APPENDIX B-1

Storm Data Base Chart

PennDOT REGION 5 PENNSYLVANIA RAINFALL INTENSITY-DURATION-FREQUENCY (Inches/Hour)

Time (Minutes)	Storm Frequency (Years)					
	2	5	10	25	50	100
5.0	4.63	5.40	6.02	6.70	7.51	8.19
6.0	4.34	5.15	5.70	6.39	7.22	7.90
7.0	4.12	4.95	5.42	6.10	6.95	7.62
8.0	3.92	4.70	5.17	5.85	6.70	7.36
9.0	3.75	4.50	4.95	5.62	6.47	7.12
10.0	3.59	4.30	4.75	5.41	6.26	6.90
11.0	3.45	4.15	4.58	5.22	6.07	6.70
12.0	3.32	4.00	4.42	5.05	5.88	6.50
13.0	3.21	3.85	4.27	4.89	5.71	6.33
14.0	3.10	3.70	4.16	4.74	5.56	6.16
15.0	3.00	3.55	4.00	4.60	5.40	6.00
20.0	2.60	3.10	3.50	4.03	4.78	5.34
25.0	2.31	2.65	3.15	3.61	4.30	4.83
30.0	2.09	2.45	2.82	3.27	3.92	4.41
40.0	1.76	2.05	2.39	2.78	3.34	3.79
50.0	1.53	1.77	2.08	2.42	2.92	3.33
60.0	1.35	1.60	1.85	2.15	2.60	2.98

APPENDIX B-2

Runoff Coefficients "C" for Rational Formula

Soil Group	A			B			C			D		
Slope	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Land Use												
Cultivated Land												
winter conditions	.14	.23	.34	.21	.32	.41	.27	.37	.48	.34	.45	.56
summer conditions	.10	.16	.22	.14	.20	.28	.19	.26	.33	.23	.29	.38
Forest/Woodland	.08	.11	.14	.10	.14	.18	.12	.16	.20	.15	.20	.25
Grass Areas												
good conditions	.10	.16	.20	.14	.19	.26	.18	.22	.30	.21	.25	.35
average conditions	.12	.18	.22	.16	.21	.28	.20	.25	.34	.24	.29	.41
poor conditions	.14	.21	.30	.18	.28	.37	.25	.35	.44	.30	.40	.50
Impervious Areas	.90	.91	.92	.91	.92	.93	.92	.93	.94	.93	.94	.95
Weighted Residential												
lot size 1/8 acre	.29	.33	36	.31	.35	.40	.34	.38	.44	.36	.41	.48
lot size 1/4 acre	.26	.30	.34	.29	.33	.38	.32	.36	.42	.34	.38	.46
lot size 1/3 acre	.24	.28	.31	.26	.32	.35	.29	.35	.40	.32	.36	.45
lot size 1/2 acre	.21	.25	.28	.24	.27	.32	.27	.31	.37	.30	.34	.43
lot size 1 acre	.18	.23	.26	.21	.24	.30	.24	.29	.36	.28	.32	.41

APPENDIX B-3

Runoff Curve Numbers "CN" for SCS Method

Soil Group	A			B			C			D		
Slope	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Land Use												
Cultivated Land												
winter conditions	48	60	75	62	73	82	68	78	90	77	88	95
summer conditions	35	51	58	48	55	65	57	65	73	64	69	79
Meadow		30			58			71			78	
Forest/Woodland	30	40	43	42	46	50	45	50	53	50	56	61
Grass Areas												
good conditions	35	51	53	48	54	63	56	59	74	62	63	80
average conditions	45	53	58	52	55	65	60	63	79	65	69	84
poor conditions	48	55	67	56	67	77	66	74	85	73	81	90
Impervious Areas	96	97	98	96	97	98	96	97	98	96	97	98
Weighted Residential												
lot size 1/8 acre	71	75	78	74	76	82	78	80	87	81	83	90
lot size 1/4 acre	62	67	71	66	69	76	67	69	76	75	78	88
lot size 1/3 acre	59	65	69	64	66	74	65	66	75	74	77	87
lot size 1/2 acre	57	63	68	62	64	73	63	65	73	72	76	86
lot size 1 acre	55	62	67	61	63	72	61	64	72	71	75	85

APPENDIX B-4

Worksheet No. 1

TIME OF CONCENTRATION (T_c) OR TRAVEL TIME (T_t)

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Existing Developed

_____

Circle one: T_c T_t through subarea

_____

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic or description of flow segments.

Sheet Flow (applicable to T_c only) Segment ID

1. Surface description (table 3-1) .....
2. Manning's roughness coeff., n (table 3-1) .....
3. Flow length. L (total L≤**150 ft) ..... ft
4. Two-year, 24-hour rainfall. P_2 ..... in
5. Land slope. s ..... ft/ft
6. $T_t = \frac{0.007\,(nl)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t ..... hr

	+		=	

Shallow Concentrated Flow Segment ID

7. Surface description (paved or unpaved) .....
8. Flow length. L ..... ft
9. Watercourse slope. s ..... ft/ft
10. Average velocity. V (figure 3-1) ..... ft/s
11. $T_t = \frac{L}{3600\ V}$ Compute T_t ..... hr

	+		=	

Channel Flow	Segment ID			
12. Cross sectional flow area. a ..... ft^2				
13. Wetted perimeter. Pw ..... ft				
14. Hydraulic radius. $r = \frac{a}{P_w}$ Compute r ..... ft				
15. Channel slope. s ..... ft/ft				
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ..... hr				
18. Flow length. L ..... ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t ..... hr		+		=
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11 and 19) ..... hr				

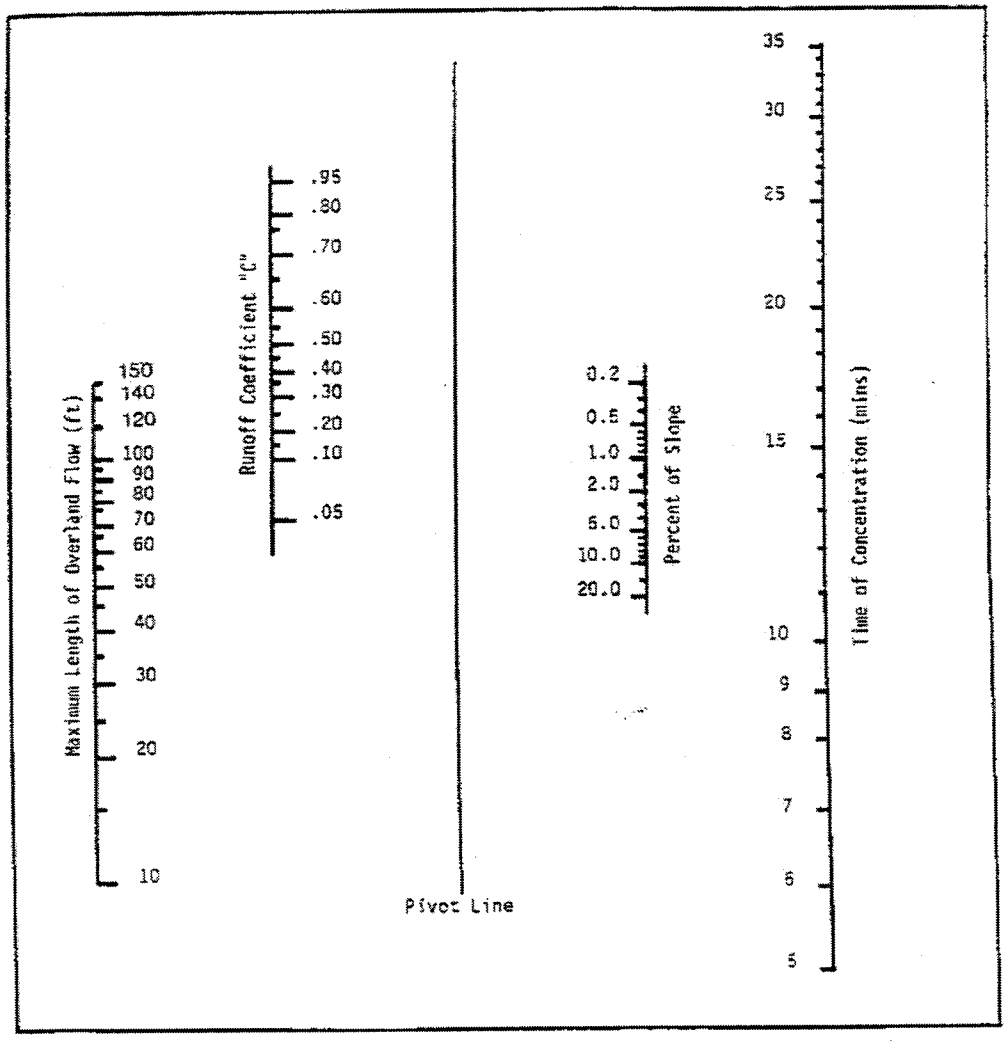
*Table 3-1 per latest TR-55, Urban Hydrology for Small Watershed.
**150' sheet flow length per latest TR-55 revision.

APPENDIX B-5

Nomograph for Determining Sheet Flow

NOMOGRAPH FOR DETERMINING SHEET FLOW

(for use with the Rational Method)



APPENDIX B-6

Shallow Concentrated Flow Chart

AVERAGE VELOCITIES FOR ESTIMATING TRAVEL TIME FOR SHALLOW CONCENTRATED FLOW

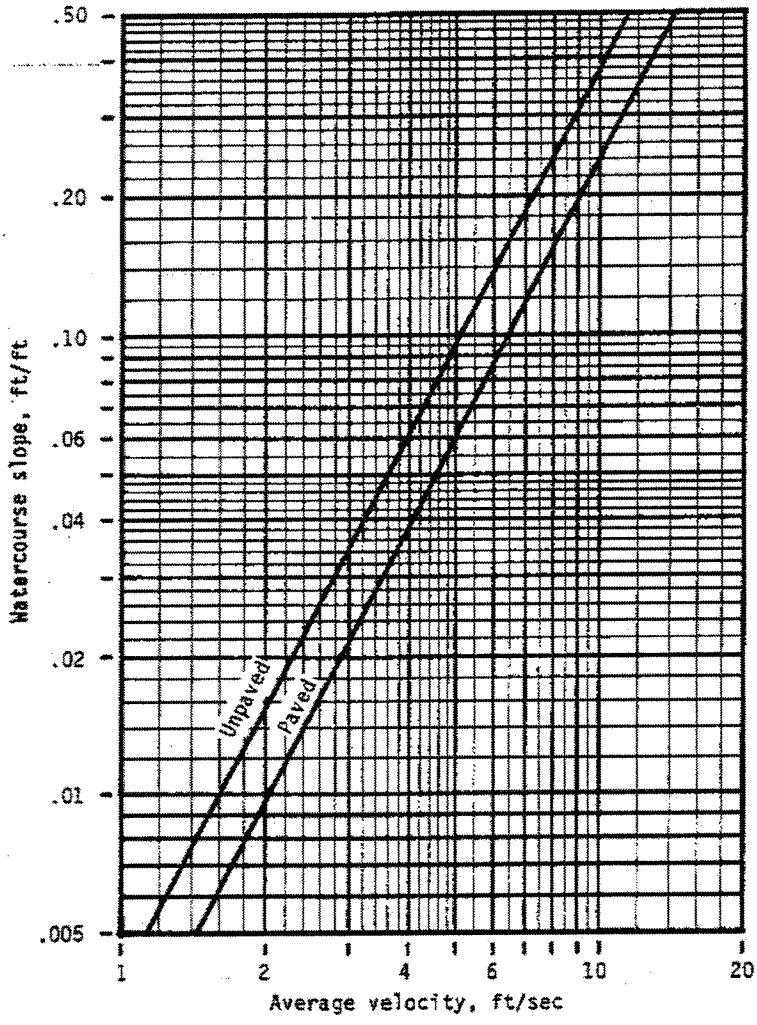


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.