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BAX ENGINEERING

SHEET 1 of 8

Project: PHEASANT POINT PLAT 4

Date: AUG. 31, 1993 Project No: 93-3875A

Designed: S.O.K. Checked: _____

ANALYSIS REVISED 11/3/93

STORMWATER DETENTION ANALYSIS

GENERAL SITE DATA & RUNOFF CALCULATIONS

1.) The tract of land is known as plat 4 of Pheasant Point Subdivision in the City of O'fallon MO. The plat contains 3.655 acres. Construction plans for Plat 4 were prepared in 1987 but it has not been constructed. It is part of a subwatershed which drains towards MO. State Highway K. Due to flooding downstream, it has been requested that a detention basin be included as part of the improvements of Plat 4. (A detention basin was not included in the originally approved construction plans.) Plans are therefore being revised to include a detention basin for which the basin characteristics are analyzed in this analysis.

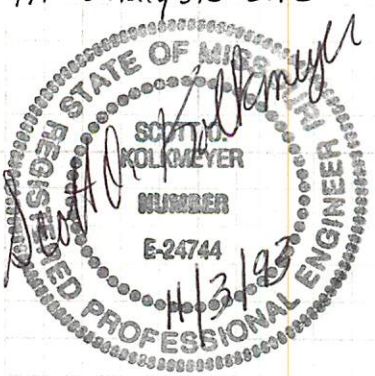
2.) In this analysis a 25 year-20 minute design storm as required by the City of O'fallon will be used for detention purposes. A 100 year-20 minute design storm shall also be checked for safe passage through the detention basin.

3.) The pre-developed P.I. factors to be used for the analysis are:

25 year-20 minute storm = 2.31 C.F.S./A^c
100 year-20 minute storm = 2.95 C.F.S./A^c

4.) The post-developed P.I. factors to be used for the analysis are:

25 year-20 minute storm = 3.26 C.F.S./A^c
100 year-20 minute storm = 4.17 C.F.S./A^c



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5.) From the drainage area map of the project, the 25 year-20 minute storm inflow to the basin is found to be $3.03\ A^c \times 3.26\ c.f.s./A^c = 9.88\ c.f.s.$

6.) The required attenuation due to development of plat 4 of Pheasant Point is estimated at:

$$\text{attenuation} = 3.655\ A^c \times (3.26\ c.f.s./A^c - 2.31\ c.f.s./A^c)$$
$$= 3.47\ c.f.s.$$

7.) The permitted release rate of the basin for the 25 year - 20 minute design storm is found by subtracting the required attenuation from the peak inflow to the basin:

$$\text{Permitted release rate} = 9.88\ c.f.s. - 3.47\ c.f.s. = 6.41\ c.f.s.$$

INFLOW HYDROGRAPH CALCULATIONS

1.) Of the flows that will inflow to the proposed detention basin, the most remote point of origination lies at lot 411 of plat 3 just east of lot 412 of plat 4. It will travel approximately 550 feet with a vertical difference of 14 feet. Therefore as shown on figure 1 attached, the time of concentration T_c to be used for the basin analysis shall be 6 minutes.

STORM ROUTING CALCULATIONS & RESULTS

1.) A computer program was used in routing the 25 year-20 minute design storm through the basin. As found in the routing calculations (Sheet 5), the peak outflow is 5.35 c.f.s. at elevation 503.96. This results in the actual detention provided by the basin as 4.53 c.f.s.

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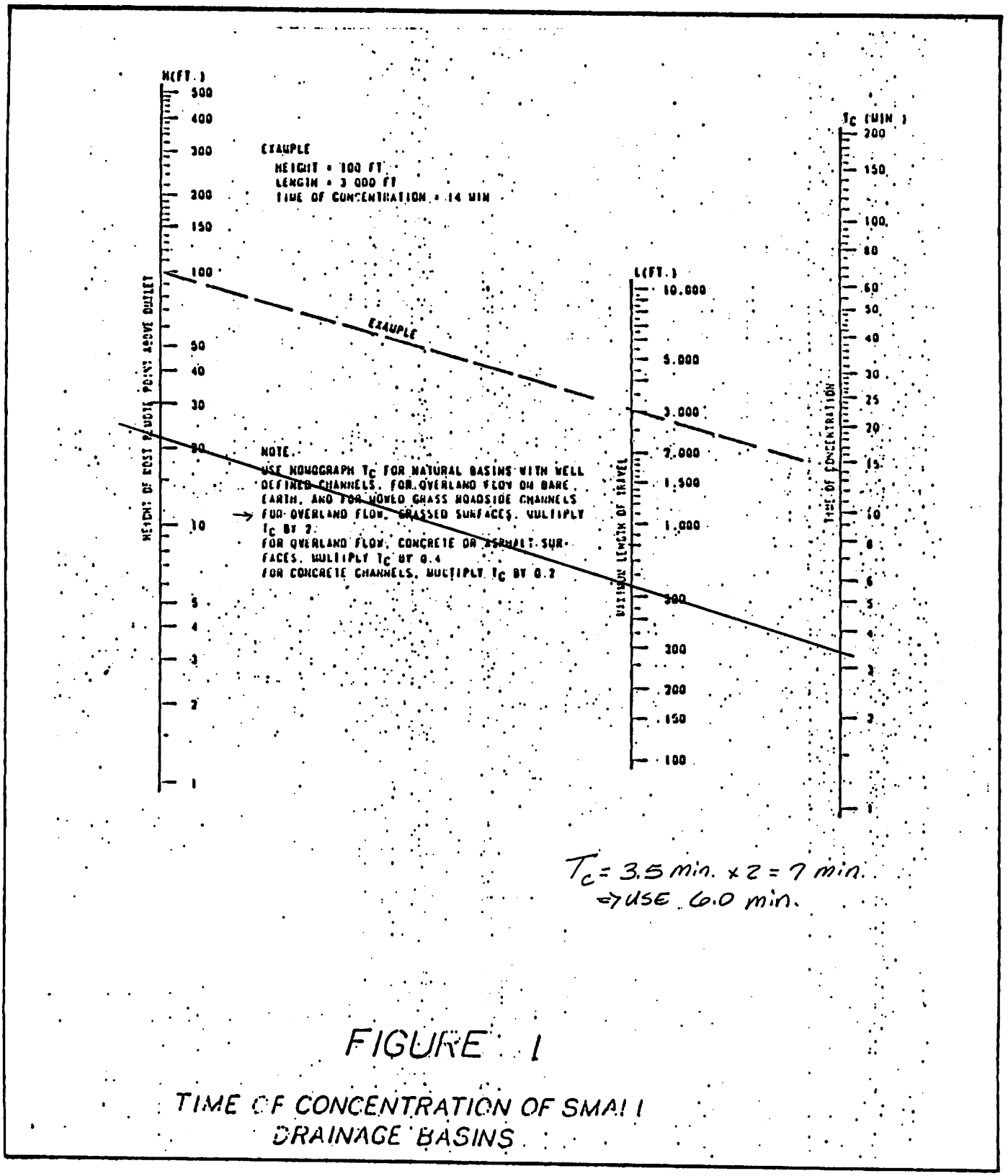

$T_C = 3.5$ min. $\times 2 = 7$ min.
$\Rightarrow$ use 6.0 min.

FIGURE 1

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

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DATA REPORT

DATE .....: 11-03-93

PROJECT NAME ..: PHEASANT POINT PLAT 4
PROJECT NUMBER : 93-3875A
CALCULATED BY .: S.B.K.

THE STORM FREQUENCY .....: 25 YEAR STORM

THE STORM DURATION .....: 20 MINUTES

TOTAL TIME OF CONCENTRATION .....: 6 MINUTE(S)

MANUAL ENTRY METHOD FOR Tc
Tc = 6

Q (C.F.S.) ENTERING THE BASIN ...: 9.88 C.F.S.

ELEVATION : 499.25 AREA .....: 0

ELEVATION : 500.00 AREA .....: 633

ELEVATION : 502.00 AREA .....: 1513

ELEVATION : 504.00 AREA .....: 2697

ELEVATION : 506.00 AREA .....: 4297

CUSTOM OVERFLOW STRUCTURE
SECTION NO. ..: 1
ELEVATION ....: 504.00
LENGTH .....: 11.67 FEET
THE REQUIRED HEIGHT OF THE SILL OPENING ..: THE SILL IS NOT REACHED
THE C VALUE .....: 3.00

SQUARE OR RECTANGULAR ORIFICE INFORMATION
SQUARE OR RECTANGULAR ORIFICE NUMBER : 1
THE WIDTH .....: 8 INCHES
THE HEIGHT .....: 10 INCHES
THE FLOWLINE ELEVATION .....: 499.25

DBASIN VERSION 1.20
DETENTION BASIN CALCULATIONS

PROJECT: PHEASANT POINT PLAT 4
PROJECT NO.: 93-3875A
DATE: 11-03-93
BY: S.D.K.

ELEVATION	AREA	INCREMENTAL VOLUME	ACTUAL ACCUM. VOLUME
499.25	0	0	0
500.00	638	239	239
502.00	1513	2151	2390
504.00	2697	4210	6600
506.00	4297	6994	13594

TIME (MIN)	INFLOW (C.F.S.)	INCR. VOL. (CU.FT.)	OUTFLOW (C.F.S.)	NET. DET. (CU.FT.)	ELEV.
0	0.00	0	0.00	0	499.25
1	1.65	99	0.34	79	499.56
2	3.29	276	1.54	184	500.04
3	4.94	460	1.71	377	500.23
4	6.59	773	1.76	667	500.50
5	8.23	1161	2.40	1017	500.86
6	9.88	1610	2.97	1432	501.28
7	9.88	2025	3.41	1820	501.66
8	9.88	2412	3.78	2185	502.02
9	9.88	2779	3.95	2541	502.19
10	9.88	3134	4.10	2888	502.36
11	9.88	3481	4.25	3226	502.52
12	9.86	3819	4.38	3556	502.68
13	9.88	4149	4.52	3878	502.84
14	9.88	4471	4.64	4192	502.99
15	9.88	4785	4.75	4500	503.14
16	9.88	5093	4.87	4801	503.29
17	9.88	5393	4.98	5095	503.43
18	9.88	5688	5.08	5383	503.57
19	9.88	5976	5.18	5665	503.71
20	9.88	6258	5.27	5942	503.84
21	8.23	6436	5.33	6115	503.93
22	6.59	6511	5.35	6189	503.96
23	4.94	6486	5.35	6165	503.95
24	3.29	6363	5.31	6044	503.89
25	1.65	6143	5.24	5829	503.79
26	0.00	5829	5.13	5521	503.64
27	0.00	5521	5.02	5220	503.49
28	0.00	5220	4.92	4925	503.35
29	0.00	4925	4.81	4636	503.21
30	0.00	4636	4.70	4354	503.07

ADDITIONAL INFORMATION

PEAK OUTFLOW = 5.35 C.F.S. AT 22 MINUTES AT HIGH WATER ELEVATION 503.96
REQUIRED DETENTION =_____C.F.S. MINIMUM.

OVERFLOW STRUCTURE CALCULATIONS

Structure shall be an area inlet. (assume low flow blocked)

$Q_{100/20} = 1.28(Q_{25/20})$

$= 1.28\ (9.88)$

$= 12.65$ c.f.s.

$Q = CLH^{3/2}$

$C = 3.0$

$L = 11.67$ ft. (area inlet 4 sides open)

$12.65 = (3)(11.67)(H)^{3/2}$

$H = 0.51$

The discharge pipe from the basin shall be an 18" R.C.P.

Inlet control check (sheet 7)

$Hw/D = 1.7$

$\therefore Hw = 1.7 \times 18" = 30.6" = 2.55'$

FE $499.25 + 2.55' = 501.80$

Outlet control check

Length of pipe = 50 ft.

FE downstream = 498.5

Calculate frictional losses through pipe:

hyd. grade $Sh = (Q/n_f)^2$

$= (12.65/105.1)^2$

$= 0.0145$

Frictional Losses, $f_L = 50 \times 0.0145$

$= 0.73$

Velocity Head loss $= 12.65/1.767 = 7.16$ ft./sec

$V^2/2g = 7.16^2/2(32.2) = .80$

$\therefore HW = 500.5 + .73 + 1/3(.80)$

$= 502.30$ ← UNDER OUTLET CONTROL

$502.3 < 504.0$ (overflow sill elevation) ✓

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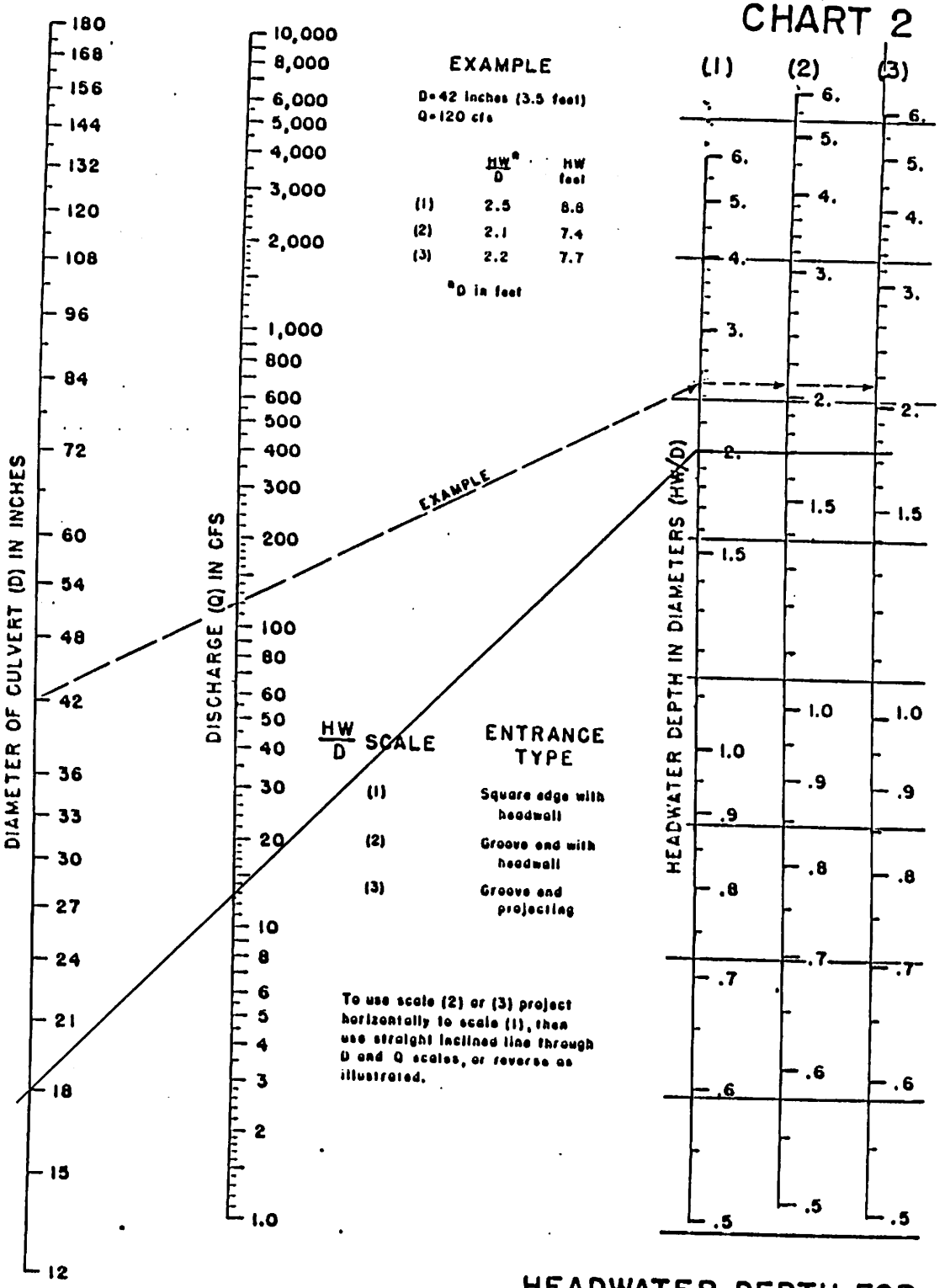
CHART 2



EXAMPLE

D=42 inches (3.5 feet)
Q=120 cfs

	$\frac{HW}{D}$ [a]	HW feet
(1)	2.5	8.8
(2)	2.1	7.4
(3)	2.2	7.7

[a] D in feet

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

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SUMMARY

The proposed detention basin has been analyzed to attenuate the increase in the stormwater runoff rate due to the development of Pheasant Point Plat 4. The detention basin is required to attenuate 3.47 c.f.s. with a peak discharge of 6.41 c.f.s. The peak release rate of the basin for a 25 year - 20 minute design storm is 5.35 c.f.s. which results in an attenuation provided by the basin of 4.53 c.f.s. The 4.53 c.f.s. attenuation is 1.31 times the amount required which would provide for approximatly 1.12 acres in additional land development in addition to Plat 4. The basin shall also have the following characteristics:

ELEVATION HIGH WATER 25 YEAR-20 MINUTE STORM	= 503.96
ELEVATION OF OVERFLOW STRUCTURE SILL	= 504.0
ELEVATION OF INSIDE BOTTOM OF TOP OF INLET	= 504.5
ELEVATION HIGH WATER 100 YEAR-20 MINUTE STORM	= 504.51

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