

STORMWATER DRAINAGE STUDY

FOR

Highland Meadows Phase 5&6

Lee's Summit Missouri

Prepared For:
Summit Homes
120 SE 30th Street
Lee's Summit MO 64082



12/14/2020

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General Information

This drainage study addresses the quantity and quality of stormwater runoff from a proposed development to be located Southeast of the intersection of Sampson Road and SW Longview Rd. in Lee's Summit Missouri. The proposed development is 29.16 acres and consists of 2 platted areas to be known generally as the 5th & 6th Plats of Highland Meadows. The development consists of 77 Single Family Residential Lots. The proposed development is zoned R-1. The property is located within the SE ¼ of Section 10, Township 47N, Range 32 West in the City of Lee's Summit, Jackson County, Missouri.

This site is previously undeveloped and consists of sparsely covered grassland and portions of thick scrub brush and grass areas. The site is currently surrounded on all sides by similar residential developments except for the south, which is vacant land. Site topography is such that the site slopes gently from North to south. A detention basin the previous development to the east drains into the project area.

The proposed development is located entirely within an area of minimal flood hazard (Zone X) as depicted on FEMA Flood Insurance Rate Map (FIRM) 29095C0418G, effective date January 20, 2017, see **Appendix C** for FEMA information.

The Natural Resources Conservation Service (NRCS) Soil Survey Map classifies the soil type on site as Sharpsburg-Urban land complex with slopes between 2 and 5 percent (Hydrologic Soil Class C) and Greenton silty clay loam, 5 to 9 percent slopes (Hydrologic Soil Class C/D). Refer to **Appendix B** for a NRCS Web Soil Survey Map and associated data.

The purpose of this report is to determine the impact of the development of this property on the existing drainage infrastructure and to show that the proposed development is in compliance with City standards. This report also addresses the water quality impact of the proposed development meeting the comprehensive control requirements of the City of Lee's Summit.



Methodology

The proposed project was analyzed utilizing the American Public Works Association section 5600, comprehensive control strategy for control of stormwater. The analysis was conducted utilizing the PondPack Ver 8.0068. An SCS Type-II 24-hr. rainfall distribution was utilized in computing unit hydrographs for varying conditions. Refer to **Appendix F** for a watershed model schematic and modeling output. The City of Lee's Summit requirement to detain and slowly release the water quality event over 40 hours was also included in the design.

Existing Conditions Analysis

The predevelopment condition is normally not directly considered in the analysis of comprehensive control. Since the proposed detention basin has offsite flows that will flow through it, it is necessary to analyze the offsite areas that contribute flow to the proposed basin. To properly compare the maximum allowable release rates it was necessary to combine offsite areas that included detention under a comparison predevelopment runoff vs. post development runoff detention scenario. This offsite drainage from adjacent developments comes primarily from the development to the East (see blue and yellow areas depicted in **Figure 2**). The concept of analysis will include passing the offsite existing flows through the proposed basin.

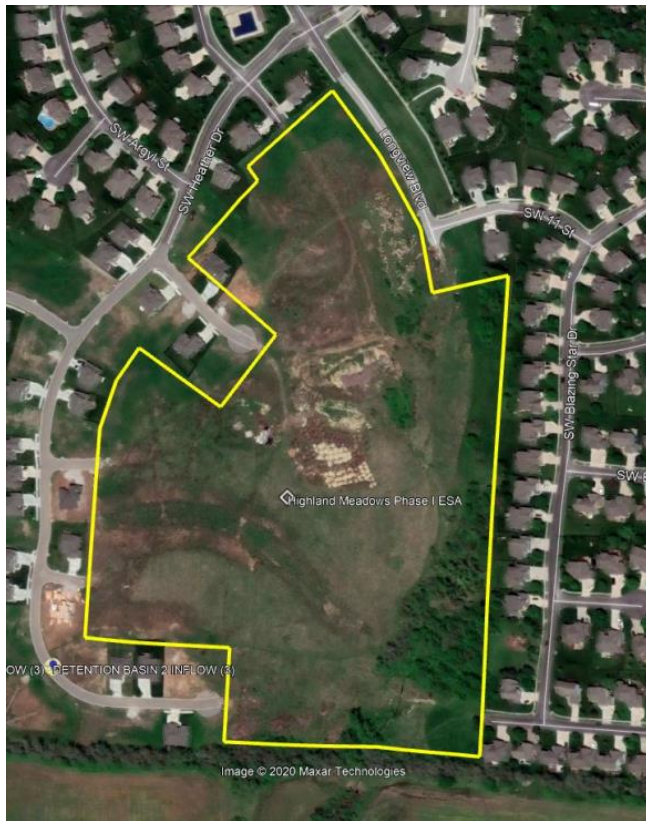


Fig 1. Existing Site

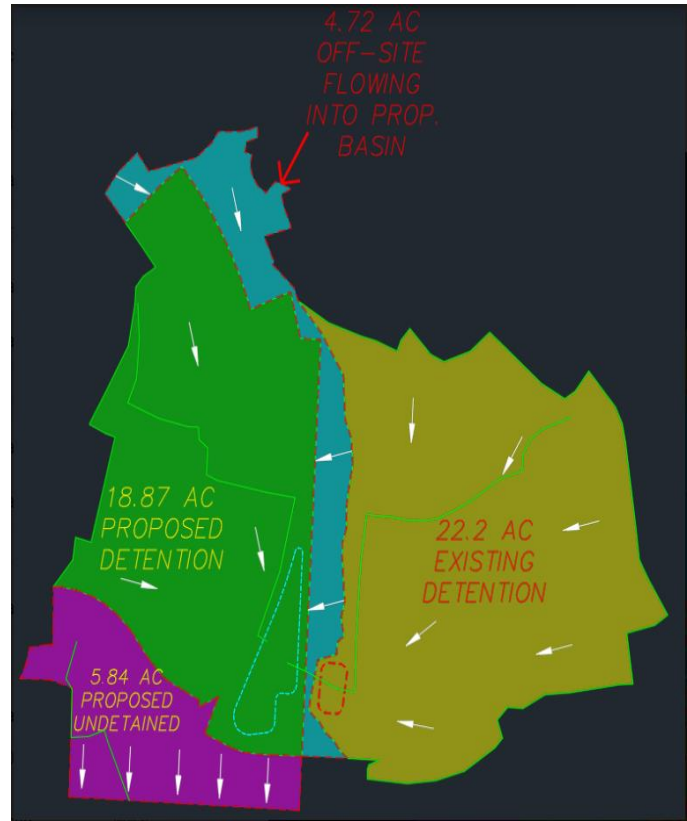


Fig 2. Offsite and Onsite runoff areas – Green and Purple areas are onsite, blue and yellow are offsite.

In the stormwater model produced, the existing offsite area were assumed to have a curve number of 74 and therefore mimic the stormwater detention and proposed conditions. This analysis should produce runoff rates from the existing developed areas equal to or greater than what is actually occurring in the design storm. The Peak rates of runoff from offsite areas are listed in **Table 1**. See **Appendix A** for Points of Interest (POI).

TABLE 1: 2-yr, 10-yr, 100-yr Rainfall Event Existing Release Rates (Offsite Areas)				
	CN	2-yr Q_p (cfs)	10-yr Q_p (cfs)	100-yr Q_p (cfs)
22.2 AC Ex. Detention	74	16.99	54.51	112.38
4.72 Ac Flowing Into Prop. Basin	74	5.83	18.06	36.75



Proposed Conditions Analysis

The proposed 5th and 6th Plats include 77 Single Family Residential Lots and associated roads. While the proposed development is required to meet the comprehensive control strategy, the offsite runoff from the adjacent 26.92 acres to the East was assumed to control stormwater release rates through a strategy of reducing stormwater peak rates to below that of the pre-existing condition. This was assumed due to the development taking place circa 2006. There is an additional 4.45 acres being developed in phase 5 that drains to the West. This area has been included in the Phase 4 detention basin and is excluded from analysis of this study. See **Appendix A** for a proposed site plan.

Because the adjacent detention basin to the East flows through the proposed detention basin, the peak pre-existing stormwater runoff rate was determined for the offsite area. This peak rate was determined for the offsite flow based on the existing condition (CN=74). The concept is to pass the existing peak runoff from offsite through the proposed detention facility, without detaining it. Since a strategy of comprehensive control was required to combine with offsite flows a direct comparison of peak flow rates requires proper analysis of timing of those peaks for accurate determination of allowable release rates. The timing of the peak from the proposed 18.87 acre onsite drainage area determines this value. The peak was determined to occur at time of 721 minutes into the 24 hour storm event required by the APWA. Below are the calculated runoff rates from the existing offsite 22.2 Ac. Basin and the 4.72 acre basin at a time of 721 minutes.

	2-yr Q _p (cfs)	10-yr Q _p (cfs)	100-yr Q _p (cfs)
22.2 AC Ex. Detention	10.17	37.60	81.78
4.72 Ac Flowing Into Prop. Basin	5.81	18.06	36.69



For the proposed basins the development has a curve number of 82 as determined by the APWA 5600 Table 5602-3. Comprehensive control will require additional detention to account for the undetained area (5.84 Ac area). The undetained 5.84 acres is collected along the southern property edge and diverted to POI #1.

TABLE 3: 2-yr, 10-yr, 100-yr Rainfall Event Comprehensive Control Limits (Offsite Areas @ 721 Min)			
	2-yr Q _p (cfs) 0.5 cfs/ac	10-yr Q _p (cfs) 2.0 cfs/ac	100-yr Q _p (cfs) 3.0 cfs/ac
18.87 AC Prop. Detention	9.44	37.74	56.61
5.84 Ac Prop. Undetained	2.92	11.68	17.52
Total Comp Control Allowable release without offsite pass through	12.36	49.42	74.13
Total Comprehensive Control allowable release with pass through from offsite	28.34	105.08	192.60

The stormwater model was built utilizing Pondpack software for which the output is included in the Appendix. Peak release rates from the model had to be determined at time step 721 min, to keep the results valid. Below is a summary of the model’s output.

TABLE 4: 2-yr, 10-yr, 100-yr Allowable Release vs. Design Storm Release at POI #1			
	2-yr Q _p (cfs)	10-yr Q _p (cfs)	100-yr Q _p (cfs)
Allowable Release	28.34	105.08	192.60
Design Storm Release Rate	10.34	88.88	183.98

Comprehensive control also requires the 40-hour extended detention of runoff from the local 90% mean annual event (1.37”/24-hour rainfall). This volume was calculated to be 55,912 cubic feet of water (per Chapter 6 of the Mid-America Regional Councils Manual for Best Management Practices, 2012 edition. This volume of water is detained within the basin and released over the required 40 hours. See **Appendix E** for Calculations.



The proposed release rates are below the allowable release rates per **Table 4** above. These release rates are accomplished via an outlet structure with varied inlet. A description of the outlet structure is included in Appendix E.

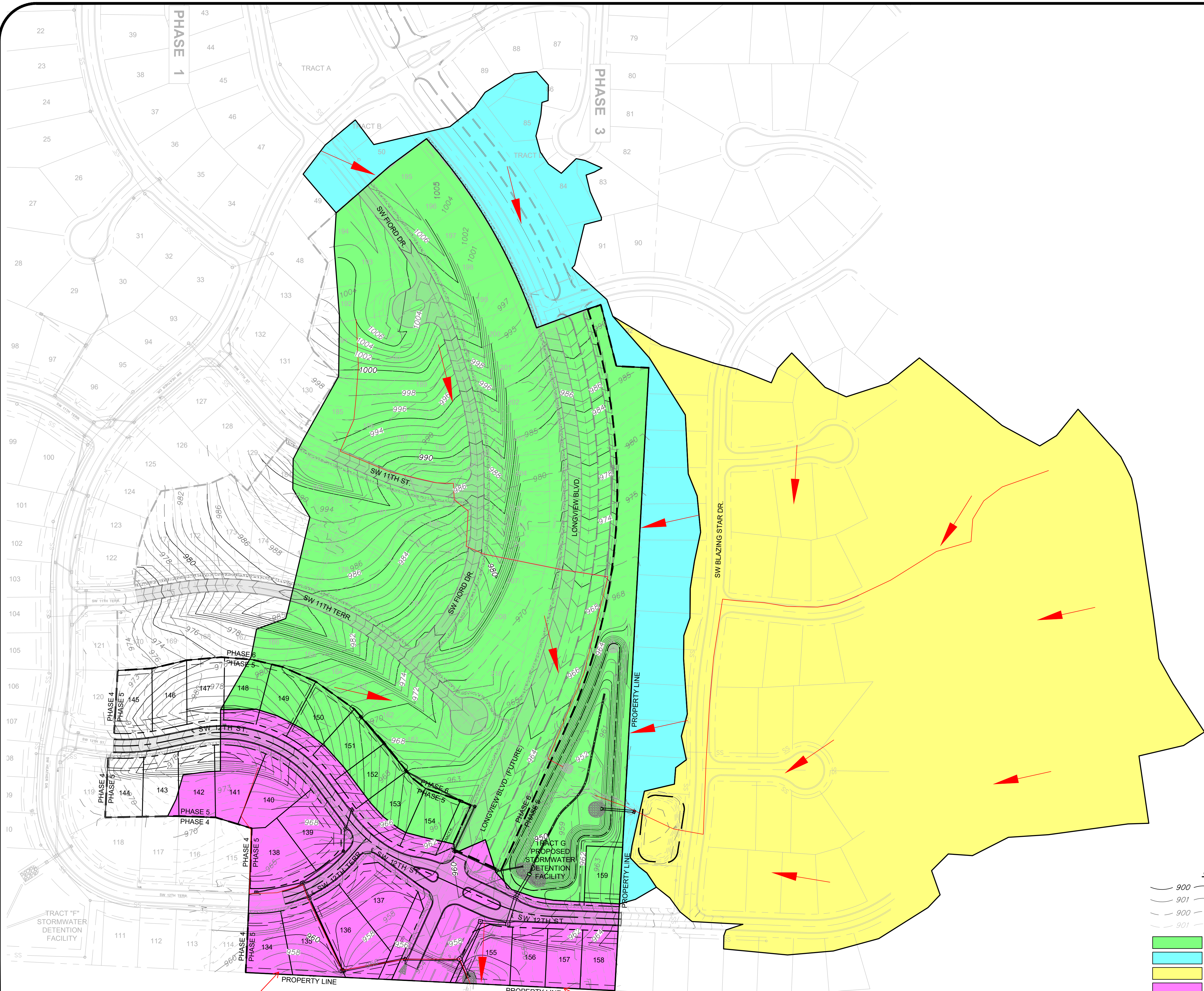
Conclusions and Recommendations

Stormwater runoff for the Highland Meadows phase 5&6, a single family housing development in Lee's Summit, MO, has been analyzed for release rate and water quality in this study. It has been shown that development of the site from its current condition to the proposed condition, if constructed as proposed with detention will not release runoff at a rate greater what is allowed by the APWA 5600, comprehensive control strategy. This will be accomplished with a single detention basin constructed on the site. This single detention basin will also release the water quality event as required by the City. It is concluded that the proposed improvements, if constructed as outlined in this study and associated plans, will meet the stormwater requirements and development criteria of the City of Lee's Summit.



Appendix A

Dec 11, 2020 - 3:49pm Plotted By: gpc G:\Shared drives\VC10 - Land Development\Projects\2020\20K10057 Highland Meadows - 5th Plat\01 CIVL\03-DWG\Sheet\STREET AND STORM\20K10057 - SH1 - DRAINAGE.dwg Layout: STORMWATER EXHIBIT



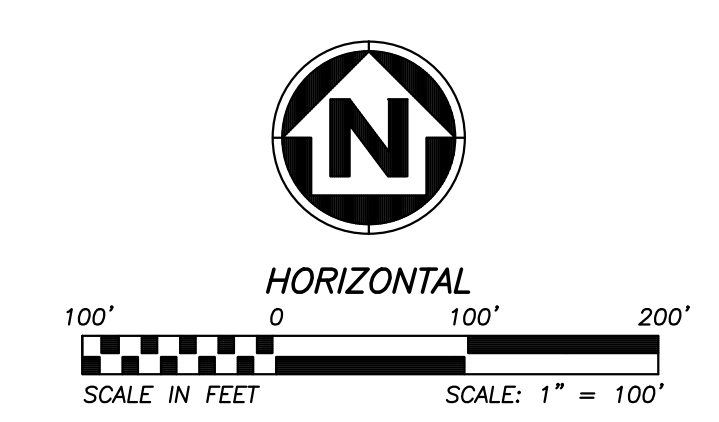
Drainage swales collect stormwater sheet flow and direct towards POI #1

POI #1

Drainage swales collect stormwater sheet flow and direct towards POI #1

LEGEND

	900	PROP. MAJOR CONTOUR
	901	PROP. MINOR CONTOUR
	900	EX. MAJOR CONTOUR
	901	EX. MINOR CONTOUR
	18.87 AC	- PH5/PH6 ON-SITE DETAINED
	4.72 AC	- OFF-SITE FLOWING INTO PH5/PH6 BASIN
	22.2 AC	- EX. DETENTION BASIN
	5.84 AC	- PH5/PH6 UNDETAINED
		GENERAL STORMWATER FLOW DIRECTION
		ASSUMED Tc FLOW PATH



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ISSUED FOR:	DRAINAGE STUDY
JOB NUMBER:	20K10057
M/D COA NO.:	000062

NO.	REVISIONS	DESCRIPTION	BY	DATE

SUMMIT HOMES KC
HIGHLAND MEADOWS - 5TH & 6TH PLAT

STORMWATER EXHIBIT

S10, T47N, R32W
LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

SHEET NUMBER

1
1 OF 1