15 YEAR STORM

spring orchard
detention basin
9-04-01

Pond File: J:\data\0101008\detent\BASIN1 .PND
Inflow Hydrograph: J:\data\0101008\detent\15YR .HYD
Outflow Hydrograph:

INFLOW HYDROGRAPH — ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.0	0.00	-----	0.0	0.0	0.00	493.50
1.0	6.38	6.4	5.7	6.4	0.36	493.78
2.0	12.76	19.1	23.0	24.8	0.88	493.98
3.0	19.14	31.9	51.7	54.9	1.60	494.16
4.0	25.52	44.7	91.4	96.4	2.52	494.34
5.0	31.90	57.4	141.8	148.8	3.47	494.53
6.0	38.28	70.2	202.9	212.0	4.56	494.71
7.0	44.66	82.9	274.6	285.8	5.60	494.88
8.0	51.04	95.7	357.1	370.3	6.61	495.05
9.0	57.42	108.5	450.4	465.6	7.62	495.22
10.0	63.80	121.2	554.6	571.6	8.49	495.39
11.0	63.80	127.6	663.8	682.2	9.19	495.55
12.0	63.80	127.6	771.9	791.4	9.77	495.69
13.0	63.80	127.6	878.9	899.5	10.29	495.82
14.0	63.80	127.6	985.0	1006.5	10.75	495.94
15.0	63.80	127.6	1090.3	1112.6	11.15	496.06
16.0	63.80	127.6	1194.8	1217.9	11.53	496.16
17.0	63.80	127.6	1298.7	1322.4	11.89	496.27
18.0	63.80	127.6	1401.9	1426.3	12.20	496.37
19.0	63.80	127.6	1504.5	1529.5	12.48	496.46
20.0	63.80	127.6	1606.6	1632.1	12.75	496.55
21.0	57.42	121.2	1701.8	1727.8	13.00	496.63
22.0	51.04	108.5	1783.8	1810.3	13.21	496.70
23.0	44.66	95.7	1852.8	1879.5	13.38	496.76
24.0	38.28	82.9	1908.7	1935.7	13.51	496.80
25.0	31.90	70.2	1951.7	1978.9	13.62	496.84
26.0	25.52	57.4	1981.7	2009.1	13.69	496.86
27.0	19.14	44.7	1998.9	2026.4	13.73	496.88
28.0	12.76	31.9	2003.3	2030.8	13.74	496.88
29.0	6.38	19.1	1995.0	2022.5	13.72	496.87
30.0	0.00	6.4	1974.1	2001.4	13.67	496.86

***************** SUMMARY OF ROUTING COMPUTATIONS *****************

Pond File: J:\data\0101008\detent\BASIN1 .PND
Inflow Hydrograph: J:\data\0101008\detent\15YR .HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 493.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 63.80 cfs
Peak Outflow = 13.74 cfs
Peak Elevation = 496.88 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 0 cu-ft
Peak Storage From Storm = 60,512 cu-ft

Total Storage in Pond = 60,512 cu-ft

25 YEAR STORM

spring orchard
detention basin
9-04-01

Pond File: J:\data\0101008\detent\BASIN1 .PND
Inflow Hydrograph: J:\data\0101008\detent\25YR .HYD
Outflow Hydrograph:

INFLOW HYDROGRAPH — ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.0	0.00	-----	0.0	0.0	0.00	493.50
1.0	7.85	7.9	7.0	7.9	0.41	493.80
2.0	15.69	23.5	28.5	30.6	1.02	494.02
3.0	23.54	39.2	64.0	67.8	1.91	494.22
4.0	31.39	54.9	113.0	118.9	2.94	494.43
5.0	39.24	70.6	175.5	183.6	4.08	494.63
6.0	47.08	86.3	251.3	261.8	5.26	494.83
7.0	54.93	102.0	340.5	353.3	6.41	495.02
8.0	62.78	117.7	443.1	458.2	7.54	495.21
9.0	70.62	133.4	559.5	576.5	8.53	495.39
10.0	78.47	149.1	689.9	708.5	9.33	495.58
11.0	78.47	156.9	826.8	846.8	10.04	495.76
12.0	78.47	156.9	962.4	983.7	10.67	495.92
13.0	78.47	156.9	1097.0	1119.3	11.18	496.06
14.0	78.47	156.9	1230.6	1253.9	11.65	496.20
15.0	78.47	156.9	1363.3	1387.5	12.09	496.33
16.0	78.47	156.9	1495.4	1520.3	12.46	496.45
17.0	78.47	156.9	1626.7	1652.3	12.81	496.57
18.0	78.47	156.9	1757.4	1783.6	13.14	496.68
19.0	78.47	156.9	1887.4	1914.3	13.46	496.79
20.0	78.47	156.9	2016.8	2044.3	13.77	496.89
21.0	70.62	149.1	2137.8	2165.9	14.05	496.98
22.0	62.78	133.4	2242.6	2271.2	14.28	497.06
23.0	54.93	117.7	2331.4	2360.3	14.47	497.13
24.0	47.08	102.0	2404.2	2433.4	14.60	497.18
25.0	39.24	86.3	2461.1	2490.5	14.70	497.22
26.0	31.39	70.6	2502.2	2531.7	14.77	497.25
27.0	23.54	54.9	2527.5	2557.1	14.82	497.27
28.0	15.69	39.2	2537.0	2566.7	14.84	497.27
29.0	7.85	23.5	2530.9	2560.6	14.83	497.27
30.0	0.00	7.9	2509.2	2538.8	14.79	497.25

***************** SUMMARY OF ROUTING COMPUTATIONS *****************

Pond File: J:\data\0101008\detent\BASIN1 .PND
Inflow Hydrograph: J:\data\0101008\detent\25YR .HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 493.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 78.47 cfs
Peak Outflow = 14.84 cfs
Peak Elevation = 497.27 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 0 cu-ft
Peak Storage From Storm = 76,556 cu-ft

Total Storage in Pond = 76,556 cu-ft

100 YEAR STORM

spring orchard
detention basin
9-04-01
rev: 10/13/01

Pond File: J:\data\0101008\detent\BASIN1 .PND
Inflow Hydrograph: J:\data\0101008\detent\100YR .HYD
Outflow Hydrograph:

INFLOW HYDROGRAPH — ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.0	0.00	-----	0.0	0.0	0.00	493.50
1.0	10.08	10.1	9.1	10.1	0.49	493.84
2.0	20.16	30.2	36.9	39.3	1.23	494.08
3.0	30.24	50.4	82.6	87.3	2.36	494.31
4.0	40.32	70.6	146.0	153.1	3.55	494.54
5.0	50.40	90.7	226.9	236.8	4.91	494.77
6.0	60.48	110.9	325.4	337.8	6.23	494.99
7.0	70.56	131.0	441.4	456.4	7.52	495.20
8.0	80.64	151.2	575.3	592.6	8.63	495.42
9.0	90.72	171.4	727.6	746.7	9.53	495.63
10.0	100.80	191.5	898.4	919.1	10.38	495.84
11.0	100.80	201.6	1077.8	1100.0	11.10	496.04
12.0	100.80	201.6	1255.9	1279.4	11.74	496.23
13.0	100.80	201.6	1432.9	1457.5	12.28	496.39
14.0	100.80	201.6	1609.0	1634.5	12.76	496.55
15.0	100.80	201.6	1784.2	1810.6	13.21	496.70
16.0	100.80	201.6	1958.5	1985.8	13.63	496.84
17.0	100.80	201.6	2132.0	2160.1	14.03	496.98
18.0	100.80	201.6	2304.8	2333.6	14.42	497.11
19.0	100.80	201.6	2476.9	2506.4	14.73	497.23
20.0	100.80	201.6	2648.5	2678.5	15.03	497.35
21.0	90.72	191.5	2809.4	2840.0	15.31	497.46
22.0	80.64	171.4	2949.2	2980.7	15.74	497.56
23.0	70.56	151.2	3068.0	3100.4	16.21	497.64
24.0	60.48	131.0	3165.8	3199.1	16.62	497.70
25.0	50.40	110.9	3239.8	3276.7	18.46	497.75
26.0	40.32	90.7	3291.0	3330.5	19.74	497.78
27.0	30.24	70.6	3320.6	3361.6	20.48	497.80
28.0	20.16	50.4	3329.6	3371.0	20.70	497.81
29.0	10.08	30.2	3319.0	3359.9	20.43	497.80
30.0	0.00	10.1	3289.7	3329.1	19.70	497.78

***************** SUMMARY OF ROUTING COMPUTATIONS *****************

Pond File: J:\data\0101008\detent\BASIN1 .PND
Inflow Hydrograph: J:\data\0101008\detent\100YR .HYD
Outflow Hydrograph:

Starting Pond W.S. Elevation = 493.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 100.80 cfs
Peak Outflow = 20.70 cfs
Peak Elevation = 497.81 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 0 cu-ft
Peak Storage From Storm = 100,510 cu-ft

Total Storage in Pond = 100,510 cu-ft

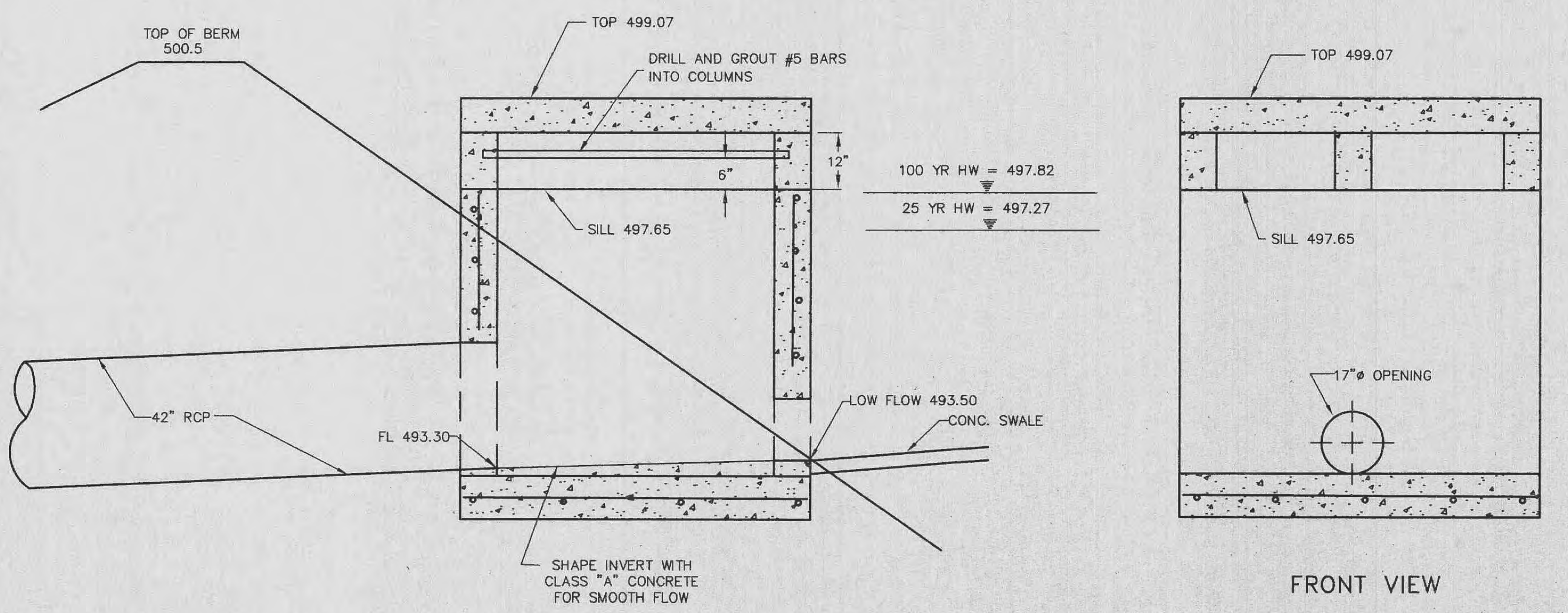
spring orchard
detention basin volumes
9-04-01

CALCULATED 09-05-2001 18:51:15
DISK FILE: J:\data\0101008\detent\BASIN1 .VOL

Planimeter scale: 1 inch = 1 ft.

Elevation (ft)	Planimeter (sq. in.)	Area (sq. ft)	A1+A2+sqr(A1*A2) (sq. ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
493.50	0.00	0	0	0	0
494.00	4,476.00	4,476	4,476	746	746
495.00	15,248.00	15,248	27,985	9,328	10,074
496.00	27,996.00	27,996	63,905	21,302	31,376
497.00	40,005.00	40,005	101,467	33,822	65,199
498.00	49,460.00	49,460	133,947	44,649	109,848
499.00	52,547.00	52,547	152,987	50,996	160,843
500.00	55,697.00	55,697	162,343	54,114	214,958

* Incremental volume computed by the Conic Method for Reservoir Volumes.
Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))
where: EL1, EL2 = Lower and upper elevations of the increment
Area1, Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2



DOUBLE AREA INLET
OPEN ALL SIDES

FRONT VIEW

NOTES: 1. USE DIMENSIONS FOR DOUBLE AREA INLET
2. REINFORCE WITH #4 BARS @ 12" O.C. BOTH WAYS ALL SIDES AND BOTTOM.

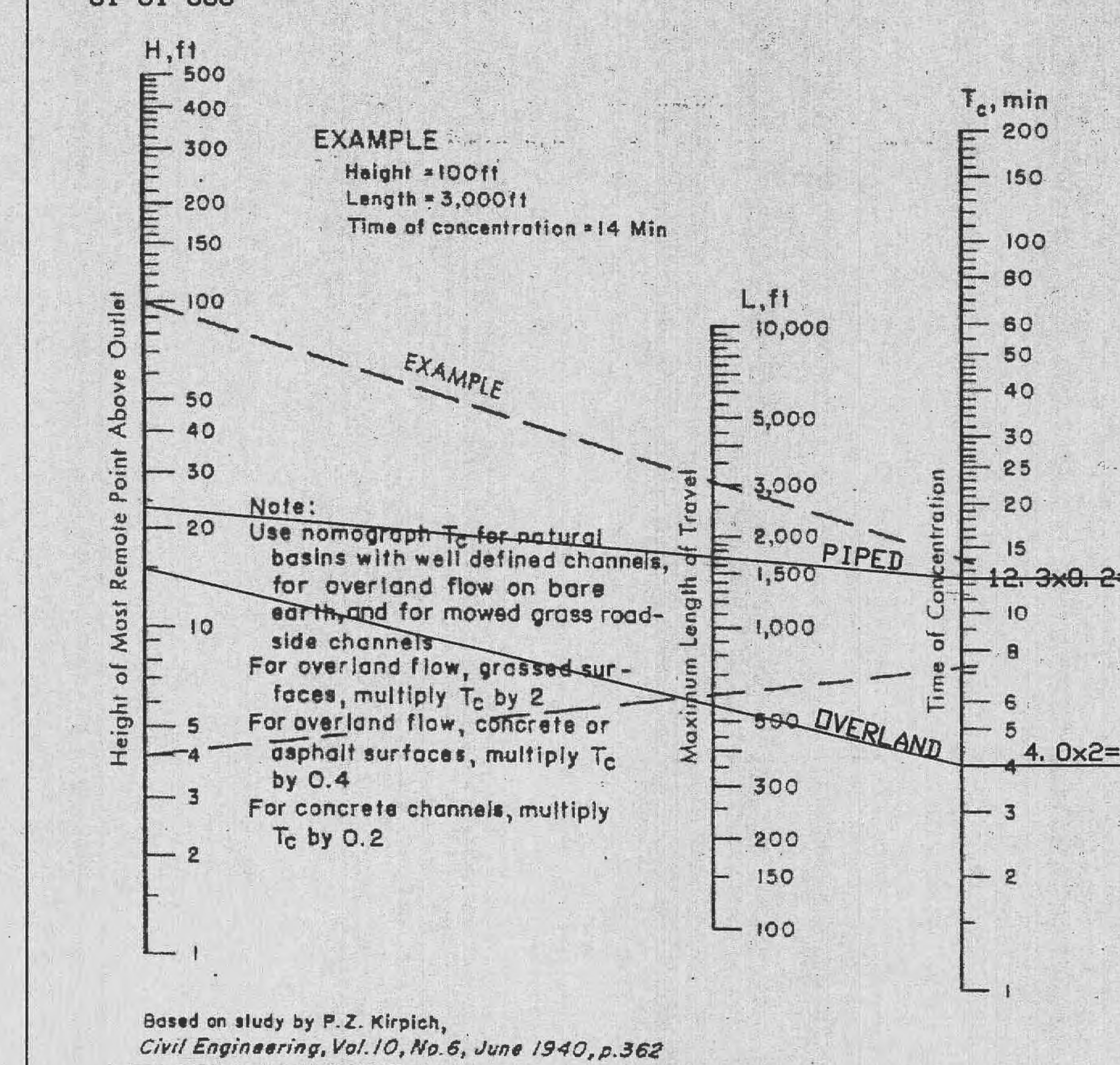
DETENTION BASIN OVERFLOW STRUCTURE "2"

N.T.S.

TIME OF CONCENTRATION

SPRING ORCHARD
01-01-008

9/05/01
JCM



OVERLAND FLOW: 550 L.F., V.D. = 538.5-523.0 = 15.5' Tc=8.0

PIPED FLOW: 1737 L.F., V.D. = 517.8-494.0 = 23.8' Tc=2.5

TOTAL = 10.5
USE 10 MIN.

Outlet Structure File:
BASIN1 .STR
****
spring orchard
basin one
9/04/01
REV. 10/13/01

SYSTEM CONNECTIVITY

Structure	No.	Q Table	Q Table
CULVERT-CR	1	->	1
WEIR-VR	3	->	3
ORIFICE	4	->	4

>>>>>> Structure No. 1 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev. (ft)?	493.5
E2 elev. (ft)?	500.001
Diam. (ft)?	1.4167
Inv. el. (ft)?	493.5
Slope (ft/ft)?	.01
T1 ratio?	
T2 ratio?	
K Coeff.?	.0045
M Coeff.?	2.0
c Coeff.?	.0317
Y Coeff.?	.69
Form 1 or 2?	1
Slope factor?	-0.5

>>>>>> Structure No. 3 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev. (ft)?	497.65
E2 elev. (ft)?	500.001
Weir coefficient?	3.32
Weir elev. (ft)?	497.65
Length (ft)?	19.00
Contracted/Suppressed (C/S)?	S

>>>>>> Structure No. 4 <<<<<<
(Input Data)

ORIFICE
Orifice - Based on Area and Datum Elevation

E1 elev. (ft)?	498.65
E2 elev. (ft)?	500.001
Orifice coeff.?	.6
Invert elev. (ft)?	497.65
Datum elev. (ft)?	498.15
Orifice area (sq ft)?	19.00

STORMWATER DETENTION ANALYSIS
PREPARED BY: THE STERLING CO.
SPRING ORCHARD SUBD., O'FALLON, MO
STERLING PROJECT NO. 01-01-008

September 5, 2001
Rev. Oct. 13, 2001

INTRODUCTION:

This tract of land is presently an undeveloped site located in the City of O'Fallon along Highway N. It is proposed that the 59.72 acre tract will be developed into 187 residential lots. One dry detention basin will be constructed at the north end of the common ground area. The storage volume and outflow rates shall be designed to insure that the peak rate of runoff leaving the tract under post-developed conditions is less than or equal to the peak rate of runoff under pre-developed conditions for the 25 year-20 minute design storm per City of O'Fallon requirements. The basin was also analyzed for the 15 year and the 100 year storm durations.

GENERAL SITE DATA AND RUNOFF CALCULATIONS:

The pre-developed P.I. factor used for the analysis:
15 year-20 min. @ 5% impervious = 1.87 cfs/ac.
25 year-20 min. @ 5% impervious = 2.31 cfs/ac.
100 year-20 min. @ 5% impervious = 2.95 cfs/ac.

The post-developed P.I. factor used for the analysis:
15 year-20 min. @ 40% impervious = 2.64 cfs/ac.
25 year-20 min. @ 40% impervious = 3.26 cfs/ac.
100 year-20 min. @ 40% impervious = 4.17 cfs/ac.

Required detention will be provided for the Spring Orchard Subd. as well as the proposed Kensington Place Addition and Avondale Spring Subdivisions located on the west side of the Spring Orchard site. Detention will be based on the area of development excluding the area to remain in the 100 year floodplain.

Required detention:	Area of development	- floodplain area	= net area
Spring Orchard	59.72 acres -	7.61 acres =	52.11 acres
Kensington Place	8.83 acres -	1.28 acres =	7.55 acres
Avondale Spring	11.40 acres -	6.06 acres =	5.34 acres
			65.00 TOTAL

Net area x differential runoff factor = required detention

15 year storm: 65.00 acres X (2.64 - 1.87) = 50.05 cfs
25 year storm: 65.00 acres X (3.26 - 2.31) = 61.74 cfs
100 year storm: 65.00 acres X (4.17 - 2.95) = 79.30 cfs

TIME OF CONCENTRATION:

Time of concentration was calculated using the most remote point that flows to the basin. Time of concentration is estimated as follows:

Basin One: 10 min.
(see attached nomograph)

BASIN PEAK INFLOWS:

Inflows to the basin have been calculated from the drainage area map.

15 year Q to basin: 63.80 cfs
25 year Q to basin: 78.47 cfs
100 year Q to basin: 100.80 cfs

STORM ROUTING CALCULATIONS AND RESULTS:

The Pondpack computer program was used in routing the design storms. As found in the routing calculations, the results are as follows:

DESIGN STORM	Q INFLOW	Q OUTFLOW	Q STORAGE	PEAK ELEV.
15 year	63.80 cfs	13.74 cfs	50.06 cfs	496.88
25 year	78.47 cfs	14.84 cfs	63.63 cfs	497.27
100 year	100.80 cfs	20.70 cfs	80.10 cfs	497.81

All design storms provide the required storage rates.

CHECK OUTFLOW WITH LOWFLOW BLOCKED:

The basin was checked for highwater with the lowflow structure blocked to ensure a minimum of two feet of freeboard during the 25 year storm and one foot of freeboard during the 100 year storm.

Q = CL(H2/3) Q = 78.47 cfs (25 yr.), 100.80 cfs (100 yr.), C = 3.32, L = 19.00' (double area inlet)
THEN H = 1.16 ft. (25 year) & 1.37 ft. (100 year)

BASIN SUMMARY:	BASIN ONE
Top Of Berm	500.50
25 year-20 min H.W.	497.27
H.W. (low flow blocked)	498.43
Freeboard provided	2.07 ft
100 year-20 min H.W.	497.82
H.W. (low flow blocked)	499.19
Freeboard provided	1.31 ft
Sill Elevation	497.65
Lowflow Elevation	493.50
Lowflow Opening	17" dia.

ISSUE	REMARKS/DATE
1	9-06-01 FIRST SUBMITTAL
2	9-26-01 D.C.S.D. COMMENTS
3	10-05-01 D.C.S.D. CITY COMMENTS
4	10-11-01 STORM & SANITARY APPROVAL
5	10-12-01 REVISE LATERALS PER CITY

PREPARED FOR:

N & K HIGHWAYS, L.L.C.
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ST. LOUIS, MISSOURI 63129
(314)-487-0440 FAX 487-8944
E-Mail: Sterling@icon-stl.net

DRAWN: DESIGNED: CHECKED:

PROJECT: SPRING ORCHARD

SHEET TITLE: DETENTION CALCULATIONS

NO. 01 01 008
M.S.D. P#
SHEET 25 OF 29

BASE MAP