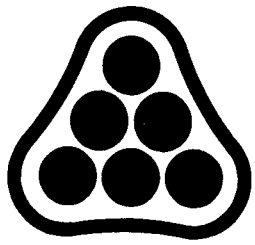

PROFESSIONAL
ENGINEERING
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PROFESSIONAL ASSOCIATION

DRAINAGE PLAN

AND

SUPPORTING CALCULATIONS

FOR

FAIRFIELD ESTATES 2ND ADDITION

TO WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
ENGINEERS
WICHITA, KANSAS

AUGUST 28, 1987

1440 EAST ENGLISH
WICHITA, KANSAS 67211
(316) 262-2691

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Date 8.27.87 Page 1 of 1

Project Fairfield Estates 2nd Addition

Item Drainage Plan - Introduction

Fairfield Estates 2nd Addition is a replat of portions of Fairfield Estates. The Drainage Plan for Fairfield Estates was submitted to the City on November 8, 1985. Due to the replat, System 600 of the original Drainage Plan will be revised. These revisions will have little or no effect on Detention Area #3 (Storm Water Drain No. 69). Therefore, this study will concentrate on the proposed storm water sewer locations, sizes, etc in this area.

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

I HYDROLOGY — Use Rational Method $Q = CIA$

A. Determine "c"

Node	Soil Type	Land Use	C_2	C_{100}
611	D	50% Res 1/3 Ac 50% Acs 1 Ac.	0.43	0.72
610	D	Res 1 Ac.	0.41	0.71
609	D	Res. 1/3 Ac.	0.46	0.73
608	D	Res 1/3 Ac.	0.46	0.73
607	D	Res. 1/3 Ac	0.46	0.73
606	D	Res. 1/3 Ac	0.46	0.73
605	D	Res 1/3 Ac.	0.46	0.73
604	D	Res 1/3 Ac	0.46	0.73
603	D	Res 1/3 Ac	0.46	0.73
602	D	Res 1/3 Ac	0.46	0.73
601	D	Res 1/3 Ac	0.46	0.73
600	(End Section)			

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

B. Determine "I"

Node	t_c	I_2	I_{100}
611	20	3.33	6.53
610	20	3.33	6.53
609	15	3.83	7.37
608	15	3.83	7.37
607	15	3.83	7.37
606	15	3.83	7.37
605	15	3.83	7.37
604	15	3.83	7.37
603	15	3.83	7.37
602	15	3.83	7.37
601	15	3.83	7.37
600	(End Section		

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

C. Determine "A"

Node	Plan. Units	Area SF	Area Acres
611	1463	234,080	5.37
610	920	147,200	3.38
609	398	63,680	1.46
608	320	51,200	1.18
607	1,307	209,120	4.80
606	592	94,720	2.17
605	213	34,080	0.78
604	1,044	167,040	3.83
603	1,593	254,880	5.85
602	817	130,720	3.00
601	653	104,480	2.40
600	(End Section.)		

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

D. Determine "Q_2"

Node	C_2	I_2	A	Q_2
611	0.43	3.33	5.37	7.7
610	0.41	3.33	3.38	4.6
609	0.46	3.83	1.46	2.6
608	0.46	3.83	1.18	2.1
607	0.46	3.83	4.80	8.5
606	0.46	3.83	2.17	3.8
605	0.46	3.83	0.78	1.4
604	0.46	3.83	3.83	6.7
603	0.46	3.83	5.85	10.3
602	0.46	3.83	3.00	5.3
601	0.46	3.83	2.40	4.2
600	(End Section)			

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

E. Determine "Q_{100}"

Node	C_{100}	I_{100}	A	Q_{100}
611	0.72	6.53	5.37	25.2
610	0.71	6.53	3.38	15.7
609	0.73	7.37	1.46	7.9
608	0.73	7.37	1.18	6.3
607	0.73	7.37	4.80	25.8
606	0.73	7.37	2.17	11.7
605	0.73	7.37	0.78	4.2
604	0.73	7.37	3.83	20.6
603	0.73	7.37	5.85	31.5
602	0.73	7.37	3.00	16.1
601	0.73	7.37	2.40	12.9
600	(End Section)			

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

II 2-YR FLOOD ROUTING / INLET SIZING

Node	Inlet Condition	L	$Q_{approach}$*	$Q_{intercept}$≠	Q_{bypass}	to Node
611	Sump	5'	7.7	7.7	0.0	-
610	On Grade	5'	4.6	34% = 1.6	3.0	609
609	On Grade	5'	2.6+3.0 = 5.6	27% = 1.5	4.1	608
608	Sump	5'	2.1+4.1 = 6.2	6.2	0.0	-
607	Sump	5'	8.5	8.5	0.0	-
606	Sump	5'	3.8	3.8	0.0	-
605	Sump	5'	1.4	1.4	0.0	-
604	Sump	5'	6.7	6.7	0.0	-
603	Sump	5'	10.3	10.3	0.0	-
602	sump	5'	5.3	5.3	0.0	-
601	Sump	5'	4.2	4.2	0.0	-
600	(End Section					

* $Q_{approach} = Q_2$

≠ Q intercept = Q input in "Storm" program

```
100 j,  169.5000  600    3   12   11
110 t,fairfield estates 2nd addition
120 t,drainage plan
130 t,storm sewer system 600 analysis
140 i,   611      0.43      5.37      0.00      0.00      7.70     20.00    181.00
150 i,   610      0.41      3.38      0.00      0.00      1.60     20.00    181.00
160 i,   609      0.46      1.46      0.00      0.00      1.50     15.00    178.50
170 i,   608      0.46      1.18      0.00      0.00      6.20     15.00    177.70
180 i,   607      0.46      4.80      0.00      0.00      8.50     15.00    177.70
190 i,   606      0.46      2.17      0.00      0.00      3.80     15.00    177.90
200 i,   605      0.46      0.78      0.00      0.00      1.40     15.00    177.60
210 i,   604      0.46      3.83      0.00      0.00      6.70     15.00    177.60
220 i,   603      0.46      5.85      0.00      0.00     10.30     15.00    177.80
230 i,   602      0.46      3.00      0.00      0.00      5.30     15.00    177.50
240 i,   601      0.46      2.40      0.00      0.00      4.20     15.00    177.50
250 m,   600    169.50
260 p,   611   610     80.00    15 0.013  30.00    0.00
270 p,   610   609    190.00    18 0.013  40.00    0.00
280 p,   609   607    240.00    24 0.013   0.00    0.00
290 p,   608   607     40.00    15 0.013  90.00    0.00
300 p,   607   606     90.00    30 0.013   0.00    0.00
310 p,   606   604    270.00    30 0.013   0.00    0.00
320 p,   605   604     40.00    15 0.013  90.00    0.00
330 p,   604   603     90.00    30 0.013   0.00    0.00
340 p,   603   601    300.00    36 0.013  40.00    0.00
350 p,   602   601     40.00    15 0.013   0.00    0.00
360 p,   601   600    230.00    36 0.013   0.00    0.00
370 e
```

III HYDRAULICS

7/15

Date: 08-27-1987
Time: 22:57:38

fairfield estates 2nd addition
drainage plan
storm sewer system 600 analysis

Input File: fair600

Storm Frequency = 2-Year

* * * HYDROLOGY * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(Ø) (Min)	I(Ø) (In/Hr)	Q(Ø) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
611	610	Ø.43	5.37	Ø.00	Ø.Ø	20.00	3.63	7.70	20.00	3.63	7.70	7.70	15"	6.27	80.00	Ø.21	20.21
610	609	Ø.41	3.38	Ø.00	Ø.Ø	20.00	3.63	1.60	20.21	3.61	1.59	9.29	18"	5.26	190.00	Ø.60	20.81
609	607	Ø.46	1.46	Ø.00	Ø.Ø	15.00	4.06	1.50	20.81	3.57	1.32	10.61	24"	3.38	240.00	1.18	22.00
608	607	Ø.46	1.18	Ø.00	Ø.Ø	15.00	4.06	6.20	15.00	4.06	6.20	6.20	15"	5.05	40.00	Ø.13	15.13
607	606	Ø.46	4.80	Ø.00	Ø.Ø	15.00	4.06	8.50	22.00	3.50	7.32	23.29	30"	4.75	90.00	Ø.32	22.31
606	604	Ø.46	2.17	Ø.00	Ø.Ø	15.00	4.06	3.80	22.31	3.48	3.25	26.55	30"	5.41	270.00	Ø.83	23.15
605	604	Ø.46	Ø.78	Ø.00	Ø.Ø	15.00	4.06	1.40	15.00	4.06	1.40	1.40	15"	1.14	40.00	Ø.58	15.58
604	603	Ø.46	3.83	Ø.00	Ø.Ø	15.00	4.06	6.70	23.15	3.43	5.66	33.40	30"	6.81	90.00	Ø.22	23.37
603	601	Ø.46	5.85	Ø.00	Ø.Ø	15.00	4.06	10.30	23.37	3.41	8.66	42.07	36"	5.95	300.00	Ø.84	24.21
602	601	Ø.46	3.00	Ø.00	Ø.Ø	15.00	4.06	5.30	15.00	4.06	5.30	5.30	15"	4.32	40.00	Ø.15	15.15
601	600	Ø.46	2.40	Ø.00	Ø.Ø	15.00	4.06	4.20	24.21	3.37	3.48	49.97	36"	7.07	230.00	Ø.54	24.75

8/15

Date: 08-27-1987
Time: 22:57:38

Input File: fair600

fairfield estates 2nd addition
drainage plan
storm sewer system 600 analysis

Storm Frequency = 2-Year

* * * HYDRAULICS * * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
611	0.01421	1.1367	0.0000	0.0000	0.0000	0.0000	0.0000	1.1367	179.4449	181.0000	1.56
610	0.00783	1.4872	0.0000	0.0364	0.0000	0.0818	0.0668	1.6722	178.3082	181.0000	2.69
609	0.00220	0.5283	0.0000	0.0504	0.0000	0.0811	-0.1399	0.5200	176.6360	178.5000	1.86
608	0.00921	0.3685	0.0000	0.0000	0.0000	0.0000	0.0000	0.3685	176.4845	177.7000	1.22
607	0.00322	0.2902	0.0000	0.0172	0.0000	0.0000	0.5907	0.8982	176.1161	177.7000	1.58
606	0.00419	1.1310	0.0000	0.0105	0.0000	0.0000	0.2280	1.3695	175.2179	177.9000	2.68
605	0.00047	0.0188	0.0000	0.0000	0.0000	0.0000	0.0000	0.0188	173.8672	177.6000	3.73
604	0.00663	0.5969	0.0000	0.0265	0.0000	0.0000	0.5579	1.1813	173.8484	177.6000	3.75
603	0.00398	1.1935	0.0000	0.0338	0.0000	0.0000	0.1464	1.3736	172.6671	177.8000	5.13
602	0.00673	0.2693	0.0000	0.0000	0.0000	0.0000	0.0000	0.2693	171.5627	177.5000	5.94
601	0.00561	1.2909	0.0000	0.0226	0.0000	0.1039	0.3760	1.7934	171.2935	177.5000	6.21
600	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	169.5000	169.5000	0.00

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

III STREET FLOW - 2 YR

Node	Q_2	Distribution	street slope	d	Comment
611	7.7	70% N = 5.4	0.4%	0.38'	OK
		30% E = 2.3	0.6%	0.26'	OK
610	4.6	100% E = 4.6	0.6%	0.33'	OK
609	2.6+3.0=5.6	100% NE = 5.6	1.1%	0.33'	OK
608	2.1+4.1=6.2	90% E = 5.6	0.32%	0.40	OK
		10% W = 0.6	0.32%	0.18	OK
607	8.5	30% N = 2.6	0.32%	0.31	OK
		70% E = 5.9	0.32%	0.42	OK
606	3.8	90% N = 3.4	0.32%	0.34'	OK
		10% W = 0.4	0.32%	0.16	OK
605	1.4	50% W = 0.7	0.32%	0.19'	OK
		50% E = 0.7	0.32%	0.19'	OK
604	6.7	90% N = 6.0	0.50%	0.38'	OK
		10% E = 0.7	0.32%	0.19	OK
603	10.3	≠ 100% N = 10.3	0.50%	0.48	OK
602	5.3	≠ 100% N = 5.3	0.86%	0.33'	OK
601	4.2	≠ 100% N = 4.2	0.86%	0.31	OK

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

V STREET FLOW 100-YR

$Q_{street} = Q_{100} - Q_{pipe}$

A. Approaching Nodes 611/610 (E)

Contributing Areas	Q_{100}	Q_{pipe}	Q_{street}	$Q_{allowable}$*	Comment
100% 610	15.7				
30% 611	7.6				
	23.3	0.0	23.3	68.3 (street slope = 0.6%)	OK Walk Grade = 0.3

B. Approaching Node 611 (N)

70% 611	17.6				
40% 607	10.3				
	27.9	0.0	27.9	55.8 (street slope = 0.4%)	OK Walk Grade = 0.3'

C. Approaching Nodes 608, 607 (E)

100% 611	25.2				
100% 610	15.7				
100% 609	7.9				
50% 608	4.2				
70% 607	18.1				
	71.1	10.6	60.5	92.5 (street slope = 1.1%)	OK Walk Grade = 0.3'

D. Approaching Nodes 605/604

100% 611	25.2				
100% 610	15.7				
100% 609	7.9				
100% 608	4.2				
100% 607	25.8				
100% 606	11.7				
50% 605	2.1				
10% 604	2.1				
	94.7	26.5	68.2	67.3 (street slope = 0.32%)	OK Walk Grade = 0.4'

* See Pages 13-15

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

E. Approaching Nodes 601/602 (E)

Contributing Areas	Q_{100}	Q_{pipe}	Q_{street}	$Q_{allowable}$*	Comment
611	25.2				
610	15.7				
609	7.9				
608	6.3				
607	25.8				
606	11.7				
605	4.2				
604	20.6				
603	31.5				
10% 602	1.6				
10% 601	1.3				
	151.8	42.1	109.7	108.1 (street slope = 0.32%)	OK Walk Grade = 0.6'

* See Pages 13-15

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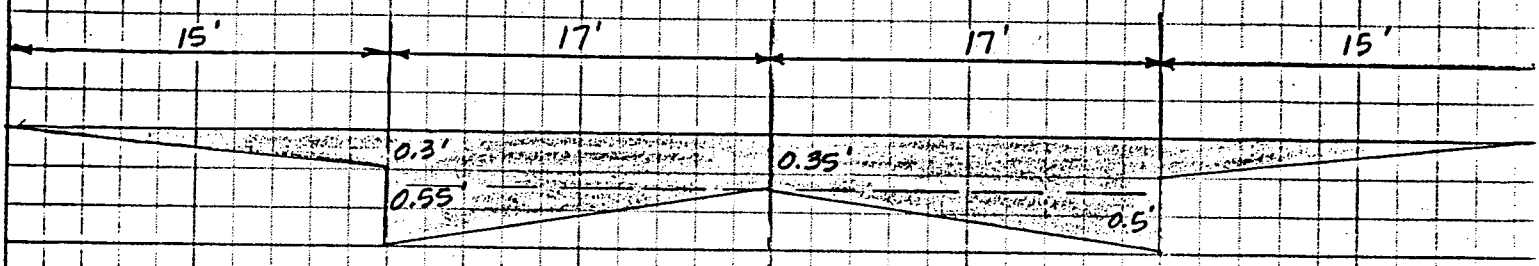
Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600

Check Street Flow 100-yr (Walk Grade +0.3')



Determine Q_{max} in Street R-O-W

Use Mannings Eq'n $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$$n = \frac{2(14.5 \times 0.030) + 2(1.05' \times 0.013) + 2(17 \times 0.016)}{65.1}$$

$n = 1.4413/65.1 = 0.0221$

$A = 2(1/2 \times 15 \times 0.3) + (34 \times 0.35) + 2(1/2 \times 0.5 \times 17)$
$= 24.90$ SF

$P = (2 \times 15) + (2 \times 17) + (2 \times 0.55)$
$= 65.1'$

$R = A/P = 24.9/65.1 = 0.38249$

$R^{2/3} = 0.527$

$Q = \frac{1.486}{0.0221} \times 24.90 \times 0.527 \times S^{1/2}$

$Q = 882.3 \times S^{1/2}$

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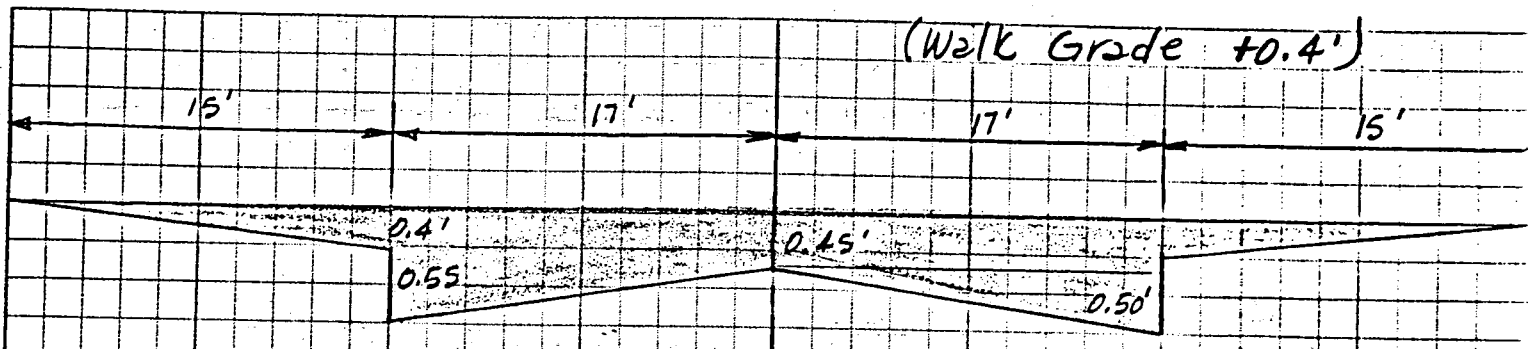
Project Fairfield Estates 2nd Addition

Item Drainage Plan - System 600



n: 0.0221 (see previous sheet)

$A = 2(\frac{1}{2} \times 15' \times 0.4') + (34 \times 0.45') + 2(\frac{1}{2} \times 17 \times 0.5')$

$= 29.8$ SF

$P = 65.1'$

$R = A/P = 29.8/65.1 = 0.4577$

$R^{2/3} = 0.594$

$Q = \frac{1.486}{0.0221} \times 29.8 \times 0.594 \times S^{1/2}$

$Q = 1,190.2\ S^{1/2}$

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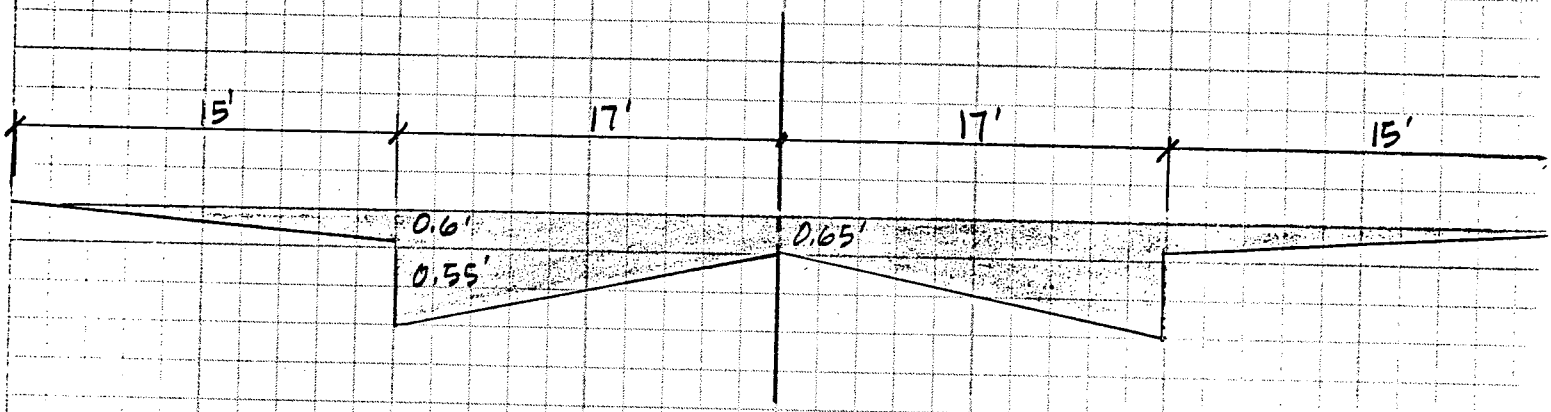
Project Fairfield Estates 2nd Add.

Item Drainage Plan - System 600

CHECK STREET FLOW 100-YEAR (WALK GRADE = 0.6')



$n = 0.0221$ (see previous sheet)

$A = 2(1/2 \times 15 \times 0.6) + (34 \times 0.65) + 2(1/2 \times 17 \times 0.5)$

$= 39.6$ SF

$P = 65.1'$

$R = A/P = 39.6/65.1 = 0.6083$

$R^{2/3} = 0.71792$

$Q_{max} = \frac{1.486}{0.0221} \times 39.6 \times 0.71792 \times S^{1/2}$

$Q_{max} = 1,911.6\ S^{1/2}$

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Project Fairfield Estates 2nd Addition

Item Drainage Plan - Detention Area.

In accordance with the Drainage Plan for Fairfield Estates, a detention area is required for limiting runoff through Wichita Country Club. This area was planned for the northeast corner of Lot 17, Block 10 Fairfield (northeast corner of proposed Lot 2, Block 2 Fairfield Estates 2nd).

Preliminary calculations from the Fairfield Estates Drainage Plan are attached for reference. Upon receipt of the proposed development concept for Lot 2, the final layout for the detention area and resulting floodways or easements will be provided.

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Project Fairfield Estates

Item Detention Area No. 2

The purpose of Detention Area No. 2 is to limit the 100-yr. runoff through the Wichita Country Club to the pre-developed Q.

Per Rock Road Improvement plans, the existing $Q_{100} = 31$ cfs.

$$Q_{100\ \text{country club}} = Q_{100\ \text{node 601}} + Q_{\text{pipe}} + Q_{\text{out Det. Area \#2}}$$

where: $Q_{100\ \text{countryclub}}$ = pre developed conditions
= 31 cfs

$Q_{100\ \text{node 601}}$ = direct flow through country club undetained
= 7.5 cfs

Q_{pipe} = flow in Fairfield Club Apartments private storm sewer. Will approx. = Q_2 (undetained)
= 11 cfs

$Q_{\text{out Det Area \#2}}$ = Max. Discharge of Detention Area #2

$$31 = 7.5 + 11 + Q_{\text{Det. Area \#2}}$$

$$Q_{\text{out Det. Area \#2}} = 12.5 \text{ cfs}$$

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Project Fairfield Estates

Item Detention Area #2

Since the development plan of Lot 17 is unknown, the exact stage-storage-discharge relationships cannot be determined.

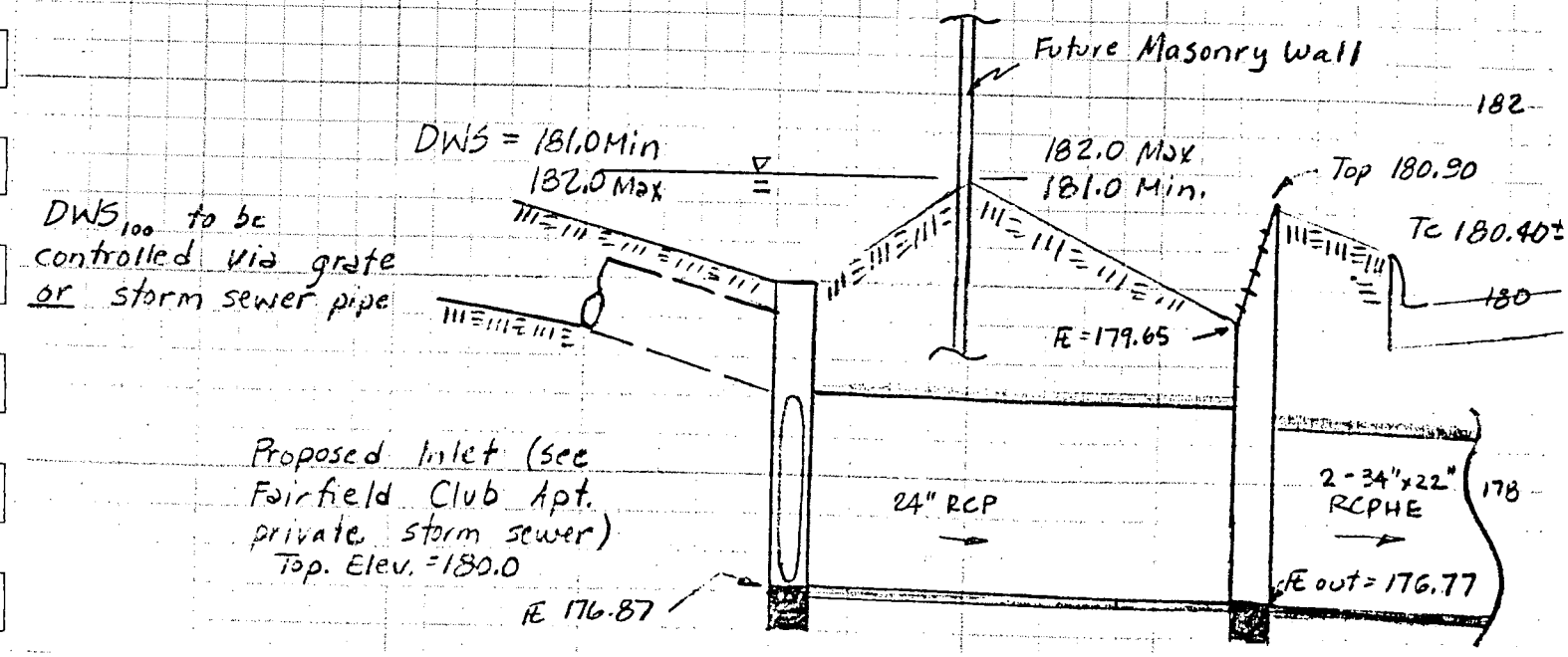
Criteria for this Detention Area design is as follows:

Q_{100} inflow from subareas 802 + 803 (see System 800 calcs) = 37 cfs

Q_{100} maximum outflow out of Det. Area #2 = 12.5 cfs.

Approx. Volume of Storage Required (See Page 3, this section) = 0.60 Ac-Ft.

DWS_{100} = 181.0 Min
182.0 Max.

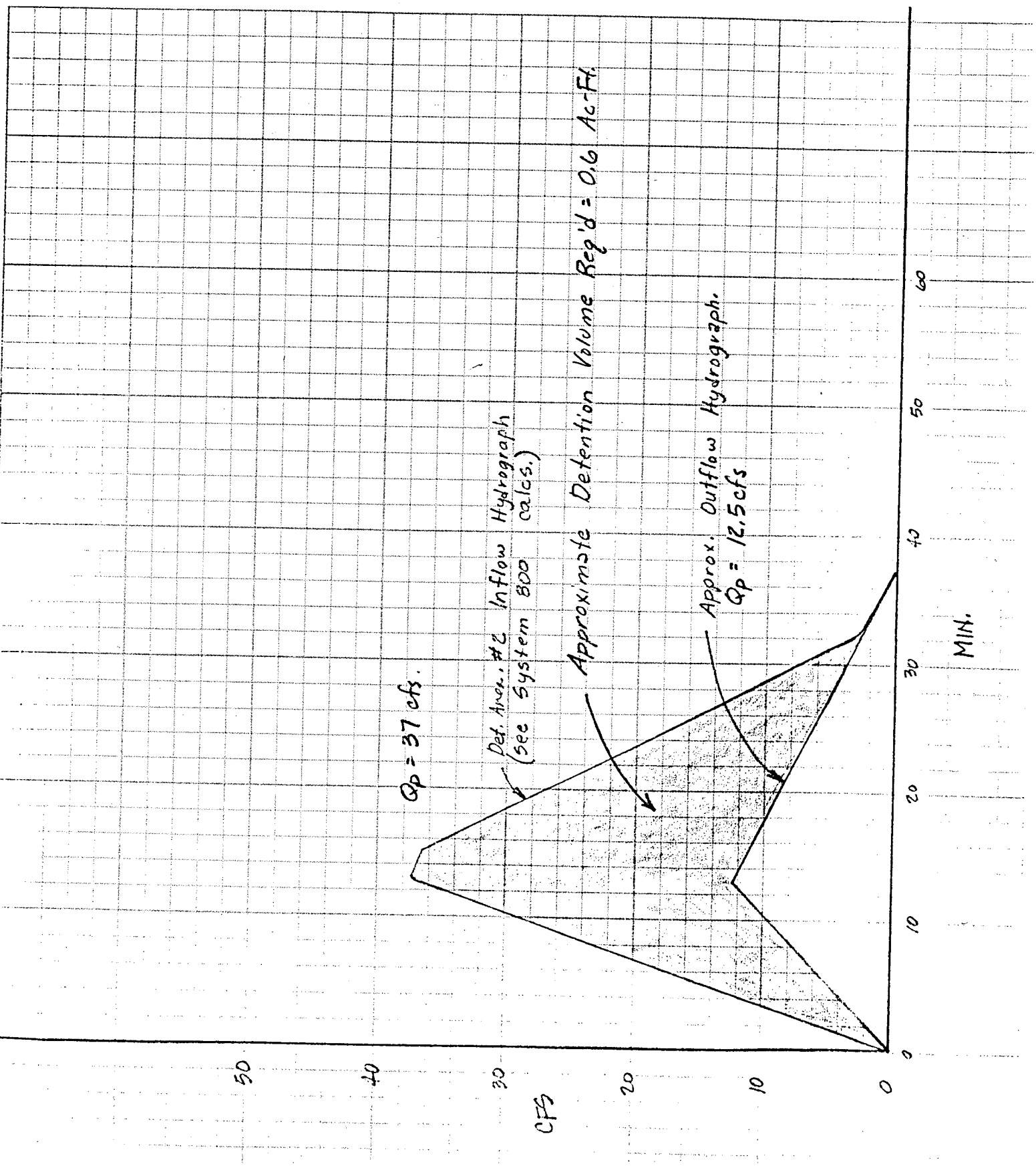


PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
1440 EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

Date 11-7-85 Page 3 of

Project Fairfield Estates

Item Detention Area #2



— SHEET NUMBER 35

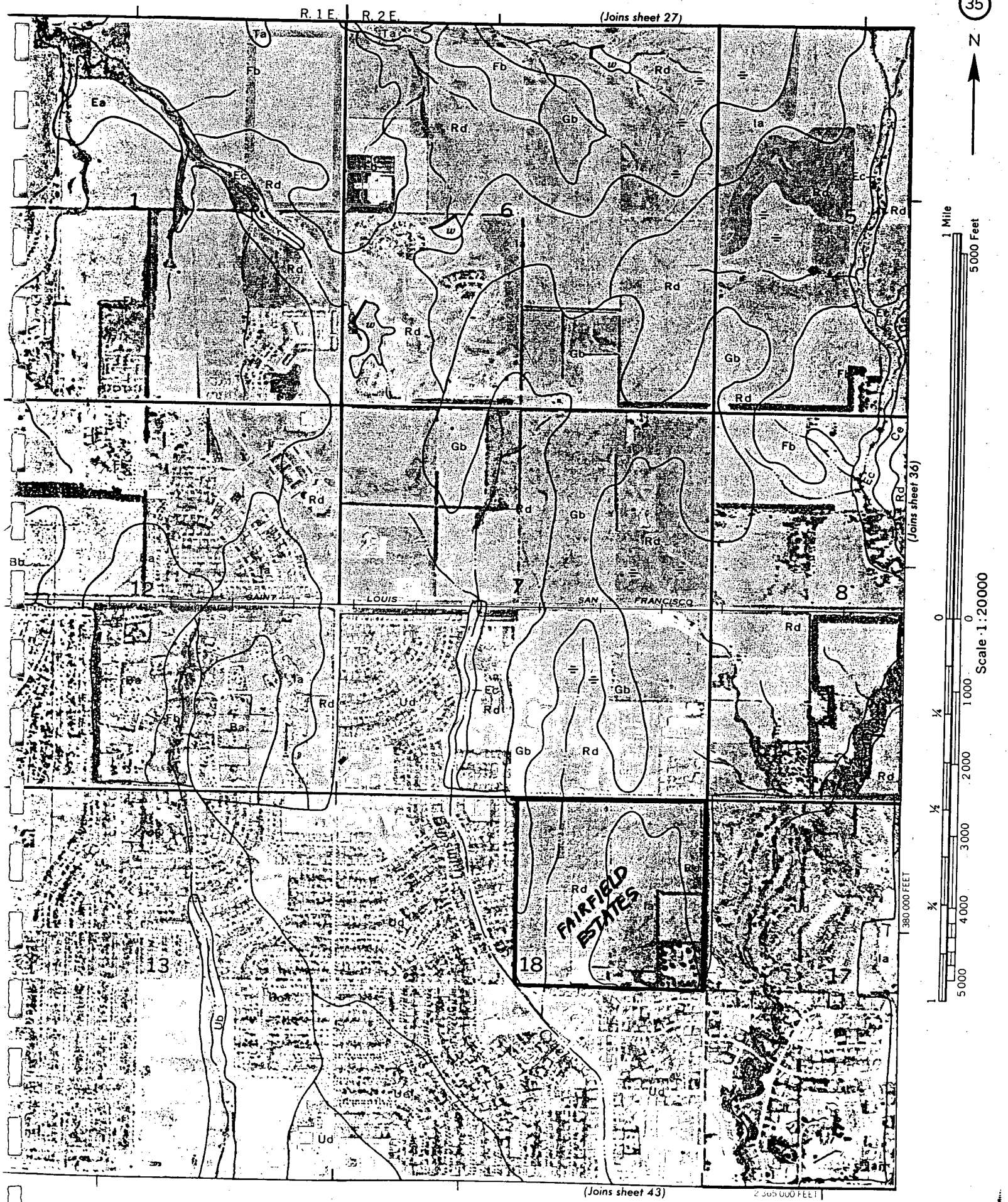


EXHIBIT NO. 1

SOIL LEGEND

SYMBOL	HYDROLOGIC GROUP	NAME
Aa	B	Albion-Shellabarger sandy loams, 1 to 4 percent slopes
Ab	B	Albion and Shellabarger sandy loans, 7 to 15 percent slopes
Ba	C	Blanket silt loam, 0 to 1 percent slopes
Bb	C	Blanket silt loan, 1 to 3 percent slopes
Ca	B	Canadian fine sandy loan
Cb	B	Canadian-Waldeck fine sandy loams
Cc	D	Carwile fine sandy loam
Cd	B	Clark-Ost clay loams, 1 to 4 percent slopes
Ce	C	Clime silty clay, 3 to 6 percent slopes
Ea	B	Elandco silt loam
Eb	B	Elandco silt loam, occasionally flooded
Ec	B	Elandco silt loam, frequently flooded
Fa	B	Farnum loam, 0 to 1 percent slopes
Fb	B	Farnum loam, 1 to 3 percent slopes
Fc	B	Farnum loam, sandy substratum, 0 to 1 percent slopes
Ga	D	Goessel silty clay, 0 to 1 percent slopes
Gb	D	Goessel silty clay, 1 to 2 percent slopes
Ia	D	Irwin silty clay loam, 1 to 3 percent slopes
Ib	D	Irwin silty clay loam, 3 to 6 percent slopes
Ic	D	Irwin silty clay loam, 2 to 6 percent slopes, eroded
La	C	Lesho loam
Lb	A	Lincoln soils
Ma	B	Milan loam, 1 to 3 percent slopes
Mb	B	Milan form, 3 to 6 percent slopes
Mc	B	Milan clay loam, 2 to 6 percent slopes, eroded
Na	B	Naron fine sandy loam
Oc	D	Owens clay loam, 1 to 3 percent slopes
Od	D	Owens-Rock outcrop complex, 3 to 10 percent slopes
Pa		Pits
Pb	D	Plevna fine sandy loam
Pc	A	Pratt loamy fine sand, undulating
Pd	A	Pratt-Tivoli complex, rolling
Ra	D	Renfrow silty clay loam, 1 to 3 percent slopes
Rb	D	Renfrow silty clay loam, 3 to 6 percent slopes
Rc	D	Renfrow-Owens clay loams, 1 to 4 percent slopes
Rd	D	Rosehill silty clay, 1 to 3 percent slopes
Sa	B	Shellabarger sandy loam, 1 to 3 percent slopes
Sb	B	Shellabarger sandy loam, 3 to 6 percent slopes
Sc	B	Shellabarger sandy loam, 3 to 6 percent slopes, eroded
Ta	D	Tabler silty clay loam
Tb	D	Tabler-Drummond complex
Ua	B	Urban land-Canadian complex
Ub	B	Urban land-Elandco complex
Uc	B	Urban land-Farnum complex, 0 to 3 percent slopes
Ud	D	Urban land-Irwin complex, 1 to 3 percent slopes
Ue	D	Urban land-Tabler complex
Va	B	Vanoss silt loam, 0 to 1 percent slopes
Vb	B	Vanoss silt loam, 1 to 3 percent slopes
Vc	B	Vanoss silt loam, 3 to 6 percent slopes
Vd	B	Vanoss silt loam, 3 to 6 percent slopes, eroded
Ve	D	Vernon sandy loam, 1 to 3 percent slopes
Vf	D	Vernon sandy loam, 3 to 6 percent lopes
Wa	C	Waldeck sandy loam
Wb	D	Waurika silt loam

(3 pages)

ATTACHMENT D

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

RECOMMENDED RUNOFF COEFFICIENTS FOR RATIONAL METHOD
AND PERCENT IMPERVIOUS FOR UNIT HYDROGRAPH METHOD

Land Use or Surface Characteristics	Percent Impervious	Frequency 2	5	10	100
1. Business:					
Downtown Areas	95	0.84	0.85	0.87	0.91
Neighborhood Areas	70	0.68	0.69	0.73	0.80
2. Residential:					
Single Family (Soil Group D)					
1/8 Acre	50	0.57	0.61	0.66	0.79
1/4 Acre	38	0.50	0.54	0.62	0.76
1/3 Acre	30	0.46	0.50	0.59	0.73
1/2 Acre	25	0.42	0.48	0.56	0.72
3/4 Acre	22	0.42	0.46	0.55	0.71
1 Acre	20	0.41	0.45	0.54	0.71
Multi-Family (Soil Group D)					
Multi-Unit (detached)	60	0.62	0.66	0.72	0.82
Multi-Unit (attached)	65	0.64	0.68	0.73	0.83
Apartments	75	0.70	0.73	0.79	0.86
Single Family (Soil Group C)					
1/8 Acre	50	0.55	0.58	0.64	0.73
1/4 Acre	38	0.48	0.51	0.57	0.68
1/3 Acre	30	0.43	0.46	0.53	0.65
1/2 Acre	25	0.40	0.43	0.50	0.63
3/4 Acre	22	0.39	0.42	0.49	0.62
1 Acre	20	0.37	0.40	0.48	0.61
Multi-Family (Soil Group C)					
Multi-Unit (detached)	60	0.60	0.63	0.69	0.77
Multi-Unit (attached)	65	0.63	0.66	0.71	0.79
Apartments	75	0.68	0.72	0.77	0.83
Single-Family (Soil Group B)					
1/8 Acre	50	0.52	0.54	0.59	0.67
1/4 Acre	38	0.44	0.46	0.52	0.61
1/3 Acre	30	0.39	0.41	0.47	0.57
1/2 Acre	25	0.36	0.38	0.44	0.54
3/4 Acre	22	0.34	0.36	0.42	0.52
1 Acre	20	0.33	0.35	0.40	0.51
Multi-Family (Soil Group B)					
Multi-Unit (detached)	60	0.58	0.60	0.65	0.72
Multi-Unit (attached)	65	0.61	0.64	0.68	0.75
Apartments	75	0.67	0.70	0.74	0.80

ATTACHMENT E

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

AVERAGE OVERLAND FLOW VELOCITY FOR USE WITH URBANIZED AREAS

Surface Type	VELOCITY IN FEET/SECOND FOR SLOPES IN PERCENT SHOWN																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	20.0
Forest with Heavy Ground Litter or Meadow	0.03	0.04	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.16	0.21	0.28	0.33	0.39	0.46	0.53	0.60	0.72	1.10
Fallow or Minimum Tillage Cultivation	0.06	0.08	0.10	0.12	0.13	0.14	0.16	0.17	0.18	0.19	0.29	0.40	0.51	0.66	0.78	0.91	1.05	1.20	1.44	2.10
Short Grass Pasture or Lawns	0.09	0.13	0.15	0.18	0.20	0.21	0.23	0.25	0.26	0.28	0.45	0.60	0.77	0.96	1.17	1.33	1.50	1.68	1.98	3.20
Almost Bare Ground	0.16	0.22	0.28	0.31	0.35	0.38	0.41	0.44	0.46	0.49	0.70	0.85	1.05	1.26	1.50	1.75	2.03	2.32	2.79	4.40
Grassed Waterway	0.35	0.48	0.58	0.67	0.77	0.84	0.91	0.98	1.05	1.12	1.54	1.82	2.10	2.38	2.78	3.20	3.66	4.14	4.56	7.00
Paved Areas (Sheet Flow) or Shallow Gutter Flow	0.44	0.62	0.77	0.91	1.05	1.12	1.19	1.26	1.33	1.40	2.00	2.55	3.20	3.83	4.41	5.04	5.70	6.00	6.20	9.00

April 15, 1986

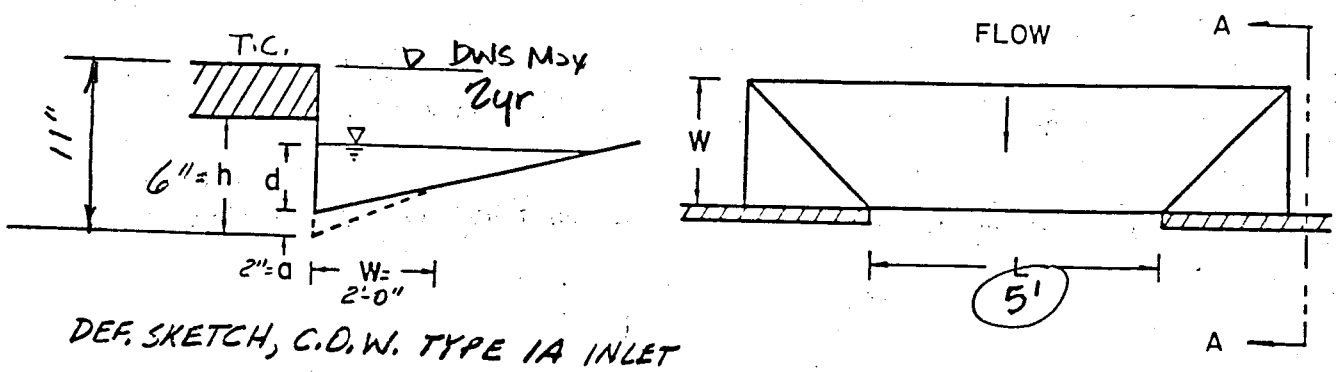
ATTACHMENT A
DRAINAGE CRITERIA MANUAL

CITY OF WICHITA, KANSAS

RAINFALL INTENSITY TABLE FOR SEDGWICK COUNTY, KANSAS

The following tabulation contains rainfall intensity in inches per hour as derived from ESSA Weather Bureau Technical Paper 40 Modified to NWS Hydro-35, 1977 During First Hour

DURATION IN MINUTES	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	4.18	5.57	6.53	7.41	8.52	9.48	10.32
6	3.99	5.32	6.25	7.09	8.16	9.09	9.89
7	3.81	5.09	5.99	6.81	7.84	8.74	9.50
8	3.66	4.89	5.75	6.55	7.55	8.42	9.15
9	3.52	4.70	5.54	6.31	7.28	8.13	8.83
10	3.39	4.52	5.34	6.09	7.04	7.86	8.54
11	3.27	4.36	5.16	5.89	6.81	7.61	8.27
12	3.18	4.21	4.99	5.71	6.60	7.38	8.02
13	3.05	4.08	4.84	5.53	6.41	7.17	7.79
14	2.96	3.95	4.69	5.37	6.23	6.97	7.57
15	2.87	3.83	4.56	5.22	6.06	6.78	7.37
16	2.78	3.72	4.43	5.08	5.90	6.60	7.18
17	2.71	3.61	4.31	4.95	5.75	6.44	7.00
18	2.63	3.51	4.20	4.83	5.61	6.29	6.84
19	2.56	3.42	4.10	4.71	5.47	6.14	6.68
20	2.50	3.33	4.00	4.60	5.35	6.00	6.53
21	2.44	3.25	3.90	4.50	5.23	5.87	6.39
22	2.38	3.17	3.81	4.40	5.12	5.75	6.26
23	2.32	3.10	3.73	4.31	5.01	5.63	6.13
24	2.27	3.03	3.65	4.22	4.91	5.52	6.01
25	2.22	2.96	3.57	4.13	4.81	5.41	5.90
26	2.20	2.90	3.50	4.05	4.72	5.31	5.79
27	2.16	2.84	3.43	3.98	4.63	5.21	5.69
28	2.14	2.78	3.37	3.90	4.55	5.12	5.59
29	2.11	2.72	3.30	3.83	4.47	5.03	5.49
30	2.08	2.67	3.24	3.76	4.39	4.94	5.40
31	2.05	2.62	3.19	3.70	4.32	4.86	5.32
32	2.02	2.57	3.10	3.63	4.25	4.79	5.22
33	1.99	2.52	3.05	3.57	4.18	4.71	5.14
34	1.96	2.48	3.01	3.51	4.11	4.63	5.07
35	1.93	2.44	2.98	3.46	4.05	4.56	5.00
36	1.91	2.39	2.93	3.41	3.99	4.50	4.93
37	1.89	2.35	2.88	3.36	3.93	4.43	4.86
38	1.87	2.32	2.84	3.31	3.87	4.37	4.79
39	1.85	2.28	2.80	3.26	3.82	4.31	4.73
40	1.83	2.24	2.76	3.22	3.76	4.25	4.66
41	1.81	2.21	2.72	3.17	3.71	4.19	4.60
42	1.79	2.18	2.68	3.13	3.66	4.13	4.54
43	1.77	2.14	2.64	3.09	3.61	4.08	4.49
44	1.75	2.11	2.61	3.05	3.57	4.03	4.43
45	1.73	2.08	2.57	3.01	3.52	3.98	4.38



DEF. SKETCH, C.O.W. TYPE 1A INLET

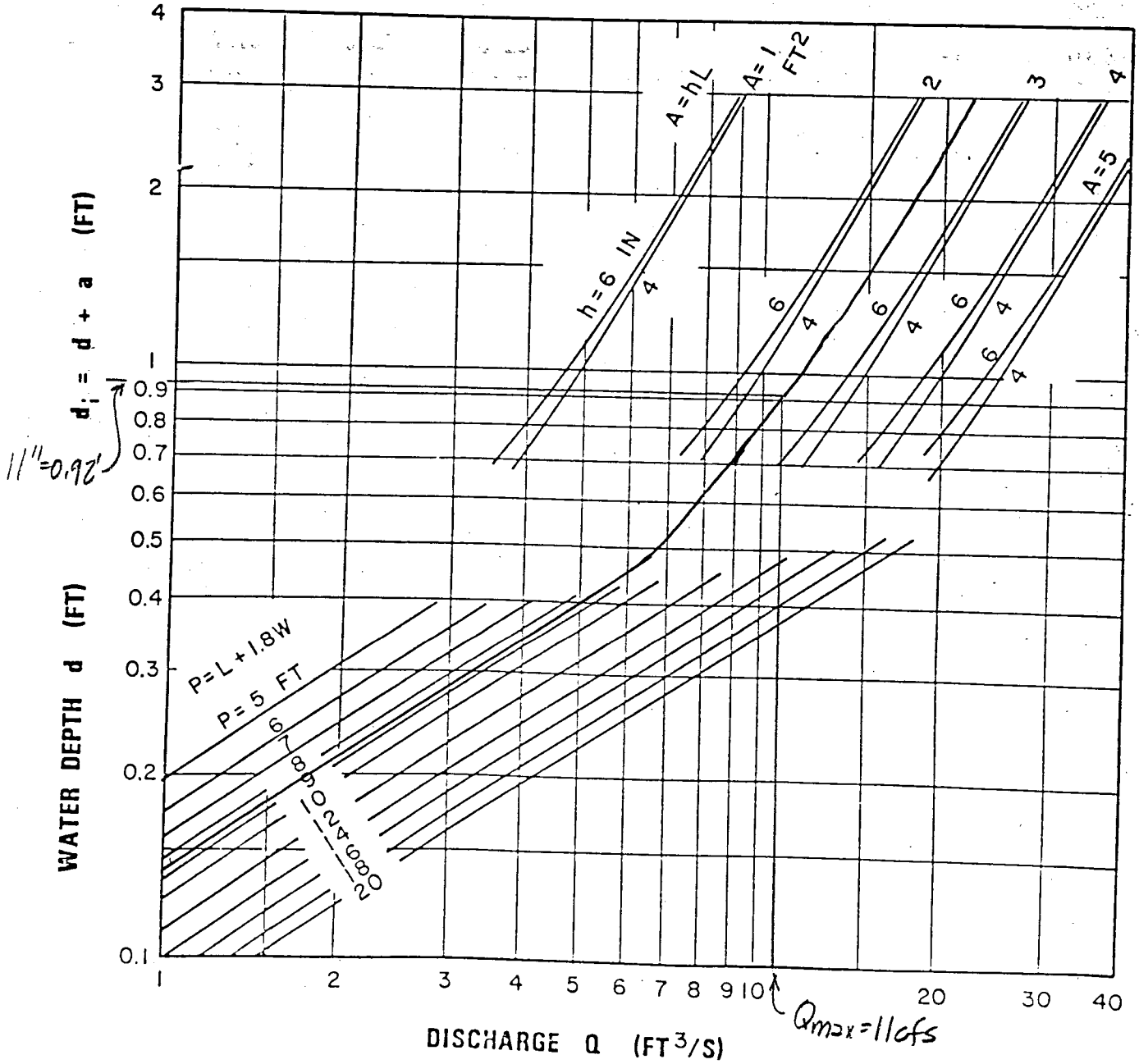


CHART 12. Depressed curb-opening inlet capacity in sump locations.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR., 1984

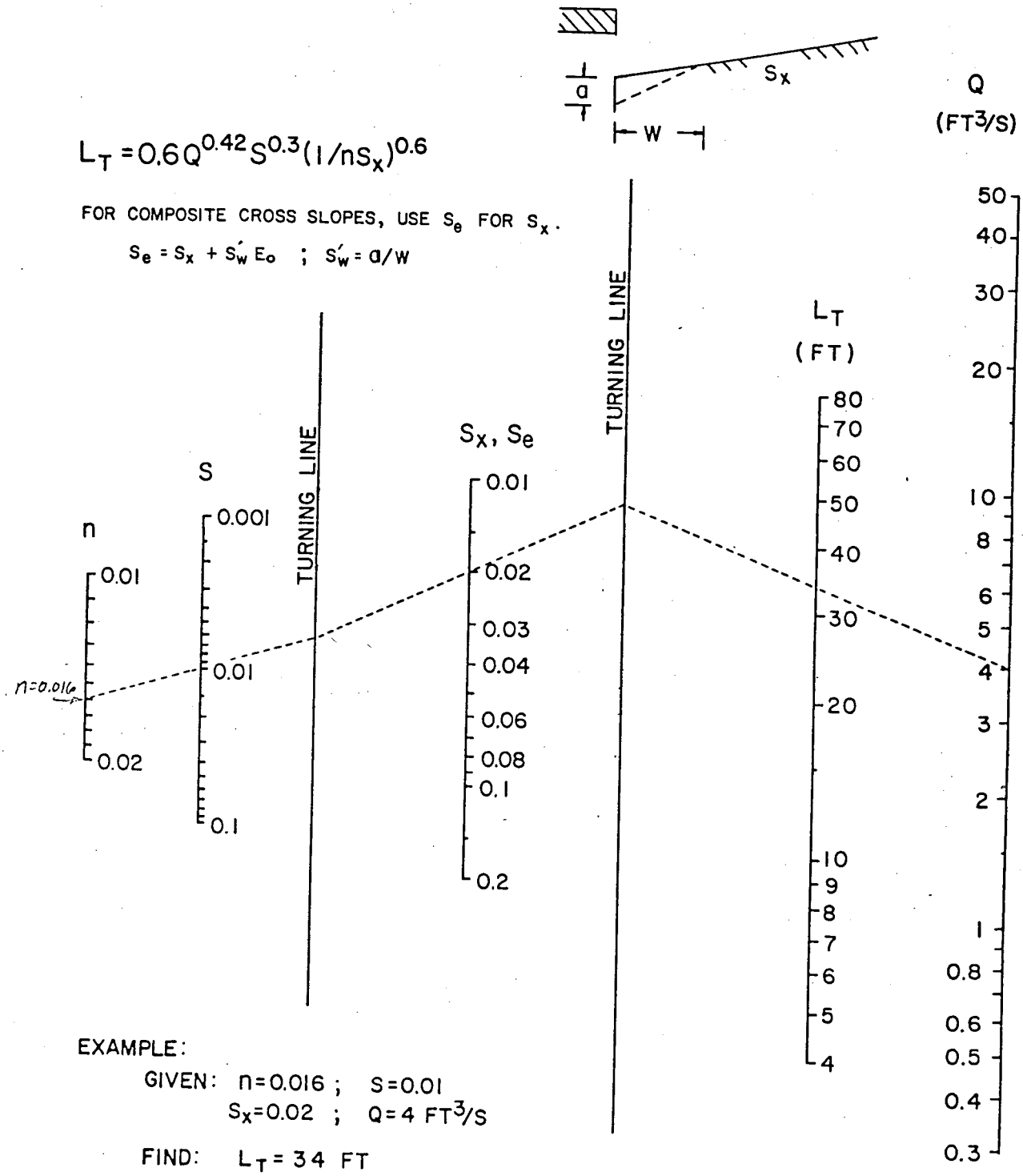


CHART 9. Curb-opening and slotted drain inlet length for total interception.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR. 1969.

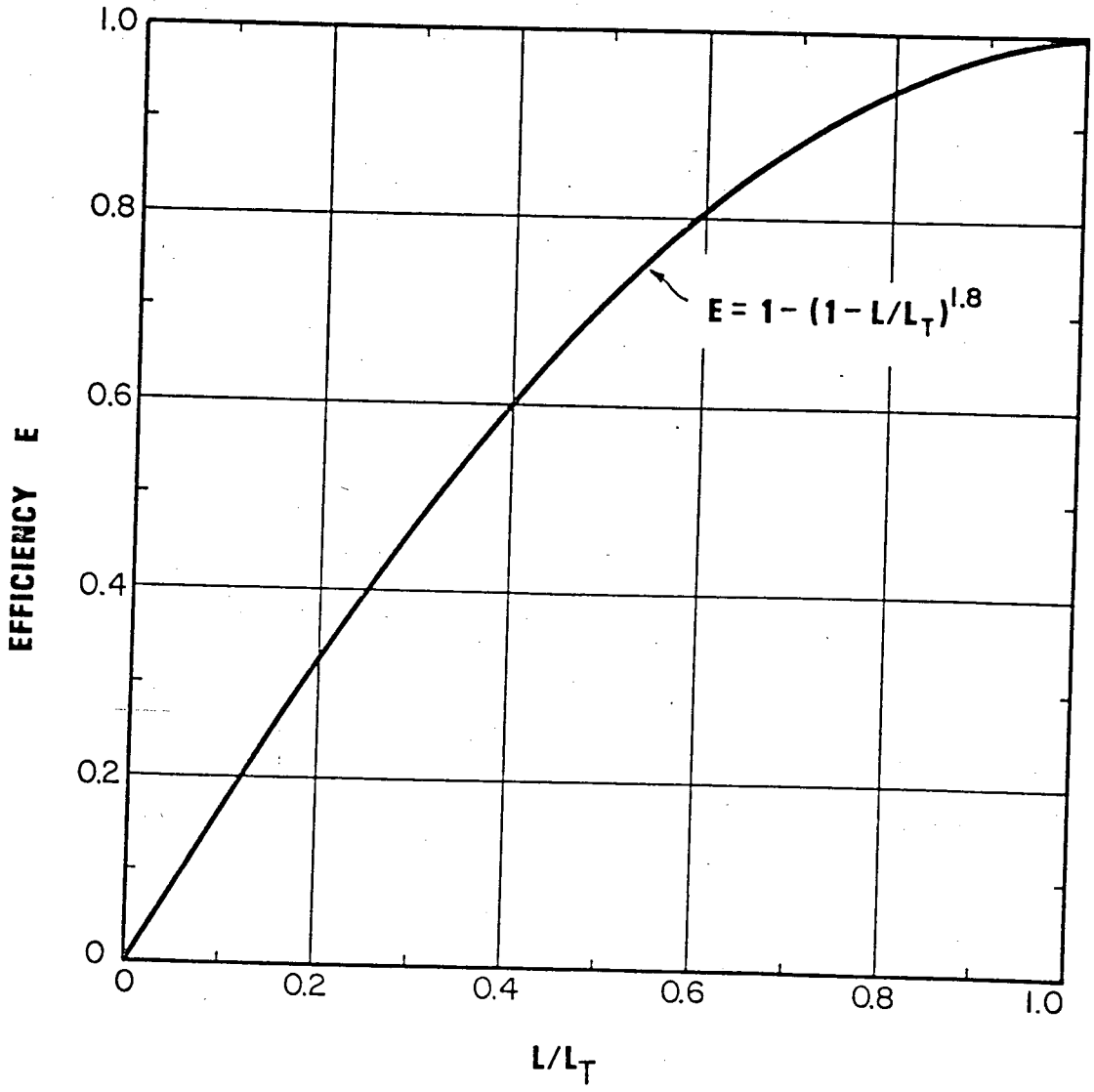


CHART 10. Curb-opening and slotted drain inlet interception efficiency.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, FHWA, MAY 1984

X-slope = 3/8 "/Ft = 0.03125

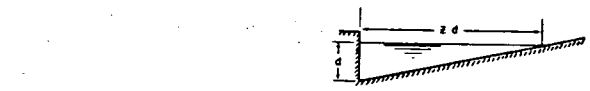
Z = 1/X-slope = 1/0.03125 = 32

n = 0.016

Z/n = 32/0.016 = 2000

Fairfield Estates 2nd

Chart 1



EQUATION: $Q = 0.56\left(\frac{z}{n}\right) s^{\frac{1}{2}} d^{\frac{8}{3}}$

n IS ROUGHNESS COEFFICIENT IN MANNING FORMULA APPROPRIATE TO MATERIAL IN BOTTOM OF CHANNEL

z IS RECIPROCAL OF CROSS SLOPE

REFERENCE: H. R. B. PROCEEDINGS 1946, PAGE 150, EQUATION (14)

EXAMPLE (SEE INSTRUCTION 1)

GIVEN: S = 0.03

z = 24

n = .02

z/n = 1200

Q = 20 CFS

FIND: d = 0.22 BY FOLLOWING DASHED LINES

RATIO z/n: 10000, 9000, 8000, 7000, 6000, 5000, 4000, 3000, 2000, 1000, 900, 800, 700, 600, 500, 400, 300, 200, 100, 90, 80, 70, 60, 50, 40, 30, 20, 10

TURNING LINE

DISCHARGE (Q) IN CFS: 100, 70, 50, 30, 20, 10, 7, 5, 3, 2, 1, .7, .5, .3, .2, .1, .07, .05, .03, .02, .01

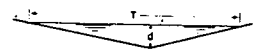
SLOPE OF CHANNEL (S) IN FT./FT.: .10, .08, .07, .06, .05, .04, .03, .02, .01, .008, .007, .006, .005, .004, .003, .002, .001

DEPTH AT CURB OR DEEPEST POINT (d) IN FT.: 2.0, 1.0, .80, .70, .60, .50, .40, .30, .20, .10, .08, .07, .06, .05, .04, .03, .02, .01

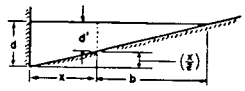
INSTRUCTIONS

1. CONNECT z/n RATIO WITH SLOPE (S) AND CONNECT DISCHARGE (Q) WITH POINT WHERE LINE CROSSES TURNING LINE READ DEPTH AT CURB (d). Q CAN BE FOUND FROM d BY CONNECTING d WITH CROSSING OF TURNING LINE.

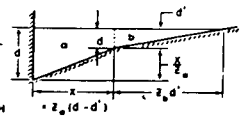
2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH AS EXPLAINED IN INSTRUCTION 1 BUT WITH $z = \frac{T}{d}$.



3. TO DETERMINE DISCHARGE Q_x IN PORTION OF CHANNEL HAVING WIDTH X: DETERMINE DEPTH d FOR TOTAL DISCHARGE IN ENTIRE SECTION AS EXPLAINED IN 1. THEN USE NOMOGRAPH TO DETERMINE Q_b IN SECTION OF WIDTH b FOR DEPTH $d' = d - \left(\frac{x}{z}\right)$. THEN $Q_x = Q - Q_b$.



4. TO DETERMINE DISCHARGE (Q_T) IN COMPOSITE SECTION:— FOLLOW INSTRUCTION 3. TO OBTAIN DISCHARGE (Q_a) IN SECTION a AT ASSUMED DEPTH d BASED ON AN EXTENSION OF SLOPE RATIO z_a TO INTERSECT WATER SURFACE; OBTAIN Q_b FOR SLOPE RATIO z_b AND DEPTH d'; $d' = d - \frac{x}{z_a}$. THEN $Q_T = Q_a + Q_b$.



BUREAU OF PUBLIC ROADS
REV. JAN. 1968

NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS