		0.440	6.4	0.451	0.563	12	<0.58
culvert e	0.38	14.18	20.780	6.4	21.279	26.598	36	0.85

See Note #1

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs'. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
LOWER BLACK NUBBLE EXISTING LOGGING ROAD (CONTINUED)								
culvert d	14.18	6.22	20.400	6.4	20.890	26.112	36	0.85
culvert c	2.33	1.58	3.910	6.4	4.004	5.005	18	0.90
culvert b	3.79	1.85	5.640	6.4	5.775	7.219	24	0.70
culvert a	1.83		1.830	6.4	1.874	2.342	12	1.00
drainage culvert #2	28.36	5.21	33.570	6.4	34.376	42.970	Dual 30	<1.00
drainage culvert #3	2.90		2.900	6.4	2.970	3.712	15	0.95
drainage culvert #4	9.95	0.50	10.450	6.4	10.701	13.376	24	1.00
drainage culvert #5	4.58	0.44	6.430	6.4	6.584	8.230	24	0.80
drainage culvert #6	1.81		1.810	6.4	1.853	2.317	12	1.00
drainage culvert #7	3.48		3.480	6.4	3.564	4.454	18	0.80
drainage culvert #8	2.95		2.950	6.4	3.021	3.776	15	1.00
drainage culvert #9	4.07		4.070	6.4	4.168	5.210	18	0.90

See Note #1

c =

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						

See Note #1

LOWER BLACK NUBBLE ACCESS ROAD

2749+00	1.60		1.600	6.4	1.638	2.048	12	0.95
2751+00	0.96		0.960	6.4	0.983	1.229	12	0.70
2753+00	11.80		11.800	6.4	12.083	15.104	30	0.80
2755+12	1.58		1.580	6.4	1.618	2.022	12	0.90

LOWER BLACK NUBBLE SUMMIT ROAD WEST LEG

2802+00	1.55		1.550	6.4	1.587	1.984	12	0.90
2804+00	1.96		1.960	6.4	2.007	2.509	15	0.75
2805+90	0.84		0.840	6.4	0.860	1.075	12	0.65
2807+50	0.06		0.060	6.4	0.061	0.077	12	<0.58
2809+50	0.12		0.120	6.4	0.123	0.154	12	<0.58
2824+35	1.41		1.410	6.4	1.444	1.805	12	0.85
2826+00	0.44		0.440	6.4	0.451	0.563	12	<0.58

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

JN 1708.08

Black Nubble Wind Farm Project
 MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	C =	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2							
LOWER BLACK NUBBLE SUMMIT ROAD WEST LEG (CONTINUED)									
2828+00	0.50		0.500	6.4		0.512	0.640	12	<0.58
2830+00	0.57		0.570	6.4		0.584	0.730	12	<0.58
2832+00	0.42		0.420	6.4		0.430	0.538	12	<0.58
2834+00	0.73		0.730	6.4		0.748	0.934	12	<0.58
2836+00	0.97		0.970	6.4		0.993	1.242	12	0.70
2838+00	1.20		1.200	6.4		1.229	1.536	12	0.80
2840+00	1.32		1.320	6.4		1.352	1.690	12	0.85
2843+50	1.58		1.580	6.4		1.618	2.022	12	0.90
2845+00	0.76		0.760	6.4		0.778	0.973	12	<0.58
2847+00	1.46		1.460	6.4		1.495	1.869	12	0.90
2848+50	1.53		1.530	6.4		1.567	1.958	12	0.90
2849+25	1.67		1.670	6.4		1.710	2.138	12	0.95
2851+00	0.80		0.800	6.4		0.819	1.024	12	0.60

See Note #1

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
LOWER BLACK NUBBLE SUMMIT ROAD WEST LEG (CONTINUED)								
2852+00	0.73		0.730	6.4	0.748	0.934	12	<0.58
2853+00	1.18		1.180	6.4	1.208	1.510	12	0.80
2855+00	0.14		0.140	6.4	0.143	0.179	12	<0.58
LOWER BLACK NUBBLE SUMMIT ROAD EAST LEG								
2901+00	0.52	0.12	0.640	6.4	0.655	0.819	12	<0.58
2907+00	0.81		0.810	6.4	0.829	1.037	12	0.65
2909+00	0.75		0.750	6.4	0.768	0.960	12	<0.58
2911+00	0.75		0.750	6.4	0.768	0.960	12	<0.58
2913+00	0.22		0.220	6.4	0.225	0.282	12	<0.58
2916+00	0.25		0.250	6.4	0.256	0.320	12	<0.58
2918+00	0.82		0.820	6.4	0.840	1.050	12	0.65
2921+00	1.33		1.330	6.4	1.362	1.702	12	0.85

See Note #1

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
LOWER BLACK NUBBLE SUMMIT ROAD EAST LEG (CONTINUED)								
2922+00	0.79		0.790	6.4	0.809	1.011	12	0.60
2923+00	0.94		0.940	6.4	0.963	1.203	12	0.70
2924+00	0.94		0.940	6.4	0.963	1.203	12	0.70
2925+00	0.99		0.990	6.4	1.014	1.267	12	0.70
2926+00	0.85		0.850	6.4	0.870	1.088	12	0.65
2927+00	1.13		1.130	6.4	1.157	1.446	12	0.80
2928+00	0.70		0.700	6.4	0.717	0.896	12	<0.58
2929+00	0.78		0.780	6.4	0.799	0.998	12	<0.58
2930+00	0.51		0.510	6.4	0.522	0.653	12	<0.58
2931+00	1.00		1.000	6.4	1.024	1.280	12	0.70
2932+00	1.07		1.070	6.4	1.096	1.370	12	0.75
2934+00	0.62		0.620	6.4	0.635	0.794	12	<0.58
2936+00	0.24		0.240	6.4	0.246	0.307	12	<0.58

See Note #1

c = 0.16 to 0.20

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
UPPER BLACK NUBBLE ACCESS ROAD								
2000+00	12.38	1.19	13.570	6.4	13.896	17.370	30	0.85
2002+00	2.80		2.800	6.4	2.867	3.584	15	0.90
2004+00	3.36		3.360	6.4	3.441	4.301	18	0.80
2006+00	2.93		2.930	6.4	3.000	3.750	15	1.00
2008+00	2.98	1.96	4.940	6.4	5.059	6.323	18	1.00
2010+00	3.37		3.370	6.4	3.451	4.314	18	0.80
2012+00	3.54		3.540	6.4	3.625	4.531	18	0.80
2014+00	5.95		5.950	6.4	6.093	7.616	24	0.70
2016+00	1.20		1.200	6.4	1.229	1.536	12	0.80
2018+00	0.99		0.990	6.4	1.014	1.267	12	0.70
2020+00	0.86		0.860	6.4	0.881	1.101	12	0.65
2022+00	4.20	0.58	4.780	6.4	4.895	6.118	18	1.00

See Note #1

Flow (cfs) 0.16 to 0.20

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
 MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
UPPER BLACK NUBBLE ACCESS ROAD (CONTINUED)								
2024+00	1.36		1.360	6.4	1.393	1.741	12	0.85
2025+00	0.58	0.11	0.690	6.4	0.707	0.883	18	<0.50
2026+00	0.22		0.220	6.4	0.225	0.282	12	<0.58
2027+00	0.39	0.03	0.420	6.4	0.430	0.538		
2028+75	0.11		0.110	6.4	0.113	0.141		
2029+00	0.03		0.030	6.4	0.031	0.038		
2031+00	0.40	0.04	0.440	6.4	0.451	0.563		
2033+00	0.04		0.040	6.4	0.041	0.051		
2033+50	0.58		0.580	6.4	0.594	0.742		
2036+00	1.26		1.260	6.4	1.290	1.613	12	0.80
2038+00	0.77	1.30	2.070	6.4	2.120	2.650	15	0.75
2041+00	1.30		1.300	6.4	1.331	1.664	12	0.85

See Note #1

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						

See Note #1

UPPER BLACK NUBBLE ACCESS ROAD (CONTINUED)

	c =				0.16	to	0.20	
2043+00	1.96		1.960	6.4	2.007		15	0.75
2045+00	1.19		1.190	6.4	1.219		12	0.80
2047+00	1.79	1.00	3.920	6.4	4.014		18	0.85
2049+00	1.10	0.65	1.750	6.4	1.792		12	1.00
2051+00	0.20		0.200	6.4	0.205		12	<0.58
2052+25	0.71	0.65	1.360	6.4	1.393		12	<0.58
2054+00	0.65		0.650	6.4	0.666		12	<0.58
2056+00	0.09		0.090	6.4	0.092		12	<0.58
2056+75	0.91	1.13	2.040	6.4	2.089		12	<0.58
2059+00	0.65		0.650	6.4	0.666		12	<0.58
2061+00	0.12		0.120	6.4	0.123		12	<0.58
2062+25	2.06		2.060	6.4	2.109		12	<0.58

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
 MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
UPPER BLACK NUBBLE ACCESS ROAD (CONTINUED)								
2064+00	1.13		1.130	6.4	1.157	0.20	12	0.80
2066+00	0.97		0.970	6.4	0.993		12	0.70
2068+00	1.27		1.270	6.4	1.300		12	0.80
2070+00	1.20		1.200	6.4	1.229		12	0.80
UPPER BLACK NUBBLE SUMMIT ROAD								
2100+00	2.45		2.450	6.4	2.509		15	0.85
2102+00	1.36		1.360	6.4	1.393		12	0.85
2103+00	2.59		2.590	6.4	2.652		15	0.90
2104+00	12.25		12.250	6.4	12.544		30*	0.80
2105+00	3.61		3.610	6.4	3.697		18	0.85
2107+00	1.59		1.590	6.4	1.628		12	0.95

See Note #1

UPPER BLACK NUBBLE ACCESS ROAD (CONTINUED)

UPPER BLACK NUBBLE SUMMIT ROAD

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing.

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

* 36 in culvert to be installed.

Black Nubble Wind Farm Project
 MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
UPPER BLACK NUBBLE SUMMIT ROAD (CONTINUED)								
2109+00	1.44		1.440	6.4	1.475	1.843	12	0.85
2111+00	1.22		1.220	6.4	1.249	1.562	12	0.80
2113+00	0.53		0.530	6.4	0.543	0.678	12	<0.58
2115+00	0.57		0.570	6.4	0.584	0.730	12	<0.58
2116+87	0.67		0.670	6.4	0.686	0.858	12	<0.58
2119+00	0.22		0.220	6.4	0.225	0.282	12	<0.58
2123+00	0.22		0.220	6.4	0.225	0.282	12	<0.58
2125+00	0.32		0.320	6.4	0.328	0.410	12	<0.58
2127+00	0.17		0.170	6.4	0.174	0.218	12	<0.58
2130+00	0.26		0.260	6.4	0.266	0.333	12	<0.58
2132+00	0.57		0.570	6.4	0.584	0.730	12	<0.58
2134+00	0.13		0.130	6.4	0.133	0.166	12	<0.58

See Note #1

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
 MDOT Design for Road Culverts
 Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
UPPER BLACK NUBBLE SUMMIT ROAD (CONTINUED)								
2135+00	0.14		0.140	6.4	0.143	0.179	12	<0.58
2137+00	0.86		0.860	6.4	0.881	1.101	12	0.65
2140+00	0.13	0.40	0.530	6.4	0.543	0.678	12	<0.58
2141+00	0.15		0.150	6.4	0.154	0.192	12	<0.58
2142+00	0.18	0.31	0.490	6.4	0.502	0.627	12	<0.58
2143+00	0.27	0.46	0.730	6.4	0.748	0.934	12	<0.58
2144+00	0.36	0.62	0.980	6.4	1.004	1.254	12	0.70
2145+00	0.35	0.42	0.770	6.4	0.788	0.986	12	<0.58
2147+00	0.18	0.23	0.410	6.4	0.420	0.525	12	<0.58
2148+00	0.19	0.65	1.520	6.4	1.556	1.946	12	0.65
2149+00	0.26	0.31	0.570	6.4	0.584	0.730	12	<0.58
2150+00	0.36		0.360	6.4	0.369	0.461	12	<0.58

See Note #1

c = 0.16 to 0.20

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
UPPER BLACK NUBBLE SUMMIT ROAD (CONTINUED)								
2151+00	0.62	0.43	1.230	6.4	1.260	1.574	12	0.80
2152+00	0.62		0.620	6.4	0.635	0.794	12	<0.58
2153+00	0.48		0.480	6.4	0.492	0.614	12	<0.58
UPPER BLACK NUBBLE SUMMIT ROAD SPUR TO TURBINE 14								
2451+00	0.49	0.47	0.960	6.4	0.983	1.229	12	0.70
2451+50	0.23		0.230	6.4	0.236	0.294	12	<0.58
2452+25	0.65	0.39	1.040	6.4	1.065	1.331	12	0.70
2453+00	0.68	0.22	0.900	6.4	0.922	1.152	12	0.65
2454+00	0.31		0.310	6.4	0.317	0.397	12	<0.58
2455+00	0.43	0.18	0.610	6.4	0.625	0.781	12	<0.58

See Note #1

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

Black Nubble Wind Farm Project
 MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
UPPER BLACK NUBBLE SUMMIT ROAD SPUR TO TURBINE 15								
2461+00	0.31		0.310	6.4	0.317	0.397	12	<0.58
2462+00	0.40		0.400	6.4	0.410	0.512	12	<0.58
2463+00	0.31		0.310	6.4	0.317	0.397	12	<0.58
2464+00	0.46		0.460	6.4	0.471	0.589	12	<0.58
2465+00	0.62		0.620	6.4	0.635	0.794	12	<0.58
2466+00	0.42		0.420	6.4	0.430	0.538	12	<0.58
2467+00	0.47		0.470	6.4	0.481	0.602	12	<0.58
2468+00	0.39		0.390	6.4	0.399	0.499	12	<0.58
2469+00	0.22		0.220	6.4	0.225	0.282	12	<0.58
2470+00	0.18		0.180	6.4	0.184	0.230	12	<0.58
2471+00	0.17		0.170	6.4	0.174	0.218	12	<0.58
2472+00	0.28		0.280	6.4	0.287	0.358	12	<0.58

See Note #1

c =

0.16 to 0.20

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

JN 1708.08

Black Nubble Wind Farm Project
 MDOT Design for Road Culverts

Final Stormwater Management Design Calculations for 12-06-06 Submission

Storm Event	25-Yr	
Runoff Coefficient	0.16	to 0.20
Rainfall Intensity (in/hr)	6.4	

Culvert Station	Tributary Drainage Areas (AC)		Total Tributary Drainage Area (AC)	Intensity (in/hr)	Flow (cfs)	Flow (cfs)	Culvert Size (in)	Hw/d
	1	2						
	1	2	3		0.16	to 0.20		
UPPER BLACK NUBBLE SUMMIT ROAD SPUR TO TURBINE 19								
2488+00	0.41	0.67	1.080	6.4	1.106	1.382	12	0.70

See Note #1

- Shaded rows are ditch turnouts

NOTE #1: Runoff coefficients found using 'Appendix D-12: Runoff Coefficients for the Rational Formula by Hydrologic Soil Group and Slope, MeDEP Stormwater Management BMPs. 'C' values are for Forested land, Hydrologic Soil Group C, and slope of 6%+. '0.16' is for storm recurrence intervals less than 25 years and '0.20' is for storm recurrence intervals of 25 years or more. Flows found using a 'C' value of 0.20 were used in culvert sizing

NOTE #2: Culverts are spaced 1 per 100 to slightly over 200 feet apart. Culverts along the ridges or where turnouts are used are spaced at greater distances where appropriate.

EXAMPLE ACCESS AND SUMMIT ROADWAY CULVERTS

BPR 1021 SERIES CALCULATIONS

		Reference
RF	=	Rainfall Factor Fig 12-5
LF	=	Land Use Factor Fig 12-6(b)
FF	=	Frequency Factor Fig 12-6(c)
Q_1	=	Runoff Index (cfs) Fig 12-6(a)
Q_{design}	=	Design Flow (cfs) unknown
Q_{design}	=	$RF \times LF \times FF \times Q_1$

Culvert Station	Storm Event	RF	LF	FF	Q_1 (cfs)	Q_{design} (cfs)
1440+23	100 year	0.79	0.3	1.39	73	24.05
1444+63	100 year	0.79	0.3	1.39	60	19.77
1212+70	100 year	0.79	0.3	1.39	47	15.48
1221+28	25 year	0.79	0.3	1.00	23	5.45

SCS Method Flow Calculations

Type III 24-hr 25yr Rainfall=4.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 2

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

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

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment 1: Figure 1

Runoff Area=22.646 ac Runoff Depth=1.79"
Flow Length=3,076' Tc=33.5 min CN=70 Runoff=27.32 cfs 3.370 af

Subcatchment 2: Figure 2

Runoff Area=16.926 ac Runoff Depth=1.79"
Flow Length=2,779' Tc=30.2 min CN=70 Runoff=21.41 cfs 2.522 af

Subcatchment 3: Figure 3

Runoff Area=12.200 ac Runoff Depth=1.79"
Flow Length=1,528' Tc=26.8 min CN=70 Runoff=16.28 cfs 1.821 af

Subcatchment 4: Figure 4

Runoff Area=4.170 ac Runoff Depth=1.87"
Flow Length=897' Tc=27.6 min CN=71 Runoff=5.74 cfs 0.648 af

Subcatchment A: Inset Area 1

Runoff Area=22.540 ac Runoff Depth=1.79"
Flow Length=2,186' Tc=33.0 min CN=70 Runoff=27.37 cfs 3.355 af

Subcatchment B: Inset Area 2

Runoff Area=49.454 ac Runoff Depth=1.76"
Flow Length=3,960' Tc=67.0 min CN=70 Runoff=40.61 cfs 7.251 af

Subcatchment C: Inset Area 7

Runoff Area=24.102 ac Runoff Depth=1.79"
Flow Length=2,782' Tc=29.5 min CN=70 Runoff=30.81 cfs 3.592 af

Total Runoff Area = 152.038 ac Runoff Volume = 22.558 af Average Runoff Depth = 1.78"

SCS Method Flow Calculations

Type III 24-hr 25yr Rainfall=4.90"

Prepared by DeLuca-Hoffman Associates, Inc.
 HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

Page 3
 8/5/2005

Subcatchment 1: Figure 1

Runoff = 27.32 cfs @ 12.49 hrs, Volume= 3.370 af, Depth= 1.79"

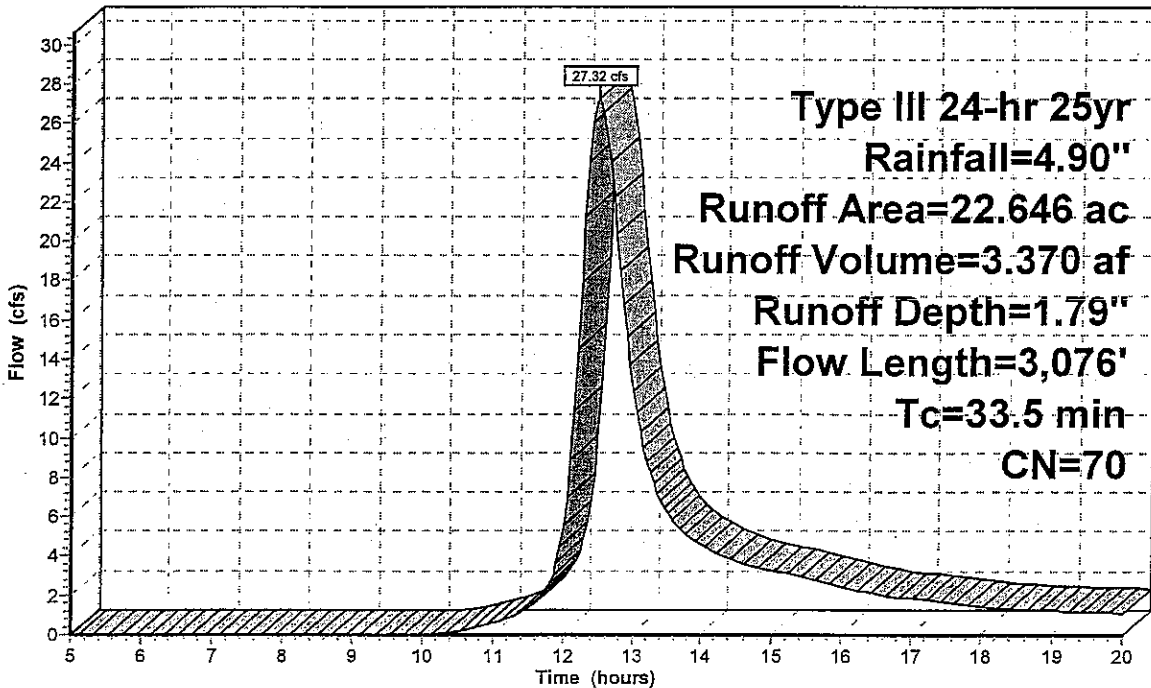
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25yr Rainfall=4.90"

Area (ac)	CN	Description
22.380	70	Forest
0.266	89	Gravel
22.646	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	50	0.1500	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
1.7	208	0.1700	2.1		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
2.4	360	0.2500	2.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.0	402	0.1100	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.3	2,056	0.2000	2.2		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
33.5	3,076	Total			

Subcatchment 1: Figure 1

Hydrograph



Runoff

SCS Method Flow Calculations

Type III 24-hr 25yr Rainfall=4.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 4

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment 2: Figure 2

Runoff = 21.41 cfs @ 12.44 hrs, Volume= 2.522 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=4.90"

Area (ac)	CN	Description
16.660	70	Forest
0.266	89	Gravel
16.926	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.1600	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
1.9	258	0.2000	2.2		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
5.0	755	0.2500	2.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.1	331	0.1300	1.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.7	1,000	0.2500	2.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.7	385	0.1200	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
30.2	2,779	Total			

SCS Method Flow Calculations

Prepared by DeLuca-Hoffman Associates, Inc.

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

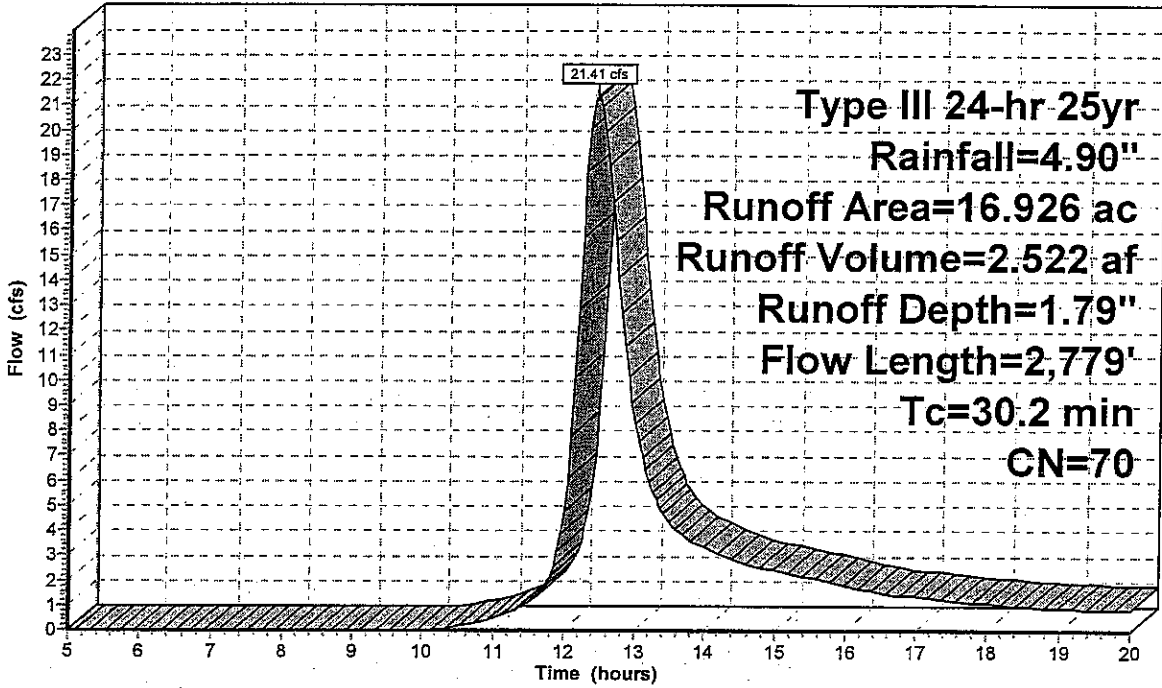
Type III 24-hr 25yr Rainfall=4.90"

Page 5

8/5/2005

Subcatchment 2: Figure 2

Hydrograph



SCS Method Flow Calculations

Type III 24-hr 25yr Rainfall=4.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 6

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment 3: Figure 3

Runoff = 16.28 cfs @ 12.39 hrs, Volume= 1.821 af, Depth= 1.79"

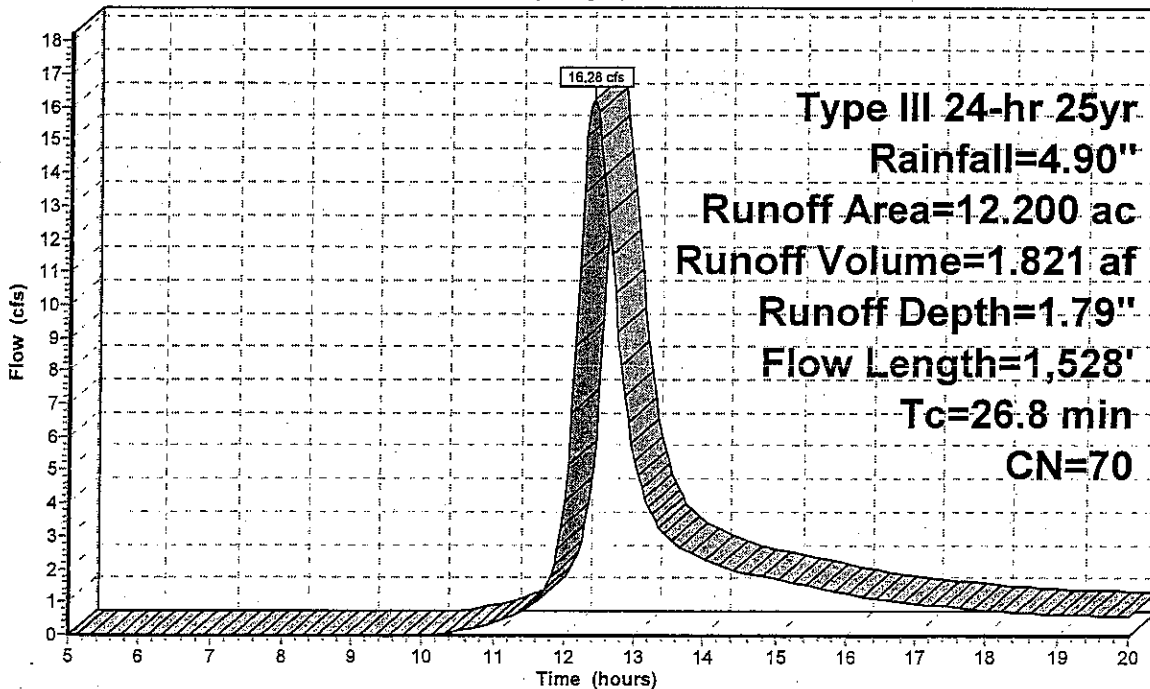
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=4.90"

Area (ac)	CN	Description
12.000	70	Forest
0.200	89	Gravel
12.200	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.1000	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
7.6	818	0.1300	1.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	343	0.0700	1.3		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.1	317	0.1200	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
26.8	1,528	Total			

Subcatchment 3: Figure 3

Hydrograph



SCS Method Flow Calculations

Type III 24-hr 25yr Rainfall=4.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 7

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment 4: Figure 4

Runoff = 5.74 cfs @ 12.40 hrs, Volume= 0.648 af, Depth= 1.87"

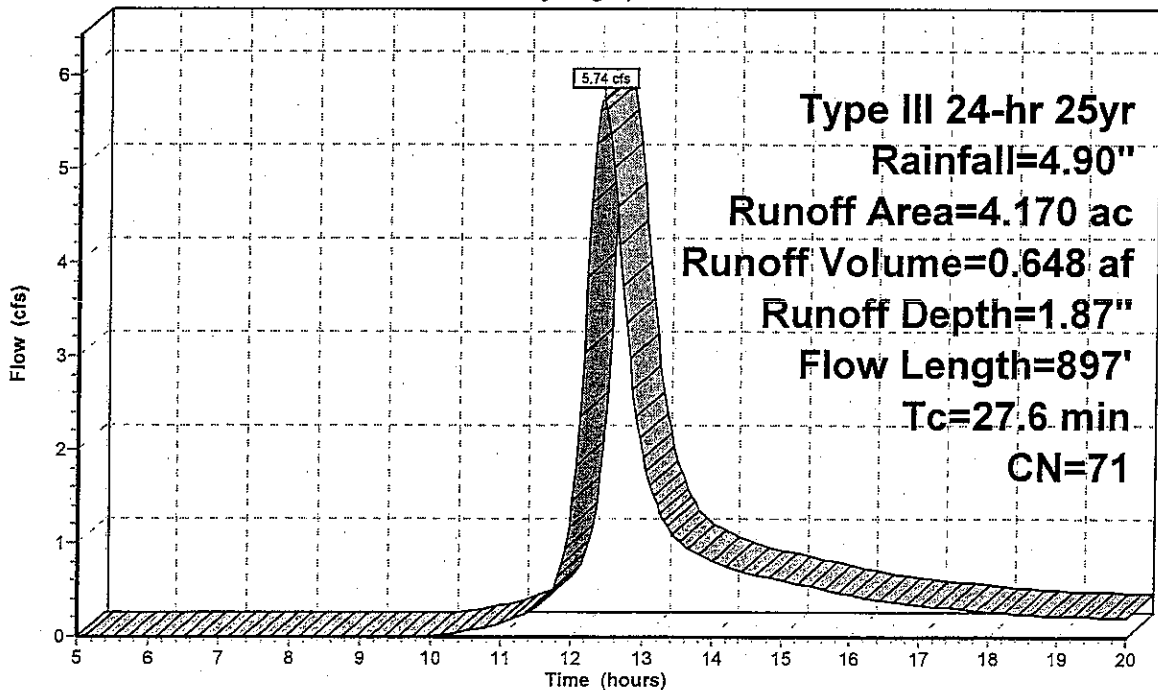
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=4.90"

Area (ac)	CN	Description
4.000	70	Forest
0.170	89	Gravel
4.170	71	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2	50	0.0300	0.0		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
3.5	232	0.0500	1.1		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.4	147	0.1200	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.4	213	0.2500	2.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
2.1	255	0.1700	2.1		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
27.6	897	Total			

Subcatchment 4: Figure 4

Hydrograph



Runoff

SCS Method Flow Calculations

Type III 24-hr 25yr Rainfall=4.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 8

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment A: Inset Area 1

Runoff = 27.37 cfs @ 12.48 hrs, Volume= 3.355 af, Depth= 1.79"

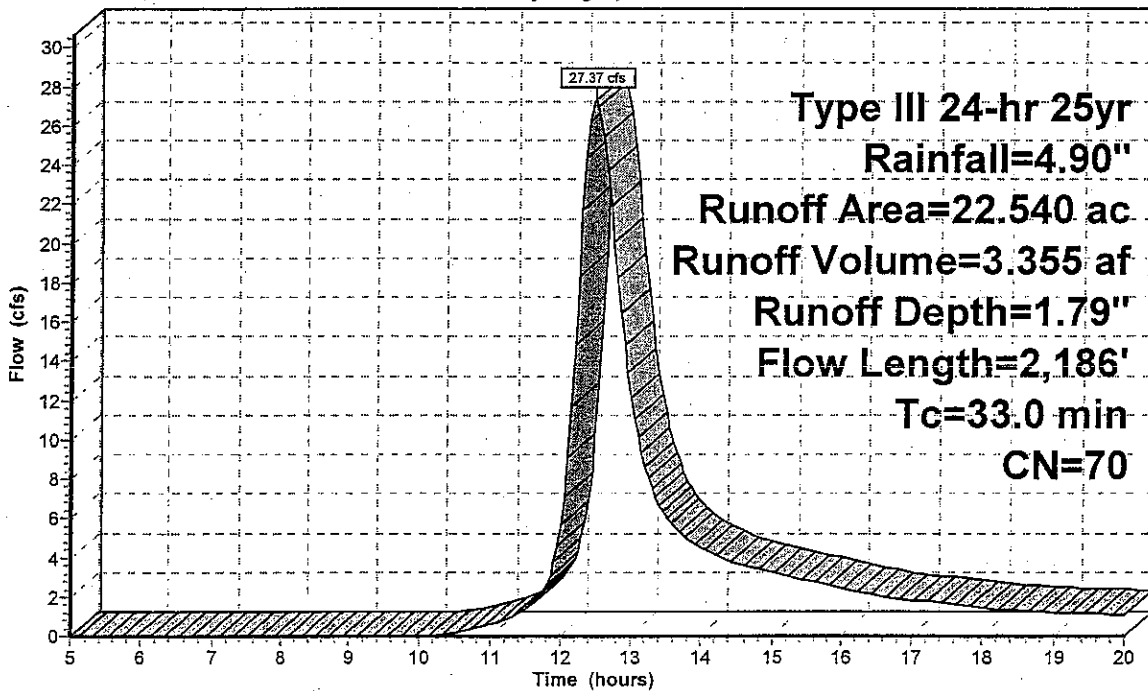
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=4.90"

Area (ac)	CN	Description
22.010	70	Forest
0.530	89	Gravel
22.540	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0500	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
8.2	820	0.1100	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.9	550	0.2200	2.3		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
5.3	766	0.2300	2.4		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
33.0	2,186	Total			

Subcatchment A: Inset Area 1

Hydrograph



Runoff

SCS Method Flow Calculations

Type III 24-hr 25yr Rainfall=4.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 9

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment B: Inset Area 2

Runoff = 40.61 cfs @ 12.93 hrs, Volume= 7.251 af, Depth= 1.76"

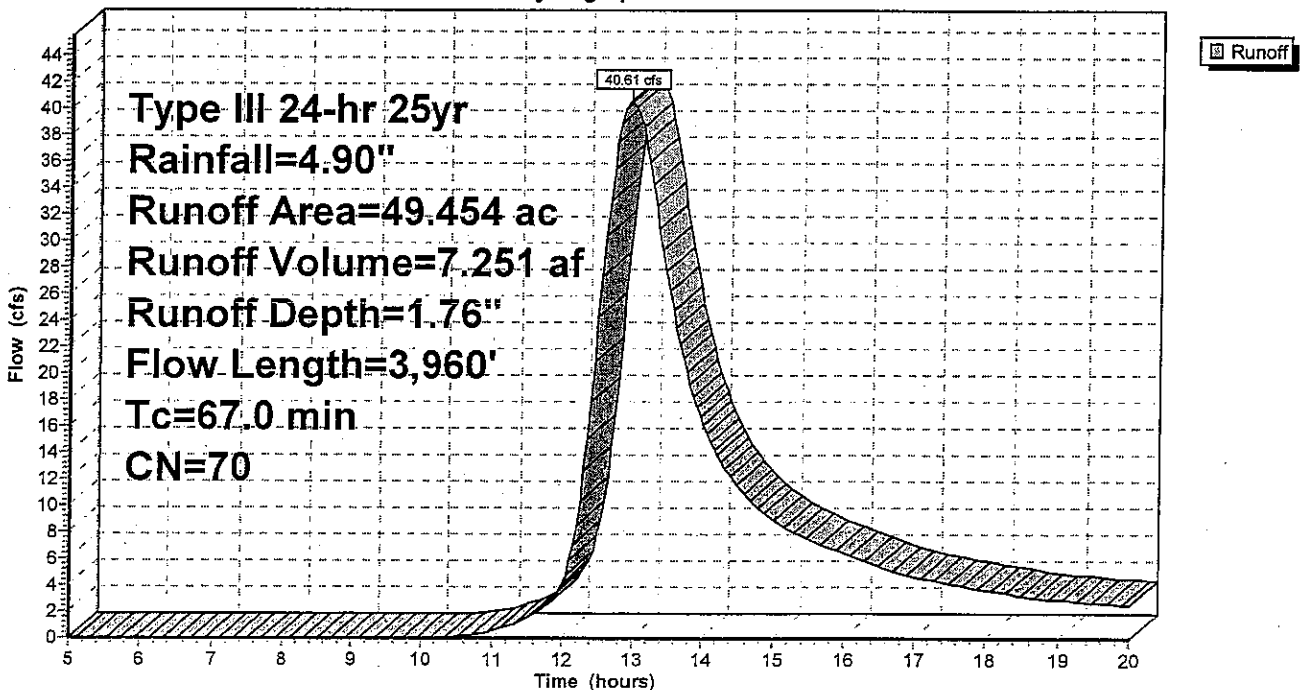
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=4.90"

Area (ac)	CN	Description
48.988	70	Forest
0.466	89	Gravel
49.454	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0500	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
10.8	916	0.0800	1.4		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.3	1,108	0.2000	2.2		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.5	736	0.0100	0.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
7.8	1,150	0.2400	2.4		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
67.0	3,960	Total			

Subcatchment B: Inset Area 2

Hydrograph



SCS Method Flow Calculations

Type III 24-hr 25yr Rainfall=4.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 10

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment C: Inset Area 7

Runoff = 30.81 cfs @ 12.43 hrs, Volume= 3.592 af, Depth= 1.79"

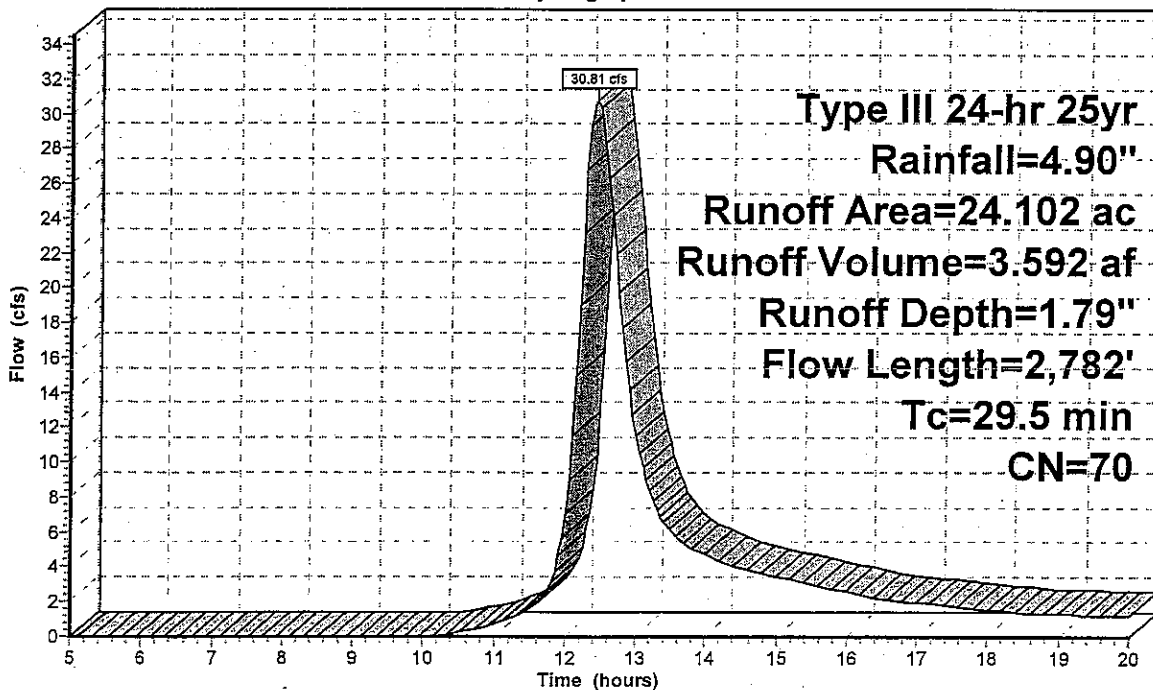
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25yr Rainfall=4.90"

Area (ac)	CN	Description
23.769	70	Forest
0.333	89	Gravel
24.102	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.4000	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
2.5	467	0.4000	3.2		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.1	1,585	0.1400	1.9		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.1	680	0.1400	1.9		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
29.5	2,782	Total			

Subcatchment C: Inset Area 7

Hydrograph



SCS Method Flow Calculations

Type III 24-hr 100yr Rainfall=5.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 11

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

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

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment 1: Figure 1

Runoff Area=22.646 ac Runoff Depth=2.50"
Flow Length=3,076' Tc=33.5 min CN=70 Runoff=38.49 cfs 4.712 af

Subcatchment 2: Figure 2

Runoff Area=16.926 ac Runoff Depth=2.50"
Flow Length=2,779' Tc=30.2 min CN=70 Runoff=30.17 cfs 3.527 af

Subcatchment 3: Figure 3

Runoff Area=12.200 ac Runoff Depth=2.50"
Flow Length=1,528' Tc=26.8 min CN=70 Runoff=22.95 cfs 2.545 af

Subcatchment 4: Figure 4

Runoff Area=4.170 ac Runoff Depth=2.59"
Flow Length=897' Tc=27.6 min CN=71 Runoff=8.02 cfs 0.901 af

Subcatchment A: Inset Area 1

Runoff Area=22.540 ac Runoff Depth=2.50"
Flow Length=2,186' Tc=33.0 min CN=70 Runoff=38.60 cfs 4.691 af

Subcatchment B: Inset Area 2

Runoff Area=49.454 ac Runoff Depth=2.46"
Flow Length=3,960' Tc=67.0 min CN=70 Runoff=57.44 cfs 10.150 af

Subcatchment C: Inset Area 7

Runoff Area=24.102 ac Runoff Depth=2.50"
Flow Length=2,782' Tc=29.5 min CN=70 Runoff=43.44 cfs 5.023 af

Total Runoff Area = 152.038 ac Runoff Volume = 31.550 af Average Runoff Depth = 2.49"

SCS Method Flow Calculations

Type III 24-hr 100yr Rainfall=5.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 12

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment 1: Figure 1

Runoff = 38.49 cfs @ 12.48 hrs, Volume= 4.712 af, Depth= 2.50"

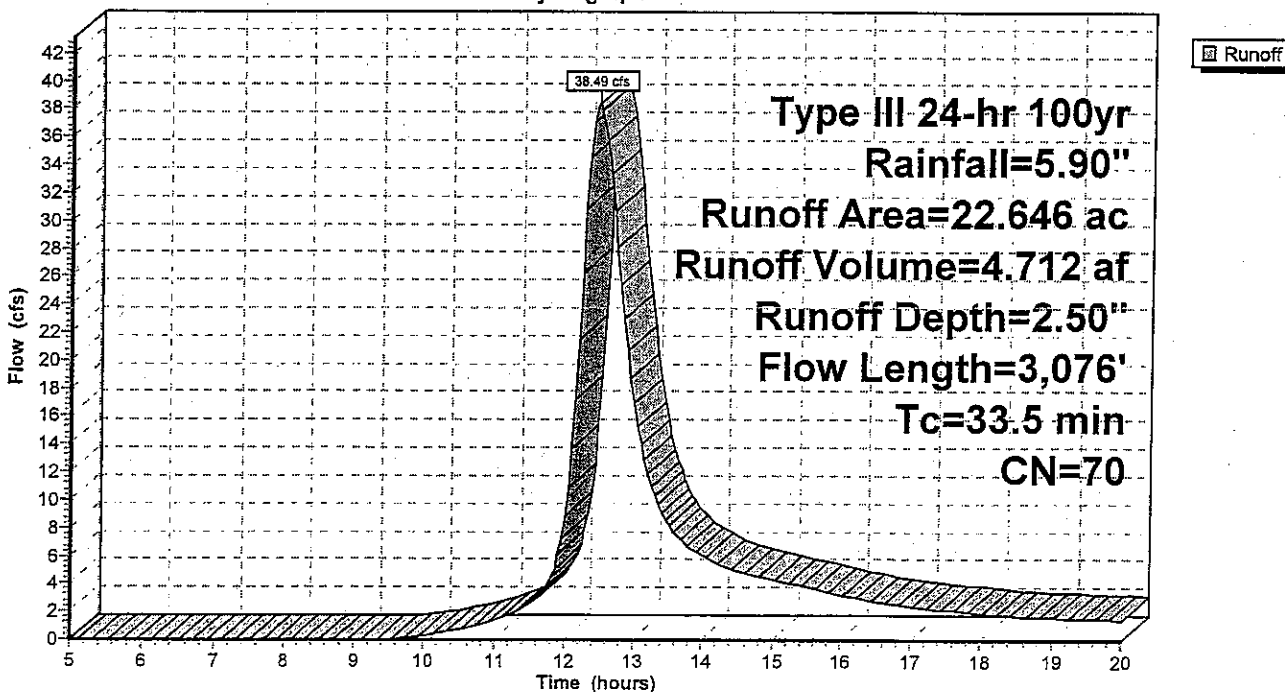
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=5.90"

Area (ac)	CN	Description
22.380	70	Forest
0.266	89	Gravel
22.646	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	50	0.1500	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
1.7	208	0.1700	2.1		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
2.4	360	0.2500	2.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.0	402	0.1100	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.3	2,056	0.2000	2.2		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
33.5	3,076	Total			

Subcatchment 1: Figure 1

Hydrograph



SCS Method Flow Calculations

Type III 24-hr 100yr Rainfall=5.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 13

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment 2: Figure 2

Runoff = 30.17 cfs @ 12.43 hrs, Volume= 3.527 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=5.90"

Area (ac)	CN	Description
16.660	70	Forest
0.266	89	Gravel
16.926	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.1600	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
1.9	258	0.2000	2.2		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
5.0	755	0.2500	2.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.1	331	0.1300	1.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.7	1,000	0.2500	2.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.7	385	0.1200	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
30.2	2,779	Total			

SCS Method Flow Calculations

Prepared by DeLuca-Hoffman Associates, Inc.

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

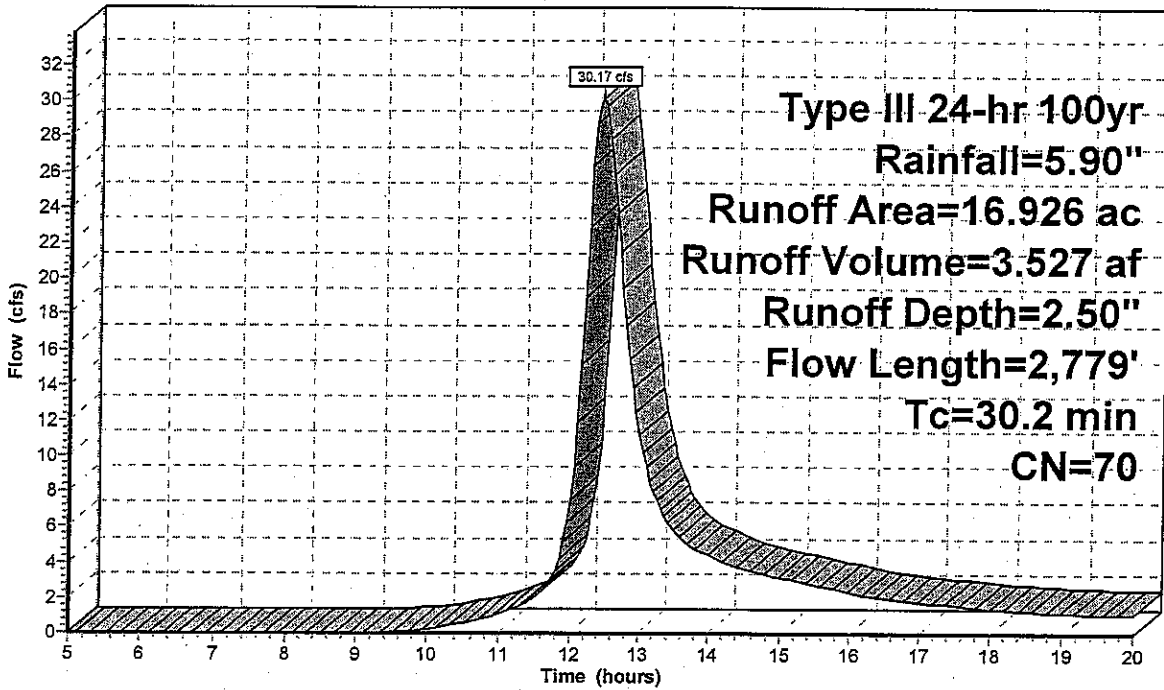
Type III 24-hr 100yr Rainfall=5.90"

Page 14

8/5/2005

Subcatchment 2: Figure 2

Hydrograph



SCS Method Flow Calculations

Type III 24-hr 100yr Rainfall=5.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 15

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment 3: Figure 3

Runoff = 22.95 cfs @ 12.38 hrs, Volume= 2.545 af, Depth= 2.50"

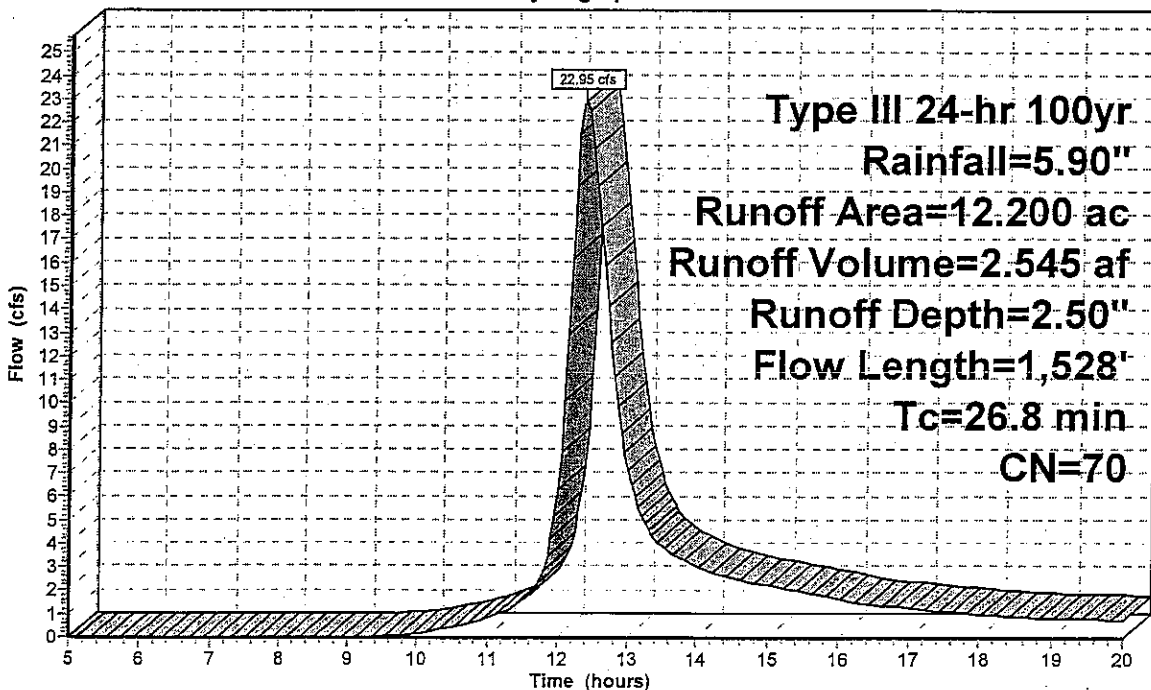
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=5.90"

Area (ac)	CN	Description
12.000	70	Forest
0.200	89	Gravel
12.200	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.1000	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
7.6	818	0.1300	1.8		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	343	0.0700	1.3		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.1	317	0.1200	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
26.8	1,528	Total			

Subcatchment 3: Figure 3

Hydrograph



Runoff

SCS Method Flow Calculations

Type III 24-hr 100yr Rainfall=5.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 16

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment 4: Figure 4

Runoff = 8.02 cfs @ 12.39 hrs, Volume= 0.901 af, Depth= 2.59"

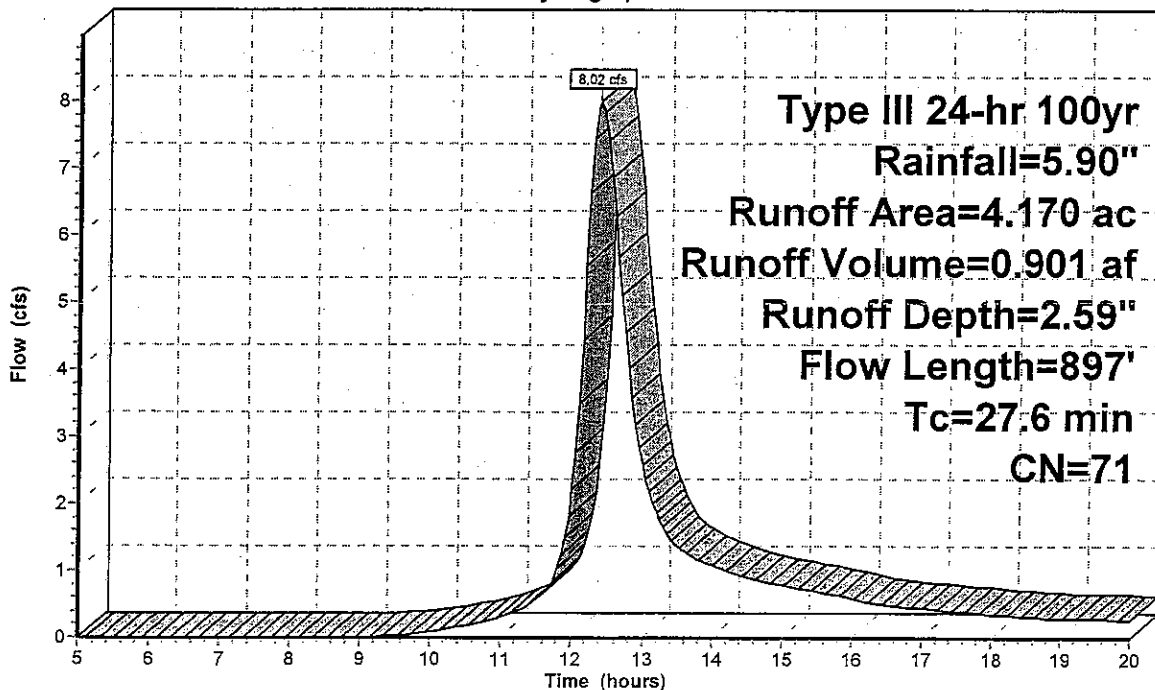
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=5.90"

Area (ac)	CN	Description
4.000	70	Forest
0.170	89	Gravel
4.170	71	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2	50	0.0300	0.0		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
3.5	232	0.0500	1.1		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.4	147	0.1200	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.4	213	0.2500	2.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
2.1	255	0.1700	2.1		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
27.6	897	Total			

Subcatchment 4: Figure 4

Hydrograph



SCS Method Flow Calculations

Type III 24-hr 100yr Rainfall=5.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 17

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment A: Inset Area 1

Runoff = 38.60 cfs @ 12.47 hrs, Volume= 4.691 af, Depth= 2.50"

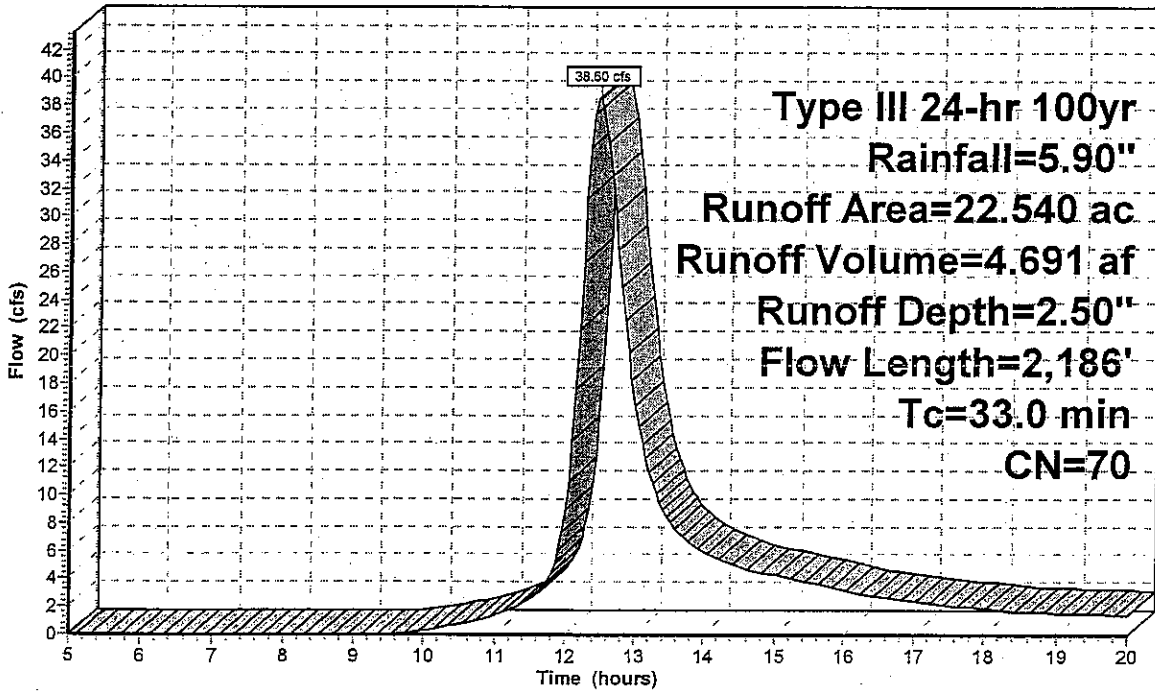
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=5.90"

Area (ac)	CN	Description
22.010	70	Forest
0.530	89	Gravel
22.540	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0500	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
8.2	820	0.1100	1.7		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.9	550	0.2200	2.3		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
5.3	766	0.2300	2.4		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
33.0	2,186	Total			

Subcatchment A: Inset Area 1

Hydrograph



Runoff

Type III 24-hr 100yr
Rainfall=5.90"
Runoff Area=22.540 ac
Runoff Volume=4.691 af
Runoff Depth=2.50"
Flow Length=2,186'
Tc=33.0 min
CN=70

SCS Method Flow Calculations

Type III 24-hr 100yr Rainfall=5.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 18

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment B: Inset Area 2

Runoff = 57.44 cfs @ 12.92 hrs, Volume= 10.150 af, Depth= 2.46"

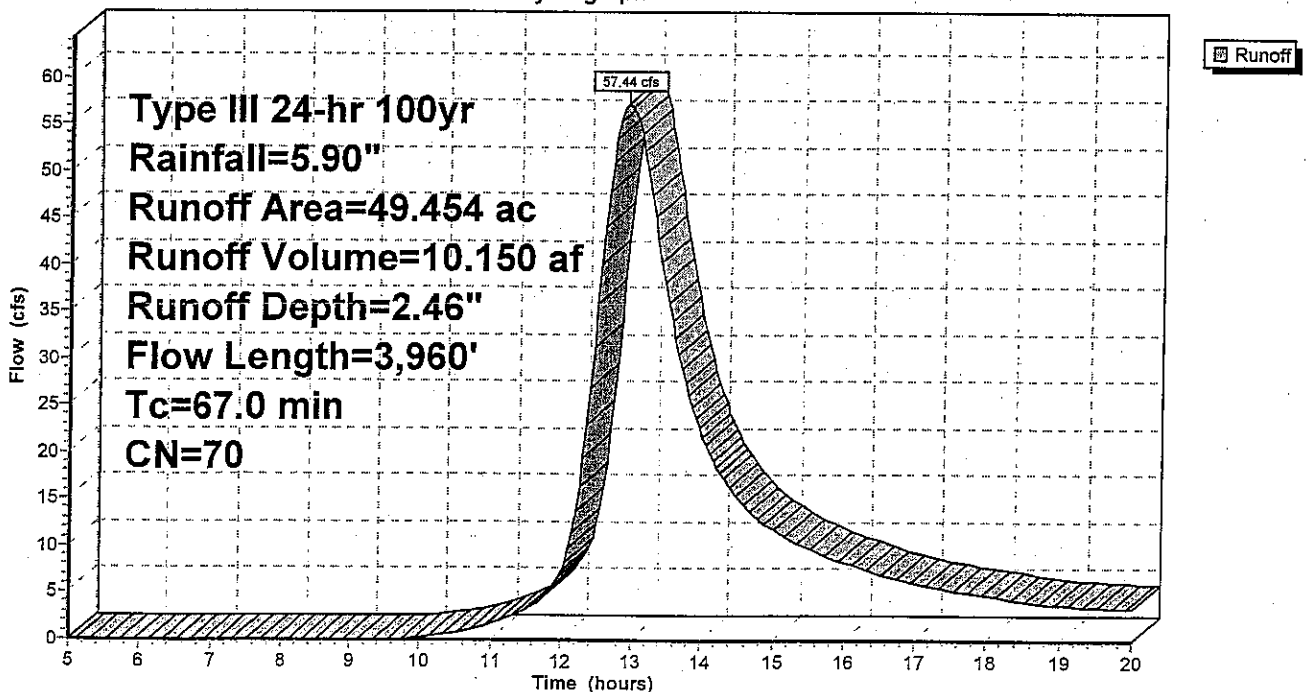
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=5.90"

Area (ac)	CN	Description
48.988	70	Forest
0.466	89	Gravel
49.454	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	50	0.0500	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
10.8	916	0.0800	1.4		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.3	1,108	0.2000	2.2		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.5	736	0.0100	0.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
7.8	1,150	0.2400	2.4		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
67.0	3,960	Total			

Subcatchment B: Inset Area 2

Hydrograph



SCS Method Flow Calculations

Type III 24-hr 100yr Rainfall=5.90"

Prepared by DeLuca-Hoffman Associates, Inc.

Page 19

HydroCAD® 7.00 s/n 000734 © 1986-2003 Applied Microcomputer Systems

8/5/2005

Subcatchment C: Inset Area 7

Runoff = 43.44 cfs @ 12.42 hrs, Volume= 5.023 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100yr Rainfall=5.90"

Area (ac)	CN	Description
23.769	70	Forest
0.333	89	Gravel
24.102	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.4000	0.1		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.90"
2.5	467	0.4000	3.2		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.1	1,585	0.1400	1.9		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.1	680	0.1400	1.9		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
29.5	2,782	Total			

Subcatchment C: Inset Area 7

Hydrograph

