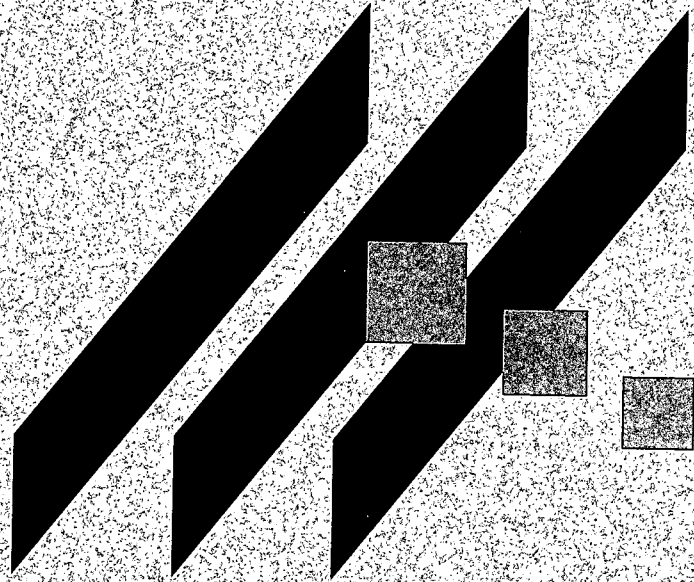


M I D - K A N S A S E N G I N E E R I N G C O N S U L T A N T S , I N C .



# **PRELIMINARY DRAINAGE REPORT**

## **THE LEGACY**

**June 24, 1998**

Preliminary Drainage Report  
The Legacy  
MKEC Project 95138  
June 24, 1998

**Location**

The site comprises approximately 80 acres in the north half of the southeast quarter of Section 13, TS R1W. The current site entrance is just under ½ mile north of 47<sup>th</sup> Street South on the west side of Meridian Avenue. Adjacent lands include numerous parcels in agriculture or large suburban lots to the north, northwest and south, and manufactured home developments southwest and east. The Wichita-Valley Center Floodway lies approximately one mile west of the site. See Figure 1.

**Site Conditions**

**Soils**

According to the NRCS (SCS) Sedgwick County Soil Survey, the site's soils fall into two series. Soil on the west 1/3 of the site is in the Tabler-Drummond Complex (Tb: HSG D), with soil on the balance of the site in the Naron Series (Na: HSG B).

The Tabler-Drummond Complex consists of nearly level, moderately well drained and somewhat poorly drained soils on terraces. It is described in the SCS Soil Survey as a dark gray silty clay loam about 9 inches thick, followed by layers of silty clay to a depth of about 60 inches. Permeability is very slow, and runoff is slow to very slow. Footings and foundations for buildings constructed on these soils should be designed to prevent structural damage caused by shrinking and swelling. Artificial drainage should be provided around buildings to keep soils from becoming saturated. If excavated material is used in yard grading, establishing yard grasses will be difficult.

The Naron series consists of nearly level and very gently sloping, well-drained soil on uplands and terraces. It is described in the SCS Soil Survey as having a surface layer of fine, sandy loam about 8 inches thick. The subsoil is about 42 inches thick, and comprises layers of sandy loam and sandy clay loam. The substratum to a depth of 60 inches is medium and fine sand. Permeability is moderate to moderately rapid, and runoff is slow. The soil is suitable for building site development.

**Current Development**

The parcel is currently undeveloped agricultural land. The wheat growing on most of the parcel is interrupted only by a grove of trees near the northeast corner.

**Landform and Slope**

The site apparently receives some runoff from the adjacent wheat fields and large suburban residential parcels. Runoff entering the property appears to be primarily sheet flow or shallow concentrated flow from the north or northwest. Three shallow swales (two major and one minor) cross the site essentially parallel to one another, as shown on Figure 2.

## Regional Drainage Conditions

Terrain is extremely flat, with regional slopes on the order of 5 to 10 ft per mile from northwest to southeast.

The major regional drainage features, shown on Figure 3, include the following:

- The Wichita – Valley Center Floodway, which lies approximately one mile west of the site. Prior to floodway construction, Cowskin Creek appears to have passed through the south part of Section 24, about 1 mile from the site. This flow is now intercepted by the floodway.
- Cowskin Creek remnants lie east of the Wichita – Valley Center Floodway south of the site.
- Big Slough South/I-235, which lie within a few hundred feet of one another in an east-west direction, and block flow that may historically have entered the area from the north.

Review of the appropriate Flood Insurance Rate Maps (Wichita Panel 35, Sedgwick County Panel 200) indicates no regulatory floodplains within ½ mile of site boundaries.

## Off-Site Drainage Conditions

### *Existing Characteristics*

The apparent watershed contributing to the site, shown on Figure 3, is roughly bounded on the north by I-235, on the east by Meridian, and on the west by West Street. Some of the land south of I-235 may flow east in the right of way toward the south side of the Big Slough South culvert. Additionally, the USGS 7.5 minute quadrangle map shows a channel originating near the southeast corner of West and MacArthur and flowing just southwest of the parcel.

The watershed's land use is predominantly agricultural. A portion of the industrial development north of MacArthur along West St. may drain to the site.

Preliminary attempts to determine the channel routes and boundaries of the watersheds contributing flow to the three swales on the site have been inconclusive. Most of the watershed that appears to drain toward the site is in wheat that is nearly ready to harvest. The tall wheat effectively obscures the actual landforms. Consequently, visual determination of low points, watershed divides, and flow directions will not be possible until after the harvest is complete. Even after the harvest, the extremely flat terrain may continue to thwart efforts to economically define off-site drainage conditions.

The natural slope of the land appears to be from northwest to southeast. Because the slopes are extremely flat, the watershed should have significant storage during virtually all runoff events.

Due to the poor watershed definition, a single watershed was assumed to flow to the north perimeter of the site for analysis purposes. The 358 acre watershed is shown on Figure 2. This is considered conservatively large, in light of drainage planning completed previously for James Place, a subdivision just west of the site. Drainage planning for that development assumes a watershed that includes all of the northwest quarter of Section 13. The off-site watershed for The Legacy shown on Figure 2 includes nearly 1/3 of the northwest quarter of section 13.

## Site Drainage Conditions

### Current Runoff Characteristics

Site runoff is currently uncontrolled. Several shallow swales cross the site from northwest to southeast. As noted previously, the watersheds contributing to each of these swales are poorly defined. The four watersheds shown on Figure 4 were established to analyze pre-development conditions.

### Drainage Analysis

The analysis was completed using the Corps of Engineers' HEC-1 computer program, standard SCS Type II 24-hour rainfall distribution, standard SCS Dimensionless Unit Hydrograph, and losses are calculated using the SCS Curve Number method. The Times of Concentration ( $T_c$ ) and Lag Times ( $T_{lag}$ ) were calculated assuming shallow concentrated flow velocities of 2.5 feet per second, and Kinematic Wave overland flow for up to 500 ft at a slope of 0.1 percent, with a minimum  $T_c$  of 15 minutes.

The complete model includes the off-site watershed to James Place, the off-site watershed to the north perimeter of the site, and the four on-site watersheds. This combination was prepared to calculate whether the increased runoff from the site should be detained, or should be discharged quickly to avoid increasing peak flow rates. Results of the analyses are presented below.

TABLE 1: Calculated Peak Flow Rates (in Cubic Feet Per Second) from HEC-1 Analysis.

Location	2-year		10-year		50-year		100-year	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
James Pl. Disch. + On-Site #1	109	105	192	185	280	269	308	296
South Perimeter Discharge	241	239	531	520	848	828	972	948
Culverts @ 47 <sup>th</sup> St. South	346	340	707	688	1105	1071	1257	1218
On-Site #4	7	11	16	24	25	37	29	42

The table indicates that the runoff from developed areas will leave the system before the off-site peak flows arrive, causing lower peak flow rates in areas affected by off-site watersheds. On-site watershed #4 is the only watershed that is not affected in this manner. Watershed #4 discharges currently exit from the extreme southeast corner of the parcel, flow to Meridian Avenue's west ditch, and join with flows from On-site Watershed #3 just before passing under Meridian through an 18 inch CMP approximately 750 ft north of 47<sup>th</sup> St.

Watershed #3 has a small channel that flows very near the house at 4631 S. Meridian, then to the 18" CMP under Meridian approximately 750 ft north of 47<sup>th</sup> St. South.

On the Derby, Kansas USGS Quadrangle, the "channel" shown downstream of Meridian stops just north of 47<sup>th</sup> St., indicating an undefined or poorly defined flow path downstream of Meridian.

### ***Proposed Drainage Plan***

The proposed drainage plan is shown on Figure 5. In the plan, an interceptor channel will be constructed along the north perimeter to receive current and future flow from the north. The discharge from the off-site area to the north will combine with flow from On-Site watersheds #2 and #3 in Reserve C. On-Site watershed #3 will be larger than under pre-development conditions to limit the amount of water entering the west Meridian Avenue ditch from the parcel.

Since the distribution of off-site runoff to OS2 and OS3 is unknown, the combined flow from Reserve C will be split to protect the house at 4631 S. Meridian. The pre-development 100-year peak runoff from On-Site watershed #3 is 47cfs. The outlet from Reserve C to Reserve D will be sized to limit discharges to this value. Preliminary analysis indicates that a single 5x3 RCB culvert will provide the desired results.

Most of the flow passing through the site will be released through Reserve E. Preliminary analysis indicates that 3-12x4 RCB culverts will be required to pass the calculated 100-year flow of 900 cfs. (The calculated flow = 948 cfs; subtract approx. 50 cfs discharged to Reserve D through the 5x3 culvert).

The area of watershed OS4 will be reduced to limit the 100-year peak flow rate to the pre-development value of 29 cfs. Drainage from the excess portion of watershed OS4 will be directed to Reserve C and combined with off-site flows from the interceptor channel. Excess flows will pass with the majority of the off-site runoff to the 2-36 inch culverts under 47<sup>th</sup> St. South. The preliminary drainage plan allows a total of 6 acres to drain to the west Meridian Avenue ditch along the site's east perimeter. The Rational Formula peak flow rate is 26 cfs.

Preliminary on-site watersheds, drainage paths, inlets, pipes, and culverts are shown on Figure 5. Rational Formula flow calculations follow.

### **Storage**

The HEC-1 model prepared for this project indicates that no detention is required to maintain pre-development peak flow rates. This is apparently due to two factors: the relative sizes of the on-site and the off-site watersheds, and the slow response time of the off-site watershed.

**DRAINAGE ANALYSIS SUMMARY  
THE LEGACY**

Area/ID**	Area ac	Accum. Area ac	C2	C100	Elev Max	Elev Min	Flow Length	Tc2 Calc	Avg V2	Tc100 Calc	I2 in/hr	I2 in/hr	Tc100 min	Tc2 min	Q2 cfs	Q100 cfs	INLET			COMMENTS
																	Inlet Size ft	Q1 cfs	Ob cfs	
A*	3.09		0.58	0.73	102.00	98.00	770.00	32.31	0.40	22.99	0.56	6.26	23	32	4.61	14.12	5	4.75	0	Custer Circle (VG)
B*	1.99		0.58	0.73	102.00	98.00	650.00	28.05	0.39	19.96	0.54	6.68	20	28	3.21	9.70				Back Yard Flows
A+B	5.1		0.58	0.73	102.00	98.00	770.00	32.31	0.40	22.99	0.56	6.26	23	32	7.57	23.21				
C*	3.61		0.58	0.73	102.00	98.00	1000.00	40.17	0.41	28.58	0.58	5.59	29	40	5.08	15.96	5			Mt. Carmel (VG)
A+B+C	9.0		0.58	0.76	102.00	98.00	1000.00	40.17	0.41	28.27	0.63	5.79	26	40	11.68	39.56				
D	4.45		0.58	0.73	102.00	94.00	1350.00	40.94	0.55	29.13	0.77	5.49	29	41	5.76	17.63				Reserve A Contribution
A+B+C+D	13.4		0.58	0.76	102.00	98.00	1000.00	40.17	0.41	28.27	0.63	5.79	26	40	17.46	59.14				To Pipe from Reserve A to Reserve F
E	3.25		0.58	0.73	102.00	98.00	800.00	33.35	0.40	23.73	0.56	6.13	24	33	4.75	14.54	5			Mt. Carmel & Custer Circles S. of 44th St. (Sump) (VGx2) *Include pipes to south for preliminary construction cost estimate
F	3.98		0.58	0.73	102.00	99.00	750.00	34.79	0.36	24.75	0.50	6.01	25	35	5.72	17.46				Reserve F Contribution
E+F	7.2		0.58	0.73	102.00	98.00	770.00	32.31	0.40	22.99	0.56	6.26	23	32	10.78	33.04				
A THROUGH F	20.7		0.58	0.75	102.00	98.00	770.00	32.31	0.40	21.78	0.59	6.39	22	32	30.81	99.00				From aerial photo, discharge S. to exist channel. Easement??
G	2.79		0.44	0.61	102.00	99.00	650.00	39.19	0.28	29.10	0.37	5.49	29	39	2.80	9.34	5	2.80	0	N. Side Inlet 43rd St. at Reserve E (VG) Sump
H	7.98		0.44	0.61	102.00	96.00	1500.00	62.44	0.40	46.36	0.54	4.33	46	62	5.79	21.08				Reserve B Contribution. Offsite Q100 = 842 cfs
G+H	10.8		0.44	0.61	102.00	98.00	770.00	41.01	0.31	30.44	0.42	5.40	30	41	10.47	35.48				Onsite Contribution To Pipe from Reserve E to Reserve C
I	1.96		0.44	0.61	102.00	99.00	600.00	36.66	0.27	27.22	0.37	5.69	27	37	2.06	6.80	5	6.80	0	S. Side Inlet 43rd St. at Reserve C (sump) 100-yr Design
J	1.13		0.44	0.61	102.00	96.00	300.00	16.33	0.31	12.13	0.41	7.37	15	16	1.85	5.08	5	5.08	0	Richmond Court (sump) 100-yr Design
K	4.67		0.47	0.67	102.00	98.00	1250.00	58.61	0.36	40.01	0.52	4.66	40	59	3.82	14.58	15	14.58	0	St. Paul Circle (VGx2) 100-yr Design
L	3.01		0.44	0.61	102.00	99.00	700.00	41.69	0.28	30.95	0.38	5.40	31	42	2.93	9.91	10	9.91	0	Richmond Circle (VG) 100-yr Design
M1	1.89		0.47	0.67	102.00	98.00	700.00	36.15	0.32	24.68	0.47	6.01	25	36	2.12	7.61				Back Yard Flow
M2	3.04		0.47	0.67	102.00	98.00	700.00	36.15	0.32	24.68	0.47	6.01	25	36	3.41	12.24				Chase Circle North (VG)
M1+M2	4.9		0.47	0.67	102.00	98.00	770.00	39.14	0.33	26.72	0.48	5.79	27	39	5.28	19.12				To Pipe from Reserve B to Reserve C
N	2.13		0.47	0.76	102.00	98.00	1000.00	48.67	0.34	26.27	0.63	5.79	26	49	6.64	31.07				Back Yard Flow
M1+M2+N	7.1		0.47	0.76	102.00	98.00	1000.00	48.67	0.34	26.27	0.63	5.79	26	49	6.64	31.07				St. Paul to N. Side Inlet 44th St. at SW side Reserve C (VG)
O	2.46		0.47	0.67	102.00	99.00	550.00	32.55	0.28	22.22	0.41	6.26	22	33	2.97	10.32				Total Inlet at N. Side 44th St., SW Side Reserve C
M1+M2+N+O	9.5		0.47	0.76	102.00	98.00	1000.00	48.67	0.34	26.27	0.63	5.79	26	49	8.95	41.89	10	8.95		Sump Area - Discharge 100-year Over S. Side to Reserve E
P	1.17		0.44	0.61	102.00	99.00	400.00	26.15	0.25	19.42	0.34	6.68	19	26	1.49	4.77	5	4.77		N Side Inlet 44th St. at SE side Reserve C

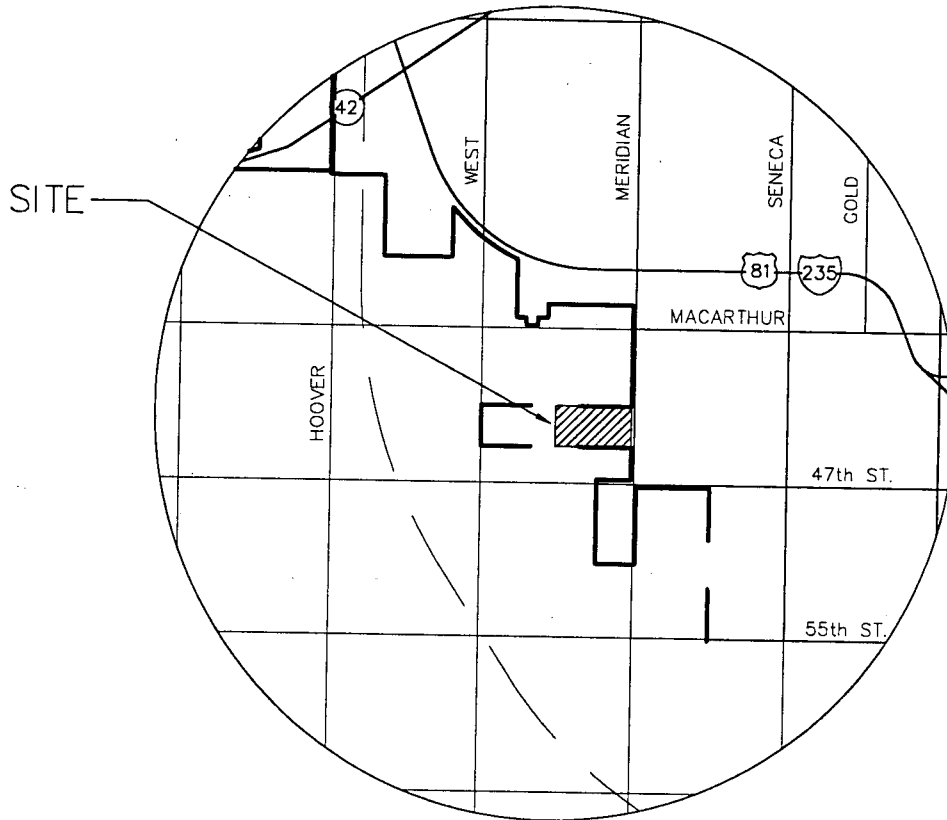
**DRAINAGE ANALYSIS SUMMARY  
THE LEGACY**

Area ID**	Area ac	Accum. Area ac	C2	C100	Elev Max	Elev Min	Flow Length	Tc2 Calc	Avg V2	Tc100 Calc	Avg V100	Tc2 min	Tc100 min	I2 in/hr	I100 in/hr	INLET			COMMENTS
																Inlet Size ft	Q1 cfs	Qb cfs	
Q	10.25		0.44	0.61	102.00	97.00	700.00	35.16	0.33	26.10	0.45	35	26	2.44	5.79	11.00	36.20	11.00	Reserve C Contribution
R	1.53		0.47	0.67	102.00	98.00	600.00	31.80	0.31	21.70	0.46	32	22	2.62	6.39	1.88	6.55	1.88	Chase Circle Back Yard Flows
U	1.43		0.47	0.67	102.00	100.00	250.00	19.31	0.22	13.18	0.32	19	15	3.42	7.37	2.30	7.06	2.30	Chase Circle South (VG)
R+U		3.0	0.47	0.67	102.00	98.00	770.00	39.14	0.33	26.72	0.48	39	27	2.28	5.79	3.17	11.48	3.17	To Pipe from Reserve B to Reserve C
S	2.46		0.47	0.67	102.00	98.00	820.00	41.25	0.33	28.15	0.49	41	28	2.21	5.59	2.56	9.21	2.56	
R+U+S		5.4	0.47	0.76	102.00	98.00	1000.00	48.67	0.34	26.27	0.63	49	26	2.00	5.79	5.09	23.85	5.09	S. Side Inlet 44th St at Reserve E (VG) Sump Area - Discharge 100-year over inlet top to Reserve E Back Yard Flows
T	1.65		0.47	0.67	102.00	98.00	550.00	29.57	0.31	20.18	0.45	30	20	2.72	6.53	2.11	7.22	2.11	
V	1.40		0.44	0.61	102.00	98.00	400.00	23.76	0.28	17.64	0.38	24	18	3.10	7.00	1.91	5.98	1.91	S. Side Inlet 44th St. at Reserve D
W	2.67		0.44	0.61	102.00	99.00	400.00	26.15	0.25	19.42	0.34	26	19	2.90	6.68	3.41	10.88	3.41	Reserve D Contribution
V+W		4.1	0.44	0.61	102.00	98.00	770.00	41.01	0.31	30.44	0.42	41	30	2.21	5.40	3.96	13.41	3.96	
X	0.89		0.44	0.61	102.00	99.00	300.00	20.58	0.24	15.28	0.33	21	15	3.33	7.37	1.30	4.00	1.30	Extreme NE Corner Back Yards to Meridian
Y	1.82		0.44	0.61	102.00	98.00	500.00	28.62	0.29	21.24	0.39	29	21	2.78	6.39	2.23	7.09	2.23	Richmond & 43rd St. to Meridian (VG) Est. Street Culvert = 6x4 RCB
Z	1.02		0.44	0.61	102.00	100.00	150.00	13.22	0.19	9.81	0.25	15	15	3.83	7.37	1.72	4.59	1.72	Richmond Back Yards to Meridian
AA	1.00		0.44	0.61	102.00	98.00	350.00	21.26	0.27	15.78	0.37	21	16	3.25	7.37	1.43	4.50	1.43	Richmond & 44th to Meridian Est. Street Culvert = 6x4 RCB
BB	1.23		0.44	0.61	102.00	97.00	400.00	22.06	0.30	16.38	0.41	22	16	3.17	7.18	1.72	5.39	1.72	Extreme SE Corner Back Yards to Meridian
X through BB		6.0	0.44	0.61	102.00	97.00	400.00	22.06	0.30	16.38	0.41	22	16	3.17	7.18	8.31	26.10	8.31	Total from Site to Meridian Ditch

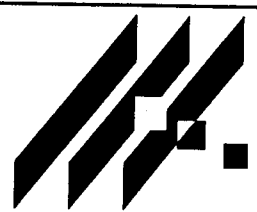
80.3

From Sedgwick Co. Soil Survey, soils on site or just north draining to the site are HSG D.  
Calculated Using City of Wichita Procedure  
Amount of offsite watersheds north of site visually checked. See assumptions in report text.

Watersheds A through G are single family 1/4 Acre areas  
Watershed I and J are Light Commercial areas  
Watershed H is Urban Lawn Area



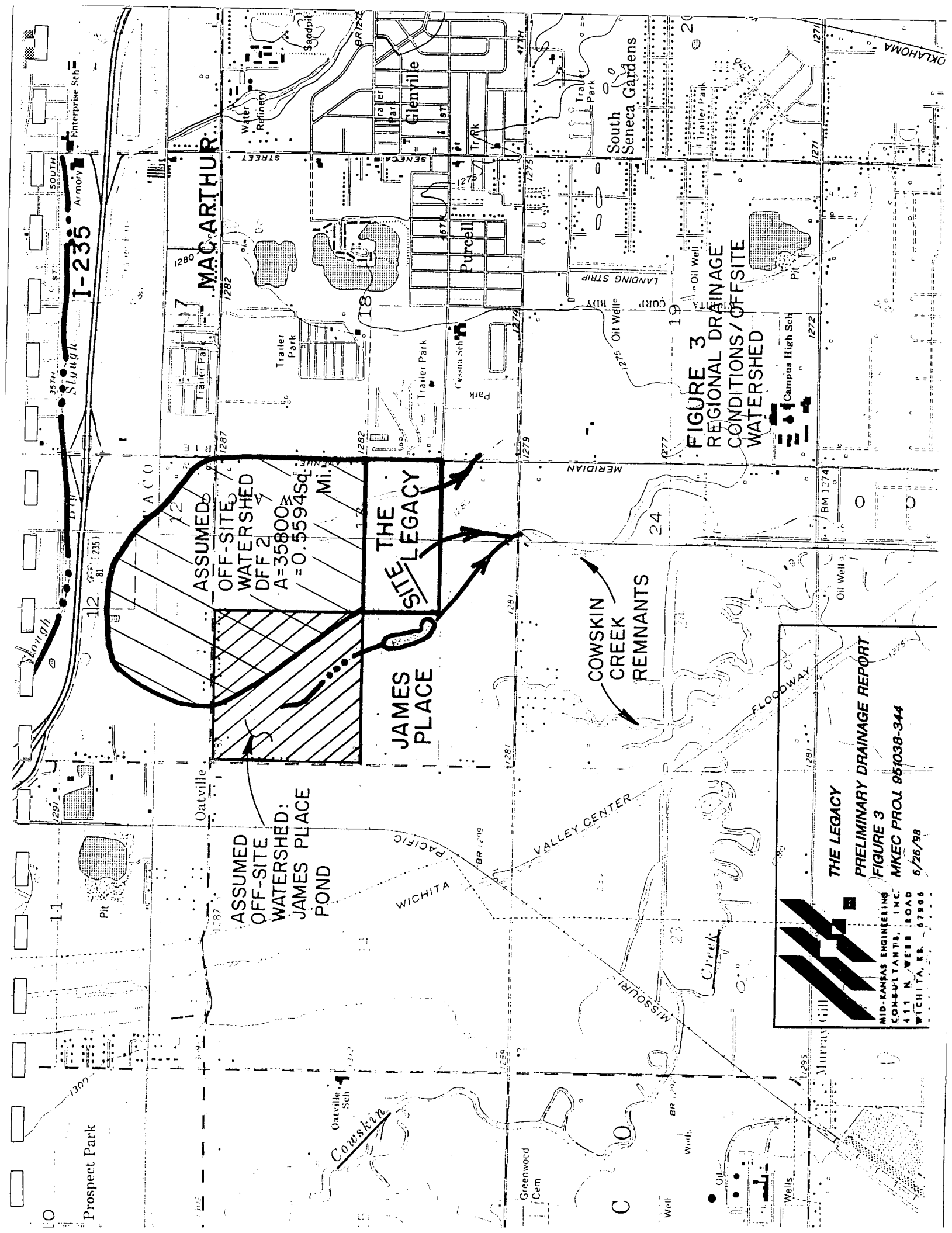
**LOCATION MAP**



**THE LEGACY  
PRELIMINARY DRAINAGE REPORT  
FIGURE 1**

**MID-KANSAS ENGINEERING  
CONSULTANTS, INC.  
411 N. WEBB ROAD  
WICHITA, KS. 67206  
316-684-9600**

**MKEC PROJ. 951038-344  
6/26/98**



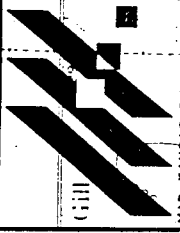
**FIGURE 3  
REGIONAL DRAINAGE  
CONDITIONS / OFFSITE  
WATERSHED**

**ASSUMED  
OFF-SITE  
WATERSHED  
DFF 2  
A = 358000  
= 0.5594 Sq. Mi.**

**THE  
LEGACY  
SITE  
JAMES  
PLACE**

**COWSKIN  
CREEK  
REMNANTS**

**ASSUMED  
OFF-SITE  
WATERSHED:  
JAMES PLACE  
POND**

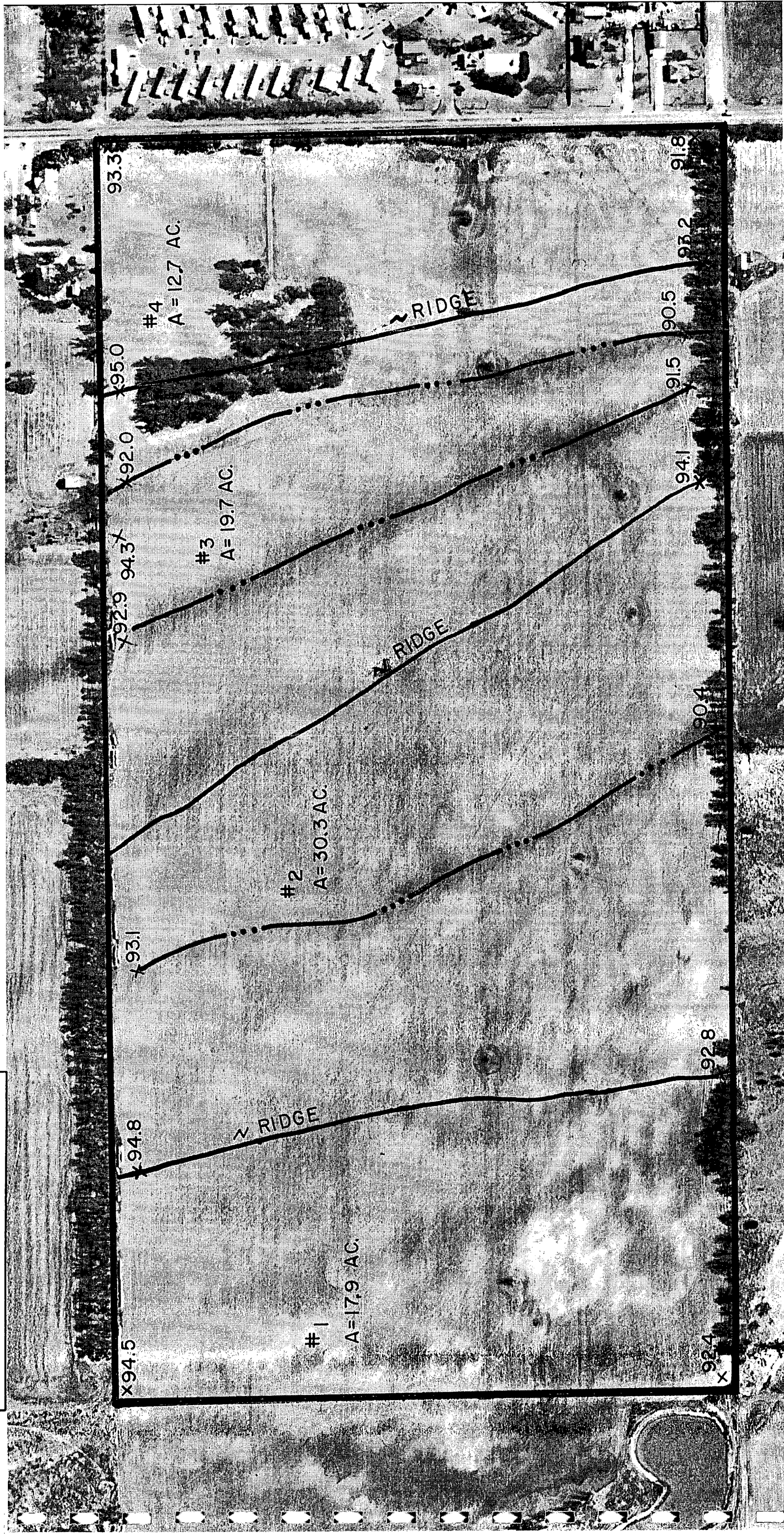
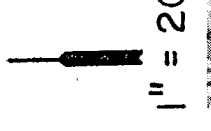
**THE LEGACY**  
  
**PRELIMINARY DRAINAGE REPORT**  
**FIGURE 3**  
**MKEC PROJ 861038-344**  
**6/26/98**

**MID-KANSAS ENGINEERING  
CONSULTANTS, INC.**  
**411 N. WEBB ROAD**  
**WICHITA, KS. 67206**

**THE LEGACY**  
**PRELIMINARY DRAINAGE REPORT**  
**FIGURE 4**  
**MID-KANSAS ENGINEERING**  
**CONSULTANTS, INC.**  
 1101 EAST 40TH  
 WICHITA, KS 67209  
 316-624-9500

**MKEC PROJ 951038-344**  
**6/26/98**

FIGURE 4: SITE WATERSHEDS: PRE-DEVELOPMENT CONDITIONS



EARLINE BRITTON  
LIVING TRUST  
SF20

ALAN D. &  
MARILYN McCLURE  
SF20

RESERVE A.  
JAMES PLACE  
ADDITION  
SF20

WILLIAM N.  
HOWARD ETAL  
SF20

LARRY E. & MARCIA  
ZIMMERMAN  
SF20

GAIL R. & GEORGE D. DOFFING  
SF20

ROBERT H. &  
VIRGINIA WICKHAM  
SF20

PATRICIA J. MILLS  
SF20

MICHAEL & PAULINA ARCHIBEQUE  
SF20

JOHN DOWNER  
ETUX  
SF20

JAMES LARRY  
ETHERIDGE  
SF20

SE Cor. N1/2, SE1/4,  
Sec.13, T28S, R1W

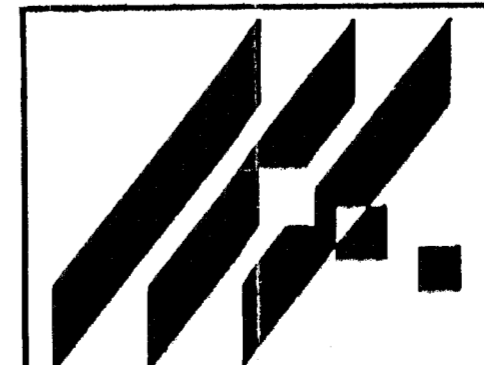
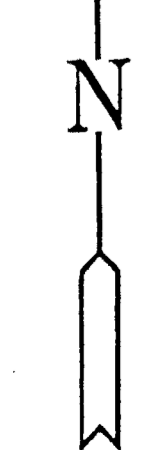
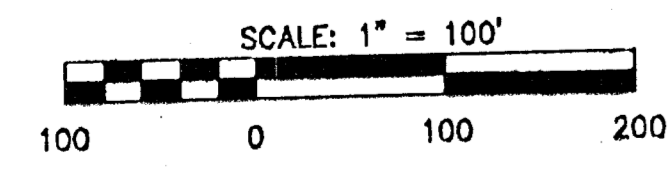
ARC SPEI, LLC  
ORINDGREFF 2ND  
ADDITION  
SF6

GARY L.  
CHARTER ETUX  
SF20

FRANCIS D.  
LOHKAMP ETUX  
SF20

FRANCIS D.  
LOHKAMP ETUX  
SF20

NORMA  
HUTSELL  
SF20



**THE LEGACY**  
PROJECT NAME  
**PRELIMINARY DRAINAGE REPORT**  
**FIGURE 5**  
SHEET TITLE  
**MKEC PROJ. 951038-344**

MID-KANSAS ENGINEERING  
CONSULTANTS, INC.  
411 N. WEBB ROAD  
WICHITA, KS. 67206  
316-684-9600

GJA/TM DESIGN BY:	DM DRAWN BY:	GJA CHECKED BY:
JUNE 1998 REVISION 001 DATE	95138DNG JOB NO.	1 / 1 SHEET / OF

65: \CVL\951038.DWG (DRNG) 95138DNG.DWG