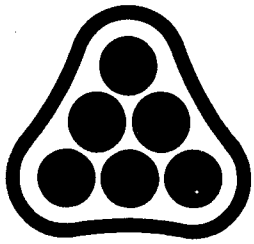
DRAINAGE PLAN
AND
SUPPORTING CALCULATIONS



PROFESSIONAL
ENGINEERING
CONSULTANTS
PROFESSIONAL ASSOCIATION

FOR

BRIARWOOD ESTATES 5TH ADDITION

AN ADDITION TO WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
ENGINEERS
1440 EAST ENGLISH
WICHITA, KANSAS

DECEMBER 9, 1985

1440 EAST ENGLISH
WICHITA, KANSAS 67211

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

Date 12-5-85 Page 1 of 1

Project Briarwood 5th Addition

Item Drainage System 100

BRIARWOOD 5TH IS A PROPOSED REPLAT OF BRIARWOOD ESTATES ADJACENT TO BRIARWOOD 4TH.

A STORM SEWER SYSTEM (SWS 263) WAS CONSTRUCTED IN BRIARWOOD 4TH. THE DRAINAGE PATTERN (AREAS & FLOW DIRECTION) UPSTREAM OF THIS EXISTING SYSTEM WILL CHANGE, BASED ON THE PROPOSED PLAT.

CONSEQUENTLY, THIS ENTIRE STORM SEWER WAS RE-EVALUATED USING THE NEW AREAS, ROSSMILLER MODIFIED RATIONAL METHOD, 10 MINUTES AS MINIMUM T_c, & HYDRO-35 FOR RAINFALL INTENSITIES.

RESULTS OF THIS EVALUATION ARE INCLUDED IN THIS SECTION.

PROJECT Briarwood 5th

TABLE 1

IMPERVIOUS AND TOTAL AREA OF EACH SUBAREA

BY CSB

DATE. 12-5-85

SUBAREA	IMPERVIOUS AREA			TOTAL AREA (ACRES)	IMPERVIOUSNESS (%)
	INTERCONNECTED (ACRES)	OTHER (ACRES)	TOTAL (ACRES)		
112			1.81	4.2	43
111			2.06	6.6	31
110			0.36	1.1	32
109			0.98	4.1	24
108			0.43	1.2	36
107			0.39	0.8	49
106			0.22	0.6	37
105			0.22	0.5	44
104			1.29	4.3	30
103			0.2	0.4	50
102			0.45	0.9	50
101	MH		—	—	—
100	HJW1		—	—	—
TOTAL					

PROJECT Briarwood 5th

TABLE 2

SHEET 2/10

BY CSB

DATE 12-5-85

RAINFALI INTENSITY AVERAGING TIME AND RAINFALL INTENSITY

(SCS METHOD)

SUBAREA	L feet	Y %	① IMP %	HLM %	② CN	③ S	④ LAG hours	F IMP	⑤ F HLM	⑥ T_C minutes	i_2* in/hour	i_{100}
112	1020	1.0	43	80	77	2.99	0.33	0.73	0.52	12.5	4.14	7.90
111	960	1.3	31	100	72	3.89	0.35	0.81	> 0.50	14.1	3.94	7.55
110	500	0.8	32	70	73	3.70	0.27	0.80	0.53	11.4	4.30	8.17
109	650	1.6	24	65	70	4.29	0.24	0.82	0.55	10.8	4.39	8.32
108	550	1.0	36	75	74	3.51	0.24	0.78	0.51	9.5	4.52	8.54
107	330	1.2	49	65	79	2.66	0.18	0.70	0.60	7.6	4.52	8.54
106	240	1.8	37	70	75	3.33	0.09	0.76	0.55	3.4	4.52	8.54
105	340	1.0	41	70	77	2.99	0.14	0.72	0.57	5.7	4.52	8.54
104	1100	0.5	30	20	72	3.89	0.40	0.80	0.87	27.8	2.79	5.61
103	140	1.0	50	90	80	2.50	0.07	0.71	> 0.50	2.5	4.52	8.54
102	370	1.0	50	80	80	2.50	0.14	0.71	0.53	5.3	4.52	8.54
101	-	-	-	-	-	-	-					
100	-	-	-	-	-	-	-					
									* Based on Hydro-35			
									Use 10 minutes min.			

L = hydraulic length of watershed
Y = average watershed land slope
HLM = hydraulic length modified (percentage of main channel that has been hydraulically improved.)
CN = SCS curve number
S = soil retention factor
LAG = basin lag in hours

① from Table 1
② CN = 98 (IMP) + X (1- IMP), where 'X' is a dimensionless integer that varies with the SCS HYD. SOIL GROUP as follows: A-39/B-61/C-74/D-80
③ $S = \left(\frac{1000}{CN}\right) - 10$
④ from Chart 1

PROJECT Briarwood 5th.

SHEET 8 OF 10

BY CSB

DATE 12-5-85

TABLE 3

RUNOFF COEFFICIENT (C)

(2 yr)

SUBAREA	S %	I in./hr.	CN	RI years	IMP	C
112	1.0	4.14	77	2	43	0.37
111	1.3	3.94	72	2	31	0.31
110	0.8	4.30	73	2	32	0.31
109	1.6	4.39	70	2	24	0.30
108	1.0	4.52	74	2	36	0.34
107	1.2	4.52	79	2	49	0.41
106	1.8	4.52	75	2	37	0.36
105	1.0	4.52	77	2	44	0.38
104	0.5	2.79	72	2	30	0.27
103	1.0	4.52	80	2	50	0.42
102	1.0	4.52	80	2	50	0.42
101	-	-	-	-	-	
100	-	-	-	-	-	

PROJECT Briarwood 5th
SHEET 4 OF 10
BY CSB
DATE 12-5-86

TABLE 4
PEAK DISCHARGE RATE (2 yr)

SUBAREA	① C	② I (IN/HOUR)	③ A (ACRES)	PEAK Q (CFS)
112	0.37	4.14	4.2	6.4
111	0.31	3.94	6.6	8.1
110	0.31	4.30	1.1	1.5
109	0.30	4.39	4.1	5.4
108	0.34	4.52	1.2	1.8
107	0.41	4.52	0.8	1.5
106	0.36	4.52	0.6	1.0
105	0.38	4.52	0.5	0.9
104	0.27	2.79	4.3	3.2
103	0.42	4.52	0.4	0.8
102	0.42	4.52	0.9	1.7
101	-	-	-	-
100	-	-	-	-

① FROM TABLE 3
② FROM TABLE 2
③ FROM TABLE 1

PROJECT Briarwood 5th

SHEET 5 OF 10

BY CSB

DATE 12-5-85

TABLE 3

RUNOFF COEFFICIENT (C)

SUBAREA	S %	I in./hr.	CN	RI years	IMP	C
112	1.0	7.90	77	100	43	0.52
111	1.3	7.55	72	100	31	0.44
110	0.8	8.17	73	100	32	0.46
109	1.6	8.32	70	100	24	0.43
108	1.0	8.54	74	100	36	0.50
107	1.2	8.54	79	100	49	0.57
106	1.8	8.54	75	100	37	0.51
105	1.0	8.54	77	100	44	0.54
104	0.5	5.61	72	100	30	0.38
103	1.0	8.54	80	100	50	0.58
102	1.0	8.54	80	100	50	0.58
101	-	-	-	-	-	-
100	-	-	-	-	-	-

PROJECT Briarwood 5th
SHEET 6 OF 10
BY CSB
DATE 12-5-85

TABLE 4
PEAK DISCHARGE RATE (100yr)

SUBAREA	① C	② I (IN/HOUR)	③ A (ACRES)	PEAK Q (CFS)
112	0.52	7.90	4.2	17.3
111	0.44	7.55	6.6	21.9
110	0.46	8.17	1.1	4.1
109	0.53	8.32	4.1	18.1
108	0.50	8.54	1.2	5.1
107	0.57	8.54	0.8	3.9
106	0.51	8.54	0.6	2.6
105	0.54	8.54	0.5	2.3
104	0.38	5.61	4.3	9.2
103	0.58	8.54	0.4	2.0
102	0.58	8.54	0.9	4.5
101	-	-	-	-
100	-	-	-	-

① FROM TABLE 3
② FROM TABLE 2
③ FROM TABLE 1

PROJECT Briarwood Sta

SHEET 7 OF 10

BY CSB

DATE 12-5-85

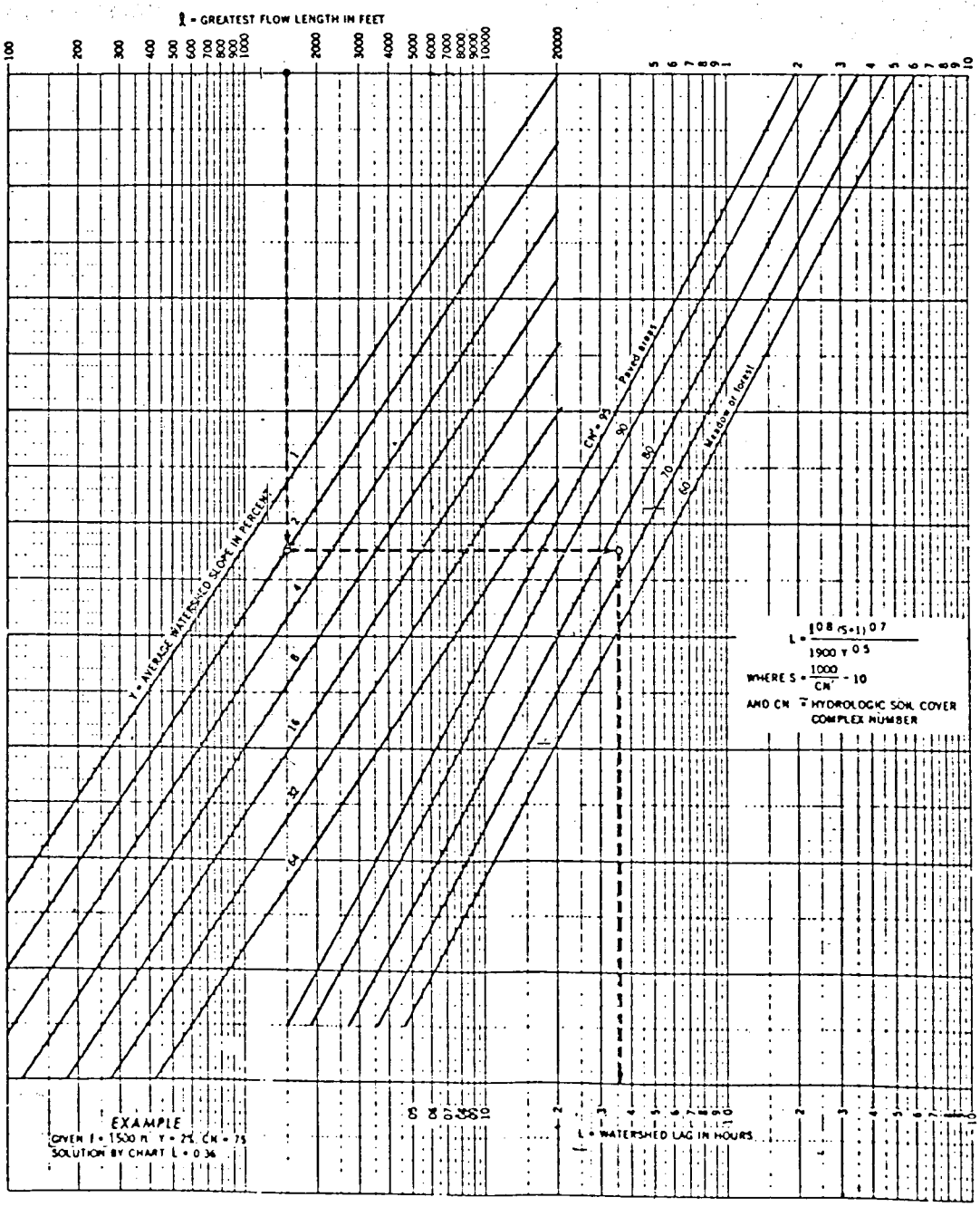


Figure 3-3.--Curve number method for estimating lag (L) for homogeneous watersheds under natural conditions up to 2,000 acres.

PROJECT Briarwood 5th

SHEET 8 OF 10

BY CSB

DATE 12-5-85

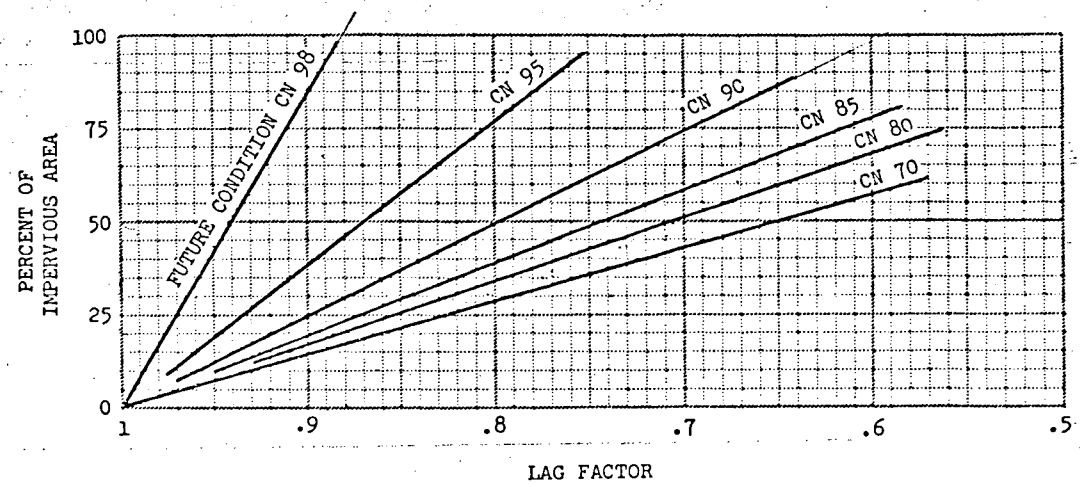


Figure 3-5.--Factors for adjusting lag from equation 3-2 or figure 3-3 when impervious areas occur in the watershed.

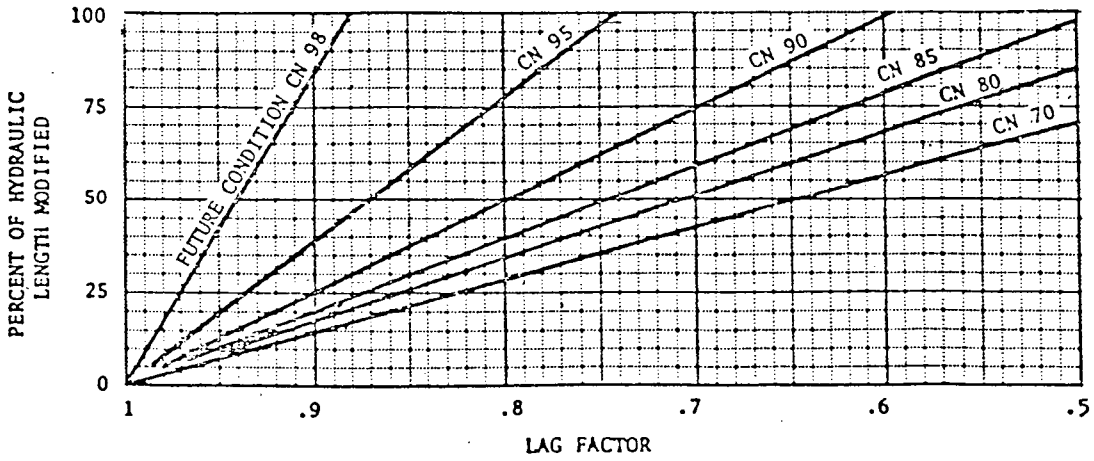
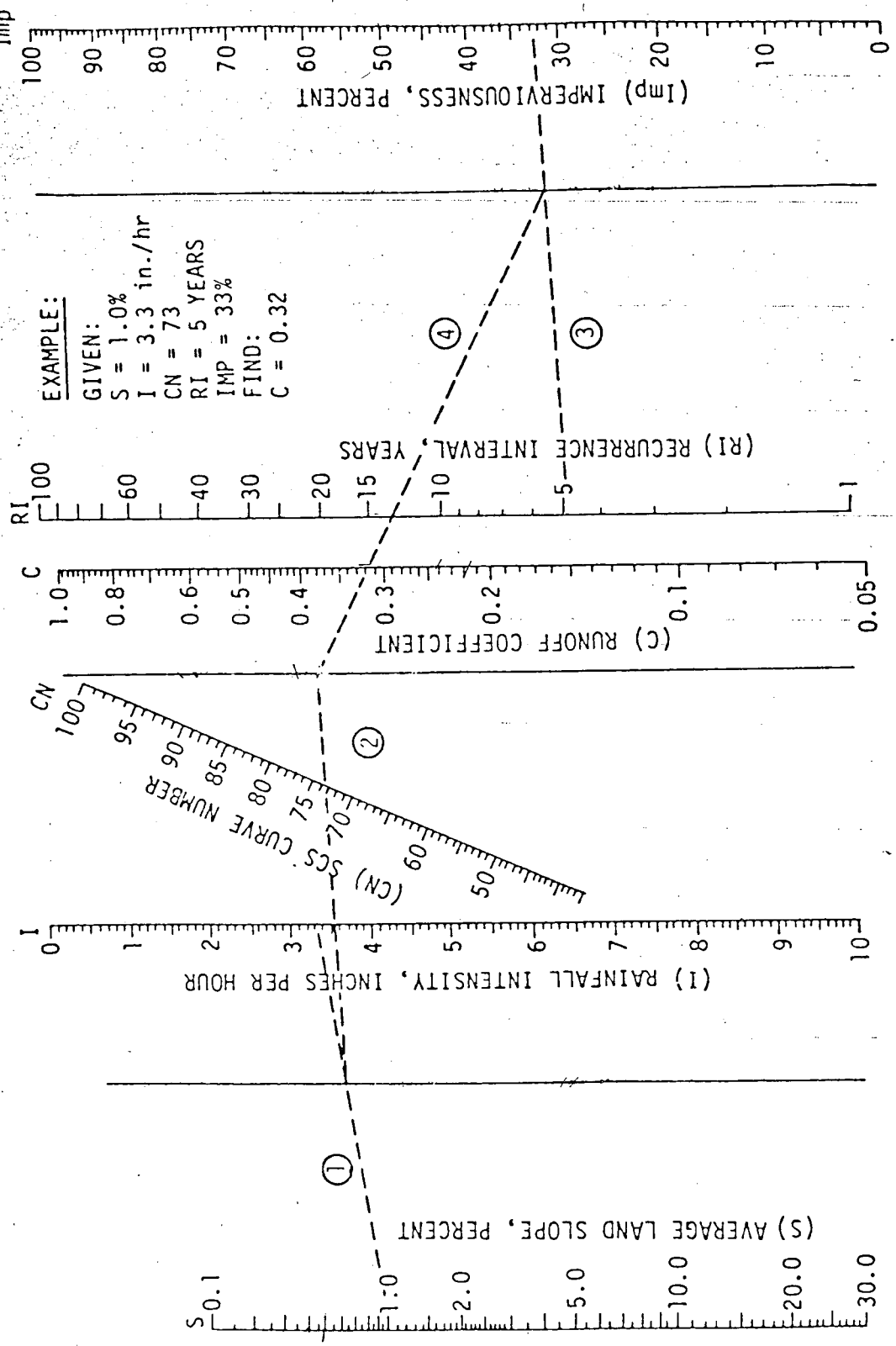


Figure 3-4.--Factors for adjusting lag from equation 3-2 or figure 3-3 when the main channel has been hydraulically improved.

PROJECT Brianwood 5A

SHEET 9 OF 10



$$C = 7.2(10)^{-7} C_N^{3} RI^{.05} ((.01CN)^{.6})^{-S^{.2}} (.001CN^{1.48})^{.15-.11((Imp+1)/2)^{.7}}$$

FIG. 3.- Nomograph for Estimating C in the Rational Formula

BY CSB

DATE 12-5-85

Comparision of Rainfall Intensities between Technical Paper No. 40, 1961 and NWS Hydro-35, 1977.

INTENSITIES (in/hr)

Frequency:	2 Year		5 Year		10 Year		25 Year		50 Year		100 Year	
Time	Tech-40	Hydro-35	Tech-40	Hydro-35	Tech-40	Hydro-35	Tech-40	Hydro-35	Tech-40	Hydro-35	Tech-40	Hydro-35
5	6.23	5.57 5.52	8.01	6.53 6.69	9.34	7.41 7.57	10.77 10.67	8.52 8.56	12.28 12.23	9.48 9.42	13.77	10.32 10.32
6	5.80	5.32	7.46	6.25	8.70	7.09	10.01	8.16	11.44	9.09	12.83	9.89
7	5.46	5.09	7.02	5.99	8.19	6.81	9.41	7.84	10.77	8.74	12.08	9.50
8	5.19	4.89	6.67	5.75	7.78	6.55	8.92	7.55	10.22	8.42	11.47	9.15
9	4.95	4.70	6.37	5.54	7.43	6.31	8.51	7.28	9.76	8.13	10.95	8.83
10	4.75	4.52 4.50	6.11	5.34 5.43	7.13	6.09 6.10	8.16	7.04 7.06	9.37 9.33	7.86 7.86	10.51	8.54 8.63
11	4.58	4.36	5.89	5.16	6.87	5.89	7.86	6.81	9.03	7.61	10.13	8.27
12	4.43	4.21	5.69	4.99	6.64	5.71	7.59	6.60	8.73	7.38	9.79	8.02
13	4.29	4.08	5.52	4.84	6.44	5.53	7.35	6.41	8.46	7.17	9.49	7.79
14	4.17	3.95	5.36	4.69	6.25	5.37	7.13	6.23	8.22	6.97	9.22	7.57
15	4.06	3.83 3.80	5.22	4.56 4.61	6.09	5.22 5.19	6.94	6.06 6.04	8.00 7.97	6.78 6.70	8.97	7.37 7.36
16	3.96	3.72	5.09	4.43	5.94	5.08	6.76	5.90	7.80	6.60	8.75	7.18
17	3.87	3.61	4.97	4.31	5.80	4.95	6.60	5.75	7.62	6.44	8.55	7.00
18	3.78	3.51	4.86	4.20	5.67	4.83	6.45	5.61	7.45	6.29	8.36	6.84
19	3.70	3.42	4.76	4.10	5.55	4.71	6.31	5.47	7.29	6.14	8.18	6.68
20	3.63	3.33	4.66	4.00	5.44	4.60	6.19	5.35	7.15	6.00	8.02	6.53
21	3.56	3.25	4.58	3.90	5.34	4.50	6.07	5.23	7.02	5.87	7.87	6.39
22	3.50	3.17	4.49	3.81	5.24	4.40	5.95	5.12	6.89	5.75	7.73	6.26
23	3.44	3.10	4.42	3.73	5.15	4.31	5.85	5.01	6.77	5.63	7.60	6.13
24	3.38	3.03	4.34	3.65	5.07	4.22	5.75	4.91	6.66	5.52	7.47	6.01
25	3.33	2.96	4.27	3.57	4.99	4.13	5.66	4.81	6.55	5.41	7.35	5.90
26	3.22	2.90	4.21	3.50	4.91	4.05	5.57	4.72	6.45	5.31	7.24	5.79
27	3.13	2.84	4.15	3.43	4.84	3.98	5.49	4.63	6.36	5.21	7.13	5.69
28	3.04	2.78	4.09	3.37	4.83	3.90	5.41	4.55	6.27	5.12	7.03	5.59
29	2.96	2.72	4.03	3.30	4.70	3.83	5.33	4.47	6.19	5.03	6.94	5.49
30	2.89	2.67 2.62	3.94 3.92	3.24 3.28	4.58	3.76 3.79	5.38 5.31	4.39 4.48	6.10	4.94 5.02	6.19 6.79	5.40 5.55
31	2.81	2.62	3.84	3.19	4.46	3.70	5.24	4.32	6.03	4.86	6.03 6.42	5.32
32	2.75	2.57	3.75	3.13	4.35	3.64	5.11	4.25	5.88	4.78	5.88	5.23
33	2.68	2.52	3.66	3.08	4.25	3.58	4.99	4.18	5.73	4.71	5.73	5.15
34	2.62	2.48	3.57	3.03	4.15	3.52	4.87	4.11	5.60	4.63	5.60	5.07
35	2.56	2.44	3.49	2.98	4.06	3.46	4.76	4.05	5.47	4.56	5.47	5.00
36	2.51	2.39	3.41	2.93	3.97	3.41	4.66	3.99	5.35	4.50	5.35	4.93
37	2.46	2.35	3.34	2.88	3.89	3.36	4.56	3.93	5.23	4.43	5.23	4.86
38	2.41	2.32	3.27	2.84	3.81	3.31	4.46	3.87	5.12	4.37	5.12	4.79
39	2.36	2.28	3.20	2.80	3.73	3.26	4.37	3.82	5.02	4.31	5.02	4.73
40	2.31	2.24	3.14	2.76	3.66	3.22	4.29	3.76	4.91	4.25	4.91	4.66
41	2.27	2.21	3.08	2.72	3.59	3.17	4.20	3.71	4.82	4.19	4.82	4.60
42	2.23	2.18	3.02	2.68	3.52	3.13	4.12	3.66	4.73	4.13	4.73	4.54
43	2.19	2.14	2.97	2.64	3.46	3.09	4.05	3.61	4.64	4.08	4.64	4.49
44	2.15	2.11	2.91	2.61	3.40	3.05	3.97	3.57	4.55	4.03	4.55	4.43
45	2.11	2.08	2.86	2.57	3.34	3.01	3.90	3.52	4.47	3.98	4.47	4.38
46	2.08	2.05	2.81	2.54	3.28	2.97	3.84	3.48	4.39	3.93	4.39	4.33
47	2.04	2.02	2.77	2.50	3.23	2.93	3.77	3.44	4.32	3.88	4.32	4.28
48	2.01	2.00	2.72	2.47	3.17	2.90	3.71	3.39	4.25	3.84	4.25	4.23
49	1.98	1.97	2.68	2.44	3.12	2.86	3.65	3.35	4.18	3.79	4.18	4.18
50	1.95	1.94	2.63	2.41	3.07	2.83	3.59	3.32	4.11	3.75	4.11	4.13
51	1.92	1.92	2.59	2.38	3.03	2.79	3.54	3.28	4.05	3.71	4.05	4.09
52	1.89	1.89	2.55	2.35	2.98	2.76	3.48	3.24	3.98	3.67	3.98	4.05
53	1.86	1.87	2.51	2.33	2.94	2.73	3.43	3.20	3.92	3.63	3.92	4.00
54	1.84	1.85	2.48	2.30	2.89	2.70	3.38	3.17	3.87	3.59	3.87	3.96
55	1.81	1.82	2.44	2.27	2.85	2.67	3.33	3.14	3.81	3.55	3.81	3.92
56	1.78	1.80	2.41	2.25	2.81	2.64	3.29	3.10	3.75	3.51	3.75	3.88
57	1.76	1.78	2.37	2.22	2.78	2.61	3.24	3.07	3.70	3.48	3.70	3.84
58	1.74	1.76	2.34	2.20	2.74	2.59	3.20	3.04	3.65	3.44	3.65	3.81
59	1.71	1.74	2.31	2.18	2.70	2.56	3.15	3.01	3.60	3.41	3.60	3.77
60	1.69	1.72 1.69	2.28	2.15 2.18	2.67	2.53 2.52	3.11	2.98 3.00	3.55	3.37 3.38	3.55	3.73 3.75
61	1.67	1.70	2.25	2.13	2.63	2.51	3.07	2.95	3.51	3.34	3.51	3.70

14112 G.B.

01/01

```
110 t,briarwood estates 5th addition
120 t,storm sewer system no 100
130 t,pec file no 36-84652
140 i,  112     0.37    4.20    0.00    0.00    6.40    12.50   148.70
150 i,  111     0.31    6.60    0.00    0.00    8.10    14.10   148.70
160 i,  110     0.31    1.10    0.00    0.00    1.50    11.40   148.70
170 i,  109     0.30    4.10    0.00    0.00    5.40    10.80   147.80
180 i,  108     0.34    1.20    0.00    0.00    1.80    10.00   147.80
190 i,  107     0.41    0.80    0.00    0.00    1.50    10.00   147.80
200 i,  106     0.36    0.60    0.00    0.00    1.00    10.00   147.50
210 i,  105     0.38    0.50    0.00    0.00    0.90    10.00   147.10
220 i,  104     0.27    4.30    0.00    0.00    3.20    27.80   146.40
230 i,  103     0.42    0.40    0.00    0.00    0.80    10.00   147.60
240 i,  102     0.42    0.90    0.00    0.00    1.70    10.00   146.40
250 m,  101   145.50
260 m,  100   142.90
270 p,  112  111    35.00   15 0.013  104.00   0.00
280 p,  111  110    80.00   24 0.013   42.00   0.00
290 p,  110  109   160.00   24 0.013   30.00   0.00
300 p,  109  107    90.00   27 0.013   53.00   0.00
310 p,  108  107    35.00   15 0.013  115.00   0.00
320 p,  107  105   310.00   30 0.013   70.00   0.00
330 p,  106  105    67.00   24 0.013   15.00   0.00
340 p,  105  102   199.00   30 0.013   87.00   0.00
350 p,  104  102    35.00   15 0.013   54.00   0.00
360 p,  103  102   101.00   15 0.013  101.00   0.00
370 p,  102  101   174.00   36 0.013   40.00   0.00
380 p,  101  100    72.00   36 0.013   90.00   0.00
390 e
```

Time: 11:42:22

Input File: briar5

briarwood estates 5th addition
storm sewer system no 100
pec file no 36-84652

Storm Frequency = 2-Year

* * * HYDROLOGY * * *

Node	to Node	C	Tributary Area: Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	Hydrology Summation: TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Conduit Data: Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
112	111	0.37	4.20	0.00	0.0	12.50	4.36	6.40	12.50	4.36	6.40	6.40	15"	5.22	35.00	0.11	12.61
111	110	0.31	6.60	0.00	0.0	14.10	4.16	8.10	14.10	4.16	8.10	14.23	24"	4.53	80.00	0.29	14.39
110	109	0.31	1.10	0.00	0.0	11.40	4.52	1.50	14.39	4.12	1.37	15.60	24"	4.96	160.00	0.54	14.93
109	107	0.30	4.10	0.00	0.0	10.80	4.61	5.40	14.93	4.07	4.76	20.36	27"	5.12	90.00	0.29	15.22
108	107	0.34	1.20	0.00	0.0	10.00	4.75	1.80	10.00	4.75	1.80	1.80	15"	1.47	35.00	0.40	10.40
107	105	0.41	0.80	0.00	0.0	10.00	4.75	1.50	15.22	4.04	1.27	23.18	30"	4.72	310.00	1.09	16.32
106	105	0.36	0.60	0.00	0.0	10.00	4.75	1.00	10.00	4.75	1.00	1.00	24"	0.32	67.00	3.51	13.51
105	102	0.38	0.50	0.00	0.0	10.00	4.75	0.90	16.32	3.93	0.74	24.85	30"	5.06	199.00	0.66	16.97
104	102	0.27	4.30	0.00	0.0	27.80	3.06	3.20	27.80	3.06	3.20	3.20	15"	2.61	35.00	0.22	28.02
103	102	0.42	0.40	0.00	0.0	10.00	4.75	0.80	10.00	4.75	0.80	0.80	15"	0.65	101.00	2.58	12.58
102	101	0.42	0.90	0.00	0.0	10.00	4.75	1.70	16.97	3.87	1.38	28.89	36"	4.09	174.00	0.71	17.68
101	100	0.00	0.00	0.00	0.0	0.00	0.00	0.00	17.68	3.81	0.00	28.89	36"	4.09	72.00	0.29	17.98

Input File: briar5

briarwood estates 5th addition
storm sewer system no 100
pec file no 36-84652

Storm Frequency = 2-Year

* * * HYDRAULICS * * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
112	0.00982	0.3436	0.0000	0.0000	0.0000	0.0000	0.0000	0.3436	148.8458	148.7000	-0.15
111	0.00396	0.3164	0.0000	0.0208	0.0000	0.2512	0.4768	1.0652	148.5022	148.7000	0.20
110	0.00475	0.7606	0.0000	0.0064	0.0000	0.0638	0.1506	0.9814	147.4370	148.7000	1.26
109	0.00432	0.3888	0.0000	0.0024	0.0000	0.0512	0.2569	0.6993	146.4557	147.8000	1.34
108	0.00078	0.0272	0.0000	0.0000	0.0000	0.0000	0.0000	0.0272	145.7835	147.8000	2.02
107	0.00319	0.9901	0.0000	0.0121	0.0000	0.1078	0.0634	1.1735	145.7564	147.8000	2.04
106	0.00002	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	144.5842	147.5000	2.92
105	0.00367	0.7306	0.0000	0.0052	0.0000	0.1281	0.1190	0.9828	144.5829	147.1000	2.52
104	0.00245	0.0859	0.0000	0.0000	0.0000	0.0000	0.0000	0.0859	143.6860	146.4000	2.71
103	0.00015	0.0155	0.0000	0.0000	0.0000	0.0000	0.0000	0.0155	143.6156	147.6000	3.98
102	0.00188	0.3264	0.0000	0.0277	0.0000	0.1911	-0.0515	0.4937	143.6001	146.4000	2.80
101	0.00188	0.1350	0.0000	0.0000	0.0130	0.0490	0.0094	0.2064	143.1064	145.5000	2.39
100	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	142.9000	142.9000	0.00

```
110 t,briarwood estates 5th addition
120 t,storm sewer system no 100
130 t,pec file no 36-84652
140 i,  112     0.52     4.20     0.00     0.00    17.30    12.50   148.70
150 i,  111     0.44     6.60     0.00     0.00    21.90    14.10   148.70
160 i,  110     0.46     1.10     0.00     0.00     4.10    11.40   148.70
170 i,  109     0.43     4.10     0.00     0.00    18.10    10.80   147.80
180 i,  108     0.50     1.20     0.00     0.00     5.10    10.00   147.80
190 i,  107     0.57     0.80     0.00     0.00     3.90    10.00   147.80
200 i,  106     0.51     0.60     0.00     0.00     2.60    10.00   147.50
210 i,  105     0.54     0.50     0.00     0.00     2.30    10.00   147.10
220 i,  104     0.38     4.30     0.00     0.00     9.20    27.80   146.40
230 i,  103     0.58     0.40     0.00     0.00     2.00    10.00   147.60
240 i,  102     0.58     0.90     0.00     0.00     4.50    10.00   146.40
250 m,  101   145.50
260 m,  100   142.90
270 p,  112  111    35.00   15 0.013  104.00    0.00
280 p,  111  110    80.00   24 0.013   42.00    0.00
290 p,  110  109   160.00   24 0.013   30.00    0.00
300 p,  109  107    90.00   27 0.013   53.00    0.00
310 p,  108  107    35.00   15 0.013  115.00    0.00
320 p,  107  105   310.00   30 0.013   70.00    0.00
330 p,  106  105    67.00   24 0.013   15.00    0.00
340 p,  105  102   199.00   30 0.013   87.00    0.00
350 p,  104  102    35.00   15 0.013   54.00    0.00
360 p,  103  102   101.00   15 0.013  101.00    0.00
370 p,  102  101   174.00   36 0.013   40.00    0.00
380 p,  101  100    72.00   36 0.013   90.00    0.00
390 e
```

Time: 13:47:31

Input File: bwd100

briarwood estates 5th addition
storm sewer system no 100
pec file no 36-84652

Storm Frequency = 100-Year

* * * HYDROLOGY * * *

Node to Node		Tributary Area C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	Hydrology Summation TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Conduit Data Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
112	111	0.52	4.20	0.00	0.0	12.50	9.63	17.30	12.50	9.63	17.30	17.30	15"	14.10	35.00	0.04	12.54
111	110	0.44	6.60	0.00	0.0	14.10	9.19	21.90	14.10	9.19	21.90	38.43	24"	12.23	80.00	0.11	14.21
110	109	0.46	1.10	0.00	0.0	11.40	9.99	4.10	14.21	9.16	3.76	42.19	24"	13.43	160.00	0.20	14.41
109	107	0.43	4.10	0.00	0.0	10.80	10.20	18.10	14.41	9.12	16.18	58.37	27"	14.68	90.00	0.10	14.51
108	107	0.50	1.20	0.00	0.0	10.00	10.51	5.10	10.00	10.51	5.10	5.10	15"	4.16	35.00	0.14	10.14
107	105	0.57	0.80	0.00	0.0	10.00	10.51	3.90	14.51	9.09	3.37	66.17	30"	13.48	310.00	0.38	14.89
106	105	0.51	0.60	0.00	0.0	10.00	10.51	2.60	10.00	10.51	2.60	2.60	24"	0.83	67.00	1.35	11.35
105	102	0.54	0.50	0.00	0.0	10.00	10.51	2.30	14.89	9.00	1.97	70.48	30"	14.36	199.00	0.23	15.12
104	102	0.38	4.30	0.00	0.0	27.80	7.05	9.20	27.80	7.05	9.20	9.20	15"	7.50	35.00	0.08	27.88
103	102	0.58	0.40	0.00	0.0	10.00	10.51	2.00	10.00	10.51	2.00	2.00	15"	1.63	101.00	1.03	11.03
102	101	0.58	0.90	0.00	0.0	10.00	10.51	4.50	15.12	8.94	3.83	81.07	36"	11.47	174.00	0.25	15.38
101	100	0.00	0.00	0.00	0.0	0.00	0.00	0.00	15.38	8.89	0.00	81.07	36"	11.47	72.00	0.10	15.48

Input File: bwd100

briarwood estates 5th addition
storm sewer system no 100
pec file no 36-84652

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-Gl Elevation	Desired Elevation	Diff. (Ft)
112	0.07172	2.5103	0.0000	0.0000	0.0000	0.0000	0.0000	2.5103	189.5201	148.7000	-40.82
111	0.02885	2.3083	0.0000	0.1525	0.0000	1.8353	3.4729	7.7691	187.0098	148.7000	-38.31
110	0.03478	5.5649	0.0000	0.0477	0.0000	0.4655	1.1155	7.1936	179.2408	148.7000	-30.54
109	0.03552	3.1964	0.0000	0.0545	0.0000	0.3747	2.7127	6.3384	172.0471	147.8000	-24.25
108	0.00623	0.2182	0.0000	0.0000	0.0000	0.0000	0.0000	0.2182	165.9269	147.8000	-18.13
107	0.02603	8.0686	0.0000	0.1048	0.0000	0.8862	0.4641	9.5238	165.7088	147.8000	-17.91
106	0.00013	0.0089	0.0000	0.0000	0.0000	0.0000	0.0000	0.0089	156.1938	147.5000	-8.69
105	0.02953	5.8758	0.0000	0.0379	0.0000	1.0436	0.8860	7.8434	156.1850	147.1000	-9.08
104	0.02028	0.7099	0.0000	0.0000	0.0000	0.0000	0.0000	0.7099	149.0515	146.4000	-2.65
103	0.00096	0.0968	0.0000	0.0000	0.0000	0.0000	0.0000	0.0968	148.4384	147.6000	-0.84
102	0.01477	2.5706	0.0000	0.2317	0.0000	1.5368	-0.5234	3.8158	148.3416	146.4000	-1.94
101	0.01477	1.0637	0.0000	0.0000	0.1021	0.3859	0.0740	1.6258	144.5258	145.5000	0.97
100	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	142.9000	142.9000	0.00

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Project Briarwood 5th

Item Drainage System 200

DRAINAGE SYSTEM 200 CONSISTS OF THE SOUTHWEST PORTION OF THE PROPOSED PLAT WHICH WILL DRAIN TO AN EXISTING STORM SEWER SYSTEM LOCATED AT ALDERNY & ALDERNY CT. INTERSECTION.

THE DRAINAGE AREAS OF NODES 202 & 201 WILL BE REVISED BY THE PROPOSED PLAT. THIS SECTION PRESENTS THE EVALUATION OF THESE 2 NODES ONLY & COMPARES THEM TO THE DESIGN FOR THE EXIST. STORM SEWER.

PROJECT Brlarwood 5th

SHEET 1 OF 7
BY CSA
DATE. 12-9-85

TABLE I
IMPERVIOUS AND TOTAL AREA OF EACH SUBAREA

SUBAREA	IMPERVIOUS AREA INTERCONNECTED (ACRES)	IMPERVIOUS AREA OTHER (ACRES)	IMPERVIOUS AREA TOTAL (ACRES)	TOTAL AREA (ACRES)	IMPERVIOUSNESS (%)
202			0.87	2.6	34
201			0.61	1.8	34
TOTAL					

PROJECT Briarwood 5th

TABLE 2

SHEET 2/7

BY CSB

DATE 12-9-85

RAINFALI INTENSITY AVERAGING TIME AND RAINFALL INTENSITY

(SCS METHOD)

SUBAREA	L feet	Y %	① IMP %	HLM %	② CN	③ S	④ LAG hours	F IMP	⑤ F HLM	⑥ T_C minutes	i_2 in/hour	i_{100}
202	720	0.6	34	78	74	3.51	0.34	0.78	0.52	13.8	3.98	7.61
201	730	0.6	34	81	74	3.51	0.34	0.78	0.51	13.5	4.02	7.68

L = hydraulic length of watershed
Y = average watershed land slope
HLM = hydraulic length modified (percentage of main channel that has been hydraulically improved.)
CN = SCS curve number
S = soil retention factor
LAG = basin lag in hours
F_{IMP} = lag adjustment factor when impervious areas occur in watershed

① from Table 1

② CN = 98 (IMP) + X (1- IMP), where 'X' is a dimensionless integer that varies with the SCS HYD. SOIL GROUP as follows: A-39/B-61/C-74/D-80

③ $S = (\frac{1000}{CN}) - 10$

④ from Chart 1

⑤ from "Adjustments to Chart 1"

PROJECT Briarwood 5th

SHEET 3 OF 7

BY CSB

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TABLE 3

RUNOFF COEFFICIENT (c)

	SUBAREA	S %	I in./hr.	CN	RI years	IMP	C
	202	0.6	3.98	74	2	34	0.32
2-YR	201	0.6	4.02	74	2	34	0.32
100-YR	202	0.6	7.61	74	100	34	0.46
	201	0.6	7.68	74	100	34	0.46

PROJECT Briarwood 5th
SHEET 4 OF 7
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DATE 12-9-85

TABLE 4
PEAK DISCHARGE RATE

	SUBAREA	① C	② I (IN/HOUR)	③ A (ACRES)	PEAK Q (CFS)
2-YR	202	0.32	3.98	2.6	3.3
	201	0.32	4.02	1.8	2.3
	202	0.46	7.61	2.6	9.1
100-YR					
	201	0.46	7.68	1.8	6.4

① FROM TABLE 3
② FROM TABLE 2
③ FROM TABLE 1

PROJECT Briarwood 5th

SHEET 5 OF 7

BY CSB

DATE 12-9-85

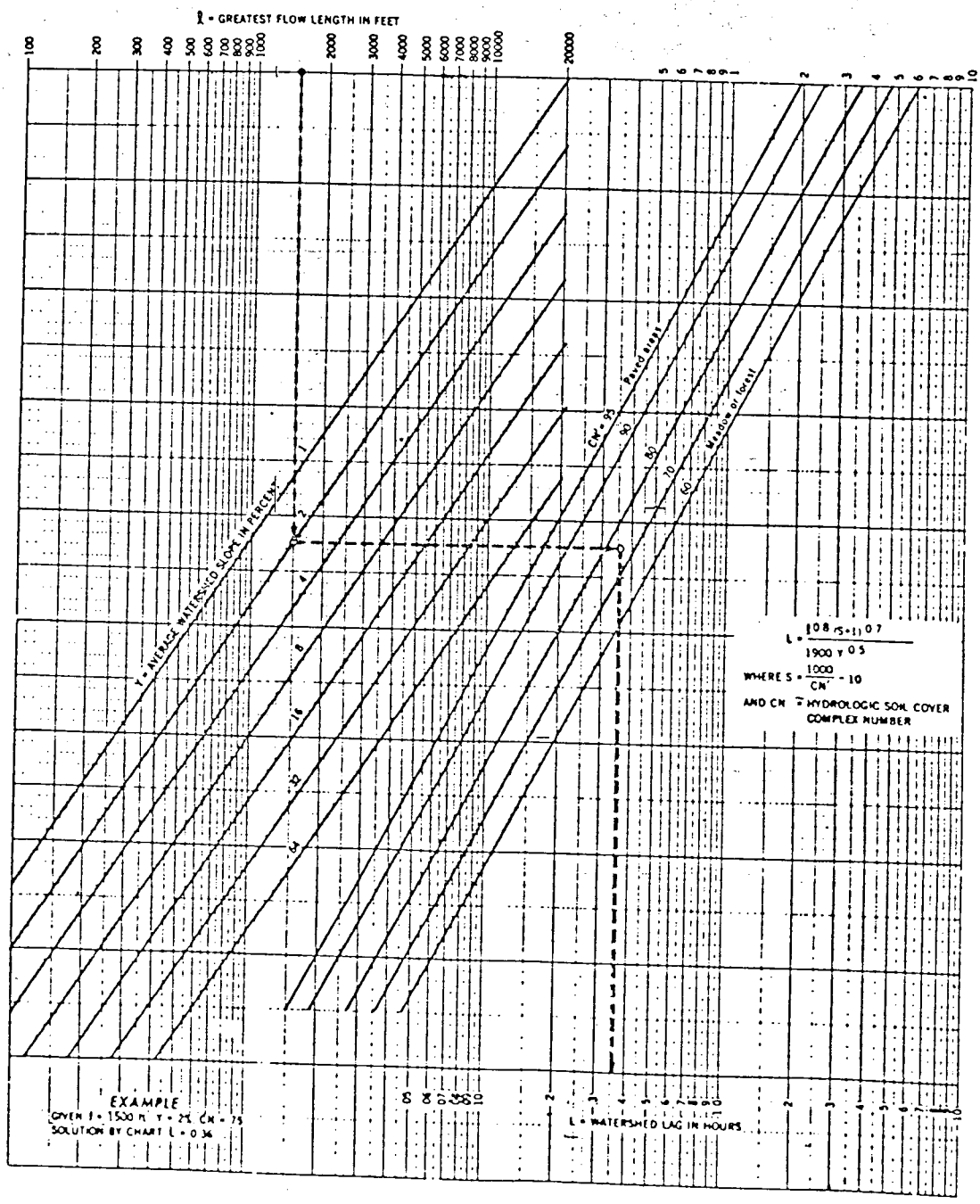

Figure 3-3.--Curve number method for estimating lag (L) for homogeneous watersheds under natural conditions up to 2,000 acres.

PROJECT Brierwood 5th

SHEET 6 OF 7

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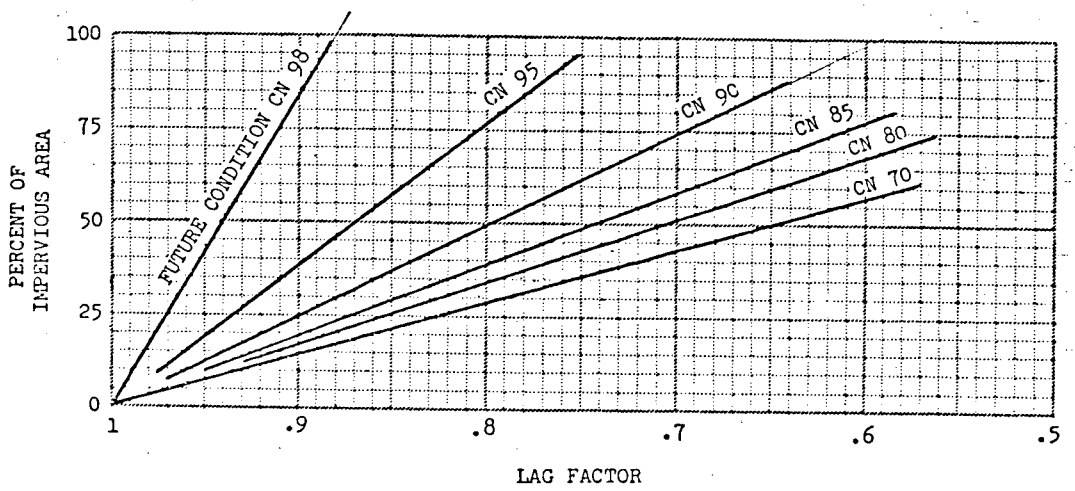


Figure 3-5.--Factors for adjusting lag from equation 3-2 or figure 3-3 when impervious areas occur in the watershed.

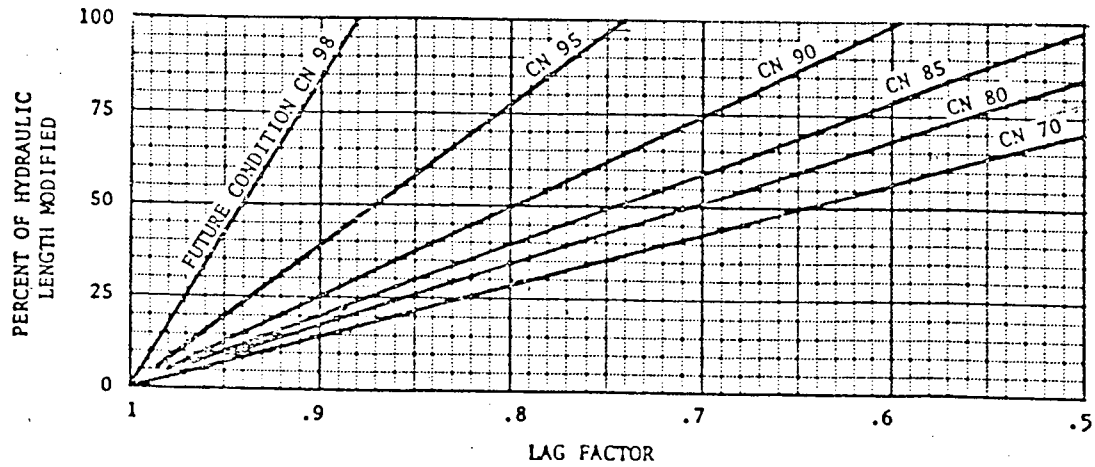
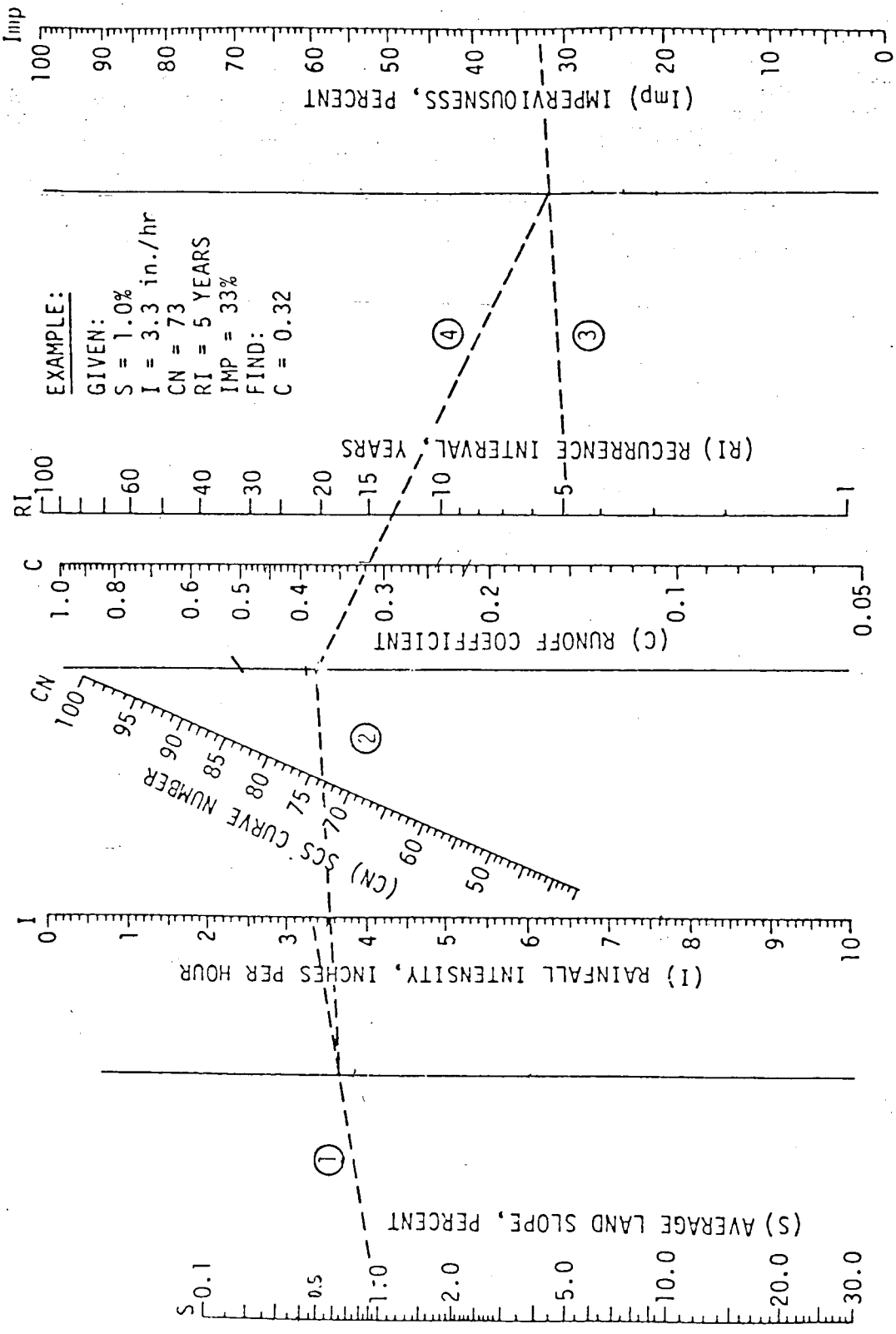


Figure 3-4.--Factors for adjusting lag from equation 3-2 or figure 3-3 when the main channel has been hydraulically improved.

PROJECT Briarwood 5th

SHEET 7 OF 7



$$C = 7.2(10)^{-7}CN^{3}RI^{.05}((.01CN)^{.6})-S^{.2}(.001CN^{1.48}).15-.11((Imp+1)/2)^{.7}$$

FIG. 3.- Nomograph for Estimating C in the Rational Formula

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Project Briarwood 5th

Item Drainage System 200

SUMMARY

	PER DESIGN SWS 263			PER PROPOSED BRIAR. 5TH		
	D.A	Q_2	Q_{100}	D.A	Q_2	Q_{100}
Node 202	4.02	8.2	18.0	2.6	3.3	9.1
Node 201	0.93	1.9	4.2	1.8	2.3	6.4

The contributing areas & resulting discharges to both nodes are decreased. Existing system can remain as is.

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Project Briarwood 5th Add.

Item Drainage

CHECK STREET FLOW - 2 YR

Allowable depth: top curb = 0.55'
Assume 3/8"/Ft X-slope ; n = 0.016.

Node	112	Q_2 = 6.4 cfs	street slope = 1.98%	d = 0.3'
Node	111	Q_2 = 8.1	street slope = 1.98%	d = 0.33'
Node	110	Q_2 = 1.5	street slope = 0.5%	d = 0.23'
Node	109	Q_2 = 5.4	street slope = 0.32%	d = 0.40'
Node	108	Q_2 = 1.8	street slope = 0.32%	d = 0.27
Node	107	Q_2 = 1.5	street slope = 0.45%	d = 0.23'
Node	106	Q_2 = 1.0	street slope = 0.32%	d = 0.21'
Node	105	Q_2 = 0.9	street slope = 0.32%	d = 0.20'
Node	104	Q_2 = 3.2	street slope = 0.92%	d = 0.28'
Node	103	Q_2 = 0.8	street slope = 0.82%	d = 0.16'
Node	102	Q_2 = 1.7	street slope = 0.92%	d = 0.21'
	101	MH		
	100	HEADWALL		

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Project Briarwood 5th Add'n

Item Drainage

CHECK STREET FLOW - 100 YR

Allowable depth = to R = 0.55' + 0.3' = 0.85'

Street Flow = $Q_{100} - Q_{pipe}$

$= Q_{100} - Q_2$

$Q_{max} = 670.66\sqrt{S} \times 2$

$Q_{max} = 670.66\sqrt{0.0032} \times 2$

$= 75.8$ cfs @ min grade

Approaching Nodes 112 + 111

$Q_{street} = Q_{100}$ nodes 112+111 $- Q_{pipe}$

$= (17.3 + 21.9) - 0$

$= 39.2$ cfs OK

Approaching Node 110

$Q_{street} = Q_{100}$ 112→110 $- Q_{pipe}$ 112-111

$= (39.2 + 4.1) - (6.4 + 8.1)$

$= 43.3 - 14.5$

$= 28.8$ cfs OK

Approaching Node 109

$Q_{street} = Q_{100}$ 112→109 $- Q_{pipe}$ 112-110

$= (43.3 + 18.1) - (14.5 + 1.5)$

$= 61.4 - 16.0$

$= 45.4$ cfs OK

Approaching Nodes 108 & 107

$Q_{street} = Q_{100}$ 112-107 $- Q_{pipe}$ 112→109

$= (61.4 + 5.1 + 3.9) - (16.0 + 5.4)$

$= 70.4 - 21.4$

OK

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Project Briarwood 5th Addition

Item Drainage

Approaching Nodes 106 & 105

$Q_{street} = Q_{100}{}_{112 \to 105} - Q_{p}{}_{112 \to 107}$

$= (70.4 + 2.6 + 2.3) - (21.4 + 1.8 + 1.5)$

$= 75.3 - 24.7$

$= 50.6$ OK

Approaching Nodes 104 & 102

$Q_{street} = Q_{100}{}_{112 \to 104,102} - Q_{p}{}_{112-105}$

$= (75.3 + 9.2 + 4.5) - (24.7 + 1.0 + 0.9$

$= (87.0) - (26.6)$

$= 60.4$ OK

Approaching Node 103

$Q_{street} = Q_{100}{}_{\text{Node 103}} - Q_{p}$

$= 2.0 \quad -0$

$= 2.0$ OK

$Z = \frac{1}{\text{X-Slope}} = \frac{1}{3/8"/ft} = \frac{1}{3/8"/12"} = \frac{1}{.03125} = 32$

Briarwood Stn Add'n
Drainage Plan.

$n = 0.016$

$\frac{Z}{n} = \frac{32}{.016} = 2000$

4/5

Chart 1

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

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

Z IS RECIPROCAL OF CROSS SLOPE

REFERENCE: H. R. B. PROCEEDINGS 1948, PAGE 150, EQUATION (14)

EXAMPLE (SEE INSTRUCTION 1)

GIVEN: S = 0.03

Z = 24, n = .02] Z/n = 1200

Q = 2.0 CFS

FIND: d = 0.22 BY FOLLOWING DASHED LINES

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

TURNING LINE

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

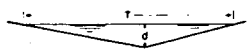
SLOPE OF CHANNEL (S) IN FT./FT.: .10, .08, .07, .06, .05, .04, .03, .02, .01, .008, .007, .006, .005, .004, .003, .002, .001

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

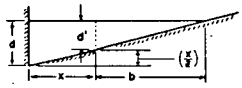
INSTRUCTIONS

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

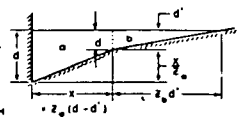
2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH AS EXPLAINED IN INSTRUCTION 1 BUT WITH $Z = \frac{T}{d}$.



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



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



BUREAU OF PUBLIC ROADS
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NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS

PROFESSIONAL ENGINEERING CONSULTANTS
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Date 5/30/85 MWB Page 5 of 5

Project BRIARWOOD 5TH

Item STREET FLOW EQUATIONS

35' BK-BK STREET (½ STREET CAPACITY)

15' x 3/8"/1 = 0.46875'

℄ to ℄ = 0.47 + 0.05 = 0.52

Curb deep flow is 0.03' above crown.

T = (depth above ℄)/Sx

n = 0.016

Sx = 3/8 in/ft = 0.03125 ft/ft

B = T − 16.6' (See I Below)

I. At d = 0.52' (Crown deep)

T = 0.52/0.03125 = 16.6'

$$Q = \frac{0.56}{0.016}(0.03125)^{5/3}(16.6)^{8/3}\sqrt{S}$$

$$= 194.58\sqrt{S}$$

II At d = 0.55' (Curb deep)

T = 17.6'

B = 1.0'

$$Q = \frac{0.56}{0.016}(0.03125)^{5/3}\sqrt{S}\left[(17.6)^{8/3} - 1^{8/3}\right]$$

$$= 227.32\sqrt{S}$$

III. At d = 0.85' (T.C. + 0.302') (14'-6" Pkg.) (¼"/1 Sl.)

d = 0.85

T = 27.26

B = 10.66

$$Q = \frac{0.56}{0.016}(0.03125)^{5/3}\sqrt{S}\left[(27.26)^{8/3} - (10.66)^{8/3}\right]$$

$$= 670.66\sqrt{S}$$

IV At T.C. +0.41' (14'-6" Pkg, 3/8"/1 Sl.)

d = 0.96'

T = 30.72'

B = 14.12'

$$Q = \frac{0.56}{0.016}(0.03125)^{5/3}\sqrt{S}\left[(30.72)^{8/3} - (14.12)^{8/3}\right]$$

$$= 878.09\sqrt{S}$$

V At T.C. +0.52' (14'-6" Pkg, ½"/1 Sl.)

d = 1.07'

T = 34.24'

B = 17.64'

$$Q = \frac{0.56}{0.016}(0.03125)^{5/3}\sqrt{S}\left[(34.24)^{8/3} - (17.64)^{8/3}\right]$$

$$= 1112.64\sqrt{S}$$

VI At T.C. +0.63' (14'-6" Pkg, 5/8"/1 Sl.)

d = 1.18'

T = 37.76'

B = 21.16'

$$Q = \frac{0.56}{0.016}(0.03125)^{5/3}\sqrt{S}\left[(37.76)^{8/3} - (21.16)^{8/3}\right]$$

$$Q = 1369.72\sqrt{S}$$