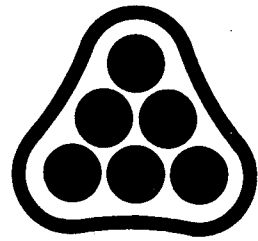


DRAINAGE PLAN  
AND  
SUPPORTING CALCULATIONS

FOR  
HARRISON PARK ADDITION  
TO WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY  
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.  
ENGINEERS

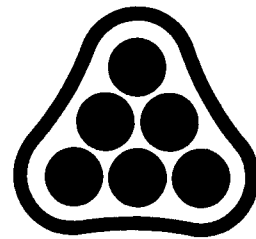
SEPTEMBER 25, 1987



**P**ROFESSIONAL  
**E**NGINEERING  
**C**ONSULTANTS  
PROFESSIONAL ASSOCIATION

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November 15, 1990

Mr. Michael E. Lindebak, P.E.  
City Engineer  
City Hall - 7th Floor  
455 N. Main  
Wichita, KS 67202

Attention: Ms. Vicky Huang, P.E.

Reference: Harrison Park Addition  
Storm Water Sewer 361  
C.O.W. Project No. 468-76-245-81824-000-000-001  
Index Code No. 750158  
PEC File No. 32-90415-1-042

Dear Ms. Huang:

Transmitted herewith are the following documents for the referenced project:

1. Original tracings (19 sheets)
2. City office check plans
3. Easements
4. Storm sewer calculations
4. Final construction cost estimate

Please schedule this project for bidding as soon as possible. The developer respectfully requests a 10-day start on this project.

If you have any questions or need any additional information, please advise.

Very truly yours,

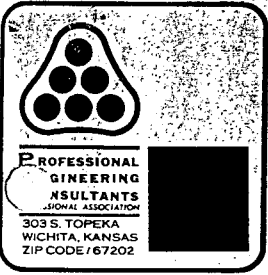
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

Charles S. Brown, P.E.  
Manager  
Land Development Division

Encl. As noted

CSB/cas

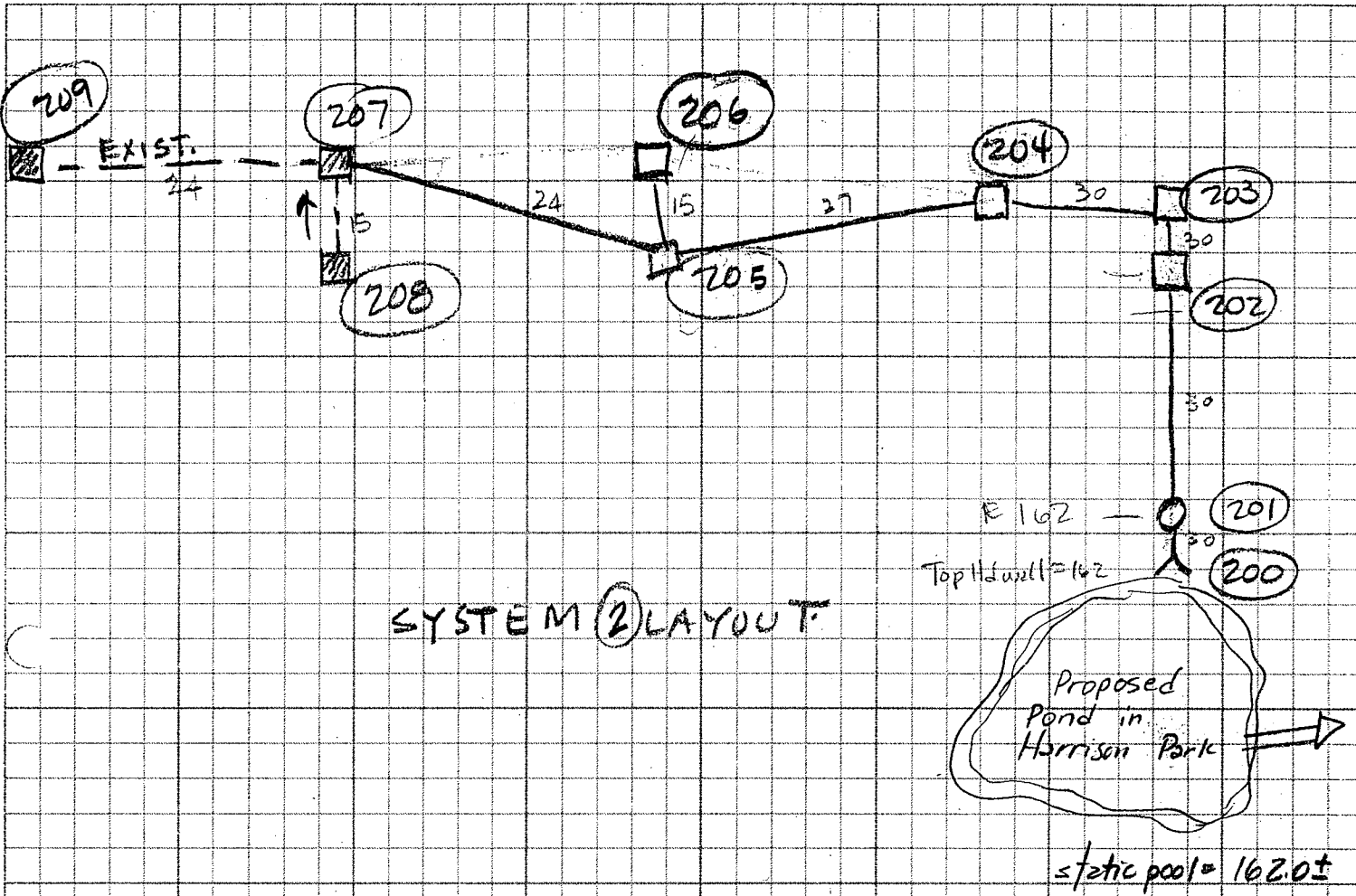
303 S. TOPEKA  
WICHITA, KANSAS 67202  
(316) 262-2691  
FAX (316) 262-3003



Date 10-12-90 Page 1 of       

Project Harrison Park

Item Drainage (SWS # 361)





Date 10/12/90 Page 2 of         
 Project Harrison Park  
 Item Drainage (SWS # 301)

HYDROLOGY

Use Rational Method

$Q = CIA$

Determine "C"

From Harrison Park  
 Drainage Study  $C = 0.57$

$C_{100} = 0.79$

Determine "I"

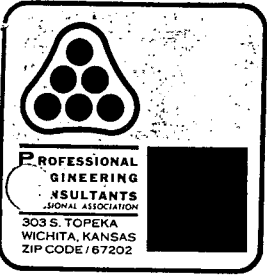
assume  $t_c = 15 \text{ min.}$

$I_2 = 3.83$

$I_{100} = 7.37$

Determine "A"

	Plan. Units	Area SF	Area Ac.
209	27.20	272,000	6.24
208	6.49	64,900	1.49
207	10.72	107,200	2.46
206	10.72	107,200	2.46
205	0.96	9,600	0.22
204	14.01	140,100	3.22
203	6.23	62,300	1.43
202	3.53	35,300	0.81
201	Manhole		18.3
200	End Section		



Date 10-12-90 Page 3 of       

Project Harrison Park

Item Drainage (SWS #361)

Q<sub>2</sub>

<u>Node</u>	<u>C<sub>2</sub></u>	<u>I<sub>2</sub></u>	<u>A</u>	<u>Q<sub>2</sub></u>
209	0.57	3.83	6.24	13.6
208	0.57	3.83	1.49	3.3
207	0.57	3.83	2.46	5.4
206	0.57	3.83	2.46	5.4
205	0.57	3.83	0.22	0.5
204	0.57	3.83	3.22	7.0
203	0.57	3.83	1.43	3.1
202	0.57	3.83	0.81	1.8
201	Manhole		<u>18.33</u>	
200	End Section			



Date 10/12/90 Page 4 of       

Project Harrison Park

Item Drainage (SWS # 361)

Q<sub>100</sub>

<u>Node</u>	<u>C<sub>100</sub></u>	<u>I<sub>100</sub></u>	<u>A</u>	<u>Q<sub>100</sub></u>
209	0.79	7.37	6.24	36.3
208	0.79	7.37	1.49	8.7
207	0.79	7.37	2.46	14.3
206	0.79	7.37	2.46	14.3
205	0.79	7.37	0.22	1.3
204	0.79	7.37	3.22	18.7
203	0.79	7.37	1.43	8.3
202	0.79	7.37	0.81	4.7
201	Manhole			
200	End Section			



Date 10/12/90 Page 5 of         

Project Harrison Park

Item Drainage (SWS # 361)

INLET SIZING / ROUTING (2yr)

<u>Node</u>	<u>Inlet Condition</u>	<u>Inlet Length</u>	<u>Q<sub>approach</sub>*</u>	<u>Q<sub>intercept</sub>‡</u>	<u>Q<sub>bypass</sub></u>	<u>Bypass to</u>
209	Sump	10'	13.6	13.6	0.0	-
208	On grade	5'	3.3	32% = 1.1	2.2	205
207	On grade	5'	5.4	27% = 1.5	3.9	206
206	Sump	5'	5.4 + 3.9 = 9.3	9.3	0.0	-
205	Sump	5'	0.5 + 2.2 = 2.7	2.7	0.0	-
204	Sump	5'	7.0	7.0	0.0	-
203	On grade	5'	3.1	22% = 0.7	2.4	104
202	On grade	5'	1.8	30% = 0.5	1.3	103
201	Manhole					
200	End section					

\* Q<sub>approach</sub> = Q<sub>2</sub> + any bypass from upstream node.

‡ input for "Storm" Program



Date: 10-18-1990  
Time: 15:54:00

Input File: harpark2

harrison park addition  
storm water sewer no. 361  
system no. 2 analysis

Storm Frequency = 2-Year

\*\*\* HYDROLOGY \*\*\*

Tributary Area										Hydrology Summation				Conduit Data				
Node to	C	Area	Slope	Length	TC(θ)	I(θ)	Q(θ)	TC	I	Q	Sum Q	Size	Velocity	Length	TT	TT+TC		
Node		(Ac)	(%)	(Ft)	(Min)	(In/Hr)	(CFS)	(Min)	(In/Hr)	(CFS)	(CFS)		(Ft/Sec)	(Ft)	(Min)	(Min)		
209	207	0.57	6.24	0.00	0.0	15.00	4.06	13.60	15.00	4.06	13.60	13.60	24"	4.33	168.50	0.65	15.65	
208	207	0.57	1.49	0.00	0.0	15.00	4.06	1.10	15.00	4.06	1.10	1.10	15"	0.90	41.70	0.78	15.78	
207	205	0.57	2.46	0.00	0.0	15.00	4.06	1.50	15.65	3.99	1.48	16.17	24"	5.15	127.40	0.41	16.06	
206	205	0.57	2.46	0.00	0.0	15.00	4.06	9.30	15.00	4.06	9.30	9.30	15"	7.58	42.50	0.09	15.09	
205	204	0.57	0.22	0.00	0.0	15.00	4.06	2.70	16.06	3.95	2.63	27.87	27"	7.01	275.60	0.66	16.72	
204	203	0.57	3.22	0.00	0.0	15.00	4.06	7.00	16.72	3.89	6.71	34.58	30"	7.05	191.50	0.45	17.17	
203	202	0.57	1.43	0.00	0.0	15.00	4.06	0.70	17.17	3.85	0.66	35.25	30"	7.18	35.80	0.08	17.25	
202	201	0.57	0.81	0.00	0.0	15.00	4.06	0.50	17.25	3.84	0.47	35.72	30"	7.28	250.00	0.57	17.83	
201	200	0.00	0.00	0.00	0.0	0.00	0.00	0.00	17.83	3.79	0.00	35.72	30"	7.28	30.00	0.07	17.89	

Date: 10-18-1998

Time: 15:54:08

Input File: harpark2

harrison park addition  
storm water sewer no. 361  
system no. 2 analysis

Storm Frequency = 2-Year

\*\*\* HYDRAULICS \*\*\*

```

*****
Node   Hyd-Slope  Friction  Bend  Transition  Manhole  Deflection  Junction  Total  Hyd-61  Desired  Diff.
      (Ft/Ft)   (Ft)     (Ft)   (Ft)        (Ft)     (Ft)       (Ft)     (Ft)   Elevation Elevation (Ft)
*****
209    0.00361    0.6090   0.0000  0.0000     0.0000   0.0000    0.0000    0.6090  173.7187  176.5000  2.78
208    0.00029    0.0121   0.0000  0.0000     0.0000   0.0000    0.0000    0.0121  173.1218  174.8000  1.68
207    0.00511    0.6506   0.0000  0.0120     0.0000   0.0068    0.2639    0.9333  173.1097  174.8500  1.74
206    0.02073    0.8809   0.0000  0.0000     0.0000   0.0000    0.0000    0.8809  173.0573  174.3400  1.28
205    0.00810    2.2323   0.0000  0.0352     0.0000   0.0183    0.6179    2.9037  172.1764  174.2300  2.05
204    0.00711    1.3613   0.0000  0.0000     0.0000   0.0000    0.3760    1.7381  169.2727  171.6600  2.39
203    0.00738    0.2644   0.0000  0.0030     0.0000   0.3854    0.0962    0.7489  167.5346  168.5000  0.97
202    0.00758    1.8961   0.0000  0.0022     0.0000   0.0000    0.0809    1.9791  166.7857  168.5000  1.71
201    0.00758    0.2275   0.0000  0.0000     0.0411   0.0000    0.0380    0.3066  164.8066  167.0000  2.19
200    0.00000    0.0000   0.0000  0.0000     0.0000   0.0000    0.0000    0.0000  164.5000  164.5000  0.00
*****

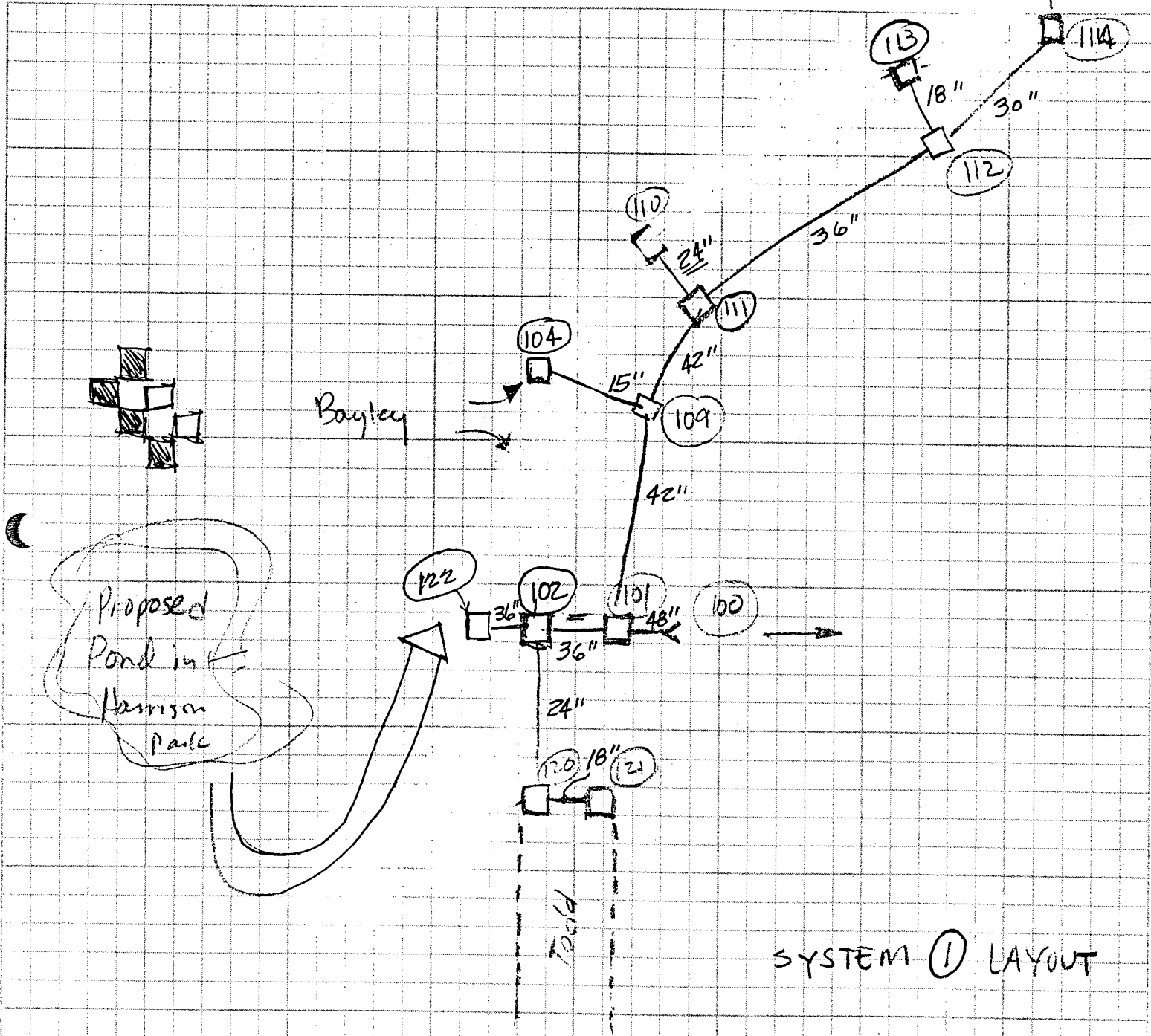
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Date 10/10/90 Page 1 of       

Project Harrison Park

Item Drainage (SWS # 361)



SYSTEM ① LAYOUT



Date 10/19/90 Page 2 of       

Project Harrison Park

Item Drainage (SWS #361)

HYDROLOGY

Use Rational Method

$Q = CIA$

Determine "c"

From Harrison Park Drainage Study

$c_2 = 0.57$

$c_{100} = 0.79$

(for residential areas)

Determine "I"

assume  $t_c = 15$  min.

$\therefore I_2 = 3.83$

$I_{100} = 7.37$

Determine "A"

<u>Node</u>	<u>Plan. Units</u>	<u>Area SF</u>	<u>Area Ac.</u>	
115	0.46	1,840,000	42.2	✓
114	2.85	28,500	0.65	✓
113	15.17	151,700	3.48	✓
112	4.97	49,700	1.14	
111	21.78	217,800	5.00	
110	26.79	267,900	6.15	
104	15.25	152,500	3.50	
109	5.14	51,400	1.18	
102	4.01	40,100	0.92	
101	2.22	27,200	0.51	
122	212.83	2,128,300	48.86	
120	2.35	23,500	0.54	
121	9.28	92,800	2.13	



Date 10/19/90 Page 3 of       

Project Harrison Park

Item Drainage (SWS 361)

Q<sub>2</sub>

<u>Node</u>	<u>C<sub>2</sub></u>	<u>I<sub>2</sub></u>	<u>A</u>	<u>Q<sub>2</sub></u>
115	0.26 *	2.35 *	42.20	25.8
114	0.57	3.83	0.65	1.4
113	0.57	3.83	3.48	7.6
112	0.57	3.83	1.14	2.5
111	0.57	3.83	5.00	10.9
110	0.57	3.83	6.15	13.4
104	0.57	3.83	3.50	7.6
109	0.57	3.83	1.10	2.6
102	0.57	3.83	0.92	2.0
101	0.57	3.83	0.51	1.1
122	0.30 *	2.08 *	48.86	30.5
121	0.57	3.83	0.54	1.2
120	0.57	3.83	2.13	4.7
100	Headwall		116.26	

\* C & I values from Harrison Park Drainage Plan



Date 10/19/90 Page 4 of         
 Project Harrison Park  
 Item Drainage (SWS 361)

Q<sub>100</sub>

<u>Node</u>	<u>C<sub>100</sub></u>	<u>T<sub>100</sub></u>	<u>A</u>	<u>Q<sub>100</sub></u>
115	0.61 *	4.86 *	42.20	125.1
114	0.79	7.37	0.65	3.8
113	0.79	7.37	3.48	20.3
112	0.79	7.37	1.14	6.6
111	0.79	7.37	5.00	29.1
110	0.79	7.37	6.15	35.8
104	0.79	7.37	3.50	20.4
109	0.79	7.37	1.18	6.9
102	0.79	7.37	0.92	5.4
101	0.79	7.37	0.51	3.0
122	0.65 *	4.38 *	48.86	139.1
121	0.79	7.37	0.54	3.1
120	0.79	7.37	2.13	12.4
100	Headwall			<u>411.0</u>



Date 10/19/90 Page 5 of       

Project Harrison Park

Item SWS 361

Node	FLOOD Inlet Condition	ROUTING $Q_{approach}$	INLET $Q_{intercept}^\#$	SIZING $Q_{bypass}$	(2yr) Inlet Length	Bypass to
115	Sump	25.8	25.8	0.0	C.B.	-
114	Sump	1.4	1.4	0.0	5'	-
113	Sump	7.6	7.6	0.0	5'	-
112	On grade	2.5	45% = 1.1	1.4	5'	111
111	Sump	10.9 + 1.4 = 12.3 (from 112)	12.3	0.0	10'	-
110	Sump	13.4	13.4	0.0	10'	-
104	Sump	7.6	7.6	0.0	5'	-
109	On grade	2.6	45% = 1.2	1.4	5'	101
102	Sump	2.0	2.0	0.0	5'	-
101	Sump	1.1 + 1.4 = 2.5 (from 109)	2.5	0.0	5'	-
122	Sump	30.5 *	30.5	0.0	C.B.	-
121	Sump	1.2	1.2	0.0	5'	-
120	Sump	4.7	4.7	0.0	5'	-
100	Headwell					

$\#$   $Q_{intercept}$  = input in "Storm" program.

\*  $Q_{approach}$  =  $Q_2$  (assumes no reduction in peak  $Q$  due to pond)

100 j, 155.3000 100 3 14 13

110 t, harrison park addition

120 t, storm water sewer no. 361

130 t, system no. 1 analysis

140 i, 115	0.26	42.20	0.00	0.00	25.80	37.00	162.20
150 i, 114	0.57	0.65	0.00	0.00	1.40	15.00	161.83
160 i, 113	0.57	3.48	0.00	0.00	7.60	15.00	161.11
170 i, 112	0.57	1.14	0.00	0.00	1.10	15.00	160.98
180 i, 111	0.57	5.00	0.00	0.00	12.30	15.00	159.48
190 i, 110	0.57	6.15	0.00	0.00	13.40	15.00	159.40
200 i, 104	0.57	3.50	0.00	0.00	7.60	15.00	159.60
210 i, 109	0.57	1.18	0.00	0.00	1.20	15.00	159.60
220 i, 102	0.57	0.92	0.00	0.00	2.00	15.00	158.42
230 i, 101	0.57	0.51	0.00	0.00	2.50	15.00	158.42
240 i, 122	0.30	48.86	0.00	0.00	50.40	45.00	157.00
250 i, 121	0.57	0.54	0.00	0.00	1.20	15.00	158.35
260 i, 120	0.57	2.13	0.00	0.00	4.70	15.00	158.35

270 m, 100 155.30

280 p, 115 114 116.40 27 0.013 44.00 0.00

290 p, 114 112 218.00 30 0.013 10.00 0.00

300 p, 113 112 63.00 18 0.013 40.00 0.00

310 p, 112 111 383.00 36 0.013 6.00 0.00

320 p, 110 111 44.40 24 0.013 84.00 0.00

330 p, 111 109 134.00 42 0.013 23.00 0.00

340 p, 104 109 45.00 15 0.013 73.00 0.00

350 p, 109 101 201.00 42 0.013 90.00 0.00

360 p, 122 102 20.00 36 0.013 0.00 0.00

370 p, 121 120 47.60 18 0.013 90.00 0.00

380 p, 120 102 137.50 24 0.013 90.00 0.00

390 p, 102 101 44.80 36 0.013 0.00 0.00

400 p, 101 100 18.80 48 0.013 0.00 0.00

410 e

Input File: harpark1

harrison park addition  
storm water sewer no. 361  
system no. 1 analysis

Storm Frequency = 2-Year

\*\*\* HYDROLOGY \*\*\*

Tributary Area				Hydrology Summation								Conduit Data					
Node to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(θ) (Min)	I(θ) (In/Hr)	Q(θ) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)	
115	114	0.26	42.20	0.00	0.0	37.00	2.46	25.00	37.00	2.46	25.80	25.80	27"	6.49	116.40	0.30	37.30
114	112	0.57	0.65	0.00	0.0	15.00	4.06	1.40	37.30	2.44	0.84	26.64	30"	5.43	218.00	0.67	37.97
113	112	0.57	3.48	0.00	0.0	15.00	4.06	7.60	15.00	4.06	7.60	7.60	18"	4.30	63.00	0.24	15.24
112	111	0.57	1.14	0.00	0.0	15.00	4.06	1.10	37.97	2.41	0.65	31.83	36"	4.50	383.00	1.42	39.39
110	111	0.57	6.15	0.00	0.0	15.00	4.06	13.40	15.00	4.06	13.40	13.40	24"	4.27	44.40	0.17	15.17
111	109	0.57	5.00	0.00	0.0	15.00	4.06	12.30	39.39	2.34	7.09	46.68	42"	4.85	134.00	0.46	39.85
104	109	0.57	3.50	0.00	0.0	15.00	4.06	7.60	15.00	4.06	7.60	7.60	15"	6.19	45.00	0.12	15.12
109	101	0.57	1.18	0.00	0.0	15.00	4.06	1.20	39.85	2.32	0.69	51.73	42"	5.38	201.00	0.62	40.47
122	102	0.30	48.86	0.00	0.0	45.00	2.11	50.40	45.00	2.11	50.40	50.40	36"	7.13	20.00	0.05	45.05
121	120	0.57	0.54	0.00	0.0	15.00	4.06	1.20	15.00	4.06	1.20	1.20	18"	0.68	47.60	1.17	16.17
120	102	0.57	2.13	0.00	0.0	15.00	4.06	4.70	15.00	4.06	4.70	5.81	24"	1.85	137.50	1.24	16.24
102	101	0.57	0.92	0.00	0.0	15.00	4.06	2.00	45.05	2.11	1.04	54.56	36"	7.72	44.80	0.10	45.14
101	100	0.57	0.51	0.00	0.0	15.00	4.06	2.50	45.14	2.11	1.30	103.41	40"	8.23	18.80	0.04	45.18

Date: 10-23-1990  
Time: 17:18:49

Input File: harpark1

harrison park addition  
storm water sewer no. 361  
system no. 1 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-GI Elevation	Desired Elevation	Diff. (Ft)
115	0.00694	0.8078	0.0000	0.0000	0.0000	0.0000	0.0000	0.8078	160.6804	162.2000	1.52
114	0.00422	0.9197	0.0000	0.0393	0.0000	0.1385	-0.1318	0.9657	159.8726	161.8300	1.96
113	0.00523	0.3298	0.0000	0.0000	0.0000	0.0000	0.0000	0.3298	159.2367	161.1100	1.87
112	0.00228	0.8723	0.0000	0.0285	0.0000	0.0164	-0.1204	0.7968	158.9069	160.9800	2.07
111	0.00215	0.2885	0.0000	0.0051	0.0000	0.0061	0.2990	0.5987	158.1101	159.4800	1.37
110	0.00351	0.1558	0.0000	0.0000	0.0000	0.0000	0.0000	0.1558	158.2659	159.4800	1.21
104	0.01384	0.6229	0.0000	0.0000	0.0000	0.0000	0.0000	0.6229	158.1343	159.6000	1.47
109	0.00264	0.5313	0.0000	0.0083	0.0000	0.0356	0.1343	0.7095	157.5114	159.6000	2.09
102	0.00669	0.2997	0.0000	0.0136	0.0000	0.0000	0.3028	0.6161	157.4180	158.4200	1.00
101	0.00518	0.0974	0.0000	0.0126	0.0000	0.0000	1.3918	1.5019	156.8019	158.4200	1.62
122	0.00571	0.1142	0.0000	0.0000	0.0000	0.0000	0.0000	0.1142	157.5322	157.0000	-0.53
121	0.00013	0.0062	0.0000	0.0000	0.0000	0.0000	0.0000	0.0062	157.6512	158.3500	0.70
120	0.00066	0.0908	0.0000	0.0046	0.0000	0.0036	0.1280	0.2270	157.6450	158.3500	0.71
100	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	155.3000	155.3000	0.00



Date Sept. 22, 1987 Page 1 of 22

Project Harrison Park Addition

Item Drainage Plan system 100

I HYDROLOGY

Use Rational Method  $Q = CIA$

A. Determine "C"

<u>Node</u>	<u>Soil Type</u>	<u>Land Use</u>	<u>C<sub>2</sub></u>	<u>C<sub>100</sub></u>
115	D	cultivated slopes 1-4%	0.26	0.61
114	D	Res. 1/8 Ac	0.57	0.79
113	D	"	0.57	0.79
112	D	"	0.57	0.79
111	D	"	0.57	0.79
110	D	"	0.57	0.79
109	D	"	0.57	0.79
108	D	"	0.57	0.79
107	D	"	0.57	0.79
106	D	"	0.57	0.79
105	D	"	0.57	0.79
104	D	"	0.57	0.79
103	D	"	0.57	0.79
102	D	park slope 1-4%	0.30	0.65
101	D	Res. 1/4 Ac.	0.50	0.76
100	(End section)			



Date 9.22.87 Page 2 of 22

Project Harrison Park Addition

Item Drainage Plan System 100

B. Determine "I"

<u>Node</u>	<u><math>f_c</math></u>	<u><math>I_2</math></u>	<u><math>I_{100}</math></u>
115	$\frac{300' @ 0.29 \text{ fps} = 17}{1200' @ 1.0 \text{ fps} = 20}$ <u>37</u>	2.35	4.86
114	15	3.83	7.37
113	15	3.83	7.37
112	15	3.83	7.37
111	15	3.83	7.37
110	15	3.83	7.37
109	15	3.83	7.37
108	15	3.83	7.37
107	15	3.83	7.37
106	15	3.83	7.37
105	15	3.83	7.37
104	15	3.83	7.37
103	15	3.83	7.37
102	$\frac{300' @ 0.45 \text{ fps} = 11}{1800' @ 1 \text{ fps} = 30}$ $\frac{800' @ 3 \text{ fps} = 4}{45}$	2.08	4.38
101	15	3.83	7.37
100	(End Section)		



Date 9.22.87 Page 3 of 22

Project Harrison Park Addition

Item Drainage Plan System 100

C. Determine "A"

<u>Node</u>	<u>Plan. Units</u>	<u>Area SF</u>	<u>Area Ac.</u>
115	0.46	1,840,000	42.2
114	2.85	28,500	0.65
113	15.17	151,700	3.48
112	23.20	232,000	5.32
111	26.75	267,500	6.14
110	2.05	20,500	0.47
109	27.20	272,000	6.24
108	7.47	74,700	1.71
107	21.42	214,200	4.92
106	14.01	140,100	3.22
105	12.47	124,700	2.86
104	10.87	108,700	2.50
103	7.04	70,400	1.62
102	0.54	2,160,000	49.6
101	17.03	170,300	3.91
100	(End Section)		



Date Sept. 22, 1987 Page 4 of 22

Project Harrison Park Addition

Item Drainage Plan System 100

D. Determine "Q<sub>2</sub>"

<u>Node</u>	<u>C<sub>2</sub></u>	<u>I<sub>2</sub></u>	<u>A</u>	<u>Q<sub>2</sub></u>
115	0.26	2.35	42.2	25.8
114	0.57	3.83	0.65	1.4
113	0.57	3.83	3.48	7.6
112	0.57	3.83	5.32	11.6
111	0.57	3.83	6.14	13.4
110	0.57	3.83	0.47	1.0
109	0.57	3.83	6.24	13.6
108	0.57	3.83	1.71	3.7
107	0.57	3.83	4.92	10.7
106	0.57	3.83	3.22	7.0
105	0.57	3.83	2.86	6.2
104	0.57	3.83	2.50	5.5
103	0.57	3.83	1.62	3.5
102	0.30	2.08	49.6	31.0
101	0.50	3.83	3.91	7.5
100	(End Section)			



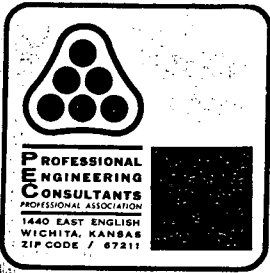
Date 9.22.87 Page 5 of 22

Project Harrison Park Addition

Item Drainage Plan System 100

E Determine "Q<sub>100</sub>"

<u>Node</u>	<u>C<sub>100</sub></u>	<u>I<sub>100</sub></u>	<u>A</u>	<u>Q<sub>100</sub></u>
115	0.61	4.86	42.2	125.1
114	0.79	7.37	0.65	3.8
113	0.79	7.37	3.48	20.3
112	0.79	7.37	5.32	31.0
111	0.79	7.37	6.14	35.7
110	0.79	7.37	0.47	2.7
109	0.79	7.37	6.24	36.3
108	0.79	7.37	1.71	10.0
107	0.79	7.37	4.92	28.6
106	0.79	7.37	3.22	18.7
105	0.79	7.37	2.86	16.7
104	0.79	7.37	2.90	14.6
103	0.79	7.37	1.62	9.4
102	0.65	4.38	49.6	141.2
101	0.76	7.37	3.91	21.9
100	(End Section)			



Date 9.22.87 Page 6 of 22

Project Harrison Park Addition

Item Drainage Plan System 100

II FLOOD ROUTING / INLET SIZING (2-YR)

<u>Node</u>	<u>Inlet Condition</u>	<u>Inlet Length</u>	<u>Q<sub>approach</sub>*</u>	<u>Q<sub>intercept</sub>†</u>	<u>Q<sub>bypass</sub></u>	<u>Bypass to Node</u>
115	Sump	Catch Basin	25.8	25.8	0.0	-
114	Sump	5'	1.4	1.4	0.0	-
113	Sump	5'	7.6	7.6	0.0	-
112	Sump	10'	11.6	11.6	0.0	-
111	Sump	10'	13.4	13.4	0.0	-
110	On Grade	5'	1.0	60% = 0.6	0.4	≠ 104
109	Sump	10'	13.6	13.6	0.0	-
108	Sump	5'	3.7	3.7	0.0	-
107	Sump	5'	10.7	10.7	0.0	-
106	Sump	5'	7.0	7.0	0.0	-
105	Sump	5'	6.2	6.2	0.0	-
104	Sump	5'	5.5 + 0.4 = 5.9	5.9	0.0	-
103	On Grade	5'	3.5	25% = 0.9	2.6	102
102	Sump	10'	31.0 + 2.6 = 33.6	22.0	11.6	101
101	Sump	10'	7.5 + 11.6 = 19.1	19.1	0.0	-
100	(End Section)					

\* Q<sub>approach</sub> = Q<sub>z</sub> + any Q<sub>bypass</sub> from upstream nodes

† Q<sub>intercept</sub> = Q input in "storm" program.



Date 9.25.87 Page 7 of 22

Project Harrison Park Addition

Item Drainage Plan System 100

III STREET FLOW - 2 YR						
Node	Q <sub>approach</sub>	Distribution	street slope	Flow Depth	Allow. Depth	Comment
115	25.1	(Catch Basin)	N/A	—	—	—
114	1.4	40% (N) = 0.6 60% (E) = 0.8	0.32 0.4	0.18 0.18	0.55 0.55	OK OK
113	7.6	20% (W) = 6.8 10% (E) = 0.8	1.1 0.4	0.34 0.18	0.55 0.55	OK OK
112	11.6	85% (N) = 11.0 5% (W) = 0.6	0.4 0.8	0.49 0.15	0.55 0.30	OK OK
111	13.4	80% (N) = 10.7 20% (E) = 2.7	0.4 0.4	0.48 0.30	0.55 0.30	OK OK
110	1.0	100% (N) = 1.0	0.4	0.21	0.55	OK
109	13.6	80% (W) = 10.9 20% (N) = 2.7	1.0 1.25	0.42 0.24	0.55 0.30	OK OK
108	3.7	≈ 100% (W) = 3.7	1.0	0.28	0.55	OK
107	10.7	50% (W) = 5.3 50% (E) = 5.4	1.0 1.0	0.32 0.32	0.55 0.55	OK OK
106	7.0	75% (W) = 5.2 25% (N) = 1.8	1.0 0.4	0.32 0.25	0.55 0.30	OK OK
105	6.2	75% (W) = 4.6 25% (N) = 1.6	2.3 0.4	0.27 0.24	0.55 0.30	OK OK
104	5.9	75% (W) = 4.4 25% (N) = 1.5	1.8 0.4	0.28 0.24	0.55 0.55	OK OK
103	3.5	100% (W) = 3.5	1.8	0.25	0.55	OK
102	33.6	30% (N) = 10.1 70% (S) = 23.5	0.4 0.32	0.48 0.55	0.55 0.55	OK 11-bcfs will top crown to Node 101



Date 9.25.87 Page 8 of 22

Project Harrison Park Addition

Item Drainage Plan System 100

Node	Q approach	Distribution	street slope	Flow Depth	Allow. Depth	Comment
101	19.1	80% (S) = 15.3 20% (N) = 3.8	0.32 0.4	0.58 0.33	0.55 0.55	* OK

\* slightly over max., but based on existing conditions, can't be avoided.

SUMMARY

Use standard curb on Todd Street + Lincoln (E) & Bayley

Goebel / Lincoln Loop is marginal for roll curb. With revisions in street slope, roll curb may be used.

Use roll curb on all other streets.



Date 9.25.87 Page 9 of 22

Project Harrison Park Addition

Item Drainage Plan System 100

IV STREET FLOW - 100 - YR

Check street flow at various locations

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

<u>Location</u>	<u>Contrib. Nodes</u>	<u>Q<sub>100</sub></u>	<u>Q<sub>pipe</sub></u>	<u>Q<sub>street</sub></u>	<u>street slope</u>	<u>Q<sub>max</sub></u>	<u>Comment</u>
Approaching Node 109	80% 109	29.0	0.0	29.0	1.0%	77.4 (From Page 12)	OK Walk Gr = +0.3'
Approaching Nodes 108, 107	100% 109 50% 107 100% 108	36.3 14.3 10.0 <u>60.6</u>	13.6	47.0	1.0%	77.4 (From Page 12)	OK Walk Gr = +0.3'
Approaching Node 106	100% 109 100% 108 100% 107 75% 106	36.3 10.0 28.6 14.0 <u>88.9</u>	27.7	61.2	1.0%	77.4 (From Page 12)	OK Walk Gr = +0.3'
Approaching Node 105	100% 109 100% 108 100% 107 100% 106 75% 105	36.3 10.0 28.6 18.7 12.5 <u>106.1</u>	34.4	71.7	2.3%	117.4 (From Page 12)	OK Walk Gr = +0.3'
Approaching Node 104 From W.	100% 109 100% 108 100% 107 100% 106 100% 105 75% 104	36.3 10.0 28.6 18.7 16.7 11.0 <u>121.3</u>	40.3	81.0	1.8%	103.8 (From Page 12)	OK Walk Gr = +0.3'



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Project Harrison Park Addition

Item Drainage Plan System 100

Location	Contrib. Nodes	Q <sub>100</sub>	Q <sub>pipe</sub>	Q <sub>street</sub>	street slope	Q <sub>max</sub>	Comment
Approaching Node 114 (N)	100% 115 25% 114	125.1 1.0 <u>126.1</u>					
			25.8	100.3	0.4	124.8	OK (From p.13) WK Gr = +0.6'
Approaching Node 113 (N)	100% 115 100% 114 10% 113						
		<u>127.5</u>	26.6	100.9	0.4	124.8	OK (From p.13) WK Gr = +0.6'
Approaching Nodes 111, 110	100% 115 100% 114 100% 113 100% 112 80% 111 100% 110						
		<u>160.3</u>	37.9	122.4	0.4	124.8	OK (From p.13) WK Gr = +0.6'
Approaching Node 104 (N)	100% 115 100% 114 100% 113 100% 112 100% 111 100% 110 25% 104 20% 101						
		<u>184.7</u>	46.0	138.7	0.4	124.8	OK (From p.13) WK Gr = +0.6'



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Project Harrison Park Addition

Item Drainage Plan System 100

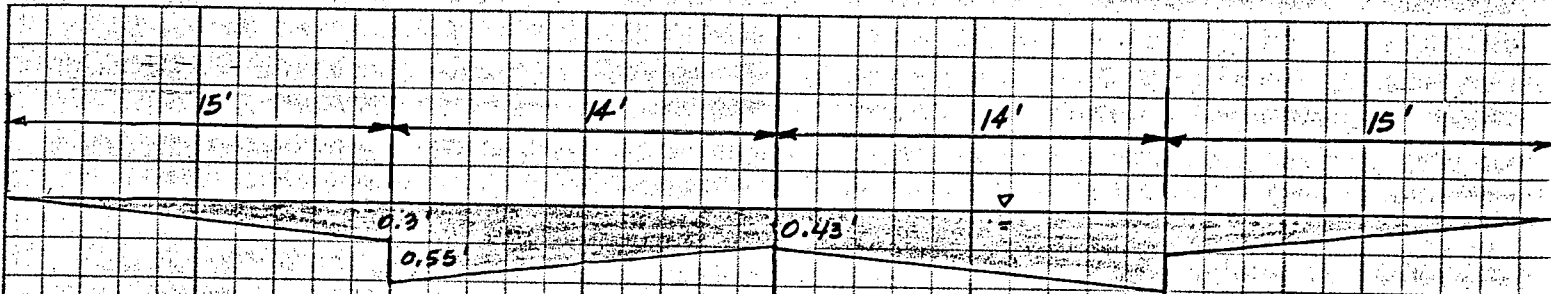
<u>Location</u>	<u>Contrib. Nodes</u>	<u>Q<sub>100</sub></u>	<u>Q<sub>pipe</sub></u>	<u>Q<sub>street</sub></u>	<u>street slope</u>	<u>Q<sub>max</sub></u>	<u>Comment</u>
Approaching	115						
Nodes 102, 101	114						
(N)	113						
	112						
	111						
	110						
	109						
	108						
	107						
	106						
	105						
	104						
	103						
	% 102						
	% 101						
		<u>271.0</u>	<u>74.3</u>	<u>196.7</u>	<u>0.7</u>	<u>201.2</u>	<u>OK</u>
						<u>(From p. 14)</u>	<u>NK Gr = +0.7'</u>



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Project Harrison Park Addition

Item Drainage Plan - System 100



58' R-O-W, std Cb,  
+ 0.3' Walk Grade

Determine  $Q_{max}$  in street R-O-W

Use Manning's Equation  $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$$n = \frac{2(14.5 \times 0.03) + 2(3.05 \times 0.013) + 2(12 \times 0.016)}{59.1}$$

$$n = 0.02256$$

$$A = 2(\frac{1}{2} \times 15 \times 0.3) + (28 \times 0.43) + 2(\frac{1}{2} \times 14 \times 0.42)$$

$$A = 22.42 \text{ SF}$$

$$R = A/p = 22.42/59.1 = 0.379357$$

$$R^{2/3} = 0.524041$$

$$Q = \frac{1.486}{0.02256} \times 22.42 \times 0.524041 \times S^{1/2}$$

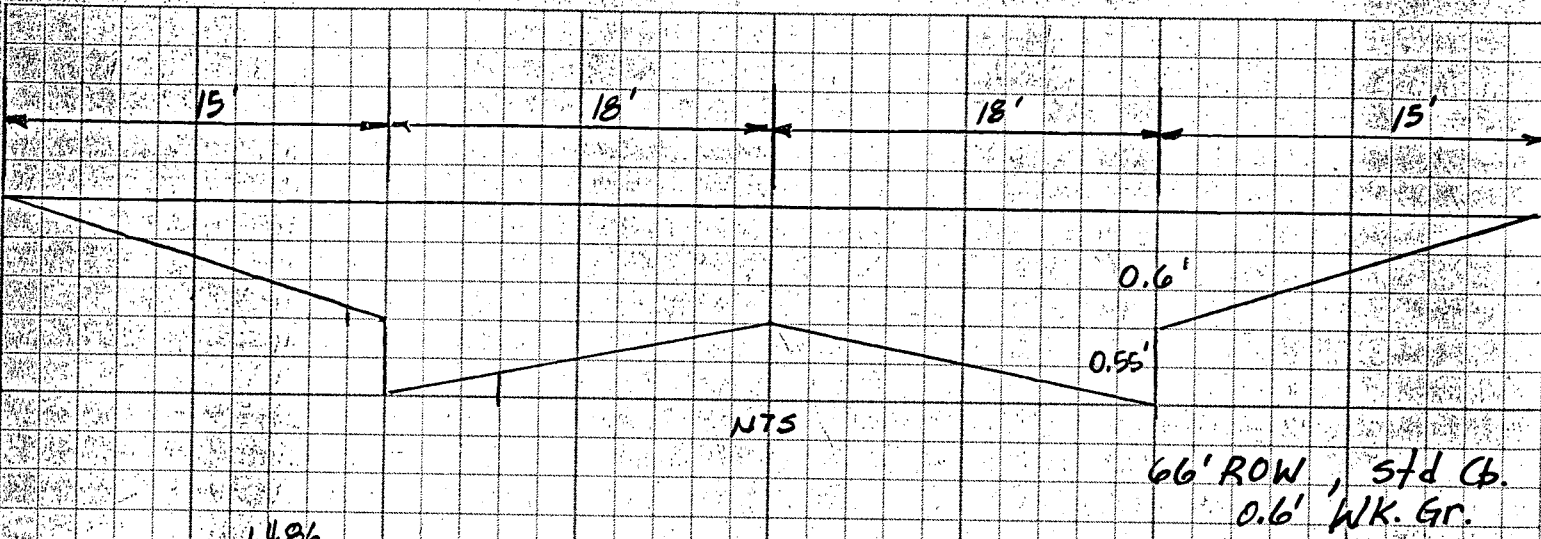
$$Q = 773.89 \sqrt{S}$$



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Project Harrison Park Add.

Item Drainage Plan



$$Q = \frac{1.486}{n} AR^{2/3} s^{1/2}$$

$$n = \frac{2(14.5 \times 0.03) + 2(3.05 \times 0.013) + 2(16 \times 0.016)}{67.1} = \frac{1.4613}{67.1} = 0.021778$$

$$A = 2\left(\frac{1}{2} \times 15 \times 0.6\right) + (0.6 \times 36) + 2\left(\frac{1}{2} \times 18 \times 0.55\right) = 40.5 \text{ SF}$$

$$p = 2(15) + 2(0.55) + 2(18) = 67.1$$

$$R = A/p = 40.5/67.1 = 0.603577$$

$$R^{2/3} = 0.714203$$

$$Q = \frac{1.486}{0.021778} \times 40.5 \times 0.714203 \times s^{1/2}$$

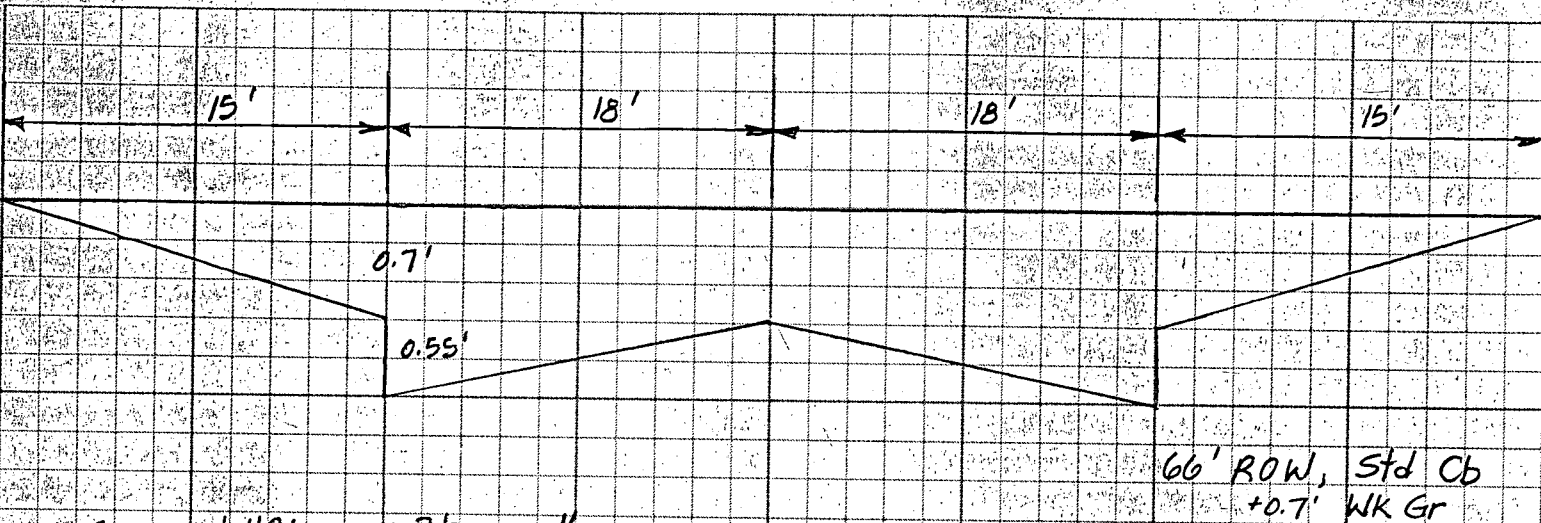
$$Q = 1,973.68 \text{ s}^{1/2}$$



Date Sept. 25, 1987 Page 14 of 22

Project Harrison Park Addition

Item Drainage Plan



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

$$n = 0.021778 \quad (\text{see page 13})$$

$$A = 2\left(\frac{1}{2} \times 15 \times 0.7\right) + 2\left(\frac{1}{2} \times 18 \times 0.55\right) + (36 \times 0.7) = 45.6 \text{ SF}$$

$$p = 67.1$$

$$R = A/p = 45.6/67.1 = 0.6795'$$

$$R^{2/3} = 0.772968$$

$$Q = \frac{1.486}{0.021778} \times 45.6 \times 0.772968 \times S^{1/2}$$

$$Q = 2,405.1 \text{ } S^{1/2}$$



Input File: hpark100

harrison park addition  
drainage plan  
storm water sewer system 100 analysis

16/22

Storm Frequency = 2-Year

\* \* \* H Y D R O L O G Y \* \* \*

Tributary Area			Hydrology Summation										Conduit Data				
Node to	C	Area	Slope	Length	TC(0)	I(0)	Q(0)	TC	I	Q	Sum Q	Size	Velocity	Length	TT	TT+TC	
Node		(Ac)	(%)	(Ft)	(Min)	(In/Hr)	(CFS)	(Min)	(In/Hr)	(CFS)	(CFS)		(Ft/Sec)	(Ft)	(Min)	(Min)	
115	114	0.26	42.20	0.00	0.0	37.00	2.46	25.80	37.00	2.46	25.80	25.80	27"	6.49	140.00	0.36	37.36
114	113	0.57	0.65	0.00	0.0	15.00	4.06	1.40	37.36	2.44	0.84	26.64	30"	5.43	180.00	0.55	37.91
113	112	0.57	3.48	0.00	0.0	15.00	4.06	7.60	37.91	2.41	4.51	31.15	36"	4.41	300.00	1.13	39.05
112	110	0.57	5.32	0.00	0.0	15.00	4.06	11.60	39.05	2.36	6.73	37.89	36"	5.36	140.00	0.44	39.48
111	110	0.57	6.14	0.00	0.0	15.00	4.06	13.40	15.00	4.06	13.40	13.40	24"	4.27	40.00	0.16	15.16
110	104	0.57	0.47	0.00	0.0	15.00	4.06	0.60	39.48	2.34	0.35	45.98	42"	4.78	170.00	0.59	40.08
109	107	0.57	6.24	0.00	0.0	15.00	4.06	13.60	15.00	4.06	13.60	13.60	24"	4.33	240.00	0.92	15.92
108	107	0.57	1.71	0.00	0.0	15.00	4.06	3.70	15.00	4.06	3.70	3.70	15"	3.02	40.00	0.22	15.22
107	106	0.57	4.92	0.00	0.0	15.00	4.06	10.70	15.92	3.97	10.45	27.69	24"	8.81	340.00	0.64	16.57
106	105	0.57	3.22	0.00	0.0	15.00	4.06	7.00	16.57	3.90	6.73	24.42	27"	8.66	290.00	0.56	17.13
105	104	0.57	2.86	0.00	0.0	15.00	4.06	6.20	17.13	3.85	5.89	40.31	30"	8.21	290.00	0.59	17.71
104	103	0.57	2.50	0.00	0.0	15.00	4.06	5.90	40.08	2.31	3.36	73.80	48"	5.87	60.00	0.17	40.25
103	102	0.57	1.62	0.50	0.0	15.00	4.06	0.90	40.25	2.30	0.51	74.32	48"	5.91	140.00	0.39	40.64
102	101	0.30	49.60	0.00	0.0	45.00	2.11	22.00	40.64	2.28	19.87	94.16	48"	7.49	40.00	0.09	40.73
101	100	0.50	3.91	0.00	0.0	15.00	4.06	19.10	40.73	2.28	10.73	104.92	48"	8.35	30.00	0.06	40.79



18/22

Computation of Peak Discharge  
Date: 09-24-1987

Title: harrison park

Rainfall 7.8 inches  
Recurrence Interval (yrs.) 100  
Runoff Curve Number 80  
Hyd. Len. 2000 feet  
Slope 2 %  
% of HLM 0 %  
% Imp. 0 %  
Area of basin 50 acres

Computed Data

Basic Lag Factor (hrs.) 0.39  
Hydr. Length Adj. 1.00  
Imp. Area Adj. 1.00  
Runoff Volume (in.) 5.44  
Computed Time of Conc. (hrs.) 0.65

Peak Discharge by Technical Release No. 55 (1975)

Peak Dis. (cfs) = 181.88 ←  
Csm/in. = 428.14  
Tc (hrs.) = 0.65

Peak Discharge by Modified Rational Formula (Rossmiller)  
Discharge for 100 year freq.

Time of Conc. (Tc) = 39.20 minutes  
Intensity = 5.51 inches/hr.  
C factor = 0.39  
Peak Dis. (cfs) = 108.78 ←

Check of  $t_c$  &  $Q$ 's for Node 102

$$\text{Avg} = \frac{181.88 + 108.78}{2} = 145.3 \text{ cfs @ } 39.2 \text{ min.}$$

USED 141.2 cfs @ 45 min. (See p.2 & p.5)

19/22

Computation of Peak Discharge  
Date: 09-24-1987

Title: Harrison Park Add.:off-site area north

Rainfall 7.8 inches  
Recurrence Interval (yrs.) 100  
Runoff Curve Number 81  
Hyd. Len. 2100 feet  
Slope 2 %  
% of HLM 0 %  
% Imp. 0 %  
Area of basin 42 acres

Computed Data

Basic Lag Factor (hrs.) 0.39  
Hydr. Length Adj. 1.00  
Imp. Area Adj. 1.00  
Runoff Volume (in.) 5.55  
Computed Time of Conc. (hrs.) 0.66

Peak Discharge by Technical Release No. 55 (1975)

Peak Dis. (cfs) = 155.28 ←  
Csm/in. = 426.05  
Tc (hrs.) = 0.66

Peak Discharge by Modified Rational Formula (Rossmiller)  
Discharge for 100 year freq.

Time of Conc. (Tc) = 39.49 minutes  
Intensity = 5.48 inches/hr.  
C factor = 0.40  
Peak Dis. (cfs) = 92.68 ←

37 min  
125.1 cfs

Check of  $t_c$  &  $Q$  for Node 115

$$\text{Avg} = \frac{155.28 + 92.68}{2} = 124.0 \text{ @ } 39.5 \text{ min}$$

USED: 125.1 cfs @  $t_c$  37 min (see p. 3 + p. 5)



Input File: hpark100-100

harrison park addition  
drainage plan  
storm water sewer system 100 analysis

21/22

Storm Frequency = 100-Year

\* \* \* H Y D R O L O G Y \* \* \*

Node to Node		Tributary Area			Hydrology Summation							Conduit Data					
C	Area (Ac)	Slope (%)	Length (Ft)	TC (Min)	I (In/Hr)	Q (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)		
115	114	0.61	42.20	0.00	0.0	37.00	5.77	125.10	37.00	5.77	125.10	125.10	27"	31.46	140.00	0.07	37.07
114	113	0.79	0.65	0.00	0.0	15.00	8.97	3.80	37.07	5.76	2.44	127.54	30"	25.98	180.00	0.12	37.19
113	112	0.79	3.48	0.00	0.0	15.00	8.97	20.30	37.19	5.75	13.00	140.54	36"	19.88	300.00	0.25	37.44
112	110	0.79	5.32	0.00	0.0	15.00	8.97	31.00	37.44	5.72	19.75	160.28	36"	22.68	140.00	0.10	37.54
111	110	0.79	6.14	0.00	0.0	15.00	8.97	35.70	15.00	8.97	35.70	35.70	24"	11.36	40.00	0.06	15.06
110	104	0.79	0.47	0.00	0.0	15.00	8.97	2.70	37.54	5.70	1.72	184.73	42"	19.20	170.00	0.15	37.69
109	107	0.79	6.24	0.00	0.0	15.00	8.97	36.30	15.00	8.97	36.30	36.30	24"	11.55	240.00	0.35	15.35
108	107	0.79	1.71	0.00	0.0	15.00	8.97	10.00	15.00	8.97	10.00	10.00	15"	8.15	40.00	0.00	15.00
107	106	0.79	4.92	0.00	0.0	15.00	8.97	28.60	15.35	8.89	28.35	74.58	24"	23.74	340.00	0.24	15.56
106	105	0.79	3.22	0.00	0.0	15.00	8.97	18.70	15.58	8.84	18.42	93.00	27"	23.39	290.00	0.21	15.79
105	104	0.79	2.66	0.00	0.0	15.00	8.97	16.70	15.79	8.79	16.37	109.37	30"	22.28	290.00	0.22	16.01
104	103	0.79	2.50	0.00	0.0	15.00	8.97	14.60	37.69	5.69	9.25	265.06	48"	21.09	60.00	0.05	37.74
103	102	0.79	1.62	0.00	0.0	15.00	8.97	9.40	37.74	5.68	5.95	271.01	48"	21.57	140.00	0.11	37.85
102	101	0.65	49.60	0.00	0.0	45.00	4.94	141.20	37.65	5.67	118.76	389.76	48"	31.02	40.00	0.02	37.87
101	100	0.76	3.91	0.00	0.0	15.00	8.97	21.90	37.87	5.66	13.82	403.59	48"	32.12	30.00	0.02	37.88

Input File: hpark100-100

harrison park addition  
 drainage plan  
 storm water sewer system 100 analysis

22/22

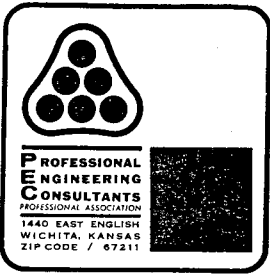
Storm Frequency = 100-Year

\* \* \* H Y D R A U L I C S \* \* \*

```

*****
Node   Hyd-Slope  Friction  Bend  Transition  Manhole  Deflection  Junction  Total  Hyd-61  Desired  Diff.
      (Ft/Ft)   (Ft)     (Ft)   (Ft)        (Ft)     (Ft)       (Ft)     (Ft)   Elevation  Elevation (Ft)
*****
115    0.16316   22.8429  0.0000  0.0000     0.0000   0.0000    0.0000   22.8429 1457.7052 1349.7000 -108.01
114    0.09668   17.4032  0.0000  0.9778     0.0000   4.7248    -3.7074   19.3985 1434.8623 1349.0000 -85.86
113    0.04440   13.3193  0.0000  0.3689     0.0000   0.8621    -2.3456   12.7047 1415.4639 1348.3000 -67.16
112    0.05775   8.0850   0.0000  0.1846     0.0000   0.0000    3.9544   12.2240 1402.7592 1347.1000 -55.66
111    0.02490   0.9961   0.0000  0.0000     0.0000   0.0000    0.0000    0.9961 1391.5312 1346.6000 -44.93
110    0.03371   5.7309   0.0000  0.4520     0.0000   0.0000    -0.0984   6.0045 1390.5352 1346.6000 -43.94
109    0.02575   6.1794   0.0000  0.0000     0.0000   0.0000    0.0000    6.1794 1495.2174 1363.5000 -131.72
108    0.02396   0.9586   0.0000  0.0000     0.0000   0.0000    0.0000    0.9586 1489.9966 1361.5000 -128.50
107    0.10868   36.9518  0.0000  0.6678     0.0000   0.0000   13.7159   51.3355 1489.0380 1361.5000 -127.54
106    0.09918   26.1513  0.0000  0.0511     0.0000   0.0000    4.0377   30.2401 1437.7025 1358.5000 -79.20
105    0.07110   20.6191  0.0000  0.1574     0.0000   0.0000    2.2353   23.0117 1407.4624 1351.5000 -55.96
104    0.03405   2.0429   0.0000  0.1184     0.0000   1.7594    3.5644    7.4852 1384.4507 1346.0000 -38.45
103    0.03559   4.9832   0.0000  0.0314     0.0000   0.5682    0.8028    6.3856 1376.9655 1346.0000 -30.97
102    0.07363   2.9450   0.0000  0.7716     0.0000   3.6109   15.7333   23.0608 1370.5798 1345.4000 -25.18
101    0.07894   2.3682   0.0000  0.1079     0.0000   0.0000    2.5430    5.0190 1347.5190 1345.4000 -2.12
100    0.00000   0.0000   0.0000  0.0000     0.0000   0.0000    0.0000    0.0000 1342.5000 1342.5000  0.00
*****

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Date Sept. 25, 1987 Page 1 of 7

Project Harrison Park Addition

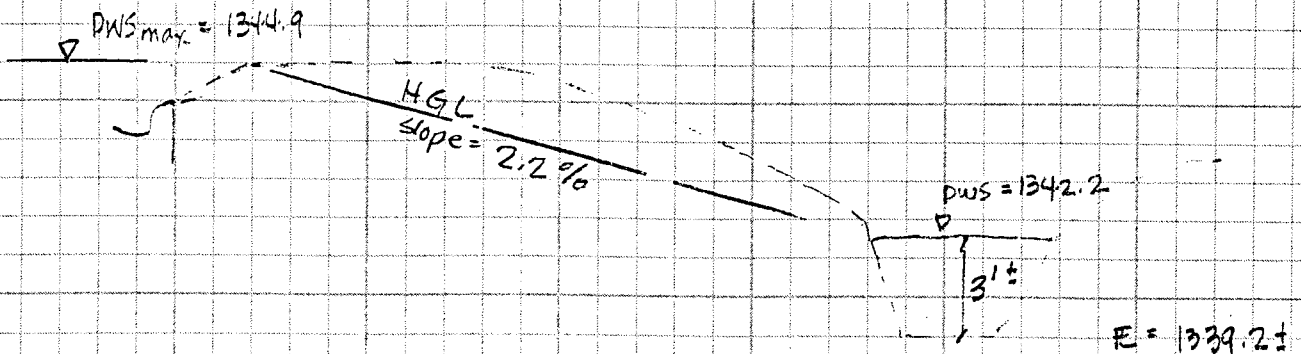
Item Drainage Plan Channel

The 100-year runoff as calculated herein (see page 21, System 100) is 403.6 cfs.

This amount of runoff will be transported out of the proposed Harrison Park Add. via:

1. Existing channel located along the south side of Harrison Park Add (north side of Park Meadows)
2. 18" pipe located at east end of Todd Court.

The estimated capacity of the 18" pipe is as follows:



capacity 18" RCP @ 2.2% = 16 cfs  
(see p.3)

Flow Pipe =  $\frac{\text{Flow from Todd Ct Sub-Basin} + \text{Overflow From Harrison Park Add.}}{100}$



Date 9.25.87 Page 2 of 7

Project Harrison Park Add

Item Drainage Plan Channel

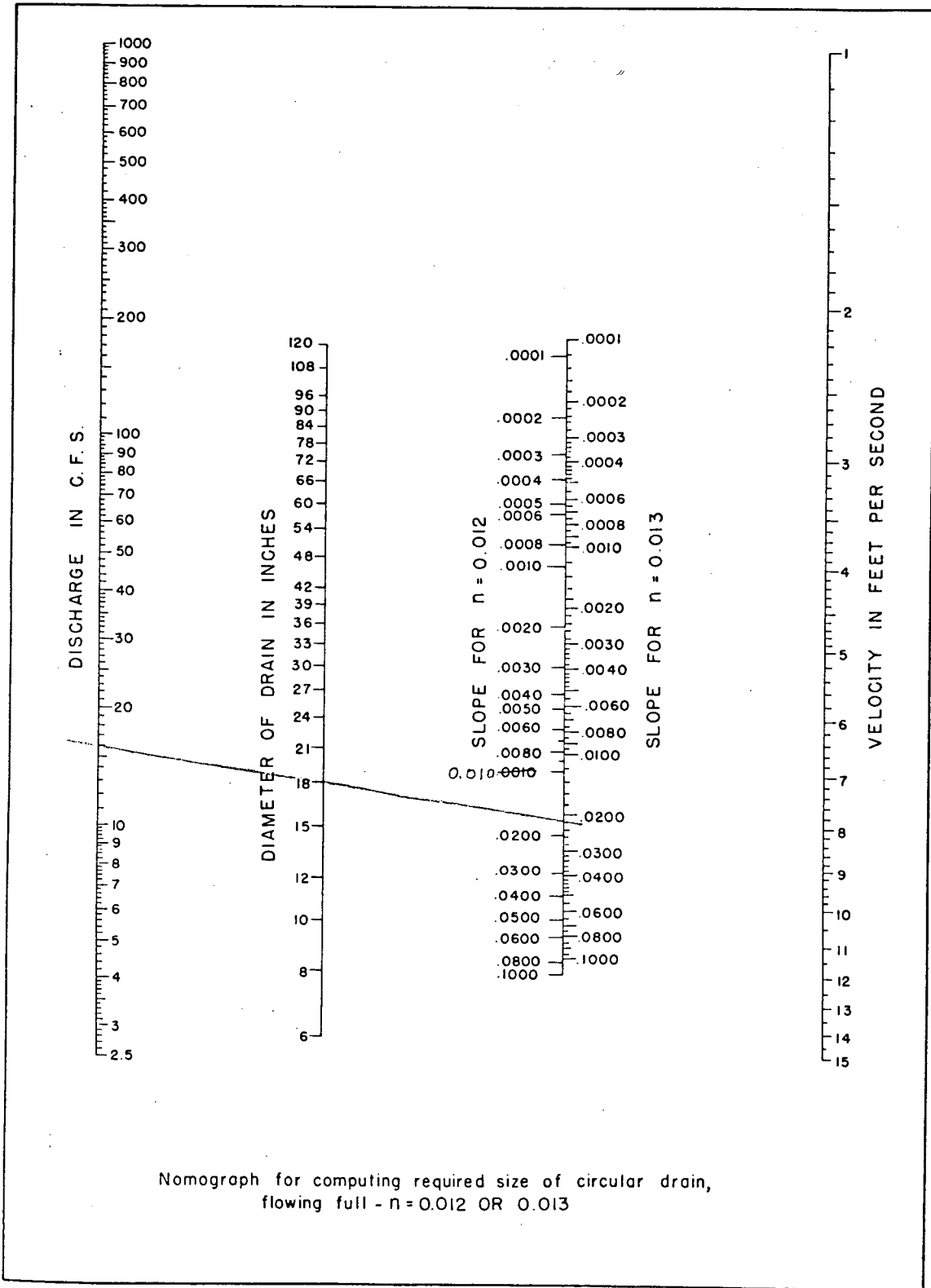
1. Flow from Todd Ct Sub-Basin

$$= CIA = 0.50 \times 7.37 \times 2.75 A_c = 10.1 \text{ cfs}$$

$$16 \text{ cfs (in pipe)} = 10.1 \text{ cfs (Todd Ct. Sub-Basin)} + \text{Overflow From Harrison Park Add.}$$

$$\therefore \text{Overflow} = 16.0 - 10.1 = 5.9 \text{ cfs.}$$

$$\text{Channel Flow} = 403.6 \text{ cfs} - 5.9 \text{ cfs} = 397.7 \text{ cfs.}$$





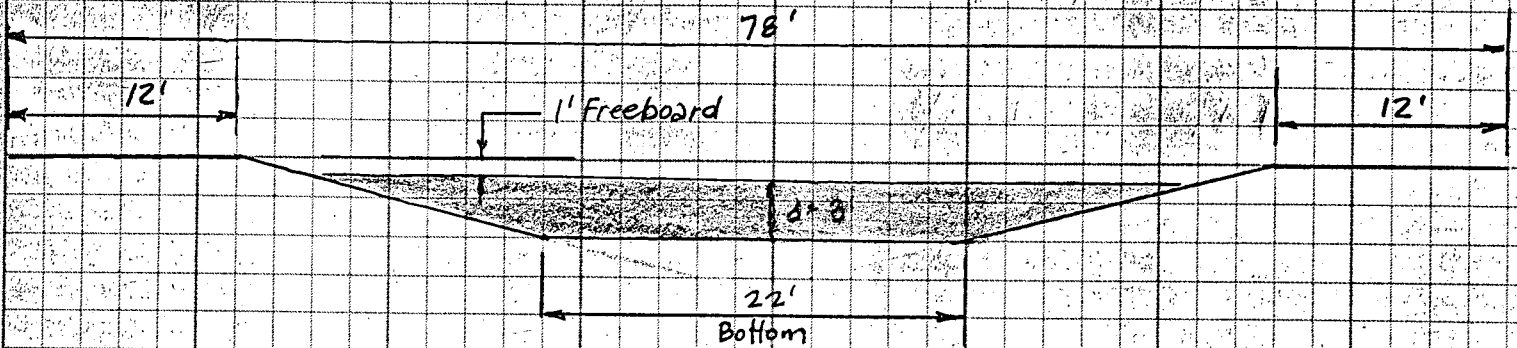
Date 9.25.87 Page 4 of 7

Project Harrison Park Addition

Item Drainage Plan Channel

The original channel was designed for 259 cfs. The channel must carry 398 cfs. The reason for this difference is the runoff coefficients and routing (see Van-Doren-Hazard-Stellings sketches & calcs attached.)

With 78' Right-of-Way available, the following section is proposed:



With known  $Q$ ,  $A$ ,  $R$  determine slope required to carry the runoff

Use Manning's equation  $Q = \frac{1.486}{n} AR^{2/3} S^{1/2}$

d	A	P	R	$R^{2/3}$
3'	102.0	46.73	2.182	1.68

$$398 = \frac{1.486}{0.03} \times 102.0 \times 1.6825 \times S^{1/2}$$

$$S^{1/2} = 0.04682$$

$$S = 0.0022 = 0.22\% \pm$$

5/7

**VAN DOREN - HAZARD - STALLINGS**  
**ARCHITECTS - ENGINEERS**  
 TOPEKA, KANSAS

Job No. \_\_\_\_\_

Date 1.10.75

Sheet 1 of \_\_\_\_\_

Project Park Meadows

By K.H. BENSTON

Subject \_\_\_\_\_

Ch'd. \_\_\_\_\_

PT. No.	Accum AREA	Comp. "C" IN	INCHES/HR 100yr	Q cfs	COMMENTS
1	16.5	.50	7.6	62.7	DRAINAGE FROM THE WEST SIDE OF WEBB ROAD
2	28.9	.54	7.05	110.7	
3	32.9	.53	6.75	119.5	
4	40	.5	6.75	135	OFF SITE DRAINAGE FROM SOUTH
5	75	.52	6.3	247	
6	84	.50	6.3	263.6	
7	70	.50	6.1	213.5	OFFSITE DRAINAGE FROM SOUTH
8	158.6	.51	6.1	490	
9	176.2	.50	5.75	495.7	
10	180.86	.50	5.6	499	
11	97.5	.45	5.9	259	OFFSITE DRAINAGE FROM NORTH & WEST

VAN DOREN - HAZARD - STALLINGS  
ARCHITECTS - ENGINEERS  
TOPEKA, KANSAS

Job No. \_\_\_\_\_

Date 11-21-74

Sheet \_\_\_\_\_ of \_\_\_\_\_

Project \_\_\_\_\_ By \_\_\_\_\_

Subject \_\_\_\_\_ Ck'd. \_\_\_\_\_

NORTH DRAINAGE SWALE

$n = 0.035$   
 $S = 0.002' / 1'$

$S^{1/2} = 0.0447214$   
 $R = 2.062$

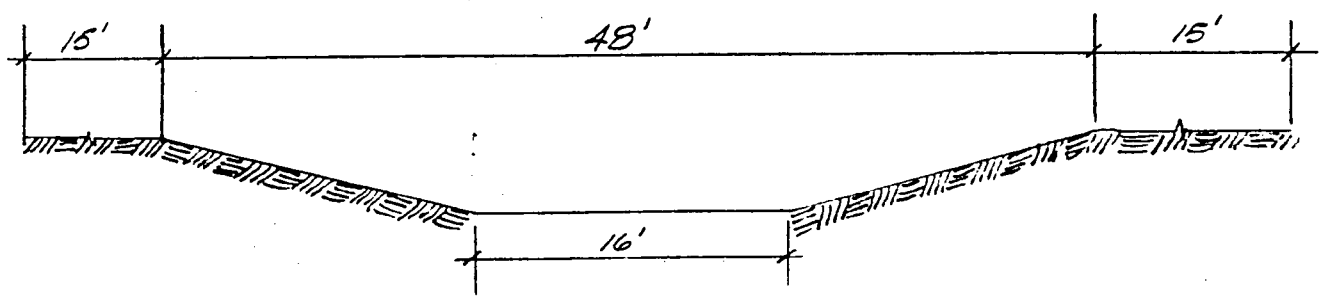
$Q = \frac{1.486}{n} R^{2/3} S^{1/2} A$

$B = 16'$

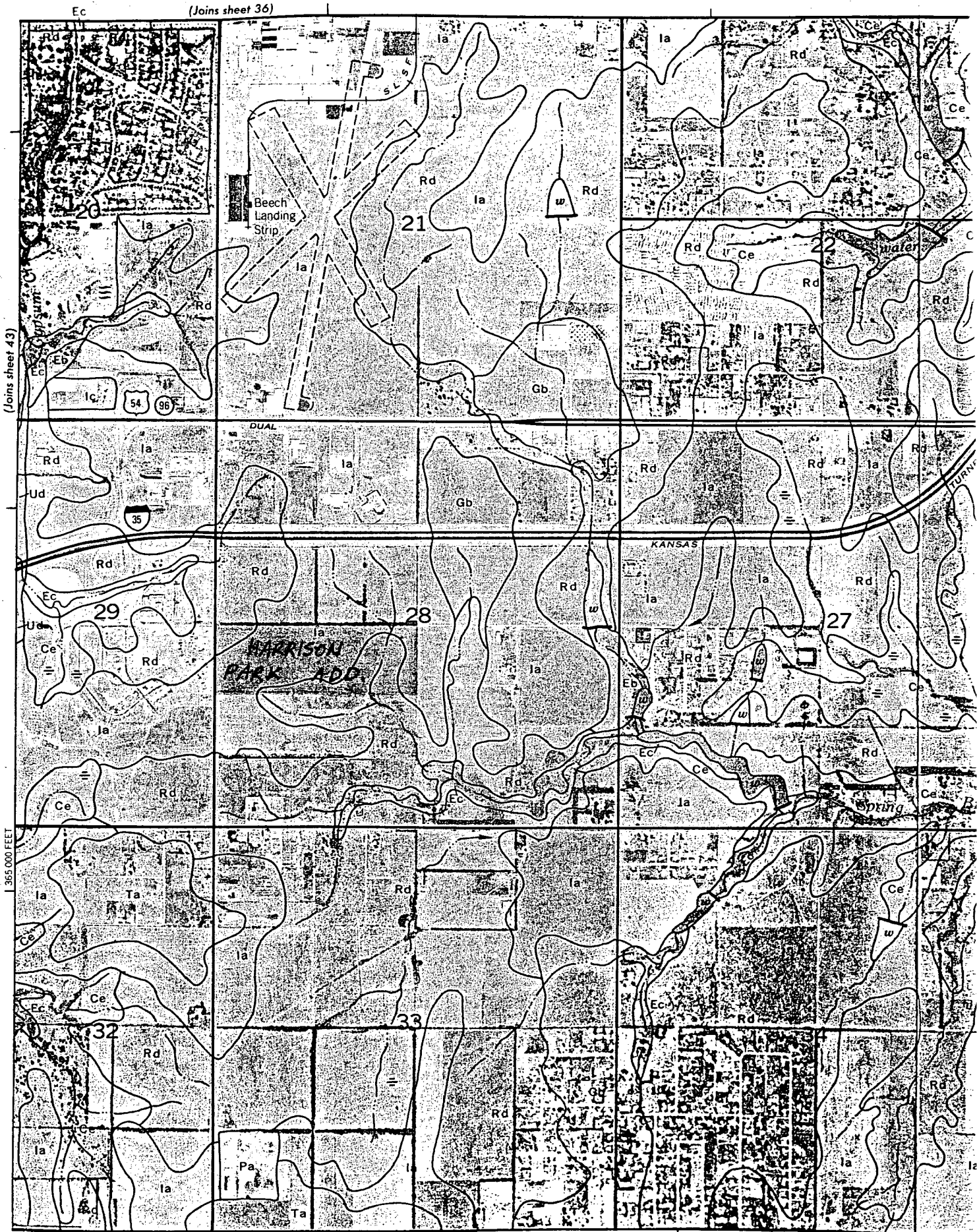
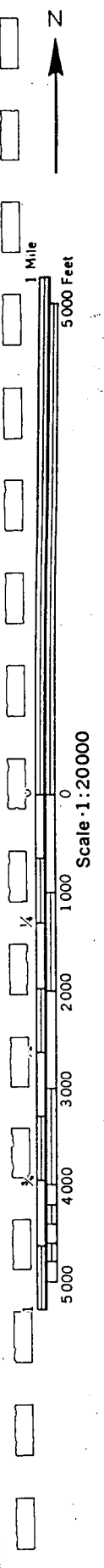
$AREA = (16 + 3.4) 3 = 84$   
 $P = (16 + 4.1231 * 3 * 2) = 40.7386$

$R^{2/3} = 1.6200$

$Q = \underline{\underline{258.39 cfs}}$







(Joins sheet 36)

(Joins sheet 43)

(Joins sheet 52)

2 370 000 FEET

## EXHIBIT NO. 1

## SOIL LEGEND

<u>SYMBOL</u>	<u>HYDROLOGIC GROUP</u>	<u>NAME</u>
Aa	B	Albion-Shellabarger sandy loams, 1 to 4 percent slopes
Ab	B	Albion and Shellabarger sandy loams, 7 to 15 percent slopes
Ba	C	Blanket silt loam, 0 to 1 percent slopes
Bb	C	Blanket silt loam, 1 to 3 percent slopes
Ca	B	Canadian fine sandy loam
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	Cline 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 slopes
Wa	C	Waldeck sandy loam
Wh	D	Waurika silt loam

## ATTACHMENT D

## DRAINAGE CRITERIA

## CITY OF WICHITA, KANSAS

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

<u>Land Use or Surface Characteristics</u>	<u>Percent Impervious</u>	<u>Frequency</u>			
		<u>2</u>	<u>5</u>	<u>10</u>	<u>100</u>
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:					
<u>Single Family (Soil Group D)</u>					
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
<u>Multi-Family (Soil Group D)</u>					
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
<u>Single Family (Soil Group C)</u>					
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
<u>Multi-Family (Soil Group C)</u>					
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
<u>Single-Family (Soil Group B)</u>					
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
<u>Multi-Family (Soil Group B)</u>					
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

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		<u>2</u>	<u>5</u>	<u>10</u>	<u>100</u>
<u>Single Family (Soil Group A)</u>					
1/8 Acre	50	0.47	0.50	0.54	0.60
1/4 Acre	38	0.39	0.41	0.45	0.52
1/3 Acre	30	0.33	0.35	0.39	0.47
1/2 Acre	25	0.30	0.31	0.35	0.44
3/4 Acre	22	0.28	0.29	0.33	0.42
1 Acre	20	0.26	0.28	0.32	0.40
<u>Multi-Family (Soil Group A)</u>					
Multi-Unit (detached)	60	0.55	0.57	0.61	0.67
Multi-Unit (attached)	65	0.58	0.60	0.64	0.70
Apartments	75	0.65	0.68	0.72	0.77
3. Industrial:					
Light Areas	70	0.68	0.69	0.73	0.80
Heavy Areas	80	0.74	0.76	0.79	0.84
4. Playgrounds:	15	0.33	0.35	0.42	0.55
5. Schools:	40	0.49	0.51	0.56	0.66
6. Railroad Yard Areas:	30	0.43	0.45	0.50	0.62
7. Undeveloped Urban Areas: Offsite Flow Analysis (when land use not defined)	45	0.52	0.54	0.59	0.68
8. Streets:					
Paved	99	0.87	0.88	0.90	0.93
Gravel	00	0.24	0.26	0.33	0.48
9. Drive, Parking Lots and Walks:	96	0.87	0.87	0.88	0.89
10. Roofs:	90	0.80	0.85	0.90	0.93
11. Urban Lawn Areas (See Note No. 1 below):					
<u>Soil Group A</u>					
Slope less than 1%	00	0.08	0.09	0.13	0.23
Slope 1% to 4%	00	0.12	0.13	0.17	0.27
Slope more than 4%	00	0.16	0.17	0.21	0.31
<u>Soil Group B</u>					
Slope less than 1%	00	0.16	0.18	0.24	0.37
Slope 1% to 4%	00	0.20	0.22	0.28	0.41
Slope more than 4%	00	0.24	0.26	0.32	0.45
<u>Soil Group C</u>					
Slope less than 1%	00	0.24	0.27	0.35	0.51
Slope 1% to 4%	00	0.26	0.29	0.37	0.53
Slope more than 4%	00	0.28	0.31	0.39	0.55

<u>Land Use or Surface Characteristics</u>	<u>Percent Impervious</u>	<u>Frequency</u>			
		<u>2</u>	<u>5</u>	<u>10</u>	<u>100</u>
<u>Soil Group D</u>					
Slope less than 1%	00	0.28	0.33	0.43	0.63
Slope 1% to 4%	00	0.30	0.35	0.45	0.65
Slope more than 4%	00	0.32	0.37	0.47	0.67

Note No. 1: Coefficients shown in the above table are for pervious open space areas with thick turf which includes pervious areas in parks and cemeteries. Coefficients shown above must be increased 0.02 for use with agricultural pasture areas. Coefficients shown above must be reduced by 0.04 for use with agricultural cultivated areas. Group A soils are well-drained, coarse textured sands with high infiltration rates. Group B soils are moderately well-drained, moderately coarse textured soils with moderate infiltration rates. Group C soils are moderately poor-drained, moderately fine textured soils with slow infiltration rates. Group D soils are poor-drained, fine textured soils with very slow infiltration rates.

GENERAL NOTE: These Rational Formula Coefficients may not be valid for basins 320 acres or larger.

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

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

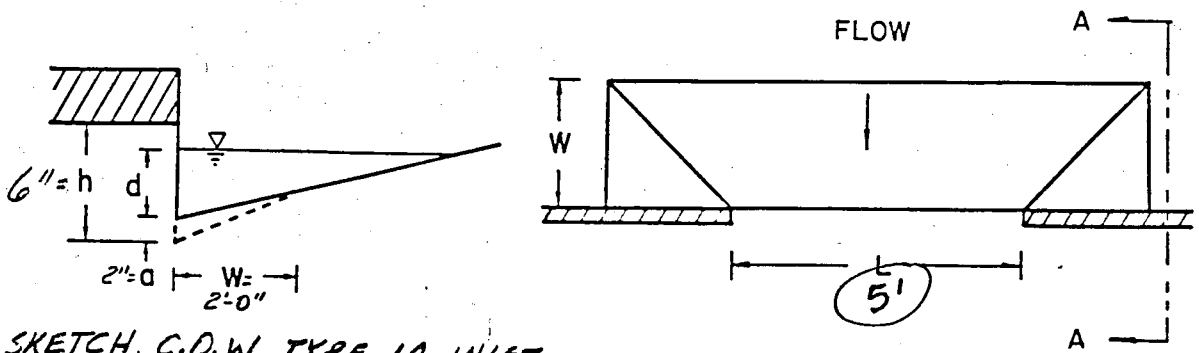
DURATION IN MINUTES	RETURN PERIODS OF						
	1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	4.18	5.57	6.53	7.41	8.52	9.48	10.32
6	3.99	5.32	6.25	7.09	8.16	9.09	9.89
7	3.81	5.09	5.99	6.81	7.84	8.74	9.50
8	3.66	4.89	5.75	6.55	7.55	8.42	9.15
9	3.52	4.70	5.54	6.31	7.28	8.13	8.83
10	3.39	4.52	5.34	6.09	7.04	7.86	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

ATTACHMENT A CONTINUED  
Page 2

<u>DURATION IN MINUTES</u>	<u>RETURN PERIODS OF</u>						
	<u>1-YR</u>	<u>2-YR</u>	<u>5-YR</u>	<u>10-YR</u>	<u>25-YR</u>	<u>50-YR</u>	<u>100-YR</u>
46	1.70	2.05	2.54	2.97	3.48	3.93	4.33
47	1.67	2.02	2.50	2.93	3.44	3.88	4.28
48	1.66	2.00	2.47	2.90	3.39	3.84	4.23
49	1.64	1.97	2.44	2.86	3.35	3.79	4.18
50	1.61	1.95	2.41	2.83	3.32	3.75	4.13
51	1.59	1.92	2.38	2.79	3.28	3.71	4.09
52	1.56	1.89	2.35	2.76	3.24	3.67	4.05
53	1.54	1.86	2.33	2.73	3.20	3.63	4.00
54	1.52	1.84	2.30	2.70	3.17	3.59	3.96
55	1.50	1.81	2.27	2.67	3.14	3.55	3.92
56	1.47	1.79	2.25	2.64	3.10	3.51	3.88
57	1.45	1.76	2.22	2.61	3.07	3.48	3.84
58	1.43	1.74	2.20	2.59	3.04	3.44	3.81
59	1.42	1.72	2.18	2.56	3.01	3.41	3.77
60	1.40	1.69	2.15	2.53	2.98	3.37	3.73
61	1.38	1.67	2.13	2.51	2.95	3.34	3.70
62	1.36	1.65	2.11	2.48	2.92	3.31	3.67
63	1.34	1.63	2.09	2.46	2.89	3.28	3.63
64	1.33	1.61	2.07	2.44	2.86	3.25	3.60
65	1.31	1.59	2.05	2.41	2.84	3.22	3.57
66	1.30	1.57	2.03	2.39	2.81	3.19	3.54
67	1.28	1.56	2.01	2.37	2.79	3.16	3.51
68	1.26	1.54	1.99	2.35	2.76	3.13	3.48
69	1.25	1.52	1.97	2.33	2.74	3.10	3.45
70	1.24	1.50	1.95	2.31	2.71	3.08	3.42
71	1.22	1.49	1.93	2.28	2.69	3.05	3.39
72	1.21	1.47	1.92	2.26	2.67	3.02	3.36
73	1.20	1.46	1.90	2.25	2.64	3.00	3.34
74	1.18	1.44	1.88	2.23	2.63	2.98	3.31
75	1.17	1.43	1.86	2.21	2.61	2.95	3.29
76	1.16	1.41	1.85	2.19	2.58	2.93	3.26
77	1.15	1.40	1.83	2.17	2.55	2.90	3.24
78	1.13	1.38	1.82	2.15	2.53	2.88	3.22
79	1.12	1.37	1.80	2.14	2.50	2.86	3.19
80	1.11	1.36	1.79	2.12	2.48	2.84	3.16
81	1.10	1.34	1.77	2.10	2.46	2.82	3.13
82	1.09	1.33	1.76	2.08	2.43	2.79	3.10
83	1.08	1.32	1.74	2.06	2.41	2.76	3.07
84	1.07	1.31	1.73	2.04	2.39	2.74	3.04
85	1.06	1.30	1.72	2.02	2.37	2.71	3.01
86	1.05	1.28	1.70	2.00	2.34	2.69	2.99
87	1.04	1.27	1.69	1.99	2.32	2.66	2.96
88	1.03	1.26	1.68	1.97	2.30	2.64	2.93
89	1.02	1.25	1.68	1.95	2.28	2.62	2.91
90	1.01	1.24	1.66	1.93	2.26	2.59	2.88

<u>DURATION IN MINUTES</u>	<u>RETURN PERIODS OF</u>						
	<u>1-YR</u>	<u>2-YR</u>	<u>5-YR</u>	<u>10-YR</u>	<u>25-YR</u>	<u>50-YR</u>	<u>100-YR</u>
91	1.00	1.23	1.65	1.92	2.24	2.57	2.86
92	1.00	1.22	1.63	1.90	2.22	2.55	2.83
93	0.99	1.21	1.62	1.89	2.20	2.53	2.81
94	0.98	1.20	1.61	1.87	2.19	2.51	2.79
95	0.97	1.19	1.59	1.85	2.17	2.49	2.76
96	0.96	1.18	1.58	1.84	2.15	2.46	2.74
97	0.96	1.17	1.57	1.82	2.13	2.44	2.72
98	0.95	1.16	1.56	1.81	2.12	2.42	2.70
99	0.94	1.15	1.54	1.80	2.10	2.41	2.67
100	0.93	1.14	1.53	1.78	2.08	2.39	2.65
101	0.93	1.13	1.52	1.77	2.07	2.39	2.65
102	0.92	1.13	1.51	1.75	2.05	2.35	2.61
103	0.91	1.12	1.50	1.74	2.04	2.33	2.59
104	0.90	1.11	1.49	1.73	2.02	2.31	2.57
105	0.90	1.10	1.47	1.72	2.01	2.30	2.55
106	0.89	1.09	1.46	1.70	1.99	2.28	2.54
107	0.88	1.09	1.45	1.69	1.98	2.26	2.52
108	0.88	1.08	1.44	1.68	1.96	2.25	2.50
109	0.87	1.07	1.43	1.67	1.95	2.23	2.48
110	0.87	1.06	1.42	1.65	1.93	2.21	2.46
111	0.86	1.06	1.41	1.64	1.92	2.20	2.45
112	0.85	1.05	1.40	1.63	1.91	2.18	2.43
113	0.85	1.04	1.39	1.62	1.89	2.17	2.41
114	0.84	1.03	1.38	1.61	1.88	2.15	2.40
115	0.84	1.03	1.37	1.60	1.87	2.14	2.38
116	0.83	1.02	1.36	1.59	1.86	2.12	2.36
117	0.82	1.01	1.36	1.58	1.84	2.11	2.35
118	0.82	1.01	1.35	1.57	1.83	2.09	2.33
119	0.81	1.00	1.34	1.56	1.82	2.08	2.32
120	0.81	0.99	1.33	1.55	1.81	2.07	2.30

<u>DURATION IN HOURS</u>	<u>RETURN PERIODS OF</u>						
	<u>1-YR</u>	<u>2-YR</u>	<u>5-YR</u>	<u>10-YR</u>	<u>25-YR</u>	<u>50-YR</u>	<u>100-YR</u>
2	0.81	0.99	1.33	1.55	1.81	2.07	2.30
3	0.59	0.72	0.97	1.13	1.32	1.51	1.68
4	0.47	0.58	0.78	0.91	1.06	1.21	1.35
5	0.40	0.49	0.66	0.77	0.89	1.02	1.14
6	0.35	0.42	0.57	0.67	0.78	0.89	0.99
8	0.28	0.34	0.46	0.53	0.62	0.71	0.79
10	0.23	0.29	0.39	0.45	0.52	0.60	0.67
12	0.20	0.25	0.33	0.39	0.45	0.52	0.58
18	0.15	0.18	0.24	0.28	0.33	0.38	0.42
24	0.12	0.15	0.20	0.23	0.27	0.31	0.34



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

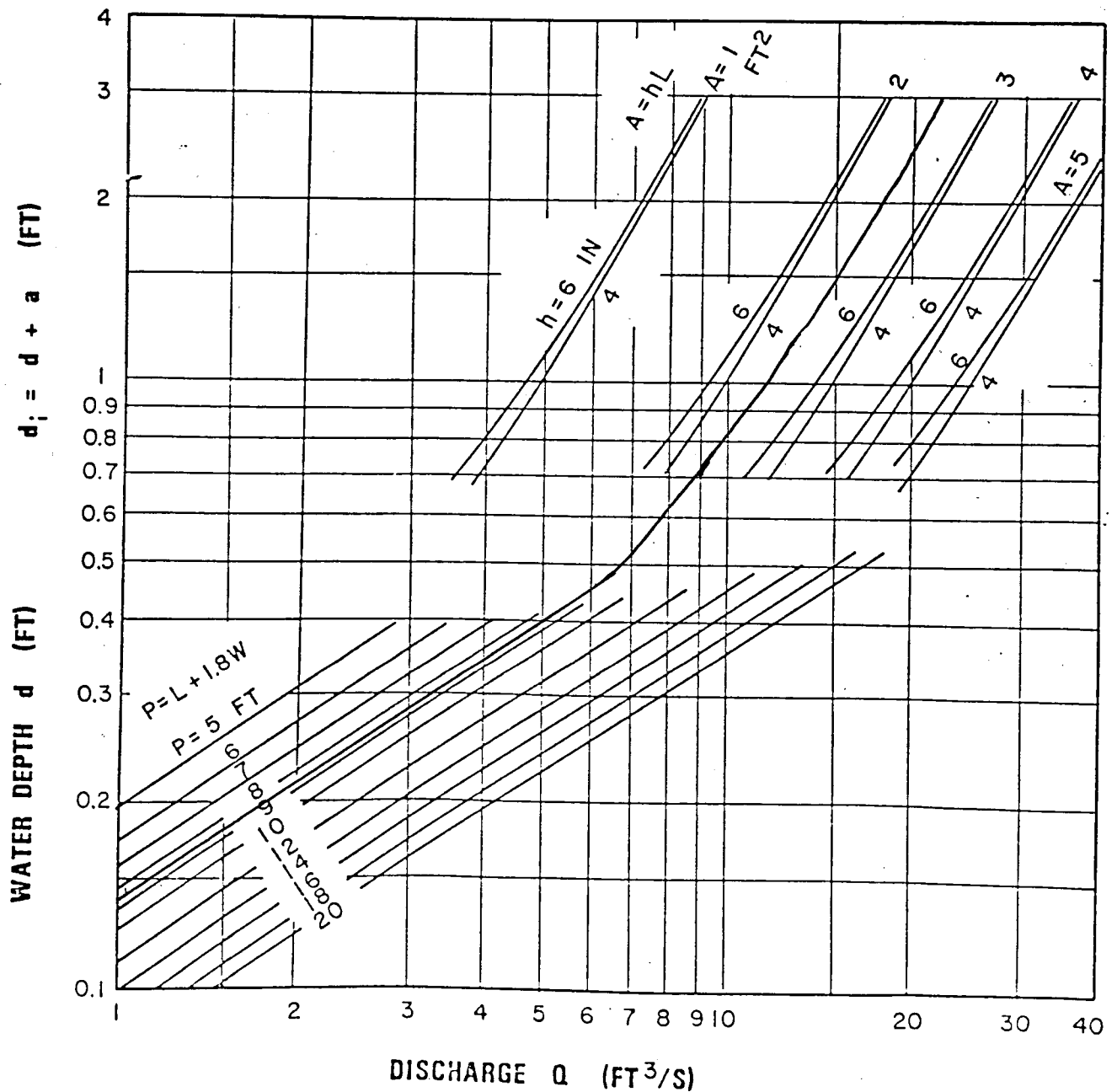
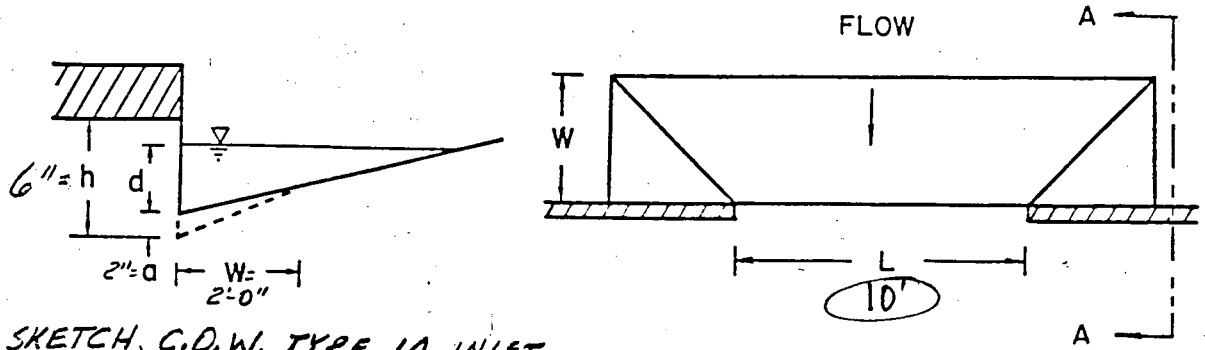


CHART 12. Depressed curb-opening inlet capacity in sump locations.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR, 1974



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

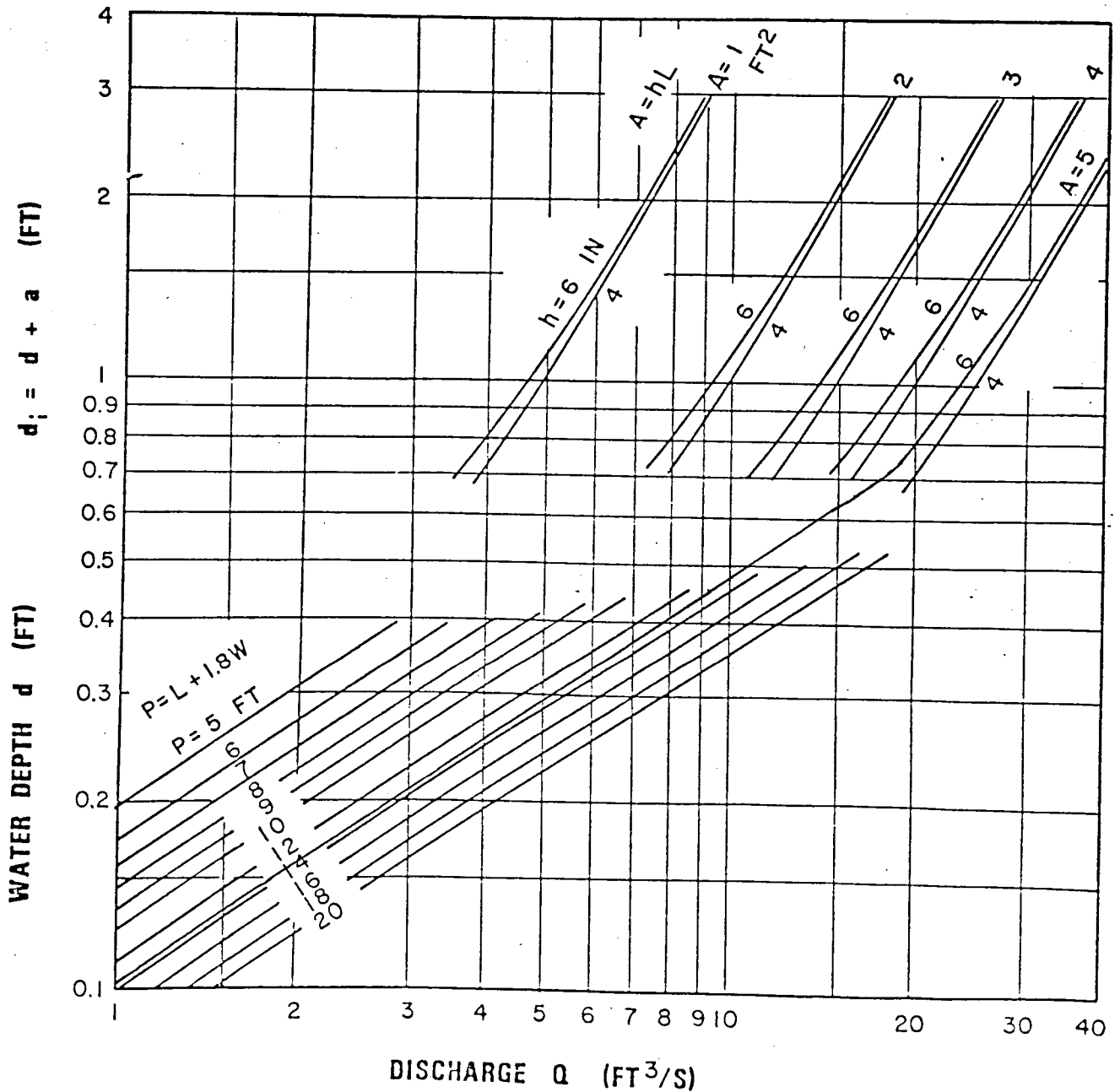
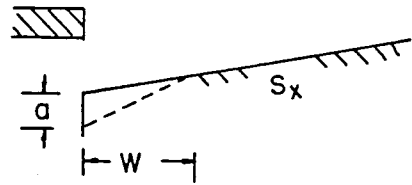


CHART 12. Depressed curb-opening inlet capacity in sump locations.

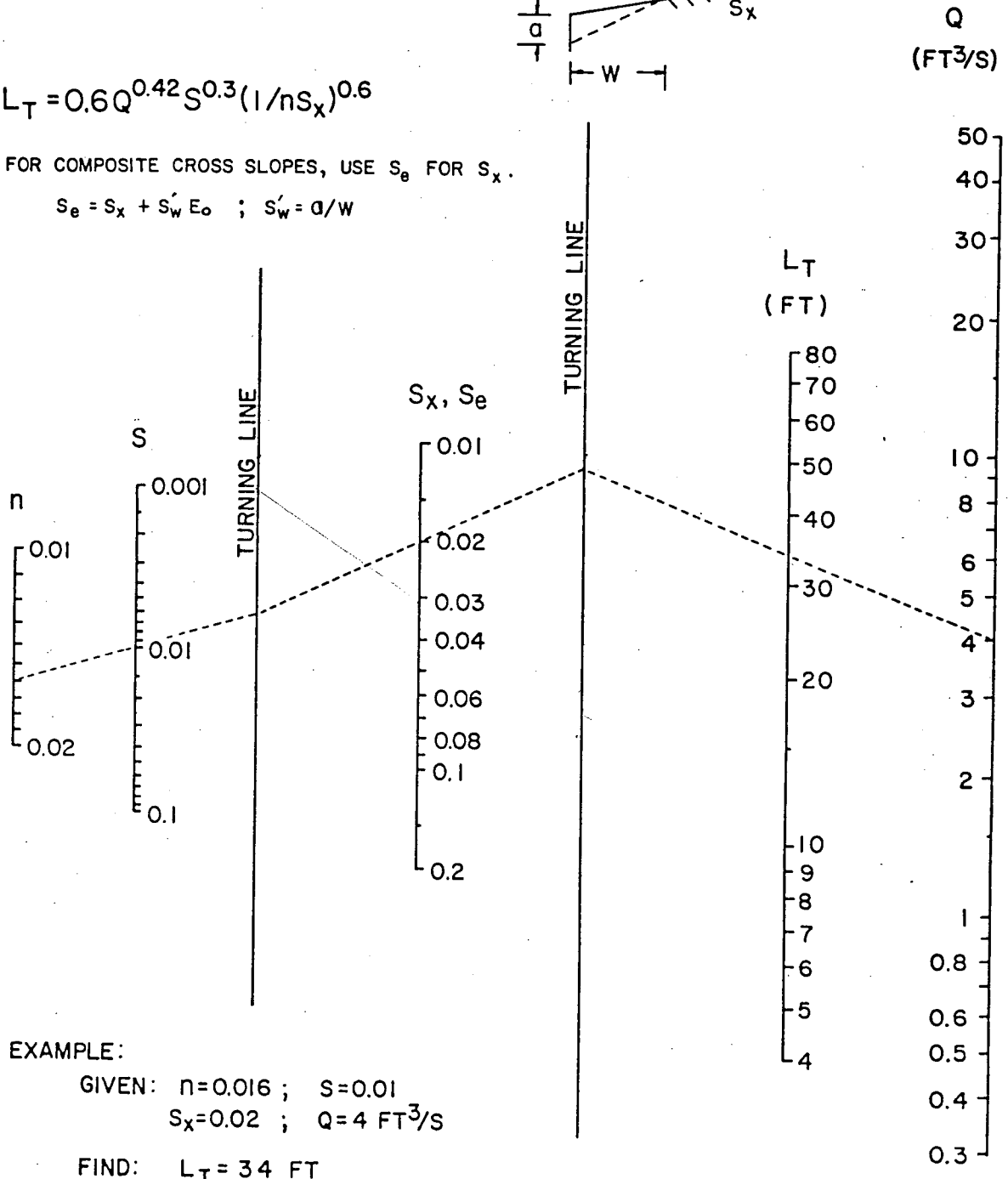
FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR., 1974



$$L_T = 0.6Q^{0.42} S^{0.3} (1/nS_x)^{0.6}$$

FOR COMPOSITE CROSS SLOPES, USE  $S_e$  FOR  $S_x$ .

$$S_e = S_x + S'_w E_o ; S'_w = a/W$$



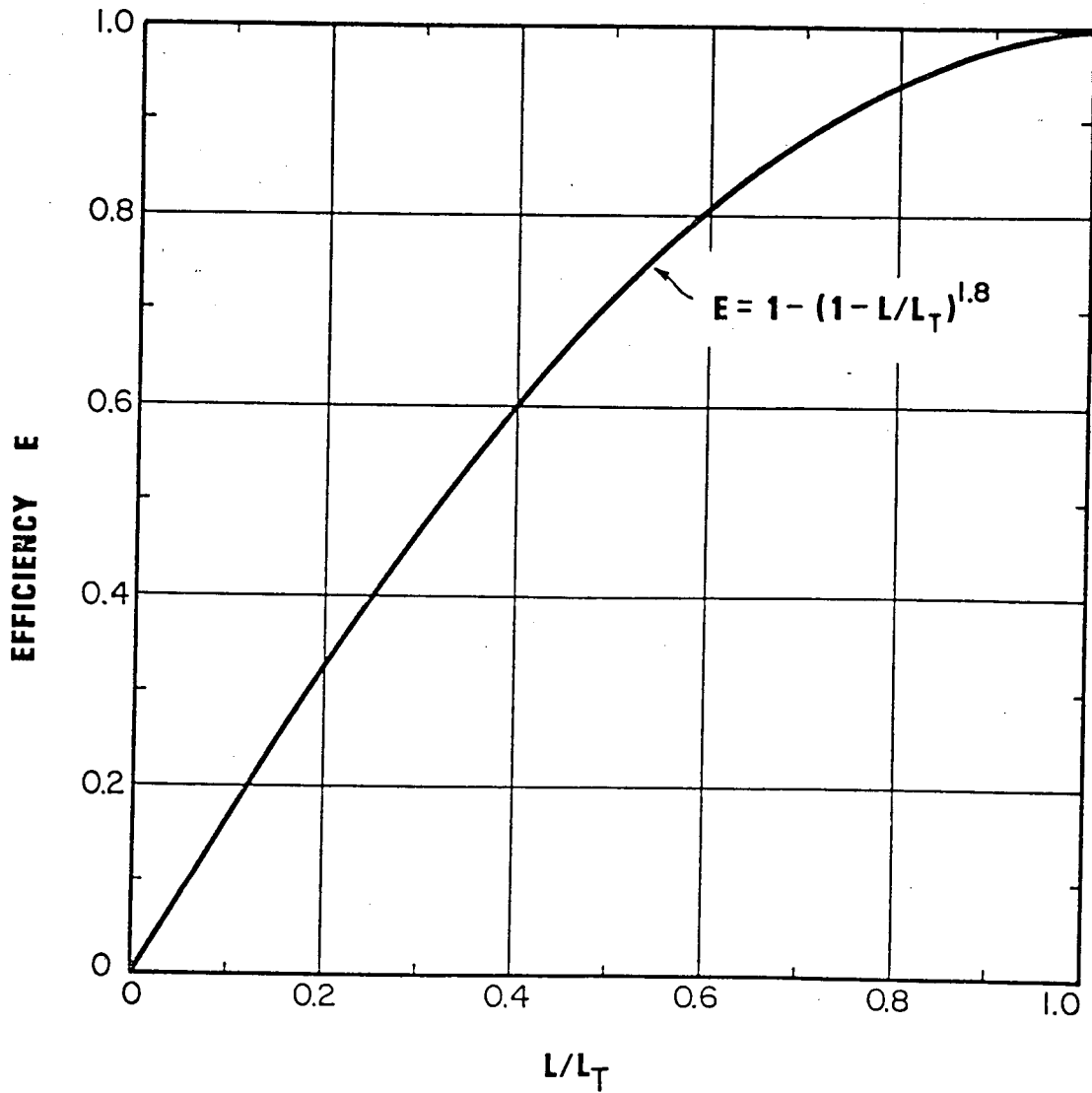
EXAMPLE:

GIVEN:  $n=0.016$  ;  $S=0.01$   
 $S_x=0.02$  ;  $Q=4 \text{ FT}^3/\text{S}$

FIND:  $L_T = 34 \text{ FT}$

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

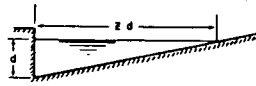
FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR. 1984.



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

*FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, FHWA, MAR. 1954*

Chart 1

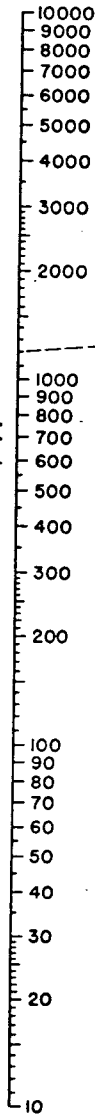


EQUATION:  $Q = 0.56 \left(\frac{z}{n}\right) z^{3/2} d^{5/2}$   
 $n$  IS ROUGHNESS COEFFICIENT IN MANNING  
 FORMULA APPROPRIATE TO MATERIAL IN  
 BOTTOM OF CHANNEL  
 $z$  IS RECIPROCAL OF CROSS SLOPE  
 REFERENCE: M. R. B. PROCEEDINGS 1948,  
 PAGE 150, EQUATION (14)

EXAMPLE (SEE INSTRUCTION 1)

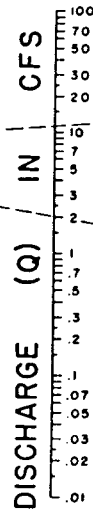
GIVEN:  $z = 0.03$   
 $z = 24$  }  $z/n = 1200$   
 $n = .02$  }  
 $Q = 20 \text{ CFS}$   
 FIND:  $d = 0.22$  BY FOLLOWING  
 DASHED LINES

RATIO  $z/n$

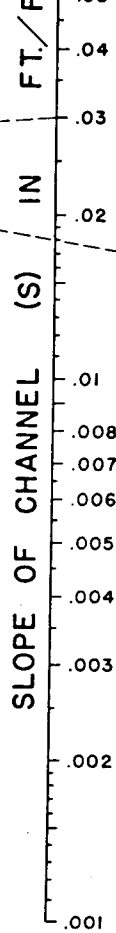


TURNING LINE

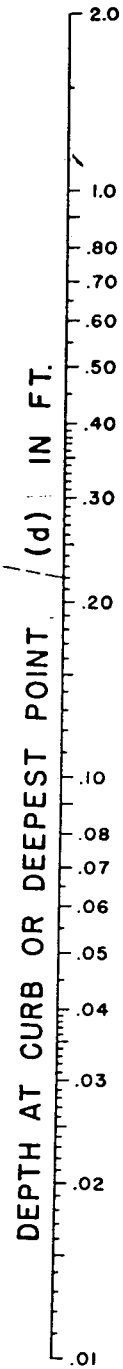
DISCHARGE (Q) IN CFS



SLOPE OF CHANNEL (S) IN FT./FT.



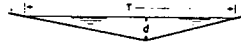
DEPTH AT CURB OR DEEPEST POINT (d) IN FT.



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  $Q_0$  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  $Q_0$  IN SECTION OF WIDTH  $d$  FOR DEPTH  $d' = d - \left(\frac{x}{z}\right)$  THEN  $Q_0 = Q - Q_0$ .



4. TO DETERMINE DISCHARGE ( $Q_0$ ) IN COMPOSITE SECTION: FOLLOW INSTRUCTION 3. TO OBTAIN DISCHARGE ( $Q_0$ ) IN SECTION  $a$  AT ASSUMED DEPTH  $d$  BASED ON AN EXTENSION OF SLOPE RATIO  $z_0$  TO INTERSECT WATER SURFACE; OBTAIN  $Q_0$  FOR SLOPE RATIO  $z_0$  AND DEPTH  $d'$ ;  $d' = d - \frac{x}{z_0}$  THEN  $Q_1 = Q_0 + Q_0$ .

