Professional Engineering Consultants, P.A.
303 S. TOPEKA • WICHITA, KANSAS 67202 • 316-262-2691 • FAX 316-262-3003 • www.pec1.com • designers@pec1.com

Angel Acres 2nd Addition
Wichita, Sedgwick County, Kansas
04/20/00

Angel Acres 2nd Addition is a residential development at 50th Street South and Seneca in Wichita, Kansas. The plat is 19.4 acres, which will be split into 44 lots, streets and a detention pond. The 19 acres consists of primarily Canadian fine sandy loam soil that is nearly level in the S ½, N ½, S ½, NW ¼ Section 20, T28S, R1E of the 6th P.M. The drainage plan, supporting computations and data for the Angel Acres 2nd Addition drainage plan are presented herein.

Hydrology

The existing landscape is nearly level cultivated agricultural field. The surrounding area is predominately flat so very little offsite drainage was included in the study of this property. An existing residential development borders this property on the south. It appears that a small portion of the plat to the south (South Seneca Gardens 2nd Addition) drains onto Angel Acres 2nd. Drainage for this small portion has been accounted for in this drainage plan. Currently most of the plat drains to the west to a low point in the field on the east side of Seneca. During a large storm, storm water may flow into Seneca and then north until it reaches the ditch to the west. About 4 acres of the plat drains to the east. This corresponds with the South Wichita Drainage Study by Van Doren, Hazard and Stallings. That study also illustrates a proposed detention pond (pond 7) to the east of this plat.

The proposed drainage plan for Angel Acres 2nd follows the VHS study and discharges water to the east to an apparent low area east of McLean Blvd right-of-way. For the western part of the property a detention pond is proposed. The pond would be a groundwater pond, to enable adequate depth for a storm sewer system outfall and provide fill material for site grading. The pond will have a controlled discharge into the 7'x3' RCB that is under Seneca north of this plat. The pond will serve to provide detention for the western portion of this plat and will reduce runoff significantly.

The pond level will be controlled by the groundwater elevation but the pond outlet elevation was used as the static water surface elevation for storage volume calculations.

Runoff coefficients were estimated based on tables presented in the Design Aids section and existing land use. A map showing the basin boundaries, drainage calculations and HEC-HMS outputs are included.

The analysis made is based on the available site data which includes the following: 1" = 100' topographic map with 1' contours of the site and adjacent areas, USGS topographic map, Sedgwick County Soil Survey Map and references noted herein.

Storm Sewer Design

The preliminary design for a storm sewer system has been completed at this time. The storm sewer system was designed for the 10-year storm event and the condition that water would be contained within the curb area. The 100-year storm event will be contained within the street right-of-way and adjacent reserves and easements.

Anticipating the development of the adjacent land to the north minimized storm sewer requirements. If the north tier of lots is graded toward the street, backyard storm sewer can be eliminated. The same thing can be done on the property to the north if that land is developed similarly. Excess excavation from the pond can be used to slope the ground with a gentle slope from the north property line of Angel Acres 2nd to the north onto the existing farmland. This decreases the amount of storm sewer required and allows the ground to continue to be farmed at this time.

Design Aids

This section includes material used to assist in designing the drainage system. A 1"=100' scale drainage plan map is enclosed in the pocket.

References

Interim Drainage and Storm Sewer Policy for Design Criteria and Documentation, City of Wichita, Kansas, 1985.

Rainfall Intensity Tables for Counties in Kansas, Kansas Department of Transportation, June 1997.

Rainfall Maps based on Storm Intensity and Duration, Dodson and Associates, Inc., Hydrologists and Civil Engineers.

Soil Survey of Sedgwick County, Kansas, US Department of Agriculture, Soil Conservation Service, 1979.

Existing Conditions

Basin	Area (acres)	t_c	CN	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
West	19.28	65 min	71	8.6	20.8	40.3
East	4.03	23 min	71	3	6.8	13.1

Developed Conditions

Time of Concentration = 15 minutes
CN = 75

Basin	Area (acres)	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
West				
A	4.44	4.9	10.4	18.7
B	1.14	1.3	2.7	4.8
C	4.56	5	10.7	19.2
D	0.18	0.2	0.4	0.8
E	0.19	0.2	0.4	0.8
F	0.7	0.8	1.6	3
G	0.99	1.1	2.3	4.2
H	2.38	2.6	5.6	10
I	0.75	0.8	1.8	3.2
J	2.75	3	6.5	11.6
K	1.2	1.3	2.8	5.1
Total	19.28	21.2	45.2	81.4
Pond Discharge		3.2	7.9	15.4

East				
L	1.77	2	4.1	7.5
M	0.83	0.9	1.9	3.5
N	0.88	1	2.1	3.7
O	0.55	0.6	1.3	2.3
Total Out		4.5	9.4	17

Professional Engineering Consultants, P.A.

S. TOPEKA ▪ WICHITA, KANSAS 67202
316-262-2691 ▪ FAX 316-262-3003
www.pec1.com ▪ designers@pec1.com

Project Angel Acres 2nd 36-00081 Date 3/16/00

Item Drainage Plan By KER

Existing Conditions

Pasture / field with one house & some trees & shrubs adjacent to an existing residential development

Water currently ponds on the property east of Seneca in a low spot

The eastern part of the property is relatively flat with no apparent drainage outlet.

Ground water is about 76° according to one soil boring taken at the edge of the property and Sycamore Ave.

Time of Concentration

West

A = 19.28 Ac
Length = 1950' slope = 0.5 %
Velocity = 0.5 ft/s
t_c = 65 min

East

Area = 4.03 acres
Length = 700' slope = 0.5% t_c = 23 min

Soil Types (Sedgwick County Soil Survey Sh. No 58)

Ca - "B" Canadian fine sandy loam, nearly level

Cb - "B & C" Canadian - Waldeck fine sandy loam
70% B & 30% C

CN = 71

HMS * Summary of Results

Project : angelacres2nd Run Name : Run 11

Start of Simulation : 11Jan00 0000 Basin Model : Existing Conditions
End of Simulation : 12Jan00 0600 Precip Model : 2-Year Storm
Execution Time : 19Apr00 1140 Control Specs : 24 Hour Rainfall

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Total Volume (ac ft)	Drainage Area (sq mi)
West	8.6003	11 Jan 00 1230	1.6996	0.030125
East	2.9531	11 Jan 00 1210	0.35527	0.006296875
Sink-1	10.028	11 Jan 00 1230	2.0549	0.036421875

HMS * Summary of Results

Project : angelacres2nd Run Name : Run 12

Start of Simulation : 11Jan00 0000 Basin Model : Existing Conditions
End of Simulation : 12Jan00 0600 Precip Model : 10-Year Storm
Execution Time : 19Apr00 1140 Control Specs : 24 Hour Rainfall

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Total Volume (ac ft)	Drainage Area (sq mi)
West	20.845	11 Jan 00 1230	3.7481	0.030125
East	6.7594	11 Jan 00 1210	0.78346	0.006296875
Sink-1	23.893	11 Jan 00 1230	4.5316	0.036421875

HMS * Summary of Results

Project : angelacres2nd Run Name : Run 13

Start of Simulation : 11Jan00 0000 Basin Model : Existing Conditions
End of Simulation : 12Jan00 0600 Precip Model : 100-Year Storm
Execution Time : 19Apr00 1141 Control Specs : 24 Hour Rainfall

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Total Volume (ac ft)	Drainage Area (sq mi)
West	40.314	11 Jan 00 1230	7.0398	0.030125
East	13.146	11 Jan 00 1200	1.4715	0.006296875
Sink-1	45.956	11 Jan 00 1220	8.5113	0.036421875

HMS * Summary of Results

Project : angelacres2nd Run Name : Run 3

Start of Simulation : 11Jan00 0000 Basin Model : Developed Conditions
End of Simulation : 12Jan00 0600 Precip Model : 2-Year Storm
Execution Time : 19Apr00 1051 Control Specs : 24 Hour Rainfall

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Total Volume (ac ft)	Drainage Area (sq mi)
A	4.9126	11 Jan 00 1200	0.47901	0.0069375
B	1.2613	11 Jan 00 1200	0.12299	0.00178125
C	5.0454	11 Jan 00 1200	0.49195	0.007125
D	0.19916	11 Jan 00 1200	0.019419	0.00028125
E	0.21022	11 Jan 00 1200	0.020498	0.000296875
F	0.77451	11 Jan 00 1200	0.075519	0.00109375
G	1.0954	11 Jan 00 1200	0.10681	0.001546875
H	2.6333	11 Jan 00 1200	0.25676	0.00371875
I	0.82983	11 Jan 00 1200	0.080913	0.001171875
J	3.0427	11 Jan 00 1200	0.29668	0.004296875
K	1.3277	11 Jan 00 1200	0.12946	0.001875
L	1.9584	11 Jan 00 1200	0.19095	0.002765625
M	0.91835	11 Jan 00 1200	0.089544	0.001296875
N	0.97210	11 Jan 00 1200	0.094785	0.001372787
O	0.60315	11 Jan 00 1200	0.058811	0.000851763
~~Reservoir 2~~	~~3.0344~~	~~11 Jan 00 1300~~	~~2.4600~~	~~0.036412050~~

HMS * Summary of Results

Project : angelacres2nd Run Name : Run 4

Start of Simulation : 11Jan00 0000 Basin Model : Developed Conditions
End of Simulation : 12Jan00 0600 Precip Model : 10-Year Storm
Execution Time : 19Apr00 1050 Control Specs : 24 Hour Rainfall

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Total Volume (ac ft)	Drainage Area (sq mi)
A	10.429	11 Jan 00 1200	0.99153	0.0069375
B	2.6777	11 Jan 00 1200	0.25458	0.00178125
C	10.711	11 Jan 00 1200	1.0183	0.007125
D	0.42279	11 Jan 00 1200	0.040197	0.00028125
E	0.44628	11 Jan 00 1200	0.042430	0.000296875
F	1.6442	11 Jan 00 1200	0.15632	0.00109375
G	2.3253	11 Jan 00 1200	0.22108	0.001546875
H	5.5902	11 Jan 00 1200	0.53150	0.00371875
I	1.7616	11 Jan 00 1200	0.16749	0.001171875
J	6.4593	11 Jan 00 1200	0.61412	0.004296875
	2.8186	11 Jan 00 1200	0.26798	0.001875
L	4.1574	11 Jan 00 1200	0.39527	0.002765625
M	1.9495	11 Jan 00 1200	0.18535	0.001296875
N	2.0636	11 Jan 00 1200	0.19620	0.001372787
O	1.2804	11 Jan 00 1200	0.12174	0.000851763
~~Reservoir-2~~	~~9.9479~~	~~11 Jan 00 1240~~	~~5.1081~~	~~0.036412050~~

HMS * Summary of Results

Project : angelacres2nd Run Name : Run 2

Start of Simulation : 11Jan00 0000 Basin Model : Developed Conditions
End of Simulation : 12Jan00 0600 Precip Model : 100-Year Storm
Execution Time : 19Apr00 1051 Control Specs : 24 Hour Rainfall

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Total Volume (ac ft)	Drainage Area (sq mi)
A	18.733	11 Jan 00 1200	1.7888	0.0069375
B	4.8098	11 Jan 00 1200	0.45930	0.00178125
C	19.239	11 Jan 00 1200	1.8372	0.007125
D	0.75944	11 Jan 00 1200	0.072521	0.00028125
E	0.80163	11 Jan 00 1200	0.076550	0.000296875
F	2.9534	11 Jan 00 1200	0.28202	0.00109375
G	4.1769	11 Jan 00 1200	0.39886	0.001546875
H	10.041	11 Jan 00 1200	0.95888	0.00371875
I	3.1643	11 Jan 00 1200	0.30217	0.001171875
J	11.603	11 Jan 00 1200	1.1080	0.004296875
	5.0629	11 Jan 00 1200	0.48347	0.001875
L	7.4678	11 Jan 00 1200	0.71312	0.002765625
M	3.5019	11 Jan 00 1200	0.33440	0.001296875
N	3.7068	11 Jan 00 1200	0.35397	0.001372787
O	2.3000	11 Jan 00 1200	0.21963	0.000851763
~~Reservoir-2~~	~~17.915~~	~~11 Jan 00 1240~~	~~9.2379~~	~~0.036412050~~

Detention Pond Design

Elev	Area	Storage Volume (total)	
78	1.39 Ac	0	Ac-ft
79	1.53 Ac	1.46	Ac-ft
80	1.68 Ac	3.065	Ac-ft
81	1.83 Ac	4.82	Ac-ft
82	2.03 Ac	6.75	Ac-ft

Rating Curve for 24" RCP

L = 275'
℄ In = 78.0
℄ Out = 76.84

Tailwater
3' channel
n = 0.012
s = 0.002

Q	Elevation
0 cfs	78
6 cfs	79.21
12 cfs	79.88
18 cfs	80.4
24 cfs	82.45
30 cfs	84.60

Elev.	Q (cfs)
78	0
79	5
80	13.4
81	19.8
82	22.7

Basins A-K are directed to pond
L-N are directed off-site

2-yr	HW = 78.6	Q_{OUT} = 3.2 cfs
10-yr	HW = 79.3	Q_{OUT} = 7.9 cfs
100-yr	HW = 80.4	Q_{OUT} = 15.4 cfs

HMS * Summary of Results for Reservoir-2

Project : angelacres2nd Run Name : Run 6

Start of Simulation	: 11Jan00 0000	Basin Model	: Pond Only
End of Simulation	: 12Jan00 0600	Precip Model	: 2-Year Storm
Execution Time	: 19Apr00 1536	Control Specs	: 24 Hour Rainfall

Computed Results

Peak Inflow	: 21.332 (cfs)	Date/Time of Peak Inflow	: 11 Jan 00 1200
Peak Outflow	: 3.1724 (cfs)	Date/Time of Peak Outflow	: 11 Jan 00 1300
Total Inflow	: 1.29 (in)	Peak Storage	: 0.92633(ac-ft)
Total Outflow	: 1.27 (in)	Peak Elevation	: 78.634(ft)

HMS * Summary of Results for Reservoir-2

Project : angelacres2nd Run Name : Run 8

Start of Simulation	: 11Jan00 0000	Basin Model	: Pond Only
End of Simulation	: 12Jan00 0600	Precip Model	: 10-Year Storm
Execution Time	: 19Apr00 1537	Control Specs	: 24 Hour Rainfall

Computed Results

Peak Inflow	: 45.285 (cfs)	Date/Time of Peak Inflow	: 11 Jan 00 1200
Peak Outflow	: 7.8837 (cfs)	Date/Time of Peak Outflow	: 11 Jan 00 1250
Total Inflow	: 2.68 (in)	Peak Storage	: 2.0110(ac-ft)
Total Outflow	: 2.63 (in)	Peak Elevation	: 79.343(ft)

HMS * Summary of Results for Reservoir-2

Project : angelacres2nd Run Name : Run 10

Start of Simulation	: 11Jan00 0000	Basin Model	: Pond Only
End of Simulation	: 12Jan00 0600	Precip Model	: 100-Year Storm
Execution Time	: 19Apr00 1538	Control Specs	: 24 Hour Rainfall

Computed Results

Peak Inflow	: 81.345 (cfs)	Date/Time of Peak Inflow	: 11 Jan 00 1200
Peak Outflow	: 15.386 (cfs)	Date/Time of Peak Outflow	: 11 Jan 00 1240
Total Inflow	: 4.83 (in)	Peak Storage	: 3.6873(ac-ft)
Total Outflow	: 4.76 (in)	Peak Elevation	: 80.355(ft)

CURRENT DATE: 04-18-2000
CURRENT TIME: 16:46:30

FILE DATE: 04-18-2000
FILE NAME: ANGEL2ND

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	78.00	76.84	275.00	1 RCP	2.00	2.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: ANGEL2ND DATE: 04-18-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
78.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
79.21	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
79.88	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
80.40	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
82.43	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
84.60	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
87.25	36.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
89.41	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
94.34	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
98.58	54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
103.28	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: ANGEL2ND DATE: 04-18-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
78.00	0.000	0.00	0.00	0.00
79.21	0.000	6.00	0.00	0.00
79.88	0.000	12.00	0.00	0.00
80.40	0.000	18.00	0.00	0.00
82.43	0.000	24.00	0.00	0.00
84.60	0.000	30.00	0.00	0.00
87.25	0.000	36.00	0.00	0.00
89.41	0.000	40.00	0.00	0.00
94.34	0.000	48.00	0.00	0.00
98.58	0.000	54.00	0.00	0.00
103.28	0.000	60.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-18-2000
CURRENT TIME: 16:46:30

FILE DATE: 04-18-2000
FILE NAME: ANGEL2ND

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	78.00	0.00	0.00	0-NF	0.00	0.00	0.00	-0.25	0.00	0.00
6.00	79.21	1.21	1.21	1-S2n	0.85	0.86	0.76	0.37	5.45	3.21
12.00	79.88	1.81	1.88	2-M2c	1.30	1.24	1.24	0.76	5.85	3.96
18.00	80.40	2.40	1.75	2-M2c	2.00	1.52	1.52	1.11	7.03	4.42
24.00	82.43	3.16	4.43	2-M2c	2.00	1.72	1.72	1.44	8.37	4.75
30.00	84.60	4.13	6.60	2-M2c	2.00	1.90	1.90	1.75	9.81	5.00
36.00	87.25	5.28	9.25	4-FFt	2.00	2.00	2.00	2.06	11.46	5.20
40.00	89.41	6.14	11.41	4-FFt	2.00	2.00	2.00	2.26	12.73	5.31
48.00	94.34	8.17	16.34	4-FFt	2.00	2.00	2.00	2.66	15.28	5.50
54.00	98.58	10.25	20.58	4-FFt	2.00	2.00	2.00	2.95	17.19	5.62
60.00	103.28	13.36	25.28	4-FFt	2.00	2.00	2.00	3.25	19.10	5.72

El. inlet face invert 78.00 ft El. outlet invert 76.84 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	78.00 ft
OUTLET STATION	275.00 ft
OUTLET ELEVATION	76.84 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0042
CULVERT LENGTH ALONG SLOPE	275.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END IN HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 04-18-2000
CURRENT TIME: 16:46:30

FILE DATE: 04-18-2000
FILE NAME: ANGEL2ND

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	3.00 ft
SIDE SLOPE H/V (X:1)	0.0
CHANNEL SLOPE V/H (ft/ft)	0.002
MANNING'S n (.01-0.1)	0.012
CHANNEL INVERT ELEVATION	76.59 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	76.84 ft

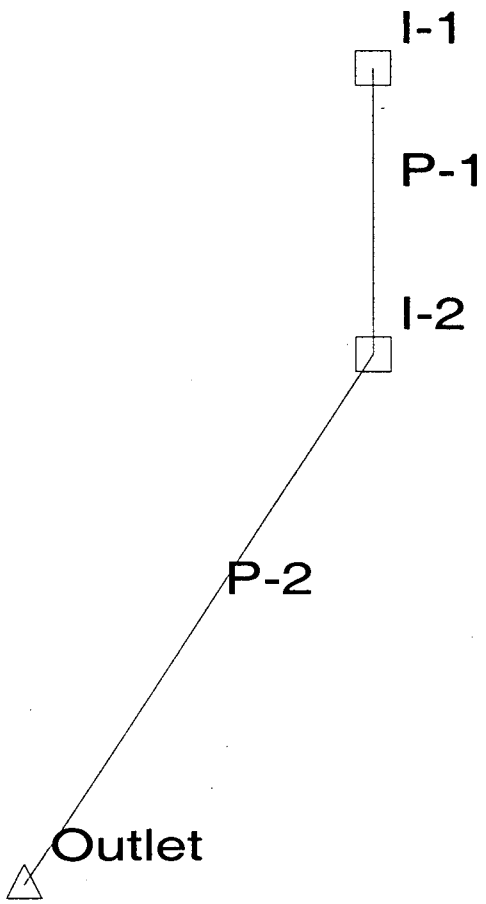
******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	76.59	0.000	0.00	0.00	0.00
6.00	77.21	0.715	0.62	3.21	0.08
12.00	77.60	0.693	1.01	3.96	0.13
18.00	77.95	0.668	1.36	4.42	0.17
24.00	78.28	0.644	1.69	4.75	0.21
30.00	78.59	0.623	2.00	5.00	0.25
36.00	78.90	0.603	2.31	5.20	0.29
40.00	79.10	0.591	2.51	5.31	0.31
48.00	79.50	0.568	2.91	5.50	0.36
54.00	79.79	0.553	3.20	5.62	0.40
60.00	80.09	0.539	3.50	5.72	0.44

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	40.00 ft
CREST LENGTH	300.00 ft
OVERTOPPING CREST ELEVATION	84.00 ft

SWS Line No. 1



```
------------------ Beginning Calculation Cycle -------------------
Discharge: 10.40 cfs  at node I-1
Discharge: 13.10 cfs  at node I-2
Discharge: 13.10 cfs  at node Outlet
Beginning iteration 1
Discharge: 10.40 cfs  at node I-1
Discharge: 13.10 cfs  at node I-2
Discharge: 13.10 cfs  at node Outlet
Discharge Convergence Achieved in 1 iterations: relative error:  0.0
Warning: No Duration data exists in IDF Table
Information: P-1 Surcharged condition
---------------------- Calculations Complete ----------------------

** Analysis Options **
Friction method:  Manning's Formula
HGL Convergence Test:  0.001000
Maximum Network Traversals:  5
Number of Pipe Profile Steps:  5
Discharge Convergence Test:  0.001000
Maximum Design Passes:  3


----------------- Network Quick View ------------------------
```

				Hydraulic Grade	
Label	Length	Size	Discharge	Upstream	Downstream
P-1	35.30	18 inch	10.40	81.40	81.05
P-2	85.00	18 inch	13.10	80.62	79.30

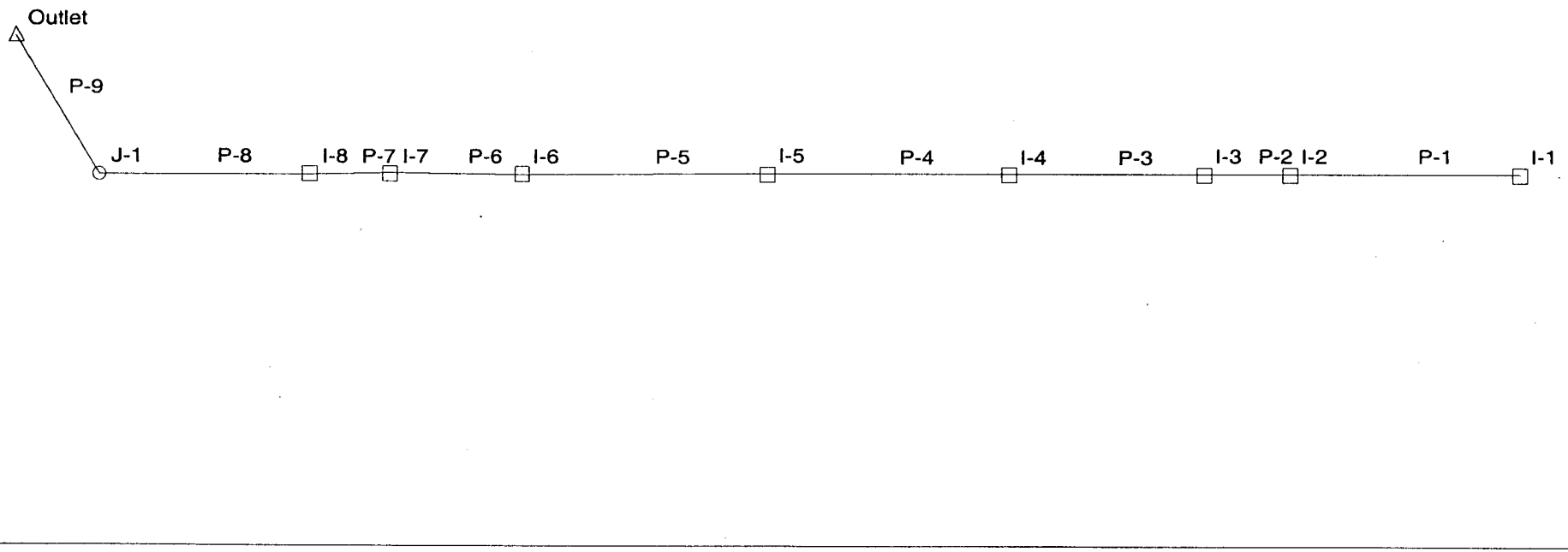
		Elevations		
Label	Discharge	Ground	Upstream HGL	Downstream HGL
I-1	10.40	81.97	81.40	81.40
I-2	13.10	81.97	81.05	80.62
Outlet	13.10	83.00	79.30	79.30

```
Elapsed: 0 minute(s) 0 second(s)
```

Pipe Report

Pipe	Upstream Node	Downstream Node	Additional Flow (cfs)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)	Average Velocity (ft/s)
P-1	I-1	I-2	10.40	10.40	35.30	0.003966	18 inch	0.013	6.61	78.46	78.32	81.97	81.97	2.01	2.15	81.40	81.05	5.89
P-2	I-2	Outlet	2.70	13.10	85.00	0.004941	18 inch	0.013	7.38	78.22	77.80	81.97	83.00	2.25	3.70	80.62	79.30	7.41
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

SWS Line No. 2



Storm Sewer System Design for 10-yr Storm

```
------------------ Beginning Calculation Cycle ------------------
Discharge: 2.82 cfs  at node I-1
Discharge: 9.28 cfs  at node I-2
Discharge: 14.87 cfs  at node I-3
Discharge: 16.63 cfs  at node I-4
Discharge: 18.96 cfs  at node I-5
Discharge: 20.60 cfs  at node I-6
Discharge: 21.05 cfs  at node I-7
Discharge: 21.47 cfs  at node I-8
Discharge: 21.47 cfs  at node J-1
Discharge: 21.47 cfs  at node Outlet
Beginning iteration 1
Discharge: 2.82 cfs  at node I-1
Discharge: 9.28 cfs  at node I-2
Discharge: 14.87 cfs  at node I-3
Discharge: 16.63 cfs  at node I-4
Discharge: 18.96 cfs  at node I-5
Discharge: 20.60 cfs  at node I-6
Discharge: 21.05 cfs  at node I-7
Discharge: 21.47 cfs  at node I-8
Discharge: 21.47 cfs  at node J-1
Discharge: 21.47 cfs  at node Outlet
Discharge Convergence Achieved in 1 iterations: relative error:  0.0
Warning: No Duration data exists in IDF Table
Information: P-9 Surcharged condition
Information: P-8 Surcharged condition
Information: P-7 Surcharged condition
Information: P-6 Surcharged condition
Information: P-5 Surcharged condition
Information: P-4 Surcharged condition
Information: P-3 Surcharged condition
Information: P-2 Surcharged condition
Information: P-1 Surcharged condition
-------------------- Calculations Complete ---------------------

** Analysis Options **
Friction method:  Manning's Formula
HGL Convergence Test:  0.001000
Maximum Network Traversals:  5
Number of Pipe Profile Steps:  5
Discharge Convergence Test:  0.001000
Maximum Design Passes:  3
```

---------- Network Quick View ----------

				Hydraulic Grade	
Label	Length	Size	Discharge	Upstream	Downstream
P-1	193.30	15 inch	2.82	84.60	84.23
P-2	37.30	18 inch	9.28	84.01	83.72
P-3	191.30	24 inch	14.87	83.55	82.72
P-4	270.00	30 inch	16.63	82.63	82.19
P-5	270.00	30 inch	18.96	82.07	81.50
P-6	103.30	30 inch	20.60	81.36	81.10
P-7	37.40	30 inch	21.05	80.96	80.86
P-8	325.00	30 inch	21.47	80.71	79.82
P-9	135.00	30 inch	21.47	79.67	79.30

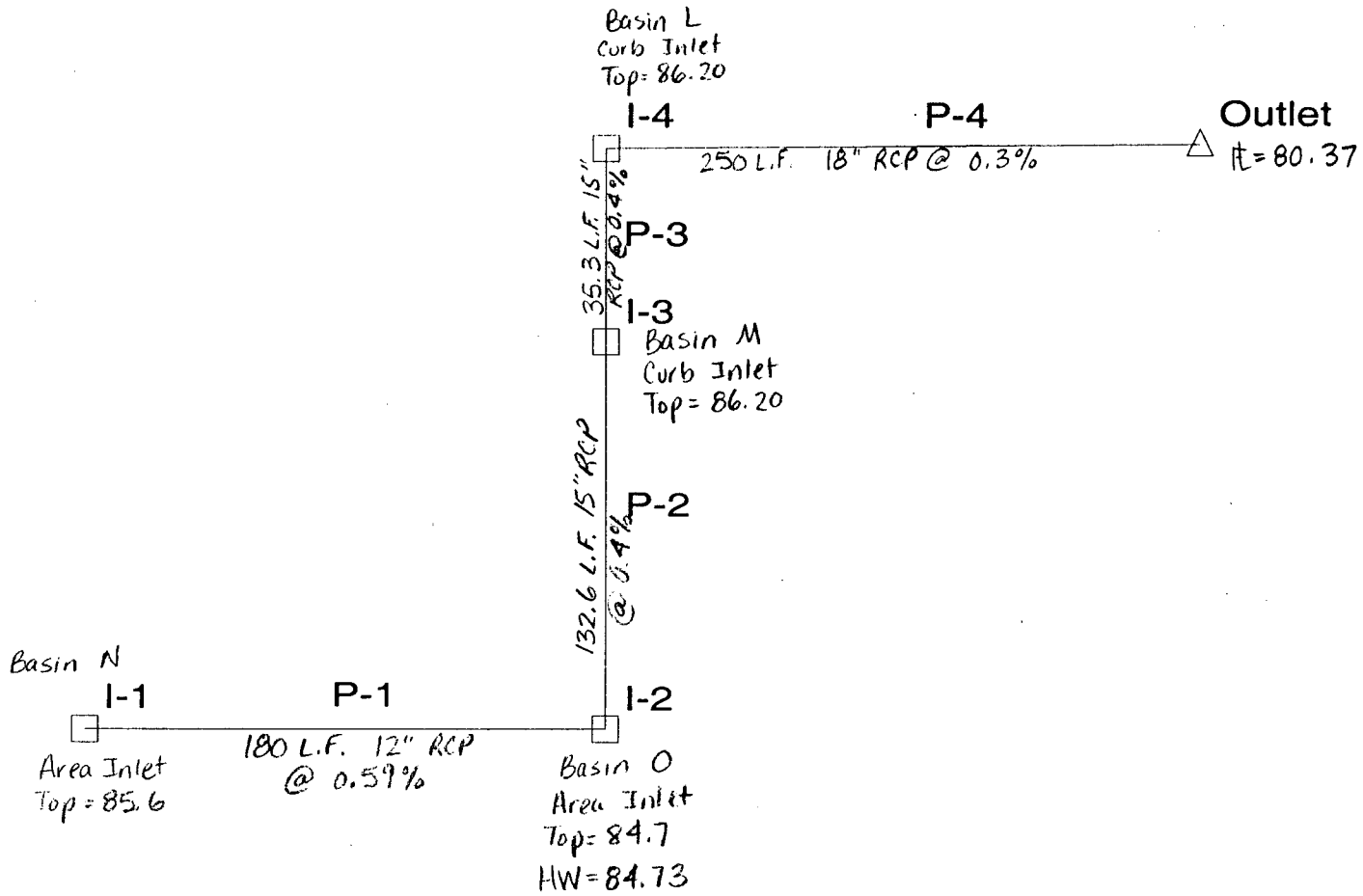
		Elevations		
Label	Discharge	Ground	Upstream HGL	Downstream HGL
J-1	21.47	81.00	79.82	79.67
Outlet	21.47	84.20	79.30	79.30
I-1	2.82	84.70	84.60	84.60
I-2	9.28	85.06	84.23	84.01
I-3	14.87	85.06	83.72	83.55

I-4	16.63	84.20	82.72	82.63
I-5	18.96	83.30	82.19	82.07
I-6	20.60	83.20	81.50	81.36
I-7	21.05	83.78	81.10	80.96
8	21.47	83.78	80.86	80.71

apsed: 0 minute(s) 1 second(s)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.02	3.12	84.60	84.23	2.30
6.44	80.59	80.45	85.06	85.06	2.97	3.11	84.01	83.72	5.25
12.46	80.35	79.77	85.06	84.20	2.71	2.43	83.55	82.72	4.73
22.46	79.67	78.86	84.20	83.30	2.03	1.94	82.63	82.19	3.39
22.46	78.76	77.95	83.30	83.20	2.04	2.75	82.07	81.50	3.86
22.47	77.85	77.54	83.20	83.78	2.85	3.74	81.36	81.10	4.20
23.23	77.44	77.32	83.78	83.78	3.84	3.96	80.96	80.86	4.29
22.52	77.22	76.24	83.78	81.00	4.06	2.26	80.71	79.82	4.37
22.60	76.14	75.73	81.00	84.20	2.36	5.97	79.67	79.30	4.37
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

SWS Line No. 3


Basin L
Curb Inlet
Top= 86.20
I-4
P-4
Outlet
250 L.F. 18" RCP @ 0.3%
Invert= 80.37
35.3 L.F. 15" RCP @ 0.4%
P-3
I-3
Basin M
Curb Inlet
Top= 86.20
132.6 L.F. 15" RCP @ 0.4%
P-2
Basin N
I-1
P-1
I-2
180 L.F. 12" RCP @ 0.59%
Area Inlet
Top= 85.6
Basin O
Area Inlet
Top= 84.7
HW= 84.73

```
------------------ Beginning Calculation Cycle ------------------
Discharge: 2.10 cfs  at node I-1
Discharge: 3.40 cfs  at node I-2
Discharge: 5.30 cfs  at node I-3
Discharge: 9.50 cfs  at node I-4
Discharge: 9.50 cfs  at node Outlet
Beginning iteration 1
Discharge: 2.10 cfs  at node I-1
Discharge: 3.40 cfs  at node I-2
Discharge: 5.30 cfs  at node I-3
Discharge: 9.50 cfs  at node I-4
Discharge: 9.50 cfs  at node Outlet
Discharge Convergence Achieved in 1 iterations: relative error:  0.0
** Problem: Flooding in system
Warning: No Duration data exists in IDF Table
Information: P-3 Surcharged condition
Information: P-2 Surcharged condition
Information: I-2 The hydraulic grade exceeds the Rim/Ground elevation
Information: I-2 Flooding condition.
Information: P-1 Surcharged condition
--------------------- Calculations Complete ---------------------

** Analysis Options **
Friction method:  Manning's Formula
HGL Convergence Test:  0.001000
Maximum Network Traversals:  5
Number of Pipe Profile Steps:  5
Discharge Convergence Test:  0.001000
Maximum Design Passes:  3


 ------------------ Network Quick View  ------------------------
```

				Hydraulic Grade	
Label	Length	Size	Discharge	Upstream	Downstream
P-1	180.00	12 inch	2.10	85.33	84.70
P-2	132.60	15 inch	3.40	84.73	84.36
P-3	35.30	15 inch	5.30	84.22	83.98
P-4	250.00	18 inch	9.50	83.75	81.56

		Elevations		
Label	Discharge	Ground	Upstream HGL	Downstream HGL
I-1	2.10	85.60	85.33	85.33
I-2	3.40	84.70	84.70	84.70
I-3	5.30	86.20	84.36	84.22
I-4	9.50	86.20	83.98	83.75
Outlet	9.50	86.00	81.56	81.56

```
Elapsed: 0 minute(s) 1 second(s)
```

Pipe Report

Pipe	Upstream Node	Downstream Node	Additional Flow (cfs)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)	Average Velocity (ft/s)
P-1	I-1	I-2	2.10	2.10	180.00	0.005889	12 inch	0.013	2.73	83.16	82.10	85.60	84.70	1.44	1.60	85.33	84.70	2.67
P-2	I-2	I-3	1.30	3.40	132.60	0.004072	15 inch	0.013	4.12	82.00	81.46	84.70	86.20	1.45	3.49	84.73	84.36	2.77
P-3	I-3	I-4	1.90	5.30	35.30	0.003966	15 inch	0.013	4.07	81.36	81.22	86.20	86.20	3.59	3.73	84.22	83.98	4.32
P-4	I-4	Outlet	4.20	9.50	250.00	0.003000	18 inch	0.013	5.75	81.12	80.37	86.20	86.00	3.58	4.13	83.75	81.56	5.85
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Inlet Sizing - 10-Yr Storm

Basin	Q_{10}	Inlet Type	Location	Size	depth	
A	10.4	Curb	Sump	10'	0.47'	
B	2.7	Curb	Sump	5'	0.28'	
C	10.7	Pond	—	—	—	
D	0.4	Curb	Sump	5'	0.18'	
E	0.4	Curb	Sump	5'	0.18'	
F	1.6	Area	Sump	2'x4' 2'x2'	0.14' 0.18'	
G	2.3	Area	Sump	2x4 2x2	0.16' 0.22'	
H	5.6	Curb	Sump	10'	0.32'	(0.37' Overflow)
I	1.8	Area	Sump	2x4 2x2	0.15' 0.19'	
J	6.5	Curb	Sump	10'	0.35'	(0.37' Overflow)
K	2.8	Area	Sump	1x4' 2'x2'	0.15 0.25'	
L	4.2	Curb	Sump	5'	0.37'	
M	1.9	Curb	Sump	5'	0.21'	
N	2.1	Area	Sump	2'x4' 2'x2'	0.15' 0.20'	
O	1.3	Area	Sump	2'x4' 2'x2'	0.11' 0.16'	

Curb Inlet were assumed to be City of Wichita Type IH curb inlets.

Area Inlets were assumed to be standard City of Wichita 2' x 4' area inlets.

2'x4' P = 12' A = 4 sq. ft (50% open area)
2'x2' P = 8' A = 2 sq. ft (50% open area)

Recommend using 2' x 2' area inlets as standard for this project.

Street Capacity

assume slope = 0.5% (Min)

Basin	Q_{10}	Depth		Q_{100}	depth		Comments
A	10.4	0.47'	overtop crown	18.7	0.58'	overtop crown	OK
B	2.7	0.29'		4.8	0.35'		OK
D	0.4	0.14'		0.8	0.18'		OK
E	0.4	0.14'		0.8	0.18'		OK
H	5.6	0.38'		10.0	0.47'		OK
J	6.5	0.39'		11.6	0.49'		OK
L	4.2	0.34'		7.5	0.42'		OK
M	1.9	0.25'		3.5	0.31'		OK

The combined 100-year flows of adjacent basins does not exceed the maximum street capacity of 53.7 cfs.

In large storms basin A will overtop the street crown and combine with basin B. In the 100-year storm this flow is still contained in the right-of-way.

Recommend using 0.3' walk grade and standard height curb.

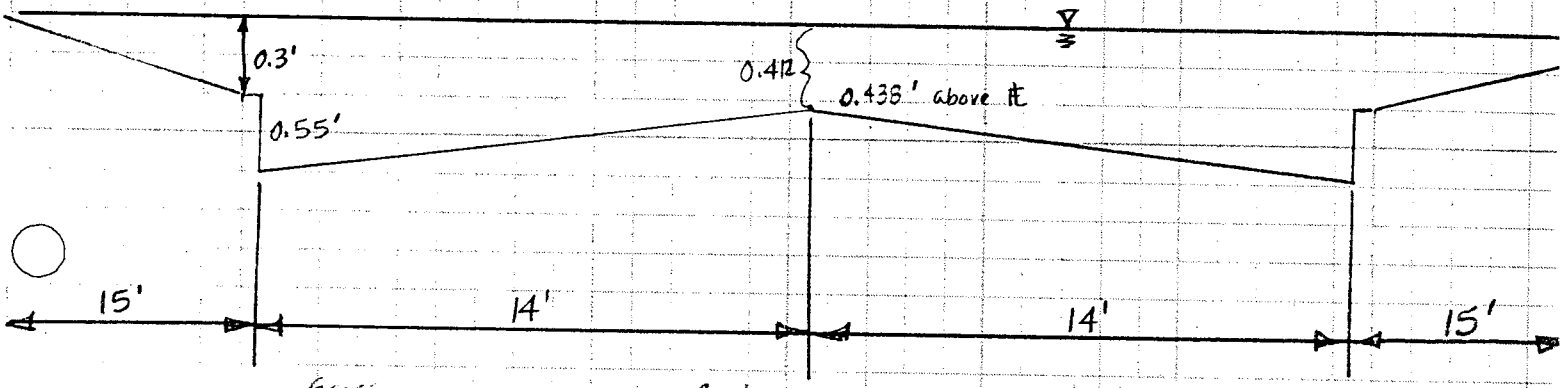
Professional Engineering Consultants, P.A.
13 S. TOPEKA • WICHITA, KANSAS 67202
316-262-2691 • FAX 316-262-3003
www.pec1.com • designers@pec1.com

Project Angel Acres 2nd Addition Date 4/19/00

Item Street Capacity - 100-yr storm By KER

58' R-O-W

0.3' Walk Grade



$$n = \frac{(2 \times 14.5 \times 0.03) + (2 \times 3.05 \times 0.013) + (\frac{1}{2} \times 12 \times 0.016)}{59.1}$$

(Grass, Curb, Asphalt)

$$= \frac{0.87 + 0.0793 + 0.384}{59.1} = \frac{1.3333}{59.1} = 0.02256$$

$$A = (2 \times \tfrac{1}{2} \times 0.3 \times 15) + (28 \times 0.412) + (2 \times \tfrac{1}{2} \times 0.438 \times 14)$$

$A = 22.168$ sq. ft

$P = 59.1$ ft

$R = A/P = 0.375093062$

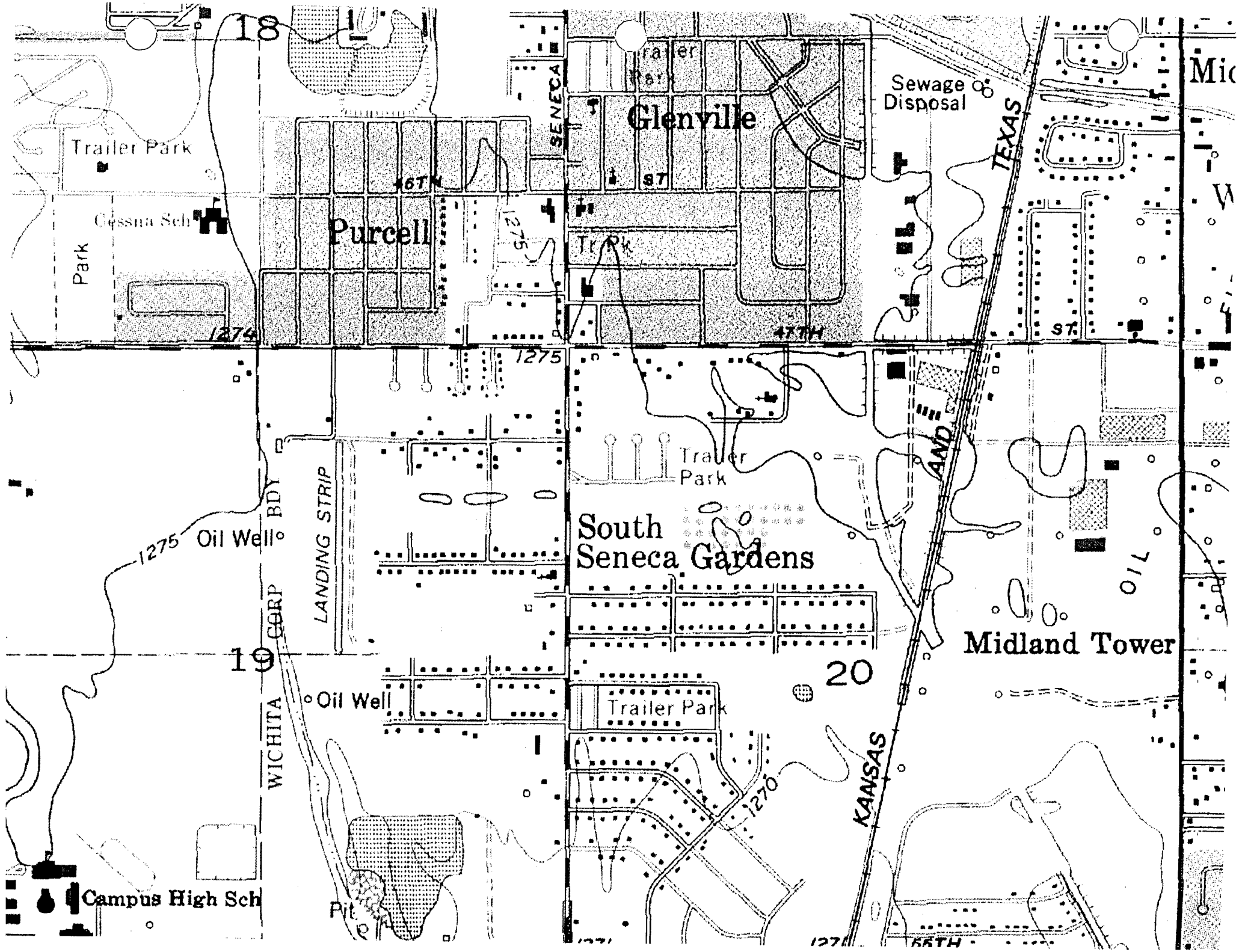
$R^{2/3} = 0.520106986$

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

$Q_{max} = 53.7$ cfs

$Q = 759.45\sqrt{S}$

$S_{min} = 0.005$


18
Trailer Park
Cessna Sch
Park
Purcell
46TH
1275
SENECA
Trailer Park
Glenville
ST
Sewage Disposal
TEXAS
47TH
ST
1274
1275
Trailer Park
AND
South Seneca Gardens
1275 Oil Well
BDY
LANDING STRIP
CORP
WICHITA
19
Oil Well
Trailer Park
20
Midland Tower
OIL
1270
KANSAS
Campus High Sch
Pit

SEDGWICK COUNTY, KANSAS — SHEET NUMBER 58

R. 1 W. R. 1 E.

T. 28 S.

(Joins sheet 59)

(Joins sheet 57)

(Joins sheet 60)

(Joins sheet 58)

Cowskin Creek

Scale 1:20000

0 1000 2000 3000 4000 5000 Feet

5000 0 5000 10000 15000 20000 25000 30000 35000 40000 45000 50000 55000 60000 65000 70000 75000 80000 85000 90000 95000 100000 105000 110000 115000 120000 125000 130000 135000 140000 145000 150000 155000 160000 165000 170000 175000 180000 185000 190000 195000 200000 205000 210000 215000 220000 225000 230000 235000 240000 245000 250000 255000 260000 265000 270000 275000 280000 285000 290000 295000 300000 305000 310000 315000 320000 325000 330000 335000 340000 345000 350000 355000 360000 365000 370000 375000 380000 385000 390000 395000 400000 405000 410000 415000 420000 425000 430000 435000 440000 445000 450000 455000 460000 465000 470000 475000 480000 485000 490000 495000 500000 505000 510000 515000 520000 525000 530000 535000 540000 545000 550000 555000 560000 565000 570000 575000 580000 585000 590000 595000 600000 605000 610000 615000 620000 625000 630000 635000 640000 645000 650000 655000 660000 665000 670000 675000 680000 685000 690000 695000 700000 705000 710000 715000 720000 725000 730000 735000 740000 745000 750000 755000 760000 765000 770000 775000 780000 785000 790000 795000 800000 805000 810000 815000 820000 825000 830000 835000 840000 845000 850000 855000 860000 865000 870000 875000 880000 885000 890000 895000 900000 905000 910000 915000 920000 925000 930000 935000 940000 945000 950000 955000 960000 965000 970000 975000 980000 985000 990000 995000 1000000 1005000 1010000 1015000 1020000 1025000 1030000 1035000 1040000 1045000 1050000 1055000 1060000 1065000 1070000 1075000 1080000 1085000 1090000 1095000 1100000 1105000 1110000 1115000 1120000 1125000 1130000 1135000 1140000 1145000 1150000 1155000 1160000 1165000 1170000 1175000 1180000 1185000 1190000 1195000 1200000 1205000 1210000 1215000 1220000 1225000 1230000 1235000 1240000 1245000 1250000 1255000 1260000 1265000 1270000 1275000 1280000 1285000 1290000 1295000 1300000 1305000 1310000 1315000 1320000 1325000 1330000 1335000 1340000 1345000 1350000 1355000 1360000 1365000 1370000 1375000 1380000 1385000 1390000 1395000 1400000 1405000 1410000 1415000 1420000 1425000 1430000 1435000 1440000 1445000 1450000 1455000 1460000 1465000 1470000 1475000 1480000 1485000 1490000 1495000 1500000 1505000 1510000 1515000 1520000 1525000 1530000 1535000 1540000 1545000 1550000 1555000 1560000 1565000 1570000 1575000 1580000 1585000 1590000 1595000 1600000 1605000 1610000 1615000 1620000 1625000 1630000 1635000 1640000 1645000 1650000 1655000 1660000 1665000 1670000 1675000 1680000 1685000 1690000 1695000 1700000 1705000 1710000 1715000 1720000 1725000 1730000 1735000 1740000 1745000 1750000 1755000 1760000 1765000 1770000 1775000 1780000 1785000 1790000 1795000 1800000 1805000 1810000 1815000 1820000 1825000 1830000 1835000 1840000 1845000 1850000 1855000 1860000 1865000 1870000 1875000 1880000 1885000 1890000 1895000 1900000 1905000 1910000 1915000 1920000 1925000 1930000 1935000 1940000 1945000 1950000 1955000 1960000 1965000 1970000 1975000 1980000 1985000 1990000 1995000 2000000 2005000 2010000 2015000 2020000 2025000 2030000 2035000 2040000 2045000 2050000 2055000 2060000 2065000 2070000 2075000 2080000 2085000 2090000 2095000 2100000 2105000 2110000 2115000 2120000 2125000 2130000 2135000 2140000 2145000 2150000 2155000 2160000 2165000 2170000 2175000 2180000 2185000 2190000 2195000 2200000 2205000 2210000 2215000 2220000 2225000 2230000 2235000 2240000 2245000 2250000 2255000 2260000 2265000 2270000 2275000 2280000 2285000 2290000 2295000 2300000 2305000 2310000 2315000 2320000 2325000 2330000 2335000 2340000 2345000 2350000 2355000 2360000 2365000 2370000 2375000 2380000 2385000 2390000 2395000 2400000 2405000 2410000 2415000 2420000 2425000 2430000 2435000 2440000 2445000 2450000 2455000 2460000 2465000 2470000 2475000 2480000 2485000 2490000 2495000 2500000 2505000 2510000 2515000 2520000 2525000 2530000 2535000 2540000 2545000 2550000 2555000 2560000 2565000 2570000 2575000 2580000 2585000 2590000 2595000 2600000 2605000 2610000 2615000 2620000 2625000 2630000 2635000 2640000 2645000 2650000 2655000 2660000 2665000 2670000 2675000 2680000 2685000 2690000 2695000 2700000 2705000 2710000 2715000 2720000 2725000 2730000 2735000 2740000 2745000 2750000 2755000 2760000 2765000 2770000 2775000 2780000 2785000 2790000 2795000 2800000 2805000 2810000 2815000 2820000 2825000 2830000 2835000 2840000 2845000 2850000 2855000 2860000 2865000 2870000 2875000 2880000 2885000 2890000 2895000 2900000 2905000 2910000 2915000 2920000 2925000 2930000 2935000 2940000 2945000 2950000 2955000 2960000 2965000 2970000 2975000 2980000 2985000 2990000 2995000 3000000 3005000 3010000 3015000 3020000 3025000 3030000 3035000 3040000 3045000 3050000 3055000 3060000 3065000 3070000 3075000 3080000 3085000 3090000 3095000 3100000 3105000 3110000 3115000 3120000 3125000 3130000 3135000 3140000 3145000 3150000 3155000 3160000 3165000 3170000 3175000 3180000 3185000 3190000 3195000 3200000 3205000 3210000 3215000 3220000 3225000 3230000 3235000 3240000 3245000 3250000 3255000 3260000 3265000 3270000 3275000 3280000 3285000 3290000 3295000 3300000 3305000 3310000 3315000 3320000 3325000 3330000 3335000 3340000 3345000 3350000 3355000 3360000 3365000 3370000 3375000 3380000 3385000 3390000 3395000 3400000 3405000 3410000 3415000 3420000 3425000 3430000 3435000 3440000 3445000 3450000 3455000 3460000 3465000 3470000 3475000 3480000 3485000 3490000 3495000 3500000 3505000 3510000 3515000 3520000 3525000 3530000 3535000 3540000 3545000 3550000 3555000 3560000 3565000 3570000 3575000 3580000 3585000 3590000 3595000 3600000 3605000 3610000 3615000 3620000 3625000 3630000 3635000 3640000 3645000 3650000 3655000 3660000 3665000 3670000 3675000 3680000 3685000 3690000 3695000 3700000 3705000 3710000 3715000 3720000 3725000 3730000 3735000 3740000 3745000 3750000 3755000 3760000 3765000 3770000 3775000 3780000 3785000 3790000 3795000 3800000 3805000 3810000 3815000 3820000 3825000 3830000 3835000 3840000 3845000 3850000 3855000 3860000 3865000 3870000 3875000 3880000 3885000 3890000 3895000 3900000 3905000 3910000 3915000 3920000 3925000 3930000 3935000 3940000 3945000 3950000 3955000 3960000 3965000 3970000 3975000 3980000 3985000 3990000 3995000 4000000 4005000 4010000 4015000 4020000 4025000 4030000 4035000 4040000 4045000 4050000 4055000 4060000 4065000 4070000 4075000 4080000 4085000 4090000 4095000 4100000 4105000 4110000 4115000 4120000 4125000 4130000 4135000 4140000 4145000 4150000 4155000 4160000 4165000 4170000 4175000 4180000 4185000 4190000 4195000 4200000 4205000 4210000 4215000 4220000 4225000 4230000 4235000 4240000 4245000 4250000 4255000 4260000 4265000 4270000 4275000 4280000 4285000 4290000 4295000 4300000 4305000 4310000 4315000 4320000 4325000 4330000 4335000 4340000 4345000 4350000 4355000 4360000 4365000 4370000 4375000 4380000 4385000 4390000 4395000 4400000 4405000 4410000 4415000 4420000 4425000 4430000 4435000 4440000 4445000 4450000 4455000 4460000 4465000 4470000 4475000 4480000 4485000 4490000 4495000 4500000 4505000 4510000 4515000 4520000 4525000 4530000 4535000 4540000 4545000 4550000 4555000 4560000 4565000 4570000 4575000 4580000 4585000 4590000 4595000 4600000 4605000 4610000 4615000 4620000 4625000 4630000 4635000 4640000 4645000 4650000 4655000 4660000 4665000 4670000 4675000 4680000 4685000 4690000 4695000 4700000 4705000 4710000 4715000 4720000 4725000 4730000 4735000 4740000 4745000 4750000 4755000 4760000 4765000 4770000 4775000 4780000 4785000 4790000 4795000 4800000 4805000 4810000 4815000 4820000 4825000 4830000 4835000 4840000 4845000 4850000 4855000 4860000 4865000 4870000 4875000 4880000 4885000 4890000 4895000 4900000 4905000 4910000 4915000 4920000 4925000 4930000 4935000 4940000 4945000 4950000 4955000 4960000 4965000 4970000 4975000 4980000 4985000 4990000 4995000 5000000 5005000 5010000 5015000 5020000 5025000 5030000 5035000 5040000 5045000 5050000 5055000 5060000 5065000 5070000 5075000 5080000 5085000 5090000 5095000 5100000 5105000 5110000 5115000 5120000 5125000 5130000 5135000 5140000 5145000 5150000 5155000 5160000 5165000 5170000 5175000 5180000 5185000 5190000 5195000 5200000 5205000 5210000 5215000 5220000 5225000 5230000 5235000 5240000 5245000 5250000 5255000 5260000 5265000 5270000 5275000 5280000 5285000 5290000 5295000 5300000 5305000 5310000 5315000 5320000 5325000 5330000 5335000 5340000 5345000 5350000 5355000 5360000 5365000 5370000 5375000 5380000 5385000 5390000 5395000 5400000 5405000 5410000 5415000 5420000 5425000 5430000 5435000 5440000 5445000 5450000 5455000 5460000 5465000 5470000 5475000 5480000 5485000 5490000 5495000 5500000 5505000 5510000 5515000 5520000 5525000 5530000 5535000 5540000 5545000 5550000 5555000 5560000 5565000 5570000 5575000 5580000 5585000 5590000 5595000 5600000 5605000 5610000 5615000 5620000 5625000 5630000 5635000 5640000 5645000 5650000 5655000 5660000 5665000 5670000 5675000 5680000 5685000 5690000 5695000 5700000 5705000 5710000 5715000 5720000 5725000 5730000 5735000 5740000 5745000 5750000 5755000 5760000 5765000 5770000 5775000 5780000 5785000 5790000 5795000 5800000 5805000 5810000 5815000 5820000 5825000 5830000 5835000 5840000 5845000 5850000 5855000 5860000 5865000 5870000 5875000 5880000 5885000 5890000 5895000 5900000 5905000 5910000 5915000 5920000 5925000 5930000 5935000 5940000 5945000 5950000 5955000 5960000 5965000 5970000 5975000 5980000 5985000 5990000 5995000 6000000 6005000 6010000 6015000 6020000 6025000 6030000 6035000 6040000 6045000 6050000 6055000 6060000 6065000 6070000 6075000 6080000 6085000 6090000 6095000 6100000 6105000 6110000 6115000 6120000 6125000 6130000 6135000 6140000 6145000 6150000 6155000 6160000 6165000 6170000 6175000 6180000 6185000 6190000 6195000 6200000 6205000 6210000 6215000 6220000 6225000 6230000 6235000 6240000 6245000 6250000 6255000 6260000 6265000 6270000 6275000 6280000 6285000 6290000 6295000 6300000 6305000 6310000 6315000 6320000 6325000 6330000 6335000 6340000 6345000 6350000 6355000 6360000 6365000 6370000 6375000 6380000 6385000 6390000 6395000 6400000 6405000 6410000 6415000 6420000 6425000 6430000 6435000 6440000 6445000 6450000 6455000 6460000 6465000 6470000 6475000 6480000 6485000 6490000 6495000 6500000 6505000 6510000 6515000 6520000 6525000 6530000 6535000 6540000 6545000 6550000 6555000 6560000 6565000 6570000 6575000 6580000 6585000 6590000 6595000 6600000 6605000 6610000 6615000 6620000 6625000 6630000 6635000 6640000 6645000 6650000 6655000 6660000 6665000 6670000 6675000 6680000 6685000 6690000 6695000 6700000 6705000 6710000 6715000 6720000 6725000 6730000 6735000 6740000 6745000 6750000 6755000 6760000 6765000 6770000 6775000 6780000 6785000 6790000 6795000 6800000 6805000 6810000 6815000 6820000 6825000 6830000 6835000 6840000 6845000 6850000 6855000 6860000 6865000 6870000 6875000 6880000 6885000 6890000 6895000 6900000 6905000 6910000 6915000 6920000 6925000 6930000 6935000 6940000 6945000 6950000 6955000 6960000 6965000 6970000 6975000 6980000 6985000 6990000 6995000 7000000 7005000 7010000 7015000 7020000 7025000 7030000 7035000 7040000 7045000 7050000 7055000 7060000 7065000 7070000 7075000 7080000 7085000 7090000 7095000 7100000 7105000 7110000 7115000 7120000 7125000 7130000 7135000 7140000 7145000 7150000 7155000 7160000 7165000 7170000 7175000 7180000 7185000 7190000 7195000 7200000 7205000 7210000 7215000 7220000 7225000 7230000 7235000 7240000 7245000 7250000 7255000 7260000 7265000 7270000 7275000 7280000 7285000 7290000 7295000 7300000 7305000 7310000 7315000 7320000 7325000 7330000 7335000 7340000 7345000 7350000 7355000 7360000 7365000 7370000 7375000 7380000 7385000 7390000 7395000 7400000 7405000 7410000 7415000 7420000 7425000 7430000 7435000 7440000 7445000 7450000 7455000 7460000 7465000 7470000 7475000 7480000 7485000 7490000 7495000 7500000 7505000 7510000 7515000 7520000 7525000 7530000 7535000 7540000 7545000 7550000 7555000 7560000 7565000 7570000 7575000 7580000 7585000 7590000 7595000 7600000 7605000 7610000 7615000 7620000 7625000 7630000 7635000 7640000 7645000 7650000 7655000 7660000 7665000 7670000 7675000 7680000 7685000 7690000 7695000 7700000 7705000 7710000 7715000 7720000 7725000 7730000 7735000 7740000 7745000 7750000 7755000 7760000 7765000 7770000 7775000 7780000 7785000 7790000 7795000 7800000 7805000 7810000 7815000 7820000 7825000 7830000 7835000 7840000 7845000 7850000 7855000 7860000 7865000 7870000 7875000 7880000 7885000 7890000 7895000 7900000 7905000 7910000 7915000 7920000 7925000 7930000 7935000 7940000 7945000 7950000 7955000 7960000 7965000 7970000 7975000 7980000 7985000 7990000 7995000 8000000 8005000 8010000 8015000 8020000 8025000 8030000 8035000 8040000 8045000 8050000 8055000 8060000 8065000 8070000 8075000 8080000 8085000 8090000 8095000 8100000 8105000 8110000 8115000 8120000 8125000 8130000 8135000 8140000 8145000 8150000 8155000 8160000 8165000 8170000 8175000 8180000 8185000 8190000 8195000 8200000 8205000 8210000 8215000 8220000 8225000 8230000 8235000 8240000 8245000 8250000 8255000 8260000 8265000 8270000 8275000 8280000 8285000 8290000 8295000 8300000 8305000 8310000 8315000 8320000 8325000 8330000 8335000 8340000 8345000 8350000 8355000 8360000 8365000 8370000 8375000 8380000 8385000 8390000 8395000 8400000 8405000 8410000 8415000 8420000 8425000 8430000 8435000 8440000 8445000 8450000 8455000 8460000 8465000 8470000 8475000 8480000 8485000 8490000 8495000 8500000 8505000 8510000 8515000 8520000 8525000 8530000 8535000 8540000 8545000 8550000 8555000 8560000 8565000 8570000 8575000 8580000 8585000 8590000 8595000 8600000 8605000 8610000 8615000 8620000 8625000 8630000 8635000 8640000 8645000 8650000 8655000 8660000 8665000 8670000 8675000 8680000 8685000 8690000 8695000 8700000 8705000 8710000 8715000 8720000 8725000 8730000 8735000 8740000 8745000 8750000 8755000 8760000 8765000 8770000 8775000 8780000 8785000 8790000 8795000 8800000 8805000 8810000 8815000 8820000 8825000 8830000 8835000 8840000 8845000 8850000 8855000 8860000 8865000 8870000 8875000 8880000 8885000 8890000 8895000 8900000 8905000 8910000 8915000 8920000 8925000 8930000 8935000 8940000 8945000 8950000 8955000 8960000 8965000 8970000 8975000 8980000 8985000 8990000 8995000 9000000 9005000 9010000 9015000 9020000 9025000 9030000 9035000 9040000 9045000 9050000 9055000 9060000 9065000 9070000 9075000 9080000 9085000 9090000 9095000 9100000 9105000 9110000 9115000 9120000 9125000 9130000 9135000 9140000 9145000 9150000 9155000 9160000 9165000 9170000 9175000 9180000 9185000 9190000 9195000 9200000 9205000 9210000 9215000 9220000 9225000 9230000 9235000 9240000 9245000 9250000 9255000 9260000 9265000 9270000 9275000 9280000 9285000 9290000 9295000 9300000 9305000 9310000 9315000 9320000 9325000 9330000 9335000 9340000 9345000 9350000 9355000 9360000 9365000 9370000 9375000 9380000 9385000 9390000 9395000 9400000 9405000 9410000 9415000 9420000 9425000 9430000 9435000 9440000 9445000 9450000 9455000 9460000 9465000 9470000 9475000 9480000 9485000 9490000 9495000 9500000 9505000 9510000 9515000 9520000 9525000 9530000 9535000 9540000 9545000 9550000 9555000 9560000 9565000 9570000 9575000 9580000 9585000 9590000 9595000 9600000 9605000 9610000 9615000 9620000 9625000 9630000 9635000 9640000 9645000 9650000 9655000 9660000 9665000 9670000 9675000 9680000 9685000 9690000 9695000 9700000 9705000 9710000 9715000 9720000 9725000 9730000 9735000 9740000 9745000 9750000 9755000 9760000 9765000 9770000 9775000 9780000 9785000 9790000 9795000 9800000 9805000 9810000 9815000 9820000 9825000 9830000 9835000 9840000 9845000 9850000 9855000 9860000 9865000 9870000 9875000 9880000 9885000 9890000 9895000 9900000 9905000 9910000 9915000 9920000 9925000 9930000 9935000 9940000 9945000 9950000 9955000 9960000 9965000 9970000 9975000 9980000 9985000 9990000 9995000 10000000

Table 2-2.--Runoff curve numbers for selected agricultural, suburban, and urban land use. (Antecedent moisture condition II, and $I_a = 0.2S$)

LAND USE DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Cultivated land[1]: without conservation treatment	72	81	88	91
: with conservation treatment	62	71	78	81
Pasture or range land: poor condition	68	79	86	89
good condition	39	61	74	80
Meadow: good condition	30	58	71	78
Wood or Forest land: thin stand, poor cover, no mulch	45	66	77	83
good cover[2]	25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.				
good condition: grass cover on 75% or more of the area	39	61	74	80
fair condition: grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious).	81	88	91	93
Residential:[3]				
Average lot size — Average % Impervious[4]				
1/8 acre or less — 65	77	85	90	92
1/4 acre — 38	61	75	83	87
1/3 acre — 30	57	72	81	86
1/2 acre — 25	54	70	80	85
1 acre — 20	51	68	79	84
Paved parking lots, roofs, driveways, etc.[5]	98	98	98	98
Streets and roads:				
paved with curbs and storm sewers[5]	98	98	98	98
gravel	76	85	89	91
dirt	72	82	87	89

[1] For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, Aug. 1972.

[2] Good cover is protected from grazing and litter and brush cover soil.

[3] Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

[4] The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

[5] In some warmer climates of the country a curve number of 95 may be used.

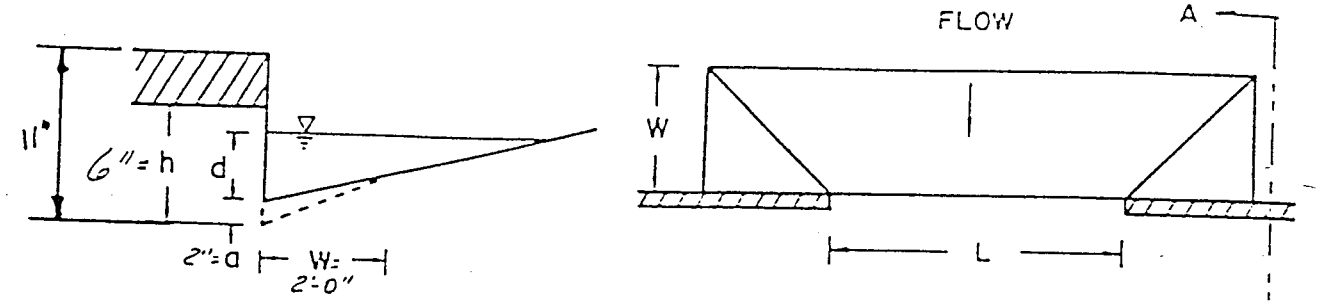
ATTACHMENT E

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
Forrest with Heavy Ground Litter or Meadow	0.08	0.11	0.14	0.16	0.18	0.19	0.20	0.22	0.23	0.25	0.35	0.42	0.50	0.55	0.60	0.66	0.70	0.75	0.80	1.10
Fallow or Minimum Tillage Cultivation	0.15	0.21	0.26	0.29	0.33	0.35	0.39	0.41	0.44	0.46	0.65	0.80	0.92	1.10	1.20	1.30	1.40	1.50	1.60	2.10
Short Grass Pasture or Lawns	0.23	0.32	0.38	0.44	0.50	0.53	0.58	0.62	0.66	0.70	1.00	1.20	1.40	1.60	1.80	1.90	2.00	2.10	2.20	3.20
Almost Bare Ground	0.32	0.44	0.53	0.62	0.69	0.75	0.82	0.87	0.92	0.98	1.40	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.10	4.40
Grassed Waterway	0.50	0.68	0.83	0.95	1.10	1.20	1.30	1.40	1.50	1.60	2.20	2.60	3.00	3.40	3.70	4.00	4.30	4.60	4.80	7.00
Paved Areas (Sheet Flow) or Shallow Gutter Flow	0.63	0.89	1.10	1.30	1.50	1.60	1.70	1.80	1.90	2.00	2.80	3.40	4.00	4.50	4.90	5.30	5.70	6.00	6.20	9.00



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

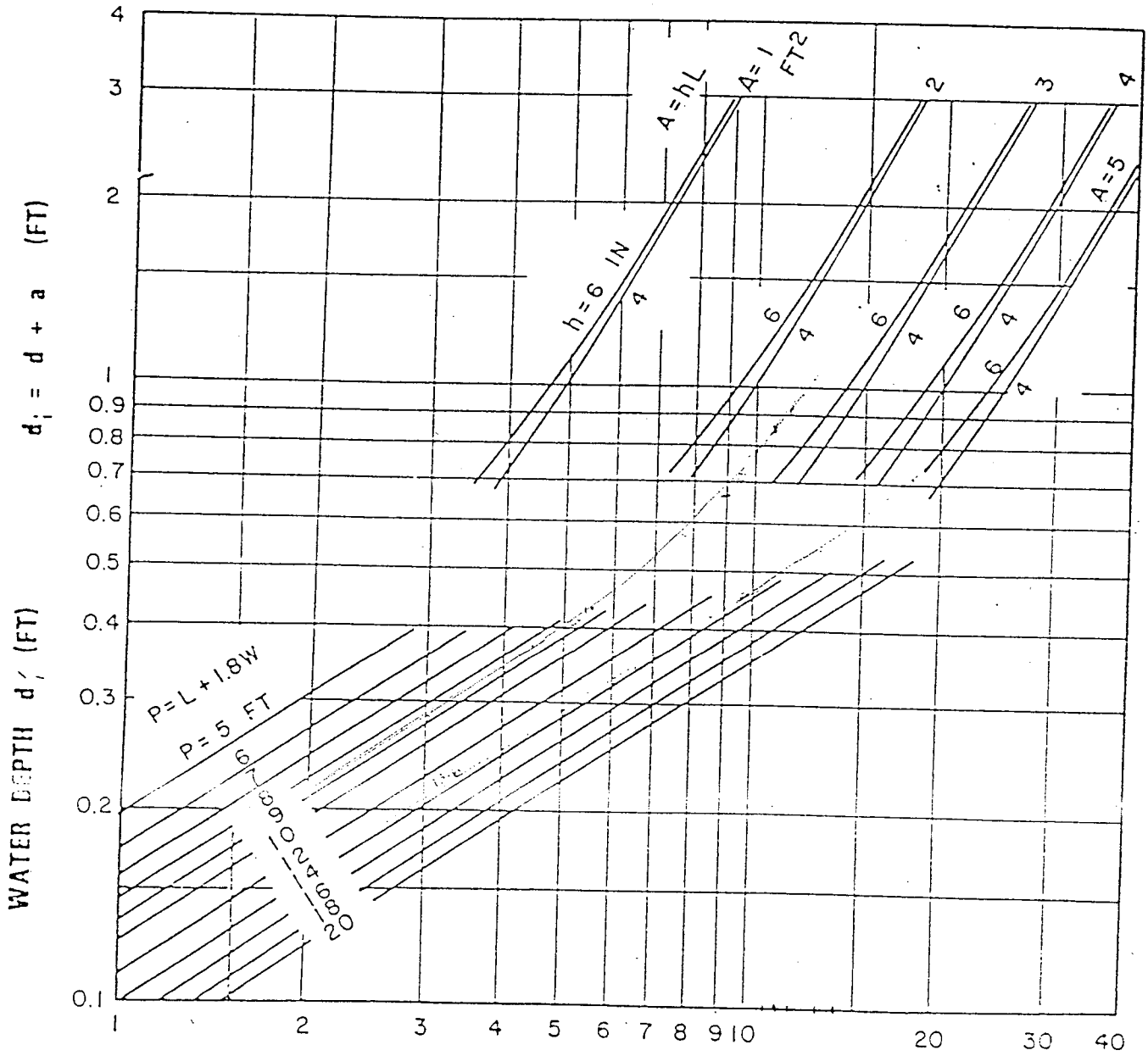
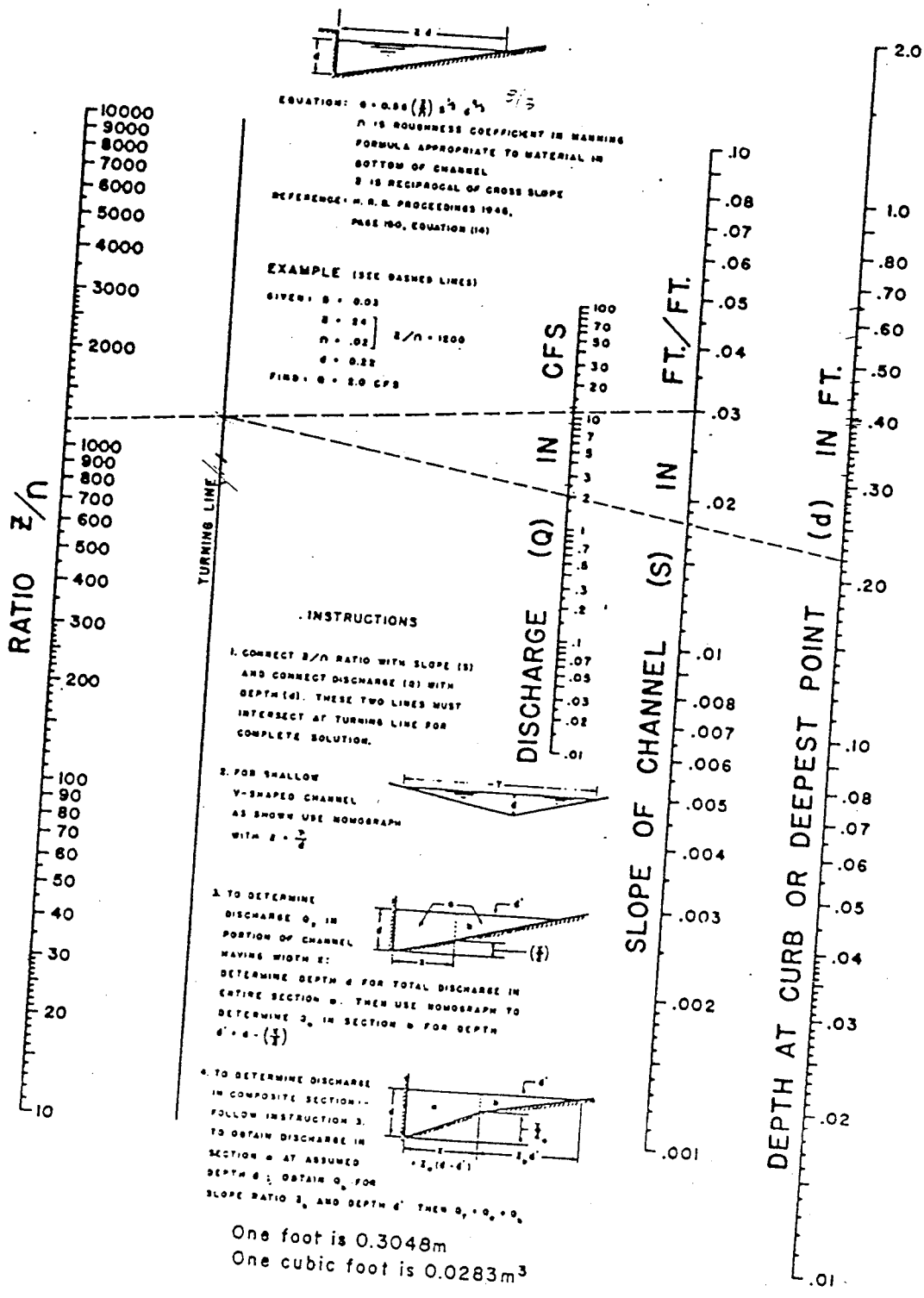


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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

NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS



One foot is 0.3048m

One cubic foot is $0.0283 m^3$

4-CORNER PLAN

ANGEL ACRES 2ND ADDITION

TO WICHITA, SEDGWICK COUNTY, KANSAS

LEGEND

- STORM SEWER AND INLET
- STORM SEWER AND MANHOLE
- 156.0 — SPOT ELEVATION
- 156.0 HP — HIGH POINT ELEVATION
- 156.04 — MATCH EXISTING ELEVATION

SCALE: 1"=100'

Add 100 to Elevations shown for City of Wichita Datum.

Add 1287.4 to Elevations shown for N.G.V.D.

BENCHMARK

BM-1 C.O.W. Disc 74' N. and 44' E. of the center intersection of Seneca and 47th St. Elevation=187.43

BM-2 Railroad Spike in W. face of Power Pole 30'± E. of ℄ of Seneca, 170'± N. of Sunrise. Elevation=184.79

BM-3 Railroad Spike in N. face of Ligh Pole on S.E. Cor. of Sunrise and Osage. Elevation=185.32

BM-4 Railroad Spike in S. face of Light Pole on S.E. Cor. of Sunrise and Sycamore Ave. Elevation=186.16

BM-5 Railroad Spike in E. face of Light Pole on N.W. Cor. of Sunrise and Gold. Elevation=187.44

N89° 34'40"E 2645.14'

N.W. 1/4 Cor., NW 1/4 Sec. 20, T28S, R1E Found 3/4" I.P. in Thimble

N.E. 1/4 Cor., NW 1/4 Sec. 20, T28S, R1E

Minimum Openings

Lots 1-5, Block 5 = 85.4
Lots 1 & 2, Block 1 = 85.4
Lots 1 & 2, Block 4 = 85.6
Lots 3-6, Block 4 = 86.2
Lots 7-9, Block 4 = 86.6
Lots 1-5, Block 3 = 87.5
Lots 6-9, Block 3 = 88.0

D-256-UP
JOHN D. BLEVENS
5157 S. SENECA
WICHITA, KS 67217

GEORGIA PACIFIC ADDITION

7'x3' RCB (Record Info)
76.55℄
16.59℄
36" RCP
24" RCP
SWS Inlet (Record Info)
SS (Record Info)
20' Drainage Easement
50TH STREET SOUTH
30" Sanitary Sewer
℄ Out=78.0
RESERVE "A"
Static=76.0±
HW_{10}= 79.3
HW_{100}= 80.4
℄ 20' Utility Esmt.
℄ 10' Utility Esmt.
25' Drainage & Utility Easement
8" Sanitary Sewer Easement (Record Info)
8" San. Sewer
SOUTH SENECA GARDENS SECOND ADDITION
SUNRISE
OSAGE AVE.
SYCAMORE AVE.
GOLD AVE.
SOUTH STREET SOUTH
20' Drainage Easement
McLEAN BLVD.
℄ SENECA ST.
BM-3
BM-4
BM-5
S.W. 1/4 Cor., NW 1/4 Sec. 20, T28S, R1E Found 3/4" I.P. in thimble
S.E. 1/4 Cor., NW 1/4 Sec. 20, T28S, R1E Found 1/2" I.P.
N89° 36'52"E 2646.32'

DSNR: KER OPER: DAR SCALE: 1=100.00
Q:\2000\00081\4Corner 04-20-2000 08:50:19 am