Drainage Calculation

New spring Church

To City of Wichita, KS

June 2009

516 S. Market
Wichita, Kansas 67202
(316) 264-0242

Drainage Calculation

Introduction

The New Spring Church is located on the Northeast corner of K-96 and 21st Street, about 1/2 mile east of Greenwich road. The property is currently platted, partially developed and is zoned as Single family (SF-5). The tract of land is about 37.2 acres total.

The land currently has a building and parking lots around it and is used for the church facility. There are two existing ponds, one on Southeast and another on southwest corner of the property. Both the ponds drain water to the existing K-96 ditch on south side. About 17.2 acres of area drains to the pond on Southwest of property and rest to the pond on Southeast.

Most of the area of the proposed .addition of building and parking lot on north of existing building will drain to the pond on Southwest corner of the property. There is 24" RCP culvert as outfall structure. Attached drainage plan shows the drainage pattern.

The area draining to Southwest pond dictates 100 year peak runoff of 40.9 cfs in undeveloped and 60.7 cfs in developed condition. The existing detention pond of 1.37 acres on Southwest corner of the property will be able to detain the excess water from the property.

The Existing pond was also modeled for 2, 5, 10, 25 yr runoff and found to be able to detain the excess water coming out of the proposed developments.

Summary of Drainage Calculation:

Time of concentration and runoff coefficient

Area	Max Elevn	Min Elevn	Flow Length(L)	Rational Runoff Coefficients(C)					Time of Concentration, Mins
				2 year	5 year	10-yr	25-yr	100 year	
Pre Developed									
Draining to pond on southwest	1390.5	1378.5	1037' Mixed flow	0.30	0.35	0.45	0.52	0.65	57
Post Developed (Single family Residential)									
Draining to pond on southwest	1390.5	1381	594' Mixed flow	0.41	0.45	0.54	0.64	0.71	32

Pre and Post developed runoff

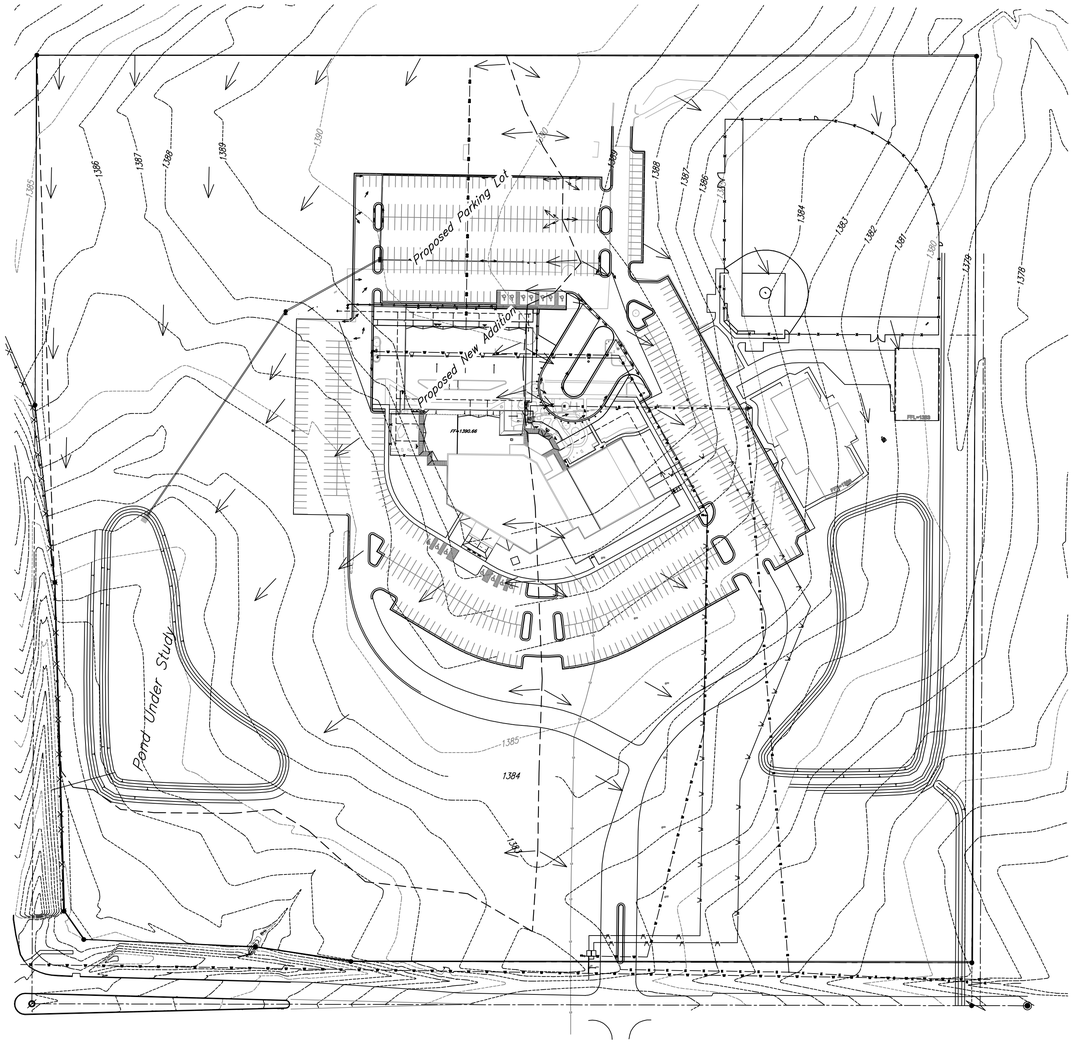
Runoff, cfs	2-yr	5-yr	10-yr	25-yr	100 yr
Pre Developed					
Runoff, Q	8.63	12.76	19.09	26.32	40.99
Post Developed (Single family Residential)					
Runoff, Q in to the pond	17.16	23.01	32.37	44.46	60.75
Post Developed (Single family Residential)					
Runoff, Q out of the pond	5.23	6.99	9.95	13.58	17.11
Available Free Board, ft					
	3.01	2.83	2.55	2.20	1.72

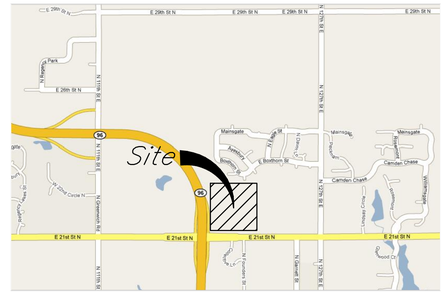
Note:

Existing and proposed site conditions have been modeled using the rational method. The Values for Rainfall Intensity and Runoff Coefficients were established using the *Drainage and Storm Sewer Policy for Design Criteria and Documentation, City of Wichita, Kansas.* A time of concentration of 15 minutes was used as it is the minimum inlet time. A proposed time of concentration of 15 minutes was also used.

Attachment:

Drainage Plan
Hydrological Analysis





LOCATION MAP
(For Visual Use Only)

Benchmark:
Greenwich and 21st Street North. Disc 41' South and 58' West of iron center lane both, 14.2' East of face P.P. 17.0' West of face P.P.

Elev. = 1361.38 (City Datum)

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

New Spring Church
Drainage Plan
Wichita, Kansas

kemiller engineering
516 S. Market,
Wichita, KS 67202
316/264-0242

PROJECT NUMBER			
KEM NO. 09044	FILE drainage	DATE 06/2009	SHEET 1
DESIGN KM	DRAWN GP	REVISED	OF 1

Summary for Reach Reach 1: Before Development

Before Development

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[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.160 ac, Inflow Depth = 0.50" for 2-Year event
Inflow = 8.63 cfs @ 0.97 hrs, Volume= 0.710 af
Outflow = 8.63 cfs @ 0.97 hrs, Volume= 0.710 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.25 hrs

Summary for Pond Pond 1: Storage Pond

Inflow Area = 17.160 ac, Inflow Depth = 0.56" for 2-Year event
Inflow = 17.20 cfs @ 0.52 hrs, Volume= 0.797 af
Outflow = 5.23 cfs @ 0.91 hrs, Volume= 0.730 af, Atten= 70%, Lag= 23.4 min
Primary = 5.23 cfs @ 0.91 hrs, Volume= 0.730 af

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.10 hrs
Peak Elev= 1,377.99' @ 0.91 hrs Surf.Area= 45,950 sf Storage= 24,918 cf

Plug-Flow detention time= 64.6 min calculated for 0.730 af (92% of inflow)
Center-of-Mass det. time= 62.5 min (94.6 - 32.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,377.00'	184,641 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,377.00	4,541	0	0
1,378.00	46,494	25,518	25,518
1,379.00	50,803	48,649	74,166
1,380.00	55,212	53,008	127,174
1,381.00	59,722	57,467	184,641

Device	Routing	Invert	Outlet Devices
#1	Primary	1,377.00'	**24.0" x 95.0' long Culvert** RCP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,376.05' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished

Primary OutFlow Max=5.21 cfs @ 0.91 hrs HW=1,377.99' (Free Discharge)
↳**1=Culvert** (Inlet Controls 5.21 cfs @ 3.38 fps)

Summary for Reach Reach 1: Before Development

Before Development

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[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.160 ac, Inflow Depth = 0.73" for 5-Year event
Inflow = 12.76 cfs @ 0.97 hrs, Volume= 1.051 af
Outflow = 12.76 cfs @ 0.97 hrs, Volume= 1.051 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.25 hrs

Summary for Pond Pond 1: Storage Pond

Inflow Area = 17.160 ac, Inflow Depth = 0.75" for 5-Year event
Inflow = 23.01 cfs @ 0.52 hrs, Volume= 1.066 af
Outflow = 6.99 cfs @ 0.91 hrs, Volume= 0.981 af, Atten= 70%, Lag= 23.4 min
Primary = 6.99 cfs @ 0.91 hrs, Volume= 0.981 af

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.10 hrs
Peak Elev= 1,378.17' @ 0.91 hrs Surf.Area= 47,210 sf Storage= 33,301 cf

Plug-Flow detention time= 61.7 min calculated for 0.957 af (90% of inflow)
Center-of-Mass det. time= 62.7 min (94.7 - 32.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,377.00'	184,641 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,377.00	4,541	0	0
1,378.00	46,494	25,518	25,518
1,379.00	50,803	48,649	74,166
1,380.00	55,212	53,008	127,174
1,381.00	59,722	57,467	184,641

Device	Routing	Invert	Outlet Devices
#1	Primary	1,377.00'	**24.0" x 95.0' long Culvert** RCP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,376.05' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished

Primary OutFlow Max=6.97 cfs @ 0.91 hrs HW=1,378.16' (Free Discharge)
↳**1=Culvert** (Inlet Controls 6.97 cfs @ 3.67 fps)

Summary for Reach Reach 1: Before Development

Before Development

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[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.160 ac, Inflow Depth = 1.10" for 10-Year event
Inflow = 19.09 cfs @ 0.97 hrs, Volume= 1.572 af
Outflow = 19.09 cfs @ 0.97 hrs, Volume= 1.572 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.25 hrs

Summary for Pond Pond 1: Storage Pond

Inflow Area = 17.160 ac, Inflow Depth = 1.05" for 10-Year event
Inflow = 32.37 cfs @ 0.52 hrs, Volume= 1.500 af
Outflow = 9.95 cfs @ 0.91 hrs, Volume= 1.386 af, Atten= 69%, Lag= 23.3 min
Primary = 9.95 cfs @ 0.91 hrs, Volume= 1.386 af

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.10 hrs
Peak Elev= 1,378.45' @ 0.91 hrs Surf.Area= 48,414 sf Storage= 46,664 cf

Plug-Flow detention time= 64.5 min calculated for 1.386 af (92% of inflow)
Center-of-Mass det. time= 62.6 min (94.7 - 32.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,377.00'	184,641 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,377.00	4,541	0	0
1,378.00	46,494	25,518	25,518
1,379.00	50,803	48,649	74,166
1,380.00	55,212	53,008	127,174
1,381.00	59,722	57,467	184,641

Device	Routing	Invert	Outlet Devices
#1	Primary	1,377.00'	**24.0" x 95.0' long Culvert** RCP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,376.05' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished

Primary OutFlow Max=9.93 cfs @ 0.91 hrs HW=1,378.44' (Free Discharge)
↳**1=Culvert** (Inlet Controls 9.93 cfs @ 4.09 fps)

Summary for Reach Reach 1: Before Development

Before Development

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[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.160 ac, Inflow Depth = 1.51" for 25-Year event
Inflow = 26.32 cfs @ 0.97 hrs, Volume= 2.166 af
Outflow = 26.32 cfs @ 0.97 hrs, Volume= 2.166 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.25 hrs

Summary for Pond Pond 1: Storage Pond

Inflow Area = 17.160 ac, Inflow Depth = 1.44" for 25-Year event
Inflow = 44.46 cfs @ 0.52 hrs, Volume= 2.060 af
Outflow = 13.58 cfs @ 0.91 hrs, Volume= 1.910 af, Atten= 69%, Lag= 23.3 min
Primary = 13.58 cfs @ 0.91 hrs, Volume= 1.910 af

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.10 hrs
Peak Elev= 1,378.80' @ 0.91 hrs Surf.Area= 49,933 sf Storage= 63,991 cf

Plug-Flow detention time= 61.5 min calculated for 1.863 af (90% of inflow)
Center-of-Mass det. time= 62.6 min (94.6 - 32.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,377.00'	184,641 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,377.00	4,541	0	0
1,378.00	46,494	25,518	25,518
1,379.00	50,803	48,649	74,166
1,380.00	55,212	53,008	127,174
1,381.00	59,722	57,467	184,641

Device	Routing	Invert	Outlet Devices
#1	Primary	1,377.00'	**24.0" x 95.0' long Culvert** RCP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,376.05' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished

Primary OutFlow Max=13.55 cfs @ 0.91 hrs HW=1,378.79' (Free Discharge)
↳**1=Culvert** (Inlet Controls 13.55 cfs @ 4.56 fps)

Summary for Reach Reach 1: Before Development

Before Development

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[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.160 ac, Inflow Depth = 2.36" for 100-Year event
Inflow = 40.99 cfs @ 0.97 hrs, Volume= 3.375 af
Outflow = 40.99 cfs @ 0.97 hrs, Volume= 3.375 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.25 hrs

Summary for Pond Pond 1: Storage Pond

Inflow Area = 17.160 ac, Inflow Depth = 1.97" for 100-Year event
Inflow = 60.75 cfs @ 0.52 hrs, Volume= 2.815 af
Outflow = 17.11 cfs @ 0.92 hrs, Volume= 2.608 af, Atten= 72%, Lag= 24.0 min
Primary = 17.11 cfs @ 0.92 hrs, Volume= 2.608 af

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.10 hrs
Peak Elev= 1,379.28' @ 0.92 hrs Surf.Area= 52,038 sf Storage= 88,569 cf

Plug-Flow detention time= 66.0 min calculated for 2.608 af (93% of inflow)
Center-of-Mass det. time= 64.1 min (96.2 - 32.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,377.00'	184,641 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,377.00	4,541	0	0
1,378.00	46,494	25,518	25,518
1,379.00	50,803	48,649	74,166
1,380.00	55,212	53,008	127,174
1,381.00	59,722	57,467	184,641

Device	Routing	Invert	Outlet Devices
#1	Primary	1,377.00'	**24.0" x 95.0' long Culvert** RCP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,376.05' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished

Primary OutFlow Max=17.06 cfs @ 0.92 hrs HW=1,379.27' (Free Discharge)
↳**1=Culvert** (Inlet Controls 17.06 cfs @ 5.43 fps)