

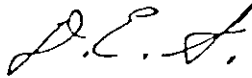
THE CITY OF WICHITA

OFFICE OF PUBLIC WORKS - ENGINEERING

DATE March 10, 1988

TO All Consulting Engineers

FROM Donald E. Schneider, P.E.



SUBJECT Interim Drainage and Storm
Sewer Policy for Design
Criteria and Documentation

The purpose of this memo is to identify acceptable supplementary design criteria and documentation on certain drainage design functions not specifically addressed by the current above noted policy. The following manuals developed under the auspices of the United States Department of Transportation identify acceptable design criteria and documentation procedures related to subjects covered by such manuals.

1. Hydraulics of Bridge Waterways (Hydraulic Design Series No. 1)
2. Design Charts for Open-Channel Flow (Hydraulic Design Series No. 3)
3. Hydraulic Design of Highway Culverts (Hydraulic Design Series No. 5)
4. Hydraulic Design of Energy Dissipators for Culverts and Channels (Hydraulic Engineering Circular No. 14)
5. Design of Stable Channels with Flexible Linings (Hydraulic Engineering Circular No. 15)

DS:sm/4617A

ATTACHMENT D

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

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

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

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		2	5	10	100
<u>Single Family (Soil Group A)</u>					
1/8 Acre	50	0.47	0.50	0.54	0.60
1/4 Acre	38	0.39	0.41	0.45	0.52
1/3 Acre	30	0.33	0.35	0.39	0.47
1/2 Acre	25	0.30	0.31	0.35	0.44
3/4 Acre	22	0.28	0.29	0.33	0.42
1 Acre	20	0.26	0.28	0.32	0.40
<u>Multi-Family (Soil Group A)</u>					
Multi-Unit (detached)	60	0.55	0.57	0.61	0.67
Multi-Unit (attached)	65	0.58	0.60	0.64	0.70
Apartments	75	0.65	0.68	0.72	0.77
3. Industrial:					
Light Areas	70	0.68	0.69	0.73	0.80
Heavy Areas	80	0.74	0.76	0.79	0.84
4. Playgrounds:					
	15	0.33	0.35	0.42	0.55
5. Schools:					
	40	0.49	0.51	0.56	0.66
6. Railroad Yard Areas:					
	30	0.43	0.45	0.50	0.62
7. Undeveloped Urban Areas: <i>TL</i>					
Offsite Flow Analysis (when land use not defined)	45	0.52	0.54	0.59	0.68
8. Streets:					
Paved	99	0.87	0.88	0.90	0.93
Gravel	00	0.24	0.26	0.33	0.48
9. Drive, Parking Lots and Walks:					
	96	0.87	0.87	0.88	0.89
10. Roofs:					
	90	0.80	0.85	0.90	0.93
11. Urban Lawn Areas (See Note No. 1 below):					
<u>Soil Group A</u>					
Slope less than 1%	00	0.08	0.09	0.13	0.23
Slope 1% to 4%	00	0.12	0.13	0.17	0.27
Slope more than 4%	00	0.16	0.17	0.21	0.31
<u>Soil Group B</u>					
Slope less than 1%	00	0.16	0.18	0.24	0.37
Slope 1% to 4%	00	0.20	0.22	0.28	0.41
Slope more than 4%	00	0.24	0.26	0.32	0.45
<u>Soil Group C</u>					
Slope less than 1%	00	0.24	0.27	0.35	0.51
Slope 1% to 4%	00	0.26	0.29	0.37	0.53
Slope more than 4%	00	0.28	0.31	0.39	0.55

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

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

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

Project Name: ~~WATCO-Moline-Quarry RR-Spur Design~~ JJA
 Project No. ~~03010401196-3000~~ JJA

USGS WATER RESOURCES INVESTIGATIONS REPORT 00-4079
 1/15/2004 TKM

CDA = 0.251563 sq mi 161 Acres
 P = 32 inches

CDA = Contributing Drainage Area in Square Miles
 P = Mean Annual Precipitation in Inches

Note: Method designed for watershed areas from .17 to 30 sq mi
*****CDA is WITHIN the normal range of applicability**

RI	A	B	C
2	0.0126	0.579	2.824
5	0.3	0.6	2.138
10	1.224	0.611	1.844
25	4.673	0.622	1.572
50	10.26	0.628	1.415
100	19.8	0.634	1.288
200	34.68	0.64	1.181

$$Q_x = A * CDA^B * P^C$$

Recurrence Interval Years	Q cfs	Q cfs/ac
2	100.9	0.626704
5	216.5	1.344911
10	314.1	1.950953
25	460.1	2.858034
50	581.5	3.611722
100	716.7	4.45125
200	859.2	5.336404

Project Name: JJA
 Project No. *****

USGS WATER RESOURCES INVESTIGATIONS REPORT 87-4008

1/15/2004 TKM

At Simpson Avenue

0.2516 CDA (CONTRIBUTING DRAINAGE AREA), SQ. MI.

3.50 I₂ (2-YEAR, 24-HOUR RAINFALL), INCHES

50.00 S₁ (MAIN CHANNEL SLOPE), FEET/MILE

0.10 S_p (SOIL PERMEABILITY)

1.14 L (MAIN CHANNEL LENGTH), MILES

5.13 S_h (BASIN SHAPE) L*L/CDA

a	b ₁	b ₂	b ₃	b ₄	b ₅
0.135	0.878	5.321	0.286	-0.147	-0.134
1.000	0.860	4.195	0.282	-0.157	-0.112
2.510	0.862	3.710	0.281	-0.156	-0.094
6.480	0.867	3.201	0.279	-0.153	-0.075
12.100	0.871	2.863	0.276	-0.153	-0.065
21.200	0.874	2.552	0.272	-0.154	-0.056

x	y	z ₁	z ₂	z ₃	z ₄	z ₅	Q _T
CDA ^{-.04}	b ₁ ^x	CDA ^y	I ₂ ^{b₂}	S ₁ ^{b₃}	S _p ^{b₄}	S _h ^{b₅}	
1.06	0.87	0.300	785.21	3.06	1.40	0.80	109.82
	0.85	0.308	191.59	3.01	1.44	0.83	212.75
	0.85	0.307	104.35	3.00	1.43	0.86	296.82
	0.86	0.305	55.15	2.98	1.42	0.88	408.72
	0.86	0.303	36.11	2.94	1.42	0.90	499.15
	0.87	0.302	24.46	2.90	1.43	0.91	590.59

$$Q_T = a * z_1 * z_2 * z_3 * z_4 * z_5$$

RECURRENCE INTERVAL (YEARS)	COMPUTED Q (CFS)	Q cfs/ac
2	110	0.7
5	213	1.3
10	297	1.8
25	409	2.5
50	499	3.1
100	591	3.7

Note: Method developed for watershed areas from .17 to 10,000 sq mi
 ***CDA is WITHIN the normal range of applicability

Other Sources

TABLE 4-1(b) AVERAGE RUNOFF COEFFICIENTS FOR RURAL AREAS

Topography and Vegetation	Soil Texture			
	Open Sandy Loam	Clay and Silt Loam	Tight Clay	
<i>Woodland¹</i>				<i>Adjusted to 100-yr Value</i>
Flat	0.10	0.30	0.40	
Rolling	0.25	0.35	0.50	
Hilly	0.30	0.50	0.60	
<i>Pasture</i>				
Flat	0.10	0.30	0.40	<i>.50</i>
Rolling	0.16	0.36	0.55	<i>.69</i>
Hilly	0.22	0.42	0.60	<i>.75</i>
<i>Cultivated Land</i>				
Flat	0.30	0.50	0.60	<i>.75</i>
Rolling	0.40	0.60	0.70	<i>.88</i>
Hilly	0.52	0.72	0.82	<i>1.0</i>

¹Note: Flat (0-5% slope); rolling (5-10%); hilly (10-30%).

Source: Schwab, R. J. et al. (1971). *Elementary Soil and Water Engineering*. 2d. ed. New York: John Wiley.

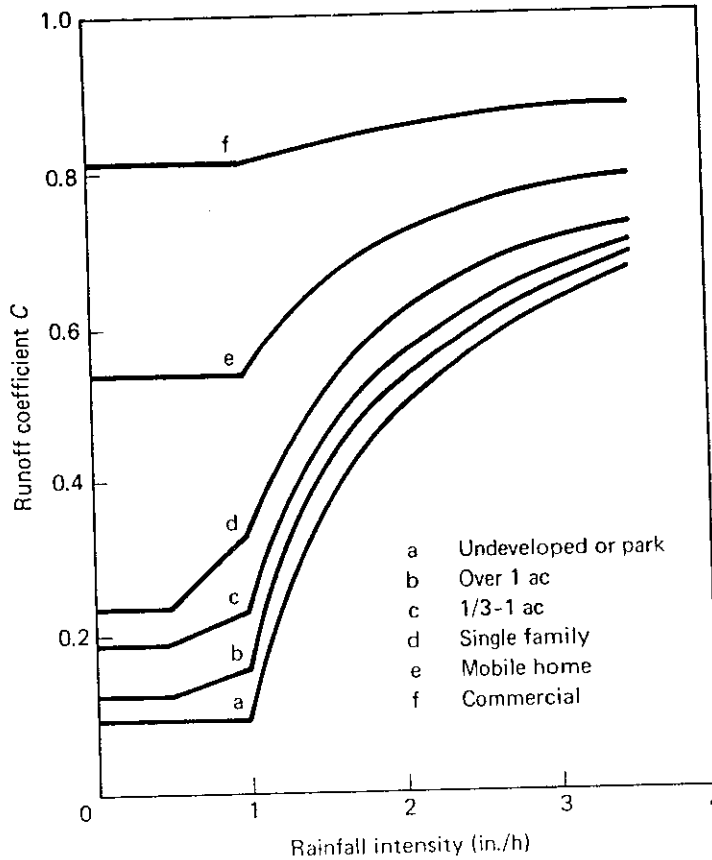
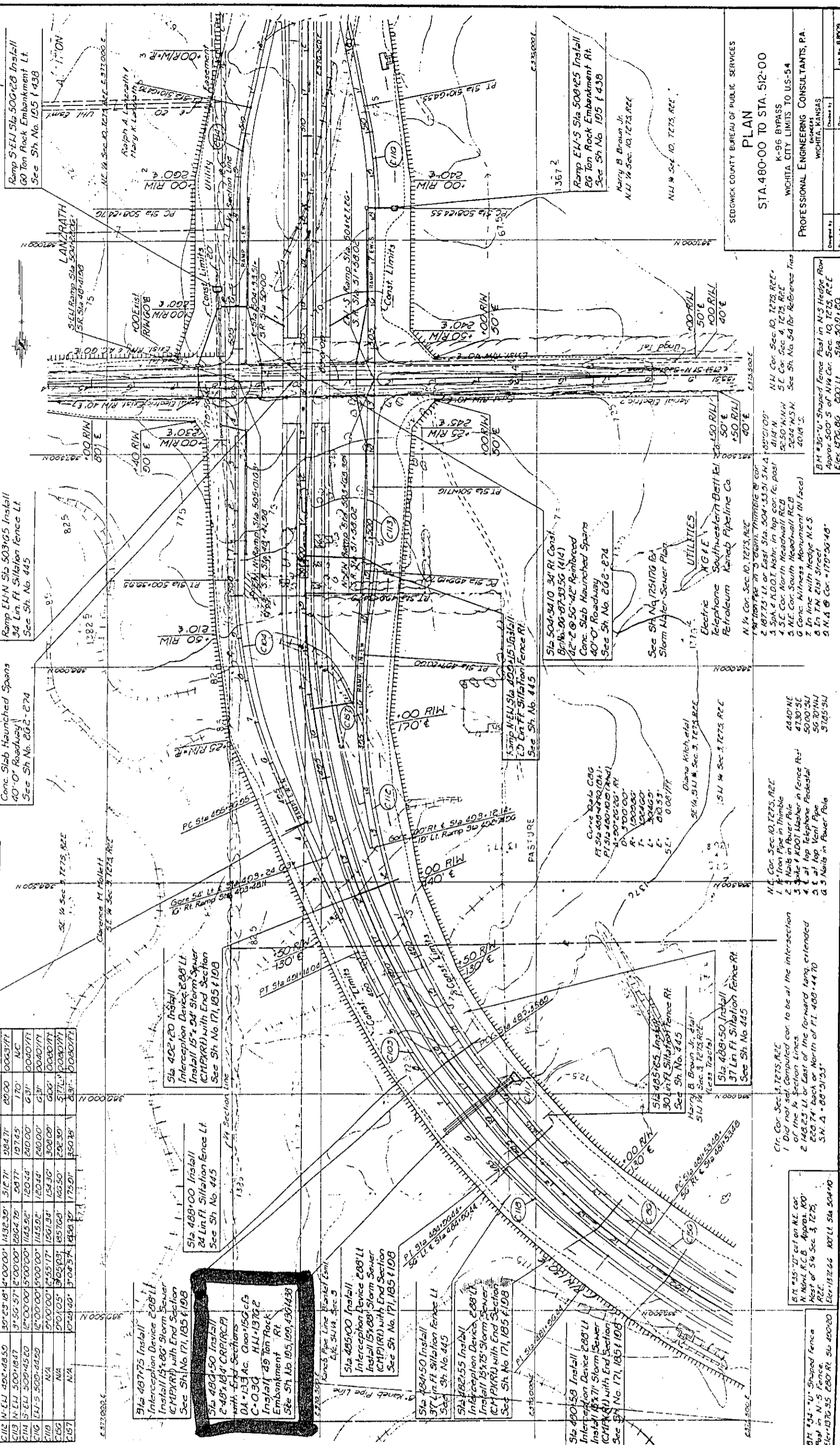


Figure 4-1 Variation of runoff coefficient with rainfall intensity [5].

DATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
06-07	K-4438-01	19	21
		20	21
		21	21



RAMP CURVE DATA									
NO.	P.I. STATION	A	D	R	L	E	S.E. (MAX)		
C103	ELN 489+01.81	187.0000	2.5653	126.58	317.30	24.50	0.0000	0.0000	0.0000
C104	ELN 490+02.37	230.0000	3.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C111	N 51.41 484+47.10	187.0000	3.0000	126.58	317.30	24.50	0.0000	0.0000	0.0000
C112	N 51.41 492+48.59	39.5918	4.0000	143.00	293.02	23.11	0.0000	0.0000	0.0000
C113	N 51.41 500+48.87	39.5918	4.0000	143.00	293.02	23.11	0.0000	0.0000	0.0000
C114	S 61.41 509+45.00	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C115	ELN 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C116	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C117	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C118	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C119	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C120	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C121	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C122	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C123	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C124	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000
C125	N 51.41 509+44.89	12.0000	5.0000	114.50	253.02	29.10	0.0000	0.0000	0.0000

Sta 480+50 Install
 2-48x18" CRP(RCP) with End Section
 DA=133 Ac. Clear=150'±
 C=0.30 H=1370.2
 Install 25 Ton Rock Embankment RT
 See Sh. No. 105, 109, 130, 143B

Sta 488+00 Install
 Interception Device 208 LI
 Install 15'± Storm Sewer (CMP)(RI) with End Section
 See Sh. No. 171, 185, 198

Sta 489+00 Install
 Interception Device 208 LI
 Install 15'± Storm Sewer (CMP)(RI) with End Section
 See Sh. No. 171, 185, 198

Sta 489+50 Install
 Interception Device 208 LI
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 See Sh. No. 171, 185, 198

Sta 493+50 Install
 Interception Device 208 LI
 Install 15'± Storm Sewer (CMP)(RI) with End Section
 See Sh. No. 171, 185, 198

SEDGWICK COUNTY BUREAU OF PUBLIC SERVICES
PLAN
 STA. 480+00 TO STA. 512+00
 K-96 BYPASS
 WICHITA CITY LIMITS TO US-54
 PROFESSIONAL ENGINEERS CONSULTANTS, P.A.
 WICHITA, KANSAS
 Drawn by: [Signature]
 Checked by: [Signature]
 Date: [Date]

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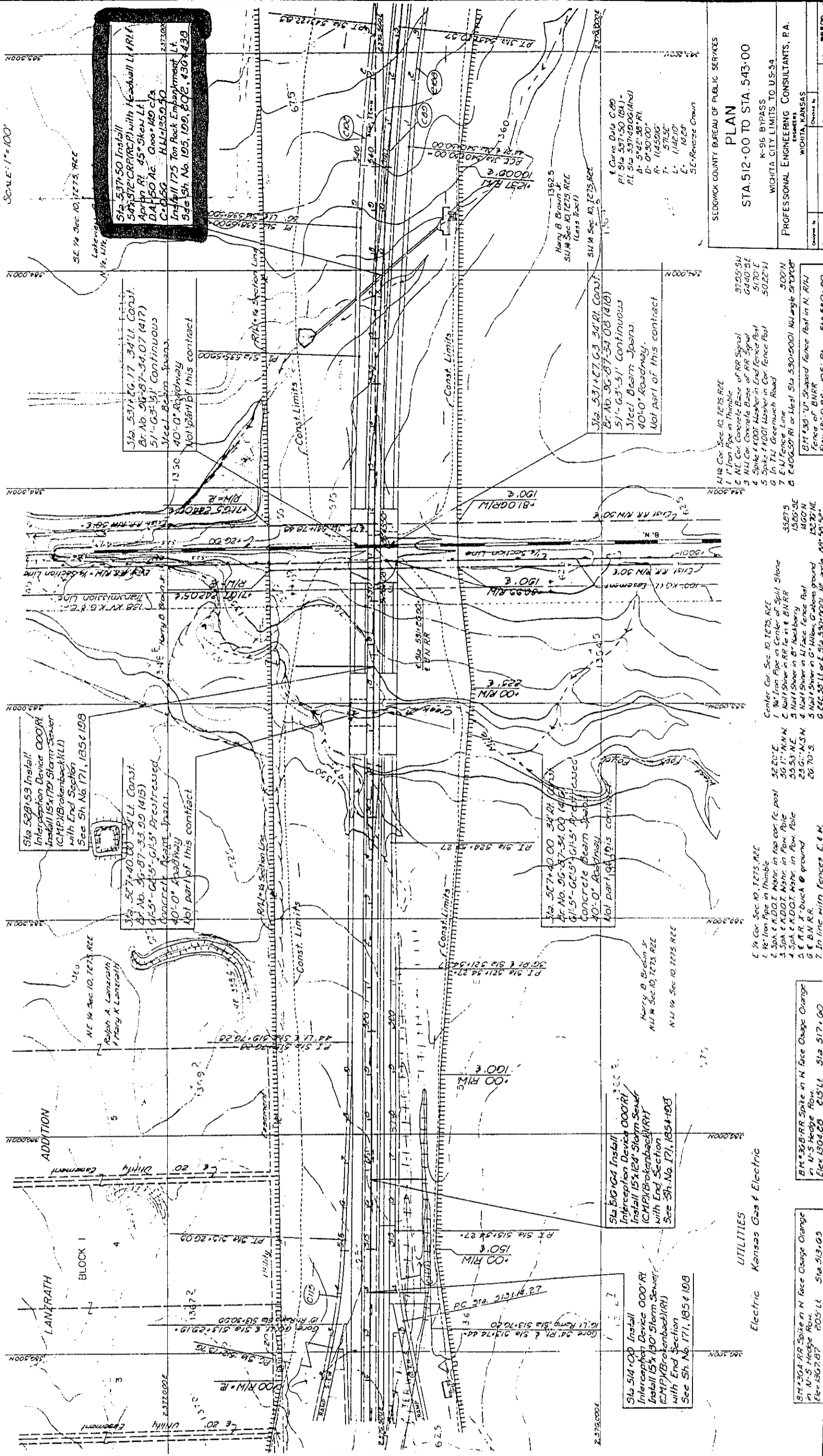
RAMP CURVE DATA								
NO.	P.I. STATION	A	D	R	T	L	E	SE. (MAX)
C113	S-EM 514+00.22	1070.27	4'00.00	1432.39	126.46	232.27	3.37	0.003717
C117	EM-S 514+34.71	1200.00	5'00.00	1143.02	120.44	240.00	0.31	0.011771
C102	EM-N 540+00.05	2792.23	0'29.51	11515.10	231.25	423.83	2.34	N/A

POT. STA. 531+20.00
 1" = 80' Rebar
 C & B.N.R.R.

No Ties

PC STA. 531+20.48
 1 3/4" Iron Pipe Capped REC. PA. No Ties
 FT. STA. 531+20.57
 1 3/4" Iron Pipe Capped REC. PA. No Ties

DATE	PROJECT NO.	YEAR	TOTAL SHEETS
08-07-4834-01	149	24	263



SCALE: 1" = 100'

Sta 537+50 Install
 54x52" CRIP (P) with Headwall L.P.R.A.
 Arched RI. 45° Skew LA
 DA 150' AE. 000-140 C/S
 C&G. H.L.L. 50.50
 Install 175 Ton Rock Employment Lt.
 See Sh. No. 185, 186, 187, 430 & 438

SEOWICK COUNTY BUREAU OF PUBLIC SERVICES
PLAN
 STA. 512+00 TO STA. 513+00
 K-96 BYPASS
 WICHITA CITY LIMITS TO U.S. 54
 PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
 WICHITA, KANSAS

DATE	PROJECT NO.	YEAR	TOTAL SHEETS
08-07-4834-01	149	24	263

NO.	DATE	REVISIONS	NOTED
1			

STATIONING: 514+00, 515+00, 516+00, 517+00

UTILITIES: Kansas Gas & Electric

Electric Kansas Gas & Electric

Notes on interceptors and storm sewers:

- Sta 514+00 Interceptor Device 000R: Install 15x124 Storm Sewer (CMP/Brokenback) (RT) with End Section. See Sh. No. 171, 183 & 198.
- Sta 516+04 Interceptor Device 000R: Install 15x124 Storm Sewer (CMP/Brokenback) (RT) with End Section. See Sh. No. 171, 183 & 198.
- Sta 517+00 Interceptor Device 000R: Install 15x124 Storm Sewer (CMP/Brokenback) (RT) with End Section. See Sh. No. 171, 183 & 198.

Notes on storm sewers:

- 7'-5" CC-3-101-15 Arched concrete storm sewer.
- 40'-0" Roadway.

Notes on utilities:

- Electric Kansas Gas & Electric.

Notes on construction limits:

- Const. Limits.

Notes on other features:

- Not part of this contract.