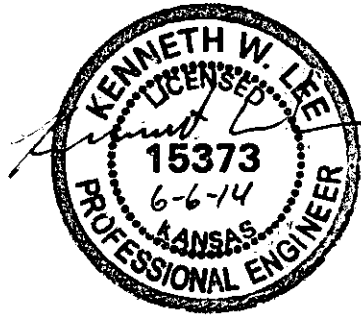


**DRAINAGE REPORT  
FOR  
THE STEPPES AT ARK VALLEY  
ADDITION  
WICHITA, SEDGWICK COUNTY,  
KANSAS**

**June 2014**



**RUGGLES  
& BOHM**

ENGINEERING | SURVEYING | LANDSCAPE ARCHITECTURE | GOVERNMENT

924 NORTH MAIN WICHITA, KANSAS 67203 P (316) 264-8008 F (316) 264-4621  
WWW.RBKANSAS.COM

**THE STEPPES AT ARK VALLEY ADDITION  
DRAINAGE ANALYSIS  
JUNE 2014**

**INTRODUCTION**

This report contains supporting documentation and calculations to provide water quality and channel protection for The Steppes at Ark Valley Addition. The plat is located at the northeast corner of Harry and 127<sup>th</sup> Street East in southeast Wichita. The site will be developed with primarily two family dwellings with a few select lots to be designated single family.

**EXISTING CONDITIONS**

The existing site has one single family residence on the 20+/- acres of the site. The remaining property is undeveloped grass and pasture. The Spring Branch of Four Mile Creek abuts the south side of the property and an unnamed tributary of the Spring Branch abuts the north side of the property. The onsite soils are 60% Rosehill silty clay (higher elevation areas) and 40% Clime silty clay (lower elevation areas). Rosehill is hydrologic soil group D Soil and Clime is hydrologic soil group C soil. There is an existing pond at the northeast corner of the site that was improved privately by the developer of the Bellechase Addition project. The pond has a rip-rap lined overflow channel with an elevation of approximately 1311.0 at the east end of the dam. There is an existing grass lined channel at the west end of the dam that currently serves as an emergency spillway.

**DEVELOPED CONDITIONS**

As previously mentioned, the site will be developed as residential with primarily two family homes. The existing home will remain on a larger lot of approximately 4.4 acres. Because of the large upstream drainage basin for this project, no detention is proposed. Water quality treatment will be provided through the installation of Snout hoods in specially designed inlets for areas on the south half of the project. Water quality in the north portion of the site will be provided by modifying the outlet of the existing pond to restrict the first flush runoff. In addition to water quality treatment, the pond will also provide channel protection volume for the site, with additional volume provided to compensate for the south half of the site. A weir modification will be performed to ensure that there is adequate protection from flooding for homes adjacent to the pond.

**HYDROLOGY**

The site has been analyzed, using HEC-HMS using SCS methodology. There is approximately 6.64 acres in the south half and 3.94 acres in the north half of the site that will not be disturbed during construction. The remaining part of the site will be approximately 50% impervious. The developed areas of the site will have a curve number of 87. Undisturbed areas will have a curve number of 79. For the purpose of this analysis and

because the pond is in the channel of the offsite tributary, the north offsite area was included as a separate basin in this analysis. Spring Branch was not included.

The site runoffs are as follows:

	North Exist	North Dev	South Exist	South Prop	Exist. Site	Dev. Site
2 year	13.7	18.5	13.0	16.2	228	233
5 year	21.0	26.7	19.8	23.9	352	355
10 year	25.7	31.7	24.0	28.7	428	432
25 year	33.5	40.2	31.2	36.7	559	564
100 year	47.1	54.6	43.6	50.5	785	791

Note: Site Total includes offsite runoff from unnamed Tributary

### **POND ROUTING INFORMATION**

The outlet of the existing pond will be modified to provide water quality and channel protection volumes. To provide adequate water quality treatment and channel protection volumes, as well as ensure that there are no flooding hazards, a new outlet weir will be installed in the west channel at a lower elevation. The pond shall be an 8" ductile iron pipe with an outflow elevation of 1309.0 while the primary outlet weir will be set with at elevation 1310.0.

<u>Stage</u>	<u>Area</u> (sq-ft)	<u>Existing</u> <u>Outlet</u> (cfs)	<u>Proposed</u> <u>Outlet</u> (cfs)
1309	1.99	-	0
1310	2.11	-	5
1311	2.36	1	56
1312	2.99	72	188
1313	3.79	231	396
1314	4.99	477	689
1315	6.26	813	1074

The summary of the detention ponds in the 100-yr storm are as follows;

#### Reserve A Pond

Peak Inflow - 816 cfs

Peak Outflow - 785 cfs

Peak W.S. - 1314.2

Peak Storage - 16.1 ac-ft

In the existing condition, the peak water surface of the pond is 1314.9 feet with a peak storage of 15.4 ac-ft. As mentioned above, the static pool of the pond will be lowered from 1311.1 to 1309.0 with the modifications proposed with this project.

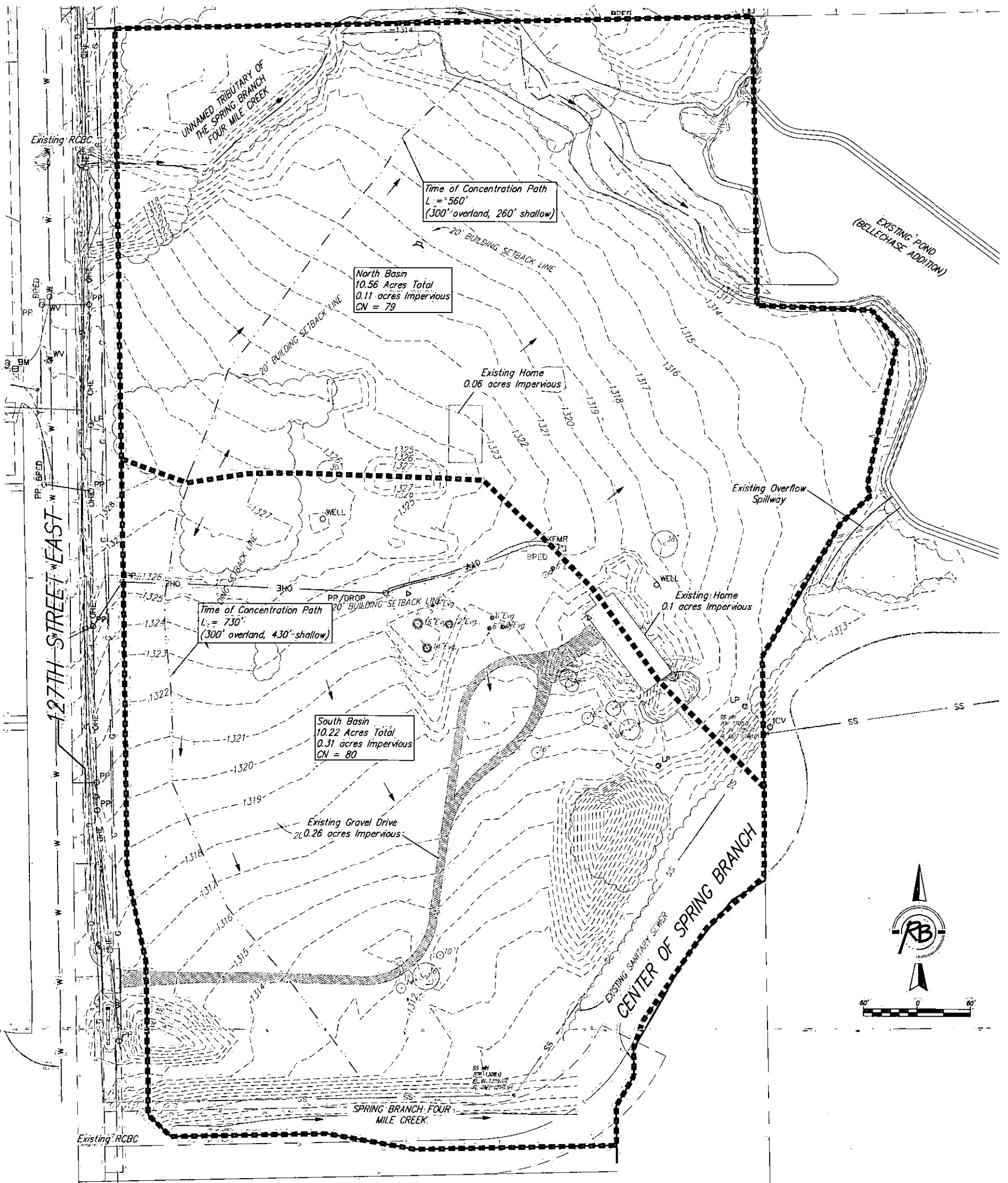
## **Water Quality / Channel Protection Volume**

Water quality at the south end of the site will be provided with the implementation of Snout water quality treatment hoods in modified inlets. Water quality for the north part of the site will be provided with modifications to the existing pond. Channel protection volume for the entire site will be provided by the pond at the north end. The water quality volume for the north part of the site was calculated to be 0.20 ac.-ft. (50% reduction due to wet pond). The channel protection volume required for the entire site is 1.52 ac-ft. The water quality volume is nested within the channel protection volume. Approximately 2.05 acre-feet is provided between the water quality and the primary outlets of the pond described above. See the spreadsheet included in this report for calculations.

## **Minimum Pad Establishment**

The minimum pad elevations for the project were set using the current FEMA FIRM maps as the baseline. A review of the preliminary FEMA maps scheduled for release in the future show that the 100 year water surface may be lowered which indicates that there should be no problems with that map revision. The lots adjacent to the detention pond have been set at least 2 feet minimum above the maximum surface of that pond.

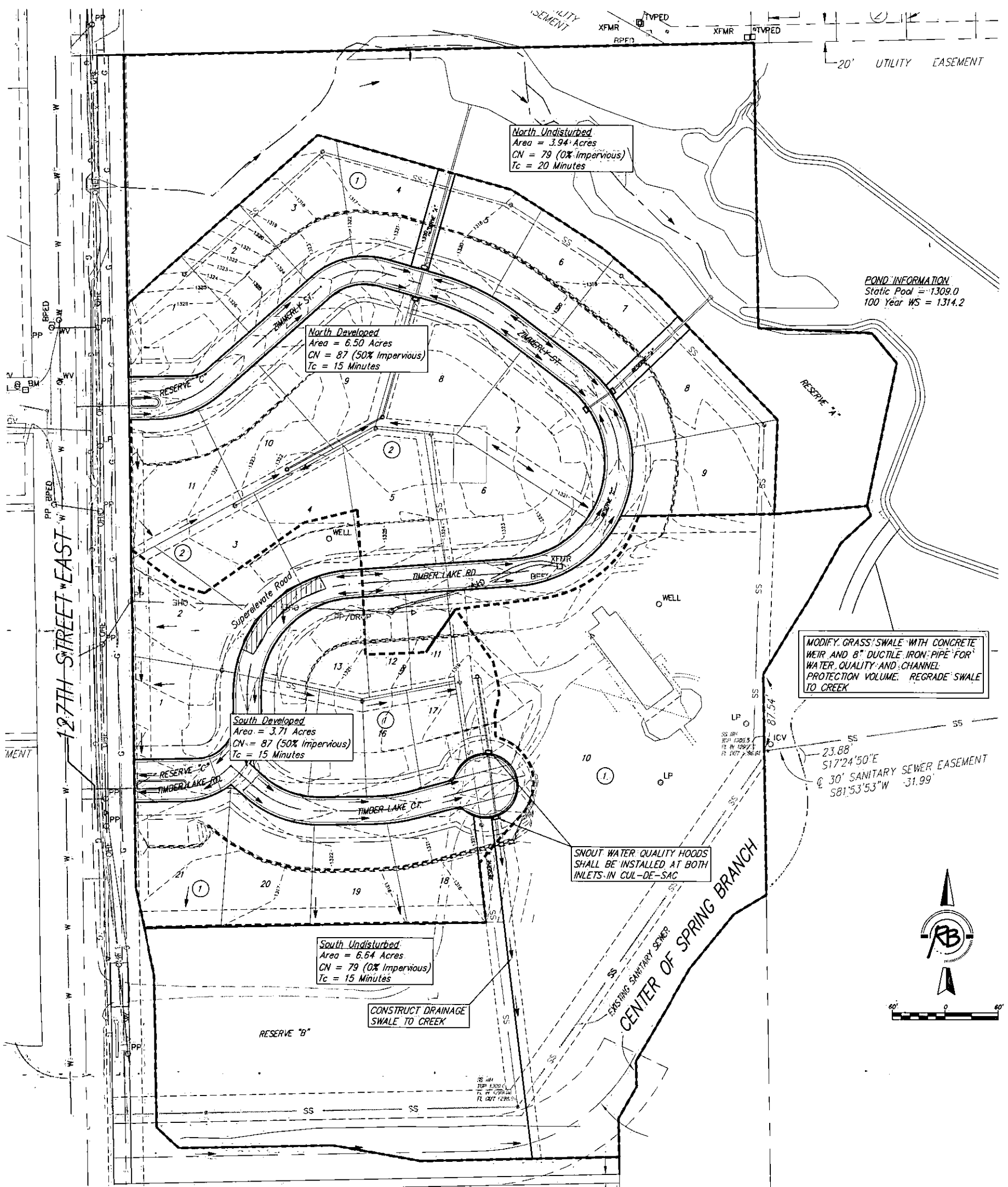
# DRAINAGE MAP



**NOTES:**

1. The site is 60% Rosehill Silty Clay (Group D Soil), and 40% Clime Silty Clay (Group C Soil).
2. Existing site is pasture and residential uses with trees over approximately 20% of the property.

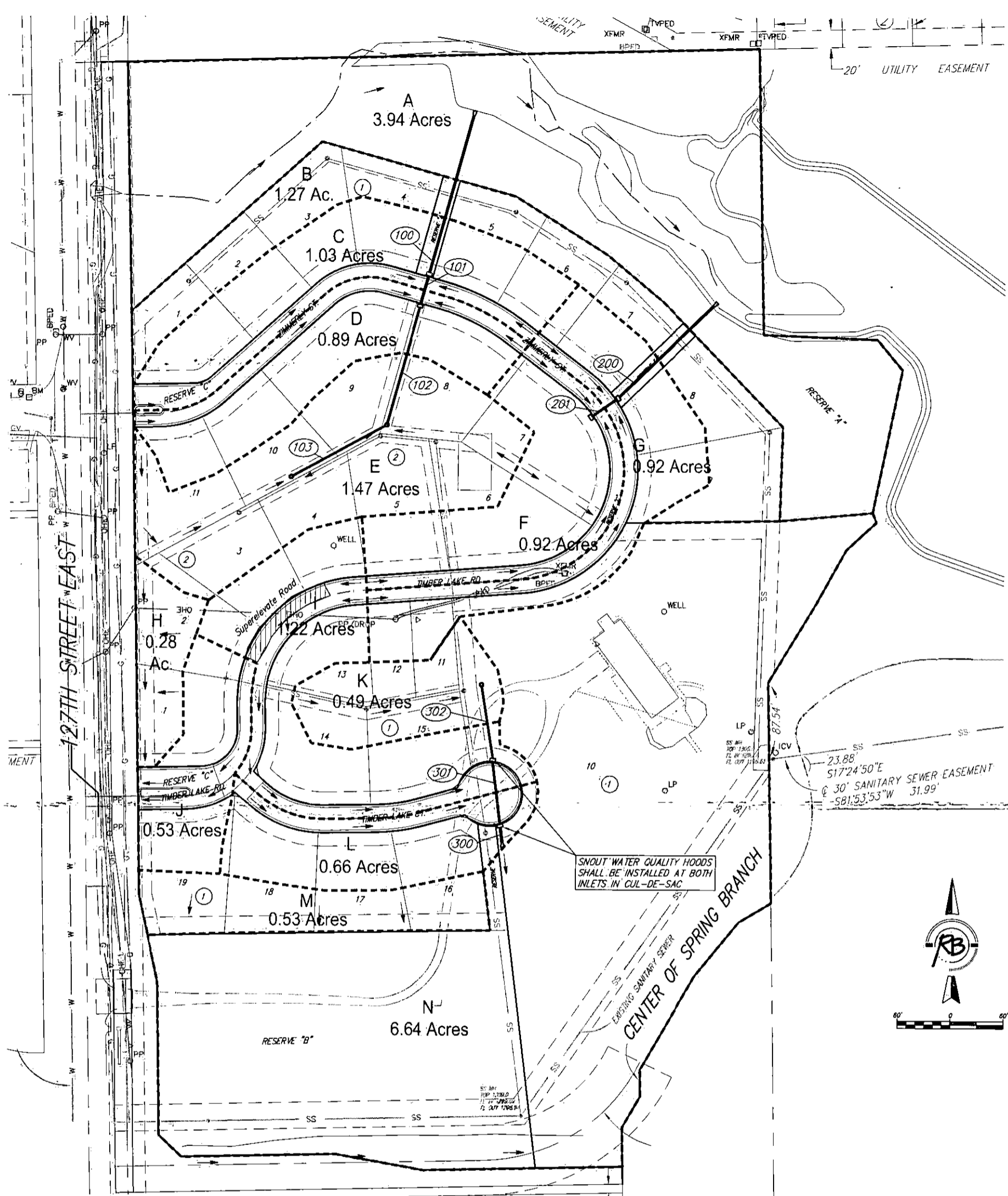
<b>THE STEPPES AT ARK VALLEY</b>	
<b>EXISTING CONDITIONS</b>	
<b>RUGGLES &amp; BOHM</b> ENGINEERING   SURVEYING   LANDSCAPE ARCHITECTURE   GOVERNMENT 924 NORTH MAIN   WICHITA, KANSAS 67201   P (316) 264-8008   F (316) 264-4621 WWW.RBMANAS.COM PROJECT NUMBER: RB JOB NO. DWG. SCALE: SHEET:	DATE: May 27, 2014 DESIGN: KWL DRAWN: KWL REVIEW: KWL SHEET: <b>1</b> OF: 1



**NOTES**

1. The site is 60% Rosehill, Silty Clay (Group D, Soil) and 40% Clime Silty Clay (Group C Soil).
2. Water Quality Treatment for storm water collected from roads will be accomplished with a biofiltration swale for the southern portion of the site and with modifications to the existing pond on the north end of the site. The developer that owns the pond has verbally agreed to allow the modifications to occur and a drainage agreement will be prepared prior to completion of the final plat.
3. A portion of the street in the middle of the plat will be super-elevated as indicated to direct storm water into the storm sewer at the southeast corner of the site so it can be exposed to the biofiltration process.
4. See SWS Basin Map for Pipe Sizing and Hydraulic Information.

<b>THE STERRES AT ARK VALLEY DRAINAGE PLAN</b>		DATE June 6, 2014 DESIGN KWL DRAWN KWL REVIEW KWL SHEET 1 OF 1
<b>RUGGLES &amp; BOHM</b>	ENGINEERING   SURVEYING   LANDSCAPE ARCHITECTURE   GOVERNMENT 924 NORTH MAIN WACHITA, ARKANSAS 72791 P (501) 264-2008 F (501) 264-1622 WWW.RBANSAS.COM	
PROJECT NUMBER	RB JOB NO.	DWG. SCALE
DRAWING FILE		



**BASIN RUNOFF CALCULATIONS**

Basin ID	Area	Runoff Coefficients				Rainfall Intensity (in/hr)				Peak Runoff				Notes
		2-yr	5-yr	10-yr	100-yr	2-yr	5-yr	10-yr	100-yr	2-yr	5-yr	10-yr	100-yr	
A	3.94	0.24	0.27	0.35	0.51	3.80	4.62	5.21	7.40	3.6	4.9	7.2	15	Undisturbed
B	1.27	0.55	0.58	0.64	0.73	3.80	4.62	5.21	7.40	2.7	3.4	4.2	6.9	
C	1.03	0.55	0.58	0.64	0.73	3.80	4.62	5.21	7.40	2.2	2.8	3.4	5.6	Single Curb Inlet
D	0.89	0.57	0.61	0.66	0.79	3.80	4.62	5.21	7.40	1.9	2.5	3.1	5.2	Single Curb Inlet
E	1.47	0.57	0.61	0.66	0.79	3.80	4.62	5.21	7.40	3.2	4.1	5.1	8.6	Rear Yard Drain
F	0.92	0.57	0.61	0.66	0.79	3.80	4.62	5.21	7.40	2.0	2.6	3.2	5.4	Single Curb Inlet
G	0.92	0.55	0.58	0.64	0.73	3.80	4.62	5.21	7.40	1.9	2.5	3.1	5.0	Single Curb Inlet
H	0.28	0.57	0.61	0.66	0.79	3.80	4.62	5.21	7.40	0.6	0.8	1.0	1.6	
J	1.22	0.57	0.61	0.66	0.79	3.80	4.62	5.21	7.40	2.6	3.4	4.2	7.1	Single Curb Inlet
L	0.53	0.57	0.61	0.66	0.79	3.80	4.62	5.21	7.40	1.1	1.5	1.8	3.1	
K	0.49	0.57	0.61	0.66	0.79	3.80	4.62	5.21	7.40	1.1	1.4	1.7	2.9	Rear Yard Drain
L	0.66	0.55	0.58	0.64	0.73	3.80	4.62	5.21	7.40	1.4	1.8	2.2	3.6	Single Curb Inlet
M	0.53	0.55	0.58	0.64	0.73	3.80	4.62	5.21	7.40	1.1	1.4	1.8	2.9	
N	6.64	0.24	0.27	0.35	0.51	3.80	4.62	5.21	7.40	6.1	8.3	12.1	25.1	Undisturbed

**PIPE FLOW INFORMATION**

PIPE ID	FLOW (CFS)	SIZE	SLOPE	NOTES
100	19	24"	1.00%	Includes 25 cfs from offsite
101	14	24"	0.50%	
102	8.6	15"	0.50%	
103	5.7	15"	0.50%	
200	10	24"	1.00%	Pressure Flow
201	5.4	24"	1.00%	
300	14	24"	0.50%	Drains South to offsite after ponds have filled from 1322 to 1324
301	10	18"	0.50%	Drains North into Pond 1
302	3	15"	0.50%	Drains North into Pond 1

**THE STEPPES AT ARK VALLEY**  
**SWS BASINS**

**RUGGLES & BOHM**

ENGINEERING | SURVEYING | LANDSCAPE ARCHITECTURE | GOVERNMENT

124 NORTH MAIN WICHITA, KANSAS 67203 P. (316) 264-8008 F. (316) 264-4623

WWW.RUGGLESANDBOHM.COM

DATE: May 27, 2014

DESIGN: KWL

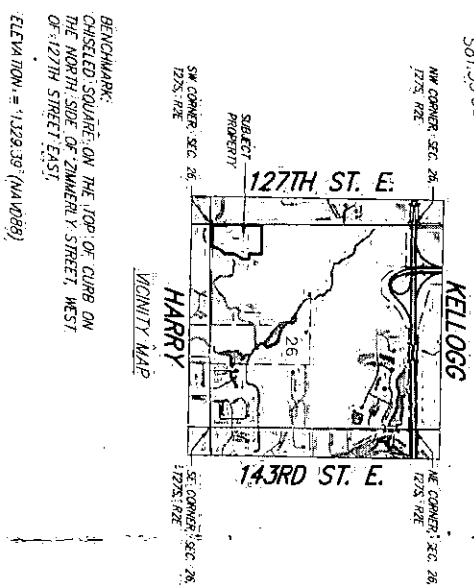
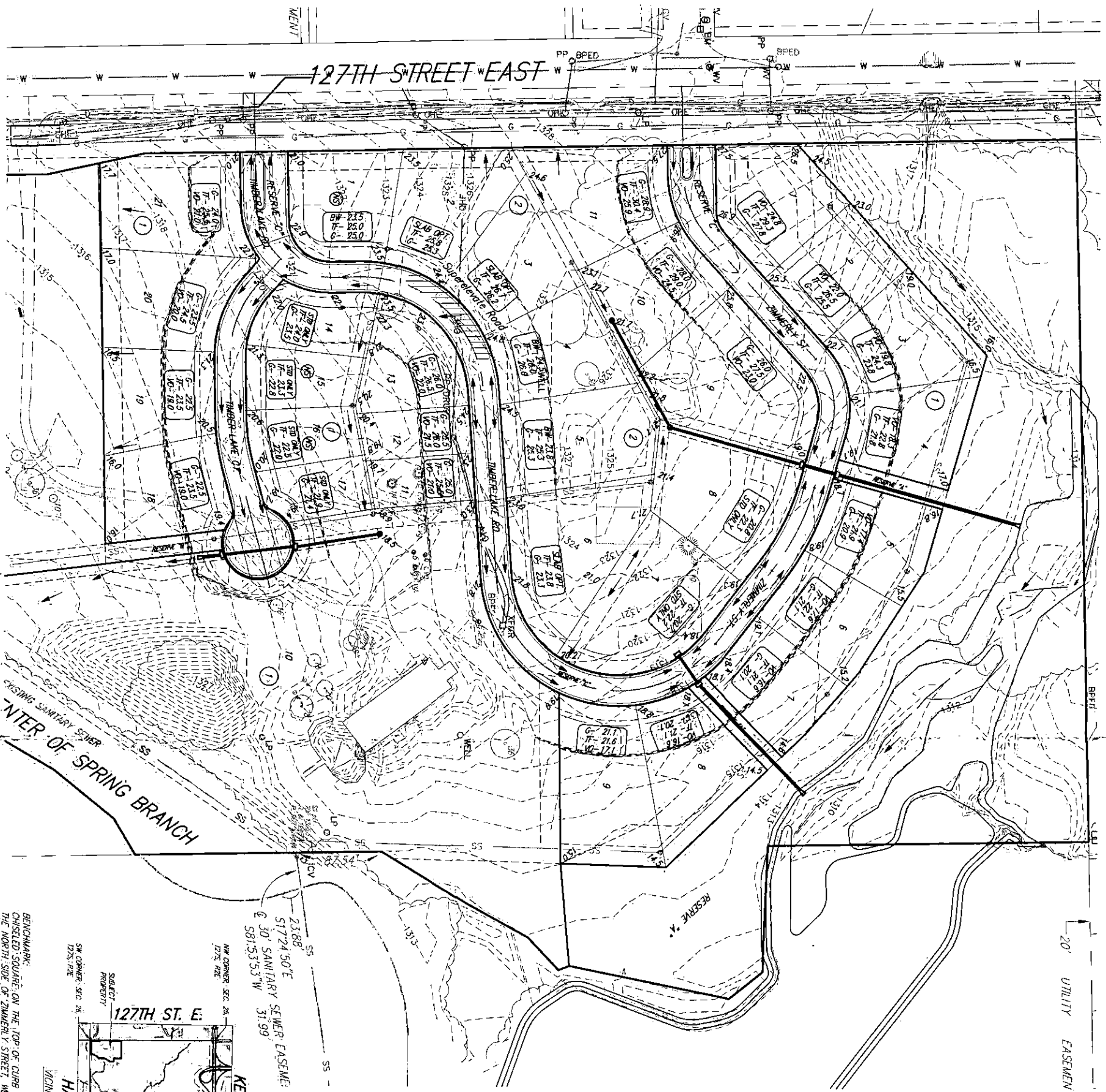
DRAWN: KWL

REVIEW: KWL

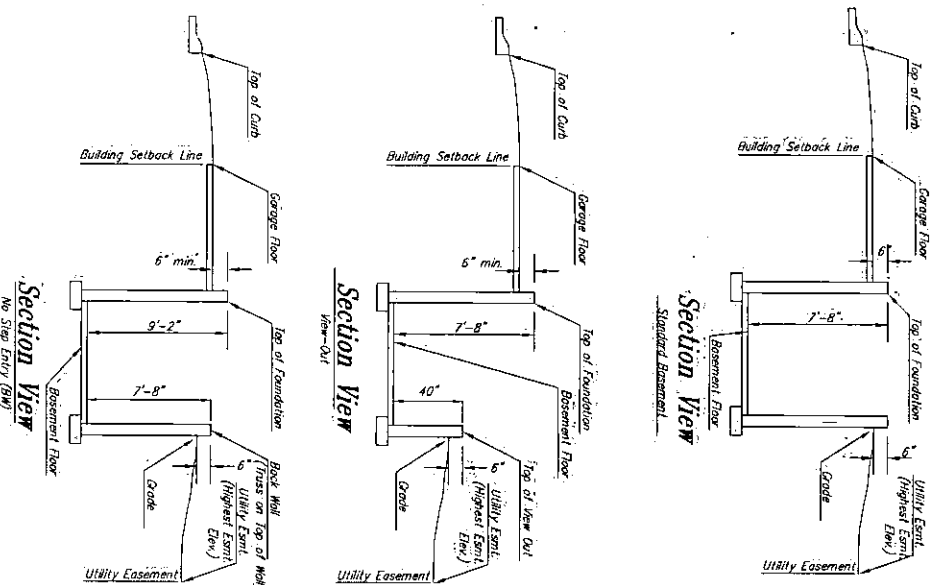
SHEET: 1

OF: 1

DRAWING FILE: ...



BLOCK	LOT NO.	ELEVATION (NAVD88)
1	1, 2, 3, 4, 5	1317.0
1	7, 8, 9	1316.5
1	18, 19	1319.0
1	20	1320.0
1	21	1321.0



THE STEPPES AT PARK VALLEY  
**PRELIMINARY GRADING PLAN**



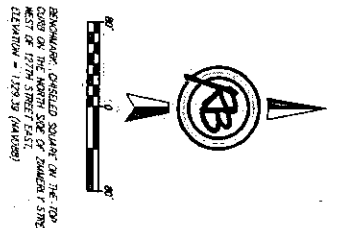
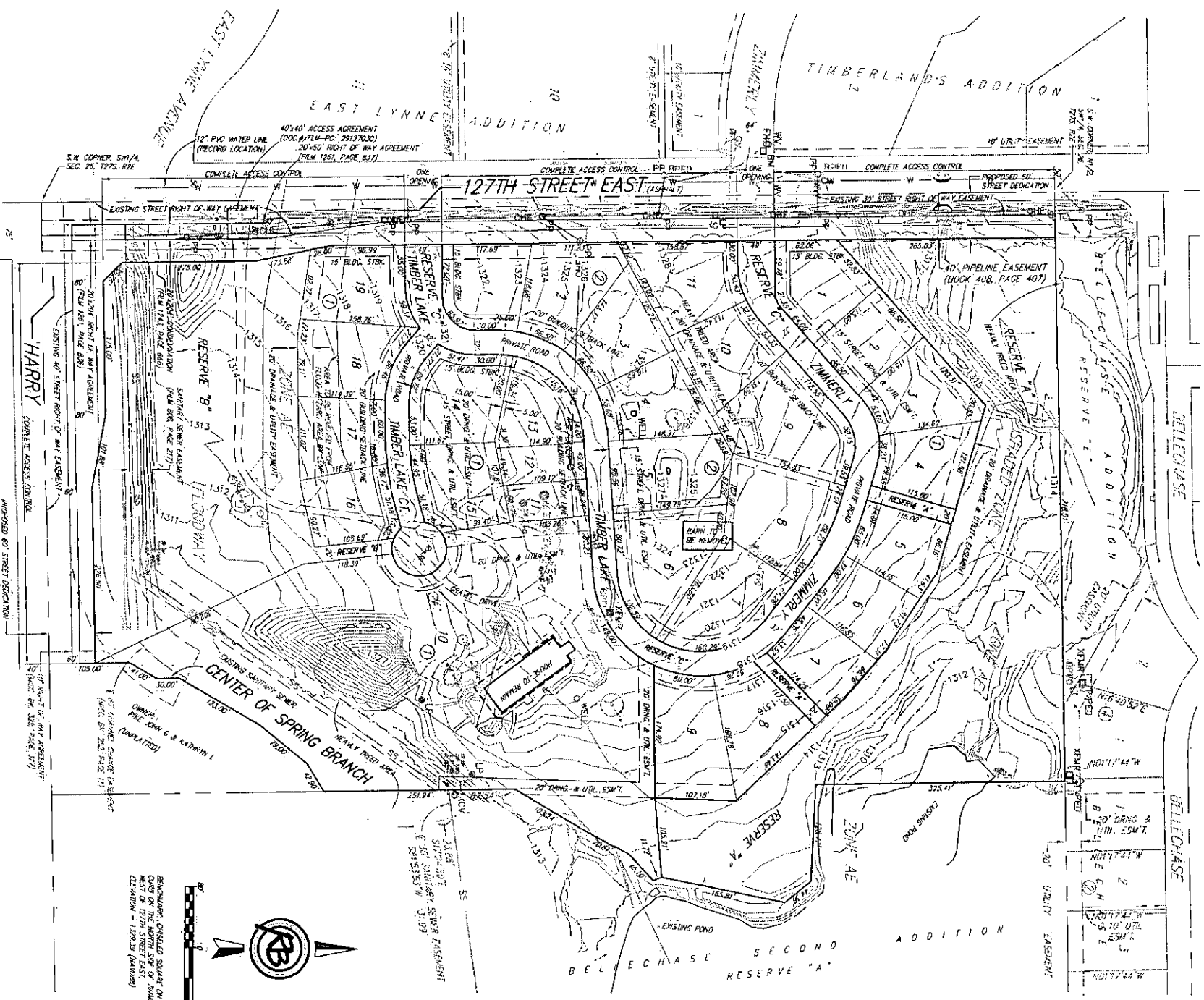
**RUGGLES BOHM**  
 ENGINEERING | SURVEYING | LANDSCAPE ARCHITECTURE | INTERIOR DESIGN  
 2110 12th St. NW, Suite 200, Grand Rapids, MI 49503  
 TEL: 616.451.1234 FAX: 616.451.1235 WWW.RUGGLESBOHM.COM

PROJECT NUMBER: 12708 NO. 1  
 DATE: May 27, 2014  
 SHEET: 1 OF 1

# Preliminary Plat

## THE STEPPES AT ARK VALLEY

### an Addition to Wichita, Sedgwick County, Kansas



REMARKS: CHECKED SQUARE ON THE 127th ST. ON THE NORTH SIDE OF ZIMMERLY STREET. DIMENSION = 129.33 (AS SHOWN)

**LEGAL DESCRIPTION:**

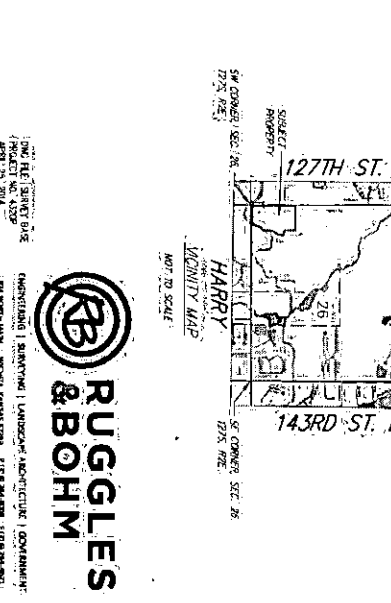
**Parcel 1:** A tract in the Southwest Quarter of Section 26, Township 27 South, Range 2 East of the 6th P.M., Sedgwick County, Kansas, described as beginning at a point on the West line of said Southwest Quarter, said point being 244 feet North of the Southwest corner thereof; thence East at right angles 400 feet; thence North at right angles 279.68 feet; thence with an angle to the right of 154 degrees 00' a distance of 81.7 feet; thence with an angle to the left of 90 degrees 00' a distance of 379.6 feet to a point 778.5 feet East of the West line of said Southwest Quarter; thence with an angle to the left of 64 degrees 20' and parallel with the West line of said Southwest Quarter a distance of 277.39 feet; thence with an angle to the left of 115 degrees 40' a distance of 499.76 feet; thence with an angle to the left of 80 degrees 00' a distance of 51 feet; thence with an angle to the right of 25 degrees 40' a distance of 111.57 feet; thence with an angle to the right of 90 degrees 00' a distance of 150 feet to the West line of said Southwest Quarter; thence South 90 feet to point of beginning.

**Parcel 2:** A tract in the Southwest Quarter of Section 26, Township 27 South, Range 2 East, described as: Beginning at the Southwest corner thereof; thence North along the West line of said Southwest Quarter, 244 feet; thence East at right angles, 400 feet; thence North at right angles, 279.68 feet; thence with an angle to the right of 154 degrees 00' a distance of 81.7 feet; thence with an angle to the left of 90 degrees 00' a distance of 379.6 feet to a point 778.5 feet East of the West line of said Southwest Quarter; thence with an angle to the left of 64 degrees 20' and parallel with the West line of said Southwest Quarter a distance of 277.39 feet; thence with an angle to the left of 115 degrees 40' a distance of 499.76 feet; thence with an angle to the left of 80 degrees 00' a distance of 51 feet; thence with an angle to the right of 25 degrees 40' a distance of 111.57 feet; thence with an angle to the right of 90 degrees 00' a distance of 150 feet to the West line of said Southwest Quarter; thence South 90 feet to point of beginning.

**Parcel 3:** The West 778.5 feet of the South Half of the Southwest Quarter of Section 26, Township 27 South, Range 2 East of the 6th P.M., Sedgwick County, Kansas, EXCEPT beginning at a point on the West line of said Southwest Quarter, said point being 244 feet North of the Southwest corner thereof; thence East at right angles, 400 feet; thence North at right angles, 279.68 feet; thence with an angle to the right of 154 degrees 00' a distance of 81.7 feet; thence with an angle to the left of 90 degrees 00' a distance of 379.6 feet to a point 778.5 feet East of the West line of said Southwest Quarter; thence with an angle to the left of 64 degrees 20' and parallel with the West line of said Southwest Quarter, a distance of 277.39 feet; thence with an angle to the left of 115 degrees 40' a distance of 499.76 feet; thence with an angle to the left of 80 degrees 00' a distance of 51 feet; thence with an angle to the right of 25 degrees 40' a distance of 111.57 feet; thence with an angle to the right of 90 degrees 00' a distance of 150 feet to the West line of said Southwest Quarter; thence South 90 feet to point of beginning.

**Parcel 4:** That part of the East 782 feet of the West 1540.3 feet of the South Half of the Southwest Quarter of Section 26, Township 27 South, Range 2 East of the 6th P.M., Sedgwick County, Kansas, described as: Commencing at the Southwest corner of said East 782 feet; thence North on the West line of said East 782 feet, with an assumed bearing of N00°12'58"W, a distance of 608.70 feet to the point of beginning; thence N00°12'58"W, a distance of 154.82 feet; thence S87°28'11"E, a distance of 128.77 feet; thence S38°46'30"E, a distance of 44.36 feet; thence S11°57'15"W, a distance of 165.81 feet; thence S2°41'53"E, a distance of 11.72 feet; thence S47°05'37"W, a distance of 46.10 feet; thence S79°18'36"W, a distance of 71.61 feet; thence S37°32'22"W, a distance of 103.23 feet to the point of beginning.

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
SS	SURVEY SINK (CITY OR MOBILE)	CP	CORNER IN RESERVE
ONE	OPEN END ELECTRIC (RESERVE)	CP	TRANSFORMER
CL	CABLE TELEPHONE (CITY OR MOBILE)	LP	POWER POLE (RESERVE)
DL	DOG LINE	LP	LIGHT POLE
W	WATER MAIN (CITY OR MOBILE)	SA	SURVEY SINK MARKER (CITY OR MOBILE)
FW	FIRE HYDRANT	DC	DISCONTINUED TREE (CITY OR MOBILE)
AW	WATER VALVE BOX	DC	DISCONTINUED TREE (CITY OR MOBILE)
SD	SEWER	DC	DISCONTINUED TREE (CITY OR MOBILE)
RD	RAILROAD		
RD	RAILROAD		



**RUGGLES & BOHM**  
 LAND SURVEYORS  
 1101 NORTH MAIN STREET, WICHITA, KANSAS 67202  
 PHONE: 620-261-1111  
 FAX: 620-261-1112



# **HYDROLOGIC OUTPUT**

Project: SteppesArkValley Simulation Run: Existing 002 Year

Start of Run: 01Jun2014, 00:00 Basin Model: Existing  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 002-yr  
Compute Time: 02Jun2014, 13:54:06 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.6000	241.7	01Jun2014, 12:56	1.66
North Basin	0.0165	13.7	01Jun2014, 12:14	1.55
Bellechase Pond	0.6165	225.8	01Jun2014, 13:12	1.66
South Basin	0.0159	13.0	01Jun2014, 12:16	1.62
Site Total	0.6324	228.1	01Jun2014, 13:12	1.66

Project: SteppesArkValley Simulation Run: Existing 005 Year

Start of Run: 01Jun2014, 00:00 Basin Model: Existing  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 005-yr  
Compute Time: 02Jun2014, 14:10:54 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.6000	365.8	01Jun2014, 12:56	2.46
North Basin	0.0165	21.0	01Jun2014, 12:12	2.36
Bellechase Pond	0.6165	348.6	01Jun2014, 13:08	2.45
South Basin	0.0159	19.8	01Jun2014, 12:14	2.44
Site Total	0.6324	352.1	01Jun2014, 13:08	2.45

Project: SteppesArkValley Simulation Run: Existing 010 Year

Start of Run: 01Jun2014, 00:00 Basin Model: Existing  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 010-yr  
Compute Time: 02Jun2014, 13:57:11 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.6000	443.6	01Jun2014, 12:54	2.96
North Basin	0.0165	25.7	01Jun2014, 12:12	2.87
Bellechase Pond	0.6165	423.7	01Jun2014, 13:08	2.95
South Basin	0.0159	24.0	01Jun2014, 12:14	2.96
Site Total	0.6324	427.9	01Jun2014, 13:08	2.95

Project: SteppesArkValley Simulation Run: Existing 025 Year

Start of Run: 01Jun2014, 00:00 Basin Model: Existing  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 025-yr  
Compute Time: 02Jun2014, 13:57:17 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.6000	576.7	01Jun2014, 12:54	3.83
North Basin	0.0165	33.5	01Jun2014, 12:12	3.74
Bellechase Pond	0.6165	553.4	01Jun2014, 13:06	3.82
South Basin	0.0159	31.2	01Jun2014, 12:14	3.84
Site Total	0.6324	559.0	01Jun2014, 13:06	3.82

Project: SteppesArkValley Simulation Run: Existing 100 year

Start of Run: 01Jun2014, 00:00 Basin Model: Existing  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 100-yr  
Compute Time: 02Jun2014, 13:54:12 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.6000	808.1	01Jun2014, 12:54	5.36
North Basin	0.0165	47.1	01Jun2014, 12:12	5.29
Bellechase Pond	0.6165	777.6	01Jun2014, 13:06	5.34
South Basin	0.0159	43.6	01Jun2014, 12:14	5.40
Site Total	0.6324	785.2	01Jun2014, 13:06	5.34

Project: SteppesArkValley

Simulation Run: Existing 100 year Reservoir: Bellechase Pond

Start of Run: 01Jun2014, 00:00 Basin Model: Existing  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 100-yr  
Compute Time: 02Jun2014, 13:54:12 Control Specifications: Control 1

Volume Units: IN

#### Computed Results

Peak Inflow :	817.8 (CFS)	Date/Time of Peak Inflow :	01Jun2014, 12:54
Peak Outflow :	777.6 (CFS)	Date/Time of Peak Outflow :	01Jun2014, 13:06
Total Inflow :	5.36 (IN)	Peak Storage :	15.4 (AC-FT)
Total Outflow :	5.34 (IN)	Peak Elevation :	1314.9 (FT)

Project: SteppesArkValley Simulation Run: Developed 002 Year

Start of Run: 01Jun2014, 00:00 Basin Model: Proposed  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 002-yr  
Compute Time: 02Jun2014, 13:53:40 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.600	241.7	01Jun2014, 12:56	1.66
North Developed	0.010	13.9	01Jun2014, 12:08	2.17
North Undisturbed	0.006	5.0	01Jun2014, 12:14	1.55
North	0.016	18.5	01Jun2014, 12:08	1.94
Bellechase Pond	0.616	230.4	01Jun2014, 13:10	1.60
South Undisturbed	0.010	8.3	01Jun2014, 12:14	1.55
South Developed	0.006	8.4	01Jun2014, 12:08	2.17
South	0.016	16.2	01Jun2014, 12:10	1.79
Site Total	0.632	232.6	01Jun2014, 13:08	1.60

Project: SteppesArkValley Simulation Run: Developed 005 Year

Start of Run: 01Jun2014, 00:00 Basin Model: Proposed  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 005-yr  
Compute Time: 02Jun2014, 14:10:49 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.600	365.8	01Jun2014, 12:56	2.46
North Developed	0.010	19.6	01Jun2014, 12:08	3.09
North Undisturbed	0.006	7.7	01Jun2014, 12:12	2.36
North	0.016	26.7	01Jun2014, 12:08	2.81
Bellechase Pond	0.616	351.9	01Jun2014, 13:06	2.39
South Undisturbed	0.010	12.8	01Jun2014, 12:12	2.36
South Developed	0.006	11.8	01Jun2014, 12:08	3.09
South	0.016	23.9	01Jun2014, 12:10	2.63
Site Total	0.632	355.2	01Jun2014, 13:06	2.40

Project: SteppesArkValley Simulation Run: Developed 010 year

Start of Run: 01Jun2014, 00:00 Basin Model: Proposed  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 010-yr  
Compute Time: 02Jun2014, 13:56:50 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.600	443.6	01Jun2014, 12:54	2.96
North Developed	0.010	23.0	01Jun2014, 12:08	3.65
North Undisturbed	0.006	9.3	01Jun2014, 12:12	2.87
North	0.016	31.7	01Jun2014, 12:08	3.35
Bellechase Pond	0.616	428.5	01Jun2014, 13:06	2.89
South Undisturbed	0.010	15.5	01Jun2014, 12:12	2.87
South Developed	0.006	13.8	01Jun2014, 12:08	3.65
South	0.016	28.7	01Jun2014, 12:10	3.16
Site Total	0.632	432.4	01Jun2014, 13:06	2.90

Project: SteppesArkValley Simulation Run: Developed 025 Year

Start of Run: 01Jun2014, 00:00 Basin Model: Proposed  
 End of Run: 02Jun2014, 00:02 Meteorologic Model: 025-yr  
 Compute Time: 02Jun2014, 13:56:58 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.600	576.7	01Jun2014, 12:54	3.83
North Developed	0.010	28.8	01Jun2014, 12:08	4.59
North Undisturbed	0.006	12.2	01Jun2014, 12:12	3.74
North	0.016	40.2	01Jun2014, 12:08	4.28
Bellechase Pond	0.616	558.6	01Jun2014, 13:06	3.76
South Undisturbed	0.010	20.3	01Jun2014, 12:12	3.74
South Developed	0.006	17.3	01Jun2014, 12:08	4.59
South	0.016	36.7	01Jun2014, 12:10	4.06
Site Total	0.632	563.6	01Jun2014, 13:04	3.76

Project: SteppesArkValley Simulation Run: Developed 100 Year

Start of Run: 01Jun2014, 00:00 Basin Model: Proposed  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 100-yr  
Compute Time: 02Jun2014, 13:53:58 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
North Offsite	0.600	808.1	01Jun2014, 12:54	5.36
North Developed	0.010	38.4	01Jun2014, 12:08	6.23
North Undisturbed	0.006	17.1	01Jun2014, 12:12	5.29
North	0.016	54.6	01Jun2014, 12:08	5.88
Bellechase Pond	0.616	784.5	01Jun2014, 13:04	5.28
South Undisturbed	0.010	28.6	01Jun2014, 12:12	5.29
South Developed	0.006	23.1	01Jun2014, 12:08	6.23
South	0.016	50.5	01Jun2014, 12:10	5.64
Site Total	0.632	791.3	01Jun2014, 13:04	5.29

Project: SteppesArkValley  
Simulation Run: Developed 100 Year Reservoir: Bellechase Pond  
Start of Run: 01Jun2014, 00:00 Basin Model: Proposed  
End of Run: 02Jun2014, 00:02 Meteorologic Model: 100-yr  
Compute Time: 02Jun2014, 13:53:58 Control Specifications: Control 1

Volume Units: IN

Computed Results

Peak Inflow :	816.4 (CFS)	Date/Time of Peak Inflow :	01Jun2014, 12:54
Peak Outflow :	784.5 (CFS)	Date/Time of Peak Outflow :	01Jun2014, 13:04
Total Inflow :	5.37 (IN)	Peak Storage :	16.1 (AC-FT)
Total Outflow :	5.28 (IN)	Peak Elevation :	1314.2 (FT)

# North End Water Quality Calcs

Area (Ac)	10.44
$R_{vu}$	0.04
$R_{vd}$	0.23
$R_{vi}$	0.95
$i$	0.31
$U$	0.38

table 4-13  
table 4-13  
table 4-13  
percent of impervious area /100  
percent of undisturbed or wooded area /100

Table 4-13. Volumetric Runoff Coefficients by Land Use and Hydrologic Soil Group

Land Use	Hydrologic Soil Group			
	A	B	C	D
Undisturbed Woods, Meadow or Ag. Land ( $R_{vu}$ )	0.02	0.03	0.04	0.05
Turf or Disturbed Soils ( $R_{vd}$ )	0.15	0.20	0.22	0.25
Impervious Cover ( $R_{vi}$ )	0.95	0.95	0.95	0.95

$R_{vu}$	0.04
$U$	0.38
$R_{vd}$	0.23
$D$	0.31
$R_{vi}$	0.95
$i$	0.31

$$R_v = R_{vu}U + R_{vd}D + R_{vi}i$$

volumetric runoff coefficient

$$R_v = 0.3810$$

$$WQV = \frac{PR_vA}{24}$$

water quality protection volume (acre-feet)

$P$	1.2
$R_v$	see above
$A$	see above

water quality rainfall depth (1.2 inches for Sedgwick County)

$$WQV = 0.3978 \text{ ac-ft}$$

(divide volume by two if permanent wet pond is used for detention)

$$Q_{wv} = \frac{PR_v}{24}$$

water quality protection volume (inches)

$P$	1.2
$R_v$	see above

water quality rainfall depth (1.2 inches for Sedgwick County)

$$Q_{wv} = 0.4572 \text{ inches}$$

$$CN = \frac{1000}{10 + 5P + 10Q_{wv} + 10(Q_{wv} + 2.25Q_{wv}P)^{0.5}}$$

$$CN = 89.99$$

curve number

$$S = \frac{1000}{CN} - 10$$

$$S = 1.11 \text{ inch}$$

$$t_s = 0.25 \text{ hr}$$

$$t_s = 0.222 \text{ inch}$$

$$= 0.1854$$

$$q_p = 700$$

from figure 4-6 using 15 min  $T_c$

$$Q_{wp} = q_p \cdot A \cdot C_{wp}$$

$$Q_{wp} = 5.22 \text{ cfs}$$

water quality peak flow

Table 4-4. Average Imperviousness per Land Use (Source NRCS, TR-55)

Land Use	Average % Impervious
<b>Urban Districts:</b>	
Commercial and business	85%
Industrial	72%
<b>Residential districts by average lot size:</b>	
1/8 acre or less (town house)	65%
1/4 acre	38%
1/3 acre	30%
1/2 acre	25%
1 acre	20%
2 acres	12%

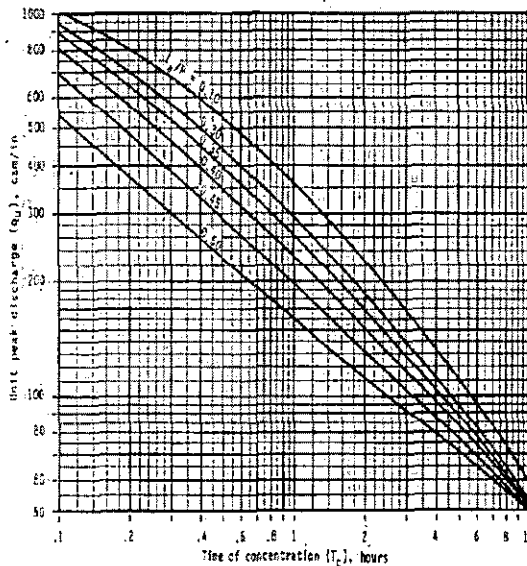


Figure 4-6 SCS Type II Unit Peak Discharge Graph

# Full Site Channel Protection Volume

Area (Ac)	20.79
$R_{vU}$	0.04 table 4-13
$R_{vD}$	0.23 table 4-13
$R_{vI}$	0.95 table 4-13
I	0.25 percent of impervious area /100
U	0.5 percent of undisturbed or wooded area /100

Table 4-13 Volumetric Runoff Coefficients by Land Use and Hydrologic Soil Group

Land Use	Hydrologic Soil Group			
	A	B	C	D
Undisturbed Woods, Meadow or Ag Land (R <sub>vU</sub> )	0.02	0.03	0.04	0.05
Turf or Disturbed Soils (R <sub>vD</sub> )	0.15	0.20	0.22	0.25
Impervious Cover (R <sub>vI</sub> )	0.95	0.95	0.95	0.95

$R_{vU} = 0.04$   
 $U = 0.5$   
 $R_{vD} = 0.23$   
 $D = 0.25$   
 $R_{vI} = 0.95$   
 $I = 0.25$

$$R_v = R_{vU}U + R_{vD}D + R_{vI}I$$

volumetric runoff coefficient

$R_v = 0.315$

$WQ_v = PR_vA$  water quality protection volume (acre-feet)  
12

$P = 1.2$  water quality rainfall depth (1.2 inches for Sedgwick County)  
 $R_v$  see above  
 $A$  see above

$WQ_v = 0.65$  ac-ft (divide volume by two if permanent wet pond is used for detention)

$Q_{wv} = PR_v$  water quality protection volume (inches)

$P = 1.2$  water quality rainfall depth (1.2 inches for Sedgwick County)  
 $R_v$  see above

$Q_{wv} = 0.38$  inches

$$CN = \frac{1000}{10 + 5P + 10Q_{wv}} = \frac{1000}{10 + 5(1.2) + 10(0.38)} = 88$$

$CN = 88$  curve number

$$S = \frac{1000}{CN} - 10 = 10.45$$

$$S = 1.35$$
 inch

$$I_a = 0.25$$

$$I_a = 0.27$$
 inch

$$I_a = 0.2258$$

$q_p = 700$  from figure 4-6 using 15 min T<sub>c</sub>

$$Q_{wq} = q_p \cdot A \cdot Q_{wv}$$

$Q_{wq} = 8.60$  cfs water quality peak flow

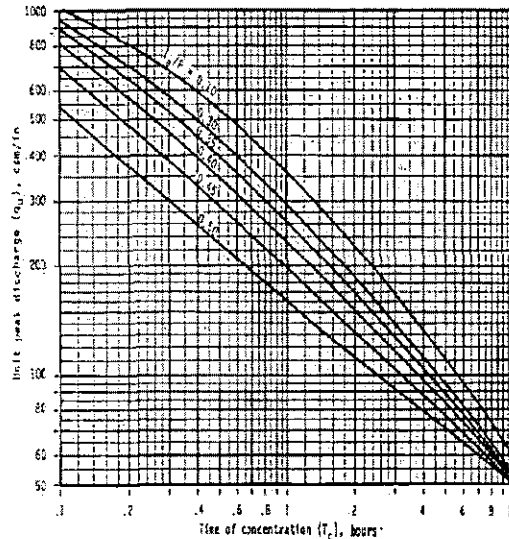


Figure 4-6 SCS Type II Unit Peak Discharge Graph

$$Q = \frac{P - I_a}{(P - I_a) + S} \cdot (P - I_a)^{0.484} \cdot S^{0.716} \cdot A$$

rainfall excess for 1 year, 24 hour rainfall

$P = 2.8$  inch 2.8 inches (the 1 year, 24 hour rainfall)  
 $CN$  see above  
 $S = 2.2$  inch  
 $I_a$  see above  
 $T_c = 15$  min  
 $A$  see above

$$Q = 1.35$$
 inch

$q_p/q = 0.025$  from figure 4-17 using T=24 hr - (this is going to be very close to the same value for every situation)

$$V_1/V_2 = 0.682 + 1.43(q_p/q) + 1.64(q_p/q)^2 + 0.804(q_p/q)^3$$

$$V_1/V_2 = 0.647$$

$$V_2 = \frac{V_1 \cdot Q_{wq}}{Q} = 12$$

required storage volume acre-feet

$CP_v$  for Q = (see above) inches

$$V_2 = 1.52$$
 acre-feet