

Preliminary Stormwater Management Plan

Orchard Woods

NE Lakewood Way & NE Woods Chapel Road
Section: SW ¼ Sec. 9-48-31
Lee's Summit, Missouri

Prepared by:



PHELPS ENGINEERING, INC
1270 N. Winchester
Olathe, KS 66061
(913) 393-1155



2500 W. 76th Street
Prairie Village, KS 66208
(913) 221-4055

Developer: Entres' Hive
424 NE Brockton Drive
Lee's Summit MO, 64064

PEI #211142
July 8, 2022

TABLE OF CONTENTS

1. INTRODUCTION.....	1
2. STORMWATER REQUIREMENTS.....	2
3. EXISTING SITE CONDITIONS	2
4. PROPOSED SITE CONDITIONS.....	3
5. STORMWATER DETENTION.....	3
6. CONCLUSION	7

FIGURES

Figure 1 - Vicinity Map	1
-------------------------------	---

APPENDICES

A. Stormwater Treatment & Detention

- NRCS Web Soil Survey
- Existing Drainage Map A1
- Proposed Drainage Map A2
- Stormwater Treatment Map A3

B. Details & Calculations

- Time of Concentration Calculations
- Existing HydroCAD Model Results
- Proposed HydroCAD Model Results
- Emergency Spillway Sizing
- Extended Dry Detention Sizing Calculations
- Extended Dry Detention

1. INTRODUCTION

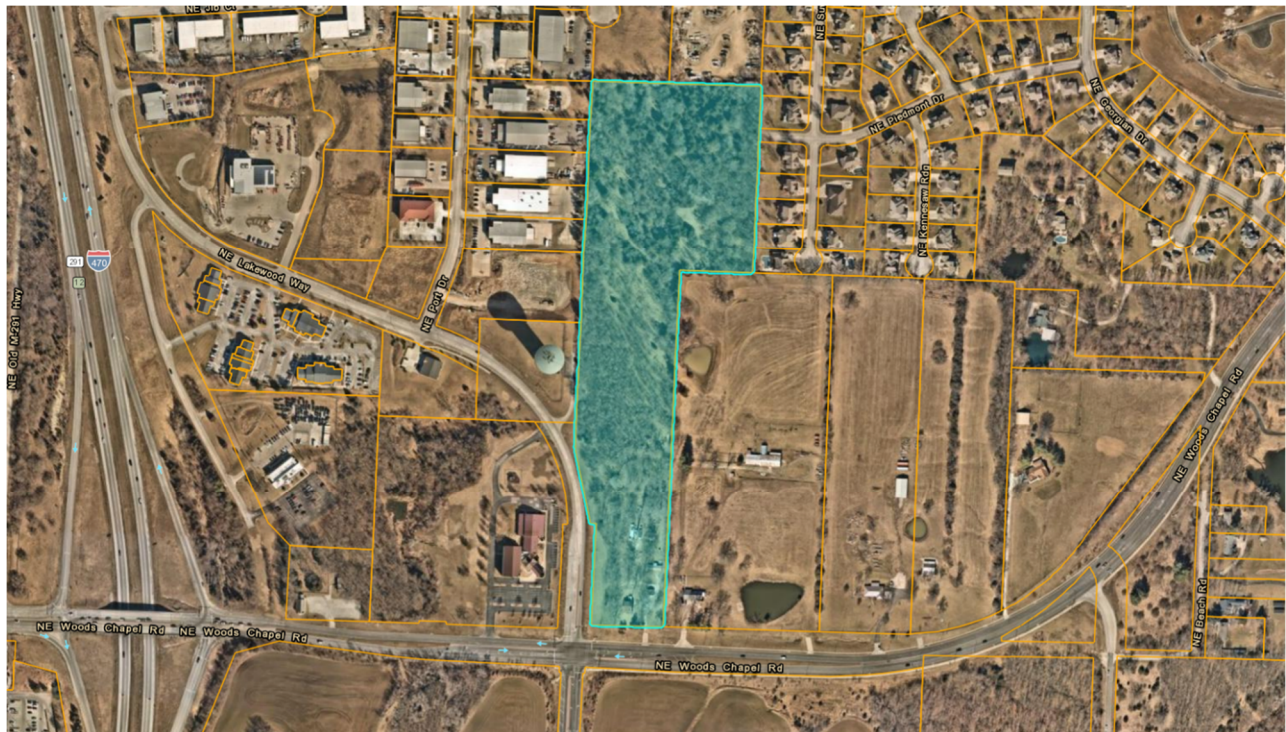
This report is a Preliminary Stormwater Management plan for the proposed Orchard Woods development located northeast of the intersection of NE Lakewood Way & NE Woods Chapel Road in the City of Lee's Summit, Jackson County, Missouri. This report has been prepared by Phelps Engineering, Inc. (PEI) and McMullen Stormwater Engineering LLC (MSE) on behalf of the developer – Entres' Hive.

The proposed site is bounded by NE Chapel Road (public) to the south, NE Lakewood Way (public) and commercial development to the west, commercial development to the north, and single-family residential development to the east. The proposed development is approximately 18.80 acres and consists of 34 single-family residential lots and a collector road which will bisect the site.

The property lies within Zone X, defined as areas determined to be outside the 0.2% annual chance floodplain, as shown on the flood insurance rate map prepared by the Federal Emergency Management Agency for the City of Lee's Summit, Community No. 290174, Jackson County, Missouri, Map No. 29095C0430G, and dated January 20, 2017.

See the Vicinity Map below.

Figure 1 - Vicinity Map



2. STORMWATER REQUIREMENTS

Stormwater design criteria are in accordance with City of Lee's Summit Technical Specifications and Design Criteria and APWA 5600.

Onsite detention will be provided for the increase in impervious area with the development. The post-development peak discharge rates from the site in the 2, 10, and 100-year storm events shall not exceed the peak discharge rates outlined in APWA Section 5608.4.C.1 – Comprehensive Control Strategy. The detention system shall also be designed to drawdown over a minimum of 40-hours during the 90% mean annual event (Water Quality storm).

All storm sewers shall be sized to convey the 10-year design storm. The 100-year overflow will be conveyed in the street system in conjunction with overflow path swales where necessary. The minimum building opening elevation (MBOE) of any adjacent building to the 100-year overflow path or detention basin will be set a minimum of two feet above the 100-year water surface elevation (WSE).

3. EXISTING SITE CONDITIONS

The existing site consists of three watersheds which discharge to the northwest, west, and southeast.

A total of 13.37 acres of onsite drainage area and 19.01 acres of offsite drainage area discharges the site in the northwest watershed into an existing enclosed storm sewer system located just west of the site.

A total of 3.82 acres of onsite drainage area discharges the site in the west watershed via an existing storm sewer system along NE Lakewood Drive.

A total of 1.61 acres of onsite drainage area discharges the site in the southeast watershed via overland flow to the unplatted property to the east.

The existing site is a large majority undeveloped and consists of Hydrologic Soil Group (HSG) Type "C" and "D" soils. Based off aerial photography and site visit, the land cover type is considered to be woods/grass combination in fair condition, corresponding to a CN value of 76 for the HSG Type "C" soils and 82 for the HSG Type "D" soils. See Appendix A of this report for the NRCS Web Soil Survey and the Existing Drainage Map for the site.

4. PROPOSED SITE CONDITIONS

The proposed site will contain 34 single-family residential lots on approximately 13.55 acres of the site located north of the proposed collector road which bisects the site. The portion of the site located south of the collector road will remain undisturbed. The proposed site will approximately maintain the existing drainage pattern. See Appendix “A” of this report for Proposed Drainage Map A2.

5. STORMWATER DETENTION

An existing conditions site runoff model determined the pre-developed 2, 10 and 100-year Allowable Release Rates for the northwest watershed. The onsite west and southeast watersheds will be undisturbed with this phase of development, and therefore detention is not required with the current phase, but a detention analysis for the west and southeast watershed shall be required in the future if developed. The existing release rates for the 2, 10 and 100-year storm events for the west and southeast watershed are shown in Table 2 below.

Detention in the northwest watershed will be provided per APWA Section 5601.5.A.4.a, the “Default Strategy – Comprehensive Protection”. The onsite allowable release rates are shown per Table 1 below for each respective recurrence interval in the northwest watershed. The offsite peak release rates for the northwest watershed are shown in Table 2, along with the total combined allowable release rates for the northwest watershed which includes the onsite and offsite areas. The northwest watershed will also be required to drawdown the 90% mean annual storm event over a minimum of 40-hours for the onsite area.

A total of 8.53 acres of the offsite northwest watershed is developed single-family residential, while 10.48 acres is currently undeveloped. In the future, if the 10.48 acres of offsite area is developed, the site would need to provide detention per APWA’s Comprehensive Protection strategy as outlined above.

All detention analyses were completed using the HydroCAD V10 storm modeling software, using SCS Unit Hydrograph detention modeling with SCS Type II 24-hr storm duration.

Table 1 – APWA Onsite Allowable Discharge – Northwest Watershed

Storm Event	Allowable Discharge (cfs)		
	Onsite Area (acres)	Discharge Rate (cfs)	Discharge (cfs)
2-Year	13.37	0.5	6.69
10-Year	13.37	2.0	26.74
100-Year	13.37	3.0	40.11

Table 2 - Existing Runoff Conditions

Watershed Area	Drainage Area (acres)	Time of Conc. (minutes)	Composite Curve Number (CN)	2-Year Allowable Discharge (cfs)	10-Year Allowable Discharge (cfs)	100-Year Allowable Discharge (cfs)
Northwest Onsite	13.37	13.7	81	6.69	26.74	40.11
Northwest Offsite	19.01	13.7	83	47.80	87.59	141.67
NORTHWEST TOTAL	32.38	-	-	54.49	114.33	181.78
WEST ONSITE (TOTAL)	3.82	11.8	76	7.47	15.36	26.64
SOUTHEAST ONSITE (TOTAL)	28.07	1.61	76	3.17	6.52	11.31

Northwest Watershed

One extended dry detention basin is proposed for the northwest watershed of the proposed development. The proposed drainage to the northwest extended dry detention basin totals 32.87 acres (13.86 acres onsite area, 19.01 acres offsite area). The outlet control system for the detention basin will consist of a V-notch weir on the east face of the proposed 7'x4' outlet structure with a 20 degree notch angle. The outlet structure will have an open top and trash rack set at an elevation of 1004.30. The V-notch weir will have a bottom elevation of 996.00 (bottom of basin) and extend up to the top elevation of the structure (1004.30) for a top width of 2.93 feet. The outlet pipe from the outlet control structure will be a 48" RCP which will tie into the existing storm sewer system located west of the basin.

Using HydroCAD, the proposed 2-year, 10-year, and 100-year peak discharges for the northwest watershed were determined and are shown in Table 3 below. See Appendix "B" of this report for proposed PondPack calculations.

Table 3: Summary of Northwest Watershed Discharges

Storm	Discharge Pt.	Existing Condition	Proposed Condition			
		Allowable Release Rate, cfs	Inflow Rate, cfs	Outflow Rate, cfs	WSE, ft	Storage, ac-ft
2-year	NW Onsite - Bypass	NA	NA	0.79	NA	NA
	NW Onsite - Detained	NA	47.80	NA	NA	NA
	NW Offsite - Detained	NA	44.21	NA	NA	NA
	Extended Dry Detention	NA	90.81	52.41	1002.57	1.280
	NORTHWEST TOTAL	54.49	NA	52.53	NA	NA
10-year	NW Onsite - Bypass	NA	NA	1.50	NA	NA
	NW Onsite - Detained	NA	77.20	NA	NA	NA
	NW Offsite - Detained	NA	87.59	NA	NA	NA
	Extended Dry Detention	NA	162.81	113.71	1004.61	2.106
	NORTHWEST TOTAL	114.33	NA	113.96	NA	NA

100-year	NW Onsite - Bypass	NA	NA	2.47	NA	NA
	NW Onsite - Detained	NA	121.22	NA	NA	NA
	NW Offsite - Detained	NA	141.67	NA	NA	NA
	Extended Dry Detention	NA	259.87	117.48	1006.40	2.992
	NORTHWEST TOTAL	<i>181.78</i>	NA	177.88	NA	NA

The 100-year water surface elevation (WSE) in the basin is 1006.40. The emergency spillway is 150 feet wide with a flowline elevation of 1006.90. The emergency spillway conveys the peak inflows for the 100-year (259.87 cfs) at WSE of 1007.66. The top of dam elevation is at 1008.66 providing a minimum freeboard of one foot over the 100-year WSE through the emergency spillway.

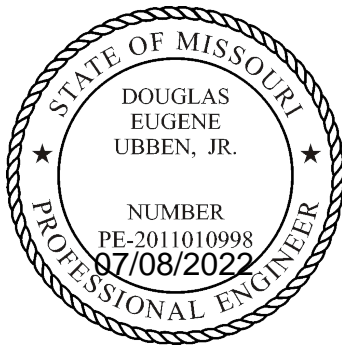
As seen in Table 2 above, the proposed peak release rates in the 2, 10, and 100-year storm events are under the allowable release rates for the respective storm events. The water quality V-notch weir in the basin was designed using the 2012 MARC BMP Manual spreadsheet for extended dry detention, which is sized to drawdown the 90% mean annual event (water quality storm) in a minimum of 40 hours. The offsite undeveloped area to the east of the proposed site has been included in the sizing of the drawdown time for the water quality storm. Therefore, any future development occurring on this offsite area will not be subject to drawdown the 90% mean annual event (water quality storm) in a minimum of 40 hours but will be required to provide detention in the 2, 10, and 100-year storm as outlined in in APWA Section 5608.4.C.1 – Comprehensive Control Strategy. See Appendix “B” for the Extended Dry Detention Design Details.

6. CONCLUSION

This report and attached appendices complete Phelps Engineering Inc. and McMullen Stormwater Engineering LLC's submittal of the Preliminary Stormwater Management plan for the proposed Orchard Woods development located northeast of the intersection of NE Lakewood Way & NE Woods Chapel Road in the City of Lee's Summit, Jackson County, Missouri. Please feel free to contact MSE at (913) 221-4055 if you require additional information.

Sincerely,

PHELPS ENGINEERING, INC. & MCMULLEN STORMWATER ENGINEERING LLC



Doug Ubben, Jr., P.E.
(Phelps Engineering, Inc.)

Daniel McMullen, P.E., CFM
(McMullen Stormwater Engineering LLC)

Enclosures

