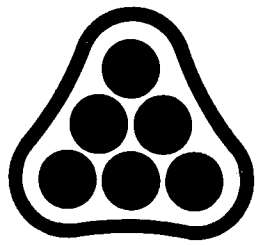

PROFESSIONAL
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PROFESSIONAL ASSOCIATION

DRAINAGE PLAN

AND

SUPPORTING CALCULATIONS

FOR

REFLECTION RIDGE 4TH ADDITION

TO WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

ENGINEERS

WICHITA, KANSAS

OCTOBER 20, 1989

1440 EAST ENGLISH
WICHITA, KANSAS 67211
(316) 262-2691

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Project Reflection Ridge 4th Addition

Item Drainage Plan System 1

I HYDROLOGY

Use Rational Method $Q = CIA$

Determine "C"

Node	Soil Type	Hyd. Group	Land Use	C_2	C_{100}
113	Sa	B	80% Golf 20% Res	0.25	0.46
112	Sa	B	Res.; 1/4 Ac	0.44	0.61
111	Sa	B	Res; 1/4 Ac.	0.44	0.61
110	(Manhole)				
109	Sa	B	Res; 1/4 Ac.	0.44	0.61
108	Fa; Ea	B	Res; 1/4 Ac.	0.44	0.61
107	Sa	B	Res; 1/4 Ac	0.44	0.61
106	Fa; Ea	B	Res; 1/4 Ac.	0.44	0.61
105	Fa; Ea	B	Res; 1/4 Ac.	0.44	0.61
104	Fa; Ea	B	Res; 1/4 Ac	0.44	0.61
103	Fa; Ea	B	Res; 1/4 Ac	0.44	0.61
102	Ea; La	B & C	50% Golf 50% Res	0.33	0.52
101	La	C	Golf Course	0.26	0.53
100	(Headwall)				

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Project Reflection Ridge 4th Addition

Item Drainage Plan System 1

Determine "I"

Node	tc	I_2	I_{100}
113	200' @ 0.28 fps + 400' @ 1.12 fps = 18	3.51	6.84
112	15 *	3.83	7.37
111	15 *	3.83	7.37
110	(Manhole)		
109	15 *	3.83	7.37
108	15 *	3.83	7.37
107	15 *	3.83	7.37
106	15 *	3.83	7.37
105	15 *	3.83	7.37
104	15 *	3.83	7.37
103	15 *	3.83	7.37
102	100' @ 0.28 fps + 1200' @ 1.12 fps = 24	3.03	6.01
101	150' @ 0.28 fps + 400' @ 1.12 fps = 15	3.83	7.37
100	(Headwall)		

* Assumed value

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Project Reflection Ridge 4th Addition

Item Drainage Plan System 1

Determine "A"

Node	Plan. Units	Area (SF)	Area (Ac.)
113	1283	205,280	4.71
112	342	54,720	1.26
111	232	37,120	0.85
110	(Manhole)		
109	312	49,920	1.15
108	523	83,680	1.92
107	1152	184,320	4.23
106	368	58,880	1.35
105	1008	161,280	3.70
104	124	19,840	0.46
103	578	92,480	2.12
102	2804	448,640	10.30
101	400	64,000	1.47
100	(Headwall)		

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Item Drainage Plan System 1

Determine "Q_2"

Node	C_2	I_2	A	Q_2
113	0.25	3.51	4.71	4.1
112	0.44	3.83	1.26	2.1
111	0.44	3.83	0.85	1.4
110	(Manhole)			
109	0.44	3.83	1.15	1.9
108	0.44	3.83	1.92	3.2
107	0.44	3.83	4.23	7.1
106	0.44	3.83	1.35	2.3
105	0.44	3.83	3.70	6.2
104	0.44	3.83	0.46	0.8
103	0.44	3.83	2.12	3.6
102	0.33	3.03	10.30	10.3
101	0.26	3.83	1.47	1.5
100	(Headwall)			
				$\Sigma = 44.5$

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Item Drainage Plan System 1

Determine "Q_{100}"

Node	C_{100}	I_{100}	A	Q_{100}
113	0.46	6.84	4.71	14.8
112	0.61	7.37	1.26	5.7
111	0.61	7.37	0.85	3.8
110	(Manhole)			
109	0.61	7.37	1.15	5.2
108	0.61	7.37	1.92	8.6
107	0.61	7.37	4.23	19.0
106	0.61	7.37	1.35	6.1
105	0.61	7.37	3.70	16.6
104	0.61	7.37	0.46	2.1
103	0.61	7.37	2.12	9.5
102	0.52	6.01	10.30	32.2
101	0.53	7.37	1.47	5.7
100	(Headwall)			
				$\Sigma = 129.3$

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Project Reflection Ridge 4th Addition

Item Drainage Plan System 1

II FLOOD ROUTING / INLET SIZING (2-YR)

Node	Inlet Cond.	Inlet Size	$Q_{approach}$*	$Q_{intercept}$	Q_{bypass} †	to Node #
113	Sump	2x4 Area Inlet	4.1	4.1	0.0	-
112	Sump	5'	2.1	2.1	0.0	-
111	Sump	5'	1.4	1.4	0.0	-
110	(Manhole)					
109	Sump	5'	1.9	1.9	0.0	-
108	On Grade	5'	3.2	36% = 1.2	2.0	106
107	Sump	5'	7.1	7.1	0.0	-
106	Sump	5'	2.3 + 2.0 = 4.3 from 108	4.3	0.0	-
105	Sump	5'	6.2	6.2	0.0	-
104	On Grade	5'	0.8	59% = 0.5	0.3	103
103	Sump	5'	3.6 + 0.3 = 3.9	3.9	0.0	-
102	Sump	2x4 Area Inlet	10.3	10.3	0.0	-
101	Sump	2x4 Area Inlet	1.5	1.5	0.0	-

* $Q_{approach} = Q_2$

† Input "Q" for storm program.

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```
100 j, 1322.0000  100    3   14   13
110 t,reflection ridge 4th addition
120 t,drainage plan
130 t,storm water sewer system 1 analysis
140 i,  113    0.25    4.71    0.00    0.00    4.10   18.00  1330.00
150 i,  112    0.44    1.26    0.00    0.00    2.10   15.00  1330.40
160 i,  111    0.44    0.85    0.00    0.00    1.40   15.00  1330.40
170 m,  110  1330.70
180 i,  109    0.44    1.15    0.00    0.00    1.90   15.00  1330.00
190 i,  108    0.44    1.92    0.00    0.00    1.20   15.00  1330.00
200 i,  107    0.44    4.23    0.00    0.00    7.10   15.00  1328.50
210 i,  106    0.44    1.35    0.00    0.00    4.30   15.00  1328.50
220 i,  105    0.44    3.70    0.00    0.00    6.20   15.00  1326.50
230 i,  104    0.44    0.46    0.00    0.00    0.50   15.00  1328.00
240 i,  103    0.44    2.12    0.00    0.00    3.90   15.00  1326.50
250 i,  102    0.33   10.30    0.00    0.00   10.30   24.00  1329.20
260 i,  101    0.26    1.47    0.00    0.00    1.50   15.00  1322.20
270 m,  100  1322.00
280 p,  113  112   160.00   18 0.013   0.00   0.00
290 p,  112  111    35.00   18 0.013  80.00   0.00
300 p,  111  110   170.00   24 0.013  35.00   0.00
310 p,  110  109   160.00   24 0.013  35.00   0.00
320 p,  109  108    85.00   24 0.013  75.00   0.00
330 p,  108  107   160.00   27 0.013  50.00   0.00
340 p,  107  105    80.00   30 0.013  25.00   0.00
350 p,  106  105    35.00   15 0.013  75.00   0.00
360 p,  105  104   220.00   30 0.013  65.00   0.00
370 p,  104  102   370.00   36 0.013  30.00   0.00
380 p,  103  102   210.00   36 0.013  40.00   0.00
390 p,  102  101   160.00   36 0.013   0.00   0.00
400 p,  101  100    20.00   36 0.013   0.00   0.00
410 e
```

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Date: 10-19-1989
Time: 12:11:26

Input File: rr4

reflection ridge 4th addition
drainage plan
storm water sewer system 1 analysis

Storm Frequency = 2-Year

* * * HYDROLOGY * * *

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)
113	112	0.25	4.71	0.00	0.0	18.00	3.78	4.10	18.00	3.78	4.10	4.10	18"	2.32	160.00	1.15	19.15
112	111	0.44	1.26	0.00	0.0	15.00	4.06	2.10	19.15	3.69	1.91	6.01	18"	3.40	35.00	0.17	19.32
111	110	0.44	0.85	0.00	0.0	15.00	4.06	1.40	19.32	3.68	1.27	7.28	24"	2.32	170.00	1.22	20.54
110	109	0.00	0.00	0.00	0.0	0.00	0.00	0.00	20.54	3.59	0.00	7.28	24"	2.32	160.00	1.15	21.70
109	108	0.44	1.15	0.00	0.0	15.00	4.06	1.90	21.70	3.51	1.65	8.92	24"	2.84	65.00	0.50	22.19
108	107	0.44	1.92	0.00	0.0	15.00	4.06	1.20	22.19	3.48	1.03	9.95	27"	2.50	160.00	1.07	23.26
107	105	0.44	4.23	0.00	0.0	15.00	4.06	7.10	23.26	3.42	5.98	15.94	30"	3.25	80.00	0.41	23.67
106	105	0.44	1.35	0.00	0.0	15.00	4.06	4.30	15.00	4.06	4.30	4.30	15"	3.50	35.00	0.17	15.17
105	104	0.44	3.70	0.00	0.0	15.00	4.06	6.20	23.67	3.40	5.19	24.74	30"	5.04	220.00	0.73	24.40
104	103	0.44	0.46	0.00	0.0	15.00	4.06	0.50	24.40	3.36	0.41	25.15	30"	5.12	370.00	1.20	25.60
103	102	0.44	2.12	0.00	0.0	15.00	4.06	3.90	25.60	3.24	3.13	28.29	36"	4.00	210.00	0.87	26.48
102	101	0.33	10.30	0.00	0.0	24.00	3.38	10.30	26.48	3.18	9.69	37.97	36"	5.37	160.00	0.50	26.97
101	100	0.26	1.47	0.00	0.0	15.00	4.06	1.50	26.97	3.13	1.16	39.13	36"	5.54	20.00	0.06	27.03

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Date: 10-19-1989
Time: 12:11:26

Input File: rr4

reflection ridge 4th addition
drainage plan
storm water sewer system 1 analysis

Storm Frequency = 2-Year

* * * HYDRAULICS * * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
113	0.00152	0.2438	0.0000	0.0000	0.0000	0.0000	0.0000	0.2438	1328.2106	1330.0000	1.79
112	0.00327	0.1145	0.0000	0.0096	0.0000	0.0000	0.2043	0.3284	1327.9668	1330.4000	2.43
111	0.00103	0.1759	0.0000	0.0192	0.0000	0.0779	-0.0345	0.2386	1327.6383	1330.4000	2.76
110	0.00103	0.1656	0.0000	0.0000	0.0042	0.0134	0.0052	0.1883	1327.3997	1330.7000	3.30
109	0.00156	0.1322	0.0000	0.0042	0.0000	0.0134	0.0985	0.2484	1327.2113	1330.0000	2.79
108	0.00103	0.1652	0.0000	0.0056	0.0000	0.0503	0.0027	0.2239	1326.9709	1330.0000	3.03
107	0.00151	0.1209	0.0000	0.0086	0.0000	0.0240	0.1942	0.3457	1326.7471	1328.5000	1.75
106	0.00443	0.1551	0.0000	0.0000	0.0000	0.0000	0.0000	0.1551	1326.5564	1328.5000	1.94
105	0.00364	0.8004	0.0000	0.0231	0.0000	0.0176	0.4506	1.2917	1326.4014	1328.5000	2.10
104	0.00376	1.3915	0.0000	0.0013	0.0000	0.1335	0.0452	1.5715	1325.1697	1328.0000	2.83
103	0.00180	0.3777	0.0000	0.0318	0.0000	0.0546	-0.0676	0.3965	1323.5382	1325.5000	1.96
102	0.00324	0.5186	0.0000	0.0199	0.0000	0.0470	0.4123	0.9978	1323.1417	1322.2000	-0.94
101	0.00344	0.0683	0.0000	0.0028	0.0000	0.0000	0.0723	0.1439	1322.1437	1322.2000	0.06
100	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1322.0000	1322.0000	0.00

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Project Reflection Ridge 4th Add.

Item Drainage Plan System 1

Check 100-yr flow approaching Node 103 (N. end of Green Meadow Circle)

Contributing Areas: Q_2 from Node 113 = 4.1 cfs
($Q_{100} - Q_2$ will flow north on golf course)

Q_{100} from Nodes 112 → 103

5.7
3.8
5.2
8.6
19.0
6.1
16.6
2.1
9.5

80.7 cfs.

Q_2 in pipe approaching Node 103: 25.2 cfs (from p. 8)

Qstreet approaching Node 103 = $Q_{100} - Q_{pipe}$
= 80.7 - 25.2 = 55.5

To avoid requirement for overflow ditch between lots, inlets @ Node 103 & its outlet pipe need to be designed for Q = 55.5 cfs.

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Project Reflection Ridge 4th Addition

Item Drainage Plan System I

Inlet sizing @ Node 103

Q = 55.5 cfs (see page 10)

w/ Ponding elev. @ 1326.7 (0.7' above TC)
d = 1.62'

10' inlet capacity = 32 cfs

5' inlet capacity = 16 cfs

∴ 2 10' inlets required

Pipe sizing out of Node 103 to Node 100:

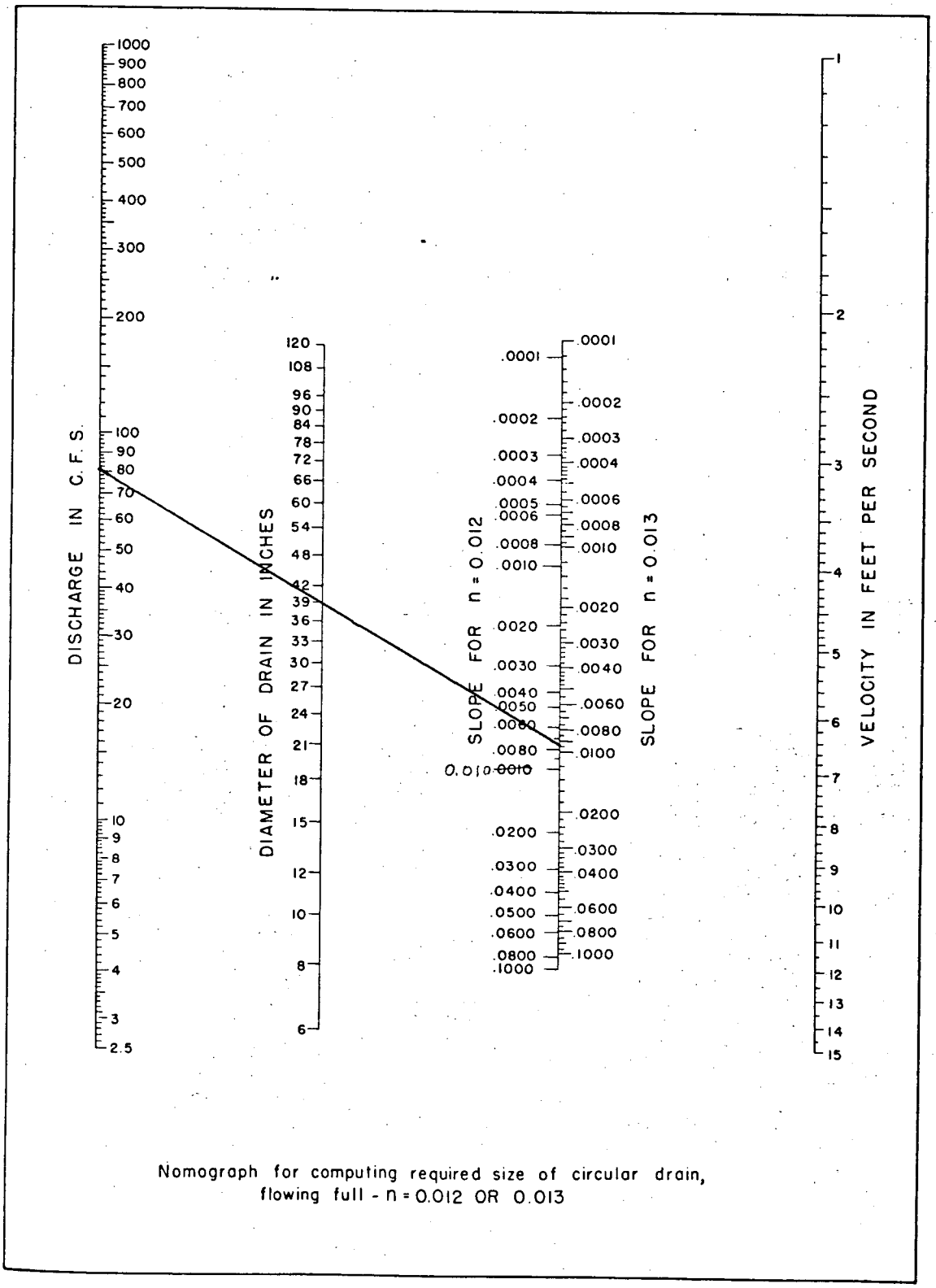
Q_{100} = 80.7 cfs (see page 10)

Hyd. slope = $\frac{1326.7 \text{ (ponding el @ 103)} - 1323.0 \text{ (DWS}_{100} \text{ @ 100)}}{390'}$

= 0.95%

From attached graph (p. 12) Use 42" RCP

(Equivalent elliptical pipe may be required due to small amount of cover)



Nomograph for computing required size of circular drain, flowing full - n = 0.012 OR 0.013

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Project Reflection Ridge 4th Addition

Item Drainage Plan System 1

III STREET FLOW

2-YR

Node	Q_2 (cfs)	Distribution	street slope (%)	d (ft)	dmax	Comment
113	(No street flow - area inlet)					
112	2.1	80% (S) = 1.7	0.32	0.26	0.30	OK
		20% (N) = 0.4	0.50	0.14	0.30	OK
111	1.4	80% (S) = 1.1	0.32	0.22	0.30	OK
		20% (N) = 0.3	0.50	0.12	0.30	OK
110	(manhole)					
109	1.9	50% (NW) = 1.0	0.68	0.19	0.55	OK
		50% (SW) = 0.9	0.32	0.20	0.30	OK
108	3.2	100% (NW) = 3.2	0.68	0.29	0.55	OK
107	7.1	10% (NW) = 0.7	0.68	0.16	0.55	OK
		90% (SE) = 6.4	0.32	0.43	0.55	OK
106	± 4.3 (includes 108 overflow)	± 100% (NW) = 4.3	0.68	0.32	0.55	OK
105	6.2	100% (S) = 6.2	0.32	0.41	0.55	OK
104	0.8	100% (W) = 0.8	0.54	0.18	0.55	OK
103	± 3.9 (includes 104 overflow)	50% (W) = 2.0	0.54	0.25	0.55	OK
		50% (E) = 1.9	0.54	0.24	0.55	OK
102	(No Street Flow - Area Inlet)					
101	" " "	"	"			
100	(Headwall)					

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Item Drainage Plan System 1

100-YR STREET FLOW

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

Location	Contributing Areas	Q_{100}	Q_{pipe}	Q_{street}	street slope	Q_{max}	Comment
Approaching Nodes 112, 111 from S.	80% 112 =	4.6					
	80% 111 =	3.0					
		7.6	0.0	7.6	0.32	22.8	OK Roll Curb 0.3' wk Gr.
Approaching Node 109 from W	2-YR 113 =	4.1					
	100% 112	5.7					
	100% 111	3.8					
	50% 109	2.6					
		16.2	7.3	8.9	0.32	22.8	OK Roll Curb 0.3' wk. Gr.
Approaching 107 & 106 from NW.	2-YR 113 =	4.1					
	100% 112 =	5.7					
	100% 111 =	3.8					
	100% 109 =	5.2					
	100% 108 =	8.6					
	10% 107 =	1.9					
	100% 106 =	6.1					
		35.4	10.0	25.4	0.68	63.7	OK Std. Cb. 0.3 wk. Gr.
Approaching 107 & 105 from S	90% 107 =	17.1					
	100% 105 =	16.6					
		33.7	0.0	33.7	0.32	43.7	OK Std. Cb. 0.3 wk. Gr.

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Project Reflection Ridge 4th Addition

Item Drainage Plan System 1

Location	Contributing Areas			Q_{100}	Q_{pipe}	Q_{street}	street slope	Q_{max}	Comment
Approaching 103	2-Yr	113	=	4.1					
	100%	112	=	5.7					
	100%	111	=	3.8					
	100%	109	=	5.2					
	100%	108	=	8.6					
	100%	107	=	19.0					
	100%	106	=	6.1					
	100%	105	=	16.6					
	100%	104	=	2.1					
	100%	103	=	9.5					
				80.7	25.2	55.5	0.54	56.8	OK
									Std Cb.
									0.3' wkGr.

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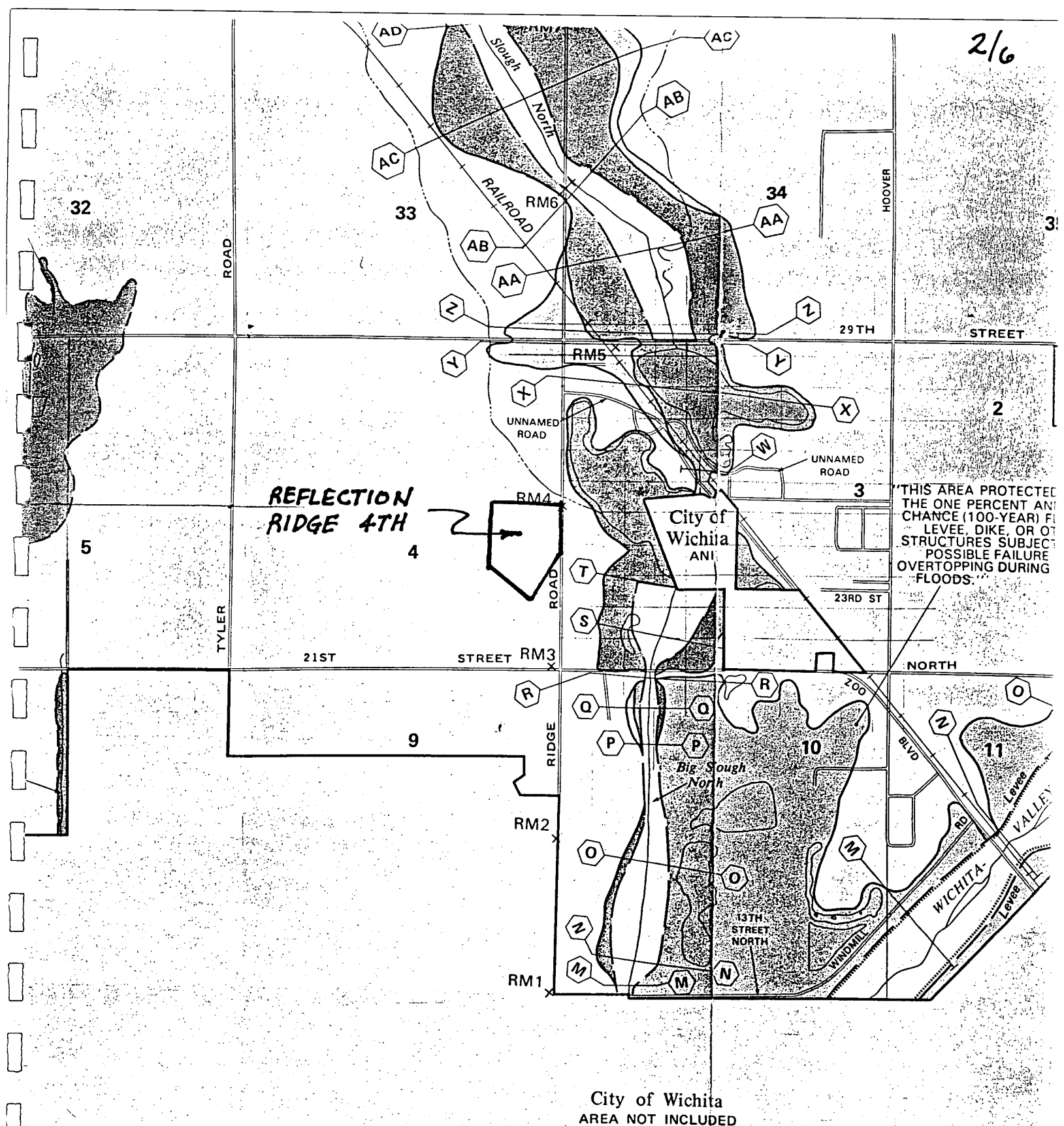
Project Reflection Ridge 4th Addition

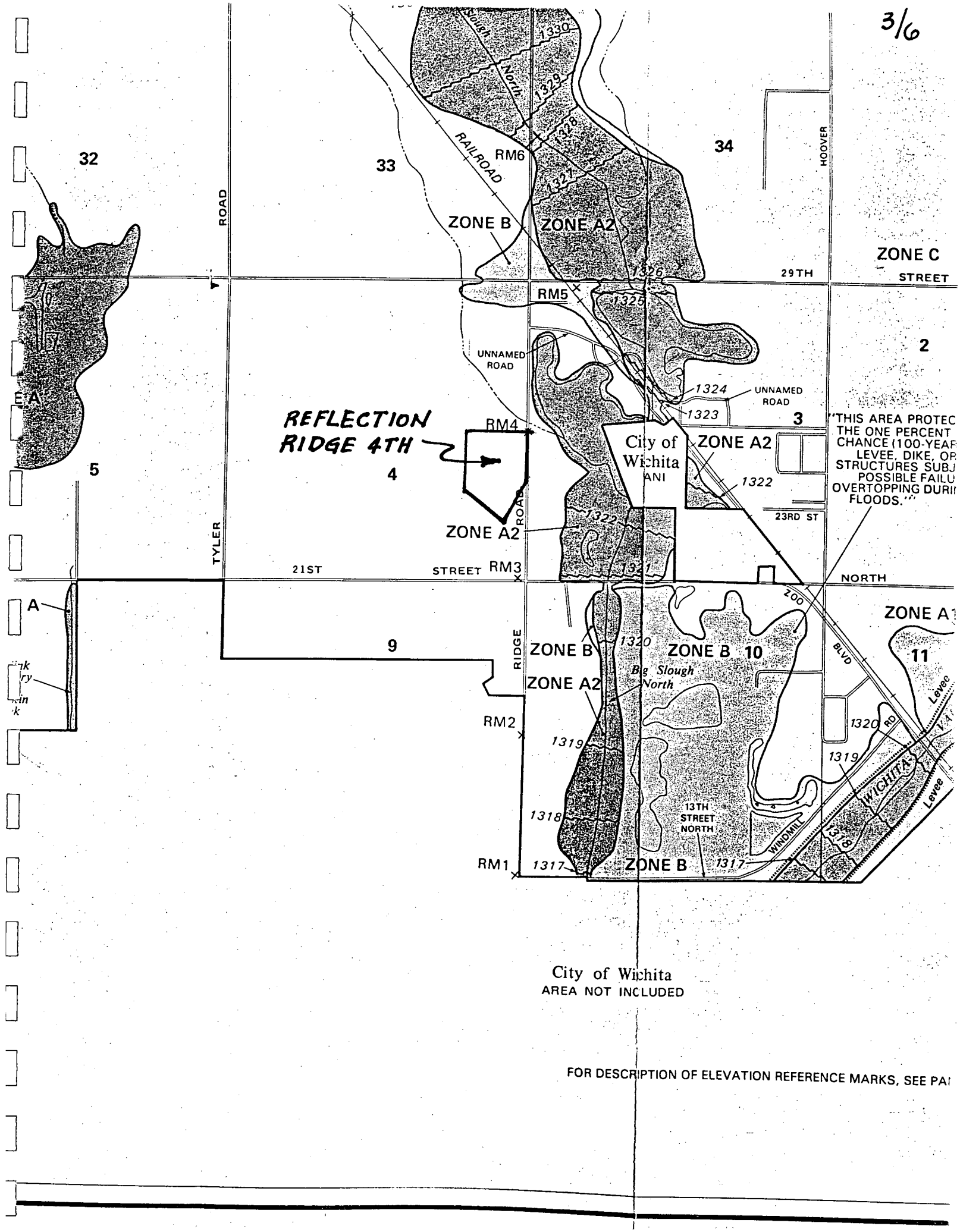
Item Drainage Plan FEMA

As seen from the FEMA maps (see pp. 2 & 3 of this section) the proposed plat is not in the FEMA flood plain. This data is included so that an estimate of the starting hydraulic grade line can be made for the storm water sewer system no. 1. The profile thru Ritchie's (& Mere Ridge) lakes indicate the Design Water Surface Elevation for the 100-year storm to be approx. 1323.0.



City of Wichita
AREA NOT INCLUDED

FOR DESCRIPTION OF ELEVATION REFERENCE MARKS, SEE PANE


3/6
32
33
34
5
4
3
2
9
10
11
ROAD
TYLER
RIDGE
HOOVER
RAILROAD
29TH STREET
21ST STREET
NORTH
23RD ST
UNNAMED ROAD
UNNAMED ROAD
ZOO BLVD
13TH STREET NORTH
WINDMILL
RM6
RM5
RM4
RM3
RM2
RM1
ZONE A
ZONE A2
ZONE B
ZONE C
ZONE A1
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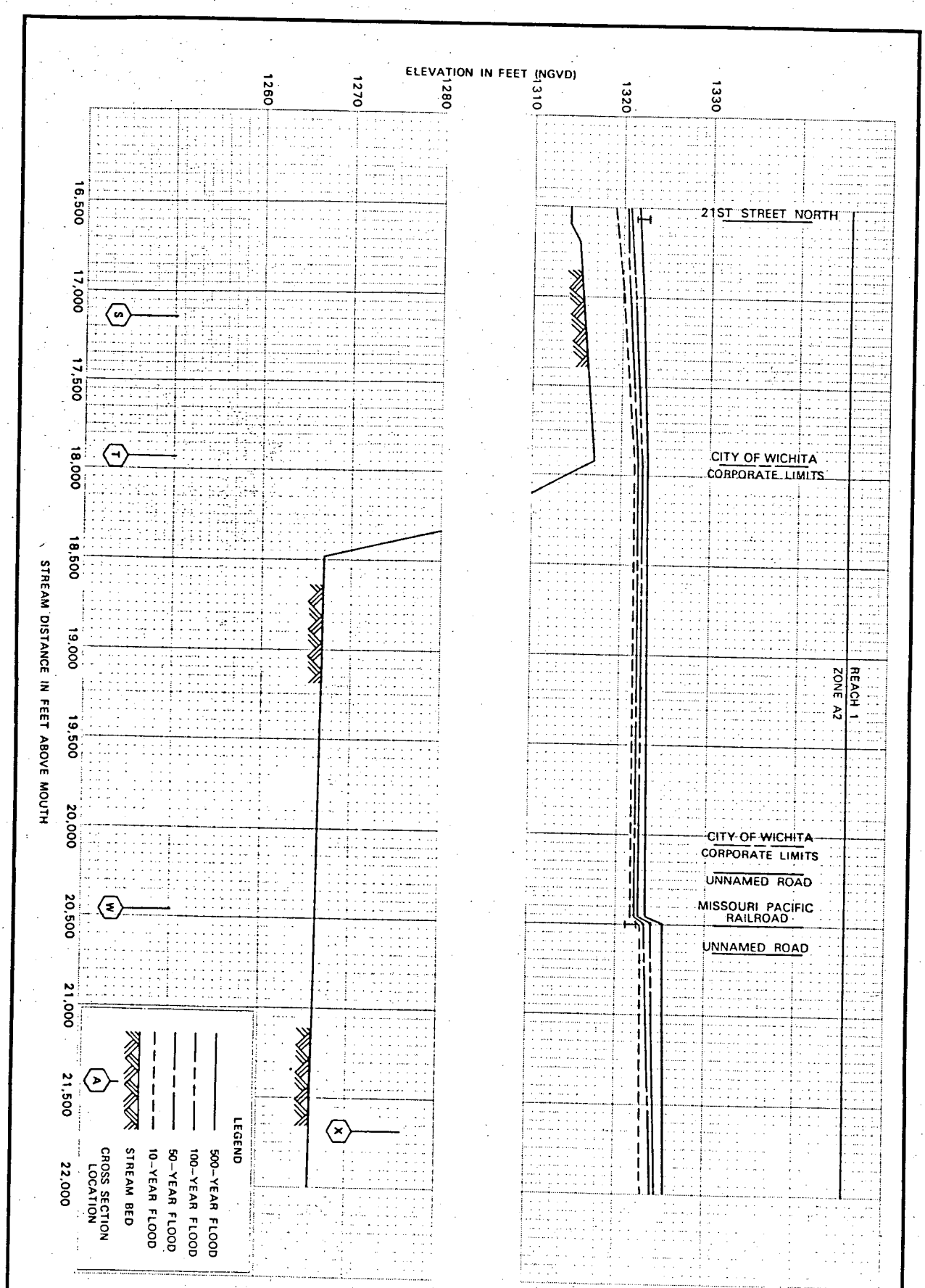
FOR DESCRIPTION OF ELEVATION REFERENCE MARKS, SEE PAI



27P

FEDERAL EMERGENCY MANAGEMENT AGENCY

SEDGWICK COUNTY, KS
(UNINCORPORATED AREAS)

FLOOD PROFILES

BIG SLOUGH NORTH

4/c

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
BIG SLOUGH NORTH								
M	11,487	197	1168	3.5	1317.1	1317.1	1317.5	0.4
N	11,887	681	1140	3.6	1317.7	1317.7	1318.0	0.3
O	13,437	659	2650	1.6	1319.0	1319.0	1319.1	0.1
P	15,417	192	774	5.3	1319.7	1319.7	1319.7	0.0
Q	15,942	318	1391	3.0	1320.7	1320.7	1320.7	0.0
R	16,491	165	973	3.5	1320.9	1320.9	1320.9	0.0
S	17,144	886	2288	1.5	1321.5	1321.5	1321.8	0.3
T	17,943	1285[2]	2123	1.6	1322.3	1322.3	1323.0	0.7
Z	22,628	730	1407	1.7	1325.8	1325.8	1326.1	0.3
AA	24,072	1070	2392	1.0	1326.6	1326.6	1327.3	0.7
AB	25,703	500	1215	2.0	1328.0	1328.0	1328.7	0.7
AC	27,342	762	2424	1.0	1330.4	1330.4	1331.2	0.8
AD	28,846	604	1565	1.5	1331.0	1331.0	1332.0	1.0
AE	30,882	600	1829	1.3	1332.7	1332.7	1333.7	1.0
AF	33,742	741	1325	1.4	1334.0	1334.0	1334.8	0.8
AG	35,486	151	880	2.2	1337.1	1337.1	1337.8	0.7
AH	39,318	930	2487	0.7	1337.2	1337.2	1338.2	1.0
AI	42,108	236	704	2.6	1338.1	1338.1	1338.6	0.5
AJ	42,978	240	969	1.9	1339.8	1339.8	1340.8	1.0
AK	48,418	264	1048	1.8	1342.9	1342.9	1343.7	0.8
AL	49,418	409	1243	1.5	1343.5	1343.5	1344.3	0.8
AM	51,693	56	350	5.3	1346.0	1346.0	1346.3	0.3

[1]FEET ABOVE MOUTH
[2]THIS WIDTH EXTENDS WITHIN AREA NOT INCLUDED

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

SEDGWICK COUNTY, KS
(UNINCORPORATED AREAS)

FLOODWAY DATA

BIG SLOUGH NORTH

5/6

TABLE 2 - SUMMARY OF DISCHARGES (Continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA SQ MILES	PEAK DISCHARGES (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
NORTH FORK CALFSKIN CREEK					
At mouth at Calfskin Creek	6.6	1,950	2,870	3,490	5,050
Upstream of confluence of Middle Fork Calfskin Creek	3.2	1,350	2,000	2,370	3,600
MIDDLE FORK CALFSKIN CREEK					
At mouth at North Fork Calfskin Creek	2.0	640	930	1,140	1,720
BIG SLOUGH NORTH					
At 13th Street	27.2	1,880	3,430	4,120	6,000
BIG SLOUGH SOUTH					
At Hydraulic Avenue	8.4	1,140	1,660	1,900	2,660
LITTLE SLOUGH					
At mouth at Big Slough North	6.2	650	960	1,080	1,390
CHISHOLM CREEK					
At Interstate 35	27.8	5,630	N/A	15,700	22,100
Upstream of confluence of West Fork Chisholm Creek	17.0	3,950	7,180	8,800	13,500
WEST BRANCH CHISHOLM CREEK					
At mouth at Chisholm Creek	17.0	2,070	3,280	4,020	6,600
Upstream of confluence of South Spasticville Slough	14.1	1,980	3,150	3,860	6,000
WEST FORK CHISHOLM CREEK					
At mouth at Chisholm Creek	9.0	1,690	2,600	3,080	4,150

SEDGWICK COUNTY, KANSAS — SHEET NUMBER 33

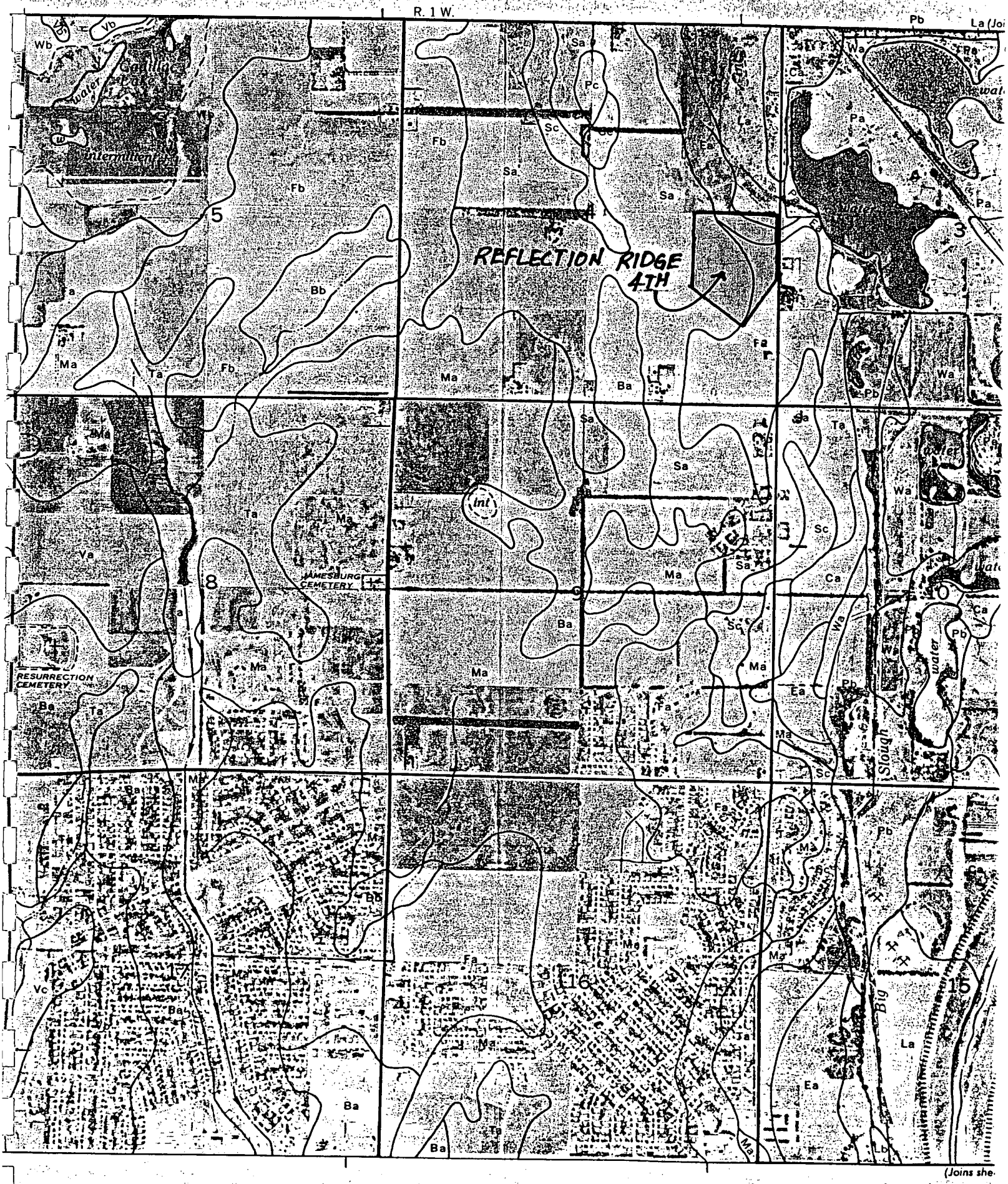


EXHIBIT NO. 1

SOIL LEGEND

SYMBOL	HYDROLOGIC GROUP	NAME
Aa	B	Albion-Shellabarger sandy loams, 1 to 4 percent slopes
Ab	B	Albion and Shellabarger sandy loans, 7 to 15 percent slopes
Ba	C	Blanket silt loam, 0 to 1 percent slopes
Bb	C	Blanket silt loan, 1 to 3 percent slopes
Ca	B	Canadian fine sandy loan
Cb	B	Canadian-Waldeck fine sandy loams
Cc	D	Carwile fine sandy loam
Cd	B	Clark-Ost clay loams, 1 to 4 percent slopes
Ce	C	Clime silty clay, 3 to 6 percent slopes
Ea	B	Elandco silt loam
Eb	B	Elandco silt loam, occasionally flooded
Ec	B	Elandco silt loam, frequently flooded
Fa	B	Farnum loam, 0 to 1 percent slopes
Fb	B	Farnum loam, 1 to 3 percent slopes
Fc	B	Farnum loam, sandy substratum, 0 to 1 percent slopes
Ga	D	Goessel silty clay, 0 to 1 percent slopes
Gb	D	Goessel silty clay, 1 to 2 percent slopes
Ia	D	Irwin silty clay loam, 1 to 3 percent slopes
Ib	D	Irwin silty clay loam, 3 to 6 percent slopes
Ic	D	Irwin silty clay loam, 2 to 6 percent slopes, eroded
La	C	Lesho loam
Lb	A	Lincoln soils
Ma	B	Milan loam, 1 to 3 percent slopes
Mb	B	Milan form, 3 to 6 percent slopes
Mc	B	Milan clay loam, 2 to 6 percent slopes, eroded
Na	B	Naron fine sandy loam
Oc	D	Owens clay loam, 1 to 3 percent slopes
Od	D	Owens-Rock outcrop complex, 3 to 10 percent slopes
Pa		Pits
Pb	D	Plevna fine sandy loam
Pc	A	Pratt loamy fine sand, undulating
Pd	A	Pratt-Tivoli complex, rolling
Ra	D	Renfrow silty clay loam, 1 to 3 percent slopes
Rb	D	Renfrow silty clay loam, 3 to 6 percent slopes
Rc	D	Renfrow-Owens clay loams, 1 to 4 percent slopes
Rd	D	Rosehill silty clay, 1 to 3 percent slopes
Sa	B	Shellabarger sandy loam, 1 to 3 percent slopes
Sb	B	Shellabarger sandy loam, 3 to 6 percent slopes
Sc	B	Shellabarger sandy loam, 3 to 6 percent slopes, eroded
Ta	D	Tabler silty clay loam
Tb	D	Tabler-Drummond complex
Ua	B	Urban land-Canadian complex
Ub	B	Urban land-Elandco complex
Uc	B	Urban land-Farnum complex, 0 to 3 percent slopes
Ud	D	Urban land-Irwin complex, 1 to 3 percent slopes
Ue	D	Urban land-Tabler complex
Va	B	Vanoss silt loam, 0 to 1 percent slopes
Vb	B	Vanoss silt loam, 1 to 3 percent slopes
Vc	B	Vanoss silt loam, 3 to 6 percent slopes
Vd	B	Vanoss silt loam, 3 to 6 percent slopes, eroded
Ve	D	Vernon sandy loam, 1 to 3 percent slopes
Vf	D	Vernon sandy loam, 3 to 6 percent lopes
Wa	C	Waldeck sandy loam
Wb	D	Waurika silt loam

(3 pages)

ATTACHMENT D

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

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

Land Use or Surface Characteristics	Percent Impervious	Frequency 2	5	10	100
1. Business:					
Downtown Areas	95	0.84	0.85	0.87	0.91
Neighborhood Areas	70	0.68	0.69	0.73	0.80
2. Residential:					
Single Family (Soil Group D)					
1/8 Acre	50	0.57	0.61	0.66	0.79
1/4 Acre	38	0.50	0.54	0.62	0.76
1/3 Acre	30	0.46	0.50	0.59	0.73
1/2 Acre	25	0.42	0.48	0.56	0.72
3/4 Acre	22	0.42	0.46	0.55	0.71
1 Acre	20	0.41	0.45	0.54	0.71
Multi-Family (Soil Group D)					
Multi-Unit (detached)	60	0.62	0.66	0.72	0.82
Multi-Unit (attached)	65	0.64	0.68	0.73	0.83
Apartments	75	0.70	0.73	0.79	0.86
Single Family (Soil Group C)					
1/8 Acre	50	0.55	0.58	0.64	0.73
1/4 Acre	38	0.48	0.51	0.57	0.68
1/3 Acre	30	0.43	0.46	0.53	0.65
1/2 Acre	25	0.40	0.43	0.50	0.63
3/4 Acre	22	0.39	0.42	0.49	0.62
1 Acre	20	0.37	0.40	0.48	0.61
Multi-Family (Soil Group C)					
Multi-Unit (detached)	60	0.60	0.63	0.69	0.77
Multi-Unit (attached)	65	0.63	0.66	0.71	0.79
Apartments	75	0.68	0.72	0.77	0.83
Single-Family (Soil Group B)					
1/8 Acre	50	0.52	0.54	0.59	0.67
1/4 Acre	38	0.44	0.46	0.52	0.61
1/3 Acre	30	0.39	0.41	0.47	0.57
1/2 Acre	25	0.36	0.38	0.44	0.54
3/4 Acre	22	0.34	0.36	0.42	0.52
1 Acre	20	0.33	0.35	0.40	0.51
Multi-Family (Soil Group B)					
Multi-Unit (detached)	60	0.58	0.60	0.65	0.72
Multi-Unit (attached)	65	0.61	0.64	0.68	0.75
Apartments	75	0.67	0.70	0.74	0.80

Land Use or Surface Characteristics	Percent Impervious	Frequency 2	5	10	100
Single Family (Soil Group A)					
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
Multi-Family (Soil Group A)					
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):					
Soil Group A					
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
Soil Group B					
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
Soil Group C					
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

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

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

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

ATTACHMENT E

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

AVERAGE OVERLAND FLOW VELOCITY FOR USE WITH URBANIZED AREAS

Surface Type	VELOCITY IN FEET/SECOND FOR SLOPES IN PERCENT SHOWN																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	20.0
Forest with Heavy Ground Litter or Meadow	0.03	0.04	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.16	0.21	0.28	0.33	0.39	0.46	0.53	0.60	0.72	1.10
Fallow or Minimum Tillage Cultivation	0.06	0.08	0.10	0.12	0.13	0.14	0.16	0.17	0.18	0.19	0.29	0.40	0.51	0.66	0.78	0.91	1.05	1.20	1.44	2.10
Short Grass Pasture or Lawns	0.09	0.13	0.15	0.18	0.20	0.21	0.23	0.25	0.26	0.28	0.45	0.60	0.77	0.96	1.17	1.33	1.50	1.68	1.98	3.20
Almost Bare Ground	0.16	0.22	0.28	0.31	0.35	0.38	0.41	0.44	0.46	0.49	0.70	0.85	1.05	1.26	1.50	1.75	2.03	2.32	2.79	4.40
Grassed Waterway	0.35	0.48	0.58	0.67	0.77	0.84	0.91	0.98	1.05	1.12	1.54	1.82	2.10	2.38	2.78	3.20	3.66	4.14	4.56	7.00
Paved Areas (Sheet Flow) or Shallow Gutter Flow	0.44	0.62	0.77	0.91	1.05	1.12	1.19	1.26	1.33	1.40	2.00	2.55	3.20	3.83	4.41	5.04	5.70	6.00	6.20	9.00

April 15, 1986

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

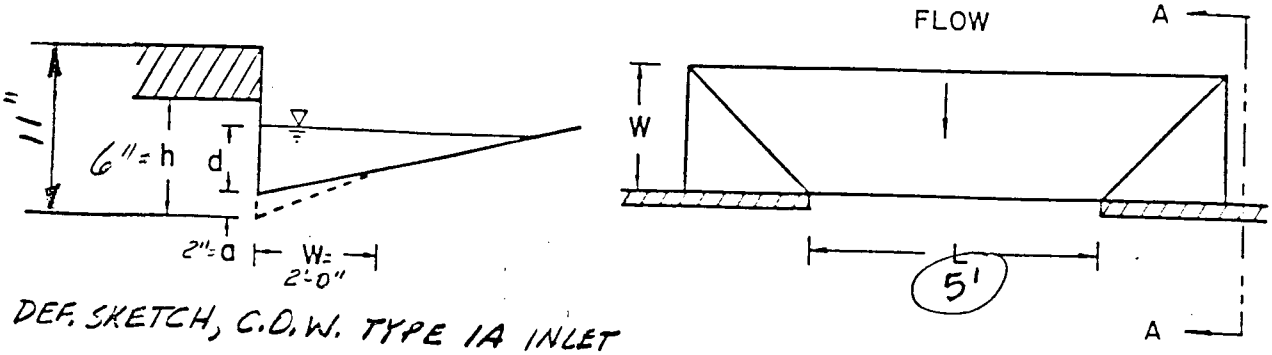
DURATION IN MINUTES	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	4.18	5.57	6.53	7.41	8.52	9.48	10.32
6	3.99	5.32	6.25	7.09	8.16	9.09	9.89
7	3.81	5.09	5.99	6.81	7.84	8.74	9.50
8	3.66	4.89	5.75	6.55	7.55	8.42	9.15
9	3.52	4.70	5.54	6.31	7.28	8.13	8.83
10	3.39	4.52	5.34	6.09	7.04	7.86	8.54
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 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	3.63
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

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

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



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

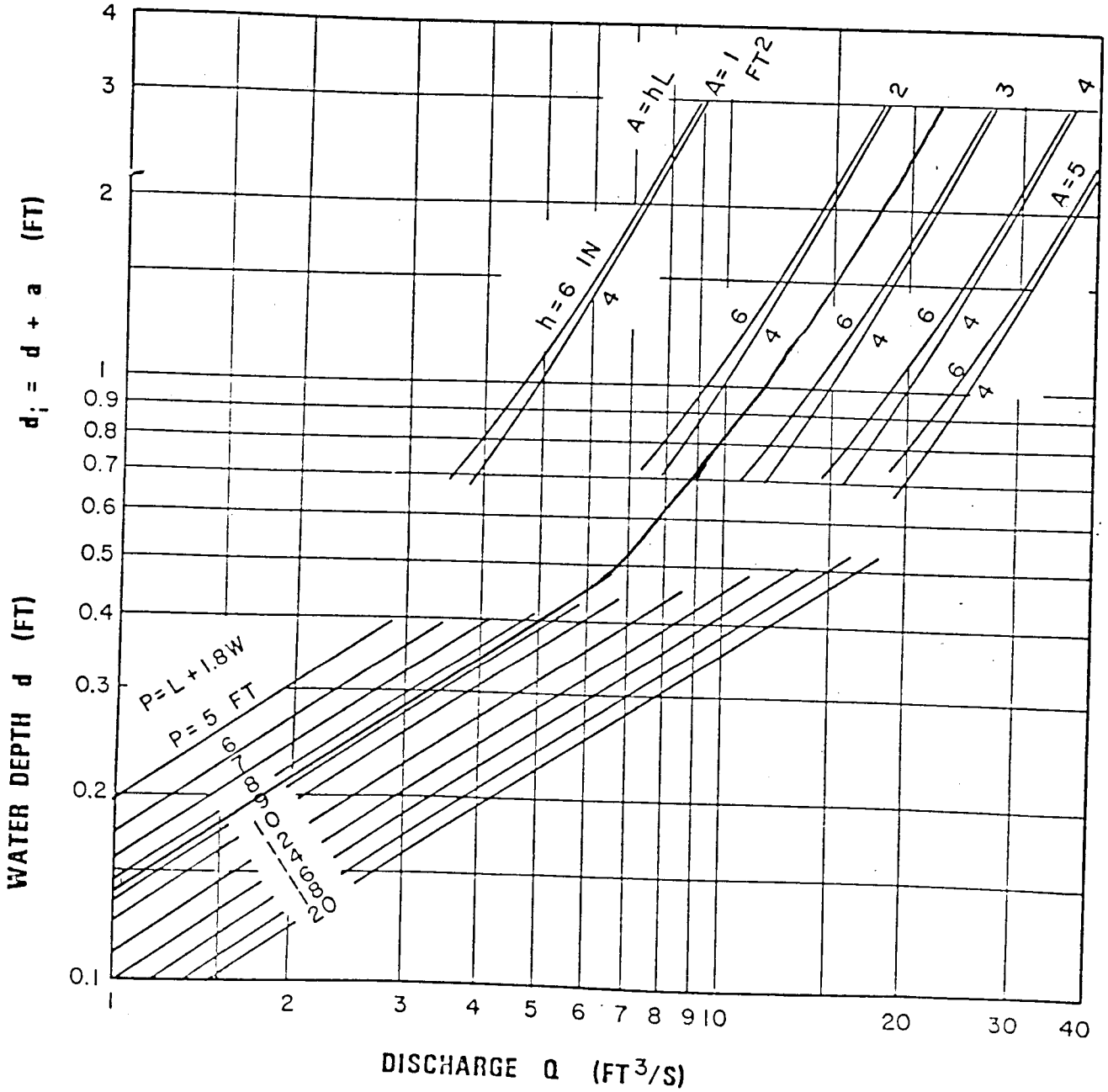
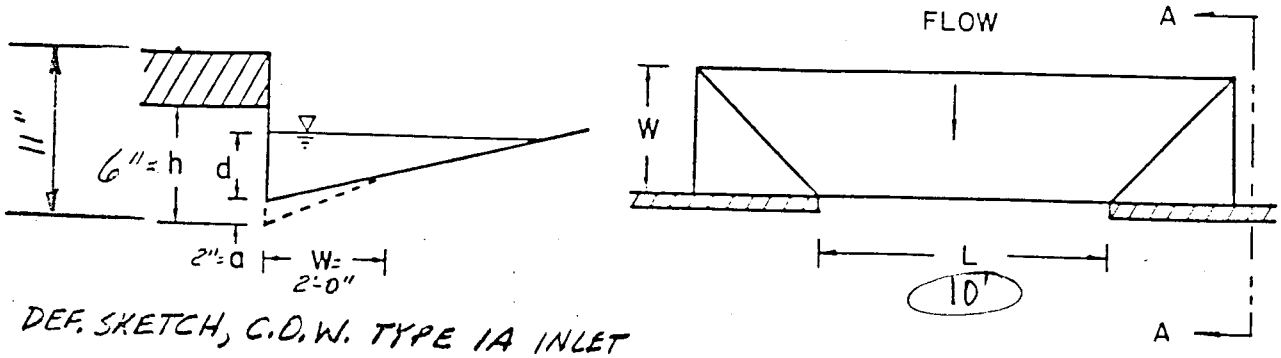


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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



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

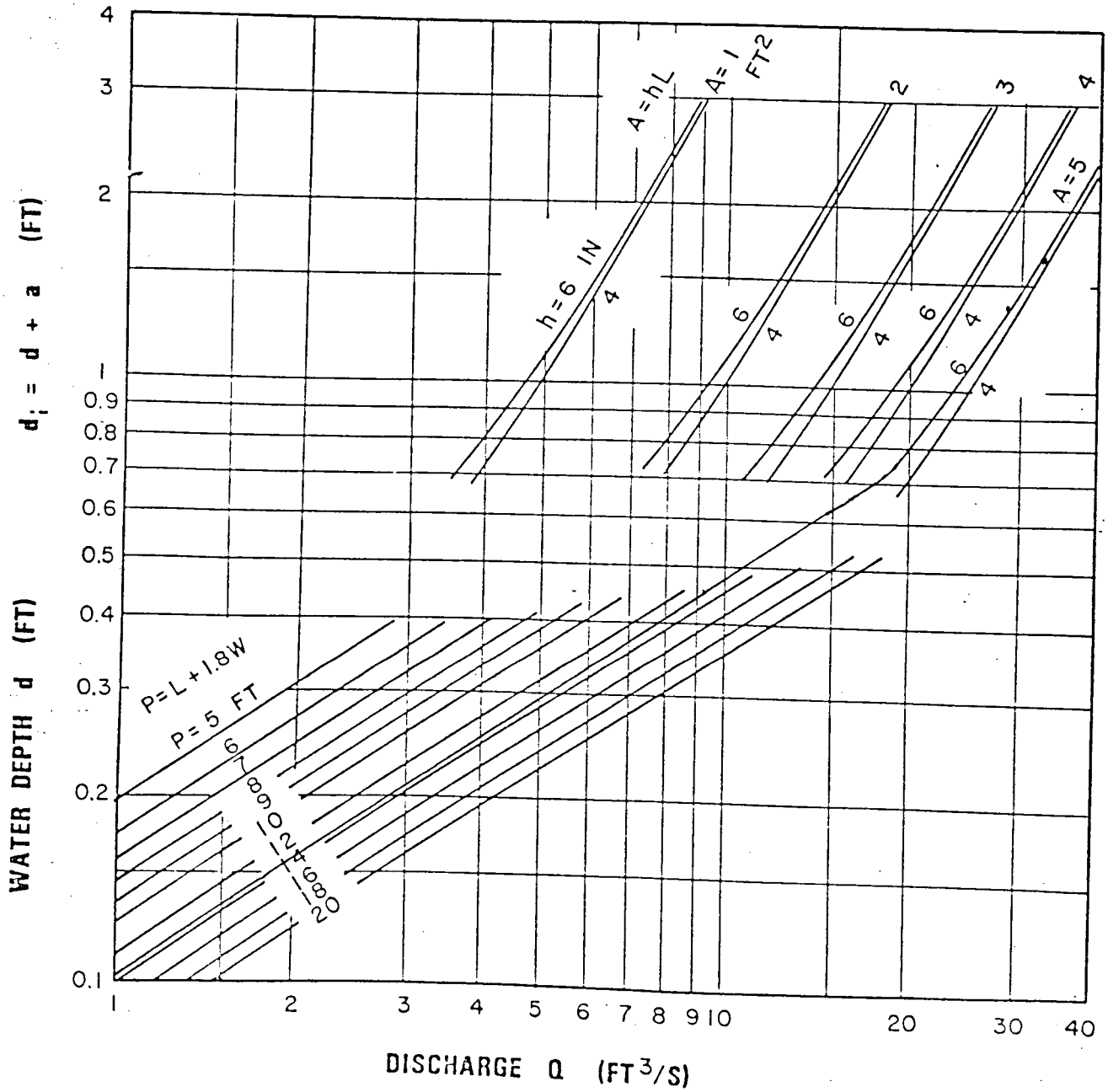


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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

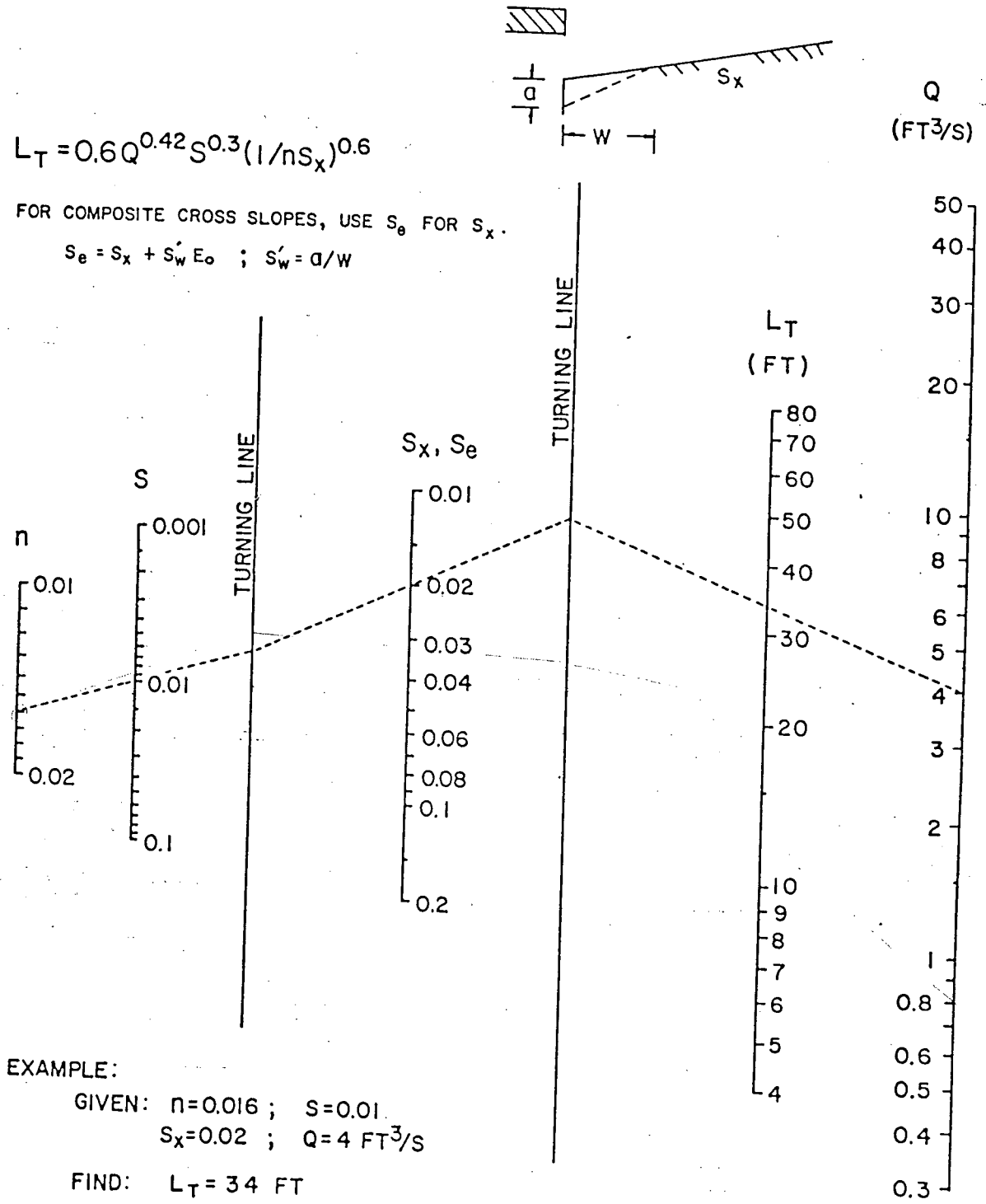


CHART 9. Curb-opening and slotted drain inlet length for total interception.

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

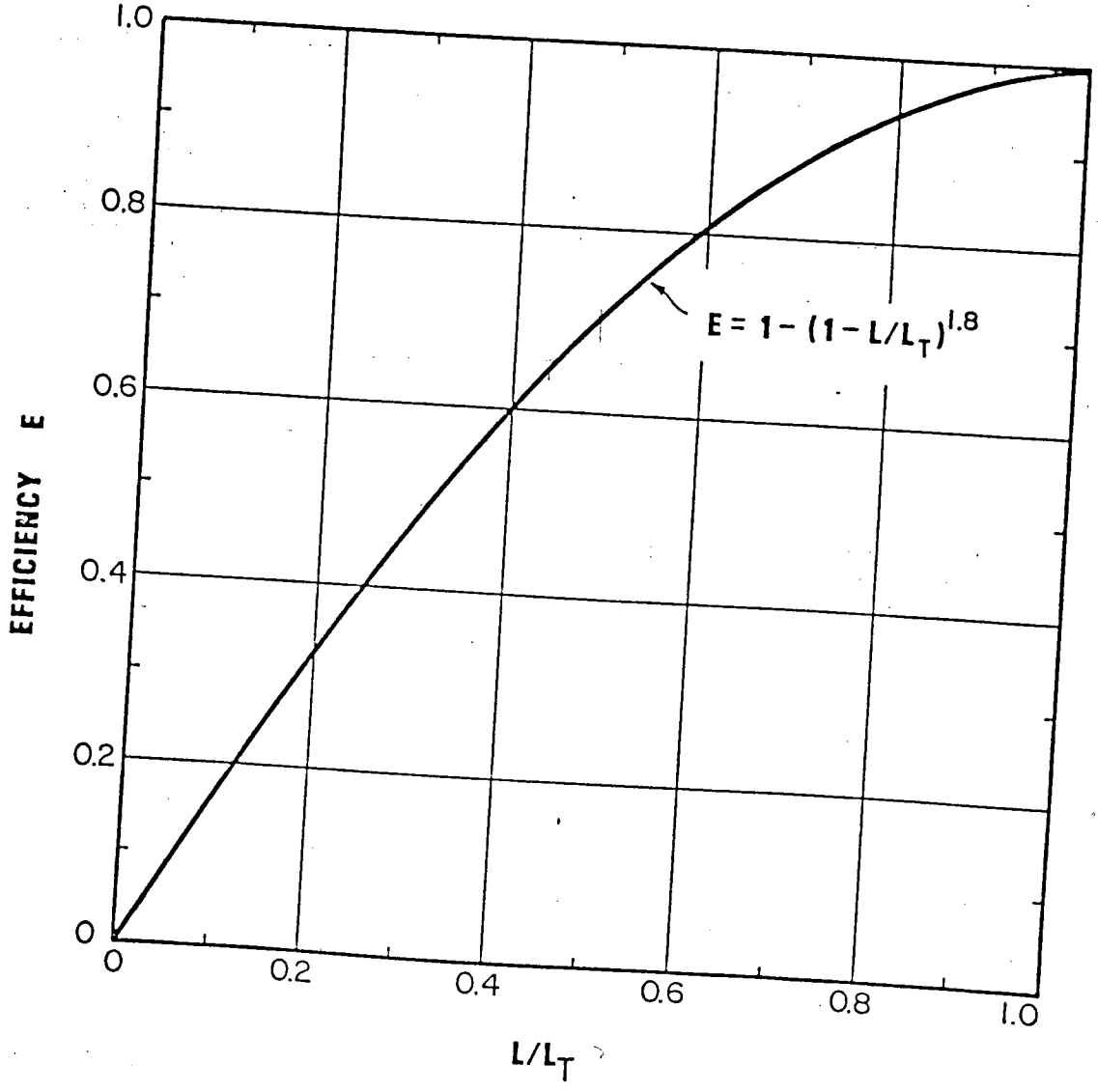
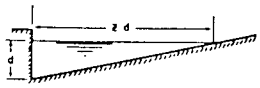


CHART 10. Curb-opening and slotted drain inlet interception efficiency.

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

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 1946, PAGE 150, EQUATION (14)

EXAMPLE (SEE INSTRUCTION 1)

GIVEN: $S = 0.03$

$z = 24$

$n = .02$ $\Big\}$ $z/n = 1200$

$Q = 20$ 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

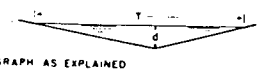
SLOPE OF CHANNEL (S) IN FT./FT.: .10, .08, .07, .06, .05, .04, .03, .02, .01, .008, .007, .006, .005, .004, .003, .002, .001

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

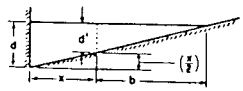
INSTRUCTIONS

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

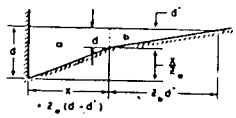
2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH AS EXPLAINED IN INSTRUCTION 1 BUT WITH $z = \frac{T}{d}$.



3. TO DETERMINE DISCHARGE Q_x 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 $Q_x = Q - Q_b$.



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 $Q_T = Q_a + Q_b$.



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NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS

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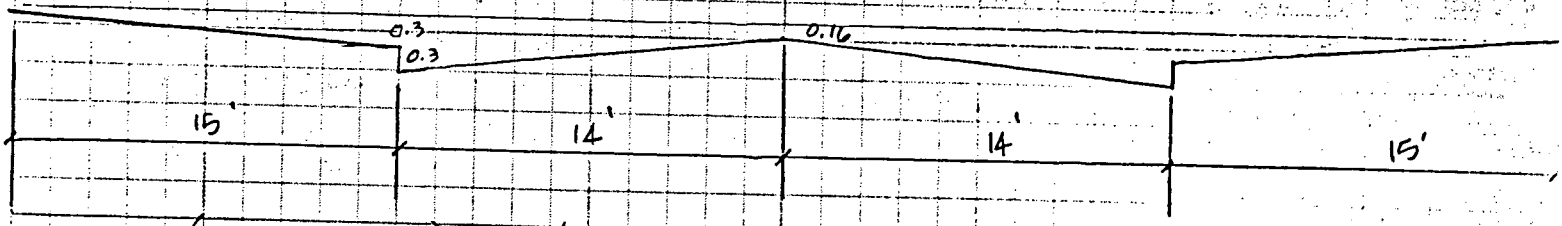
Project Reflection Ridge 4th Add.

Item Drainage Plan

Determine Capacities of Roll-curb streets w/ Various Walk Grades for 100-year storm analysis (58' R-O-W)

0.3'
Walk Grade



$$n = \frac{(2 \times 14.5 \times 0.03) + (2 \times 2.8 \times 0.013) + (2 \times 12 \times 0.016)}{58.6}$$

$$= \frac{(0.87) + (0.0728) + (0.384)}{58.6} = \frac{1.3268}{58.6} = 0.0226$$

$$A = (2 \times \tfrac{1}{2} \times 15 \times 0.3) + (28 \times 0.16) + (2 \times \tfrac{1}{2} \times 14 \times 0.44)$$

$$= 4.5 + 4.48 + 6.16$$

$$= 15.14 \text{ SF}$$

$$P = 58.6$$

$$R = A/P = 15.14/58.6 = 0.258362 \qquad R^{2/3} = 0.40565$$

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

$$= \frac{1.486}{0.0226} \times 15.14 \times 0.40565 \times S^{1/2}$$

$$Q = 403.82 \sqrt{S}$$

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Project Reflection Ridge 4th Add

Item Drainage Plan

0.4 Walk Grade

58' R-O-W
Roll Curb

$n = 0.0226$

$A = (2 \times 1/2 \times 15 \times 0.4) + (28 \times 0.26) + (2 \times 1/2 \times 14 \times 0.44)$

$= 6.0 + 7.28 + 6.16$

$= 19.44$

$p = 58.6$

$R = A/p = 19.44/58.6 = 0.33174$ $\quad R^{2/3} = 0.479217$

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2} = \frac{1.486}{0.0226} \times 19.44 \times 0.479217 \times S^{1/2}$

$Q = 612.55\sqrt{S}$

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Project Reflection Ridge 4th Add

Item Drainage Plan

0.5 Walk Grade

58' R-O-W
Roll Curb

$n = 0.0226$

$A = (2 \times 1/2 \times 15 \times 0.5) + (28 \times 0.36) + (2 \times 1/2 \times 14 \times 0.44)$

$= 7.5 + 10.08 + 6.16$

$= 23.74$

$p = 58.6$

$R = A/p = 23.74/58.6 = 0.405119 \quad R^{2/3} = 0.547506$

$Q = \frac{1.486}{0.0226} \times 23.74 \times 0.547506 \times s^{1/2}$

$= 854.63\sqrt{s}$

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Project Reflection Ridge 4th Add.

Item Drainage Plan

0.6 Walk Grade

58' R-O-W
Roll curb

$n = 0.0226$

$A = (2 \times 1/2 \times 15 \times 0.6) + (28 \times 0.46) + (2 \times 1/2 \times 14 \times 0.44)$

$= 9.0 + 12.88 + 6.16$

$= 28.04$

$p = 58.6$

$R = A/p = 28.04/58.6 = 0.478498 \quad R^{2/3} = 0.611768$

$$Q = \frac{1.486}{0.0226} \times 28.04 \times 0.611768 \times S^{1/2}$$

$= 1,127.91 \sqrt{S}$

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Project Reflection Ridge 4th Add.

Item Drainage Plan

0.7 Walk Grade

58' R-O-W
Roll Curb

$n = 0.0226$

$A = (2 \times 1/2 \times 15 \times 0.7) + (28 \times 0.56) + (2 \times 1/2 \times 14 \times 0.44)$

$= 10.5 + 15.68 + 6.16$

$= 32.34$

$p = 58.6$

$R = A/p = 32.34/58.6 = 0.551877 \quad R^{2/3} = 0.672814$

$$Q = \frac{1.486}{0.0226} \times 32.34 \times 0.672814 \times S^{1/2}$$

$Q = 1,430.69 \sqrt{S}$

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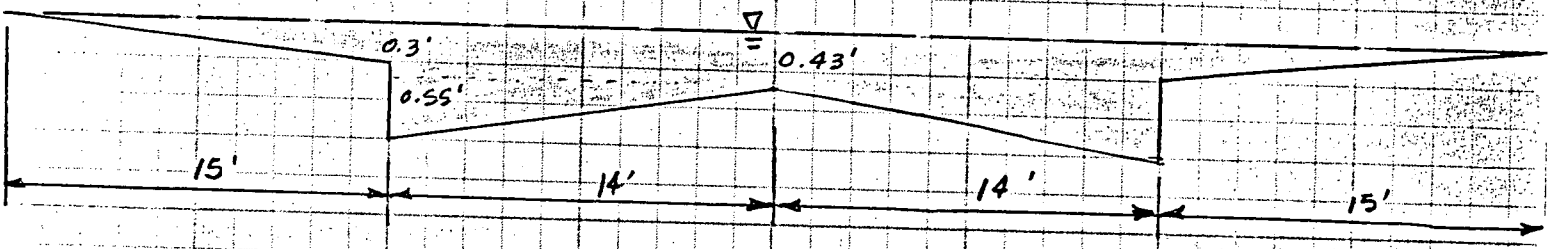
Project Reflection Ridge 4th Add.

Item Drainage Plan

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

0.3' WALK GRADE



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

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

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

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

$$= 22.42$$

$P = 59.1$

$R = A/P = 22.42/59.1 = 0.379357$ $\quad R^{2/3} = 0.52404$

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

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

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

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Project Reflection Ridge 4th Add.

Item Drainage Plan

58' R-O-W
Std. Curb

0.4' WALK GRADE

$n = 0.0226$

$A = (2 \times 1/2 \times 15 \times 0.4) + (28 \times 0.53) + (2 \times 1/2 \times 14 \times 0.42)$

$= (6.00) + (14.84) + (15.88)$

$= 26.72$

$p = 59.1$

$R = A/p = 26.72/59.1 = 0.452115$ $\quad R^{2/3} = 0.589069$

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

$$Q = \frac{1.486}{0.0226} \times 26.72 \times 0.589069 \times S^{1/2}$$

$$Q = 1,034.93 \sqrt{S}$$

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Project Reflection Ridge 4th Add

Item Drainage Plan

58' R-O-W
std curb

0.5' WALK GRADE

$n = 0.0226$

$A = (2 \times 1/2 \times 15 \times 0.5) + (28 \times 0.63) + (2 \times 1/2 \times 14 \times 0.42)$

$= (7.5) + (17.64) + (5.88)$

$= 31.02$ SF

$p = 59.1$

$R = A/P = 31.02/59.1 = 0.524873 \quad R^{2/3} = 0.650683$

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

$Q = \frac{1.486}{0.0226} \times 31.02 \times 0.650683 \times S^{1/2}$

$Q = 1,327.15 \sqrt{S}$

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Project Reflection Ridge 4th Add

Item Drainage Plan

58' R-O-W
Std. Curb

0.6' WALK GRADE

$n = 0.0226$

$A = (2 \times 1/2 \times 15 \times 0.6) + (28 \times 0.73) + (2 \times 1/2 \times 14 \times 0.42)$

$= (9.0) + (20.44) + (5.88)$

$= 35.32$

$p = 59.1$

$R = A/p = 35.32/59.1 = 0.597631 \quad R^{2/3} = 0.709505$

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

$Q = \frac{1.486}{0.0226} \times 35.32 \times 0.709505 \times S^{1/2}$

$Q = 1,647.73 \sqrt{S}$

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Project Reflection Ridge 4th Add

Item Drainage Plan

58' R-o-W
Std Curb

0.7' WALK GRADE

$n = 0.0226$

$A = (2 \times 1/2 \times 15 \times 0.7) + (28 \times 0.83) + (2 \times 1/2 \times 14 \times 0.42)$

$= (10.5) + (23.24) + (5.88)$

$= 39.62$

$p = 59.1$

$R = A/p = 39.62/59.1 = 0.670389 \quad R^{2/3} = 0.765981$

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

$$Q = \frac{1.486}{0.0226} \times 39.62 \times 0.765981 \times S^{1/2}$$

$$Q = 1,995.46 \sqrt{S}$$