

5/3/2018

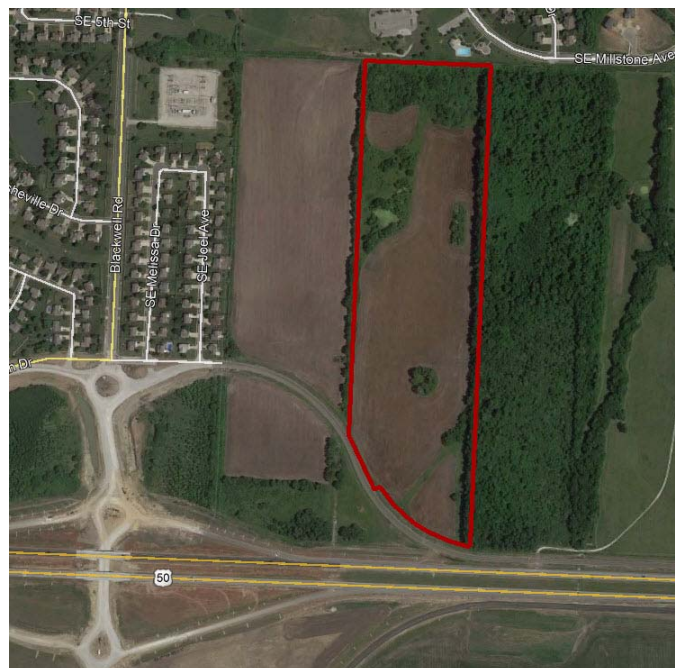
City of Lee's Summit
Development Services
220 SE Green
Lee's Summit, MO 64063
816-980-1200

Re: Detention Analysis

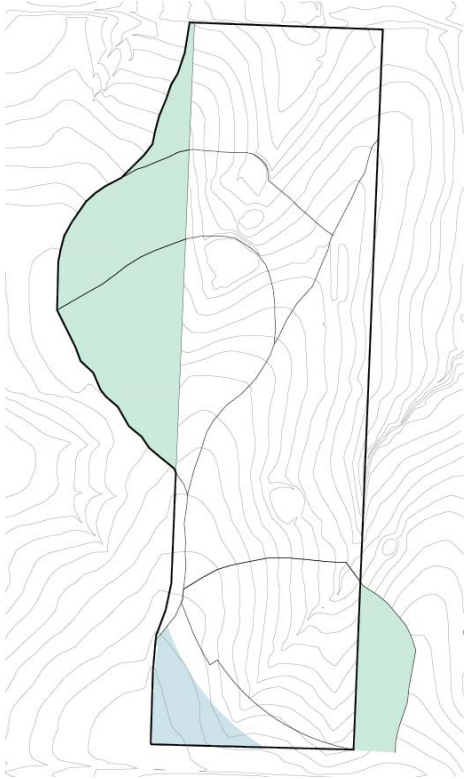
Case Properties

Artisan Point (Robbins Site)

This study outlines drainage and on-site detention requirements in support of the multi-family housing development proposed for a 35.36 Acre site located in the NW/4 of Section 11, T-47-N, R-31-W, within the jurisdiction of the City of Lee's Summit. The property lies north of Shenandoah Drive approximately 1,600 feet east of Blackwell, within the upper reaches of the South Prairie Lee Watershed.



Subject Property



Contributing Drainage Area

The subject property, together with additional offsite areas, currently drains to the north and northeast corner of the site. Approximately 4.5 acres of drainage originating south of Shenandoah will be intercepted and piped through the site to the historical drainageway leaving at the east property line. Additionally, sheet flow along the west will be intercepted and piped to a temporary detention area within the northeast corner of the seller's remainder tract.

The downstream receiving drainage system consists of a 15" plastic pipe stubbed to the north property line. Excess runoff flows overland to a surface inlet located within the Summit Mill Addition.

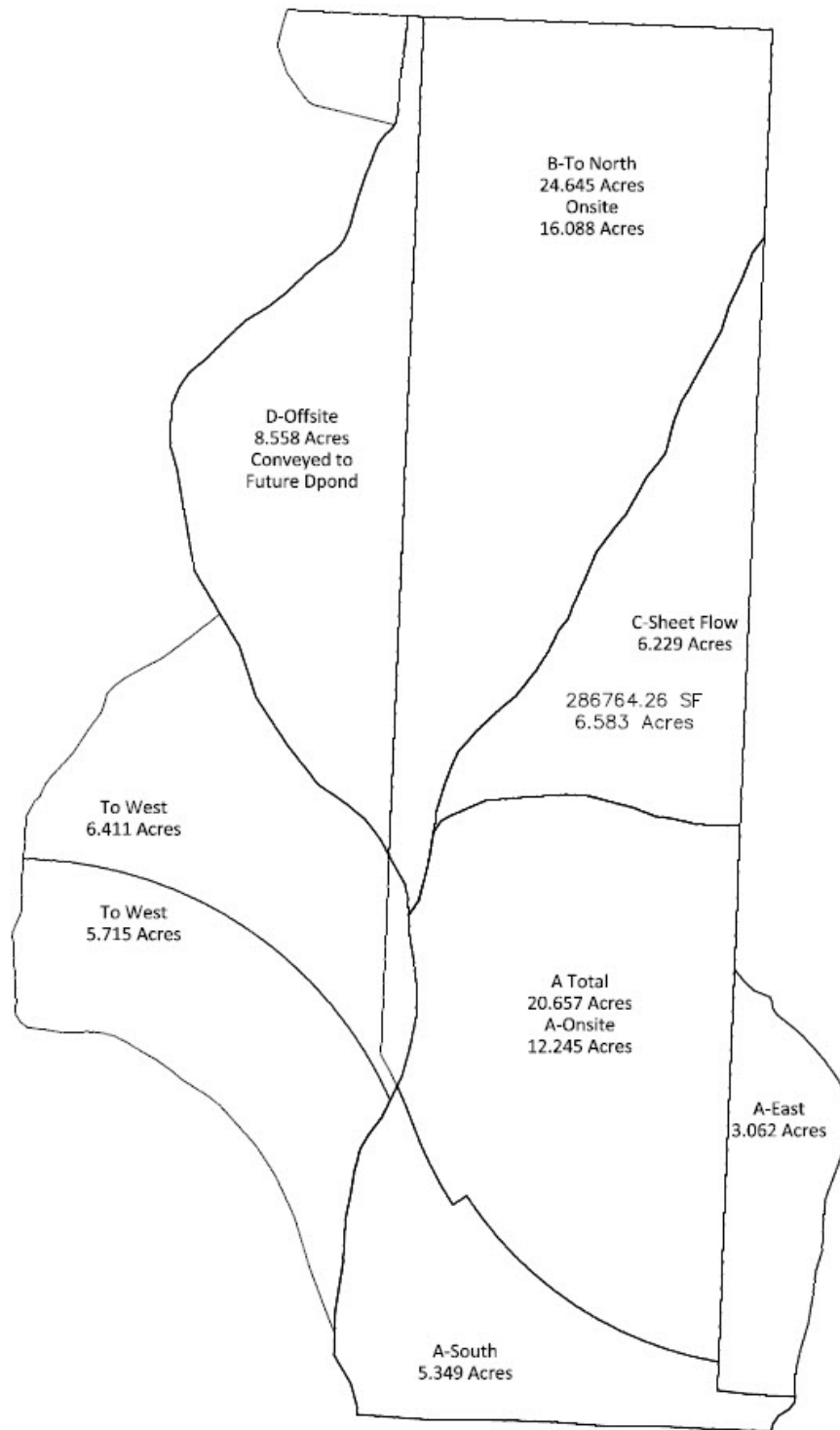


Downstream Summit Mill Inlet

The drainage analysis prepared for the Preliminary Development Plan application largely consists of HEC-HMS modeling together with rational method sizing of storm drain networks. The 1-Year, 10-Year and 100-Year storm frequencies were modeled.

- SCS hydrographs were prepared for the existing and developed conditions given existing soils, vegetative cover states and the proposed apartment development.
- Times of concentration were calculated from overland travel paths as outlined in Technical Release 55.
- GIS Topographic mapping was used for offsite contributing drainage areas. On-site topography was prepared from field surveys conducted in April 2018.
- Rainfall was taken from NOAA 14 for this specific site.

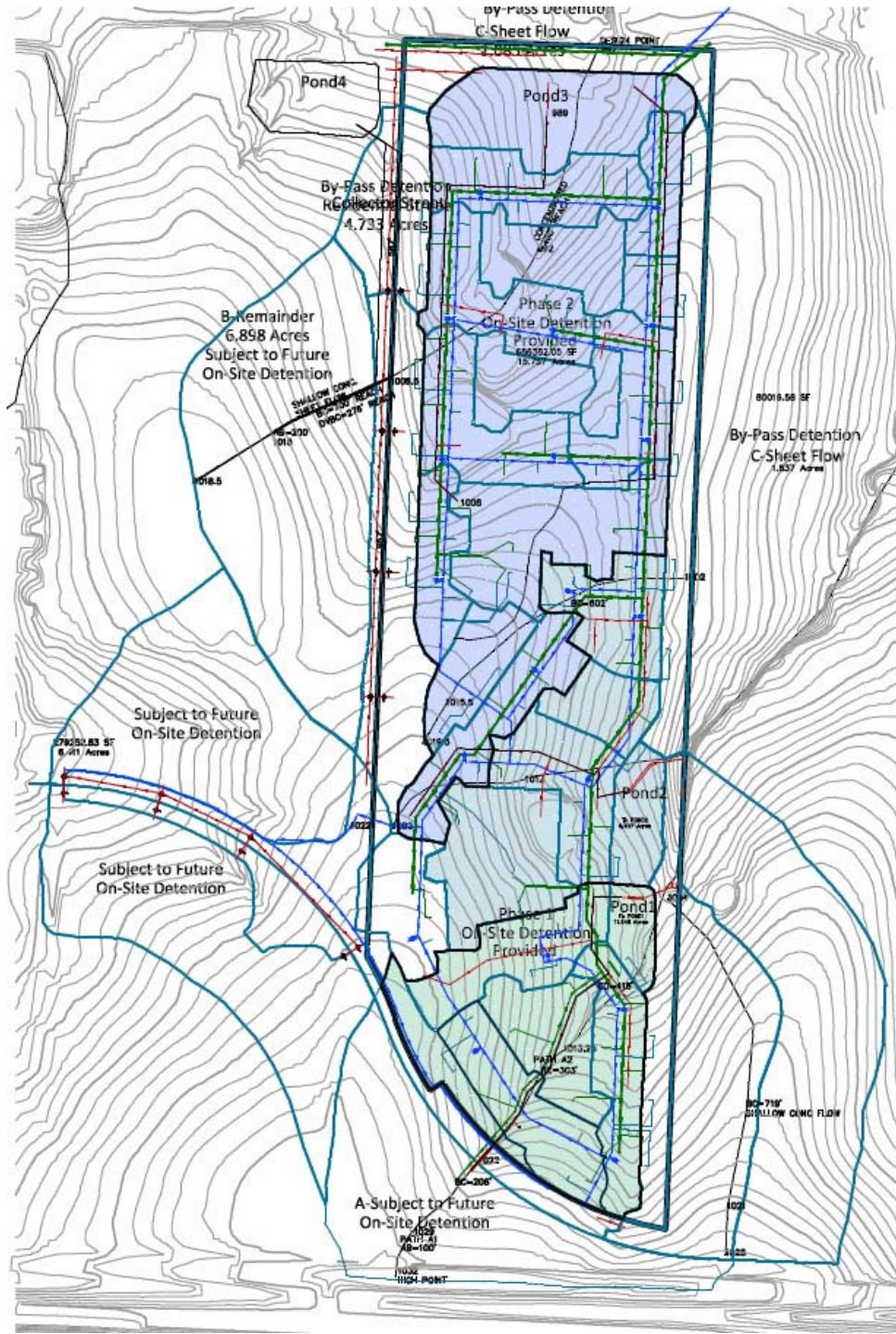
Construction activities related to the proposed round about fall within a drainage basin flowing west toward the Asbury Park subdivision. The first phase of apartment development flows to a historical drainageway running east through unincorporated land, then north to the Summit Mill subdivision. The second phase of apartment development flows north to the open space along SE Millstone Avenue. (See the following illustration).



Existing Conditions Drainage Area Map

Onsite Drainage Design

The site design will accommodate 2 phases with respect to drainage and detention. Two detention ponds will be provided for phase 1, the south phase. A third pond will be provided along the north boundary for phase 2.



Phase 1 – Onsite Detention

Preliminary sizing of the phase 1 detention facilities was undertaken considering receiving and passing the 4.5-acre drainage area situated south of Shenandoah under two scenarios. Option One is to route the offsite water through the proposed ponds. Option 2 is route the offsite load around the ponds.

Pond Volumes were estimated from preliminary development grading plans.

Pond 1 – Apr.26

STAGE STORAGE TABLE						
ELEV	AREA (sq. ft.)	DEPT H (ft)	AVG END INC. VOL. (cu. ft.)	AVG END TOTAL VOL. (cu. ft.)	CONIC INC. VOL. (cu. ft.)	CONIC TOTAL VOL. (cu. ft.)
997.000	6.36	N/A	N/A	0.00	N/A	0.00
998.000	2,318.28	1.000	1162.32	1162.32	815.36	815.36
999.000	6,083.49	1.000	4200.88	5363.20	4052.40	4867.76
1,000.000	7,124.22	1.000	6603.85	11967.06	6597.01	11464.77
1,001.000	8,363.35	1.000	7743.78	19710.84	7735.51	19200.27
1,002.000	9,686.49	1.000	9024.92	28735.76	9016.83	28217.10
1,003.000	11,093.64	1.000	10390.07	39125.83	10382.12	38599.22
1,004.000	12,584.80	1.000	11839.22	50965.05	11831.39	50430.61
1,005.000	14,159.96	1.000	13372.38	64337.43	13364.64	63795.25
1,006.000	16,538.84	1.000	15349.40	79686.83	15334.02	79129.26
1,007.000	18,365.59	1.000	17452.22	97139.05	17444.25	96573.51
1,007.000	20,429.23	0.000	0.00	97139.05	0.00	96573.51

Pond 2 – Apr.26

STAGE STORAGE TABLE						
ELEV	AREA (sq. ft.)	DEPT H (ft)	AVG END INC. VOL. (cu. ft.)	AVG END TOTAL VOL. (cu. ft.)	CONIC INC. VOL. (cu. ft.)	CONIC TOTAL VOL. (cu. ft.)
995.000	7.10	N/A	N/A	0.00	N/A	0.00
996.000	6,268.29	1.000	3137.70	3137.70	2162.12	2162.12
997.000	7,572.73	1.000	6920.51	10058.21	6910.24	9072.37
998.000	8,938.92	1.000	8255.83	18314.03	8246.39	17318.76
999.000	10,366.84	1.000	9652.88	27966.91	9644.07	26962.82
1,000.000	11,856.24	1.000	11111.54	39078.45	11103.21	38066.03
1,001.000	13,406.61	1.000	12631.42	51709.87	12623.49	50689.52
1,002.000	15,017.58	1.000	14212.09	65921.97	14204.48	64894.00
1,003.000	16,689.14	1.000	15853.36	81775.32	15846.01	80740.01
1,004.000	18,421.30	1.000	17555.22	99330.55	17548.10	98288.10
1,005.000	20,214.06	1.000	19317.68	118648.23	19310.74	117598.85
1,006.000	22,067.41	1.000	21140.73	139788.96	21133.96	138732.81
1,007.000	23,981.36	1.000	23024.38	162813.34	23017.75	161750.56

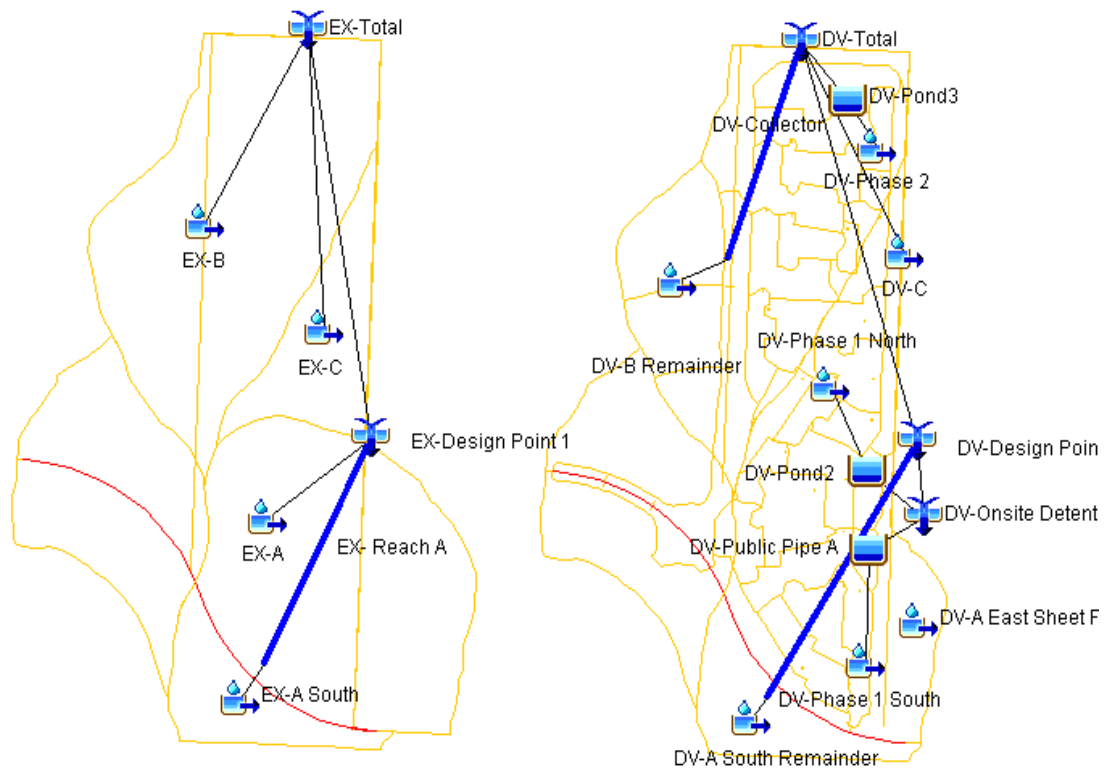
Pond Volumes (Continued)

Pond 3 - Phase 2

ELEV	AREA (sq. ft.)	DEPT H (ft)	AVG END INC. VOL. (cu. ft.)	AVG END TOTAL VOL. (cu. ft.)	CONIC INC. VOL. (cu. ft.)	CONIC TOTAL VOL. (cu. ft.)
988.000	288.43	N/A	N/A	0.00	N/A	0.00
989.000	13,194.69	1.000	6741.56	6741.56	5144.66	5144.66
990.000	17,901.76	1.000	15548.22	22289.79	15488.50	20633.16
991.000	22,907.33	1.000	20404.54	42694.33	20353.19	40986.35
992.000	29,361.70	1.000	26134.52	68828.85	26067.84	67054.19
993.000	35,894.34	1.000	32628.02	101456.87	32573.39	99627.58
994.000	48,704.33	1.000	42299.33	143756.20	42136.75	141764.33

HMS-Modeling

Detention control structures were modeled as 12" low flow orifices with supplemental over flow weirs. The model includes an artificial junction representing total site change.



Existing Condition

Developed Condition

Preliminary HMS-Model

Summary Tables

HEC-HMS Results		PUBLIC LINE ROUTED AROUND POND 1			ROUTED THROUGH POND1		
	Area (SM)	001-Yr	010-Yr	100-Yr	001-Yr	010-Yr	100-Yr
DV-Phase 1 South	0.01867	41.30	78.70	127.40	41.30	78.70	127.40
DV-Pond1	0.01867	13.60	21.50	52.80	7.60	17.70	31.50
DV-Phase 1 North	0.01079	23.90	45.50	73.60	7.60	17.70	31.30
DV-Pond2	0.01079	5.50	7.70	9.60	14.90	38.20	72.20
DV-Onsite Detention	0.02946	19.10	29.10	61.90	23.90	45.50	73.60
DV-A South Remainder	0.00700	7.60	17.70	31.50	5.70	7.70	9.70
DV-Public Pipe A	0.00700	7.60	17.70	31.30	20.60	45.80	81.50
DV-Design Point 1	0.03646	26.50	43.20	93.20	20.60	45.80	81.50
DV-Phase 2	0.02462	54.50	103.70	168.00	54.50	103.70	168.00
DV-Pond3	0.02462	30.50	45.90	59.80	30.50	45.90	59.80
DV-B Remainder	0.01078	8.40	19.70	35.10	8.40	19.70	35.10
DV-Collector	0.01078	8.40	19.70	35.10	8.40	19.70	35.10
DV-C	0.00457	10.70	20.50	33.10	10.70	20.50	33.10
DV-Total	0.07643	66.60	111.90	193.00	60.20	115.10	183.70
EX-A South	0.00700	7.60	17.70	31.50	7.60	17.70	31.50
EX- Reach A	0.00700	7.60	17.70	31.30	7.60	17.70	31.30
EX-A	0.02112	16.20	38.10	68.00	16.20	38.10	68.00
EX-Design Point 1	0.02812	21.70	51.10	91.20	21.70	51.10	91.20
EX-B	0.03847	25.60	60.30	107.90	25.60	60.30	107.90
EX-C	0.00973	8.60	20.10	35.70	8.60	20.10	35.70
EX-Total	0.07632	52.70	124.60	222.80	52.70	124.60	222.80
DV-A East Sheet Flow	0.01364	12.80	30.00	53.20	12.80	30.00	53.20
Total Site		13.90	-12.70	-29.80	7.50	-9.50	-39.10
Design point 1		4.80	-7.90	2.00	-1.10	-5.30	-9.70

Routing Summary		PUBLIC LINE ROUTED AROUND POND 1			ROUTED THROUGH POND1		
		001-Yr	010-Yr	100-Yr	001-Yr	010-Yr	100-Yr
		Stage	Stage	Stage	Stage	Stage	Stage
Pond 1	1007.00	1000.70	1003.50	1005.30	1001.40	1004.10	1006.40
12"	797.50						
30"	1003.50						
15' Weir	1006.00						
100-Yr Freeboard				1.70			0.60
Pond 2	1005.00	997.60	999.60	1002.00	997.80	999.70	1002.00
	995.50						
20' Weir	1006.00						
100-Yr Freeboard				3.00			3.00
Pond 3	993.00	Not Applicable					
36"	989.50				990.3	991.3	992.6
40' Weir	993.00						
100-Yr Freeboard							0.40

Summary of Findings

The stormwater runoff impact from phase one has been isolated and designated as “Design Point 1”. Comparison of the existing conditions to the detention pond discharges show slight increases in flow for the 1-year and 100-year flow rates under the option of piping the southerly offsite drainage area around the pond. The model shows reduction in flow rate for all frequencies under the piping through the pond option. This difference is due to the timing of the movement of the offsite peak flow through the system in combination with attenuation of the additional peak flow routing through the pond. Final design will address and resolve the differences. The preliminary design routing substantiate that on-site detention facilities have been reasonably sized.

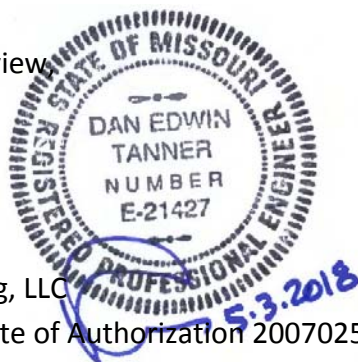
Analysis of the total site conditions indicates that the 10-year and 100-year frequencies are controlled to pre-development flow rates. Final design will further reduce the 1-year event by providing additional low flow storage or further reduce the capacity of each low flow orifice. The routing results of all three ponds are summarized in the table above.

The detention modeling herein is in support of the apartment project alone. The drainage originating on the remainder of the property is not considered. Separate facilities will be required for future adjacent development.

The storm sewer network related to the round-about will be connected to the drainage system located at the western extent of the Shenandoah improvements where a storm drain is available for connection between lots 31 and 32 of Asbury Park.

The storm drain system related to the proposed north-south residential collector street will discharge to an area in the north east corner of the adjacent remainder where temporary detention will be provided until further developed.

Submitted for review



Dan E. Tanner, PE
Tanner Consulting, LLC
Missouri Certificate of Authorization 2007025524
Expires 12/31/2018

