PROFESSIONAL
ENGINEERING
CONSULTANTS
PROFESSIONAL ASSOCIATION

DRAINAGE PLAN

AND

SUPPORTING CALCULATIONS

FOR

WOODBRIDGE 6TH ADDITION

TO WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

ENGINEERS

WICHITA, KANSAS

JUNE 4, 1992

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WICHITA, KANSAS 67202
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ZIP CODE / 67202

Date 6/4/92

Project Woodbridge 6th Addition

Item Drainage Plan

I. HYDROLOGY Use Rational Method $Q = CIA$

Determine "c"

Node	Soil Type	Hydrologic Group	Land Use	C_2	C_{100}
109	Va	B	Res; 1/8 Ac	0.52	0.67
108	Va	B	Res; 1/8 Ac.	0.52	0.67
107	Va	B	Res; 1/8 Ac.	0.52	0.67

Determine "I"

Assume t_c all nodes = 15 minutes

$\therefore$ I_2 = 3.83 I_{100} = 7.37

Determine "A"

Node	Plan Units	Area (SF)	Area (Ac)
109	17.19	171,900	3.95
108	9.18	91,800	2.11
107	2.16	21,600	0.50

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Determine "Q_2"

Node	C_2	I_2	A	Q_2
109	0.52	3.83	3.95	7.9
108	0.52	3.83	2.11	4.2
107	0.52	3.83	0.50	1.0

TOTAL Q_2 = 13.1 cfs

Compare to Q_2 designed for Node 107 in Woodbridge 3rd Drainage Plan (2/26/86) = 13.6 cfs

OK

Determine "Q_{100}"

Node	C_{100}	I_{100}	A	Q_{100}
109	0.67	7.37	3.95	19.5
108	0.67	7.37	2.11	10.4
107	0.67	7.37	0.50	2.5

TOTAL Q_{100} = 32.4 cfs

Compare to Q_{100} designed for Node 107 in Wood Bridge 3rd Drainage Plan (2/26/86) = 30.1 cfs.

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Project Woodbridge 6th Add.

Item Drainage Plan

II. INLET SIZING

Size inlets on Q_2

Node	Q_2	Q max 5'	Use
109	7.9	11.0	1 - 5' Curb Inlet
108	4.2	11.0	1 - 5' curb Inlet
107	1.0	N/A	Exist. 2'x4' Drop Inlet

III. STREET FLOW - 2 YR.

Node	Q_2	Distribution	st. slope	d	d max	Comment
109	7.9	60% (W) = 4.7	0.32 %	0.37'	0.55'	OK
		40% (N) = 2.2	0.40 %	0.26'	0.55'	OK
108	4.2	60% (W) = 2.5	0.32%			
		40% (N) = 1.7	0.40%			

IV. STREET FLOW - 100-YR.

Location	Contrib. Area	Q_{100}	Qpipe	Qstreet	street slope	Qmax	Comment
Approaching Nodes 109 & 108 from (W)	60% 109 =	11.7					
	60% 108 =	6.2					
		17.9	0.0	17.9	0.32%	43.7	OK Std Cb WR Gr = 0.3'
Approaching Nodes 109 & 108 from (N)	40% 109 =	7.8					
	40% 108 =	4.2					
		12.0	0.0	12.0	0.40%	48.9	OK "

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Project Woodbridge 6th

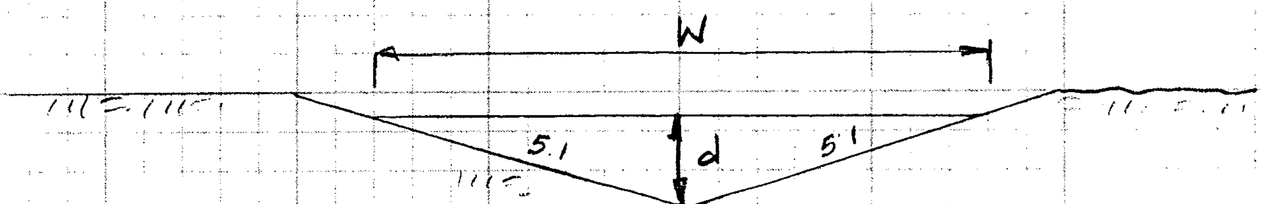
Item Drainage Plan

V OVERFLOW CHANNEL (Between Nodes 108 & 107)

Q_{100} = 19.5 (Node 109)
+ 10.4 (Node 108)
29.9 cfs

Q_2 = 7.9 (Node 109)
+ 4.2 (Node 108)
12.1

$Q_{overflow} = Q_{100} - Q_2$
= 29.9 - 12.1 = 17.8 cfs



CHANNEL SECTION:

USE Manning's Eq'n $Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$

$17.8 = \frac{1.486}{0.03} A R^{2/3} (0.01)^{1/2}$

$A R^{2/3} = 3.59$

d	A	P	R	$R^{2/3}$	$AR^{2/3}$
1.0	5.0	10.20	0.49	0.62	3.10
1.1	6.05	11.22	0.54	0.66	4.00

Use: d = 1.1' $V = Q/A = 17.8/6.05 = 2.94$ OK $W = 2 \times 1.1' \times 5 = 11'$ OK

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Project Woodbridge 6th
Item Drainage Plan

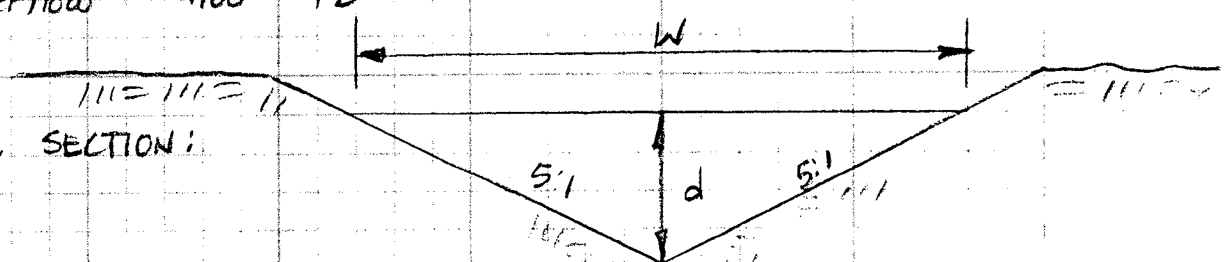
VI OVERFLOW CHANNEL (Between Node 107 & Inlet in Parkridge Court to East)

Q_{100} = 19.5 (Node 109)
10.4 (Node 108)
+ 2.5 (Node 107)
32.4 cfs

Q_2 = 7.9 (Node 109)
4.2 (Node 108)
+ 1.0 (Node 107)
13.1

$Q_{overflow} = Q_{100} - Q_2 = 32.4 - 13.1 = 19.3$ cfs

CHANNEL SECTION:



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

$19.3 = \frac{1.486}{0.03} A R^{2/3} (0.01)^{1/2}$

$A R^{2/3} = 3.89$

(See p. 4 d = 1.1' V = 2.94 fps OK w = 11' OK

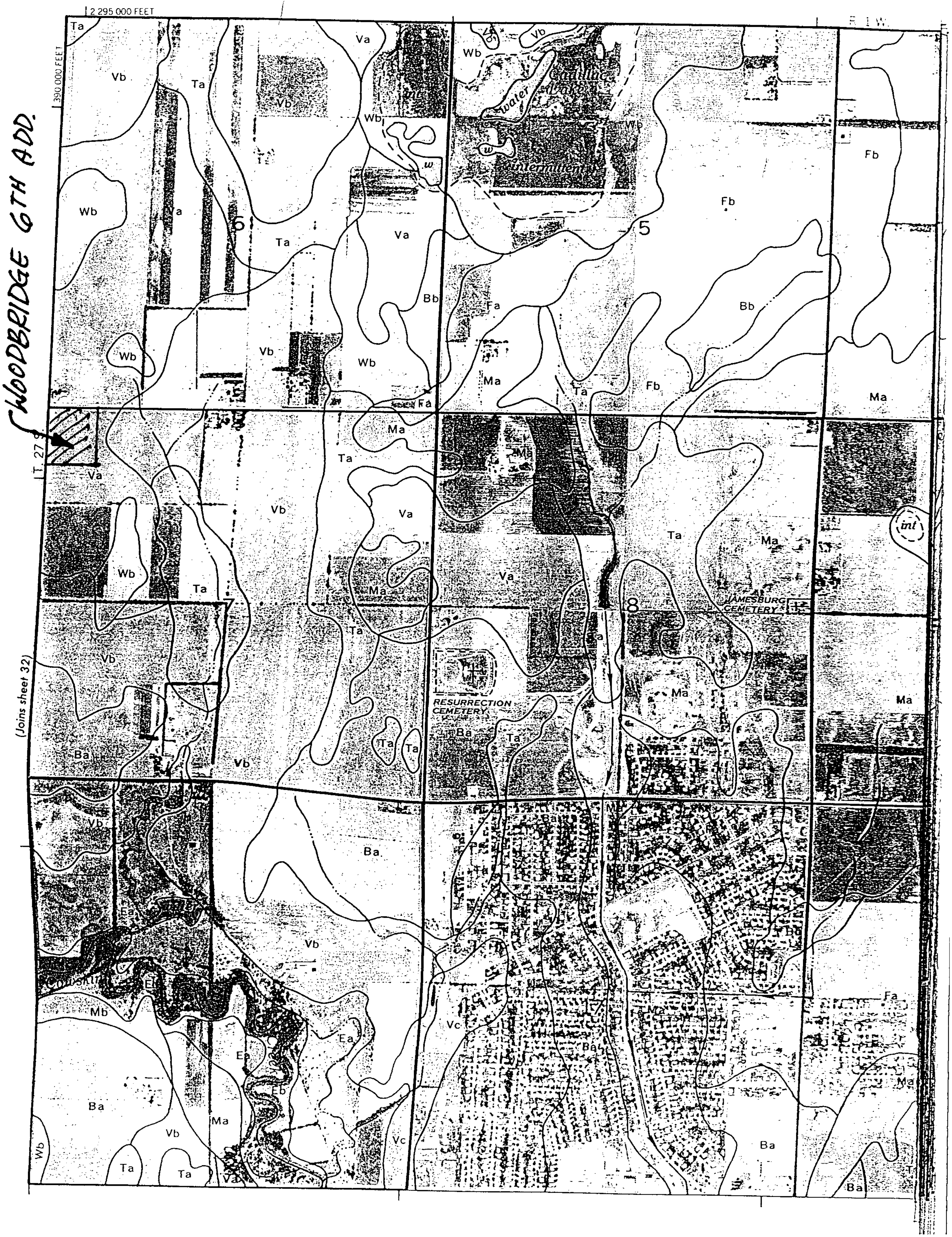

WOODBRIDGE 6TH ADD.
2 295 000 FEET
390 000 FEET
(Joins sheet 32)
Cadillac Lake
water
intermittent
RESURRECTION CEMETERY
JAMESBURG CEMETERY
int
6
5
7
8
17
Ta
Va
Vb
Wb
Fb
Bb
Fa
Ma
Ba
Vc
Ea
Eb
Mb

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

(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

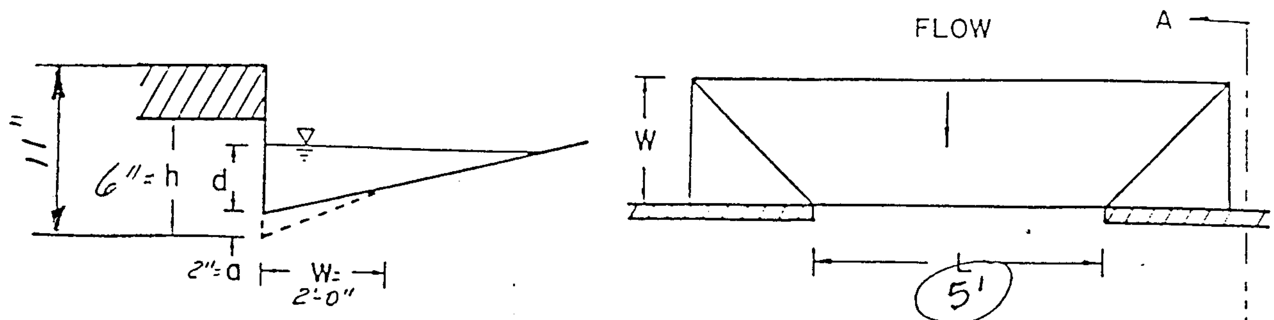
ATTACHMENT A
DRAINAGE CRITERIA MANUAL

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

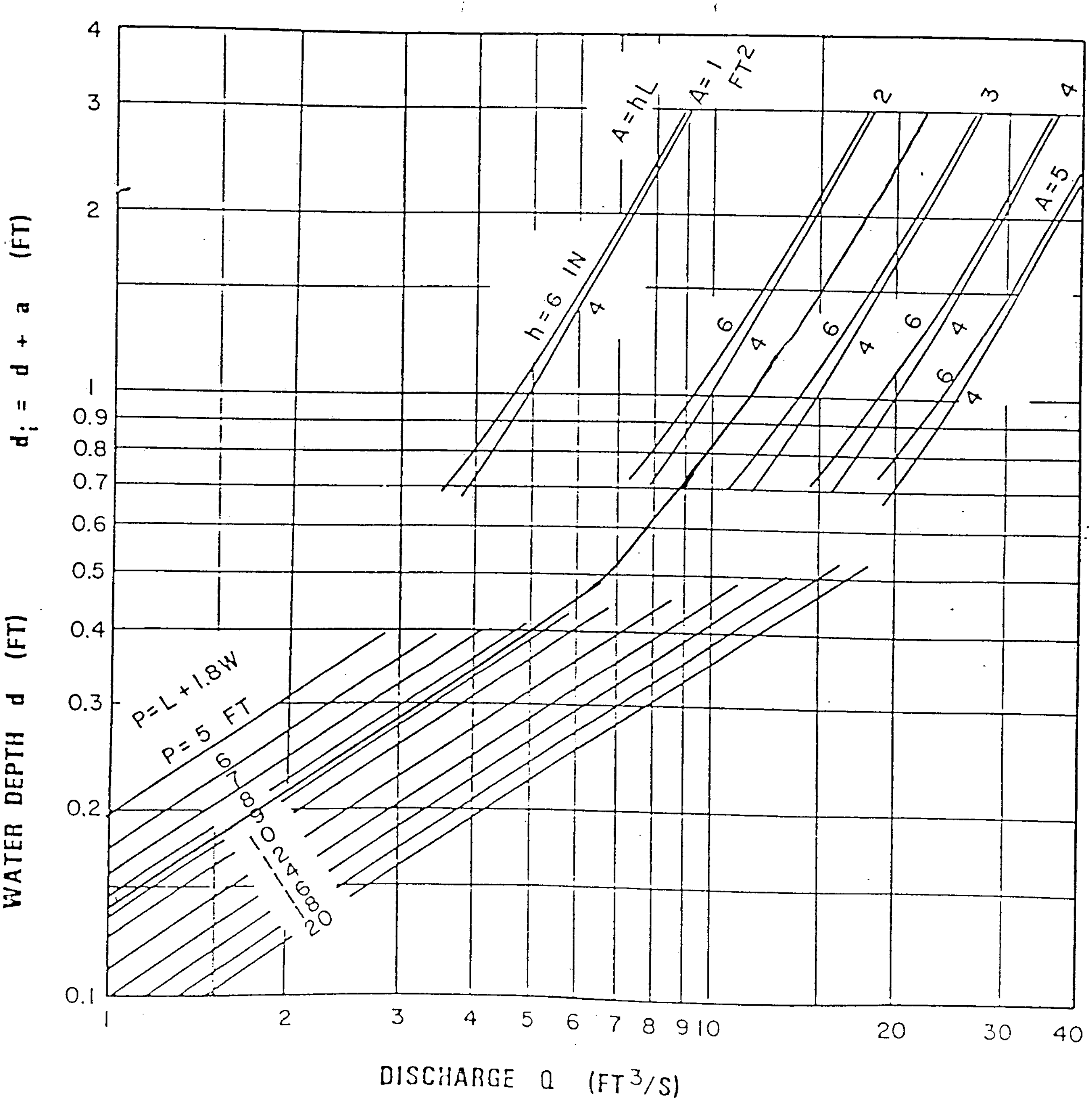
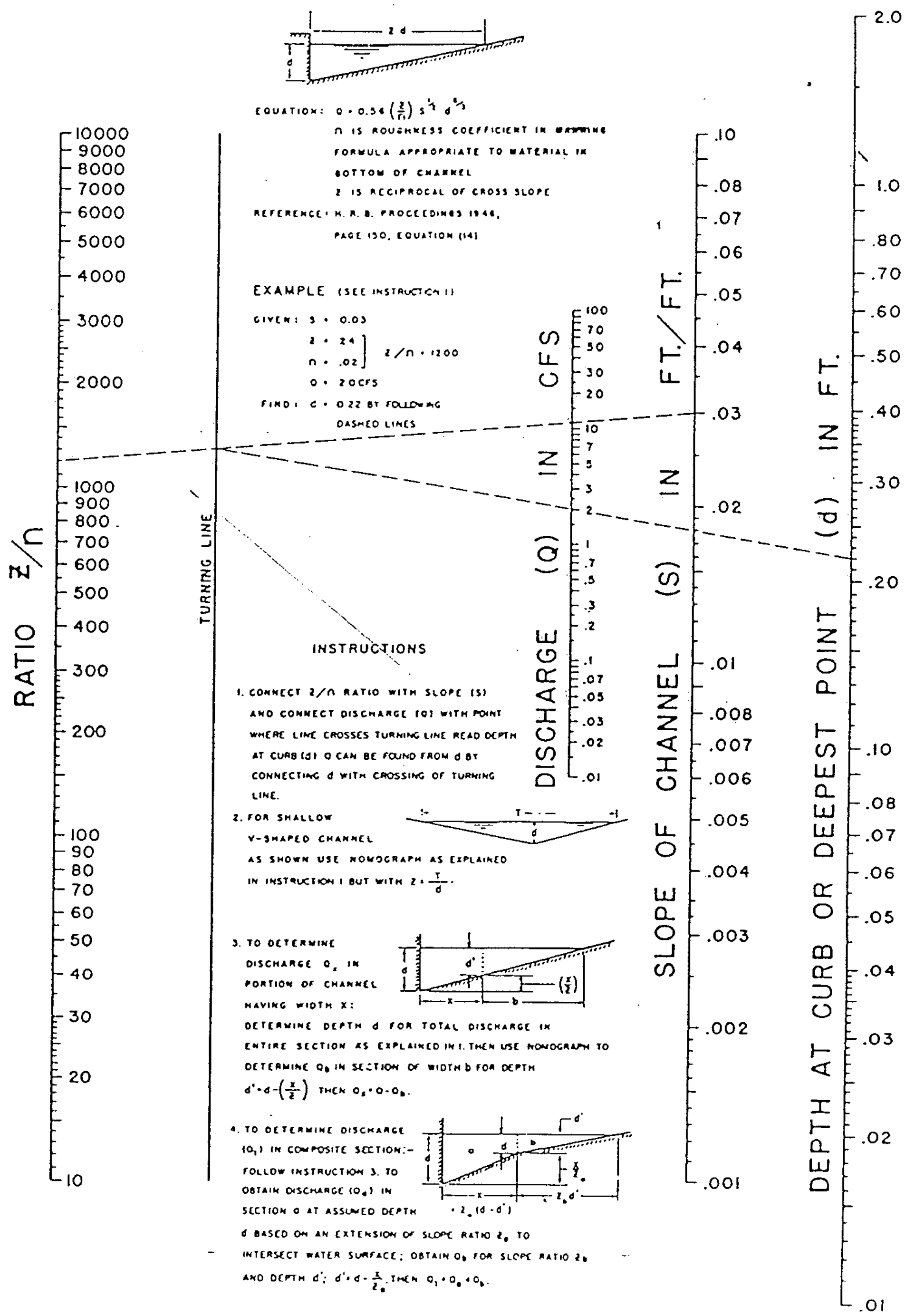


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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

Chart 1



BUREAU OF PUBLIC ROADS
REV. JAN. 1968

NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS

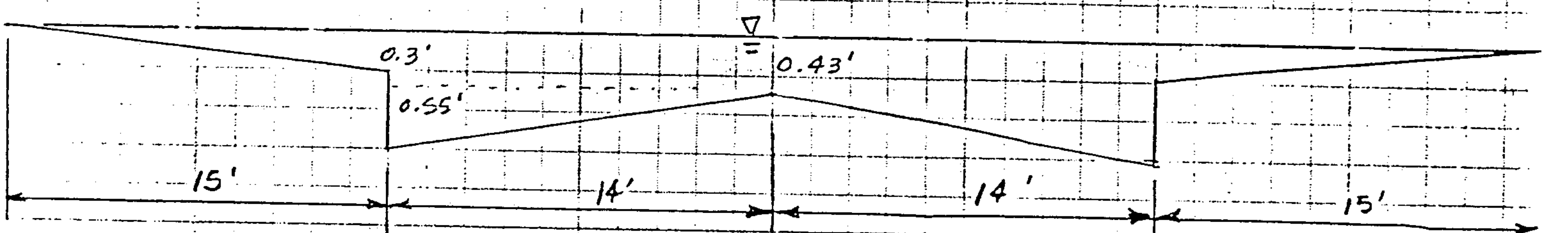
Date ______ Page ______ of ______

Project: Woodbridge 6th Add.

Item: Drainage Plan

Determine Capacities of Standard Curb Streets w/ Various Walk Grades for 100-year storm analysis (58' R-O-W)

0.3' WALK GRADE



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

$$= \frac{(0.87) + (0.0793) + (0.384)}{59.1} = \frac{1.3333}{59.1} = 0.0226$$

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

$= (4.5) + (12.04) + (5.88)$

$= 22.42$

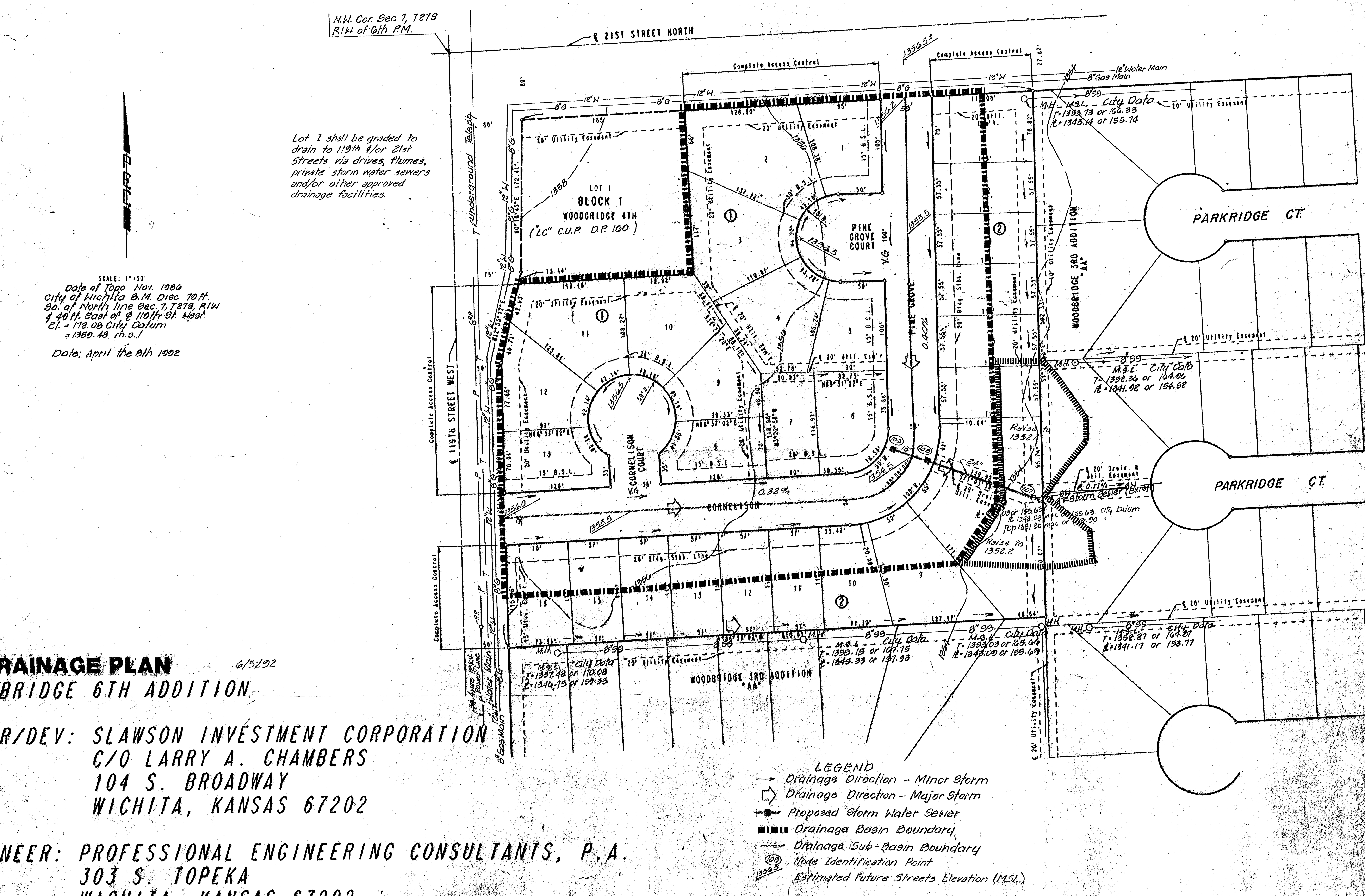
$p = 59.1$

$R = A/p = 22.42/59.1 = 0.379357$ $R^{2/3} = 0.52404$

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

$$Q = \frac{1.486}{0.0226} \times 22.42 \times 0.52404 \times s^{1/2}$$

$$Q = 772.5 \sqrt{s}$$



DRAINAGE PLAN 6/5/92

WOODBRIDGE 6TH ADDITION

OWNER/DEV: SLAWSON INVESTMENT CORPORATION
C/O LARRY A. CHAMBERS
104 S. BROADWAY
WICHITA, KANSAS 67202

ENGINEER: PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
303 S. TOPEKA
WICHITA, KANSAS 67202