McCLURE

February 21, 2020
Updated April 1, 2020

Mr. Kent Monter
Development Review Manager
City of Lee's Summit
220 SE Green St
Lee's Summit, Missouri 64083

Re: Stormwater Calculations—Flex Facility Expansion on St Luke's East campus

Dear Mr. Monter:

We have performed the stormwater runoff calculations for the Flex Facility Expansion on the Saint Luke's hospital site on the southwest corner of Interstate 470 and Douglas Road.

Existing runoff patterns for the area in question drained northerly into storm sewers and bypassed the detention basin on-site. Proposed runoff patterns for the new building and adjacent areas are similar to the existing runoff patterns. The detention basin was initially designed so that the post-development flow was equal to or below the pre-development flow for the 25-year storm (per City of Lee's Summit design criteria at the time). The maximum release rate based on previous analysis was 142cfs, but the detention basin was designed with a peak outflow of 93.28cfs for the 25-year storm.

The attached Pondpack and CulvertMaster calculations are provided to show the effects of the increased impervious area on the site and the subsequent flows going toward the detention basin and the culvert immediately downstream on the northwest corner of the site (an 8' x 5' RCB heading north under Interstate-470).

The table below summarizes the flows before and after the parking lots are placed.

Flow Location--Pondpack Node Name (Hydrology)	Flow Case	Flows (cfs)			
		2-year	10-year	25-year	100-year
Undetained--"EX-DEV-UNDET2" (DA=12.49ac, CN=84, t_c =10min)	Existing	34.44	60.73	72.52	96.06
Undetained--"PRO-DEV-UNDET2" (DA=12.49ac, CN=85, t_c =10min)	Proposed	35.73	62.12	73.90	97.40
Detained--"EX-DEV-DET" (DA=26.32ac, CN=89, t_c =15min)	Existing	76.66	126.75	148.88	192.87
Detained--"PRO-DEV-DET" (DA=26.32ac, CN=89, t_c =15min)	Proposed	76.66	126.75	148.88	192.87
RCB Under Interstate 470	Existing	231.91	384.54		594.01
RCB Under Interstate 470	Proposed	233.20	385.93		595.35

All of the flow from the building addition will be captured via roof drains and storm sewers. None of the existing on-site storm sewer pipes will be effected as a result of the increased impervious area. The 25-year flow leaving the detention basin remains 97.35cfs, which is unchanged from the Surgicenter Expansion submittal in August of 2011.

Based on the timing of all of the flows going toward the downstream culvert, the 100-year flow remains unchanged at 595.35cfs. As the effects on amount of flow toward the culvert are unchanged, previous capacity analysis is included. The attached CulvertMaster output shows the 595.35cfs that would be heading to the 8' x 5' RCB to be well within the capacity of the culvert before it overtops (overtopping flow is 720cfs).

Please contact me if you should have questions about this letter.

SHAFER, KLINE & WARREN, INC.

By: Matt Eblen, P.E.
Senior Project Manager

Enclosure(s)

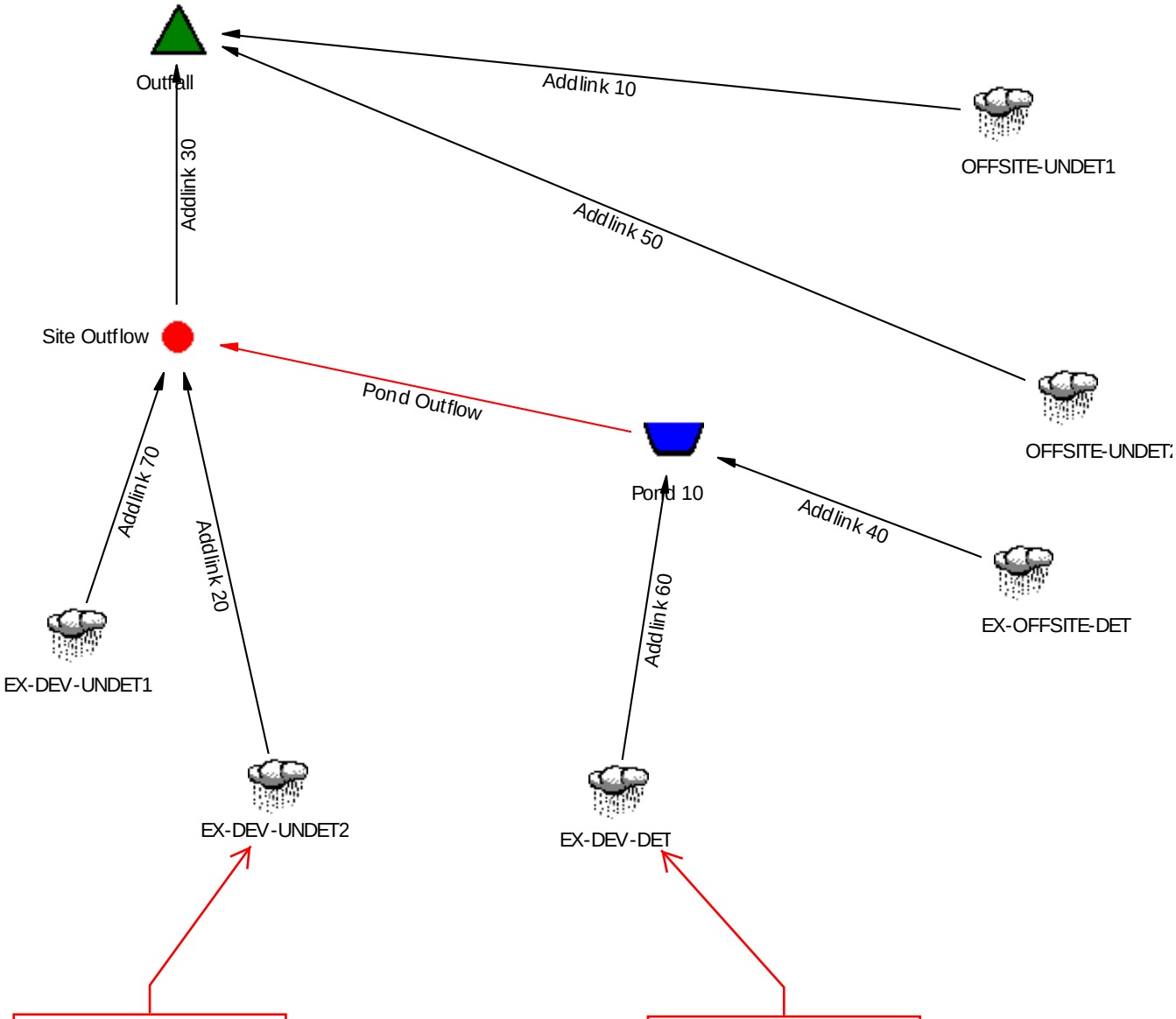
PONDPACK OUTPUT

SPECIFIC TO CURRENT CAMPUS AND WORK
RELATED TO PROPOSED FLEX FACILITY EXPANSION
(ANALYSIS LOOKED AT FLOWS FOR 2-, 5-,
10-, 25-, 50- & 100-YEAR STORM EVENTS)

This work was done in 2013 as part of the Radiation/Oncology/Urology addition

1700 Swift Ave., Suite 100, North Kansas City, MO 64116

EXISTING CONDITIONS



DA = 12.49 acres
CN = 84
Tc = 10 minutes
Effected Subbasin

DA = 26.32 acres
CN = 87
Tc = 15 minutes

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
EX-DEV-UNDET2	KC-ALL - Synthetic Curve, 2 yrs	2	2.105	12.000	34.44
EX-DEV-UNDET2	KC-ALL - Synthetic Curve, 5 yrs	5	3.025	12.000	48.97
EX-DEV-UNDET2	KC-ALL - Synthetic Curve, 10 yrs	10	3.787	12.000	60.73
EX-DEV-UNDET2	KC-ALL - Synthetic Curve, 25 yrs	25	4.563	12.000	72.52
EX-DEV-UNDET2	KC-ALL - Synthetic Curve, 50 yrs	50	5.251	12.000	82.83
EX-DEV-UNDET2	KC-ALL - Synthetic Curve, 100 yrs	100	6.144	12.000	96.06
EX-DEV-DET	KC-ALL - Synthetic Curve, 2 yrs	2	5.373	12.050	76.66
EX-DEV-DET	KC-ALL - Synthetic Curve, 5 yrs	5	7.436	12.050	104.52
EX-DEV-DET	KC-ALL - Synthetic Curve, 10 yrs	10	9.115	12.050	126.75
EX-DEV-DET	KC-ALL - Synthetic Curve, 25 yrs	25	10.812	12.050	148.89
EX-DEV-DET	KC-ALL - Synthetic Curve, 50 yrs	50	12.306	12.050	168.18
EX-DEV-DET	KC-ALL - Synthetic Curve, 100 yrs	100	14.236	12.050	192.88
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 2 yrs	2	5.789	12.100	73.82
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 5 yrs	5	8.386	12.100	106.51
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 10 yrs	10	10.542	12.100	133.13
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 25 yrs	25	12.745	12.100	159.91
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 50 yrs	50	14.700	12.100	183.39
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 100 yrs	100	17.242	12.100	213.57
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 2 yrs	2	2.002	12.050	29.08
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 5 yrs	5	2.972	12.050	43.16
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 10 yrs	10	3.785	12.050	54.75
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 25 yrs	25	4.623	12.050	66.49
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 50 yrs	50	5.369	12.050	76.83
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 100 yrs	100	6.344	12.050	90.16

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 2 yrs	2	0.492	11.950	8.36
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 5 yrs	5	0.686	11.950	11.52
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 10 yrs	10	0.844	11.950	14.05
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 25 yrs	25	1.004	11.950	16.57
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 50 yrs	50	1.145	11.950	18.76
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 100 yrs	100	1.328	11.950	21.58
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 2 yrs	2	0.880	12.050	12.75
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 5 yrs	5	1.255	12.050	18.01
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 10 yrs	10	1.564	12.050	22.26
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 25 yrs	25	1.879	12.050	26.51
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 50 yrs	50	2.157	12.050	30.23
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 100 yrs	100	2.519	12.050	34.99

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Site Outflow	KC-ALL - Synthetic Curve, 2 yrs	2	8.850	12.000	108.48
Site Outflow	KC-ALL - Synthetic Curve, 5 yrs	5	12.402	12.000	135.14
Site Outflow	KC-ALL - Synthetic Curve, 10 yrs	10	15.311	12.000	154.83
Site Outflow	KC-ALL - Synthetic Curve, 25 yrs	25	18.258	12.000	173.68
Site Outflow	KC-ALL - Synthetic Curve, 50 yrs	50	20.859	12.000	189.59
Site Outflow	KC-ALL - Synthetic Curve, 100 yrs	100	24.227	12.000	209.64
Outfall	KC-ALL - Synthetic Curve, 2 yrs	2	16.641	12.050	209.26
Outfall	KC-ALL - Synthetic Curve, 5 yrs	5	23.760	12.050	280.97
Outfall	KC-ALL - Synthetic Curve, 10 yrs	10	29.639	12.050	337.37

Subsection: Master Network Summary

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Outfall	KC-ALL - Synthetic Curve, 25 yrs	25	35.625	12.050	393.11
Outfall	KC-ALL - Synthetic Curve, 50 yrs	50	40.929	12.050	441.71
Outfall	KC-ALL - Synthetic Curve, 100 yrs	100	47.813	12.050	503.65

Pond Summary

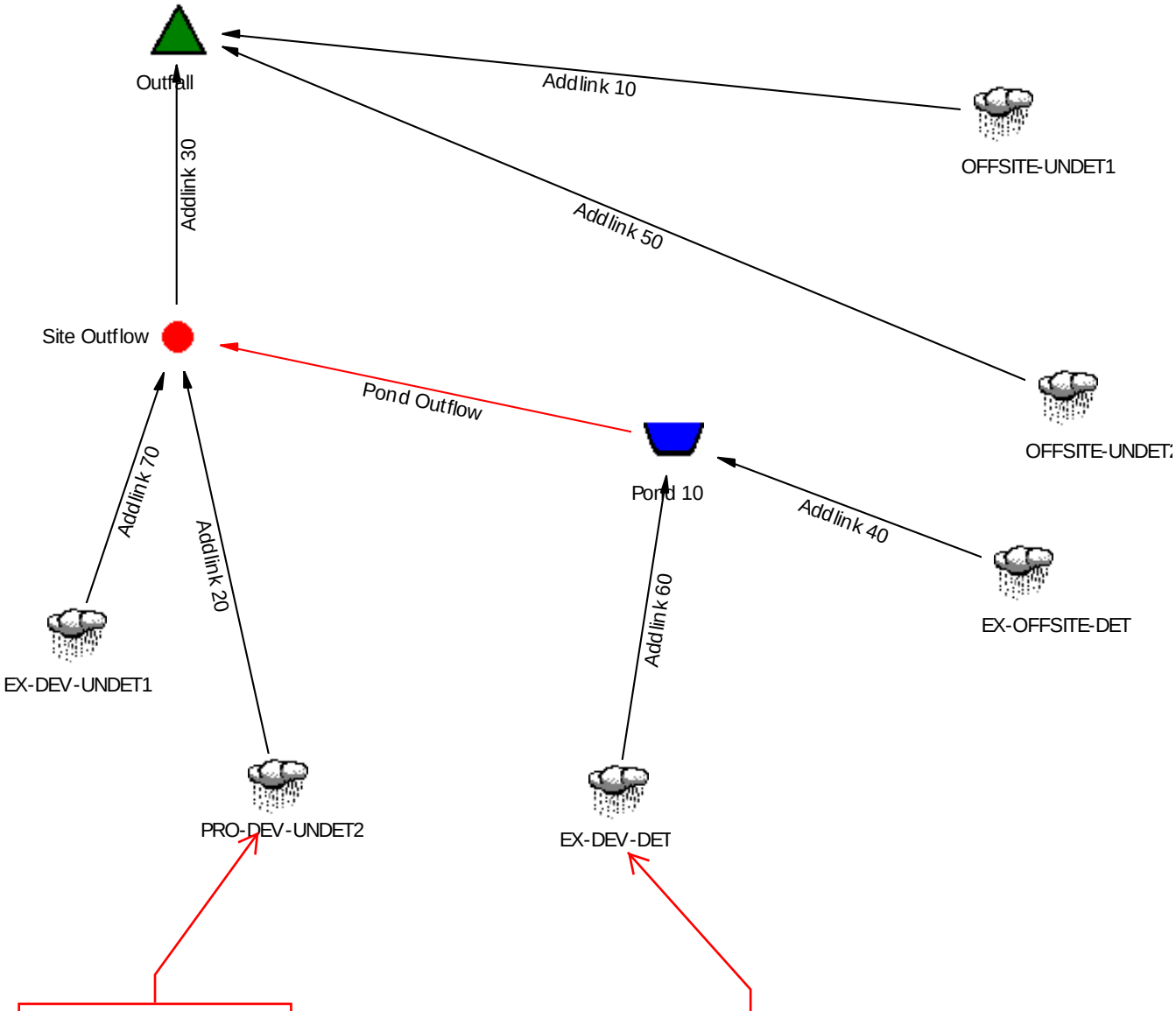
Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Pond 10 (IN)	KC-ALL - Synthetic Curve, 2 yrs	2	6.253	12.050	89.41	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 2 yrs	2	6.253	12.150	72.69	966.16	0.356
Pond 10 (IN)	KC-ALL - Synthetic Curve, 5 yrs	5	8.691	12.050	122.53	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 5 yrs	5	8.691	12.150	84.27	967.76	0.821
Pond 10 (IN)	KC-ALL - Synthetic Curve, 10 yrs	10	10.680	12.050	149.01	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 10 yrs	10	10.680	12.200	91.13	968.82	1.275
Pond 10 (IN)	KC-ALL - Synthetic Curve, 25 yrs	25	12.691	12.050	175.40	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 25 yrs	25	12.691	12.200	97.35	969.85	1.798
Pond 10 (IN)	KC-ALL - Synthetic Curve, 50 yrs	50	14.463	12.050	198.40	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 50 yrs	50	14.463	12.200	101.98	970.66	2.283
Pond 10 (IN)	KC-ALL - Synthetic Curve, 100 yrs	100	16.755	12.050	227.87	(N/A)	(N/A)

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 100 yrs	100	16.755	12.200	140.86	971.30	2.724

PROPOSED CONDITIONS



DA = 12.49 acres
CN = 85
Tc = 10 minutes
Effected Subbasin

DA = 26.32 acres
CN = 87
Tc = 15 minutes

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 2 yrs	2	2.190	12.000	35.73	+1.29
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 5 yrs	5	3.123	12.000	50.34	
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 10 yrs	10	3.892	12.000	62.12	+1.39
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 25 yrs	25	4.675	12.000	73.90	
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 50 yrs	50	5.368	12.000	84.20	
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 100 yrs	100	6.266	12.000	97.40	+1.34
EX-DEV-DET	KC-ALL - Synthetic Curve, 2 yrs	2	5.373	12.050	76.66	
EX-DEV-DET	KC-ALL - Synthetic Curve, 5 yrs	5	7.436	12.050	104.52	
EX-DEV-DET	KC-ALL - Synthetic Curve, 10 yrs	10	9.115	12.050	126.75	
EX-DEV-DET	KC-ALL - Synthetic Curve, 25 yrs	25	10.812	12.050	148.89	
EX-DEV-DET	KC-ALL - Synthetic Curve, 50 yrs	50	12.306	12.050	168.18	
EX-DEV-DET	KC-ALL - Synthetic Curve, 100 yrs	100	14.236	12.050	192.88	
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 2 yrs	2	5.789	12.100	73.82	
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 5 yrs	5	8.386	12.100	106.51	
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 10 yrs	10	10.542	12.100	133.13	
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OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 5 yrs	5	2.972	12.050	43.16	
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 10 yrs	10	3.785	12.050	54.75	
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 25 yrs	25	4.623	12.050	66.49	
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 50 yrs	50	5.369	12.050	76.83	
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 100 yrs	100	6.344	12.050	90.16	

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EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 2 yrs	2	0.492	11.950	8.36
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 5 yrs	5	0.686	11.950	11.52
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 10 yrs	10	0.844	11.950	14.05
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 25 yrs	25	1.004	11.950	16.57
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 50 yrs	50	1.145	11.950	18.76
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 100 yrs	100	1.328	11.950	21.58
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 2 yrs	2	0.880	12.050	12.75
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 5 yrs	5	1.255	12.050	18.01
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 10 yrs	10	1.564	12.050	22.26
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 25 yrs	25	1.879	12.050	26.51
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 50 yrs	50	2.157	12.050	30.23
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 100 yrs	100	2.519	12.050	34.99

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Site Outflow	KC-ALL - Synthetic Curve, 2 yrs	2	8.935	12.000	109.77
Site Outflow	KC-ALL - Synthetic Curve, 5 yrs	5	12.500	12.000	136.50
Site Outflow	KC-ALL - Synthetic Curve, 10 yrs	10	15.416	12.000	156.22
Site Outflow	KC-ALL - Synthetic Curve, 25 yrs	25	18.370	12.000	175.06
Site Outflow	KC-ALL - Synthetic Curve, 50 yrs	50	20.976	12.000	190.96
Site Outflow	KC-ALL - Synthetic Curve, 100 yrs	100	24.349	12.000	210.98
Outfall	KC-ALL - Synthetic Curve, 2 yrs	2	16.726	12.050	210.33
Outfall	KC-ALL - Synthetic Curve, 5 yrs	5	23.858	12.050	282.09
Outfall	KC-ALL - Synthetic Curve, 10 yrs	10	29.744	12.050	338.50

Subsection: Master Network Summary

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Outfall	KC-ALL - Synthetic Curve, 25 yrs	25	35.737	12.050	394.23
Outfall	KC-ALL - Synthetic Curve, 50 yrs	50	41.045	12.050	442.82
Outfall	KC-ALL - Synthetic Curve, 100 yrs	100	47.935	12.050	504.73

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Pond 10 (IN)	KC-ALL - Synthetic Curve, 2 yrs	2	6.253	12.050	89.41	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 2 yrs	2	6.253	12.150	72.69	966.16	0.356
Pond 10 (IN)	KC-ALL - Synthetic Curve, 5 yrs	5	8.691	12.050	122.53	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 5 yrs	5	8.691	12.150	84.27	967.76	0.821
Pond 10 (IN)	KC-ALL - Synthetic Curve, 10 yrs	10	10.680	12.050	149.01	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 10 yrs	10	10.680	12.200	91.13	968.82	1.275
Pond 10 (IN)	KC-ALL - Synthetic Curve, 25 yrs	25	12.691	12.050	175.40	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 25 yrs	25	12.691	12.200	97.35	969.85	1.798
Pond 10 (IN)	KC-ALL - Synthetic Curve, 50 yrs	50	14.463	12.050	198.40	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 50 yrs	50	14.463	12.200	101.98	970.66	2.283
Pond 10 (IN)	KC-ALL - Synthetic Curve, 100 yrs	100	16.755	12.050	227.87	(N/A)	(N/A)

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 100 yrs	100	16.755	12.200	140.86	971.30	2.724

PONDPACK OUTPUT

SPECIFIC TO FLOW GOING TOWARD
8’ X 5’ RCB UNDER INTERSTATE 470
ANALYSIS LOOKED AT FLOW FOR 1-, 10-,
& 100-YEAR STORM EVENTS

This work was done in November 2016 as part of a parking expansion west of the current campus

1700 Swift Ave., Suite 100, North Kansas City, MO 64116

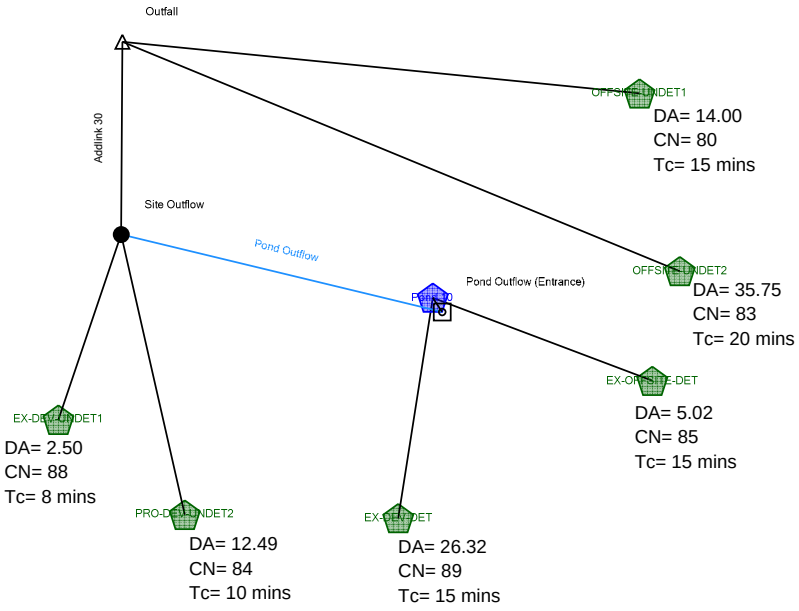
APPENDIX I

Pondpack Calculations (Site Storm Runoff)
&
CulvertMaster Calculations

NOTE: We noticed that all areas had not been accounted for in the finalizing outflows to the culvert under Interstate 470. The accompanying Pondpack schematics and calculation summaries in this report show all drainage areas associated with the current campus, proposed campus addition to the west and off-site areas to the east, south and west.

As shown in the CulvertMaster output, the culvert is still shown as being within capacity of the incoming flows.

Scenario: KC-ALL - Synthetic Curve, 100 yrs



Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 2 yrs	2	2.105	12.000	34.44
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 10 yrs	10	3.787	12.000	60.73
PRO-DEV-UNDET2	KC-ALL - Synthetic Curve, 100 yrs	100	6.144	12.000	96.06
EX-DEV-DET	KC-ALL - Synthetic Curve, 2 yrs	2	5.373	12.050	76.66
EX-DEV-DET	KC-ALL - Synthetic Curve, 10 yrs	10	9.115	12.050	126.75
EX-DEV-DET	KC-ALL - Synthetic Curve, 100 yrs	100	14.236	12.050	192.88
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 2 yrs	2	5.789	12.100	73.82
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 10 yrs	10	10.542	12.100	133.13
OFFSITE-UNDET2	KC-ALL - Synthetic Curve, 100 yrs	100	17.242	12.100	213.57
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 2 yrs	2	2.002	12.050	29.08
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 10 yrs	10	3.785	12.050	54.75
OFFSITE-UNDET1	KC-ALL - Synthetic Curve, 100 yrs	100	6.344	12.050	90.16
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 2 yrs	2	0.492	11.950	8.36
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 10 yrs	10	0.844	11.950	14.05
EX-DEV-UNDET1	KC-ALL - Synthetic Curve, 100 yrs	100	1.328	11.950	21.58
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 2 yrs	2	0.880	12.050	12.75
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 10 yrs	10	1.564	12.050	22.26
EX-OFFSITE-DET	KC-ALL - Synthetic Curve, 100 yrs	100	2.519	12.050	34.99

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Site Outflow	KC-ALL - Synthetic Curve, 2 yrs	2	8.850	12.000	108.48
Site Outflow	KC-ALL - Synthetic Curve, 10 yrs	10	15.311	12.000	154.83
Site Outflow	KC-ALL - Synthetic Curve, 100 yrs	100	24.227	12.000	209.64

Subsection: Master Network Summary

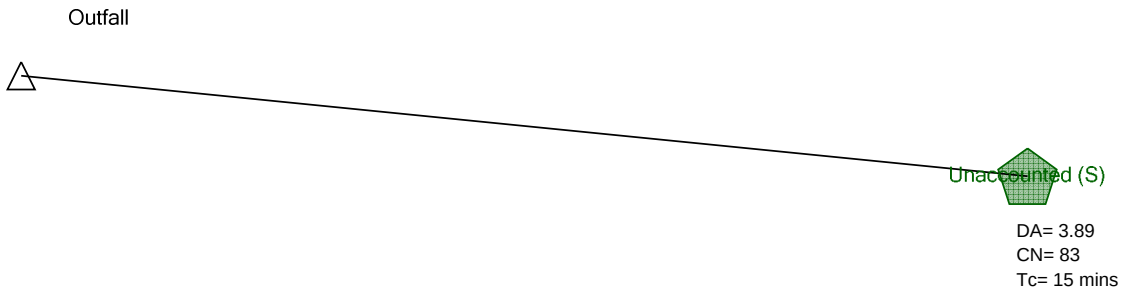
Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Outfall	KC-ALL - Synthetic Curve, 2 yrs	2	16.641	12.050	209.26
Outfall	KC-ALL - Synthetic Curve, 10 yrs	10	29.639	12.050	337.37
Outfall	KC-ALL - Synthetic Curve, 100 yrs	100	47.813	12.050	503.65

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Pond 10 (IN)	KC-ALL - Synthetic Curve, 2 yrs	2	6.253	12.050	89.41	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 2 yrs	2	6.253	12.150	72.69	966.16	0.356
Pond 10 (IN)	KC-ALL - Synthetic Curve, 10 yrs	10	10.680	12.050	149.01	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 10 yrs	10	10.680	12.200	91.13	968.82	1.275
Pond 10 (IN)	KC-ALL - Synthetic Curve, 100 yrs	100	16.755	12.050	227.87	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 100 yrs	100	16.755	12.200	140.86	971.30	2.724

Scenario: KC-ALL - Synthetic Curve, 100 yrs



Subsection: Master Network Summary

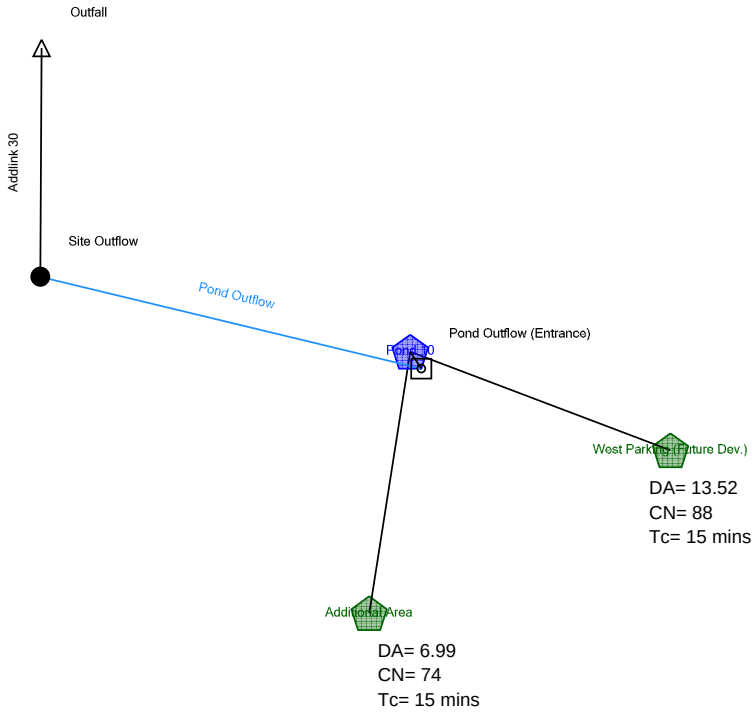
Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Unaccounted (S)	KC-ALL - Synthetic Curve, 2 yrs	2	0.630	12.050	9.15
Unaccounted (S)	KC-ALL - Synthetic Curve, 10 yrs	10	1.147	12.050	16.45
Unaccounted (S)	KC-ALL - Synthetic Curve, 100 yrs	100	1.876	12.050	26.33

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Outfall	KC-ALL - Synthetic Curve, 2 yrs	2	0.630	12.050	9.15
Outfall	KC-ALL - Synthetic Curve, 10 yrs	10	1.147	12.050	16.45
Outfall	KC-ALL - Synthetic Curve, 100 yrs	100	1.876	12.050	26.33

Scenario: KC-ALL - Synthetic Curve, 100 yrs



Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Additional Area	KC-ALL - Synthetic Curve, 2 yrs	2	0.763	12.050	10.85
Additional Area	KC-ALL - Synthetic Curve, 10 yrs	10	1.565	12.050	22.76
Additional Area	KC-ALL - Synthetic Curve, 100 yrs	100	2.765	12.050	39.96
West Parking (Future Dev.)	KC-ALL - Synthetic Curve, 2 yrs	2	2.659	12.050	38.13
West Parking (Future Dev.)	KC-ALL - Synthetic Curve, 10 yrs	10	4.563	12.050	63.88
West Parking (Future Dev.)	KC-ALL - Synthetic Curve, 100 yrs	100	7.180	12.050	97.96

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Site Outflow	KC-ALL - Synthetic Curve, 2 yrs	2	3.422	12.350	13.50
Site Outflow	KC-ALL - Synthetic Curve, 10 yrs	10	6.129	12.300	30.72
Site Outflow	KC-ALL - Synthetic Curve, 100 yrs	100	9.945	12.250	64.03
Outfall	KC-ALL - Synthetic Curve, 2 yrs	2	3.422	12.350	13.50
Outfall	KC-ALL - Synthetic Curve, 10 yrs	10	6.129	12.300	30.72
Outfall	KC-ALL - Synthetic Curve, 100 yrs	100	9.945	12.250	64.03

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Pond 10 (IN)	KC-ALL - Synthetic Curve, 2 yrs	2	3.422	12.050	48.99	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 2 yrs	2	3.422	12.350	13.50	960.69	1.309
Pond 10 (IN)	KC-ALL - Synthetic Curve, 10 yrs	10	6.129	12.050	86.63	(N/A)	(N/A)

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 10 yrs	10	6.129	12.300	30.72	962.13	2.255
Pond 10 (IN)	KC-ALL - Synthetic Curve, 100 yrs	100	9.945	12.050	137.91	(N/A)	(N/A)
Pond 10 (OUT)	KC-ALL - Synthetic Curve, 100 yrs	100	9.945	12.250	64.03	963.59	3.337

Culvert Designer/Analyzer Report
Culvert-1-8x5

Analysis Component			
Storm Event	Design	Discharge	595.35 cfs

Peak Discharge Method: User-Specified			
Design Discharge	595.35 cfs	Check Discharge	720.00 cfs

Tailwater properties: Irregular Channel

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	1+01	0.080
1+01	1+32	0.040
1+32	2+03	0.080

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	908.58
0+50	905.48
0+61	905.18
0+77	904.43
0+88	903.01
1+01	901.95
1+05	898.29
1+09	898.36
1+17	898.00
1+32	902.00
1+50	903.38
2+00	907.18
2+03	907.58

Tailwater conditions for Design Storm.			
Discharge	595.35 cfs	Actual Depth	5.20 ft
Velocity	4.35 ft/s		

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-8 x 5 ft Box	595.36 cfs	911.50 ft	16.80 ft/s
Weir	Roadway	0.00 cfs	911.50 ft	N/A
Total	----------	595.36 cfs	911.50 ft	N/A

Culvert Designer/Analyzer Report
Culvert-1-8x5

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	911.50	ft	Discharge	595.36	cfs
Inlet Control HW Elev.	911.50	ft	Tailwater Elevation	903.20	ft
Outlet Control HW Elev.	910.16	ft	Control Type	Inlet Control	
Headwater Depth/Height	2.30				

Grades					
Upstream Invert	900.00	ft	Downstream Invert	898.50	ft
Length	150.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	4.43	ft
Slope Type	Steep		Normal Depth	4.08	ft
Flow Regime	Supercritical		Critical Depth	5.00	ft
Velocity Downstream	16.80	ft/s	Critical Slope	0.009548	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	8.00	ft
Section Size	8 x 5 ft		Rise	5.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	910.16	ft	Upstream Velocity Head	3.44	ft
Ke	0.50		Entrance Loss	1.72	ft

Inlet Control Properties					
Inlet Control HW Elev.	911.50	ft	Flow Control	Submerged	
Inlet Type	45° non-offset wingwall flares		Area Full	40.0	ft²
K	0.49700		HDS 5 Chart	12	
M	0.66700		HDS 5 Scale	1	
C	0.03390		Equation Form	2	
Y	0.80300				

Culvert Designer/Analyzer Report
Culvert-1-8x5

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	911.50	ft
Roadway Width	100.00	ft	Overtopping Coefficient	2.90	US
Low Point	915.00	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	903.20	ft			

Sta (ft)	Elev. (ft)
0.00	917.08
50.00	916.04
100.00	915.38
117.53	915.00
150.00	915.50
200.00	916.00
250.00	916.87

Culvert Designer/Analyzer Report
Culvert-1-8x5

Analysis Component			
Storm Event	Check	Discharge	720.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	595.35 cfs	Check Discharge	720.00 cfs

Tailwater properties: Irregular Channel

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	1+01	0.080
1+01	1+32	0.040
1+32	2+03	0.080

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	908.58
0+50	905.48
0+61	905.18
0+77	904.43
0+88	903.01
1+01	901.95
1+05	898.29
1+09	898.36
1+17	898.00
1+32	902.00
1+50	903.38
2+00	907.18
2+03	907.58

Tailwater conditions for Check Storm.			
Discharge	720.00 cfs	Actual Depth	5.64 ft
Velocity	4.33 ft/s		

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-8 x 5 ft Box	720.02 cfs	914.97 ft	18.00 ft/s
Weir	Roadway	0.00 cfs	914.97 ft	N/A
Total	----------	720.02 cfs	914.97 ft	N/A

Culvert Designer/Analyzer Report
Culvert-1-8x5

Component:Culvert-1

Culvert Summary					
Computed Headwater Eleva	914.97	ft	Discharge	720.02	cfs
Inlet Control HW Elev.	914.97	ft	Tailwater Elevation	903.64	ft
Outlet Control HW Elev.	913.29	ft	Control Type	Inlet Control	
Headwater Depth/Height	2.99				

Grades					
Upstream Invert	900.00	ft	Downstream Invert	898.50	ft
Length	150.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.14	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	5.00	ft
Velocity Downstream	18.00	ft/s	Critical Slope	0.013964	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	8.00	ft
Section Size	8 x 5 ft		Rise	5.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	913.29	ft	Upstream Velocity Head	5.04	ft
Ke	0.50		Entrance Loss	2.52	ft

Inlet Control Properties					
Inlet Control HW Elev.	914.97	ft	Flow Control	Submerged	
Inlet Type	45° non-offset wingwall flares		Area Full	40.0	ft²
K	0.49700		HDS 5 Chart	12	
M	0.66700		HDS 5 Scale	1	
C	0.03390		Equation Form	2	
Y	0.80300				

Culvert Designer/Analyzer Report
Culvert-1-8x5

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	914.97	ft
Roadway Width	100.00	ft	Overtopping Coefficient	2.90	US
Low Point	915.00	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	903.64	ft			

Sta (ft)	Elev. (ft)
0.00	917.08
50.00	916.04
100.00	915.38
117.53	915.00
150.00	915.50
200.00	916.00
250.00	916.87