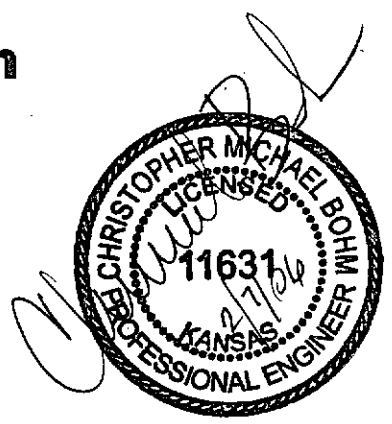


SCANNED

**Final Drainage Plan**

**Belle Chase Addition  
Wichita, Kansas**

**January 2006**



**Ruggles & Bohm P.A.**

**Engineering, Surveying, Land Planning**

**Drainage Report  
Belle Chase Addition  
Wichita, Sedgwick County, Kansas**

February 2, 2006

**Introduction:** Belle Chase Addition is located near the northwest corner of the intersection of 127<sup>th</sup> Street East and Harry Street. The plat consists of approximately 16.3 Acres. From the *Soil Survey of Sedgwick County, Kansas*, the predominant soils on site are Rd and Ce, Type D and C Hydrological Group soils respectively. For the sake of the drainage analysis, Type D Hydrological Group soils will be used for analysis. The site is used for pasture at this time.

Belle Chase is situated immediately south of Country Hollow Addition, Wichita, Sedgwick County, Kansas, with a tributary feeding Spring Creek draining from north to south across the site. A FEMA Zone B Flood Zone exists on the site, looping into Reserve E, South of the South Entrance. There is no other flood zone encroachment on the Addition.

**Drainage Plan References:**

*Drainage Report, The Country Hollow Addition, Wichita, Sedgwick County, Kansas, July 2005, prepared by MKEC Engineering Consultants, Inc. (MKEC Report)*

*Spring Branch Master Drainage Plan, City of Wichita, Kansas, December 2004, prepared by PEC, P.A. (PEC Report)*

**Detention Storage:** From the MKEC Report, the area immediately north of Belle Chase Addition located in The Country Hollow Addition consists of 10 acres noted as West Area. This 10 acre basin produces a 100 year flow of 60.5 cfs in the undeveloped condition, and 0 cfs in the developed condition.

Inspection of the detention storage provided by Country Hollow Addition yields a net reduction of the 100 year flow from the site from a pre-developed total of 519.3 cfs (from three drainage basins) to a post developed flow of 437.2 cfs (from two drainage basins). Each of the remaining Country Hollow basins discharge at a rate lower than the 100 year pre-developed peak, indicating that the site has been designed to decrease the 100 year post-developed discharge below pre-developed peaks.

The area that naturally drains to the outlet in Belle Chase Addition (not counting the 10 acres from Country Hollow Addition) is 35.2 Acres (See Map 1). The SCS Curve Number for the undeveloped condition is 80 (see MKEC). Adding the 10 acres from the Country Hollow Addition results in 45.2 acres that flow into the Belle Chase tributary.

In keeping with the methodology used on the Country Hollow Addition site, the FAA Time of Concentration method of estimating will be used. Results of each of the basins can be found on Exhibit A – Time of Concentration Calculations – Belle Chase Addition.

In the undeveloped condition, the 45.2 acres tributary has a Tc of 23 minutes.

This data modeled in HEC-HMS yields the following results:

**Undeveloped Condition Input Data:**

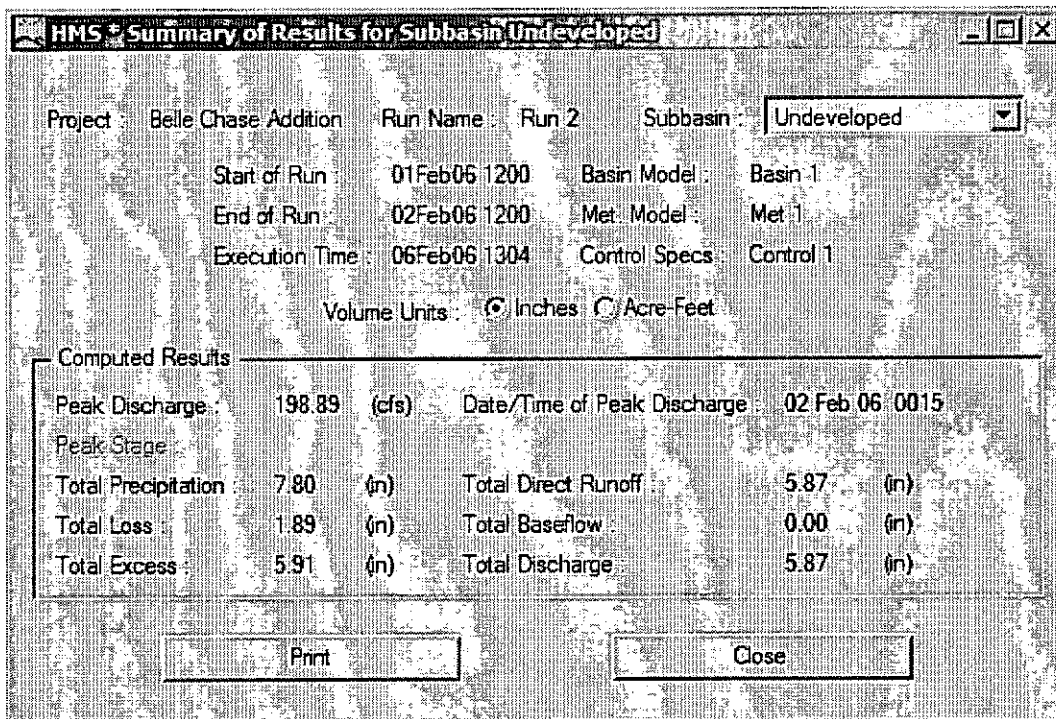
Basin Area = 45.2 acres = 0.07063 square miles

Tc = 23 minutes

CN = 80

Rainfall Event: 100 year – 24 hour precipitation of 7.8 inches, using SCS Type II Distribution.

Output results:



**Developed Basin:** (Includes adjacent area that will be platted in the future, and eliminates the 10 acres formerly draining through the tributary) = 33.3 Acres. To model the developed basin, a 30 percent impervious area will be added to the model. Also, a Tc of 16 minutes is calculated for the developed condition (See Appendix A).

**Results of Developed Basin:**

**HMS - Summary of Results for Subbasin Developed Basin**

Project: Belle Chase Addition    Run Name: Run 2    Subbasin: Developed Basin

Start of Run: 01Feb06 1200    Basin Model: Basin 1  
 End of Run: 02Feb06 1200    Met Model: Met 1  
 Execution Time: 06Feb06 1534    Control Specs: Control 1

Volume Units:  Inches     Acre-Feet

---

**Computed Results**

Peak Discharge: 192.95 (cfs)    Date/Time of Peak Discharge: 02 Feb 06 0008  
 Peak Stage: \_\_\_\_\_

Total Precipitation: 7.80 (in)    Total Direct Runoff: 6.45 (in)  
 Total Loss: 1.33 (in)    Total Baseflow: 0.00 (in)  
 Total Excess: 6.47 (in)    Total Discharge: 6.45 (in)

Print    Close

The difference in the peak pre and post developed condition are as follows:

Pre-Developed Peak flow (100 year rainfall event) = 199 cfs  
 Post-Developed Peak flow (100 year rainfall event) = 193 cfs  
 No detention required for this subdivision.

Localized Drainage Areas: (See Map for Descriptions)

Runoff from these basins is calculated using the Rational Method ( $Q = CiA$ ), with data from Attachment D, City of Wichita Drainage Criteria.

Basin	Area (sf)	Area (Ac)	Tc (Min)	C2	C100	I2 (In/Hr)	I100 (In/Hr)	Q2	Q100
A	57766	1.3	15	0.5	0.76	3.83	7.37	2.5	7.4
B	187210	4.3	15	0.5	0.76	3.83	7.37	8.2	24.1
C	429349	9.9	15	0.5	0.76	3.83	7.37	18.9	55.2
D	387171	8.9	15	0.5	0.76	3.83	7.37	17.0	49.8
E	69767	1.6	15	0.5	0.76	3.83	7.37	3.1	9.0
F	109387	2.5	15	0.5	0.76	3.83	7.37	4.8	14.1
G	194449	4.5	15	0.5	0.76	3.83	7.37	8.5	25.0

### **Storm Water Sewer Systems:**

The hydraulic capacity of each storm water sewer system is analyzed using Haestad Method's STORMCad program. Adjacent to known floodplains, the starting water surface elevation is the BFE (100 year storm).

To the extent possible, the natural drainage ways that exist on the property will be maintained. Storm water sewer systems will be placed only as necessary to cross streets, or provide an outlet for rear yard drainage.

#### **System 100: Northerly most SWS Crossing of Spring Valley Street**

**Inlet capacity:** The major street sump intercepts 24.1 cfs of flow. Two 5 foot type 1A Inlets in a sump condition can accommodate 26 cfs in capacity at R/W elevation, so use two 10' type 1A Inlets at this location. The beehive inlet to the north of the sump can be a single inlet, with overspill permitted to the street. The beehive is set at the same elevation as the top of curb to allow overspill.

#### **System 200: Southeasterly sump crossing Belle Chase**

**Inlet Capacity:** The approach flow at this sump location is 49.8 cfs, with need for inlet capacity to accept a large portion of this flow. Two 10 foot inlets in a sump condition can capture 52 cfs, and with the ability to overspill south, this is acceptable. The pipe system is designed to handle the 100 year storm.

#### **System 300: South system near south-central portion of the addition**

**Inlet Capacity:** The approach flow in the street is 14.1 cfs, use 2 – 5' Type 1A Inlets. This system is sized for 100 year pipe capacity.

For output data for each run, see the STORMCad generated profiles included with this report.

Area F – Side road drainage. This flow is not intercepted by the interior street system, but directed to the street R/W of 127th Street East. A culvert pipe under the new entrance at Spring Valley will need to be sized in conjunction with the street plans, and take into consideration the proximity of the existing Conoco-Phillips Pipeline.

Included with this report is a lot grading plan and the aforementioned exhibits.

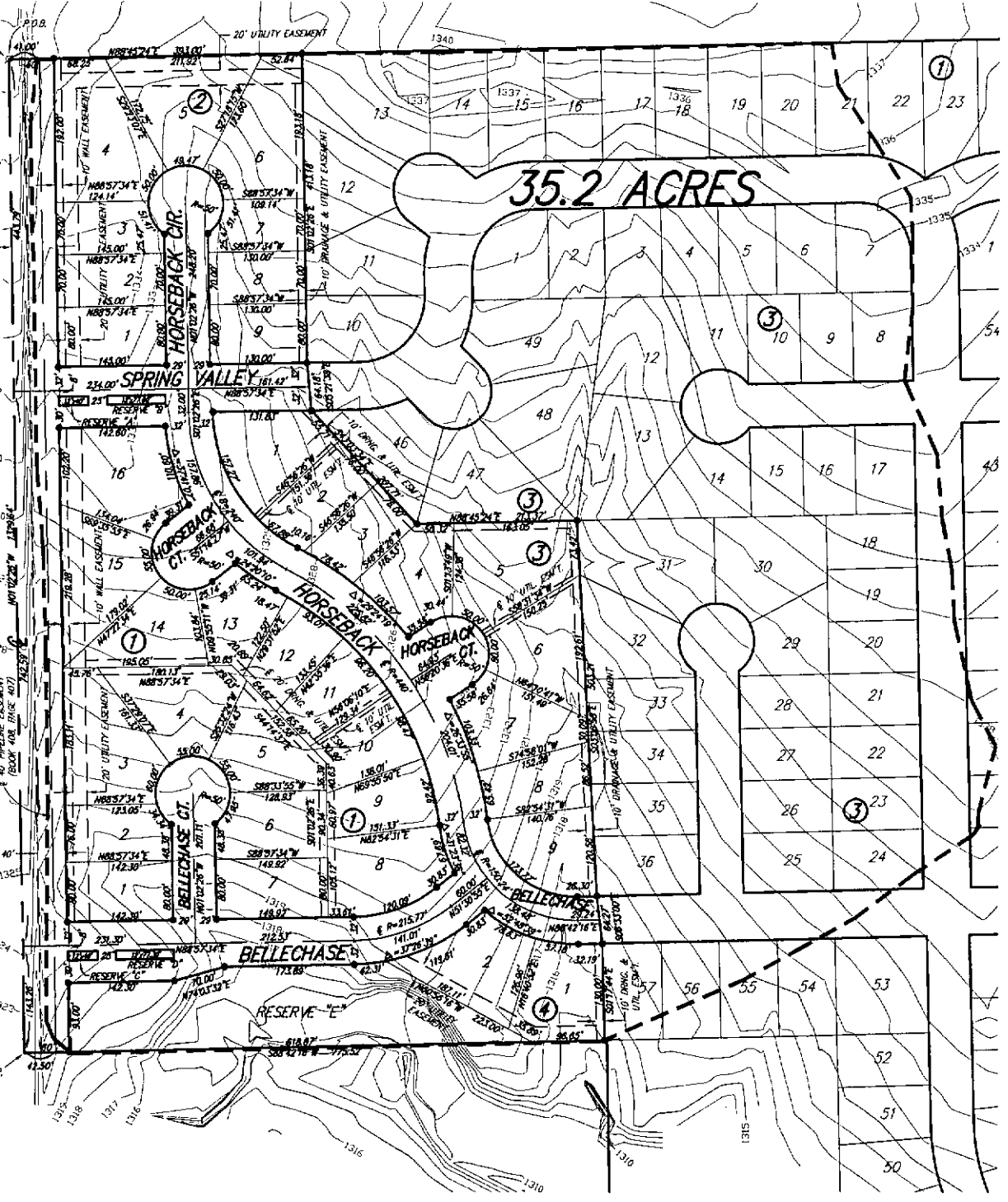
N.W. CORNER, SW 1/4, SEC. 26, T27S, R2E




1" = 200'

127TH STREET EAST

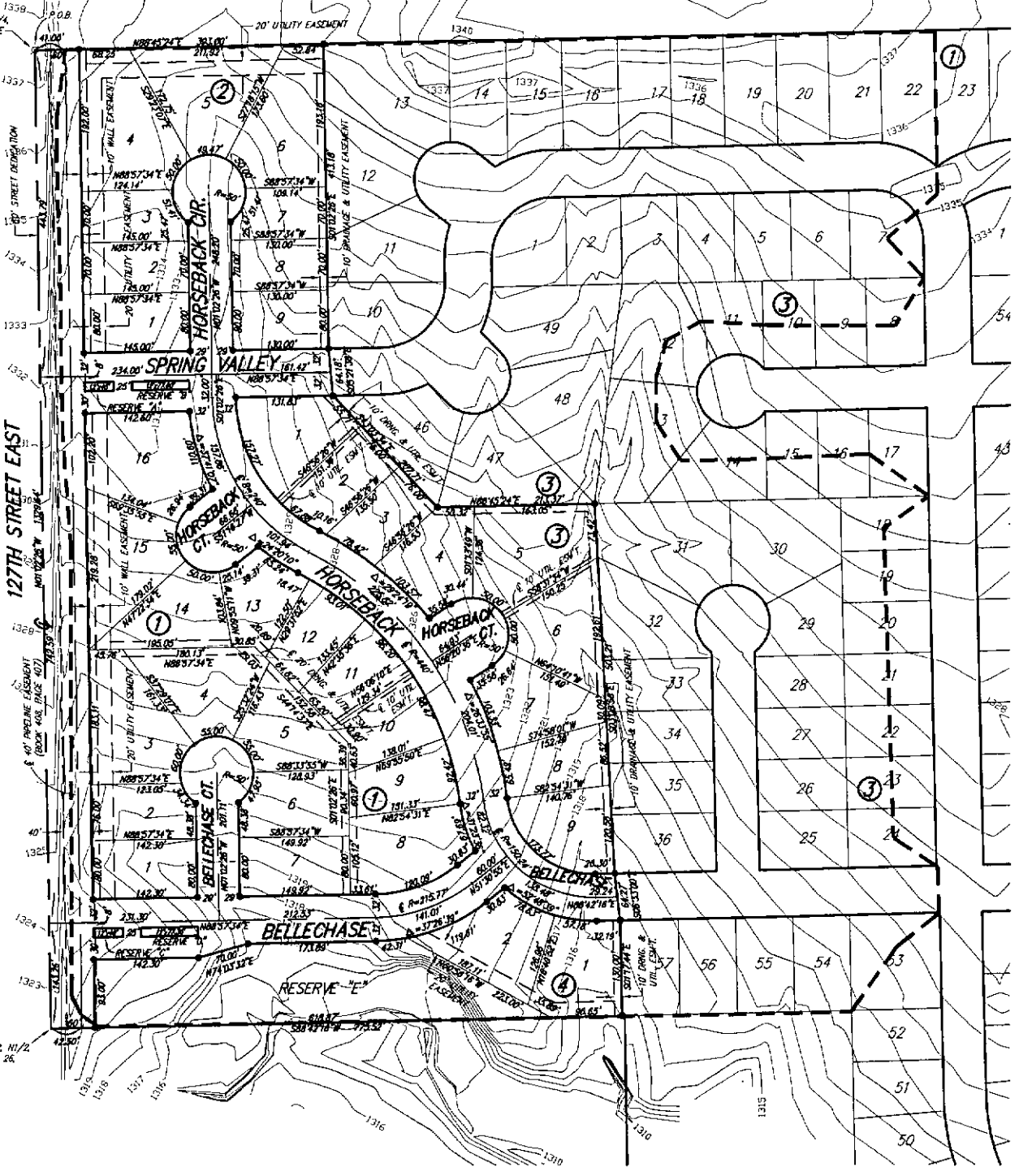
S.W. CORNER, NW 1/2, SW 1/4, SEC. 26, T27S, R2E




**MAP 1 - EXISTING TRIBUTARY DRAINAGE AREA  
BELLE CHASE ADDITION**

	<b>Ruggles &amp; Bohm, P.A.</b> Engineering, Surveying, Land Planning		DESIGN	SHEET OF
	924 North Main Wichita, Kansas 67203 www.rbkansas.com		(316) 264-6008 (316) 264-4621 fax E-mail: info@rbkansas.com	
DRAWING FILE	PROJECT NUMBER	DATE	DRAWN	
			REVIEW	
			UTILITY	

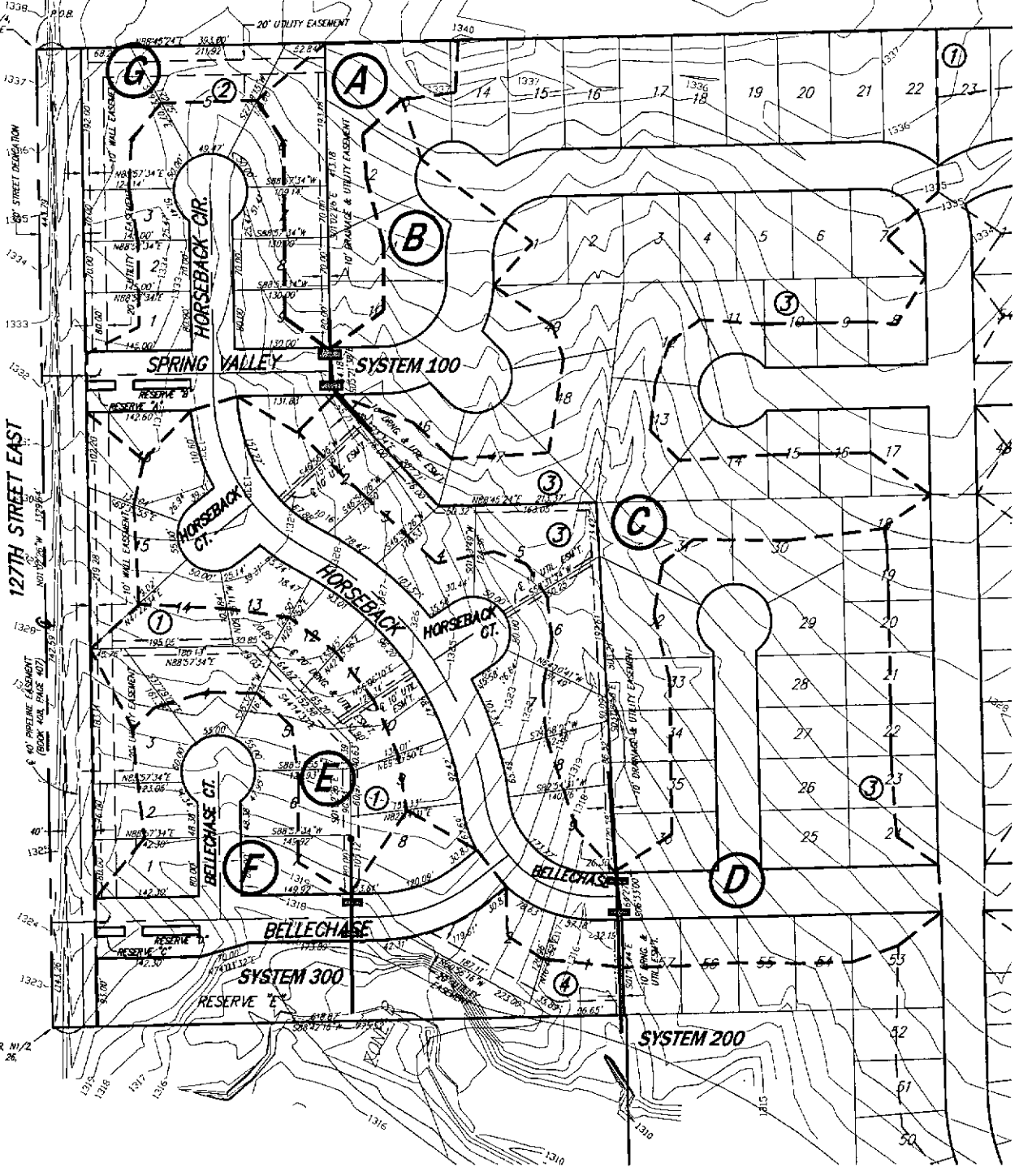
N.W. CORNER, SW 1/4, SEC. 26, T27S, R2E



**MAP 2 - FUTURE DEVELOPED DRAINAGE BASIN  
BELLE CHASE ADDITION**

	<b>Ruggles &amp; Bohm, P.A.</b> Engineering, Surveying, Land Planning		DESIGN	SHEET
	624 North Main Wichita, Kansas 67203 www.rbkansas.com		(316) 264-6008 (316) 264-4621 fax E-mail: info@rbkansas.com	
DRAWING FILE		PROJECT NUMBER		DATE

N.W. CORNER SW1/4, SEC. 26, T27S, R2E



S.W. CORNER N1/2 SW1/4, SEC. 26, T27S, R2E

**MAP 3 - ON-SITE DEVELOPED BASINS  
BELLE CHASE ADDITION**



**Ruggles & Bohm, P.A.**  
Engineering, Surveying, Land Planning  
924 North Main (316) 264-8008  
Wichita, Kansas 67203 (316) 264-4621 fax  
www.rbkansas.com E-mail: info@rbkansas.com

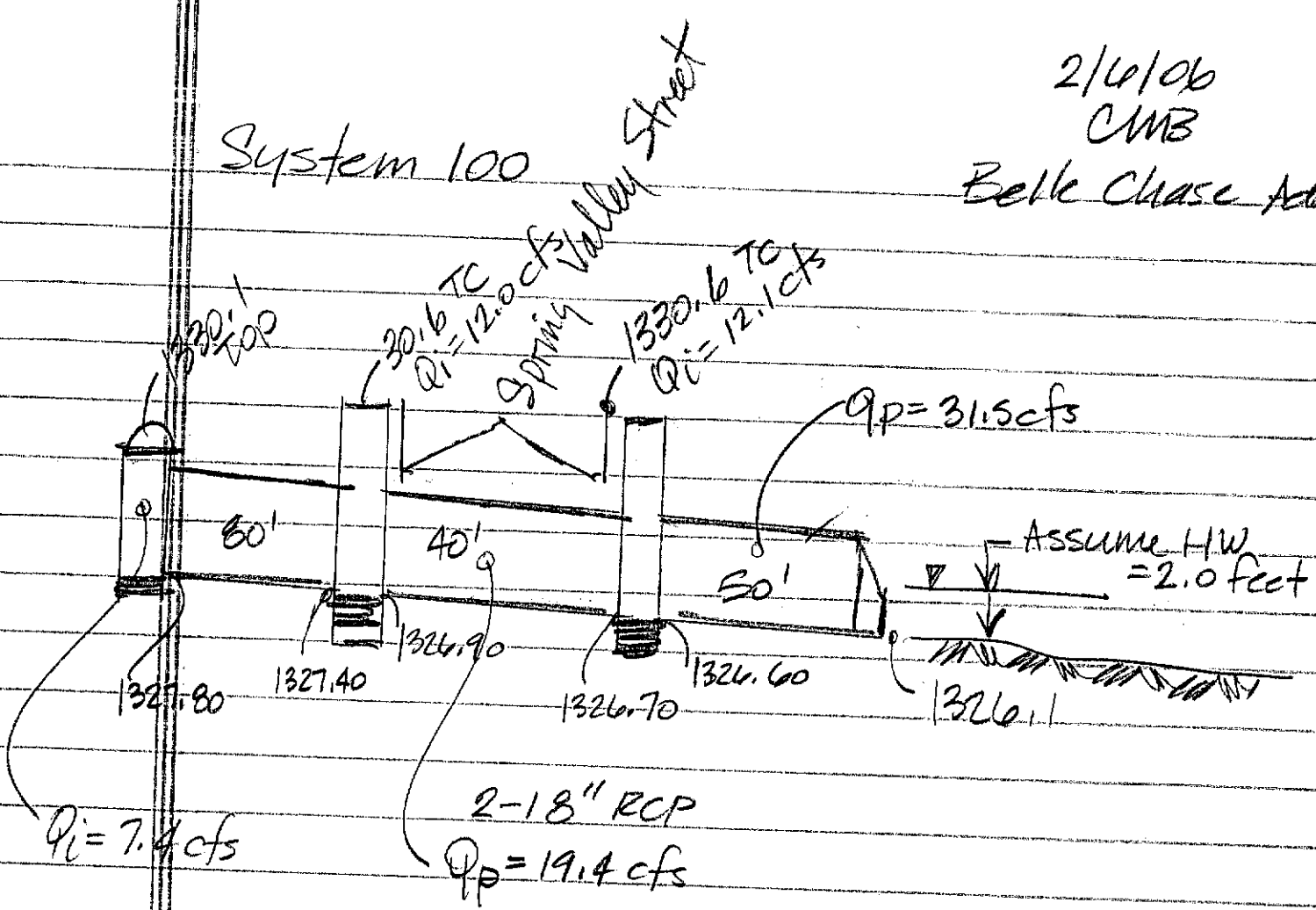
DRAWING FILE	PROJECT NUMBER	DATE	DESIGN	DRAWN	REVIEW	UTILITY

REVISION	SHEET
	OF

System 100

2/6/06  
CMB

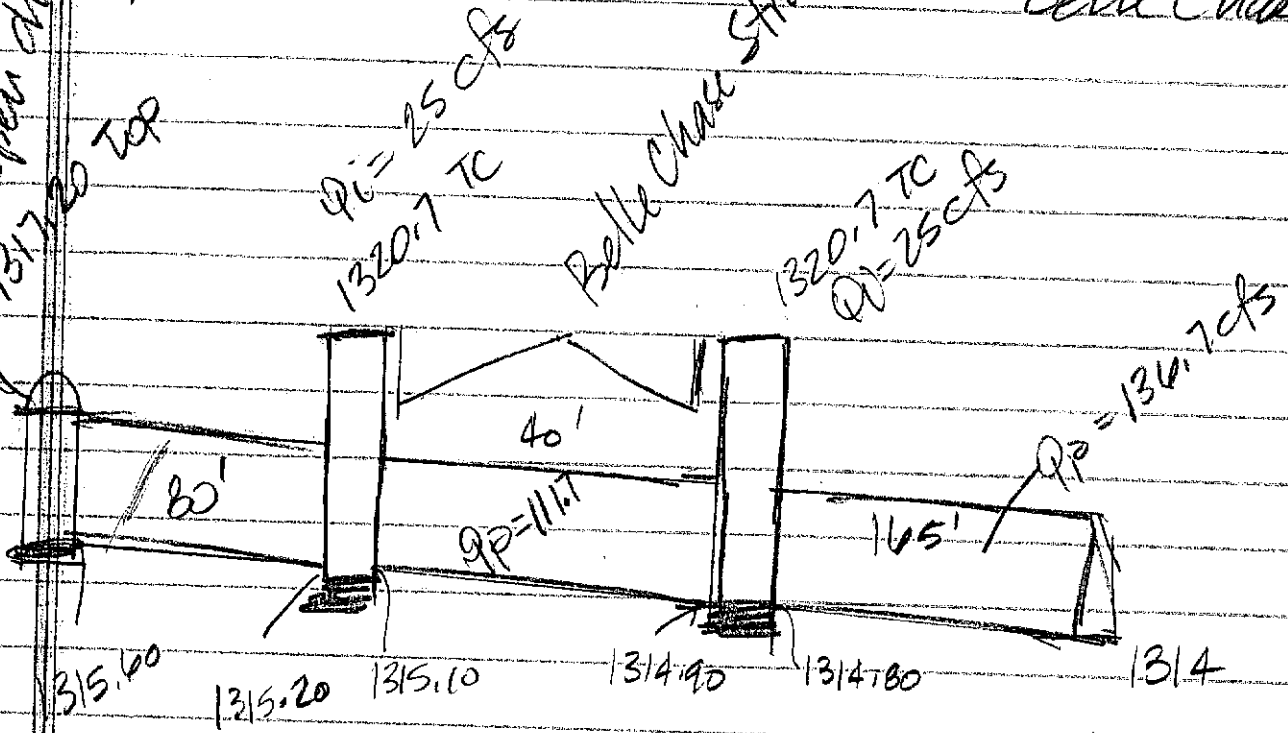
Belle Chase Adv



2/7/2006  
CNR  
Belle Chase

System 200

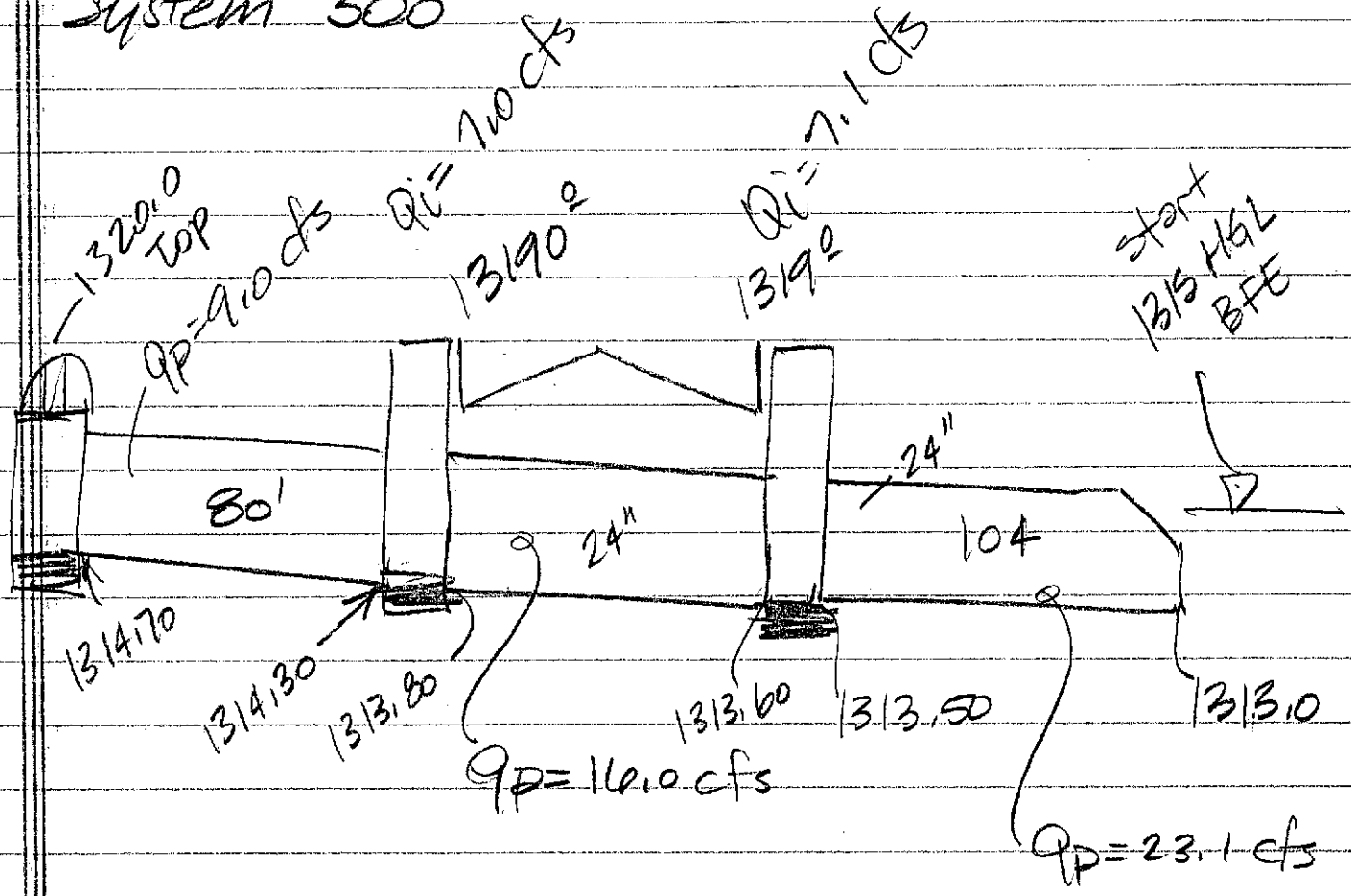
For Modeling Only  
No Inlet Here -  
Open Channel



$$Q = \text{System 100 (31.5 cfs)} + \text{Area C} = 55.2 \text{ cfs} = 86.7 \text{ cfs}$$

2/7/2006  
CMB

# System 300



**Exhibit A**

Time of Concentration Calculations for Belle Chase Addition

Feb 6 2006

***Time of Concentration (using the FAA Formula):***

$$T_c = ((1.8) (1.1 - C) (D^{0.5})) / (S^{0.33})$$

where:

T<sub>c</sub> = time of concentration in minutes

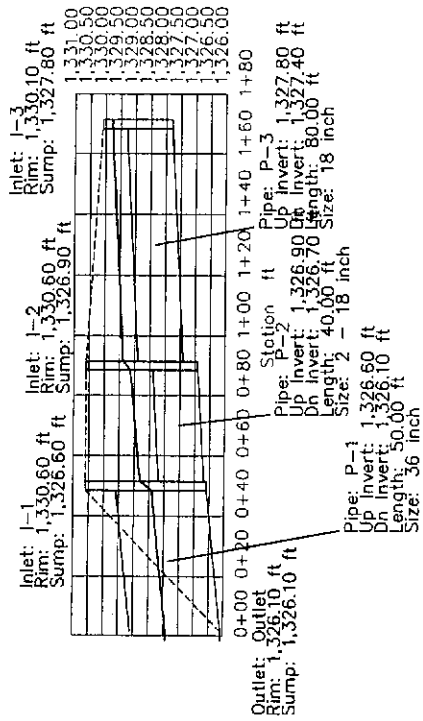
C = runoff coefficient (dimensionless, 0 < C < 1.0)

D = distance in feet from the point of interest to the point in the watershed from which the time of flow is the greatest

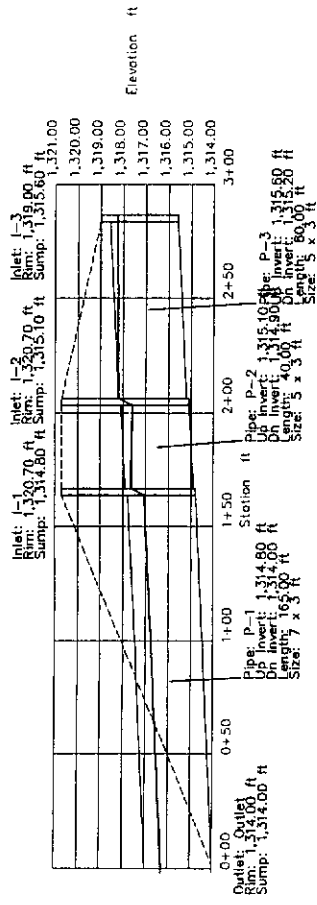
S = slope in percent

<b>Basin Name</b>	<b>C factor</b>	<b>D (Dist)(feet)</b>	<b>High Elevation (Feet)</b>	<b>Low Elevation (Feet)</b>	<b>S (calculated)</b>	<b>T<sub>c</sub></b>
West (Undeveloped)	0.67	2465	1348	1314	0.014	23
West (Developed)	0.76	1645	1333	1314	0.012	16

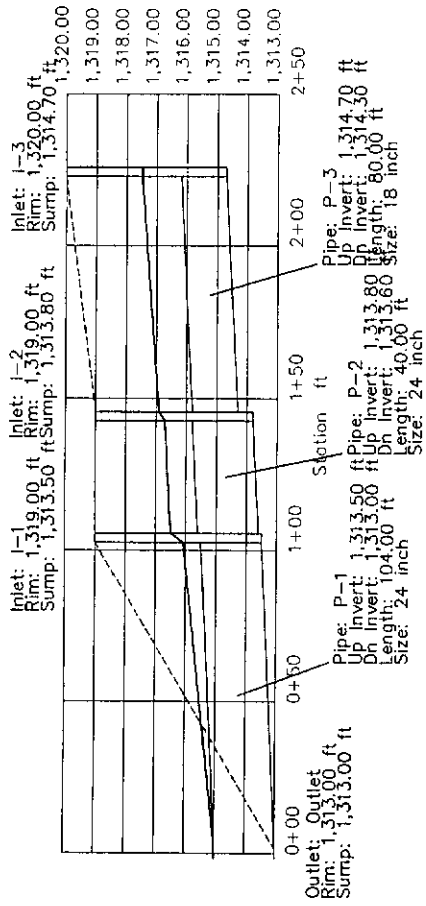
SYSTEM 100 PROFILE



SYSTEM 200 PROFILE



SYSTEM 300 PROFILE



BELLE CHASE ADDITION  
SWS PROFILES



Ruggles & Bohm, Inc.  
Engineering, Surveying, Land Planning  
25110 204th Street  
Mableton, Georgia 30127  
Phone: (770) 421-1111  
Fax: (770) 421-1112  
www.ruggles-bohm.com

Sheet	1
Scale	AS SHOWN
Date	2/20/08
Project	BELLE CHASE ADDITION
Drawn by	W. BOHME
Checked by	W. BOHME
Project Number	08-001
Job No.	08-001



**SCANNED**

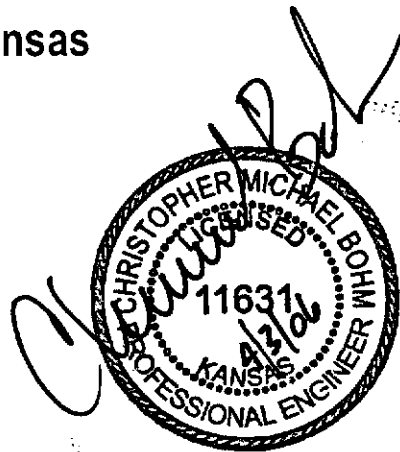
in PDF FORMAT

- Drainage Report
- ~~FAA Concentration~~
- FAA Time of concentration work sheet
- FEMA AREA MAP
- Lot Grading Plan
- MAP1 - Existing Drainage Basin
- MAP2 - Developed Drainage BASIN
- MAP3 - On site Developed Basins
- SWS Profiles

**Final Drainage Plan  
Bellechase Addition**

Wichita, Sedgwick County, Kansas

March 29, 2006



**Ruggles & Bohm P.A.**

Engineering, Surveying, Land Planning

**Drainage Report  
Belle Chase Addition  
Wichita, Sedgwick County, Kansas**

February 2, 2006

Updated March 28, 2006

**Introduction:** Belle Chase Addition is located near the northwest corner of the intersection of 127<sup>th</sup> Street East and Harry Street. The plat consists of approximately 16.3 Acres. From the *Soil Survey of Sedgwick County, Kansas*, the predominant soils on site are Rd and Ce, Type D and C Hydrological Group soils respectively. For the sake of the drainage analysis, Type D Hydrological Group soils will be used for analysis. The site is used for pasture at this time.

Belle Chase is situated immediately south of Country Hollow Addition, Wichita, Sedgwick County, Kansas, with a tributary feeding Spring Creek draining from north to south across the site. A FEMA Zone B Flood Zone exists on the site, looping into Reserve E, South of the South Entrance. There is no other flood zone encroachment on the Addition.

**Drainage Plan References:**

*Drainage Report, The Country Hollow Addition, Wichita, Sedgwick County, Kansas, July 2005, prepared by MKEC Engineering Consultants, Inc. (MKEC Report)*

*Spring Branch Master Drainage Plan, City of Wichita, Kansas, December 2004, prepared by PEC, P.A. (PEC Report)*

**Detention Storage:** From the MKEC Report, the area immediately north of Belle Chase Addition located in The Country Hollow Addition consists of 10 acres noted as West Area. This 10 acre basin produces a 100 year flow of 60.5 cfs in the undeveloped condition, and 0 cfs in the developed condition.

Inspection of the detention storage provided by Country Hollow Addition yields a net reduction of the 100 year flow from the site from a pre-developed total of 519.3 cfs (from three drainage basins) to a post developed flow of 437.2 cfs (from two drainage basins). Each of the remaining Country Hollow basins discharge at a rate lower than the 100 year pre-developed peak, indicating that the site has been designed to decrease the 100 year post-developed discharge below pre-developed peaks.

The area that naturally drains to the outlet in Belle Chase Addition (not counting the 10 acres from Country Hollow Addition) is 35.2 Acres (See Map 1). The SCS Curve Number for the undeveloped condition is 80 (see MKEC). Adding the 10 acres from the Country Hollow Addition results in 45.2 acres that flow into the Belle Chase tributary.

In keeping with the methodology used on the Country Hollow Addition site, the FAA Time of Concentration method of estimating will be used. Results of each of the basins can be found on Exhibit A – Time of Concentration Calculations – Belle Chase Addition.

In the undeveloped condition, the 45.2 acres tributary has a Tc of 23 minutes.

This data modeled in HEC-HMS yields the following results:

**Undeveloped Condition Input Data:**

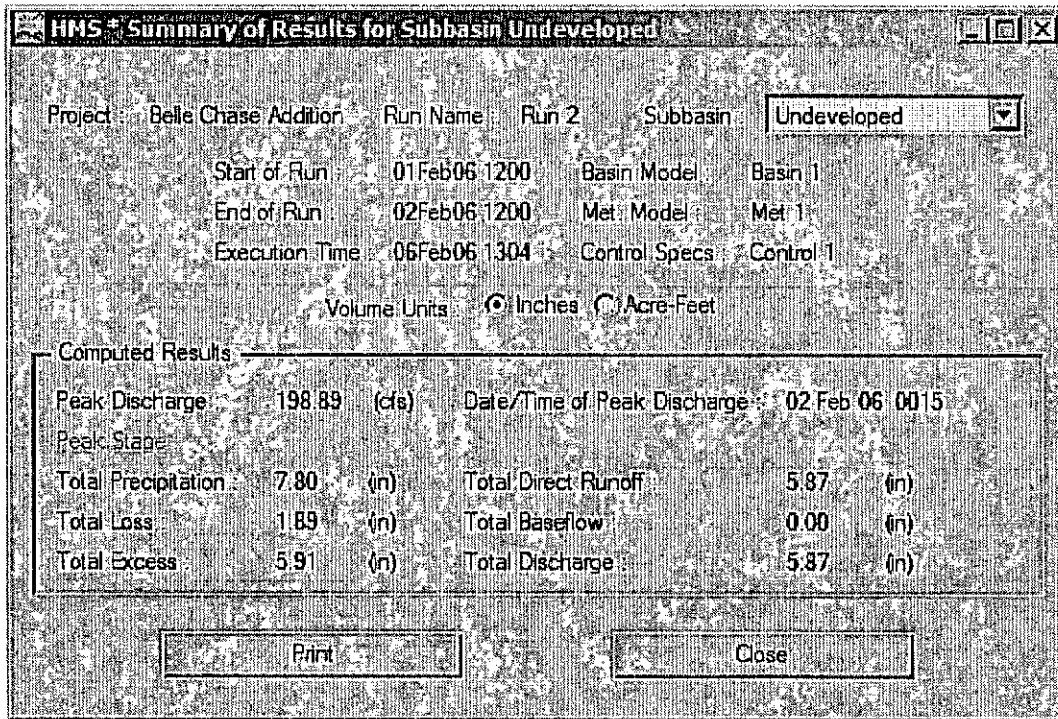
Basin Area = 45.2 acres = 0.07063 square miles

Tc = 23 minutes

CN = 80

Rainfall Event: 100 year – 24 hour precipitation of 7.8 inches, using SCS Type II Distribution.

Output results:



**Developed Basin:** (Includes adjacent area that will be platted in the future, and eliminates the 10 acres formerly draining through the tributary) = 33.3 Acres. To model the developed basin, a 30 percent impervious area will be added to the model. Also, a Tc of 16 minutes is calculated for the developed condition (See Appendix A).

## Results of Developed Basin:

The screenshot shows a software window titled "HMS Summary of Results for Subbasin Developed Basin". It contains the following information:

Project: Belle Chase Addition    Run Name: Run 2    Subbasin: Developed Basin

Start of Run: 01Feb06 1200    Basin Model: Basin 1  
End of Run: 02Feb06 1200    Met. Model: Met 1  
Execution Time: 06Feb06 1534    Control Specs: Control 1

Volume Units:  Inches     Acres-Feet

**Computed Results**

Peak Discharge:	192.95 (cfs)	Date/Time of Peak Discharge:	02 Feb 06 0008
Peak Stage:			
Total Precipitation:	7.80 (in)	Total Direct Runoff:	6.45 (in)
Total Loss:	1.33 (in)	Total Baseflow:	0.00 (in)
Total Excess:	6.47 (in)	Total Discharge:	6.45 (in)

Buttons: Print, Close

The difference in the peak pre and post developed condition are as follows:

Pre-Developed Peak flow (100 year rainfall event) = 199 cfs

Post-Developed Peak flow (100 year rainfall event) = 193 cfs

Pre-Developed Peak flow (2 year rainfall event) = 68.4 cfs

Post-Developed Peak flow (100 year rainfall event) = 73.3 cfs

Pre-Developed Peak flow (5 year rainfall event) = 97.4 cfs

Post-Developed Peak flow (5 year rainfall event) = 100.3 cfs

No detention required for this subdivision.

Localized Drainage Areas: (See Map for Descriptions)

Runoff from these basins is calculated using the Rational Method ( $Q = CiA$ ), with data from Attachment D, City of Wichita Drainage Criteria.

Basin	Area (sf)	Area (Ac)	Tc (Min)	C2	C100	I2 (In/Hr)	I100 (In/Hr)	Q2	Q100
A	57766	1.3	15	0.5	0.76	3.83	7.37	2.5	7.4
B	187210	4.3	15	0.5	0.76	3.83	7.37	8.2	24.1
C	429349	9.9	15	0.5	0.76	3.83	7.37	18.9	55.2
D	387171	8.9	15	0.5	0.76	3.83	7.37	17.0	49.8
E	69767	1.6	15	0.5	0.76	3.83	7.37	3.1	9.0
F	109387	2.5	15	0.5	0.76	3.83	7.37	4.8	14.1
G	53736	1.2	15	0.5	0.76	3.83	7.37	2.4	6.9
H	77346	1.8	15	0.5	0.76	3.83	7.37	3.4	9.9

### Storm Water Sewer Systems:

The hydraulic capacity of each storm water sewer system is analyzed using Haestad Method's STORMCad program. Adjacent to known floodplains, the starting water surface elevation is the BFE (100 year storm).

To the extent possible, the natural drainage ways that exist on the property will be maintained. Storm water sewer systems will be placed only as necessary to cross streets, or provide an outlet for rear yard drainage.

#### System 100: Northerly most SWS Crossing of Spring Valley Street

Inlet capacity: The major street sump intercepts 24.1 cfs of flow. Two 5 foot type 1A Inlets in a sump condition can accommodate 26 cfs in capacity at R/W elevation, so use two 10' type 1A Inlets at this location. The beehive inlet to the north of the sump can be a single inlet, with overspill permitted to the street. The beehive is set at the same elevation as the top of curb to allow overspill.

#### System 200: Southeasterly sump crossing Belle Chase

Inlet Capacity: The approach flow at this sump location is 49.8 cfs, with need for inlet capacity to accept a large portion of this flow. Two 10 foot inlets in a sump condition can capture 52 cfs, and with the ability to overspill south, this is acceptable. The pipe system is designed to handle the 100 year storm.

#### System 300: South system near south-central portion of the addition

Inlet Capacity: The approach flow in the street is 14.1 cfs, use 2 – 5' Type 1A Inlets. This system is sized for 100 year pipe capacity.

For output data for each run, see the STORMCad generated profiles included with this report.

**Area G** – Side road drainage crossing under Spring Valley Street. The 100 year flow at this location totals 6.9 cfs. With inlet control, an 18" RCP culvert can pass 7.0 cfs – use an 18" RCP Culvert pipe at this location.

Areas H (and area G) have a combined flow of 16.8 cfs in the 100 year event. With inlet control, a 24" RCP Culvert pipe will pass this flow with a HW depth of 2.3 feet. Coordination with Conoco-Phillips Pipeline Company will be necessary at the actual time of design.

Included with this report is a lot grading plan and the aforementioned exhibits.

**Exhibit A**

Time of Concentration Calculations for Belle Chase Addition  
Feb 6 2006

**Time of Concentration (using the FAA Formula):**

$$T_c = ((1.8) (1.1 - C) (D^{0.5})) / (S^{0.33})$$

where:

T<sub>c</sub> = time of concentration in minutes

C = runoff coefficient (dimensionless, 0 < C < 1.0)

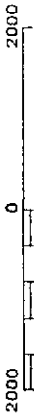
D = distance in feet from the point of interest to the point in the watershed from which the time of flow is the greatest

S = slope in percent

<b>Basin Name</b>	<b>C factor</b>	<b>D (Dist)(feet)</b>	<b>High Elevation (Feet)</b>	<b>Low Elevation (Feet)</b>	<b>S (calculated)</b>	<b>Tc</b>
West (Undeveloped)	0.67	2465	1348	1314	0.014	23
West (Developed)	0.76	1645	1333	1314	0.012	16



APPROXIMATE SCALE



NATIONAL FLOOD INSURANCE PROGRAM

# FIRM FLOOD INSURANCE RATE MAP

SEDGWICK  
COUNTY,  
KANSAS  
(UNINCORPORATED AREAS)

PANEL 225 OF 300

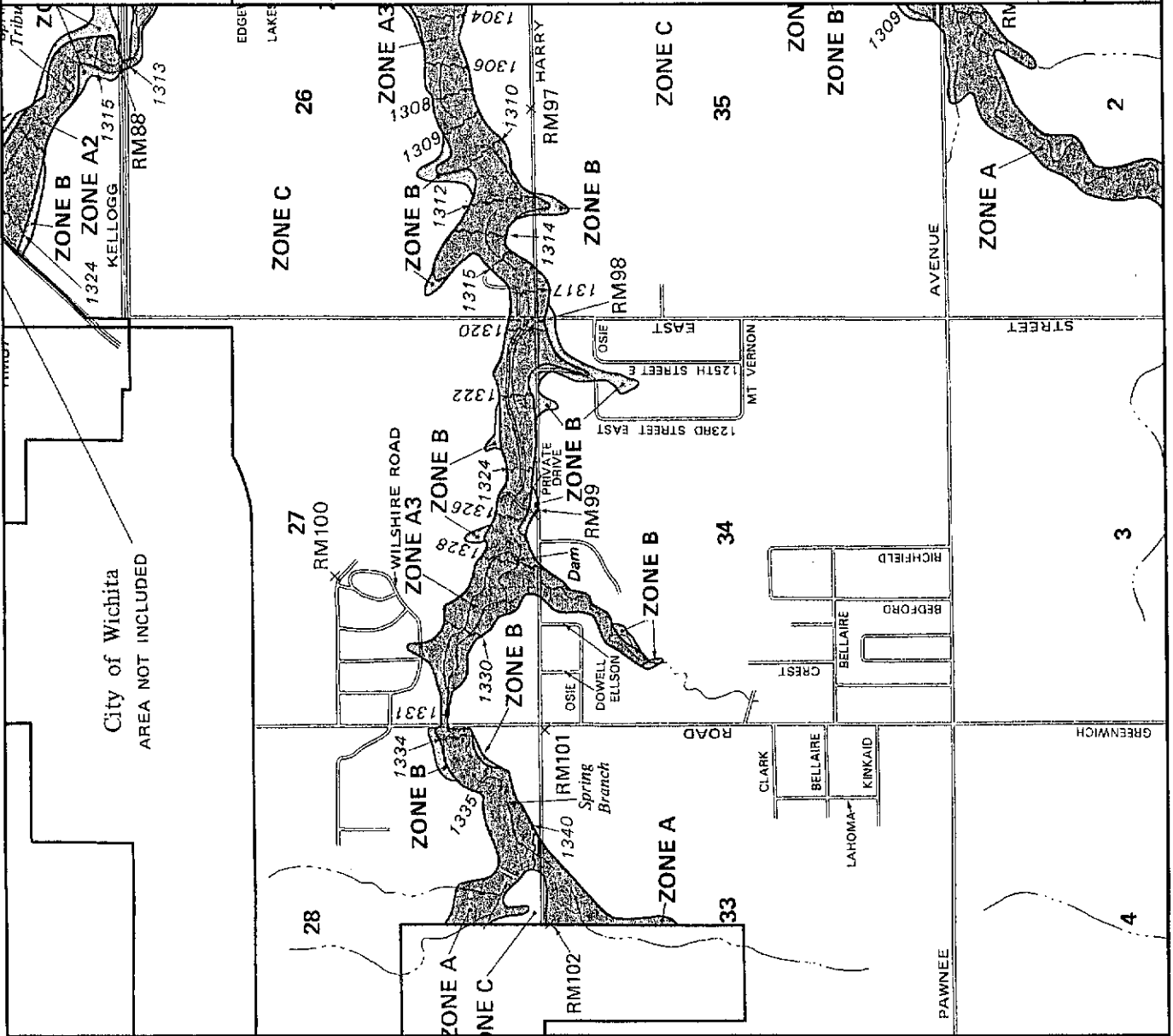
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200321 0225 A

EFFECTIVE DATE:  
JUNE 3, 1986

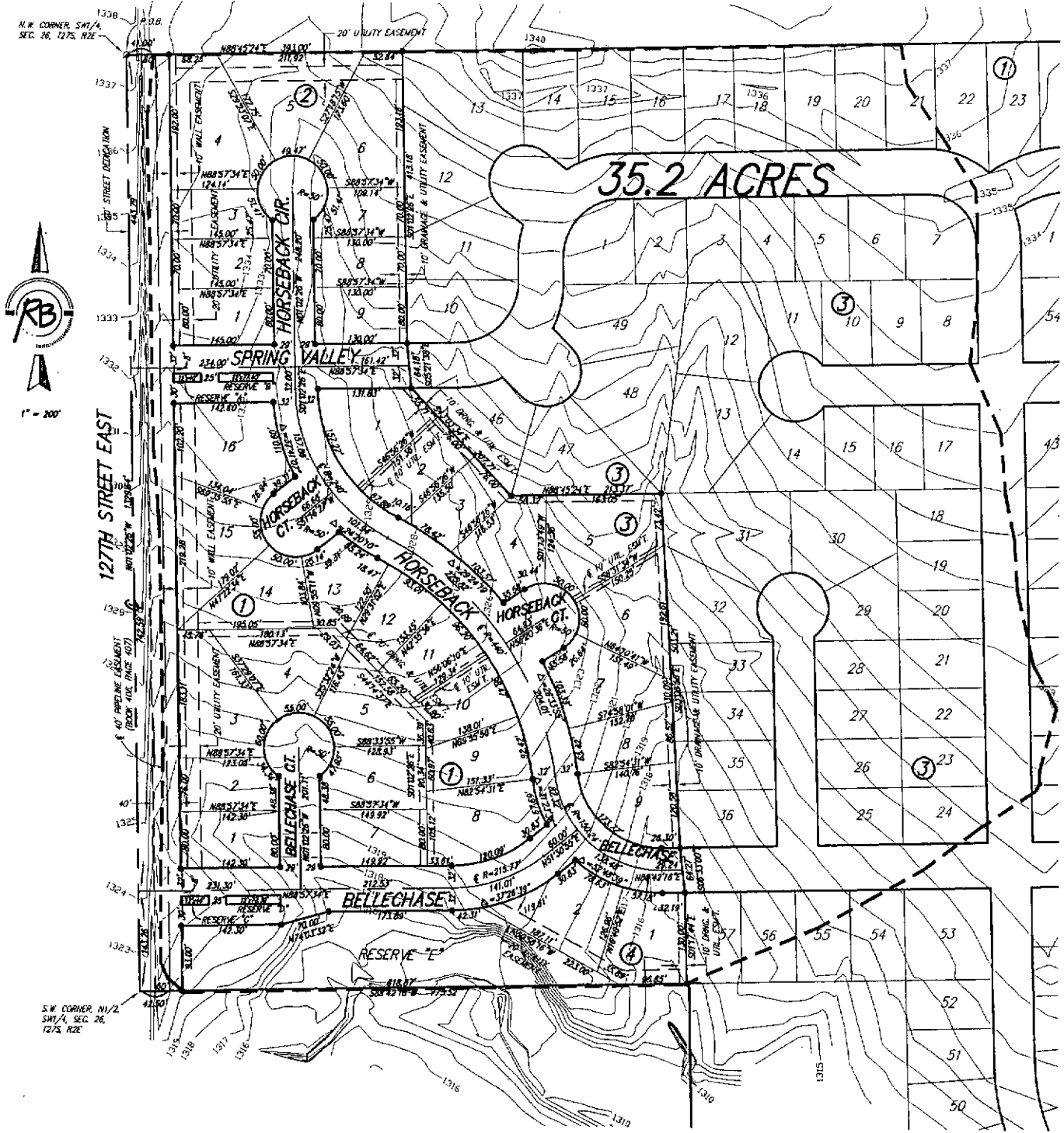


Federal Emergency Management Agency


This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

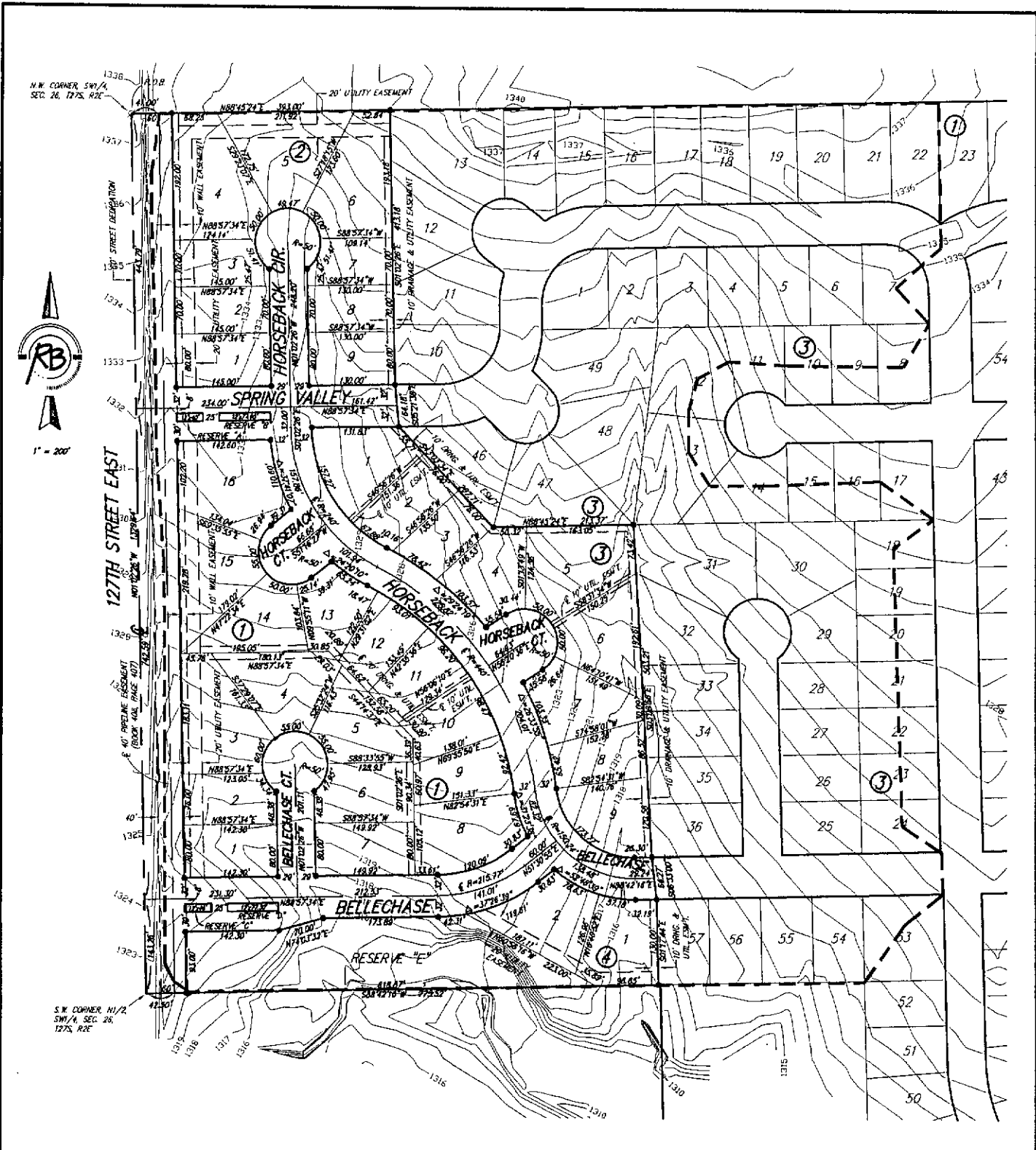


City of Wichita  
AREA NOT INCLUDED




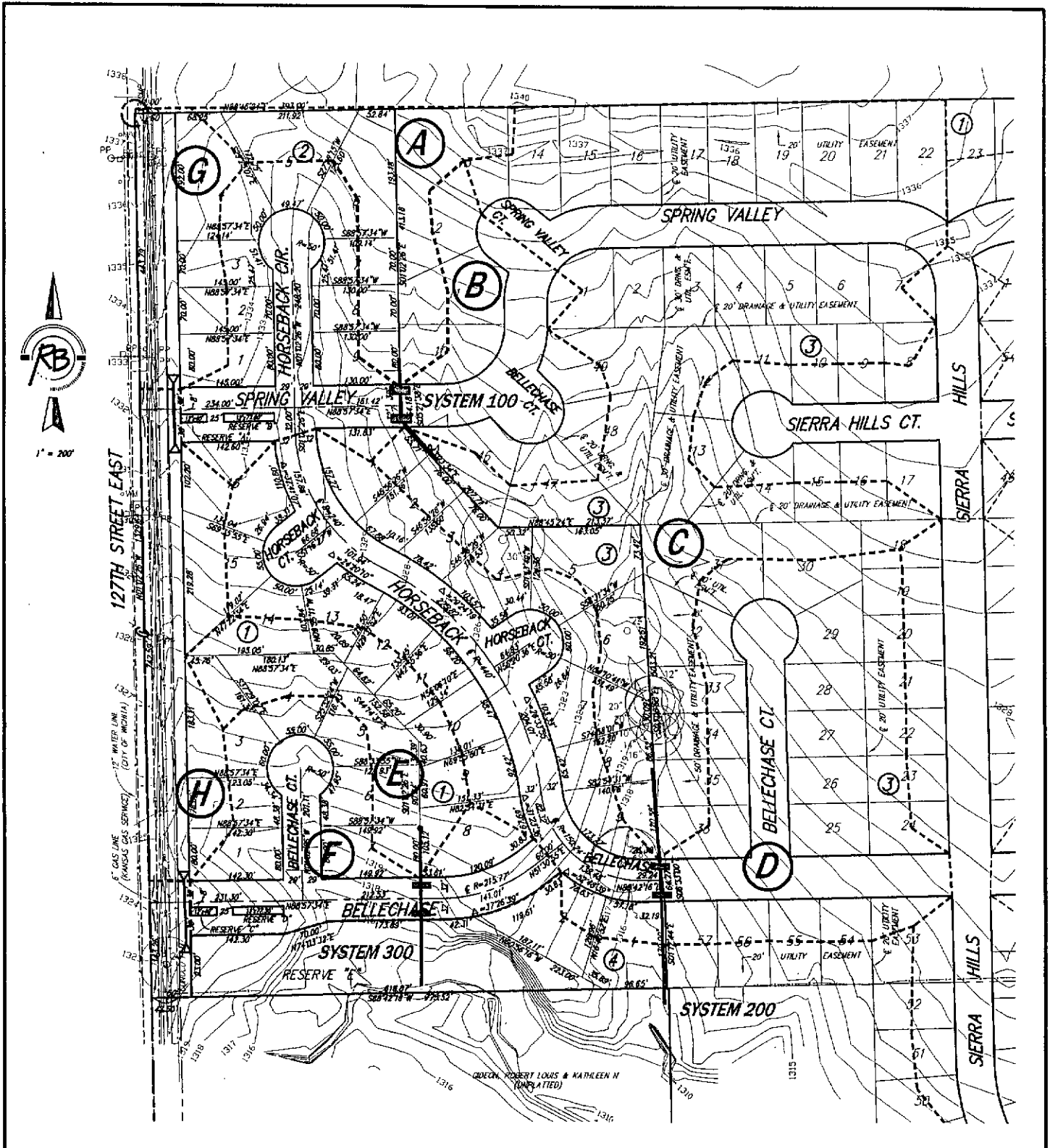
**MAP 1 - EXISTING TRIBUTARY DRAINAGE AREA  
BELLE CHASE ADDITION**

 <p><b>Ruggles &amp; Bohm, P.A.</b> Engineering, Surveying, Land Planning</p> <p>624 North Main Wichita, Kansas 67203 www.rbkansas.com</p> <p>(316) 264-5008 (316) 264-4621 fax E-mail: info@rbkansas.com</p>	DESIGN	SHEET
	DRAWN	
	REVIEW	OF
	UTILITY	
DRAWING FILE	PROJECT NUMBER	DATE

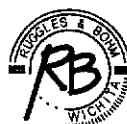


**MAP 2 - FUTURE DEVELOPED DRAINAGE BASIN  
BELLE CHASE ADDITION**

 <p><b>Ruggles &amp; Bohm, P.A.</b> Engineering, Surveying, Land Planning</p> <p>524 North Main Wichita, Kansas 67203 www.rbkansas.com</p> <p>(318) 284-8008 (318) 264-4621 fax E-mail: info@tkansas.com</p>	DESIGN	SHEET OF
	DRAWN	
	REVIEW	
	UTILITY	
DRAWING FILE	PROJECT NUMBER	DATE



**MAP 3 - ON-SITE DEVELOPED BASINS  
BELLE CHASE ADDITION**



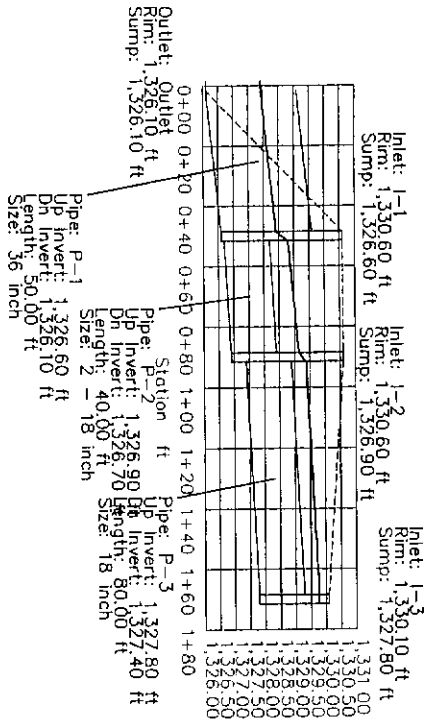
Ruggles & Bohm, P.A.  
Engineering, Surveying, Land Planning

924 North Main (316) 264-8008  
Wichita, Kansas 67203 (316) 264-4621 fax  
www.rbkansas.com E-mail: info@rbkansas.com

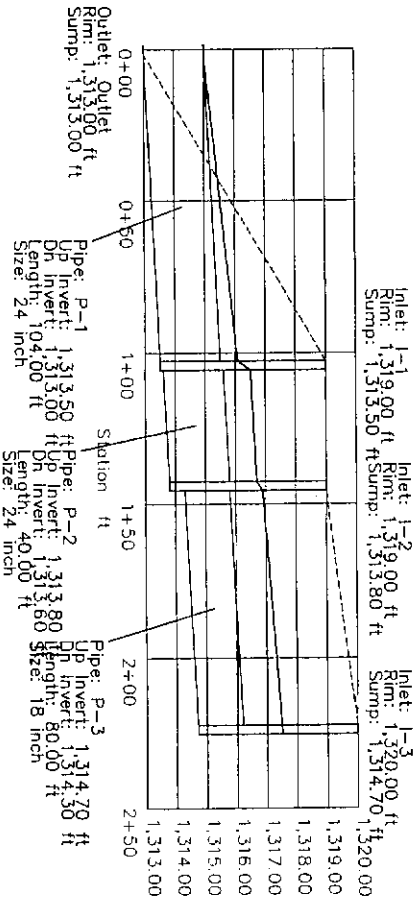
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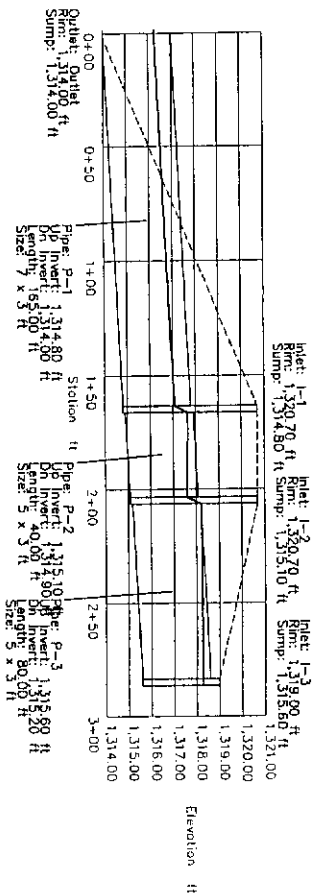
SYSTEM 100 PROFILE



SYSTEM 300 PROFILE



SYSTEM 200 PROFILE



BELLE CHASE ADDITION  
SMS PROFILES



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SCALE	AS SHOWN
PROJECT	BELLE CHASE ADDITION
SHEET	2-1-08