

PRELIMINARY STORMWATER STUDY

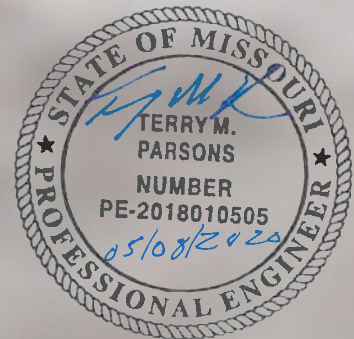
LS MIDDLE SCHOOL #4
Lee's Summit, Jackson County, Missouri

Prepared for:

Lee's Summit School District
Lee's Summit, Missouri

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SUMMARY

This storm drainage study is being submitted on behalf of the Lee's Summit School District for the proposed development of the property located south of Bailey Road between Dalton Drive and Ranson Road, in Lee's Summit, Jackson County, Missouri. This property is an existing terraced row crop field with no existing buildings. This preliminary report is being submitted to the City of Lee's Summit with the Preliminary Development Plans for approval of this institutional development.

1. INTRODUCTION

This final stormwater management study is being submitted on behalf of Lee's Summit School District for a development on a 51.85 acre parcel of land generally located south of Bailey Road between Dalton Drive and Ranson Road, in Lee's Summit, Jackson County, Missouri.

1.1. Project Location and Description

The proposed site is located in the northeast quarter of Section 16, Township 47 North, Range 31 West. The existing site is currently undeveloped consisting of terraced row crop. The site drains to the southeast into an unnamed tributary that runs along the entirety of the east side of the property. The tributary flows south to Big Creek. The site is not located within the flood plain.

1.2. Study Purpose

The purpose of this report is to verify this development's conformance with the City of Lee's Summit Design Criteria and Plan Requirements for Public Improvement Plans 2019 edition. Storm water drainage facilities are designed according to section F of aforementioned criteria. This study will outline methods to mitigate impacts on storm water runoff resulting from the development for the 1, 10 and 100-year rainfall events and for treatment of stormwater runoff with the use of permanent stormwater treatment facilities.

2. METHODOLOGY

2.1. General Criteria and References

Analytical and design criteria conform to those of Division V - Section 5600 – "Storm Drainage Systems and Facilities" of the Kansas City Metropolitan Chapter of the American Public Works Association's "Standard Specifications and Design Criteria". Based on these criteria's, Post-development discharge rates for the 2, 10, and 100-year storm events will be limited to provisions in section 5608.4-C1 Performance Criteria – "Comprehensive Control". Post-development discharge rates are limited to 0.5 cfs per acre for 2-Year, 2.0 cfs per acre for 10-year, and 3.0 cfs per acre for 100-year storm events.

Post development flows from the site are shown below and were calculated using HEC-HMS for the 2, 10 and 100-year storm events. Existing and proposed hydrographs were calculated using the 24-hour SCS Type II rainfall distribution. Existing times of concentration were determined using Inlet Time and Travel Time equations found in Section 5602.7 of APWA Section 5600.

2.2. Soils Description

Soil classifications by the United States Department of Agriculture (USDA) on the Natural Resources Conservation Service (NRCS) Soils website for Johnson County, Kansas show the existing site consisting of the following soil types:

10117 – Sampsel Silty Clay Loams, 5 to 9 percent slopes – HSG Type C/D

10082 – Arisburg-Urban Land Complex, 1 to 5 percent slopes – HSG Type C

**HSG – Hydrologic Soils Group (The NRCS information is included in the Appendix B).*

3. HYDROLOGIC/HYDRAULIC ANALYSES

3.1. Existing Conditions

The property is bounded by residential lots to the west and north. Bailey Road is also located on the north side of the property. To the south and east the adjacent properties are currently undeveloped. A tributary to Big Creek, that flows to the south, lies along the entire east property line of the site. The storm drainage from the residential lots to the north comes under Bailey Road and empties into the north end of the tributary. The property currently contains no impervious area and runoff flows southeasterly to the tributary. An Exhibit of the Existing Conditions is included in Appendix A.

With the comprehensive control method is being used for drainage design, an existing curve number analysis is not required for the site.

3.2. Stream Protection and Buffer Zones

A portion of the property will be defined as a Stream Protection Buffer Zone. The proposed buffer zone will meet the requirements established in Section 5603.5 of the APWA Section 5600 Design Criteria.

The width of the setback is determined by the drainage area to the stream. Using USGS contours the drainage area for the stream was determined at different points. A minor tributary from the east is the location for Point 1. The drainage area to Point 1 is 138 acres. Therefore, a 60' offset from the ordinary high water mark (OHM), i.e. surveyed top of bank, is used to determine the buffer extent to that point. Point 2 is located where the stream exits at the southern edge of the property. The total drainage to this point is 210 acres. The setback from Point 1 to Point 2 is 100'. An exhibit of the stream setback drainage areas is included in Appendix A.

3.3. Proposed Conditions Analysis

Post development, the entirety of the of the property will continue to flow to the tributary to the east. The proposed site will include the middle school, a softball/baseball complex (with 4 fields), a track, practice fields, outdoor classrooms, parking, three extended dry detention basins, private storm, and associated utilities. Roof drains, private storm sewer pipe and inlets will allow adequate drainage of the proposed school, athletic facilities and parking areas. The private storm will drain into the detention basins and then be routed to the tributary. A private road will be constructed for access to the bus turnaround and parking areas. The road will connect to the existing Bailey Road on the north to proposed Cape Road on the south.

The proposed Cape Road will be located on the southern portion of the property. The right of way will be dedicated to the city with a portion the road being constructed to connect to existing Cape Road to the west. When the road is completely constructed a public storm system will drain to road to the tributary. Temporary provisions will be implemented to drain the constructed road to the stream.

The backyards of the residential subdivisions to the west also drain onto the existing sight. These 2.5 acres will drain to the proposed north-south private road and will enter into the proposed storm system for the road.

The site will be divided into four main drainage areas. An exhibit of the Stormwater Management Plan drainage areas is included in Appendix A. Each drainage area will have collection system and an extended dry detention basin with control structure. A general description of what is draining to each area is as follows:

Drainage Area 1 (6.3 acres)	Two north ball fields
Drainage Area 2 (8.6 acres)	Southeast ball field and north end of middle school
Drainage Area 3 (17.6 acres)	Southwest ball field, south end of middle school, north-south drive, main parking area, bus turnaround area, and practice fields
Drainage Area 4 (4.2 acres)	Track and track infield

Approximately 1.8 acres east of the proposed building and eastern drive will flow into the tributary. Improvement in this area are minimal so no detention will be required.

The ballfields and the track will have synthetic surfacing with underdrain systems. The current plan is for the two north fields to have synthetic turf on the infields and outfields. The two south fields will have synthetic turf on the infields only. If the budget allows, there is a possibility that the

two south fields will also have synthetic turf in the outfields. For the purposes of this report, the ballfields will be treated as if they have a complete synthetic surface.

The synthetic surface will act as impervious surface. However, the underdrain system, with its aggregate subsurface rock layer and underdrain piping, will increase the time of concentration (Tc) for the runoff that is guided through the underdrain system. The increase in Tc will be from 30 to 45 minutes based on the final underdrain design. An increase of thirty minutes will be used for the purposes of the preliminary report. The HEC-HMS model based its Tc's on a time to inlet of 5 minutes and then an estimation of pipe travel time. This was used as the Tc for the impervious and pervious areas in the drainage area. The synthetic fields had an additional time of 30 minutes added to their Tc's.

Based on the completed models the peak flows for each area are included in the table below:

Table 1. Post-Development Peak Flows

Site Description	Total Area (ac)	CN	Storm Event	Runoff Q (cfs)
Area 1	6.3	79.4	2-YR	10.2
			10-YR	15.4
			100-YR	22.4
Area 2	8.6	90.6	2-YR	12.4
			10-YR	29.1
			100-YR	42.9
Area 3	17.6	90.5	2-YR	33.1
			10-YR	78.1
			100-YR	115.2
Area 4	4.2	80.7	2-YR	8.3
			10-YR	13.3
			100-YR	20.4

3.4. Stormwater Detention

As stated previously, a new detention basin will be constructed for each area to mitigate the increase in flow due to the increase in impervious area. A control structure will be located at the outlet of the basin. An orifice/weir plate in the control structure will limit outflow in the 2, 10, and 100-year storms.

The control structure for each basin is designed to limit the outlet flow to the allowable release rate for each storm based on the Comprehensive Control Strategy. Hydrographs for the combined flows of the detained and undetained areas are shown in Appendix C.

To meet water treatment requirements, the basin will act as extended dry detention. The water quality volume (WQv) will be controlled by a series of 1" orifices at the bottom of the orifice plate. The conduit will release the water quality volume over a 40-hour period to allow pollutants to settle out of this precipitation event.

Table 2. Detention Basin Information

Area	Drainage Area (acres)	Storm Event	Allowable Release Rate (cfs)	Design Release Rate (cfs)	Storage Required (ac-ft)	WSE (ft elev)
1	6.3	2-YR	3.2	3.2	0.5	1010.4
		10-YR	12.6	10.6	0.7	1011.1
		100-YR	18.9	18.3	0.9	1011.5
2	8.6	2-YR	4.3	4.1	0.4	1001.7
		10-YR	17.2	14.7	1.0	1003.4
		100-YR	25.8	24.9	1.4	1004.3
3	17.6	2-YR	8.8	8.5	0.8	996.0
		10-YR	35.2	35.2	2.0	997.6
		100-YR	52.8	58.1	2.9	998.6
4	4.2	2-YR	2.1	2.1	0.1	997.2
		10-YR	8.4	7.6	0.3	998.4
		100-YR	12.6	12.3	0.4	999.0

4. STORM WATER TREATMENT REQUIREMENTS

As stated previously, the four detention basins will be designed to act as extended dry bottom detention facilities to treat stormwater per MARC water quality standards. The orifice plate for

the basin will be sized to release the water quality volume (1.37") over a 40-hour period to allow pollutants to settle from runoff before entering the public stormwater system.

5. CLEANWATER ACT SECTION 404 PERMITTING REQUIREMENTS

Construction will not be occurring within jurisdictional Waters of the United States. Therefore, a Section 404 permit is not required.

6. FEMA/DWR PERMIT REQUIREMENTS

No FEMA permitting or submittals will be required on this site because there are no FEMA delineated floodplains on the site. A copy of the FIRM map for this area has been included in Appendix B.

7. CONCLUSIONS AND RECOMMENDATIONS

As outlined in the preceding report, increased runoff rates in the post-development conditions are mitigated by the detention basin. Drainage patterns on the site remain will relatively unchanged. Lastly, four extended dry detention basins will be designed to limit site runoff to comprehensive control rates and to improve the storm water quality. Based on these facts and other information provided herein, we request approval of this stormwater study.