Stormwater Detention Analysis

Four Seasons Center
95-179
18 October 1995

1. Gross Acreage = 7.28 Ac

2. Estimate of Pre-developed Rate of Run-off
25 Year Frequency, 20 Minute Duration Rational Method Storm

$$Q = C I A$$
$$Q = 2.31 \text{ cfs/Ac} \times 7.28 \text{ Ac}$$
$$Q = 16.82 \text{ cfs}$$

3. Estimate of Post-developed Rate of Run-off
25 Year Frequency, 20 Minute Duration Rational Method Storm

$$Q = C I A$$
$$Q = 4.75 \text{ cfs/Ac} \times 7.28 \text{ Ac}$$
$$Q = 34.58 \text{ cfs}$$

4. Estimate of Increase in Rate of Run-off
25 Year Frequency, 20 Minute Duration Rational Method Storm

$$Q_{increase} = Q_{post\text{-}dev} - Q_{pre\text{-}dev}$$
$$= 34.58 \text{ cfs} - 16.82 \text{ cfs}$$
$$= 17.76 \text{ cfs}$$

5. Attenuation Req'd. = $Q_{increase}$
= 17.76 cfs

3

6. Inflow Hydrograph - 25 Year Frequency 20 Minute Duration Rational Method Storm

D.A. to Basin ≅ 7.46 Ac

Travel Distance pipe ≅ 738 LF (FE 13 → AI 21)

Travel Distance overland ≅ 310 LF (To AI 21)

Total Distance ≅ 1,048 LF

T_c ≅ 1,048 LF ÷ 7 FT/Sec ≅ 2.5 minutes

use T_c = 2 minutes

Q_{peak} = 7.46 Ac × 4.75 in/hr Ac ≅ 35.44 CFS

TIME (min.)	INFLOW RATE (cfs)
0	0.00
1	17.72
2	35.44
3 → 19	35.44
20	35.44
21	17.72
22	0.00

7. Depth - Storage Volume Calculations

$E_{out} = 563.0'$

ELEV.	AREA (FT^2)	AVG. AREA (FT^2)	INC. OF DEPTH (FT.)	INC. OF VOLUME ($FT.^3$)	TOTAL VOLUME (FT^3)
563.0'	0				0
		1,670	1.0'	1,670	
564.0'	3,340				1,670
		4,110	2.0'	8,220	
566.0'	4,880				9,890
		5,730	2.0'	11,460	
568.0'	6,580				21,350
		7,037.5	1.0'	7,037	
569.0'	7,495				28,387
		7,977.5	1.0'	7,977	
570.0'	8,460				36,364

a. Depth - Outflow Calculations

Outflow estimated by orifice equation,

$$Q_{out} = C\,a\,\sqrt{2g\,h}$$

Outflow orifice is a "slot," 12" wide & 18" tall

$\therefore$ $a = 12" \times 18" = 216\ in^2 = 1.5\ ft^2$

$\therefore$ $Q_{out} = (0.6)(1.5)\sqrt{64.4\ h'}$

$= 0.9\sqrt{64.4\ h'}$

ELEV.	h	Qout Slot (cfs)	Qout Riser (cfs)	TOTAL Qout (cfs)
563.0	0	0.00	0	0.00
564.0	0.25	~~3.61~~ 3.00	0	3.00
566.0	2.25	10.83	0	10.83
568.0	4.25	14.89	0	14.89
569.0	5.25	16.55	0	16.55
570.0	6.25	18.06	33.0	51.06

note: h = ELEV - 563.75

* Qout estimated by weir equation

$Q_{out} = C\,L\,H^{3/2}$

$Q_{out\ Riser} = C\,L\,H^{3/2}$

where L = 11.0 ft

C = 3.0

H = ELEV - 469.0

9. RESULTS OF ROUTING CALCULATIONS

25 YEAR, 20 MINUTE RATIONAL METHOD STORM

PEAK Q_{in} = 35.44 CFS

PEAK Q_{out} = 16.39 CFS

ATTENUATION = 35.44 - 16.39 = 19.05 CFS

HIGH WATER ELEV. = 568.90

(See Exhibit "A" Attached)

10. CHECK STORM OF GREAT INTENSITY

Check 100 year frequency, 20 minute duration Rational Method Storm

$Q_{100} \cong 7.46\ A^{\pm}$ @ 6.05 CFS/A$^{\pm}$

$\cong$ 45.36 CFS

Results of Routing Calculations

$Q_{out} \cong$ 37 cfs

High Water ~~Elevation~~ $\cong$ 469.60

(See Exhibit "C" Attached)

11. Check 15 Year frequency 20 Minute Duration Rational Method Storm

Q_{in} = 28.71 CFS

Q_{out} = 14.89 CFS

High Water Elev $\cong$ +67.99

(See Exhibit "E" Attached)