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June 20, 2024

Preliminary Stormwater Management & Drainage Report

Client

Intrinsic Development
3622 Endeavor Ave, Ste. 101
Columbia, MO 65201

Project

Discovery Crossing
SW Corner of Douglas St and Colbern Rd
Lee's Summit, MO

P.N. 24KC10015

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Project Description and General Information

The proposed project is a 268 acre mixed use development located at the intersection of Colbern Road and Douglas Street in Lee's Summit, Missouri. Discovery Crossing is the second phase of the Discovery Park project located on the south side of Colbern Road.

The purpose of this report is to analyze the stormwater impacts of the proposed mixed use development and show that the post-development conditions meet the regulations established by the City of Lee's Summit. This phase of the development is located on the southwest corner of Douglas Street and Colbern Road in Lee's Summit, Missouri. The full site is bounded by Cobern Road to the north, Douglas Street to the east, Interstate 470 to the south, and Main Street to the west. This phase is the easternmost portion encompassing approximately 18 acres of the overall site. The existing site is undeveloped, consisting mostly of grass and farmland.

The existing soil characteristics as published in the Soil Survey for Jackson County, Missouri are summarized in the table below. Additional information on the existing soil is provided in the Web Soil Survey located in the Appendix.

Table 1: Soil Classifications

Map Unit Symbol	Map Unit Name	Slopes	Hydrologic Soil Group
10113	Oska Silty Clay Loam	5 to 9%	D
10120	Sharpsburg Silty Loam	2 to 5%	C
10128	Sharpsburg-Urban Land Complex	2 to 5%	D
10180	Udarents-Urban Land-Sampsel Complex	2 to 5%	C
30080	Greenton Silty Clay Loam	5 to 9%	C/D
40107	Snead-Rock Outcrop Complex	5 to 14%	D

According to FEMA flood maps (FIRM Panel 29095C0409G), the site is located in zone X, an area of minimal flood hazard. No amendments or revisions to the map are being proposed.

Methodology

The Discovery Crossing site was analyzed in both the pre-development and post-development conditions. The analysis was conducted utilizing HydroCAD which uses an SCS Type-II 24 hr. rainfall distribution data in computing unit hydrographs for varying conditions. Precipitation depths used in the analysis have been interpolated from the "Technical Paper No. 40 Rainfall Frequency Atlas of the United States" (TP-40).

Table 2: Rainfall Precipitation

Annual Exceedance Probability (AEP)	Rainfall Depth (inches)
90% (Water Quality Event)	1.37
50% (2 year)	3.50
10% (10 year)	5.34
1% (100 year)	7.71

The post-development rates were determined utilizing the APWA 5600 Comprehensive Protection Strategy in accordance with the City of Lee's Summit regulations. Under this strategy, peak runoff control is provided for the 1%, 10%, and 50% chance storms and volumetric and/or extended detention control (≥40 hr.) of the 90% mean annual event storm. The maximum allowable release rates for the design storm events are established for the 2-year (0.50 cfs/acre), 10-year (2.0 cfs/acre), 100-year (3.0 cfs/acre).

Existing Conditions Analysis

The site generally drains to the north and west. The north watershed drains to the existing storm sewer network along Colbern Road and the first phase of Discovery Park, and ultimately into the regional detention basin. The west and south watersheds drain into the stream located west of the site that crosses under Colbern Road into Unity Lake Number One on the north side of Colbern Road. Refer to the Pre-Development Plan in the Appendix. A summary of the existing conditions design parameters is in the table below.

Table 3: Existing Conditions Parameters

Subarea	Total Area (ac)	Onsite Area (ac)	Offsite Area (ac)	NRCS Weighted CN	Time of Concentration (min)
North	13.45	9.21	4.24	83	6.2
West	9.32	9.32	0	79	10.3

The portion draining to the north has been included in the previous drainage study titled "Discovery Park Macro Stormwater Report" prepared by Olsson dated October 24, 2023 and the drainage study titled "Stormwater Management and Drainage Report" prepared by OWN, Inc. dated June 20, 2024. The previous studies determined the allowable release rates and calculated the required detention for The Village at Discovery Park, Aria Apartments, and a portion of Discovery Crossing. A portion of Discovery Crossing will drain into the existing basin constructed as part of the Village at Discovery Park. Water quality treatment for Discovery Crossing was not provided and has been included in the proposed improvements. The existing peak runoff rates were calculated for the design storms and summarized below.

Table 4: Existing Peak Flow Summary

Watershed	Peak Flow 2-yr Event (cfs)	Peak Flow 10-yr Event (cfs)	Peak Flow 100-yr Event (cfs)
North	42.80	77.55	123.66
West	21.83	42.99	71.48

Proposed Conditions Analysis

The proposed development for this phase consists of 9 lots containing retail and restaurant buildings and associated surface parking. The proposed site has 3 watersheds; north (lots 1-5), west (lot 9), and south (lots 6-8). The west and south watershed ultimately drain into the same creek and should be combined when compared to the existing west watershed. Refer to the Post-Development Plan in the Appendix. The allowable release rates were determined using the Comprehensive Control Strategy as defined in APWA 5608.4. A summary of the allowable release rates is provided in the table below:

Table 5: Allowable Release Rates

Design Storm	Allowable Release Rate (cfs/acre)	South (6.29 ac.) (cfs)	West (2.24 ac.) (cfs)
50% (2 year)	0.5	3.15	1.14
10% (10 year)	2.0	12.58	4.58
1% (100 year)	3.0	18.87	6.87

*Note: The north watershed (Lots 1-5) is not included in the allowable release rate calculations as detention has been previously provided.

A summary of the proposed design parameters is in the table below.

Table 6: Proposed Conditions Parameters

Subarea	Total Area (ac)	Onsite Area (ac)	Offsite Area (ac)	NRCS Weighted CN	Time of Concentration (min)
North	11.27	8.71	2.56	94	6
South	6.41	6.29	0.12	94	6
West	2.29	2.29	0	94	6

To mitigate the impact of the proposed increase in impervious area associated with the development and to satisfy the requirement for detention, two above ground detention basins are proposed to capture stormwater and release at rates at or below the allowable release rates as established above. The proposed basins will receive stormwater from enclosed pipe systems that collect water from the streets and parking lots.

Outlet control structures with multiple stage release controls are proposed to provide controlled release over the design storms. Specific detail of each outlet control structure is provided in the associated watershed review below.

North Watershed

The proposed improvements in the north watershed are consistent with the previously approved drainage studies. Below is a comparison summary of the previously assumed parameters for the sizing of the regional detention basin and the proposed improvements.

Table 7: Existing Basin Design Comparison Summary

	Previous Studies	Proposed
Total Area (ac.)	13.42	11.27
Onsite Area (ac.)	9.88	8.71
NRCS CN	94	94

The proposed total area is smaller due to the inclusion of the Colbern Road right-of-way in the original study. The proposed condition onsite area shows a reduction in the area originally proposed and therefore no additional detention is required.

The storm sewer network was also analyzed to confirm the proposed site can be served by the existing storm crossings under Colbern Road. Design of the pipe crossings to convey the 100-year flows without overtopping was provided in the approved Public Storm Sewer Plans prepared by Olsson dated 9/8/2023.

Per the previous studies, water quality treatment was not provided for the area within Discovery Crossing. As such, water quality treatment is proposed to treat the storm drainage prior to leaving the site for the north watershed. Two hydrodynamic separators are proposed to provide the required water quality treatment. The hydrodynamic separators will be sized to treat the flow resulting from the APWA Water Quality Storm. Final design and sizing will be provided with the Final Development Plans for the associated lots.

South Watershed

The south watershed is approximately 6.41 acres located on Lots 6-8 and consists of three commercial buildings and associated parking lots. The calculated CN for this area is 94, which is consistent with urban commercial development.

An above ground extended dry detention basin is proposed to provide the volume needed to meet the allowable release rate for this development. The basin will have a 6'x6' outlet control structure to control the release rates for the 2-yr, 10-yr, and 100-yr design storms and to provide a controlled release of the water quality storm. A 2-inch diameter orifice is proposed to drain the water quality storm over the required 40 hour period. The associated water quality volume and sizing calculations are provided in the Appendix. A 42-inch by 6-inch rectangular opening and 72-inch by 72-inch open top will provide the controlled release of the 2-yr, 10-yr, and 100-yr design storms. The peak release rates are summarized in the table below:

Table 9: South Watershed Release Rate Summary

Storm Event	Allowable Release Rate (cfs)	Proposed Peak Release Rates (cfs)
2 year	3.15	2.92
10 year	12.58	12.03
100 year	18.87	17.46

West Watershed

The west watershed is approximately 2.29 acres located on Lot 9 and consists of a commercial building and associated parking lot. The calculated CN for this area is 94, which is consistent with urban commercial development.

An above ground extended dry detention basin is proposed to provide the volume needed to meet the allowable release rate for this development. The basin will have a 5'x5' outlet control structure to control the release rates for the 2-yr, 10-yr, and 100-yr design storms and to provide a controlled release of the water quality storm. A 1.25-inch diameter orifice is proposed to drain the water quality storm over the required 40 hour period. The associated water quality volume and sizing calculations are provided in the Appendix. A 24-inch by 5-inch rectangular opening and 60-inch by 60-inch open top and 9.5-inch orifice will provide the controlled release of the 2-yr, 10-yr, and 100-yr design storms. The peak release rates are summarized in the table below:

Table 10: West Watershed Release Rate Summary

Storm Event	Allowable Release Rate (cfs)	Proposed Peak Release Rates (cfs)
2 year	1.14	0.99
10 year	4.58	4.25
100 year	6.87	6.03

The peak flows were also compared to the existing flows and summarized in the table below. The proposed west and south watershed peak flows were combined to compare to the existing west watershed.

Table 11: Peak Flow Comparison

Watershed	Existing Peak Flow 2-yr Event (cfs)	Proposed Peak Flow 2-yr Event (cfs)	Existing Peak Flow 10-yr Event (cfs)	Proposed Peak Flow 10-yr Event (cfs)	Existing Peak Flow 100-yr Event (cfs)	Proposed Peak Flow 100-yr Event (cfs)
North	42.80	63.79	77.55	101.22	123.66	148.82
West	21.83	6.76	42.99	20.80	71.48	30.14

The north watershed shows an increase in the peak flow rates as a result of the development. This increase has already been mitigated with the detention basin previously provided in the first phase of the project.

Summary and Recommendations

The existing site is undeveloped, consisting mostly of grass and farmland. The proposed development for this phase consists of 9 lots containing retail and restaurant buildings and associated surface parking. To mitigate the increase in runoff release rates due to the increase in impervious area, an enclosed pipe network in conjunction with above ground detention basins with an outlet control structure was designed. As stated previously, approximately 13 acres of the north watershed was included in the design of the first phase of Discovery Park and the proposed changes in this phase still meet the assumed parameters set for its design. Peak runoff control is provided for the 1%, 10%, and 50% chance storms and volumetric and/or extended detention control (≥40 hr.) of the 90% mean annual event storm. Post-development site conditions and detention basins were modeled and analyzed using HydroCAD. Detailed calculations are presented in the Appendix to support the presented release rate summaries, detention volumes, and maximum water surface elevations.

Appendix

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Pre-Development Plan

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DISOVERY CROSSING PRELIMINARY STORMWATER REPORT

SW CORNER OF DOUGLAS ST
AND COLBERN RD
LEE'S SUMMIT, MO

REVISIONS

NO.	DESCRIPTION	DATE
1	INITIAL SUBMISSION	06/20/2024

DRAWING INFORMATION

PROJECT NO: 24KC10025
DRAWN BY: JGD
CHECK BY: JWB
ISSUED DATE: 06/20/2024
FIELD BOOK:

ISSUED BY:
LICENSE NO: ____

SHEET TITLE

PRE-DEVELOPMENT PLAN

SHEET NUMBER

1

1 OF 2

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Post-Development Plan

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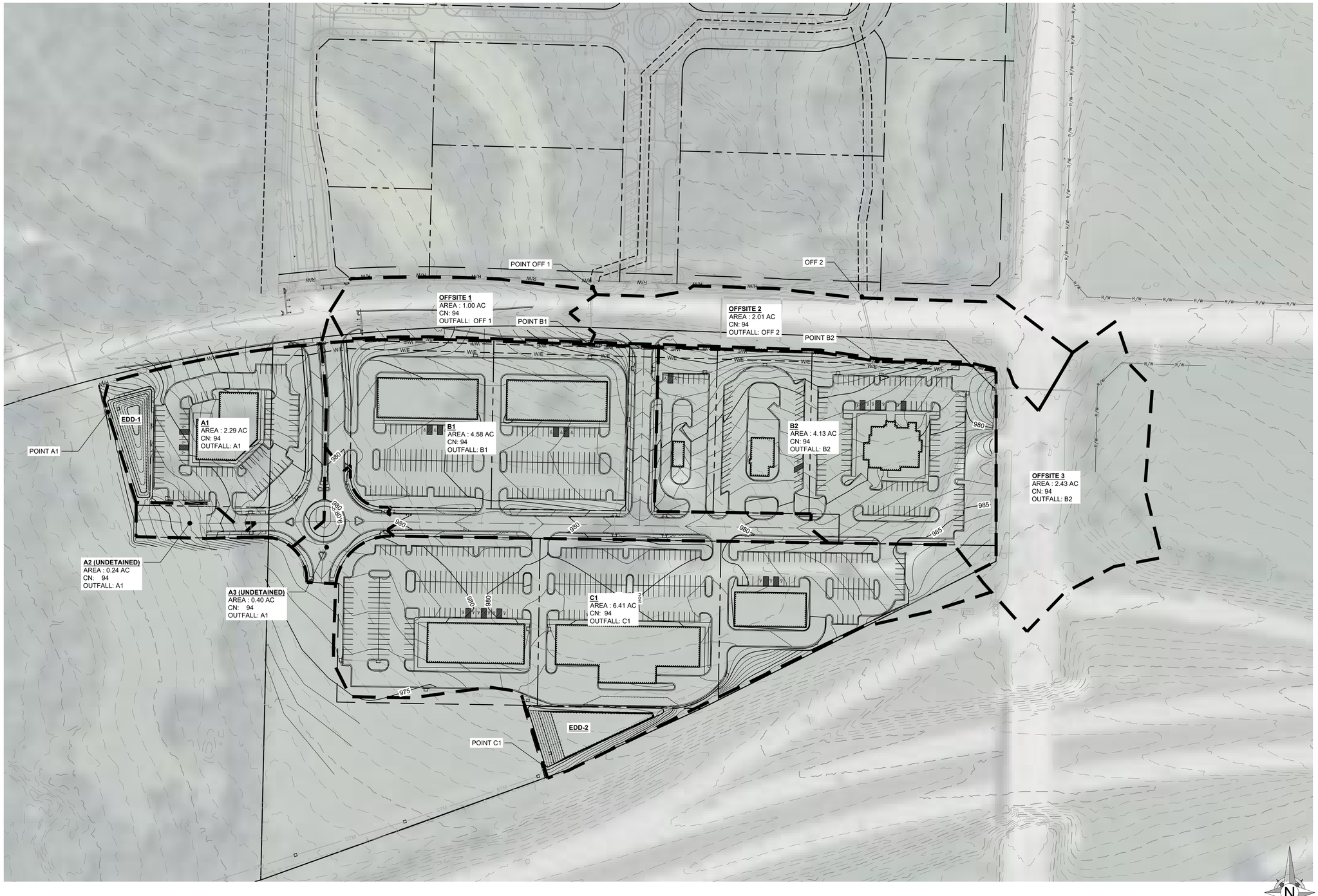

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DISOVERY CROSSING PRELIMINARY STORMWATER REPORT

SW CORNER OF DOUGLAS ST
AND COLBERN RD
LEE'S SUMMIT, MO

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NO.	DESCRIPTION	DATE
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SHEET TITLE

POST-DEVELOPMENT PLAN

SHEET NUMBER

2

2 OF 2

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