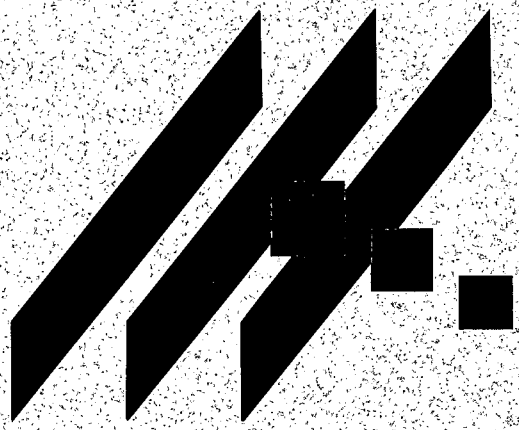
MKEC ENGINEERING CONSULTANTS, INC.



PRELIMINARY DRAINAGE REPORT

FOR

GREENWICH BUSINESS CENTER
Wichita, Sedgwick County, Kansas

August 2005

411 N. WEBB ROAD • WICHITA, KS 67206 • 316-684-9600 • FAX 316-684-5100

Preliminary Drainage Report
Greenwich Business Center
Wichita, Sedgwick County, Kansas

Location

The subject property will be annexed by the city of Wichita, Sedgwick County, Kansas. The proposed development is located on the southeast corner of 29th Street North and Greenwich Road, and generally comprises the north half of the northwest quarter and the west half of the northeast quarter of Section 3, Township 27 South, Range 2 East. The plat has an area of 187 acres. The site is shown on the Andover, Kansas Quadrangle, located in Appendix A.

Soils

According to the NRCS (SCS) Sedgwick County Soil Survey (Appendix B) soils on the site are;

A. Rosehill silty clay, 1-3% slopes, (Rd – HSG "D"),
B. Goessel silty clay, 1-2% slopes (Gb – HSG "D"),
C. Irwin silty clay loam 1-3% slopes, (Ia – HSG "D"),
D. Irwin silty clay loam 2-6% slopes, (Ic – HSG "D").

The HSG used to select runoff coefficients is "D".

Pre-Project Conditions

Pre-Project Land Use
The site is currently pastureland.

Pre-Project Landform and Slope
The project site is at a ridge top, straddling the divide between the Fourmile Creek and West Fork Fourmile Creek watersheds. Slopes across the site range from 0.1% to 3.0%.

Pre-Project Drainage Conditions
The entire site is in Zone C – areas outside of the 500-year flood plain. The nearest 100-year flood plain (Zone A) is just southwest of the site. (FIRM Panel 150, Sedgwick County, Kansas, June 3, 1986 (Appendix C). Two additional Zone A floodplain areas are shown slightly more than ¼ mile east of the site.

Pre-Project Runoff Characteristics

The site contributes flow to the watersheds shown on the Detention Plan in Appendix G. The West and East watersheds drain into unnamed tributaries to West Fork Fourmile Creek. These tributaries flow under K-96 through a 2-6'x3' RCB culvert and a 2-48" RCP culvert respectively. The Northeast watershed drains east into an unobstructed and unnamed tributary to Fourmile Creek.

The Corps of Engineers' HEC-HMS software (version 2.2.2) was used to calculate hydrographs/peak flow rates from the watersheds. Peak flow rates for the three watersheds under pre-project conditions are shown in Table 1 below. A summary of the results for existing, interim, and developed conditions is in Appendix E.

Calculation methods include the following:

- Time of concentration (T_c) values were calculated using the FAA method and are shown in a spreadsheet, Appendix D.
- SCS Type II 24-hour rainfall distribution.
- SCS Curve Number method for calculating loss rates.
- SCS Dimensionless Unit Hydrograph for hydrograph transformation.

Table 1. Pre-Project runoff.

	2-Year	5-Year	10-Year	50-Year	100-Year
West	279	454	569	847	978
East	150	234	291	448	508
Northeast	101	152	188	280	323

Post-Project Conditions

Post-Project Development

The site will develop as industrial and commercial lots.

Post-Project Landform and Slope

Final slopes have not yet been determined, but are expected to range from 0.5% to 3.0%. Storm sewers (still to be designed) will carry runoff from the site to proposed detention ponds.

Post-Project Runoff Characteristics

The site has been divided into three sub-watersheds for the purpose of sizing detention facilities. The Drainage and Utility Plan, Appendix D, shows the sub-watershed boundaries and a preliminary storm sewer layout. The detailed storm sewer layout will be provided in the final drainage report to be submitted with the final plat.

Appendix G shows the proposed detention plan. There are three separate locations where runoff will leave the property. Two of the three discharge locations flow to culverts under K-96. The design flow values shown on KDOT construction documents for these culverts are much lower than calculated peak flow rates shown in Table 1 above for the West and East watershed. The proposed solution for the East Watershed is to work with the adjacent landowner to develop a combination of detention and conveyance to protect the existing development at The Fairmont and maintain current conditions at the K-96 culvert. The proposed solution for the West Watershed includes asking the City to require all property owners in the watershed to ensure that post-development discharges will accommodate the existing culvert capacity restrictions. The normal requirement to avoid increasing peak flow rates above pre-development conditions applies to the Northeast watershed.

Details of the watershed plans follow.

Northeast Watershed

The calculated 100-year peak discharge (existing conditions) from the site at the northeast corner is approximately 323 cfs. This includes unattenuated flow from a small watershed north of 29th St. Detention planned for Reserve B in the plat's northeast corner will reduce the 100-year peak discharge to approximately 314 cfs. This presumes that at the time of development the property north of 29th St. will construct detention facilities to reduce the 100-year peak discharge across 29th St. to under 140 cfs. Peak discharges calculated for pre- and post- development conditions are show in the following table.

Table 2: Northeast Watershed Summary of Calculated Peak Flow Rates

Conditions	2-Year	5-Year	10-Year	50-Year	100-Year
Existing					
Onsite	63.761	95.565	118.61	175.95	203.21
Offsite	50.396	75.01	92.819	136.87	157.76
Combined	101.08	151.78	188.48	279.58	322.9
Developed					
Onsite	120.51	163.59	193.65	266.18	300.08
Offsite	57.66	79.12	93.59	125.45	138.72
Combined	177.89	242.22	286.76	390.87	437.92
Det. Disch.	116.39	165.98	200.28	279.89	314.52

East Watershed

The East Watershed drains through adjacent property to a culvert under K-96 comprising two 48" RCPs. According to KDOT construction documents, the design flow for the

culvert is 156 cfs. The calculated peak flow rate to the culvert is 508 cfs as shown in Table 1 above.

The hydrologic model representing existing conditions includes the detention already constructed at The Fairmont subdivision, as well as the unplanned detention at K-96. Detailed survey of existing ground adjacent to K-96 was used to develop detention characteristics adjacent to K-96.

The existing conditions model indicates that significant detention is provided upstream from the KDOT culvert on a roughly triangular parcel in the SW ¼ of Section 3 north of K-96. The model indicates that the water temporarily stored behind the K-96 embankment during a 100-year event is approximately 5.5 ft deep, and the actual peak discharge is approximately 215 cfs (presuming inlet control conditions at the culvert), rather than the design flow of 156 cfs.

The proposed conditions model calculates the developed peak flow rate from the K-96 culvert to be 230 cfs using the existing unplanned detention. Minor grading in the detention area will reduce the peak flow rate to less than the current value of 215 cfs.

Table 3: East Watershed Summary of Calculated Peak Flow Rates

Conditions	2-Year	5-Year	10-Year	50-Year	100-Year
Existing					
Fairmont	9.0	14.1	34.5	80.6	108.3
GBC	101.2	150.8	186.6	275.1	317.2
South Prop.	81.6	121.7	150.7	222.5	256.6
Det Disch.	95.9	127.2	147.9	196.4	214.8
Developed					
Fairmont	9.0	14.1	34.5	80.6	108.3
GBC	208.43	272.09	316.37	423.25	473.32
South Prop.	88.72	115.65	134.38	179.6	200.79
Det Disch.	134.84	161.28	177.88	216.45	230.17

How Going Down?

West Watershed

The West watershed includes several off-site parcels as shown on the Figure in Appendix G. The existing land form provides no effective detention at the K-96 embankment. The proposed solution requires detention facilities at Watersheds A1, A2, B, D, and E. Target discharges and preliminary maximum water surface elevations are shown in Appendix G. Detention at Watershed D is sized to accommodate the requirements for Watershed C. Existing and proposed discharges from each watershed are shown in Appendix E.

Table 4 provides a summary peak flow rates at locations where flow enters or leaves the site as well as calculated flow rates at K-96 under existing and developed conditions. As the existing land form provides no detention, much of the 100-year event at K-96 is expected to pass to the south through the K-96 bridge over Greenwich.

Table 4: West Watershed Summary of Calculated Peak Flow Rates

Conditions	2-Year	5-Year	10-Year	50-Year	100-Year
Existing					
A1 (at 29th)	31.98	47.82	59.264	87.644	101.17
A2 (at 29th)	29.712	44.55	55.31	82.069	94.79
Greenwich W	69.662	104.2	129.16	190.99	220.35
Greenwich E	108.58	163.28	202.88	301.5	348.49
Ex. Farm Pond	217.85	346.59	432.67	643.46	743.3
South Prop	83.194	124.74	154.87	229.79	265.42
K96 Res W In	299.66	454.29	579.51	861.43	995.14
K96 Res W Out	279.22	454.29	569.21	846.93	978.72
Developed					
A1 (at 29th)	6.5023	8.8932	10.423	13.754	15.14
A2 (at 29th)	7.2916	9.8425	11.561	15.015	16.28
Greenwich W	66.186	89.981	106.61	146.54	165.18
Greenwich E	105.53	143.56	170.14	234.16	263.93
GBC Res W	57.468	86.219	105.07	144.33	160.02
South Prop	160.14	217.39	257.4	353.92	399.05
K96 Res W In	192.05	271.4	327	457.61	517.03
K96 Res W Out	76.07	116.41	144.22	204.94	229.55

Development in the watershed will require several years to complete. Two interim conditions were modeled to project peak flow rates under conditions of partial development. A total of four conditions were analyzed

- Existing conditions shows current performance, including the current essentially ineffective detention at K-96 using contours based on recent survey.
- Interim 1 conditions shows calculated peak flow rates when only Greenwich Business Center is developed and on-site detention is provided just north of 27th Street.
- Interim 2 conditions shows calculated peak flow rates when the property south of 27th Street is developed, and significant additional detention is added just north of K-96 and east of Greenwich Road.
- Developed conditions shows calculated peak flow rates when all properties in the watershed are developed and the recommended off-site detention is provided.

Table 5 provides a summary of peak flow rates at K-96 under the four conditions analyzed. For practical purposes, calculated flows exceeding 240 cfs at the K-96 Reservoir West Outlet are expected to pass to the south through the K-96 bridge over Greenwich.

Table 5: West Watershed Summary of Calculated Interim Peak Flow Rates at K-96

Conditions	2-Year	5-Year	10-Year	50-Year	100-Year
Existing					
K96 Res W In	299.66	454.29	579.51	861.43	995.14
K96 Res W Out	279.22	454.29	569.21	846.93	978.72
Interim 1					
K96 Res W In	142.78	218.42	269.49	404.15	575.86
K96 Res W Out	142.53	214.86	264.67	401.42	570.48
Interim 2					
K96 Res W In	198.11	281.5	340.8	478.84	540.29
K96 Res W Out	85.648	130.15	159.58	235.06	283.22
Developed					
K96 Res W In	192.05	271.4	327	457.61	517.03
K96 Res W Out	76.07	116.41	144.22	204.94	229.55

Local Stormwater System

Details of the local stormwater system will be provided with the final drainage report. Preliminary locations for these facilities are shown on the map in Appendix F.

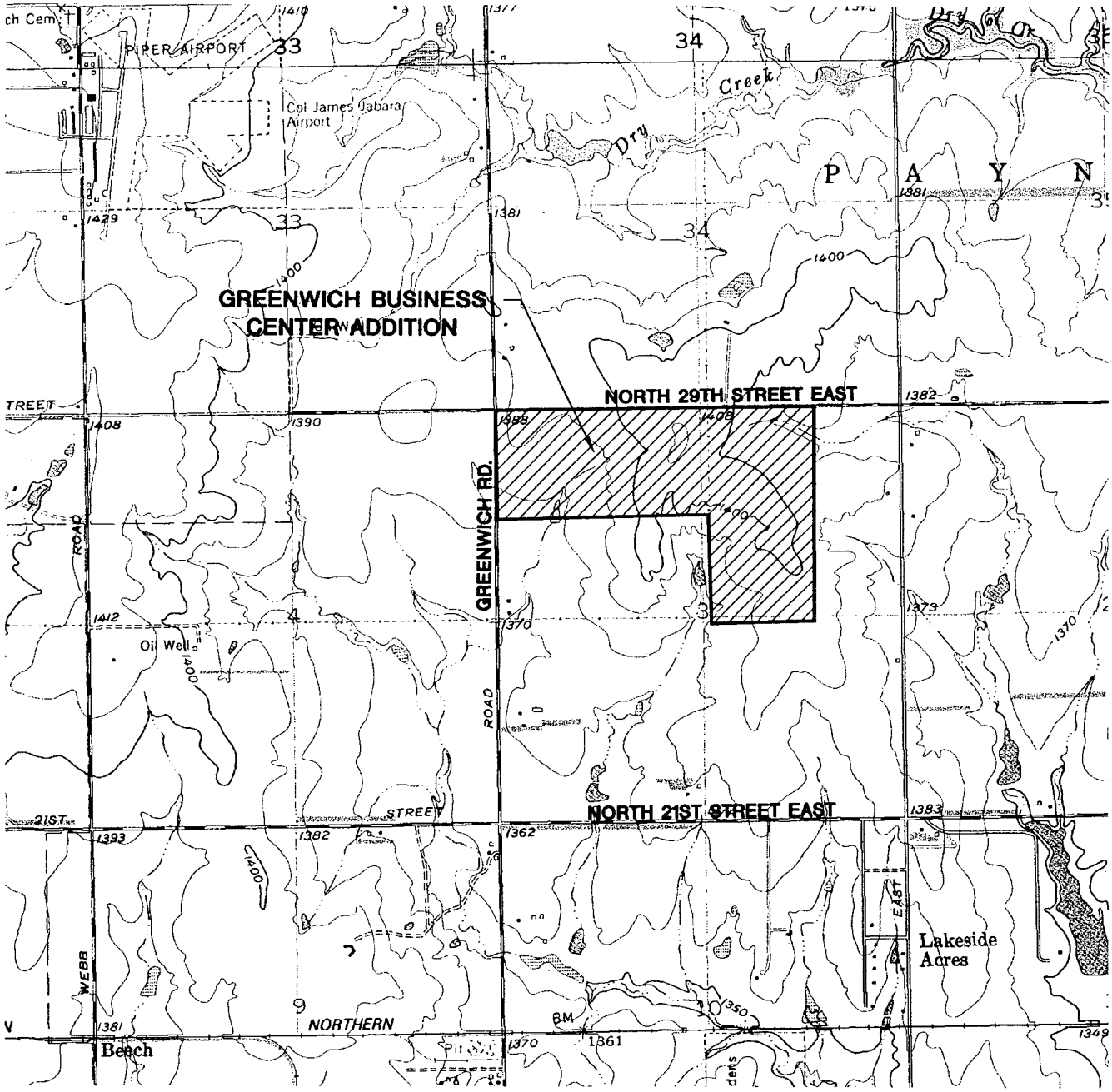
Summary

Greenwich Business Center comprises approximately 187 acres to be developed as general commercial and light industrial lots. The site is located at Greenwich Road and 29th Street North. The site receives flow from the north and west, and discharges flow south to K-96 right of way, and east near the north east boundary to undeveloped property.

The detention pond at the site's northeast corner will reduce the 100-year peak discharge from the Northeast watershed to a rate slightly lower than the rate experienced under pre-development conditions. The detention scheme proposed for the West and East watersheds will reduce peak discharges to the capacities of the existing structures under K-96. Full participation by the adjacent property owners will be required for the scheme to be effective.

Appendix A

Quadrangle Map



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1 .5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

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MKEC ENGINEERING CONSULTANTS
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

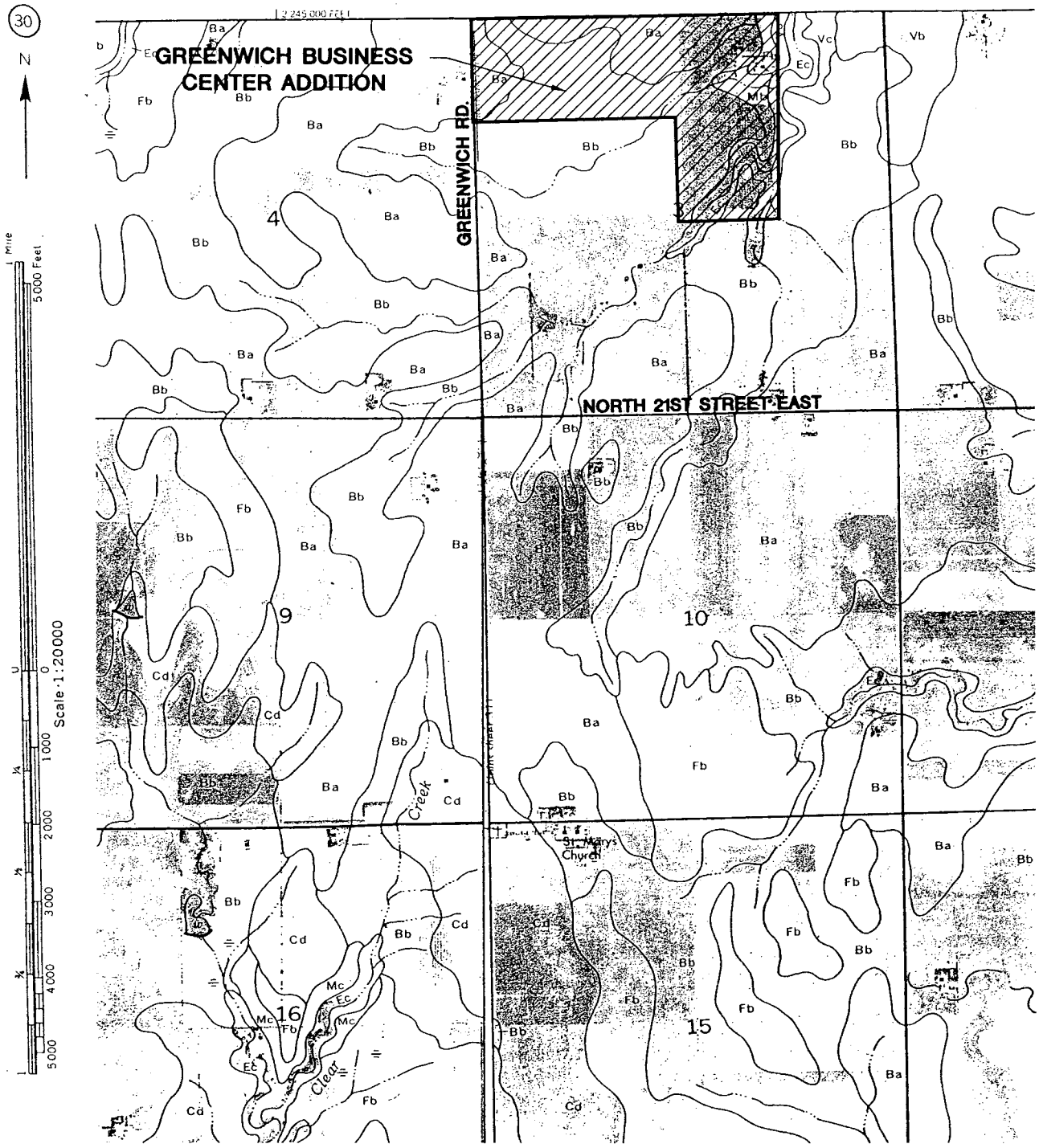
GREENWICH BUSINESS CENTER ADDITION
PROJECT NAME

ANDOVER QUADRANGLE, KANSAS
SHEET TITLE

AK	KWS	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
AUGUST 2005	04542	1 / 1
DATE	JOB NO.	SHEET/OF

Appendix B

Soil Survey Map



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MKEC ENGINEERING CONSULTANTS
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

GREENWICH BUSINESS CENTER ADDITION
PROJECT NAME

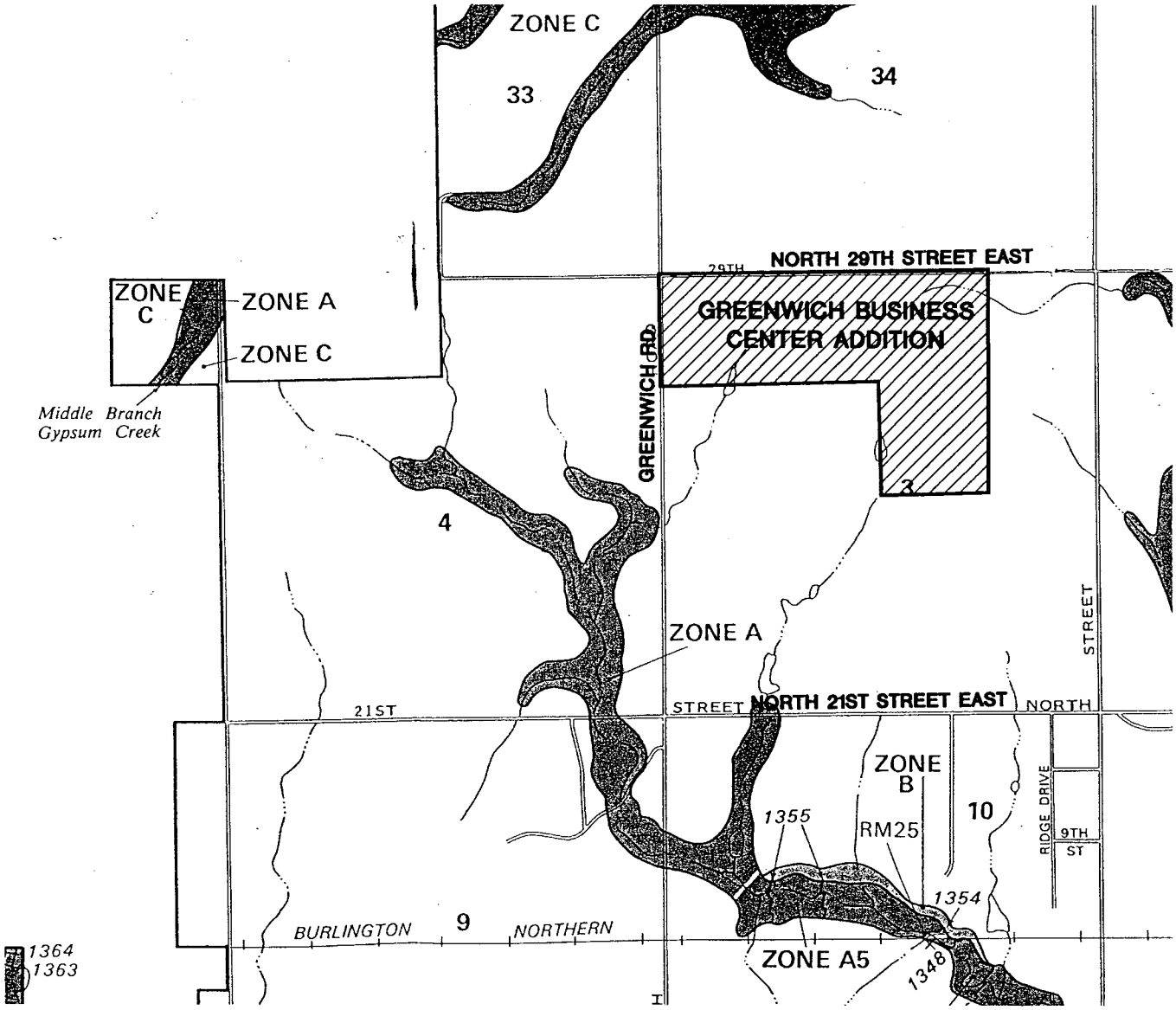
SOIL SURVEY
SEDGWICK COUNTY, KANSAS
SHEET TITLE

AK	KWS	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
AUGUST 2005	04542	1 / 1
DATE	JOB NO.	SHEET/OF

Appendix C

Flood Insurance Rate Map

Flood Boundary/Floodway Map



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

SEDGWICK COUNTY, KANSAS
(UNINCORPORATED AREAS)

PANEL 150 OF 300

COMMUNITY-PANEL NUMBER
200321 0150 A

EFFECTIVE DATE:
JUNE 3, 1986

Federal Emergency Management Agency

APPROXIMATE SCALE

2000 0 2000 FEET

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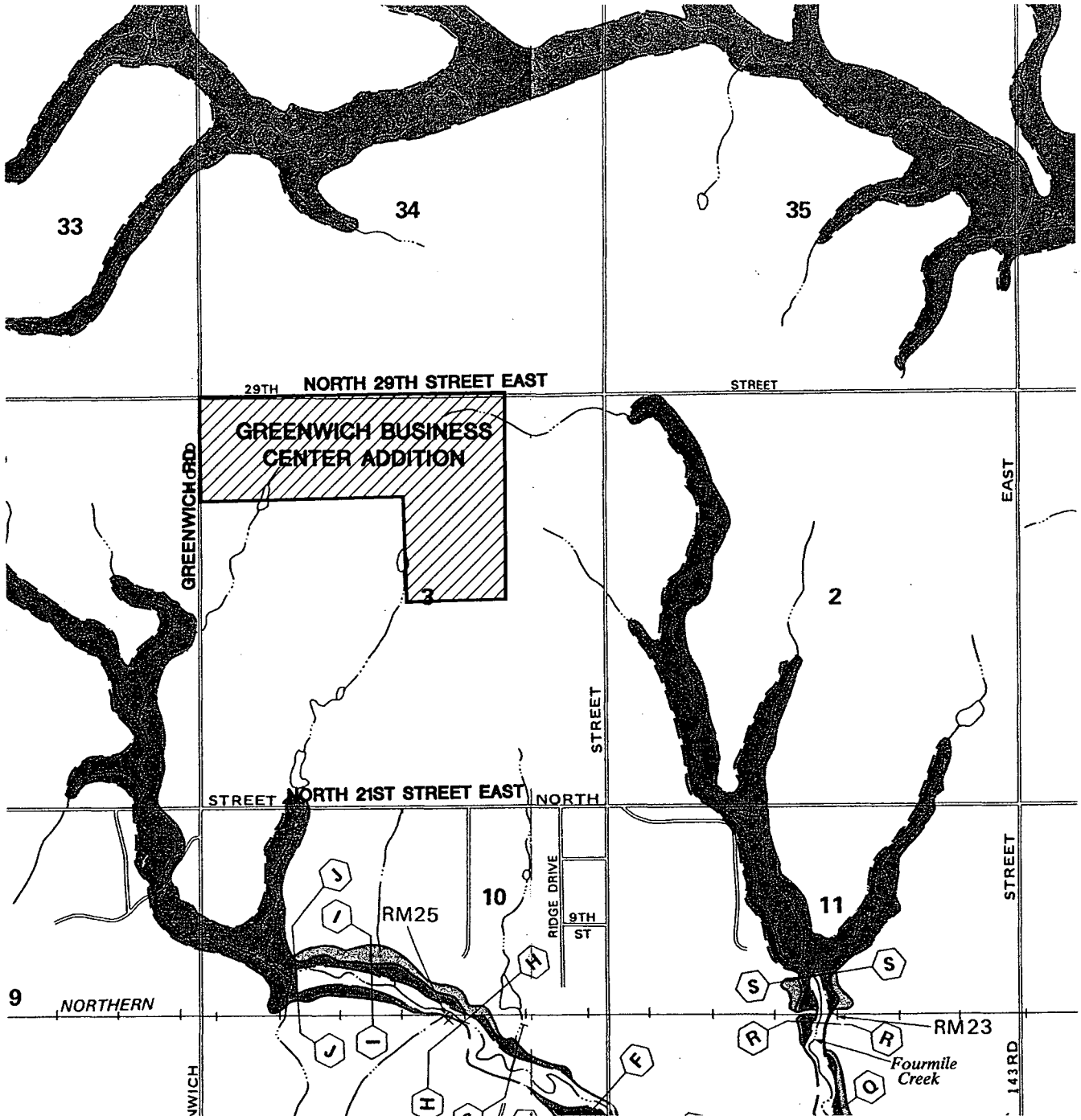
MKEC ENGINEERING CONSULTANTS
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

GREENWICH BUSINESS CENTER ADDITION
PROJECT NAME

FIRM PANEL 150 OF 300 SEDGWICK COUNTY, KANSAS
SHEET TITLE

AJK	KWS	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
AUGUST 2005	04542	1 / 1
DATE	JOB NO.	SHEET/OF



SEDGWICK CO 150 F6F

NATIONAL FLOOD INSURANCE PROGRAM

FLOODWAY
FLOOD BOUNDARY AND FLOODWAY MAP

SEDGWICK COUNTY, KANSAS
(UNINCORPORATED AREAS)

PANEL 150 OF 300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
200321 0150

EFFECTIVE DATE:
JUNE 3, 1986

Federal Emergency Management A

APPROXIMATE SCALE
2000 0 2000 FEET

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MKEC ENGINEERING CONSULTANTS
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

GREENWICH BUSINESS CENTER ADDITION
PROJECT NAME

FLOOD BOUNDARY AND FLOODWAY MAP
SHEET TITLE

AJK	KWS	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
AUGUST 2005	04542	1 / 1
DATE	JOB NO.	SHEET/OF

Appendix D

Time of Concentration Calculations

Appendix D

HEC-HMS Output Summary

Storm Average Recurrence Interval, years

Northeast

	2	5	10	50	100
Existing					
Onsite	63.761	95.565	118.61	175.95	203.21
Offsite	50.396	75.01	92.819	136.87	157.76
Combined	101.08	151.78	188.48	279.58	322.9
Developed					
Onsite	120.51	163.59	193.65	266.18	300.08
Offsite	57.66	79.12	93.59	125.45	138.72
Combined	177.89	242.22	286.76	390.87	437.92
Det. Disch.	116.39	165.98	200.28	279.89	314.52

Storm Average Recurrence Interval, years

East Design = 156 cfs

	2	5	10	50	100
Existing					
Fairmont	9.0	14.1	34.5	80.6	108.3
GBC	101.2	150.8	186.6	275.1	317.2
South Prop.	81.6	121.7	150.7	222.5	256.6
Det Disch.	95.9	127.2	147.9	196.4	214.8
Developed					
Fairmont	9.0	14.1	34.5	80.6	108.3
GBC	208.43	272.09	316.37	423.25	473.32
South Prop.	88.72	115.65	134.38	179.6	200.79
Det Disch.	134.84	161.28	177.88	216.45	230.17

	Storm Average Recurrence Interval, years				
	2	5	10	50	100
West	Design = 232 cfs				
Existing					
A1 (at 29th)	31.98	47.82	59.264	87.644	101.17
A2 (at 29th)	29.712	44.55	55.31	82.069	94.79
Greenwich W	69.662	104.2	129.16	190.99	220.35
Greenwich E	108.58	163.28	202.88	301.5	348.49
ExFarmPond	217.85	346.59	432.67	643.46	743.3
South Prop	83.194	124.74	154.87	229.79	265.42
K96 Res W In	299.66	454.29	579.51	861.43	995.14
K96 Res W Ou	279.22	454.29	569.21	846.93	978.72

Interim 1					
A1 (at 29th)	31.98	47.82	59.264	87.644	101.17
A2 (at 29th)	29.712	44.55	55.31	82.069	94.793
Greenwich W	87.972	123.24	148.21	209.13	237.8
Greenwich E	146.97	207.31	250.17	355.07	404.55
GBC Res W	72.727	109.32	132.88	238.93	352.45
South Prop	83.194	124.74	154.87	229.79	265.42
K96 Res W In	142.78	218.42	269.49	404.15	575.86
K96 Res W Ou	142.53	214.86	264.67	401.42	570.48

Interim 2					
A1 (at 29th)	31.98	47.82	59.264	87.644	101.17
A2 (at 29th)	29.712	44.55	55.31	82.069	94.793
Greenwich W	87.972	123.24	148.21	209.13	237.8
Greenwich E	146.97	207.31	250.17	355.07	404.55
GBC Res W	72.727	109.32	132.88	238.93	352.45
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Appendix F

Drainage and Utility Plan

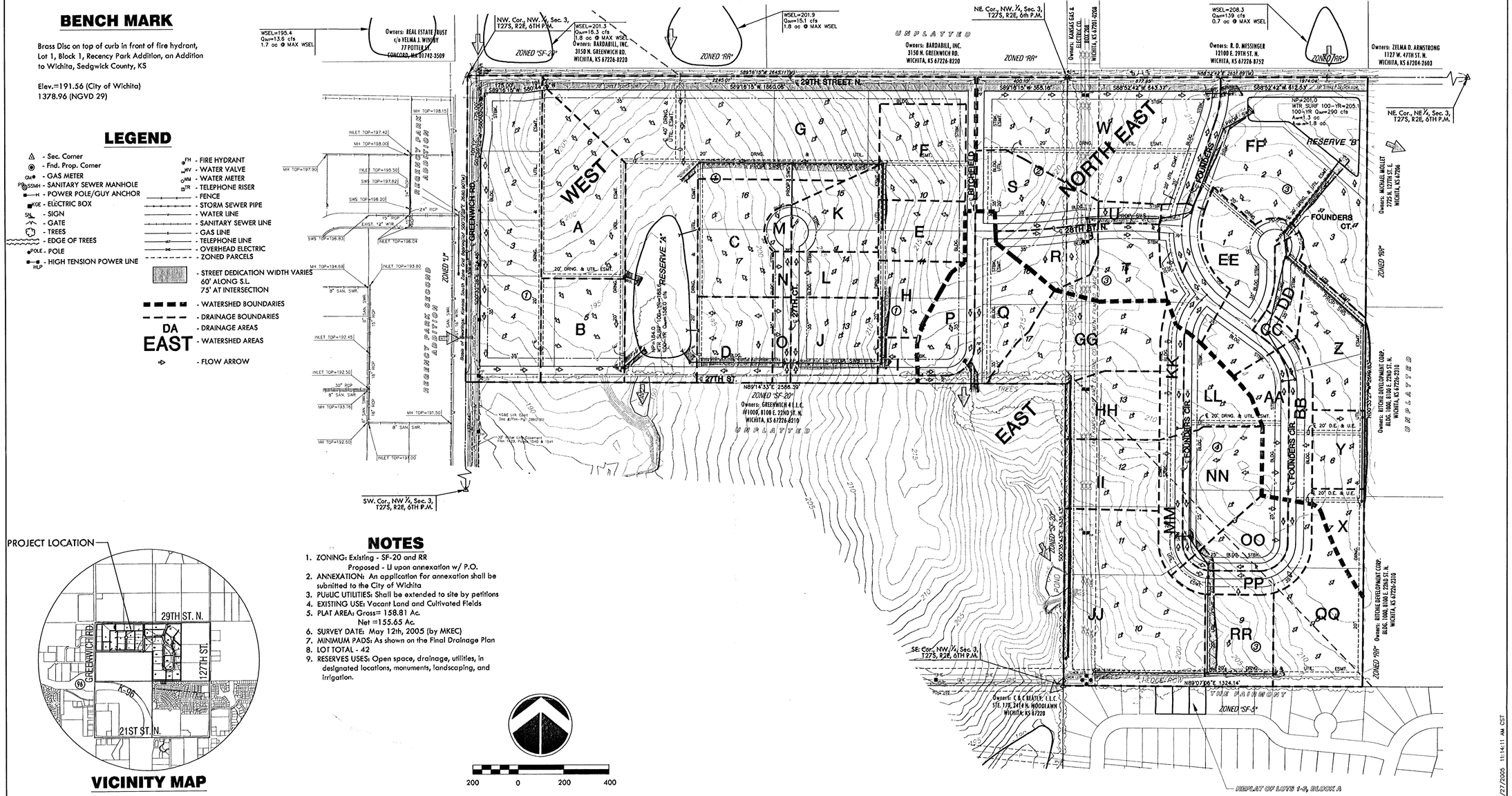
BENCH MARK

Brass Disc on top of curb in front of fire hydrant, Lot 1, Block 1, Recency Park Addition, an Addition to Wichita, Sedgwick County, KS

Elev.=191.56 (City of Wichita)
1378.96 (NGVD 29)

LEGEND

- Sec. Corner
- Fnd. Prop. Corner
- GM - GAS METER
- SSMH - SANITARY SEWER MANHOLE
- POLE - POWER POLE/GUY ANCHOR
- EGE - ELECTRIC BOX
- SIGN
- GATE
- TREES
- EDGE OF TREES
- POLE - POLE
- HELP - HIGH TENSION POWER LINE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- TR - TELEPHONE RISER
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS LINE
- TELEPHONE LINE
- OVERHEAD ELECTRIC
- ZONED PARCELS
- STREET DEDICATION WIDTH VARIES 60' ALONG S.L. 75' AT INTERSECTION
- WATERSHED BOUNDARIES
- DRAINAGE BOUNDARIES
- DA - DRAINAGE AREAS
- EAST - WATERSHED AREAS
- FLOW ARROW



VICINITY MAP

NOTES

1. ZONING: Existing - SF-20 and RR
   Proposed - LI upon annexation w/ P.O.
2. ANNEXATION: An application for annexation shall be submitted to the City of Wichita
3. PUBLIC UTILITIES: Shall be extended to site by petitions
4. EXISTING USE: Vacant Land and Cultivated Fields
5. PLAT AREA: Gross= 158.81 Ac.
   Net =155.65 Ac.
6. SURVEY DATE: May 12th, 2005 (by MKEC)
7. MINIMUM PADS: As shown on the Final Drainage Plan
8. LOT TOTAL - 42
9. RESERVES USES: Open space, drainage, utilities, in designated locations, monuments, landscaping, and irrigation.

200 0 200 400

PRELIMINARY DRAINAGE & UTILITY PLAN

GREENWICH BUSINESS CENTER ADDITION

OWNER / DEVELOPER: Ritchie Development Corporation 8100 E. 22nd North, #1000 Wichita, KS 67226-2310 (316) 684-7300

Date: JULY 26th, 2005

MKEC ENGINEERING CONSULTANTS
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9500

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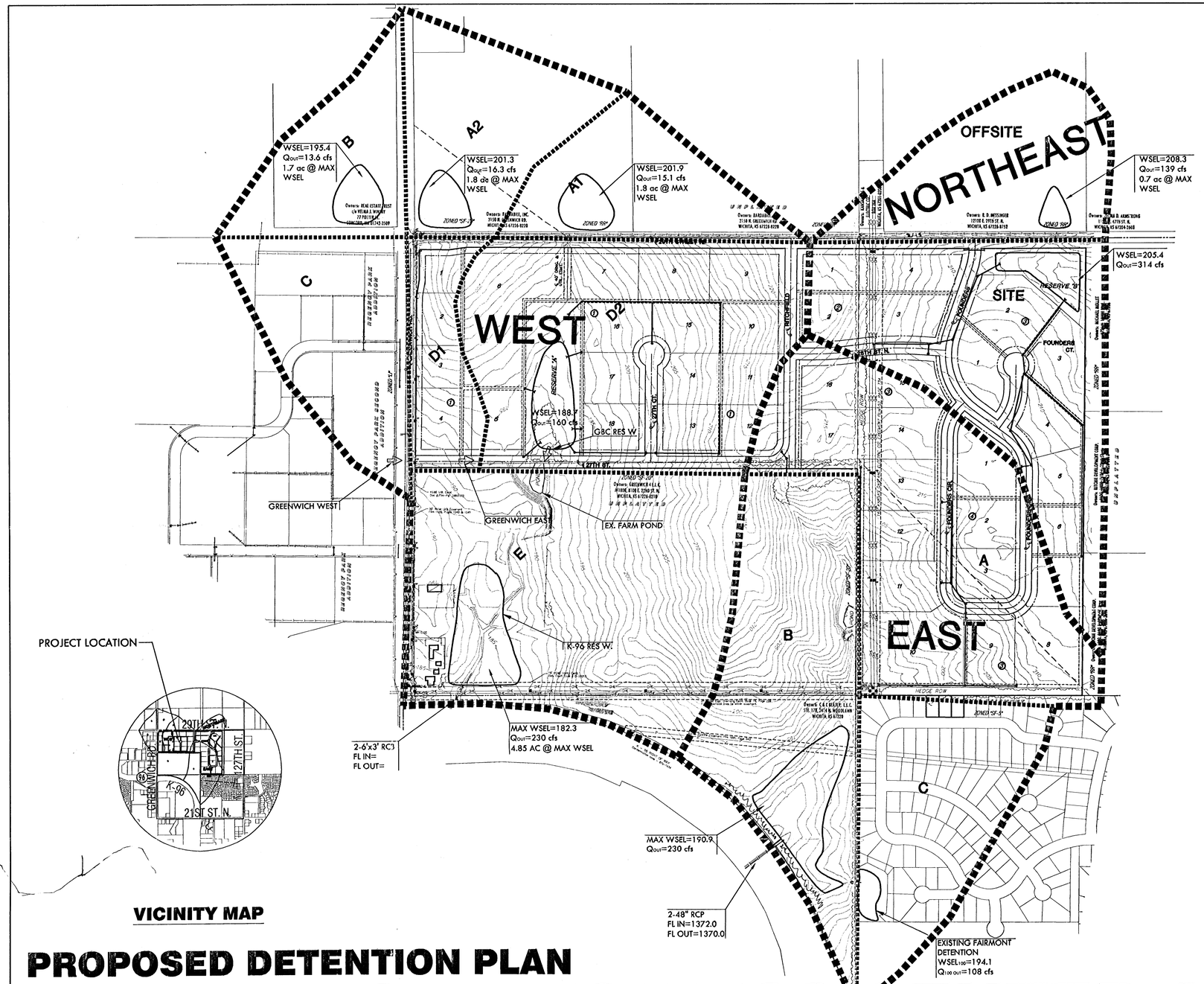

VICINITY MAP

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BENCH MARK

Brass Disc on top of curb in front of fire hydrant, Lot 1, Block 1, Recency Park Addition, an Addition to Wichita, Sedgwick County, KS

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1378.96 (NGVD 29)

LEGEND

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- Fnd. Prop. Corner
- GM - GAS METER
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- H - POWER POLE/GUY ANCHOR
- EGE - ELECTRIC BOX
- SN - SIGN
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- TREES
- EDGE OF TREES
- POLE - POLE
- HLP - HIGH TENSION POWER LINE
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- WM - WATER METER
- TR - TELEPHONE RISER
- FENCE
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- STREET DEDICATION WIDTH VARIES 60' ALONG S.L. 75' AT INTERSECTION
- WATERSHED BOUNDARIES
- DRAINAGE BOUNDARIES
- DA - DRAINAGE AREAS
- EAST - WATERSHED AREAS
- FLOW ARROW

SCALE: 1"=300'
300 0 300 600

PROPOSED DETENTION PLAN

GREENWICH BUSINESS CENTER ADDITION

OWNER / DEVELOPER: Ritchie Development Corporation 8100 E. 22nd North, #1000 Wichita, KS 67226-2310 (316) 684-7300

Date: JULY, 2005

MKEC ENGINEERING CONSULTANTS
411 N. WEBB ROAD
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