RAINTREE VILLAGE PRELIMINAY DEVELOPMENT PLAN MICRO STORMWATER DRAINAGE STUDY

Prepared for:

Scenic Development

Lee Summit, Missouri

March 2022

Olsson Project No. 021-04054-A

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1. GENERAL INFORMATION

The Raintree Village development is a proposed senior living facility located on 11.86-acres in Lee Summit, Jackson County, Missouri., The development will include three phases for the complete development of the lot. Phase 1 will include one 91,380 S.F. building and associated drives, parking, and utilities. Phase 2 will include five 6,987 S.F. buildings and associated sidewalk, and utilities. Phase 3 is a building addition to the phase 1 building that will be 9,045 S.F.

This report will analyze and establish detention and BMP requirements for the development.

1.1. Project Location

Raintree Villaget is located entirely in the City of Lee Summit, Missouri. The property is bounded by SW Arborwalk Blvd. on the north, Arboridge Drive on the west, MO State HW 150 on the south, and existing commercial properties to the east. Development areas, as described above and the project location are shown in Figure 1.

Figure 1. Site Location.

1.2. FEMA Floodplain Information

The site lies entirely within areas determined to be of minimal flood hazard (unshaded Zone X) as depicted on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community Panel No. 29095 C 0531 G, effective date: 01/20/2017. A copy of the firmette is included in Appendix C.

1.3. Soils Information

Information obtained from the United States Department of Agriculture (USDA) Web Soil Survey website indicates site soils as:

Table 1. Soil Classifications

HSG	Map Symbol	Type	Slopes
D	10082	Arisburg-Urban Land Complet	1-5%
D	10181	Udarents-Urban Land-Sampsel Complex	5-9%

Natural Resources Conservation Services (NRCS) Runoff Curve Numbers (CN's) in this study have been assigned to tributary areas based upon these Hydrologic Soil Groups and associated existing and proposed land use. A copy of the NRCS printout is included in Appendix D.

1.4. Existing Stormwater Systems

No existing storm sewer systems exist on the property. Public storm sewers exist along SW Arborwalk Blvd and Arboridge Drive and south along State HW 150. This storm sewer then travels west/south to Tract 4, just west of our site before continuing south across State HW 150. Proposed storm sewers will be conveyed via the existing culvert pipes along the SW section of our site to Tract 4 before continuing south.

The existing storm sewer inlets and piping along SW Arborwalk Dr. were installed with previous phases of the Arborwalk development. This land area was shown as commercial development in the previously prepared and approved Arborwalk Preliminary Development Plan (PDP) prepared for Gale Communities dated June 19, 2003. During the previous PDP phases, stormwater management approaches where analysis for the land and uses shown. There are currently two large areas set aside for stormwater management, in a tract located north of SW Arborwalk Blvd and south of SW Arbor Park Drive and a tract located west of Arborridge and south of SW Arborwalk Blvd. There is also a basin currently installed on the unplatted land to the west of Arborridge just north of Highway 150. This basin is assumed to be temporary since located in unplatted land.

2. METHODOLOGY

This drainage study has been prepared to evaluate the hydrologic impact generated by development of Woodside Ridge Second Plat. The base data for the models prepared for this report has been obtained from available online maps and aerial imagery. Stormwater quantity management is based upon methods and objectives defined in the Kansas City Metropolitan Chapter of the American Public Works Association (KC-APWA) “Section 5600 Storm Drainage Systems & Facilities” (2011).

The following methods were used in this study to model existing and proposed (micro) conditions for stormwater runoff:

Runoff rates and conveyance systems were analyzed using Autodesk Storm and Sanitary Analysis 2020 (SSA). SSA utilizes the following approved methods:

- NRCS TR-55 Unit Hydrograph Method
- 2-year, 10-year, and 100-year, 24-hour Storm Precipitation Depths
    - ARC Type II Soil Moisture Conditions
    - 24-Hour NRCS Type II Rainfall Distribution
    - Runoff Curve Numbers per NRCS TR-55 (Tables 2-2a – 2-2c)
    - NRCS TR-55 Methods for Time of Concentration and Travel Time.
- Hydrodynamic routing of storm sewer systems
    - Manning’s ‘n’ and Junction Loss (k) values within KCAPWA Section 5600

Stormwater runoff models were created for the 100-Year (1 percent), 10_Year (10 percent), and 2-Year (50 percent) design storm events. The precipitation depths used in the analyses have been obtained from the National Oceanic and Atmospheric Administration (NOAA), Point Precipitation Frequency Estimates based on NOAA’s Atlas 14, Volume 8, Version 2 publication. Table 2 summarizes the rainfall depths used in this analysis:

Table 2. Precipitation Depths

Return Period	24-hour Precipitation Depth (in)
2-Year (50% Storm)	3.69
10-Year (10% Storm)	5.62
100-Year (1% Storm)	9.17

3. EXISTING CONDITIONS

The Raintree Village property is an undeveloped lot just north of State HW 150 and east of Arboridge Drive. This section will analyze the project areas described above to provide the baseline runoff results required for comparison to the developed conditions that will be presented in Section 4.

The existing study area is split between areas that drain to culvert pipes along the west and southwest of the site as shown on the exhibits in Appendix A. Existing land cover is undeveloped area with native grasses. Runoff in Basin E1 is conveyed overland to an existing 24'' CMP that travels west across Arboridge Drive. Runoff in Basin E2 is conveyed overland to an existing 36'' CMP that travels west across Arboridge Drive. The remainder OS1 and OS2 are conveyed overland to the road before entering an existing inlet and traveling via the existing storm network. The entire area E1, E2, OS1, and OS2 ultimately outlet to the Tract 4 just west of our site across Arboridge Drive before ultimately traveling south via existing infrastructure ending at Winnebago Lake.

Runoff Curve Numbers have been developed for each subbasin based on the existing land cover/use obtained from survey data and aerial photography and using TR-55 values for the corresponding land cover/use, as stated in Section 2. Table 3 summarizes the subbasin input data used for the analysis. Refer to the exhibit within Appendix A for a visual representation of the tributary areas and CN values.

Table 3. Existing Conditions Hydrologic Input

Subbasin	Drainage Area (ac)	CN	Tc (min)
E1	3.17	74.00	7.36
E2	7.82	74.00	19.04
OS1	0.43	74.00	6.20
OS2	0.44	74.00	7.09
Total	**11.86**		

Existing peak runoff rates and times are summarized in Table 4 and can be found in their entirety in **Error! Reference source not found.**.

Table 4. Existing Conditions Runoff Results

Subbasin	2-Year		10-YeaR		100-Year	
	Peak Q (cfs)	Peak Time (hr)	Peak Q (cfs)	Peak Time (hr)	Peak Q (cfs)	Peak Time (hr)
E1	6.30	12.00	13.47	12.00	27.83	12.00
E2	11.79	12.00	25.06	12.00	51.66	12.00
OS1	0.88	12.00	1.87	12.00	3.82	12.00
OS2	0.89	12.00	1.89	12.00	3.88	12.00
Total	18.00		38.15		78.62	

4. PROPOSED CONDITIONS

Improvements to the site will include the construction of one 91,380 S.F. building and associated drives, parking, and utilities, phase 1. Plus, the construction of five 6,987 S.F. buildings and associated sidewalk, and utilities, phase 2. Finally, the construction of one 9.045 S.F. building, phase 3, attached to the phase 1 building. Phase 1 is to be constructed now while Phase 2/3 is to be constructed at a future date, at which point the site will be verified to conform to the assumptions made within this study. Watershed areas will be generally maintained with the site releasing at the SW of the lot similar to the existing conditions. Paved surfaces and building roofs will be graded to direct runoff into the existing private storm system, minus a section of the site that will exit the site via overland flow to the existing storm sewer network along SW Arborwalk Blvd and Arboridge Drive.

The difference between the existing conditions model and the proposed conditions model is a direct result of the construction of Tract 1.

Since this land area is apart of an existing approved development plan where stormwater management was required to be reviewed, we are still working with the city to determine the best path forward on this land and requirements based on the previously approved studies. For the purpose of the Preliminary Development Plan Submittal, we have laid out potential scenarios and paths forward to allow all parties time to resolve the on-going discussions regarding previously approved studies and intent for this area. The paths forward have been listed below and when each phase submits for construction documents an updated Stormwater Study shall be provided to evaluate the current conditions and discussions with City of Lee's Summit.

Phase 1

As noted, Phase 1 will consist of one 91,380 S.F. building and associated, drives, parking, and utilities. Since this phase is intended to be constructed before the west property and may occur prior to having full resolution on stormwater management for the area, a temporary detention pond will be construction in the SW corner of the site, to control stormwater in an interm condition. The pond will be designed to allow the full Phase 1/2 runoff to be held without any future dentition when phase 2 is constructed, case it is ultimately required. As the pond is located at the site of two of the future building the future layout may be modified to a three-building configuration if necessary. For permeant detention there are a few options available that are being considered.

- **Option 1:** Maintain interim condition detention pond and reconfigure phase 2 layout to eliminate two of the proposed memory care buildings.
- **Option 2:** This option involves coordinating with the adjacent lot to the west, Tract 1 for a combined detention system for both lots. We are currently coordinating between owners to determine if a combined storm system can be installed with the proposed layout for this lot. Once it is determined if combined stormwater can be installed a determination will be made on where the permanent detention pond will be located.
- **Option 3:** There are on-going conversations with the city regarding the previously approved study and what the stormwater management approach for this area was. Pending what these discussions lead to, stormwater management approaches may be revisited to determine if there is a need for this area to have a basin installed based on upstream controls measures and compliance with the previously approved Preliminary Development Plan.

Phase 2

Phase 2 will consist of five 6,987 S.F. buildings and associated sidewalk, and utilities. Detention was constructed during the phase 1 plans for the ultimate build out condition, however it should be revisited at time of Phase 2 to determine if the basin from Phase 1 is still needed or if other stormwater control measures have been installed. If the basin is still needed this phase will consist of less buildings, then shown, however ideally all five will be constructed, thus shown on the Preliminary Development Plan.

Phase 3

Phase 3 will consist of one 9,045 S.F. buildings and associated sidewalk, and utilities. Detention was constructed during the phase 1 plans for the ultimate build out condition, however it should be revisited at time of Phase 3 to determine if the basin from Phase 1 is still needed or if other stormwater control measures have been installed.

Runoff Curve Numbers have been updated for each subbasin based on the existing and proposed land cover/uses obtained from survey data, aerial photography, and proposed design, using TR-

55 values for the corresponding land cover/use, as stated in Section 2. Table 5 summarizes the subbasin input data used for the analysis. Refer to the exhibit within Appendix A for a visual representation of the tributary areas and CN values.

Table 5. Proposed Conditions Hydrologic Input

Subbasin	Drainage Area (ac)	CN	Tc (min)
P1	9.50	83.98	5.00
OS1	1.25	74.00	5.00
OS2	1.11	74.00	8.46
Total	**11.86**		

Proposed peak runoff rates, and detention basin results are summarized in the tables below

Table 6. Proposed Conditions Runoff Results

Subbasin	2-Year		10-YeaR		100-Year	
	Peak Q (cfs)	Peak Time (hr)	Peak Q (cfs)	Peak Time (hr)	Peak Q (cfs)	Peak Time (hr)
P1	30.37	12.00	55.32	12.00	101.50	12.00
OS1	2.72	12.00	5.66	12.00	11.62	12.00
OS2	2.13	12.00	4.52	12.00	9.39	12.00

Table 7. Allowable Peak Flowrate Comparison

Subbasin	Storm Event	Existing (cfs)	Allowable (cfs)
Tract 1 (Overall)	2-Year	18.00	18.00
	10-Year	38.15	38.15
	100-Year	78.62	78.62

Above tables show the peak allowable release rate for the proposed conditions site when fully developed.

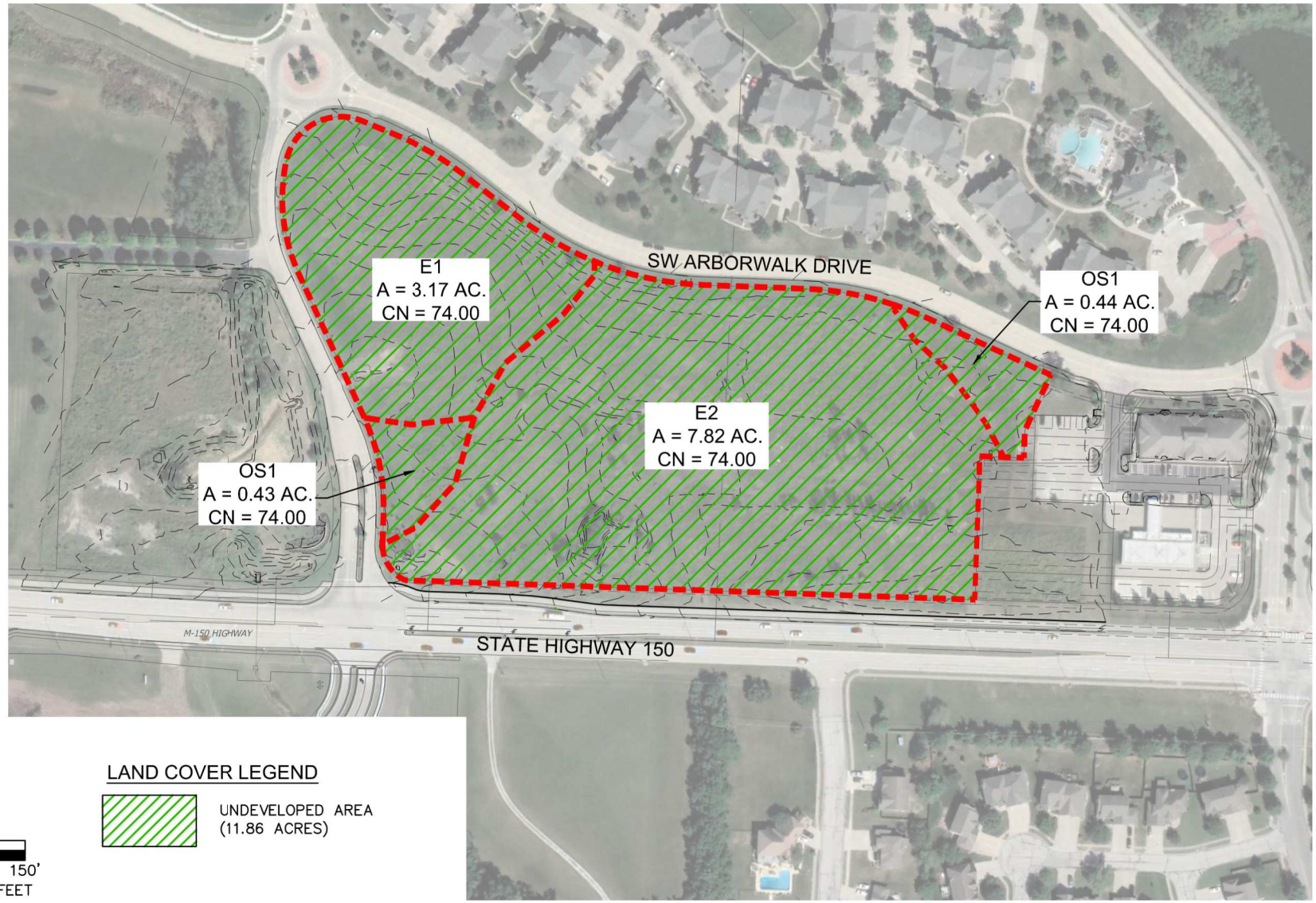
5. CONCLUSION

The Raintree Village development is a proposed senior living facility development in Lee Summit, Jackson County, Missouri. This study has been prepared for the proposed project to review the site design in conformance with the city's proposed runoff and water quality criteria.

At the time this study was prepared there still is on-going overall discussions with the city regarding stormwater management for the land area. Along with discussions with the city, there are also discussions between the property owner to the west and this property owner and what can be done jointly to address stormwater. As these discussions are activily occurring, we have laid out a few paths forward to detail options. With each phase of construction an updated stormwater study shall be submitted to outline site conditions and serve as an update to the currently on-going discussions.

APPENDIX A

Exhibits



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PROJECT NO: A21-04054 DRAWN BY: CSM DATE: 03/25/2022	RAINTREE VILLAGE - EXISTING CONDITIONS	olsson 1301 Burlington Street North Kansas City, MO 64116 TEL 816.361.1177	EXHIBIT 1

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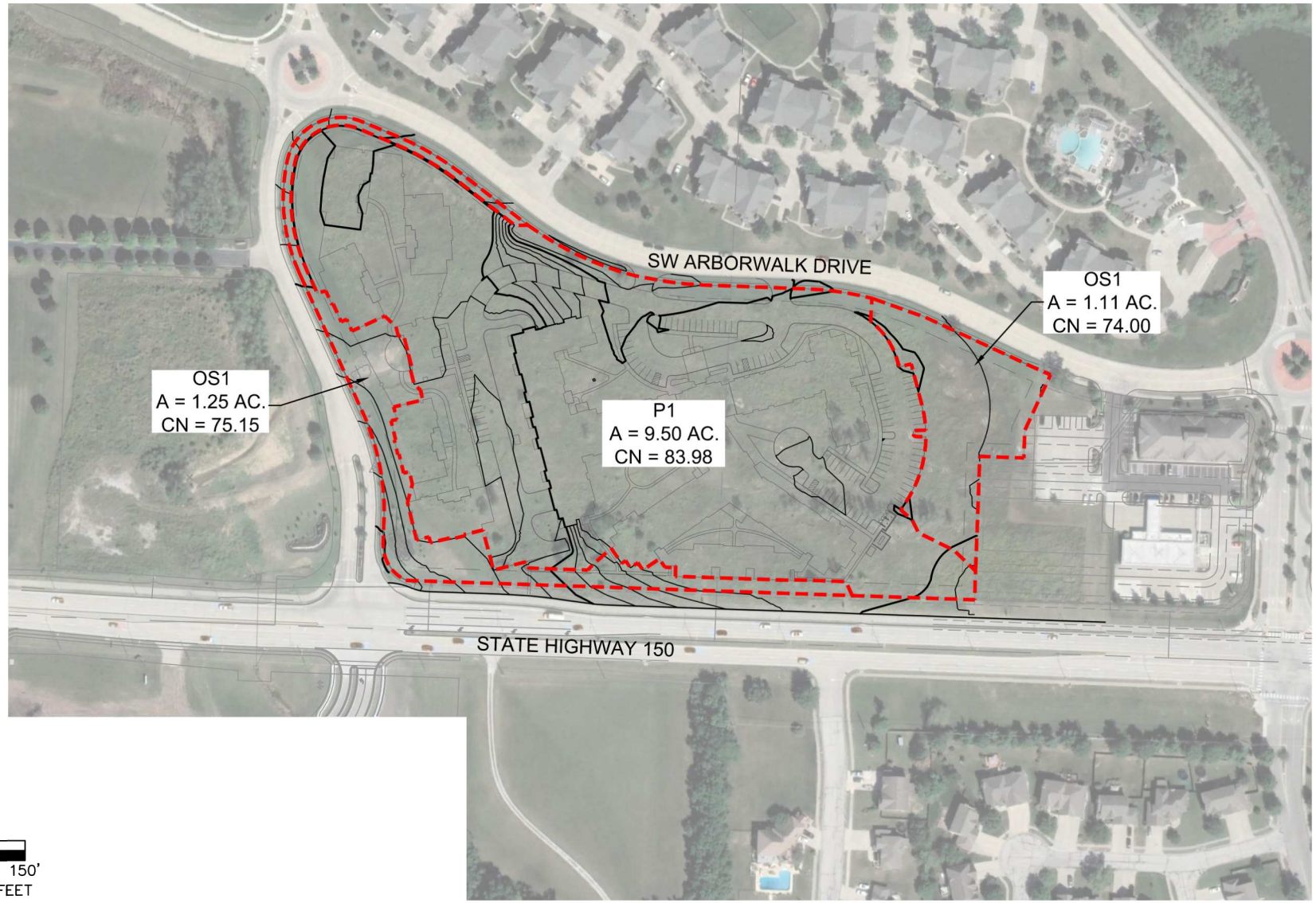
PROJECT NO: A21-04054	RAINTREE VILLAGE - PROPOSED LAND COVER	olsson 1301 Burlington Street North Kansas City, MO 64116 TEL 816.361.1177	EXHIBIT 2
DRAWN BY: CSM			
DATE: 03/25/2022			



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PROJECT NO: A21-04054	RAINTREE VILLAGE - PROPOSED DRAINAGE AREAS	EXHIBIT
DRAWN BY: CSM		3
DATE: 03/25/2022		

olsson
1301 Burlington Street
North Kansas City, MO 64116
TEL 816.361.1177