

PROFESSIONAL
ENGINEERING
CONSULTANTS
PROFESSIONAL ASSOCIATION

DRAINAGE PLAN
AND
SUPPORTING CALCULATIONS

FOR
WOODBIDGE 5TH ADDITION
TO WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY

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

MAY 1, 1987



Date April 24, 1987 Page 1 of 23

Project Woodbridge 5th Addition

Item Drainage Plan System 200

INTRODUCTION:

Woodbridge Fifth Addition is a replat of a portion of Echo Hill 2nd Addition.

Drainage Plan + Supporting Calculations were done originally for Echo Hills 2nd. Storm Sewer System 200 was changed in concept in conjunction with Woodbridge 3rd Preliminary Plat.



HYDROLOGY

Use Rational Method $Q = cIA$

Assume $t_c = 15$ minutes all subbasins

Determine "c"

Soil Types

Hyd. Group

T_a

B

W_b

B

T_a

D

Since dividing line between soils groups coincides with sub-basin boundaries, use the following values for "c" :

Node 214 Manhole
 Nodes 213 - 205 "B" Soils $\frac{1}{8}$ Acre Lots $c_2 = 0.52$

$c_{100} = 0.67$

Nodes 204 - 202 "D" Soils $\frac{1}{8}$ Acre Lots $c_2 = 0.57$

$c_{100} = 0.79$

Node 201 Manhole
 Node 200 End Section



Date April 24, 1987 Page 3 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Determine "I"

with $t_c = 15$ minutes for all nodes, use the following "I" values

$$I_2 \text{ (all nodes)} = 3.83$$

$$I_{100} \text{ (all nodes)} = 7.37$$



Date April 24, 1987 Page 4 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Determine "A" (Acreage) of each sub-basin:

<u>Node</u>	<u>Units</u>	<u>Area (SF)</u>	<u>Area (Acres)</u>
214	(Manhole)		
213	2355	376,800	8.65
212	294	47,040	1.08
211	668	106,880	2.45
210	210	33,600	0.77
209	112	17,920	0.41
208	930	148,800	3.42
207	427	68,320	1.57
206	317	50,720	1.16
205	301	48,160	1.11
204	345	55,280	1.27
203	212	33,970	0.78
202	398	63,680	1.46
201	(Man hole)		
200	(End Section)		



Date April 24, 1987 Page 5 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Determine Runoff Q - 2yr storm

$$Q_2 = C_2 \times I_2 \times A$$

<u>Node</u>	<u>"C₂"</u>	<u>I₂</u>	<u>A</u>	<u>Q₂</u>
214	Manhole			
213	0.52	3.83	8.65	17.2
212	0.52	3.83	1.08	2.2
211	0.52	3.83	2.45	4.9
210	0.52	3.83	0.77	1.5
209	0.52	3.83	0.41	0.8
208	0.52	3.83	3.42	6.8
207	0.52	3.83	1.57	3.1
206	0.52	3.83	1.16	2.3
205	0.52	3.83	1.11	2.2
204	0.57	3.83	1.27	2.8
203	0.57	3.83	0.78	1.7
202	0.57	3.83	1.46	3.2
201	(Manhole)			
200	(End Section)			



Date April 24, 1987 Page 6 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

FLOOD ROUTING / INLET SIZING

<u>Node</u>	<u>Inlet Conditions</u>	<u>L</u>	<u>Q_{approach}*</u>	<u>Q_{intercept}†</u>	<u>Q_{bypass}</u>	<u>to</u>
213	On Grade	10'	17.2	36% = 6.2	11.0	211
212	On Grade	5'	2.2	40% = 0.9	1.3	210
211	Sump	10'	4.9 + 11.0 = 15.9	15.9	-	-
210	On Grade	5'	1.5 + 1.3 = 2.8	38% = 1.1	1.7	209
209	Sump	5'	0.8 + 1.1 = 1.9	1.9	-	-
208	Sump	5'	6.8	6.8	-	-
207	Sump	5'	3.1	3.1	-	-
206	Sump	5'	2.3	2.3	-	-
205	Sump	5'	2.2	2.2	-	-
204	Sump	5'	2.8	2.8	-	-
203	Sump	5'	1.7	1.7	-	-
202	Sump	5'	3.2	3.2	-	-
201	(Manhole)					
200	(End Section)					

* $Q_{approach} = Q_2 + Q_{bypass}$

† $Q_{intercept} = \text{Input } Q \text{ for "Storm" program}$

7/23

Date: 04-30-1987
Time: 14:27:34

Input File: wood5

woodbridge 5th addition
drainage plan
storm water sewer system 200 analysis

Storm Frequency = 2-Year

*** HYDROLOGY ***

		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)						
213	212	0.52	8.65	0.00	0.0	15.00	4.06	6.20	15.00	4.06	6.20	6.20	15"	5.05	40.00	0.13	15.13				
212	210	0.52	1.08	0.00	0.0	15.00	4.06	0.90	15.13	4.04	0.90	7.10	18"	4.02	220.00	0.91	16.04				
211	210	0.52	2.45	0.00	0.0	15.00	4.06	15.90	15.00	4.06	15.90	15.90	24"	5.06	40.00	0.13	15.13				
210	208	0.52	0.77	0.00	0.0	15.00	4.06	1.10	16.04	3.95	1.07	23.71	30"	4.83	170.00	0.59	16.63				
209	208	0.52	0.41	0.00	0.0	15.00	4.06	1.90	15.00	4.06	1.90	1.90	15"	1.55	70.00	0.75	15.75				
208	207	0.52	3.42	0.00	0.0	15.00	4.06	6.80	16.63	3.90	6.53	32.10	36"	4.54	200.00	0.73	17.37				
207	205	0.52	1.57	0.00	0.0	15.00	4.06	3.10	17.37	3.83	2.93	35.03	36"	4.96	80.00	0.27	17.63				
206	205	0.52	1.16	0.00	0.0	15.00	4.06	2.30	15.00	4.06	2.30	2.30	15"	1.87	40.00	0.36	15.36				
205	214	0.52	1.11	0.00	0.0	15.00	4.06	2.20	17.63	3.81	2.07	39.27	36"	5.56	270.00	0.81	18.44				
203	214	0.57	0.78	0.00	0.0	15.00	4.06	1.70	15.00	4.06	1.70	1.70	15"	1.39	50.00	0.60	15.60				
204	202	0.57	1.27	0.00	0.0	15.00	4.06	2.80	15.00	4.06	2.80	2.80	15"	2.28	40.00	0.29	15.29				
202	214	0.57	1.46	0.00	0.0	15.00	4.06	3.20	15.29	4.03	3.18	5.98	18"	3.38	90.00	0.44	15.74				
214	201	0.00	0.00	0.00	0.0	0.00	0.00	0.00	18.44	3.74	0.00	46.48	42"	4.83	180.00	0.62	19.07				
201	200	0.00	0.00	0.00	0.0	0.00	0.00	0.00	19.07	3.70	0.00	46.48	42"	4.83	50.00	0.17	19.24				

8/23

Date: 04-30-1987
Time: 14:27:34

Input File: wood5

woodbridge 5th addition
drainage plan
storm water sewer system 200 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)
213	0.00921	0.3685	0.0000	0.0000	0.0000	0.0000	0.0000	0.3685	160.8171	162.7000	1.88
214	0.00213	0.3942	0.0000	0.0234	0.0000	0.0000	0.0334	0.4410	156.2339	159.2000	2.97
212	0.00456	1.0042	0.0000	0.0292	0.0000	0.1982	-0.0241	1.2074	160.4486	162.7000	2.25
211	0.00494	0.1976	0.0000	0.0000	0.0000	0.0000	0.0000	0.1976	159.4388	161.1000	1.66
210	0.00334	0.5680	0.0000	0.0071	0.0000	0.1471	0.0769	0.7991	159.2412	161.1000	1.86
209	0.00087	0.0606	0.0000	0.0000	0.0000	0.0000	0.0000	0.0606	158.5027	159.9000	1.40
208	0.00232	0.4633	0.0000	0.0084	0.0000	0.0485	0.1634	0.6835	158.4421	159.9000	1.46
207	0.00276	0.2207	0.0000	0.0061	0.0000	0.0050	0.1351	0.3668	157.7586	159.7000	1.94
206	0.00127	0.0507	0.0000	0.0000	0.0000	0.0000	0.0000	0.0507	157.4425	159.5000	2.06
205	0.00347	0.9361	0.0000	0.0098	0.0000	0.0000	0.2120	1.1579	157.3918	159.5000	2.11
204	0.00188	0.0752	0.0000	0.0000	0.0000	0.0000	0.0000	0.0752	156.9504	159.1000	2.15
203	0.00069	0.0346	0.0000	0.0000	0.0000	0.0000	0.0000	0.0346	156.2685	159.3000	3.03
202	0.00324	0.2913	0.0000	0.0097	0.0000	0.0404	0.3000	0.6414	156.8753	159.1000	2.22
201	0.00213	0.1067	0.0000	0.0000	0.0181	0.1573	0.0107	0.2929	155.7929	159.6000	3.81
200	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	155.5000	155.5000	0.00

9/23

100 j, 155.5000 200 3 15 14

110 t, woodbridge 5th addition

120 t, drainage plan

130 t, storm water sewer system 200 analysis

140 i, 213 0.52 8.65 0.00 0.00 6.20 15.00 162.70

150 m, 214 159.20

160 i, 212 0.52 1.08 0.00 0.00 0.90 15.00 162.70

170 i, 211 0.52 2.45 0.00 0.00 15.90 15.00 161.10

180 i, 210 0.52 0.77 0.00 0.00 1.10 15.00 161.10

190 i, 209 0.52 0.41 0.00 0.00 1.90 15.00 159.90

200 i, 208 0.52 3.42 0.00 0.00 6.80 15.00 159.90

210 i, 207 0.52 1.57 0.00 0.00 3.10 15.00 159.70

220 i, 206 0.52 1.16 0.00 0.00 2.30 15.00 159.50

230 i, 205 0.52 1.11 0.00 0.00 2.20 15.00 159.50

240 i, 204 0.57 1.27 0.00 0.00 2.80 15.00 159.10

250 i, 203 0.57 0.78 0.00 0.00 1.70 15.00 159.30

260 i, 202 0.57 1.46 0.00 0.00 3.20 15.00 159.10

270 m, 201 159.60

280 m, 200 155.50

290 p, 213 212 40.00 15 0.013 90.00 0.00

300 p, 212 210 220.00 18 0.013 20.00 0.00

310 p, 211 210 40.00 24 0.013 70.00 0.00

320 p, 210 208 170.00 30 0.013 30.00 0.00

330 p, 209 208 70.00 15 0.013 30.00 0.00

340 p, 208 207 200.00 36 0.013 5.00 0.00

350 p, 207 205 80.00 36 0.013 0.00 0.00

360 p, 206 205 40.00 15 0.013 90.00 0.00

370 p, 205 214 270.00 36 0.013 0.00 0.00

380 p, 203 214 50.00 15 0.013 60.00 0.00

390 p, 204 202 40.00 15 0.013 90.00 0.00

400 p, 202 214 90.00 18 0.013 90.00 0.00

410 p, 214 201 180.00 42 0.013 80.00 0.00

420 p, 201 200 50.00 42 0.013 0.00 0.00

430 e



Date 4.27.87 Page 10 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Check Street Flow - 2 yr.

<u>Node</u>	<u>Approach</u>	<u>Distribution</u>	<u>street slope</u>	<u>d</u>	<u>d_{max}</u>	<u>Comment</u>
213	17.2	100% (W) = 17.2	0.74%	0.53'	0.55'	OK
212	2.2	100% (W) = 2.2	0.74	0.24'	0.55'	OK
211	4.9 + 11.0 = 15.9	11.0 + 30% (W) = 12.5 70% (S) = 3.4	0.74 0.60	0.46' 0.30'	0.55' 0.30'	OK OK
210	1.5 + 1.3 = 2.8	100% (W) = 2.8	0.74	0.27'	0.55'	OK
209	0.8 + 1.1 = 1.9	1.1 + 50% (NW) = 1.5 50% (SW) = 0.4	0.78 0.74	0.21' 0.13'	0.55' 0.55'	OK OK
208	6.8	100% (SW) = 6.8	0.74	0.37'	0.55'	OK
207	3.1	10% (N) = 0.3 90% (S) = 2.8	0.32 0.32	0.13 0.32	0.55' 0.55'	OK OK
206	2.3	25% (E) = 0.6 75% (W) = 1.7	0.32 0.32	0.18 0.32	0.55' 0.55'	OK OK
205	2.2	25% (E) = 0.6 75% (S) = 1.6	0.32 0.32	0.18 0.25	0.55' 0.55'	OK OK
204	2.8	30% (W) = 0.8 70% (S) = 2.0	0.32 0.32	0.20 0.28	0.55' 0.55'	OK OK
203	1.7	50% (E) = 0.8 50% (W) = 0.9	0.32 0.32	0.20 0.21	0.55' 0.55'	OK OK
202	3.2	30% (N) = 1.0 70% (S) = 2.2	0.32 0.32	0.22 0.29	0.55' 0.55'	OK OK



Date 4.27.87 Page 11 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Determine Runoff Q - 100 yr. storm

$$Q_{100} = C_{100} I_{100} A$$

<u>Node</u>	<u>C₁₀₀</u>	<u>I₁₀₀</u>	<u>A</u>	<u>Q₁₀₀</u>
213	0.67	7.37	8.65	42.7
212	0.67	7.37	1.08	5.6
211	0.67	7.37	2.45	12.1
210	0.67	7.37	0.77	3.8
209	0.67	7.37	0.41	2.0
208	0.67	7.37	3.42	16.9
207	0.67	7.37	1.57	7.8
206	0.67	7.37	1.16	5.7
205	0.67	7.37	1.11	5.5
204	0.79	7.37	1.27	7.4
203	0.79	7.37	0.78	4.5
202	0.79	7.37	1.46	8.5
201	(Manhole)			
200	(End Section)			

12/23

Date: 04-30-1987

Time: 17:00:45

Input File: wood5-100

woodbridge 5th addition
drainage plan
storm water sewer system 200 analysis

Storm Frequency = 100-Year

* * * HYDROLOGY * * *

		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)	
213	212	0.67	8.65	0.00	0.0	15.00	8.97	42.70	15.00	8.97	42.70	42.70	15"	34.80	40.00	0.02	15.02
212	210	0.67	1.08	0.00	0.0	15.00	8.97	5.60	15.02	8.97	5.60	48.30	18"	27.33	220.00	0.13	15.15
211	210	0.67	2.45	0.00	0.0	15.00	8.97	12.10	15.00	8.97	12.10	12.10	24"	3.85	40.00	0.17	15.17
210	208	0.67	0.77	0.00	0.0	15.00	8.97	3.80	15.15	8.94	3.78	64.17	30"	13.07	170.00	0.22	15.37
209	208	0.67	0.41	0.00	0.0	15.00	8.97	2.00	15.00	8.97	2.00	2.00	15"	1.63	70.00	0.72	15.72
208	207	0.67	3.42	0.00	0.0	15.00	8.97	16.90	15.37	8.89	16.74	82.86	36"	11.72	200.00	0.28	15.65
207	205	0.67	1.57	0.00	0.0	15.00	8.97	7.80	15.65	8.82	7.67	90.53	36"	12.81	80.00	0.10	15.76
206	205	0.67	1.16	0.00	0.0	15.00	8.97	5.70	15.00	8.97	5.70	5.70	15"	4.64	40.00	0.14	15.14
205	214	0.67	1.11	0.00	0.0	15.00	8.97	5.50	15.76	8.80	5.40	101.54	36"	14.37	270.00	0.31	16.07
203	214	0.79	0.78	0.00	0.0	15.00	8.97	4.50	15.00	8.97	4.50	4.50	15"	3.67	50.00	0.23	15.23
204	202	0.79	1.27	0.00	0.0	15.00	8.97	7.40	15.00	8.97	7.40	7.40	15"	6.03	40.00	0.11	15.11
202	214	0.79	1.46	0.00	0.0	15.00	8.97	8.50	15.11	8.95	8.48	15.88	18"	8.98	90.00	0.17	15.28
214	201	0.00	0.00	0.00	0.0	0.00	0.00	0.00	16.07	8.73	0.00	121.51	42"	12.63	180.00	0.24	16.31
201	200	0.00	0.00	0.00	0.0	0.00	0.00	0.00	16.31	8.68	0.00	121.51	42"	12.63	50.00	0.07	16.38

13/23

Date: 04-30-1987
Time: 17:00:45

Input File: wood5-100

woodbridge 5th addition
drainage plan
storm water sewer system 200 analysis

Storm Frequency = 100-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)
213	0.43694	17.4775	0.0000	0.0000	0.0000	0.0000	0.0000	17.4775	251.0106	162.7000	-88.31
214	0.01459	2.6256	0.0000	0.1455	0.0000	0.0000	0.3472	3.1183	160.6198	159.2000	-1.42
212	0.21140	46.5082	0.0000	1.4402	0.0000	9.3998	-1.8207	55.5275	233.5332	162.7000	-70.83
211	0.00286	0.1144	0.0000	0.0000	0.0000	0.0000	0.0000	0.1144	178.1201	161.1000	-17.02
210	0.02447	4.1604	0.0000	1.7891	0.0000	0.9540	-4.0430	2.8604	178.0057	161.1000	-16.91
209	0.00096	0.0671	0.0000	0.0000	0.0000	0.0000	0.0000	0.0671	175.2124	159.9000	-15.31
208	0.01543	3.0868	0.0000	0.1039	0.0000	0.3550	0.7741	4.3198	175.1453	159.9000	-15.25
207	0.01842	1.4739	0.0000	0.0413	0.0000	0.0333	0.9130	2.4616	170.8254	159.7000	-11.13
206	0.00779	0.3114	0.0000	0.0000	0.0000	0.0000	0.0000	0.3114	168.6753	159.5000	-9.18
205	0.02318	6.2577	0.0000	0.0657	0.0000	0.0000	1.4206	7.7441	168.3639	159.5000	-8.86
204	0.01312	0.5249	0.0000	0.0000	0.0000	0.0000	0.0000	0.5249	165.6782	159.1000	-6.58
203	0.00485	0.2426	0.0000	0.0000	0.0000	0.0000	0.0000	0.2426	160.8624	159.3000	-1.56
202	0.02284	2.0557	0.0000	0.0699	0.0000	0.2823	2.1266	4.5335	165.1533	159.1000	-6.05
201	0.01459	0.7293	0.0000	0.0000	0.1238	1.0752	0.0731	2.0014	157.5014	159.6000	2.10
200	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	155.5000	155.5000	0.00



Date 4.30.87 Page 14 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Check 100 Yr Street Flow

Check Flow Approaching Nodes 213-212

Contributing Areas	Q_{100}	ΣQ_{100}
213	42.7	
212	5.6	
		<u>48.3</u>

$$Q_{\text{pipe}} = 0$$

$$\begin{aligned} Q_{\text{street}} &= Q_{100} - Q_{\text{pipe}} \\ &= 48.3 - 0.0 \\ &= 48.3 \text{ cfs} \end{aligned}$$

$$\text{Street Slope} = 0.74\%$$

$$\begin{aligned} \text{Allowable } Q &= 882.3 \sqrt{S} \quad (\text{walk grade} = +0.3') \\ &= 882.3 \sqrt{0.0074} \\ &= 75.9 \text{ cfs} \end{aligned}$$

$$\text{Actual } Q_{\text{street}} < Q_{\text{allowable}}$$

Street Flow OK



Date 5.1.87 Page 15 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Check street Flow Approaching Nodes 211-210

Contributing Areas Q_{100} ΣQ_{100}

Node 213 42.7

212 5.6

211 12.1

210 3.8

64.2 cfs

$$Q_{\text{pipe}} (212-210) = 7.1$$

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

$$= 64.2 - 7.1$$

$$= 57.1 \text{ cfs}$$

$$\text{street slope} = 0.74\%$$

$$\text{Allowable } Q = 882.3 \sqrt{S'} \quad (\text{walk grade} = +0.3')$$

$$= 882.3 \sqrt{0.0074}$$

$$= 75.9 \text{ cfs}$$

Actual $Q_{\text{street}} < Q_{\text{allowable}}$

Street Flow OK



Date 5.1.87 Page 16 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Check Street Flow Approaching Nodes 209-208

<u>Contributing Areas</u>	<u>Q₁₀₀</u>	<u>Σ Q₁₀₀</u>
Node 213	42.7	
212	5.6	
211	12.1	
210	3.8	
50% 209	1.0	
208	16.9	
		<u>82.1</u>

$$Q_{\text{pipe (210-208)}} = 23.7$$

$$\begin{aligned} Q_{\text{street}} &= Q_{100} - Q_{\text{pipe}} \\ &= 82.1 - 23.7 \\ &= 58.4 \text{ cfs} \end{aligned}$$

$$\begin{aligned} \text{Street Slope} &= 0.74\% \\ Q_{\text{allowable}} &= 882.3 \sqrt{S} \quad (\text{walk grade} = +0.3') \\ &= 882.3 \sqrt{0.0074} \\ &= 75.9 \text{ cfs} \end{aligned}$$

Actual $Q_{\text{street}} < Q_{\text{allowable}}$

Street Flow OK



Date 5.1-87 Page 17 of 23
 Project Woodbridge 5th Addition
 Item Drainage Plan

Check Street Flow Approaching Nodes 201, 206, 205

Contributing Areas:

Node	Q_{100}	ΣQ_{100}
213	42.7	
212	5.6	
211	12.1	
210	3.8	
209	2.0	
208	16.9	
207	7.8	
206	5.7	
205	5.5	
		<u>102.1 cfs</u>

$$Q_{\text{pipe}} (207-205) = 35.0$$

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

$$= 102.1 - 35.0 = 67.1$$

$$\text{street Slope} = 0.32\%$$

$$\text{Allowable } Q = 1206.8 \sqrt{S} \quad (\text{with grade} = +0.4')$$

$$= 1206.8 \sqrt{0.0032}$$

$$= 68.3$$

street Flow OK



Date 5-1-87 Page 18 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Check Street Flow Approaching Nodes 214, 203

Contributing Areas		Q_{100}	ΣQ_{100}
Node	213	42.7	
	212	5.6	
	211	12.1	
	210	3.8	
	209	2.0	
	208	16.9	
	207	7.8	
	206	5.7	
	205	5.5	
	203	4.5	
			<u>106.6</u>

$Q_{\text{pipe}} (205-214) = 39.3$

$Q_{\text{street}} = Q_{100} - Q_{\text{pipe}}$
 $106.6 - 39.3 = 67.3$

street slope = 0.32%

Allowable $Q = 1206.8 \sqrt{S}^1$ (walk grade = +0.4')
 $= 68.3$

street Flow OK



Date 5-1-07 Page 19 of 23

Project Woodbridge 5th Addition

Item Drainage Plan

Check Street Flow @ RCB

Contributing Areas ΣQ_{100}

200-214 inclusive 121.5

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

$$= 121.5 - 46.5$$

$$= 75 \text{ cfs}$$

$$\text{Street Flow} = 0.32\%$$

$$Q_{\text{allow.}} = 1564.0 \sqrt{S} \quad (\text{walk grade} = +0.5')$$

$$= 1564.0 \sqrt{0.0032}$$

$$= 88.5 \text{ cfs}$$

$$Q_{\text{actual}} < Q_{\text{allow}}$$

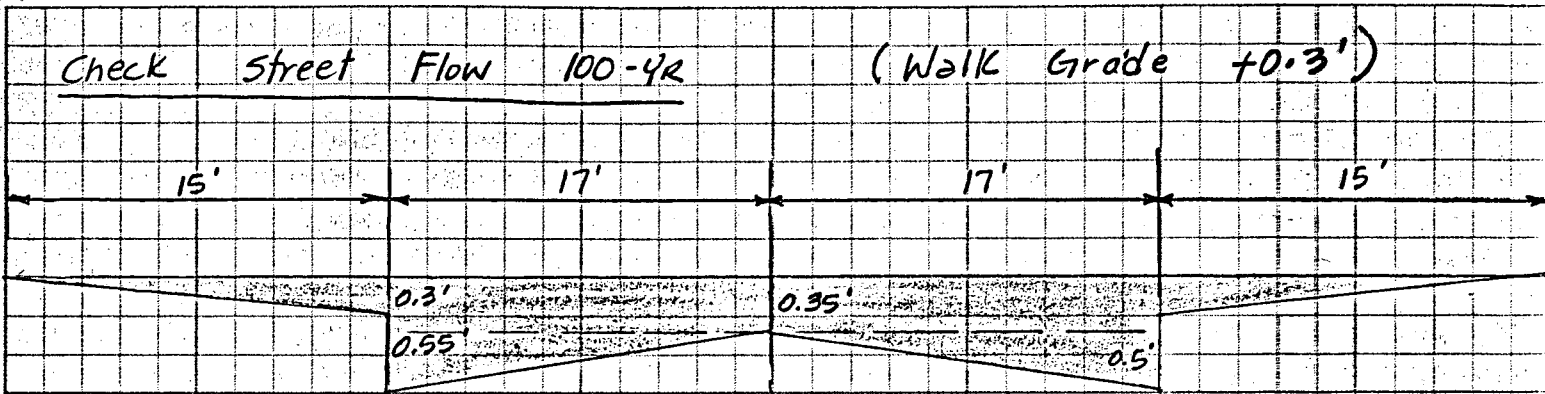
Street Flow OK



Date 5-1-87 Page 20 of 23

Project Woodbridge 5th Addition

Item Drainage Plan



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

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

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

$$n = \frac{1.4413}{65.1} = 0.0221$$

$$A = 2\left(\frac{1}{2} \times 15 \times 0.3\right) + (34 \times 0.35) + 2\left(\frac{1}{2} \times 0.5 \times 17\right)$$

$$= 24.90 \text{ SF}$$

$$p = (2 \times 15) + (2 \times 17) + (2 \times 0.55)$$

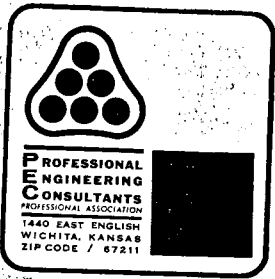
$$= 65.1'$$

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

$$R^{2/3} = 0.527$$

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

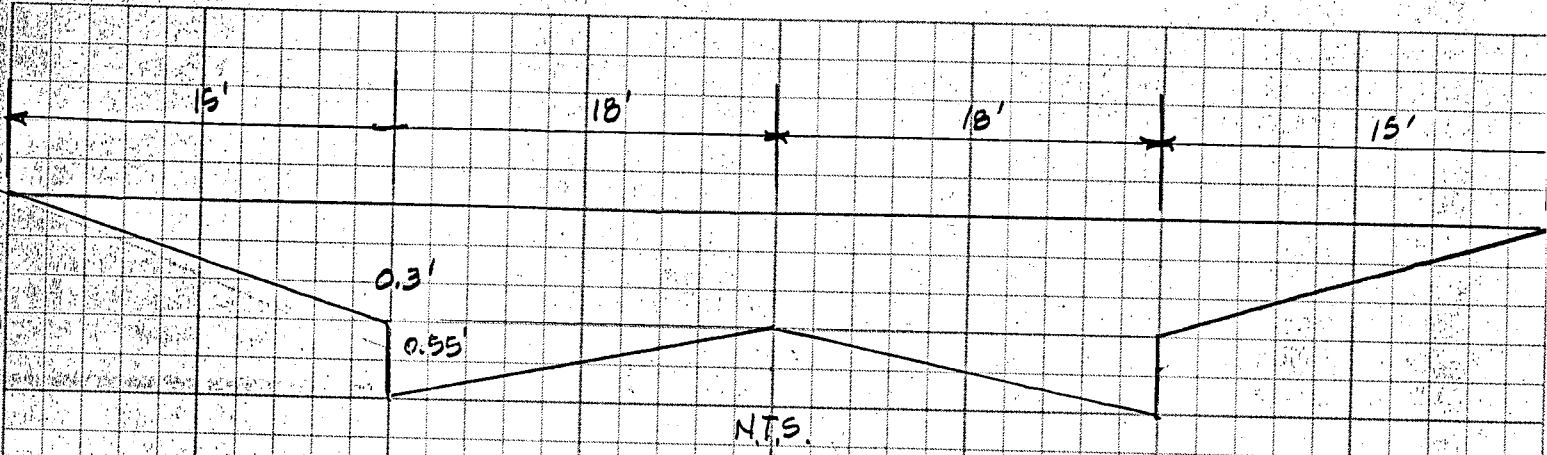
$$Q = 882.3 \times S^{1/2}$$



Date 5.1.87 Page 21 of 23

Project Woodbridge 5th Addition

Item Drainage Plan



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

$$n = \frac{2(14.5 \times 0.030) + 2(1.05' \times 0.013) + 2(18' \times 0.016)}{67.1}$$

$$= 0.02196$$

$$A = 2\left(\frac{1}{2} \times 0.55' \times 18\right) + (0.3 \times 36) + 2\left(\frac{1}{2} \times 15' \times 0.3'\right)$$

$$= 25.2 \text{ SF}$$

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

$$= 67.1$$

$$R = A/p = \frac{25.2}{67.1} = 0.37556$$

$$R^{2/3} = 0.52054$$

$$Q = \frac{1.486}{0.02196} \times 25.2 \times 0.52054 \text{ s}^{1/2}$$

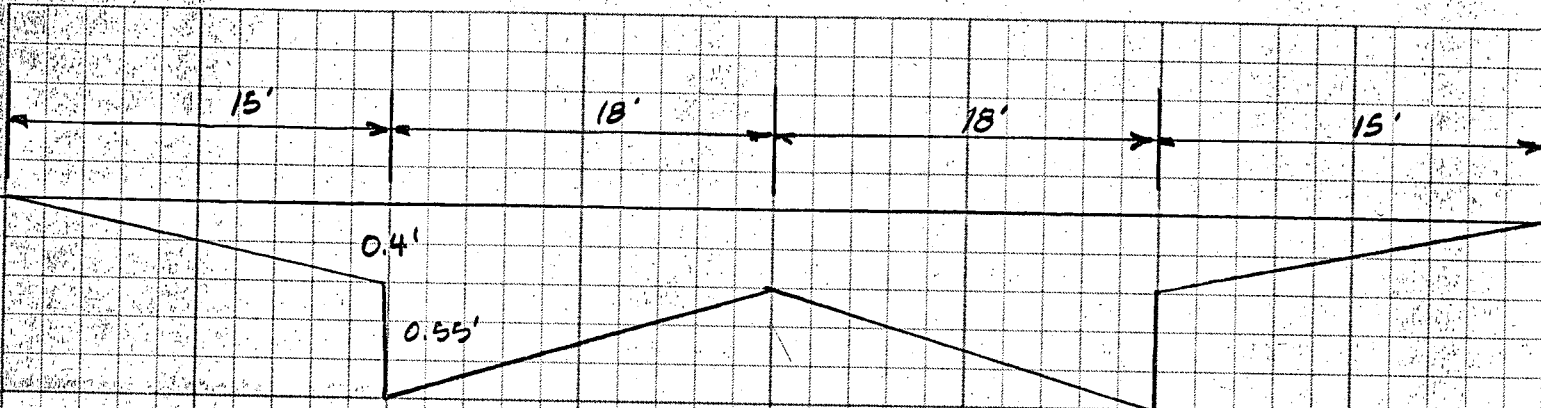
$$Q = 887.6 \text{ s}^{1/2}$$



Date 5.1.87 Page 22 of 23

Project Woodbridge 5th Addition

Item Drainage Plan



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

$$n = 0.02196$$

$$A = 2\left(\frac{1}{2} \times 15 \times 0.4\right) + (0.4 \times 36) + 2\left(\frac{1}{2} \times 18 \times 0.55\right)$$
$$= 30.3$$

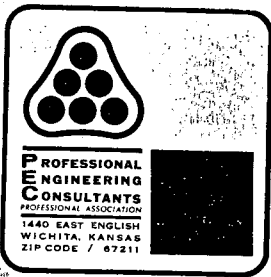
$$p = 67.1$$

$$R = A/p = 30.3/67.1 = 0.45157$$

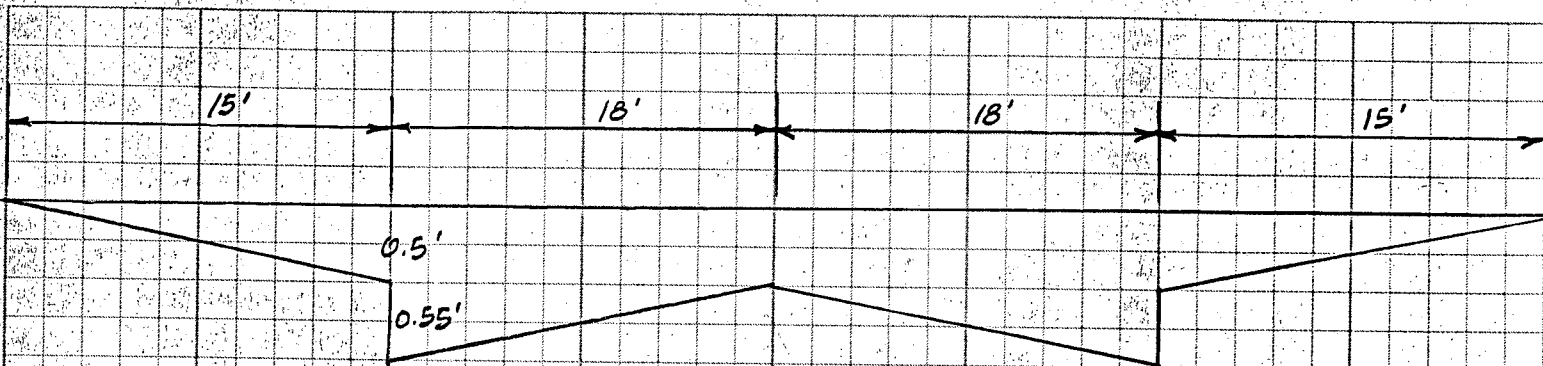
$$R^{2/3} = 0.58859$$

$$Q = \frac{1.486}{0.02196} \times 30.3 \times 0.58859 \times S^{1/2}$$

$$= 1206.8 S^{1/2}$$



Date 5.1.87 Page 23 of 23
Project Woodbridge 5th Addition
Item Drainage Plan



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

$$n = 0.02196$$

$$A = 2\left(\frac{1}{2} \times 0.5 \times 15\right) + (0.5 \times 36) + 2\left(\frac{1}{2} \times 0.55 \times 18\right)$$
$$= 35.4$$

$$p = 67.1$$

$$R = A/p = 35.4/67.1 = 0.52757$$

$$R^{2/3} = 0.6529$$

$$Q = \frac{1.486}{0.02196} \times 35.4 \times 0.6529 \times S^{1/2}$$

$$Q = 1,564.0 \sqrt{S}$$

1:295,000 FEET

390 000 FEET
T. 27 S.

(joins sheet 32)

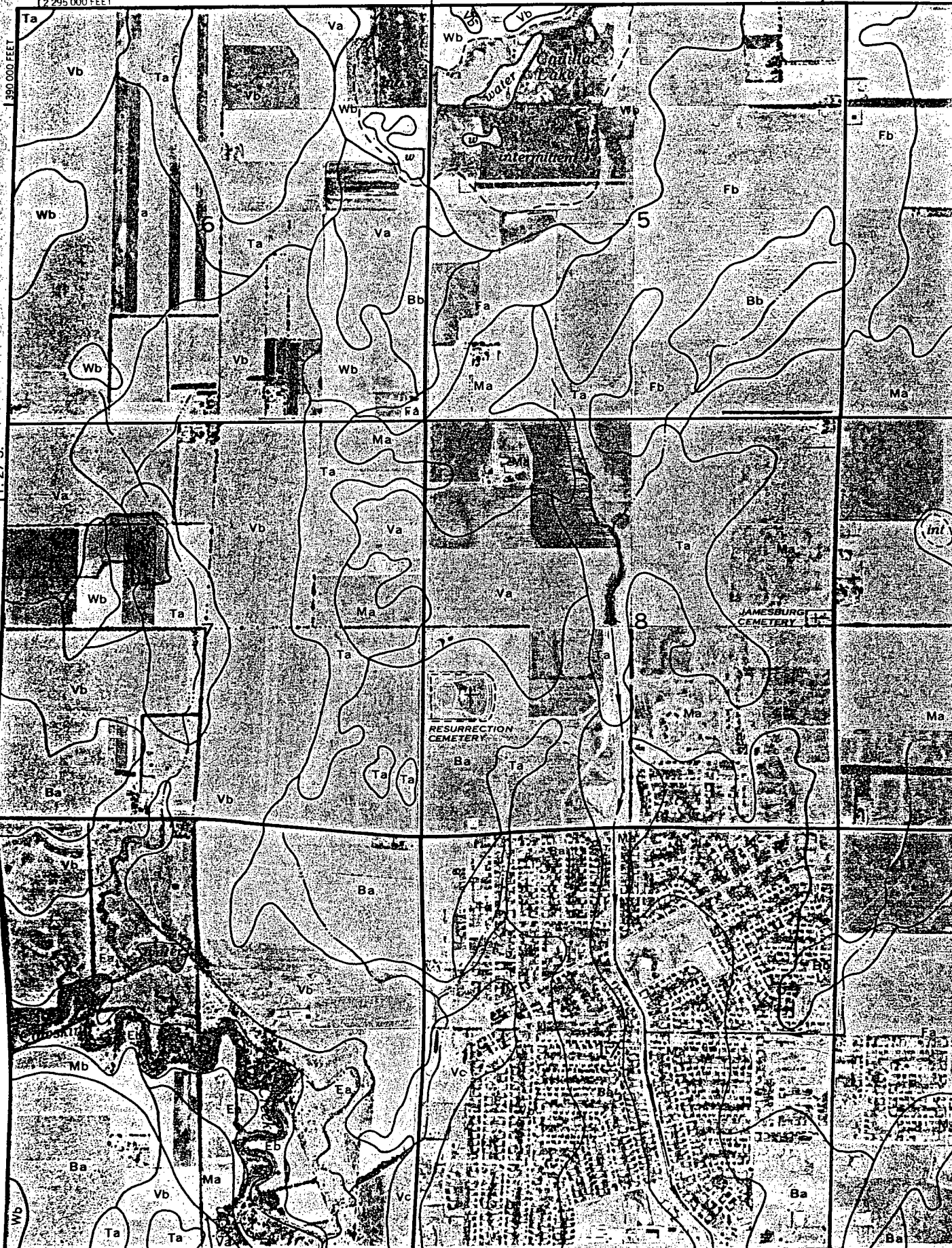


EXHIBIT NO. 1

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	n	Waurika silt loam

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:					
<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 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

DURATION IN MINUTES	RETURN PERIODS OF						
	<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

ATTACHMENT A CONTINUED
Page 3

<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

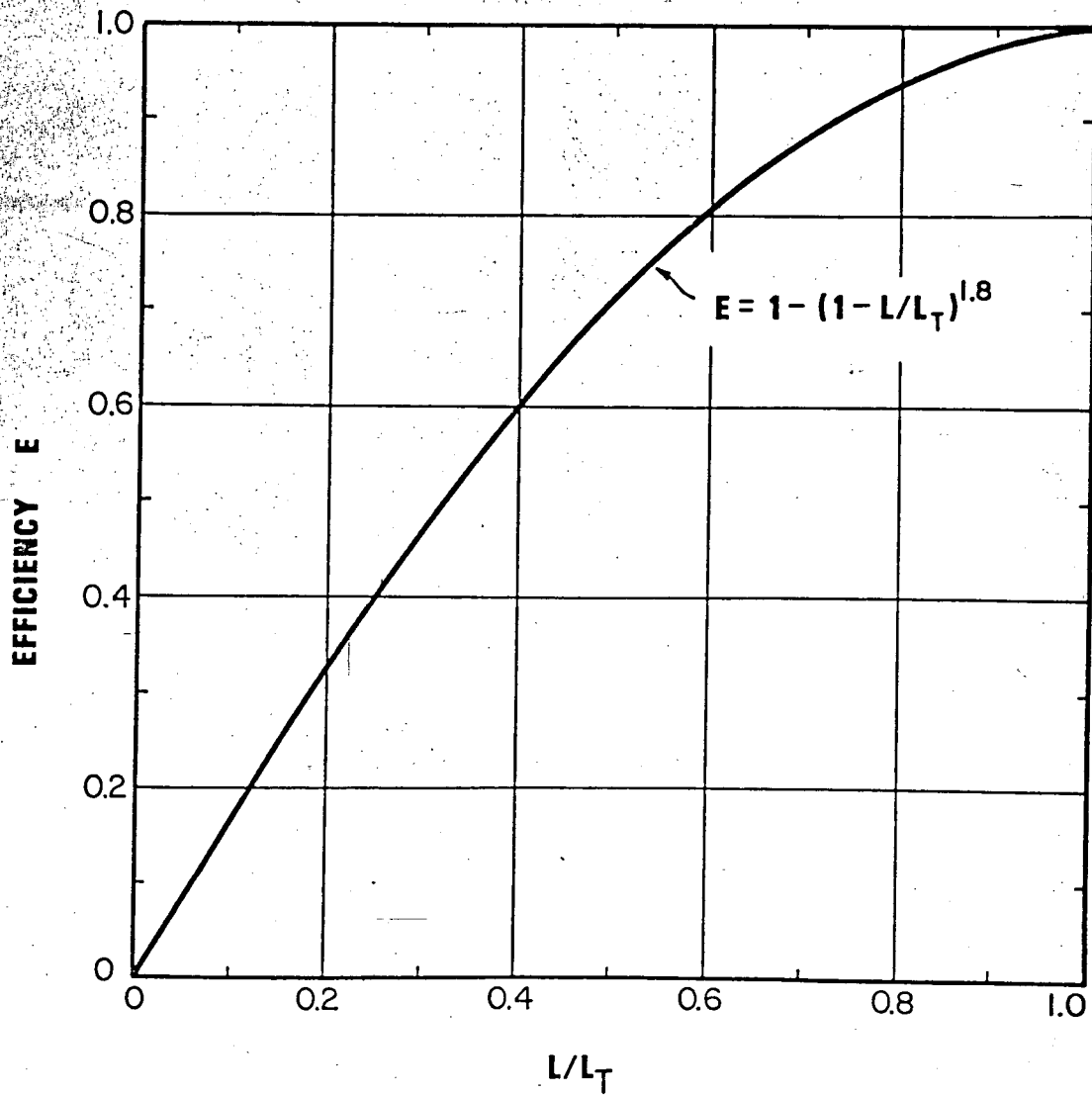
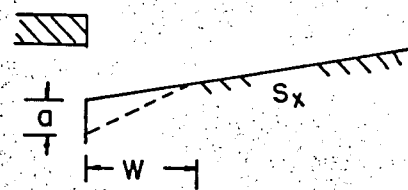


CHART 10. Curb-opening and slotted drain inlet interception efficiency.

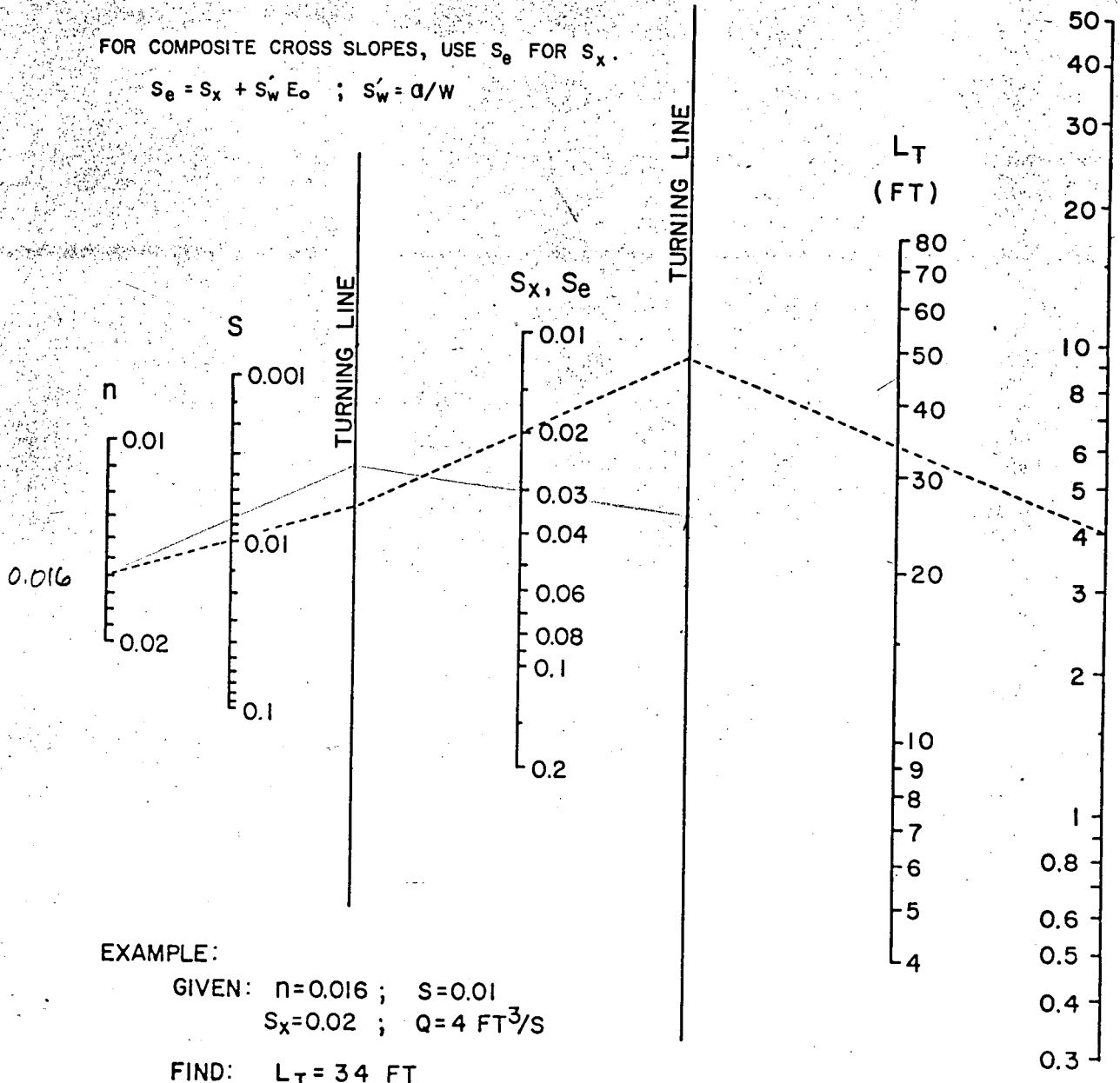
FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., Mar. 1964



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

FOR COMPOSITE CROSS SLOPES, USE S_e FOR S_x .

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



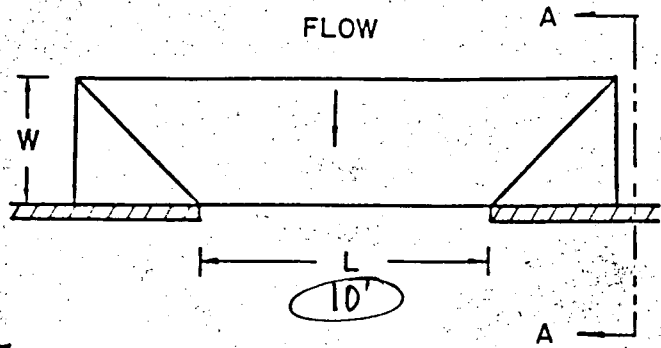
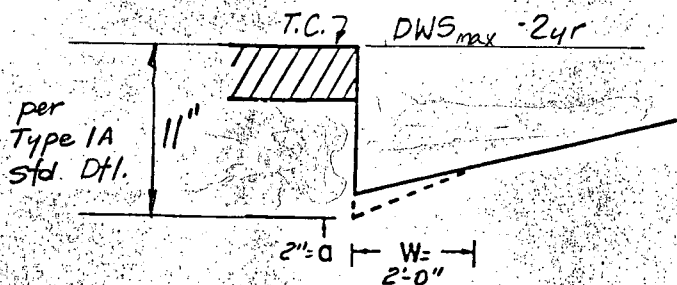
EXAMPLE:

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. 1964.



DEF. SKETCH, C.O.W. TYPE IA INLET

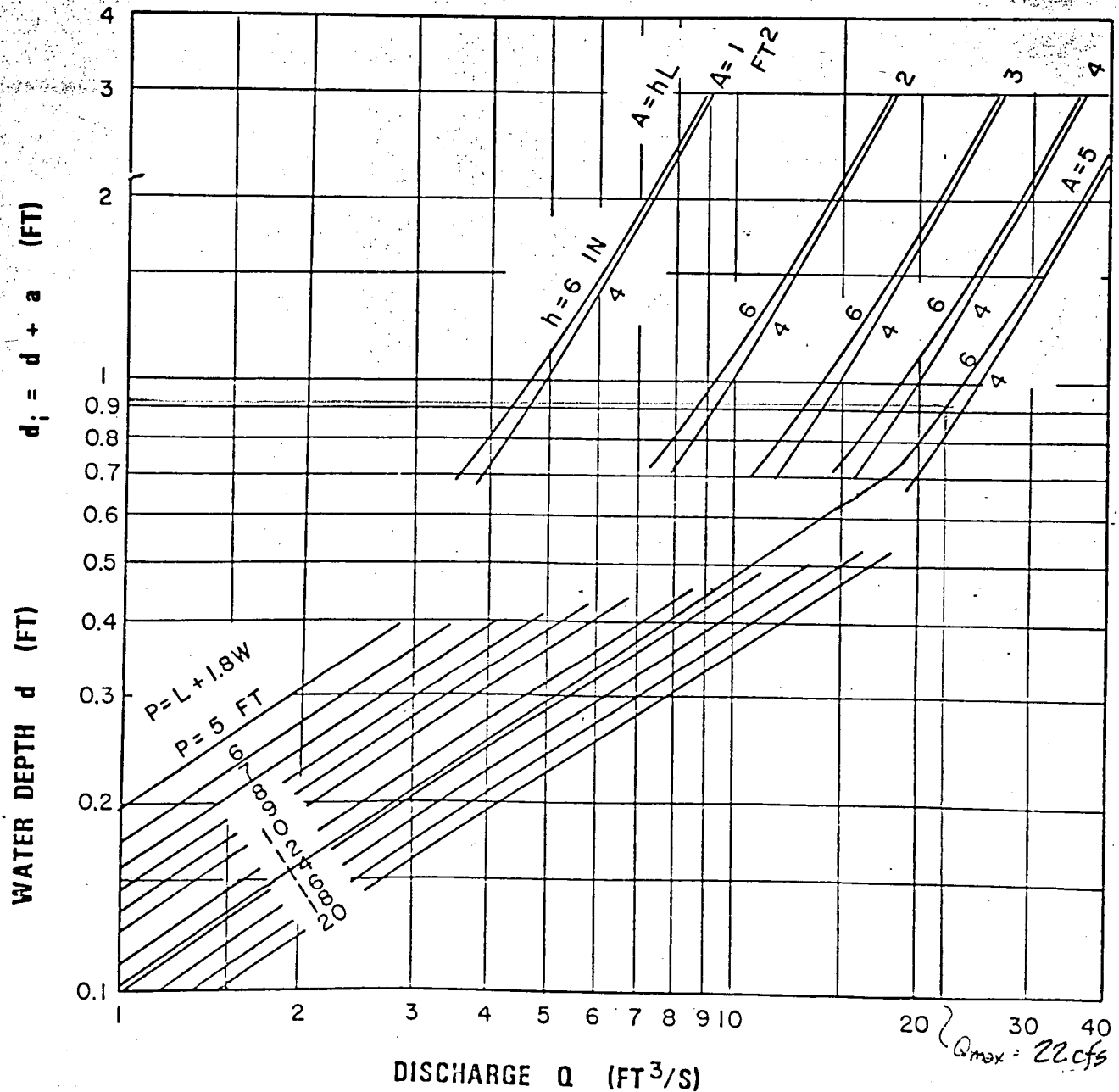


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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

Cross-slope = $\frac{3}{8} " / ' = 0.03125 ' / '$

$Z = \frac{1}{0.03125} = 32$

$n = 0.016$

$\frac{Z}{n} = \frac{32}{0.016} = 2,000$

Woodbridge 5th Addition
Drainage Plan

Chart 1

