

NORTHRIDGE LAKES ADDITION

February 19, 1996

Enclosed herein are the computations and supporting data for the revised Volume II of the NorthRidge Lakes Drainage Plan Volume II dated May 1, 1995. Note that several drainage systems on the East side of the property remain unchanged from the original drainage plan because construction has already taken place, specifically system 4, system 5 and system 7 and all drainage structures pertinent to detention ponds discussed in Volume 1 of the reference plan.

NorthRidge Lakes Addition is single family residential development in Northwest Wichita encompassing approximately 67 acres. The Rational Method has been used for hydrologic analysis of all storm sewer systems that serve the residential streets and yards. Portions of the drainage system have been designed for the major storm, or 100 year storm. Systems designed for the minor storm have major storm overflows directed through pipes at sump locations to the ponds.

For street conveyance, curb-deep flow is tolerable for the minor, or 2 year storm. For each inlet, street flooding and inlet capacity has been checked for the minor storm. It has been assumed that 3-5/8" roll curb and gutter will be used throughout, except on Pepper Ridge and Meadow Pass which require standard 6-5/8" curb. City of Wichita Type 1A street inlets and 3/8 in./ft. street cross-slope were assumed. Minimum walk grade has been assumed to be 0.3 above top of curb unless otherwise noted. Standard 4' x 2' grate inlets were assumed for back yard drains.

To simplify analysis the following assumptions were made:

1. The time of concentration is identical for both pipe flow and street flow for both major and minor storm; a conservative estimate since pipe velocities generally exceed gutter velocities.
2. Street conveyance was analyzed using only the street width. Depths above curb up to the walk grade were used, but the conveyance of the parking was neglected. In general, the parking area conveyance is quite small, due to a relatively higher "n" factor.

Hydraulic computations for the pipe system were performed using Manning's Equation. All pipes were assumed to be reinforced concrete with a Manning's "n" factor of 0.013. It is desirable to keep the hydraulic grade line approximately one foot below the top of curb elevations for the minor storm.

A 1"=100' scale drainage map is enclosed in the pocket.

2/19/96

**NORTHRIDGE LAKES ADDITION
HYDROLOGY**

36-95054-3466

BASIN #	AREA (ac)	C2 *	C100 *	tc	i2 (in/hr)	i100 (in/hr)	Q2 (cfs)	Q100 (cfs)
A	0.68	0.39	0.57	15	3.83	7.37	1.02	2.88
B	0.84	0.39	0.57	15	3.83	7.37	1.26	3.56
C	1.10	0.39	0.57	15	3.83	7.37	1.66	4.66
D	0.84	0.39	0.57	15	3.83	7.37	1.26	3.56
E	1.11	0.39	0.57	15	3.83	7.37	1.67	4.70
G	2.44	0.39	0.57	15	3.83	7.37	3.67	10.33
H	1.70	0.39	0.57	15	3.83	7.37	2.56	7.20
J	0.56	0.39	0.57	15	3.83	7.37	0.84	2.37
K	0.59	0.39	0.57	15	3.83	7.37	0.89	2.50
L	0.74	0.39	0.57	15	3.83	7.37	1.11	3.13
M	0.22	0.39	0.57	15	3.83	7.37	0.33	0.93
N	0.62	0.39	0.57	15	3.83	7.37	0.93	2.63
O	1.03	0.39	0.57	15	3.83	7.37	1.55	4.36
P	0.81	0.39	0.57	15	3.83	7.37	1.22	3.43
Q	4.33	0.39	0.57	15	3.83	7.37	6.52	18.34
R	1.17	0.39	0.57	15	3.83	7.37	1.76	4.95
S	0.54	0.39	0.57	15	3.83	7.37	0.81	2.29
T	1.27	0.39	0.57	15	3.83	7.37	1.91	5.38
U	2.13	0.39	0.57	15	3.83	7.37	3.21	9.02
V	1.07	0.39	0.57	15	3.83	7.37	1.61	4.53
W	1.15	0.39	0.57	15	3.83	7.37	1.73	4.87
X	3.29	0.39	0.57	15	3.83	7.37	4.95	13.93
Y	2.30	0.39	0.57	15	3.83	7.37	3.46	9.74
Z	1.62	0.39	0.57	15	3.83	7.37	2.44	6.86
AA	1.34	0.39	0.57	15	3.83	7.37	2.02	5.67
BB	1.09	0.39	0.57	15	3.83	7.37	1.64	4.62
CC	2.25	0.39	0.57	15	3.83	7.37	3.39	9.53
DD	1.03	0.39	0.57	15	3.83	7.37	1.55	4.36
EE	1.36	0.39	0.57	15	3.83	7.37	2.05	5.76
FF	1.11	0.39	0.57	15	3.83	7.37	1.67	4.70
GG	1.31	0.39	0.57	15	3.83	7.37	1.97	5.55
HH	0.48	0.39	0.57	15	3.83	7.37	0.72	2.03
II	0.96	0.39	0.57	15	3.83	7.37	1.45	4.07
JJ	0.92	0.39	0.57	15	3.83	7.37	1.39	3.90
LL	6.10	0.39	0.57	15	3.83	7.37	9.18	25.83
MM	1.24	0.39	0.57	15	3.83	7.37	1.87	5.25
NN	0.88	0.39	0.57	15	3.83	7.37	1.32	3.73
OO	0.67	0.39	0.57	15	3.83	7.37	1.01	2.84
PP	1.23	0.39	0.57	15	3.83	7.37	1.85	5.21
QQ	7.69	0.39	0.57	15	3.83	7.37	11.58	32.56

* - Runoff coefficient "C" based on class B soils and 1/3 acre residential lots.

Date 1-26-96 of Page of Comp by FDW
 Project North Ridge Lakes 96064-3466 VMB
 Item R2 System 100 - Street Inlets
 $z/n = 2000$ $z = 1.5x$ $h = .016$ (MANNING)

INLET CAPACITY

NODE No.	HYDROLOGY		APPROACHING FLOW				INLET			ON-GRADE COMP.				SUMP COMP.		
	Q ₀ cfs	Q ₀ +Q _b cfs	S ₀ o/o	S _x in/ft	d ft	T ft	TYPE	L	L _t ft	L/L _t	E ft	d _i ft	d _o ft	T _s ft	Q _i cfs	Q _b cfs
101	1.02	/	1.12	3/8"	.19	6	1A	5'				.16	-	OK	1.02	-
102	1.26	/	1.12		.20	6.9	1A	5'				.19	.02	.6	1.26	-
103	1.66	/	1.12		.23	7.9	1A	5'				.22	.05	1.6	1.66	-



Date 1-26-96 Page of Comp by PDM
 Project Northridge Lakes 96064-3466
 Item Q₂ System 200 - Street Inlets
 z/n = 2000 1/3/96
INLET CAPACITY



NODE No.	HYDROLOGY		APPROACHING FLOW			INLET		ON-GRADE COMP.			SUMP COMP.			Q _b cfs	
	Q ₀ cfs	Q ₀ +Q _b cfs	S ₀ o/o	S _x in/ft	d ft	T ft	TYPE	L	L _t ft	L/L _t	E ft	d _i ft	d ft		T ft
208	11.58	0.93	.54	3/8"	.47°	13.44	1A	5'	→	flow to		.15	—	OK	1.2
209	1.55	13.13	.86	3/8"	.48°	14	1A	10'				.57	.40	12.78	13.13
212	.73		.32	3/8"	.056	5.1	1A	5'				<11 ft	—	OK	.4
204	4.95		.5	3/8"	.35	12	1A	5'				.40	.33	10.5	4.95
Q ₁₀₀	overflow			to	30'	ESMIT	NEAR								

Q₂

208

Q₁₀₀



Date 1-26-96 Page of Comp by PDM
 Project Northridge Lakes 96064-3466
 Item System 300 Street Inlets.

INLET CAPACITY

z/n =

NODE No.	HYDROLOGY		APPROACHING FLOW			INLET			ON-GRADE COMP			SUMP COMP.				
	Q ₀ cfs	Q ₀ +Q _b cfs	S ₀ o/o	S _x in/ft	d ft	T ft	TYPE	L	Lt ft	L/Lt	E ft	d _i ft	d ft	T ft	Q _i cfs	Q _b cfs
305	2.67		.65	3/8"	.21		1A	5'							3.67	
304	2.56		.73	3/8"	.27		1A	5'							2.56	
By Pass	(Q ₁₀₀)		(Q ₂)	from	System 200		to	System 300.								
10.33			.65	3/8"			1A	5							3.67	6.66
18.34			1.35	3/8"			B.Y. Drain								6.52	11.82
(Q ₁₀₀)															Σ to 303	18.48
303	3.56	22.04	.47	3/8"	.62	21	1A	2-5'				.77	.6	19.17	22.04	0
	7.20		.73	3/8"			1A	5							2.56	4.64
(Q ₁₀₀)																
302	4.70	9.34	.47	3/8"	.52	16	1A	2-5'				.60	.43	13.74	13.38	0

M

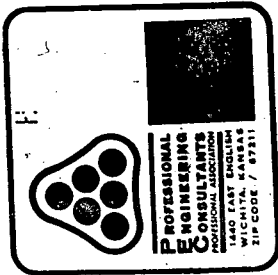
Project Northridge Lakes 95054-3466

Item Q2 System 600 - Street Inlets

1 DRC
2/10/96

INLET CAPACITY

z/h = 2.000



INLET	HYDROLOGY		APPROACHING FLOW			INLET		ON-GRADE COMP.			SUMP COMP.						
	NO. No.	Q ₀ cfs	Q ₀ +Q _b cfs	S ₀ o/o	S _x in/ft	d ft	T ft	TYPE	L	Lt ft	L/Lt	E ft	d _i ft	d ft	T ft	Q _i cfs	Q _b cfs
C	602	4.95		1.1	3/8"	.31	11.0	1A	5'				.41	.24	7.7	4.95	
C	603	3.46		1.1	3/8"	.27	8.0	1A	5'				.32	.15	4.0	3.46	
D	605	1.55		.5	3/8"	.22	7.9	1A	5'				.18	.01	—	1.55	
F	606	1.67		.5	3/8"	.23	8.1	1A	5'				.19	.02	—	1.67	
B	611	2.02		.33	3/8"	.25	9.0	1A	5'				.21	.04	—	2.02	
A	613	1.64		.33	3/8"	.27	9.5	1A	5'				.19	.02	—	1.64	

Date 1-26-96

Page _____ of _____

Comp by PM

Project Northridge Lakes 95054-3466

Item 8,000 System 800 Street Inlets

✓ DRC
2.16.96

z/h = 2600

INLET CAPACITY



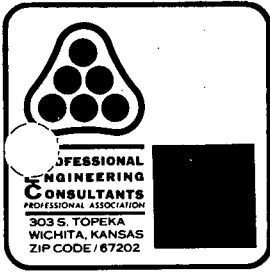
NODE No.	HYDROLOGY		APPROACHING FLOW			INLET		ON-GRADE COMP			SUMP COMP.				
	Q _o cfs	Q _o +Q _b cfs	S _x in/ft	d ft	T ft	TYPE	L	L _t ft	L/L _t	E ft	d _i ft	d ft	T ft	Q _i cfs	Q _b cfs
1 803	9.02		3/8"	.33	11	1A	5'				.67	.50	16.0	9.02	0
1 802	5.38		3/8"	.25	9	1A	5'				.45	.28	0.9	5.38	0

Date 1-26-96 Page of Comp by PDM
 Project Northridge Lakes 95084-3466
 Item Q₁₀₀ System 900 Street Inlets
 z/n =

INLET CAPACITY



NODE No.	HYDROLOGY		APPROACHING FLOW				INLET		ON-GRADE COMP.			SUMP COMP.				
	Q ₀ cfs	Q ₀ +Q _b cfs	S ₀ o/o	S _x in/ft	d ft	T ft	TYPE	L	Lt ft	L/Lt	E ft	di ft	d ft	T ft	Q _i cfs	Q _b cfs
✓ 902	4.53		1.11	3/8"	.31	10'	1A	5				.38	.21	-	4.53	∅
✓ 903	4.97		1.2	3/8"	.31	10'	1A	5				.39	.22	-	4.97	∅

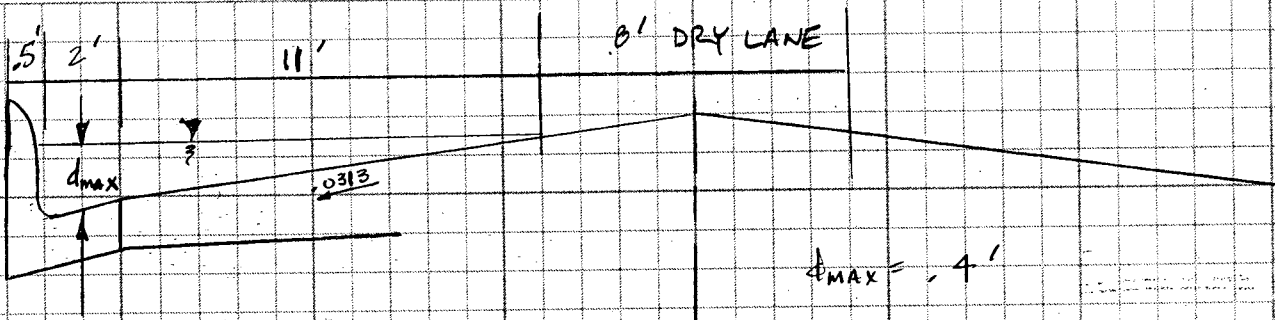


Date 2-5-96 Page of

Project Northridge Lakes

Item 2 yr Street flow Check

3 5/8" Roll curb on 64' ROW → 35' BK-BK



$P = \text{Wetted Perimeter} = 11 + 2 + .4 = 13.4$

$A = \frac{1}{2} (13) (.4) = 2.6 \text{ ft}^2$

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$

Where $R = \frac{A}{P}$ & $S = \text{slope in ft/ft}$

$Q = \frac{1.49}{.016} (2.6) \left(\frac{2.6}{13.4}\right)^{2/3} S^{1/2}$

$Q = 81.15 \sqrt{S}$

LOCATION	S (%)	Q_{max} (cfs)	Q (cfs)	Comment
103	1.12	8.59	1.26	OK
208	.86	7.53	.93	OK
N of 302	.47	5.56	2.5	OK
502	.5	5.74	1.45	OK
Lot 37, Blk 3	1.04	8.27	9.18	OK
06	.5	5.74	1.67	OK
611	.39	5.07	1.64	OK
903	1.2%	8.96	1.73	

Date: 02-07-1996
Time: 10:03:51

Input File: nrl.out

NorthRidge Lakes
SWS System 2
pdm 2/7/96

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)		

214	213	.00	.00	.00	.0	15.00	3.83	6.52	15.00	3.83	6.52	6.52	18"	3.69	70.00	.32	15.32	
213	212	.00	.00	.00	.0	.00	.00	.00	15.32	3.79	.00	6.52	18"	3.69	150.00	.68	15.99	
212	209	.00	.00	.00	.0	15.00	3.83	.33	15.99	3.72	.32	6.84	18"	3.87	60.00	.26	16.25	
211	210	.00	.00	.00	.0	15.00	3.83	1.22	15.00	3.83	1.22	1.22	15"	.99	105.00	1.76	16.76	
210	209	.00	.00	.00	.0	.00	.00	.00	16.76	3.64	.00	1.22	15"	.99	80.00	1.34	18.10	
209	208	.00	.00	.00	.0	15.00	3.83	13.13	16.25	3.69	12.65	20.59	30"	4.19	45.00	.18	16.43	
208	205	.00	.00	.00	.0	15.00	3.83	.93	16.43	3.67	.89	21.48	30"	4.38	130.00	.50	16.93	
207	206	.00	.00	.00	.0	15.00	3.83	.83	15.00	3.83	.83	.83	15"	.68	180.00	4.44	19.44	
206	205	.00	.00	.00	.0	15.00	3.83	.89	19.44	3.38	.79	1.62	15"	1.32	190.00	2.40	21.84	
205	203	.00	.00	.00	.0	15.00	3.83	3.13	16.93	3.62	2.96	25.69	30"	5.23	185.00	.59	17.52	
204	203	.00	.00	.00	.0	15.00	3.83	4.95	15.00	3.83	4.95	4.95	15"	4.03	130.00	.54	15.54	
203	202	.00	.00	.00	.0	15.00	3.83	2.29	17.52	3.56	2.13	32.50	36"	4.60	185.00	.67	18.19	
202	201	.00	.00	.00	.0	.00	.00	.00	18.19	3.50	.00	32.50	36"	4.60	30.00	.11	18.29	

Input File: nrl.out

NorthRidge Lakes
SWS System 2
pdm 2/7/96

Storm Frequency = 2-Year

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

```

*****
Node   Hyd-Slope  Friction  Bend      Transition  Manhole  Deflection  Junction  Total  Hyd-Gl  Desired  Diff.
      (Ft/Ft)   (Ft)     (Ft)      (Ft)        (Ft)     (Ft)       (Ft)     (Ft)   Elevation Elevation (Ft)
*****
201    .00000     .0000    .0000     .0000       .0000    .0000      .0000    .0000  54.0000  54.0000  .00
202    .00237     .0712    .0000     .0000       .0164    .1319      .0119    .2314  54.2314  57.0000  2.77
203    .00237     .4393    .0000     .0194       .0000    .0000      .0935    .5522  54.7836  57.0000  2.22
204    .00587     .7633    .0000     .0000       .0000    .0000      .0000    .7633  55.5470  59.7000  4.15
205    .00392     .7259    .0000     .0128       .0000    .0000      .2732    1.0120  55.7956  57.0000  1.20
206    .00063     .1189    .0000     .0020       .0000    .0000      .0417    .1627  55.9583  57.0000  1.04
207    .00017     .0297    .0000     .0000       .0000    .0000      .0000    .0297  55.9880  57.0000  1.01
208    .00274     .3566    .0000     .0024       .0000    .0159      .0616    .4365  56.2321  62.0000  5.77
209    .00252     .1134    .0000     .0041       .0000    .0935      .5808    .7917  57.0238  62.0000  4.98
211    .00036     .0375    .0000     .0000       .0000    .0000      .0000    .0375  57.0985  63.4000  6.30
210    .00036     .0285    .0000     .0000       .0008    .0062      .0018    .0373  57.0611  62.6000  5.54
212    .00424     .2544    .0000     .0021       .0000    .0174      .0629    .3369  57.3607  62.0000  4.64
214    .00385     .2697    .0000     .0000       .0000    .0000      .0000    .2697  58.3438  60.0000  1.66
213    .00385     .5779    .0000     .0000       .0106    .1057      .0193    .7135  58.0741  60.7000  2.63
*****

```

Date: 02-07-1996
Time: 15:59:17

Input File: nr3

NorthRidge Lakes
SWS System 3
pdm 2/7/96

Storm Frequency = 100-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)		
305	304	.00	.00	.00	.0	15.00	7.37	3.67	15.00	7.37	3.67	3.67	18"	2.08	45.00	.36	15.36	
304	303	.00	.00	.00	.0	15.00	7.37	2.56	15.36	7.30	2.54	6.21	24"	1.98	295.00	2.49	17.85	
303	302	.00	.00	.00	.0	15.00	7.37	18.00	15.00	7.37	18.00	23.22	36"	3.28	45.00	.23	15.23	
302	301	.00	.00	.00	.0	15.00	7.37	13.38	15.23	7.32	13.30	36.51	42"	3.80	50.00	.22	15.45	

Input File: nr3

NorthRidge Lakes
SWS System 3
pdm 2/7/96

Storm Frequency = 100-Year

* * * HYDRAULICS * * *

```

*****
Node      Hyd-Slope  Friction  Bend   Transition  Manhole  Deflection  Junction  Total  Hyd-Gl  Desired  Diff.
          (Ft/Ft)   (Ft)     (Ft)   (Ft)         (Ft)     (Ft)       (Ft)     (Ft)   Elevation  Elevation (Ft)
*****
301      .00000    .0000    .0000   .0000        .0000    .0000      .0000    .0000  55.0000  55.0000   .00
302      .00132    .0659    .0000   .0056        .0000    .0098      .2388    .3200  55.3200  56.2000   .88
303      .00121    .0545    .0000   .0107        .0000    .0243      .3949    .4844  55.8044  56.2000   .40
304      .00075    .2220    .0000   .0013        .0000    .0269      .0637    .3139  56.1183  56.5000   .38
305      .00122    .0549    .0000   .0000        .0000    .0000      .0000    .0549  56.1732  56.5000   .33
*****

```

Date: 02-07-1996
Time: 11:10:22

Input File: nr

NorthRidge Lakes
SWS System 6
pdm 2/7/96

Storm Frequency = 2-Year

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

Tributary Area										Hydrology Summation				Conduit Data				
Node to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)		
613 611	.00	.00	.00	.0	15.00	3.83	2.02	15.00	3.83	2.02	2.02	15"	1.65	45.00	.46	15.46		
612 611	.00	.00	.00	.0	15.00	3.83	3.39	15.00	3.83	3.39	3.39	15"	2.76	145.00	.87	15.87		
611 609	.00	.00	.00	.0	15.00	3.83	1.64	15.87	3.73	1.60	6.98	15"	5.69	270.00	.79	16.67		
610 609	.00	.00	.00	.0	15.00	3.83	1.55	15.00	3.83	1.55	1.55	15"	1.26	110.00	1.45	16.45		
609 606	.00	.00	.00	.0	.00	.00	.00	16.67	3.65	.00	8.52	18"	4.82	120.00	.41	17.08		
608 607	.00	.00	.00	.0	15.00	3.83	2.05	15.00	3.83	2.05	2.05	15"	1.67	110.00	1.10	16.10		
607 606	.00	.00	.00	.0	.00	.00	.00	16.10	3.71	.00	2.05	15"	1.67	50.00	.50	16.60		
606 605	.00	.00	.00	.0	15.00	3.83	1.67	17.08	3.60	1.57	12.12	18"	6.86	50.00	.12	17.20		
604 603	.00	.00	.00	.0	15.00	3.83	2.44	15.00	3.83	2.44	2.44	15"	1.99	120.00	1.01	16.01		
605 603	.00	.00	.00	.0	15.00	3.83	1.85	17.20	3.59	1.74	13.85	24"	4.41	210.00	.79	18.00		
603 602	.00	.00	.00	.0	15.00	3.83	3.46	18.00	3.51	3.18	19.34	24"	6.16	45.00	.12	18.12		
602 601	.00	.00	.00	.0	15.00	3.83	4.95	18.12	3.50	4.53	23.87	24"	7.60	170.00	.37	18.49		

02-07-1996

Date: 02-07-1996
Time: 11:10:22

Input File: nr

NorthRidge Lakes
SWS System 6
pdm 2/7/96

Storm Frequency = 2-Year

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

```
*****
Node      Hyd-Slope  Friction  Bend      Transition  Manhole  Deflection  Junction  Total  Hyd-Gl  Desired  Diff.
      (Ft/Ft)   (Ft)     (Ft)      (Ft)        (Ft)     (Ft)       (Ft)     (Ft)   Elevation  Elevation  (Ft)
*****
```

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)
601	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	46.0000	46.0000	.00
607	.00101	.0504	.0000	.0000	.0022	.0217	.0050	.0792	52.0355	63.2000	11.16
602	.01113	1.8920	.0000	.0308	.0000	.0000	.6629	2.5856	48.5856	60.5000	11.91
603	.00731	.3288	.0000	.0286	.0000	.1510	.5533	1.0617	49.6474	60.5000	10.85
604	.00143	.1712	.0000	.0000	.0000	.0000	.0000	.1712	49.8186	58.5000	8.68
605	.00375	.7875	.0000	.0856	.0000	.0000	-.2362	.6369	50.2843	62.9000	12.62
606	.01331	.6654	.0000	.0369	.0000	.1806	.7890	1.6719	51.9562	63.3000	11.34
608	.00101	.1108	.0000	.0000	.0000	.0000	.0000	.1108	52.1462	58.6000	6.45
609	.00658	.7901	.0000	.0283	.0000	.0180	.0744	.9108	52.8670	63.5000	10.63
610	.00058	.0633	.0000	.0000	.0000	.0000	.0000	.0633	52.9304	58.9000	5.97
611	.01169	3.1553	.0000	.0384	.0000	.0754	.7915	4.0606	56.9277	63.9000	6.97
612	.00275	.3993	.0000	.0000	.0000	.0000	.0000	.3993	57.3270	58.9000	1.57
613	.00098	.0440	.0000	.0000	.0000	.0000	.0000	.0440	56.9717	63.9000	6.93

```
*****
```

02-07-1996

Date: 02-07-1996
Time: 15:01:32

Input File: nr1sys8.stm

NorthRidge Lakes
SWS System 800
100 yr
pdm 2/7/96

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)			
*****										*****					*****				
803	802	.00	.00	.00	.0	15.00	7.37	9.02	15.00	7.37	9.02	9.02	24"	2.87	45.00	.26	15.26		
802	801	.00	.00	.00	.0	15.00	7.37	5.38	15.26	7.32	5.34	14.36	24"	4.57	65.00	.24	15.50		
*****										*****					*****				

02-07-1996

Date: 02-07-1996
Time: 15:01:32

Input File: nrlsys8.stm

NorthRidge Lakes
SWS System 800
100 yr
pdm 2/7/96

Storm Frequency = 100-Year

* * * HYDRAULICS * * *

```
*****  
Node      Hyd-Slope  Friction   Bend      Transition  Manhole  Deflection  Junction  Total   Hyd-Gl   Desired  Diff.  
          (Ft/Ft)   (Ft)      (Ft)      (Ft)        (Ft)     (Ft)        (Ft)     (Ft)   Elevation Elevation (Ft)  
*****  
801      .00000     .0000     .0000     .0000       .0000     .0000       .0000     .0000  55.5000  55.5000  .00  
802      .00403     .2620     .0000     .0197       .0000     .0075       .4079     .6971  56.1971  56.2000  .00  
803      .00159     .0715     .0000     .0000       .0000     .0000       .0000     .0715  56.2686  56.2000  -.07  
*****
```

02-07-1996

Date: 02-07-1996
Time: 15:09:39

Input File: nrlsys9.stm

NorthRidge Lakes
SWS System 9
100 yr
pdm 2/7/96

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)		
903	902	.00	.00	.00	.0	15.00	7.37	4.84	15.00	7.37	4.84	4.84	15"	3.94	45.00	.19	15.19	
902	901	.00	.00	.00	.0	15.00	7.37	4.53	15.19	7.33	4.51	9.35	15"	7.62	160.00	.35	15.54	

02-07-1996

Date: 02-07-1996
Time: 15:09:39

Input File: nrlsys9.stm

NorthRidge Lakes
SWS System 9
100 yr
pdm 2/7/96

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-Gl  Desired  Diff.
          (Ft/Ft)   (Ft)     (Ft)   (Ft)         (Ft)     (Ft)        (Ft)     (Ft)   Elevation Elevation (Ft)
*****
901      .00000     .0000    .0000   .0000        .0000     .0000       .0000     .0000  54.0000  54.0000   .00
902      .02094     3.3502   .0000   .0659        .0000     .0000       1.3876     4.8037  58.8037  64.5000   5.70
903      .00561     .2526    .0000   .0000        .0000     .0000       .0000     .2526  59.0563  64.5000   5.44
*****

```

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

TDF

<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>
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

DURATION IN MINUTES	RETURN PERIODS OF						
	1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
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	3.64

TABLE 3
FULL FLOW COEFFICIENT VALUES
CIRCULAR CONCRETE PIPE

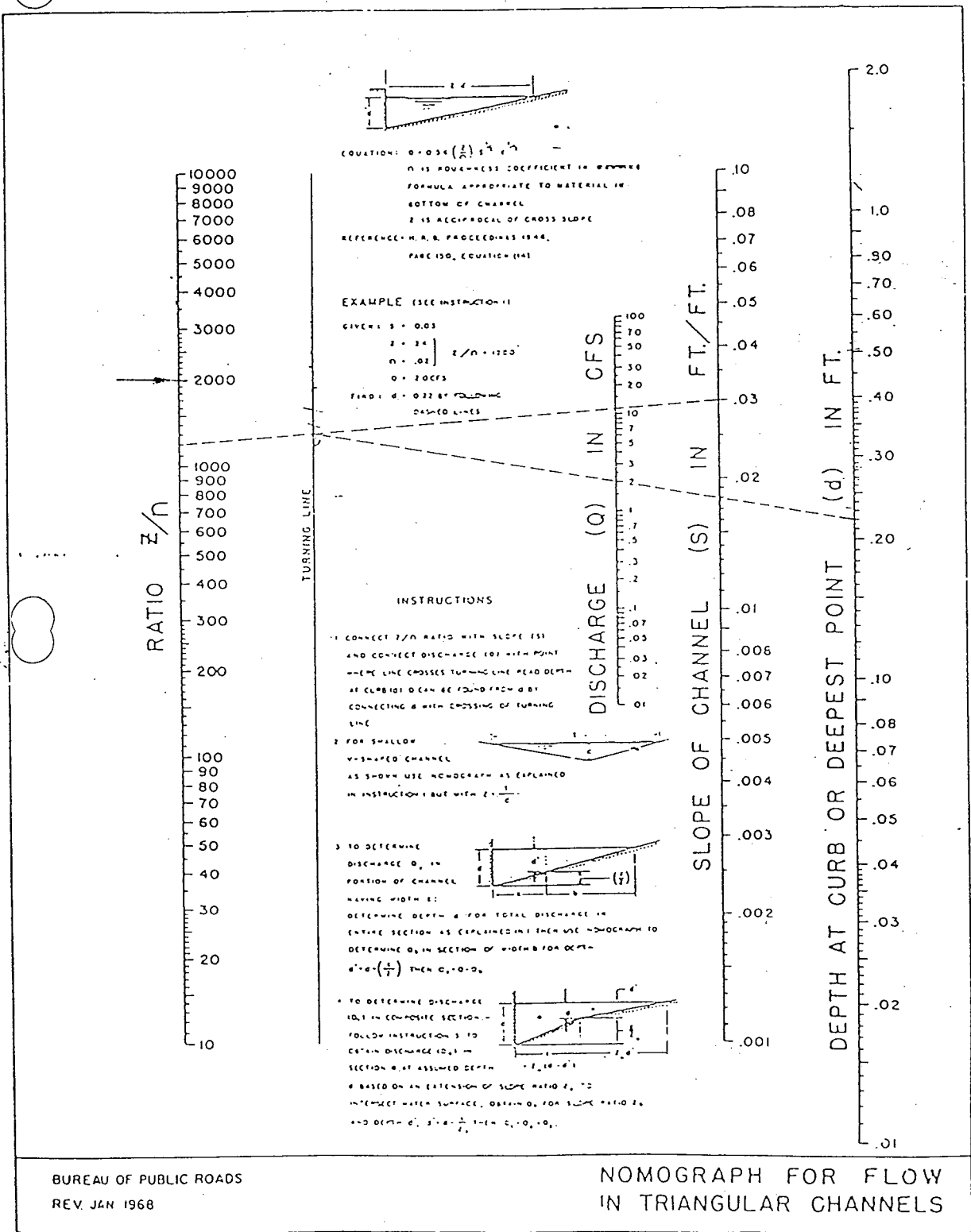
D Pipe Diameter (inches)	A Area (Square Feet)	R Hydraulic Radius (Feet)	Value of $C_1 = \frac{1.486}{n} \times A \times R^{2/3} = K$			
			n=0.010	n=0.011	n=0.012	n=0.013
8	0.349	0.167	15.8	14.3	13.1	12.1
10	0.545	0.208	28.4	25.8	23.6	21.8
12	0.785	0.250	46.4	42.1	38.6	35.7
15	1.227	0.312	84.1	76.5	70.1	64.7
18	1.767	0.375	137	124	114	105
21	2.405	0.437	206	187	172	158
24	3.142	0.500	294	267	245	226
27	3.976	0.562	402	366	335	310
30	4.909	0.625	533	485	444	410
33	5.940	0.688	686	624	574	530
36	7.069	0.750	867	788	722	666
42	9.621	0.875	1308	1189	1090	1006
48	12.566	1.000	1867	1698	1556	1436
54	15.904	1.125	2557	2325	2131	1967
60	19.635	1.250	3385	3077	2821	2604
66	23.758	1.375	4364	3967	3636	3357
72	28.274	1.500	5504	5004	4587	4234
78	33.183	1.625	6815	6195	5679	5242
84	38.485	1.750	8304	7549	6920	6388
90	44.170	1.875	9985	9078	8321	7681
96	50.266	2.000	11850	10780	9878	9119
102	56.745	2.125	13940	12670	11620	10720
108	63.617	2.250	16230	14760	13530	12490
114	70.882	2.375	18750	17040	15620	14420
120	78.540	2.500	21500	19540	17920	16540
126	86.590	2.625	24480	22260	20400	18830
132	95.033	2.750	27720	25200	23100	21330
138	103.870	2.875	31210	28370	26010	24010
144	113.100	3.000	34960	31780	29130	26890

$Q = K \sqrt{S}$
 $K = \frac{Q}{\sqrt{S}}$
 $S = \frac{Q^2}{K^2}$

$= \frac{1}{2} \times \text{slope} = \frac{1}{2} \times 0.03125 = 0.015625 \approx 0.016$

$= 0.016$

$n = 32 / 0.016 = 2000$

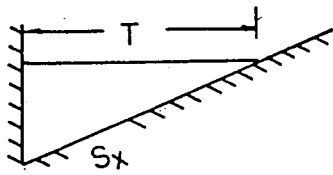


BUREAU OF PUBLIC ROADS
 REV. JAN 1968

NOMOGRAPH FOR FLOW
 IN TRIANGULAR CHANNELS

RAINAGE PLAN

DRAINAGE PLAN



$$Q = \frac{0.56}{n} S_x^{1.67} S^{0.5} T^{2.67}$$

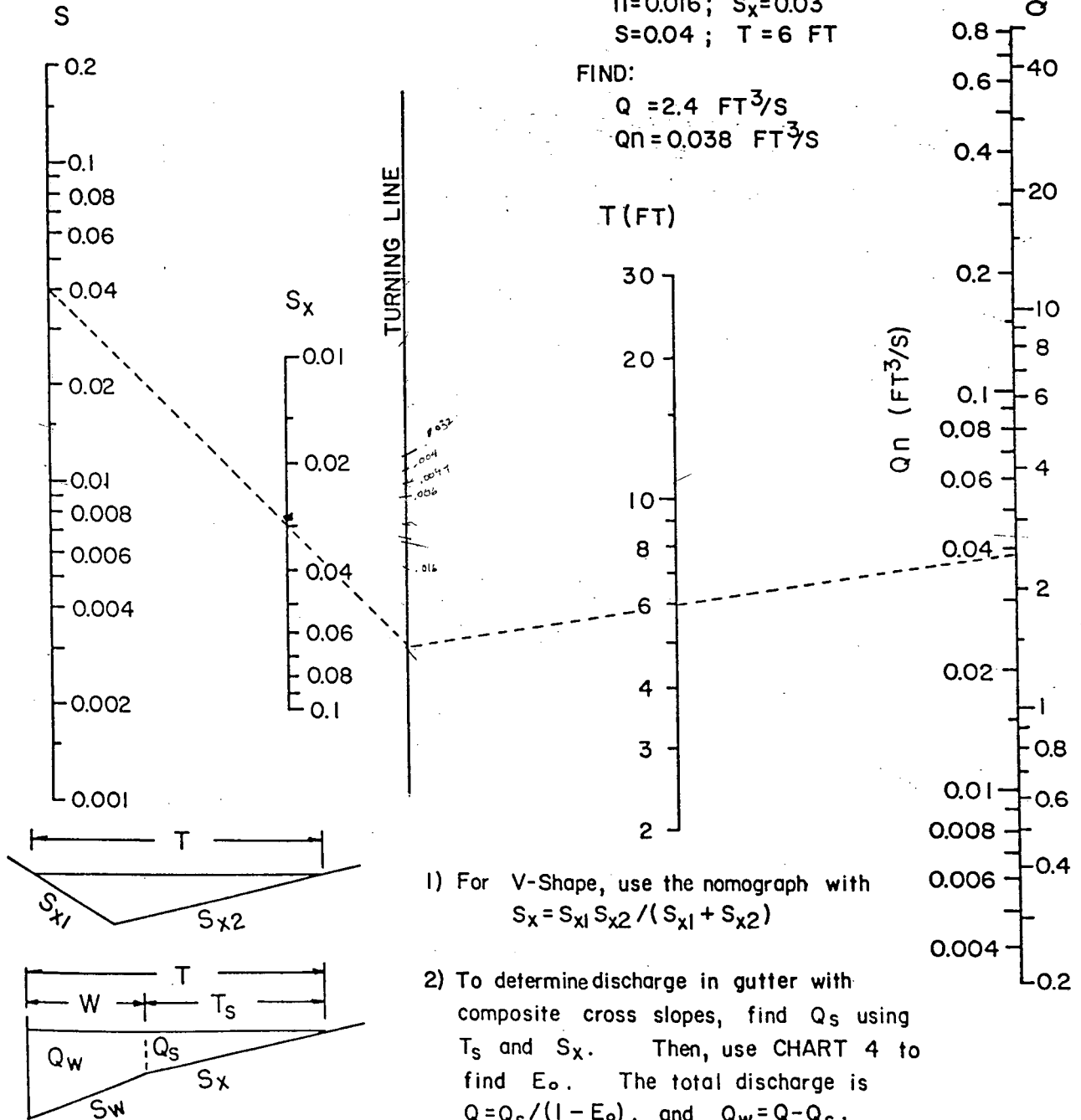
EXAMPLE:

GIVEN:

$n = 0.016$; $S_x = 0.03$
 $S = 0.04$; $T = 6$ FT

FIND:

$Q = 2.4$ FT³/S
 $Qn = 0.038$ FT³/S

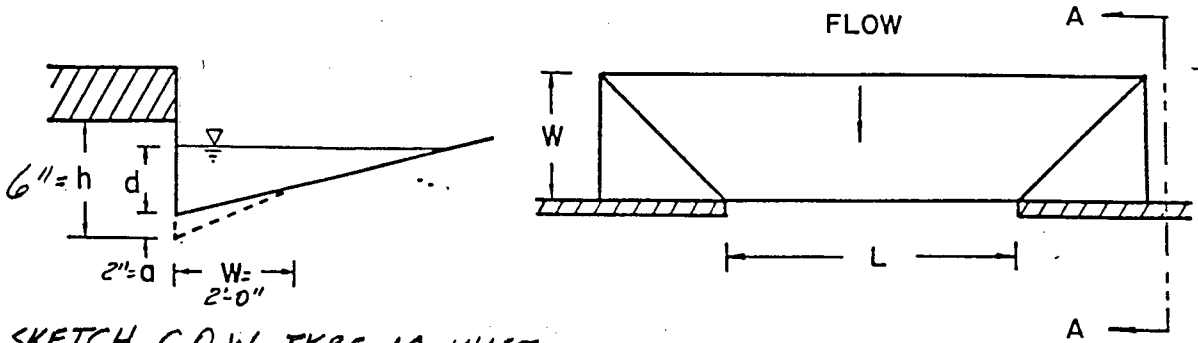


1) For V-Shape, use the nomograph with
 $S_x = S_{x1} S_{x2} / (S_{x1} + S_{x2})$

2) To determine discharge in gutter with composite cross slopes, find Q_s using T_s and S_x . Then, use CHART 4 to find E_o . The total discharge is $Q = Q_s / (1 - E_o)$, and $Q_w = Q - Q_s$.

CHART 3. Flow in triangular gutter sections.

From: HEC-12: DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., Mar. 1984



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

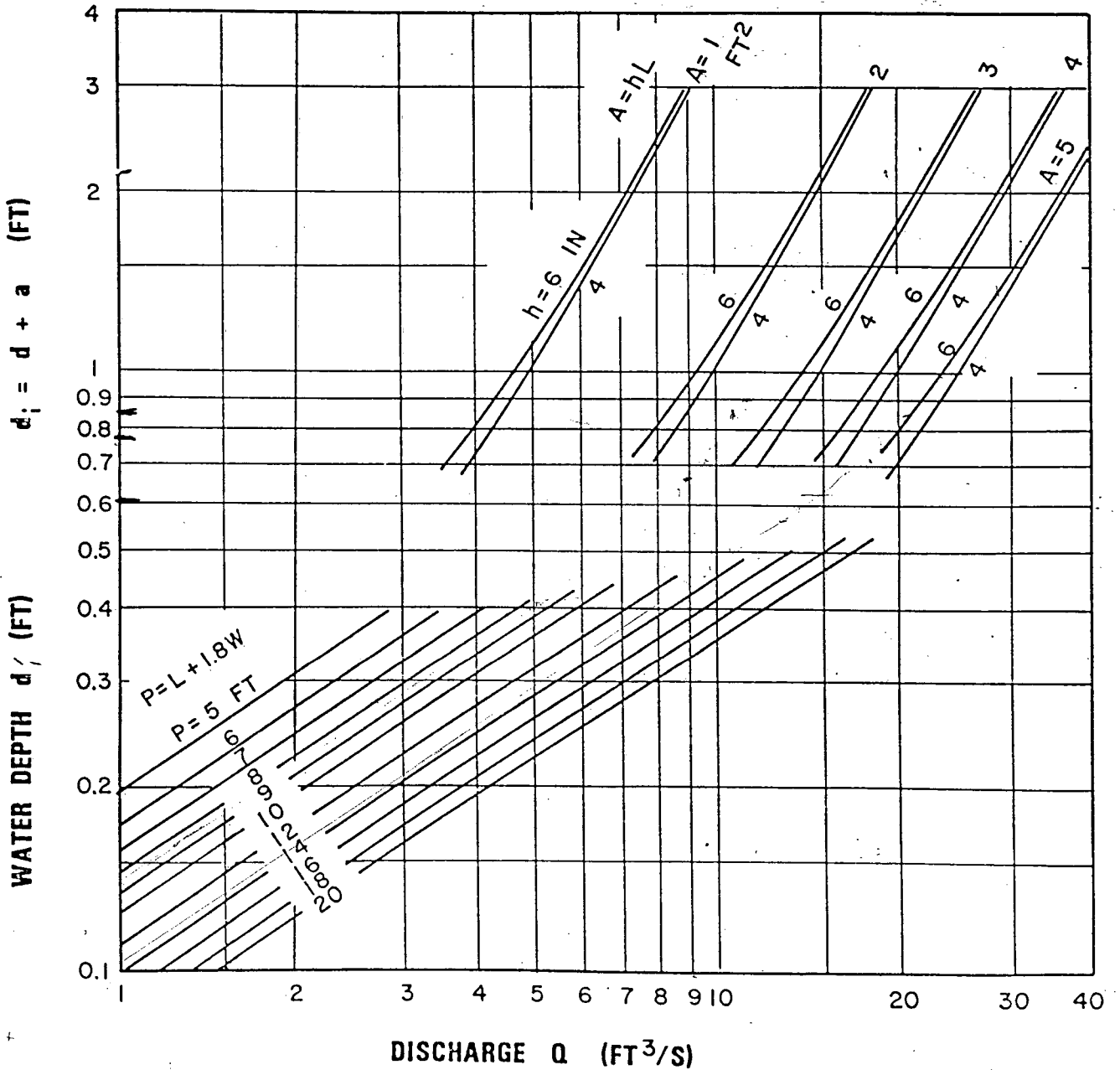


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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

$d_i = 5'$

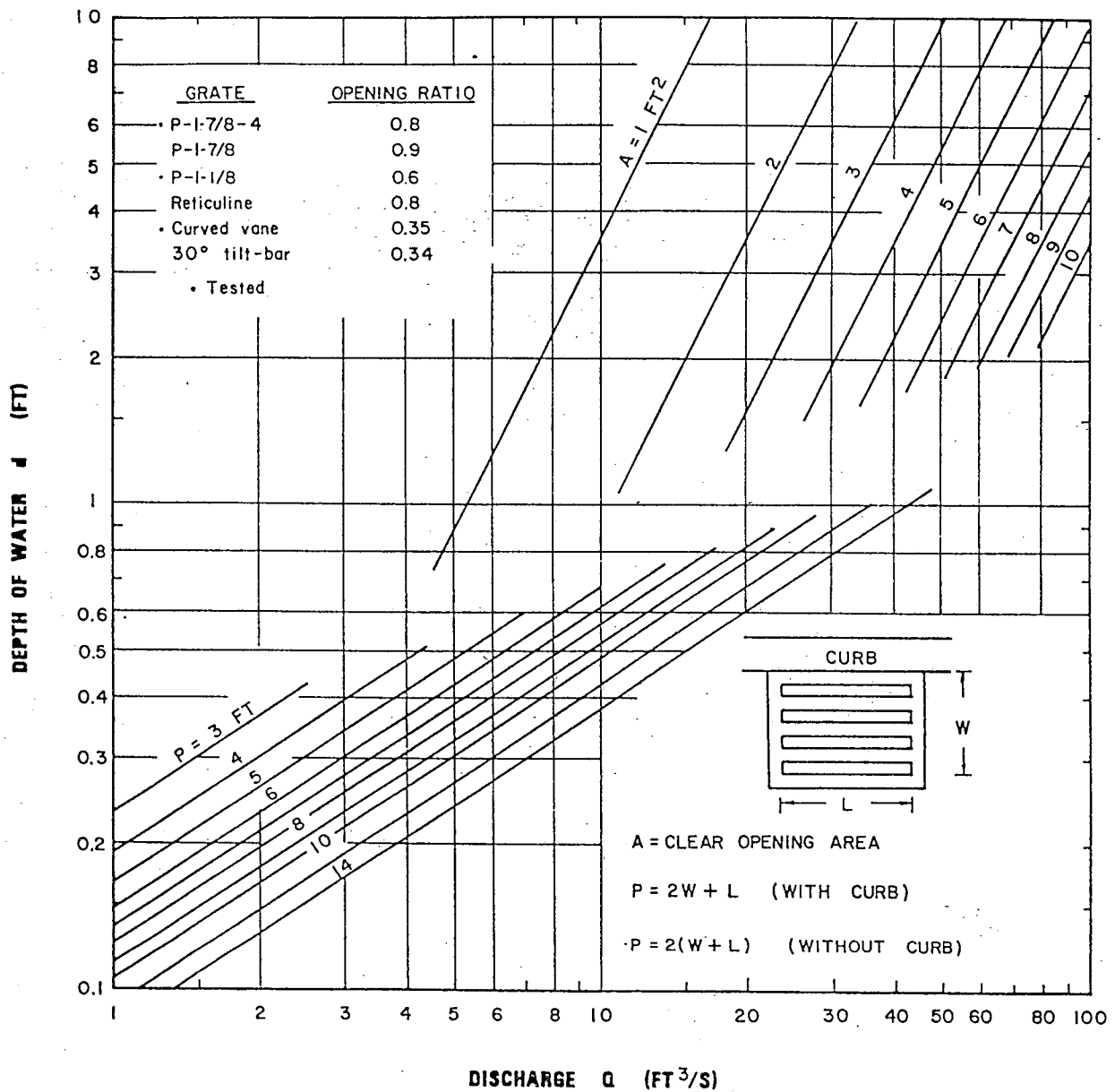


CHART 11. Grate inlet capacity in sump conditions.

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