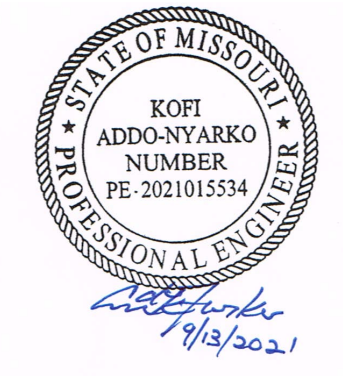
DRAINAGE STATEMENT
MO' BETTAHS

520 NW CHIPMAN RD.,
LEE SUMMIT, MO 64086

Prepared for:
Savory Development Fund, LLC
1557 W. Innovation Way,
Lehi Utah 84043

Prepared by:
Bowman Consulting Group
5601 Democracy Dr., Ste 205
Plano, TX 75024
972-497-2991

January, 2021
Bowman Project No. 070460-01-001



1.0 INTRODUCTION

The purpose of the Drainage Statement is to identify drainage impacts resulting from land development activities and determine the improvements necessary to control the increase in storm water runoff and to treat the pollutants that can adversely impact water quality.

The proposed 0.88-acre subject site is located at 520 NW Chipman Rd. within the City of Lee's Summit, Missouri city limits. The overall lot is described as Lot 4C-2, Summit Orchard, Lot 4C-1, 4C-2 and 4C-3, corrected Summit Orchard, Lot 4A-4E, a subdivision in the City of Lee's Summit, Jackson County, Missouri, according to the recorded plat thereof. West and east of the subject site is a proposed restaurant and coffee shop with drive thru respectively, north is a commercial strip center and south is NW Chipman Rd.

The subject site is undeveloped. The purpose of this report is the following:

- Establish onsite drainage criteria for the development.
- Show compliance with the City of Lee's Summit Design Standards.

2.0 SITE DESCRIPTION

2.1 Drainage Basin

The site is currently undeveloped. Onsite storm water runoff will flow towards the master planned storm system. The site currently contains no visible retention basins. The drainage map for this site is in Appendix A. Existing elevations vary from 1006'-1008'. The site slopes from northwest corner to the southeast onto the master plan system.

2.2 Floodplain Status

According to FEMA FIRM Map 29095C0417G with effective date of January 20, 2017, the site lies in Zone X which is considered as an area of minimal flood hazard, known as areas outside the Special Flood Hazard Areas and higher than the elevation of the 0.2-percent-annual-chance flood.

3.0 DESIGN

3.1 Pre vs Post Development Comparison

The pre-development vs post-development drainage area maps were analyzed to determine the peak flows. The pre-developed runoff coefficient for the proposed site is 0.38 and a post-developed runoff coefficient for the proposed site is 0.70.

Using the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) Precipitation Frequency Data Server (PFDS), the precipitation for a 100-year recurrence is 4.21 inches/hour for a time of concentration of 5 minutes.

Hydrology calculations were performed using City of Lee's Summit "Rational Method". Flows from the watersheds were computed for a 5-year storm occurrence, 10-year storm occurrence, 25-year storm occurrence, 50-year storm occurrence and a 100-year occurrence for both the existing and proposed site conditions. The hydrology calculations are included in the appendix.

3.0 CONCLUSION

The Mo' Bettahs restaurant development has been designed in accordance with the City of Lee's Summit Drainage criteria. All drainage is designed to be carried through the proposed underground system which eventually connects to the proposed master plan system that accounts for the increase in flow for this proposed development.

APPENDIX A

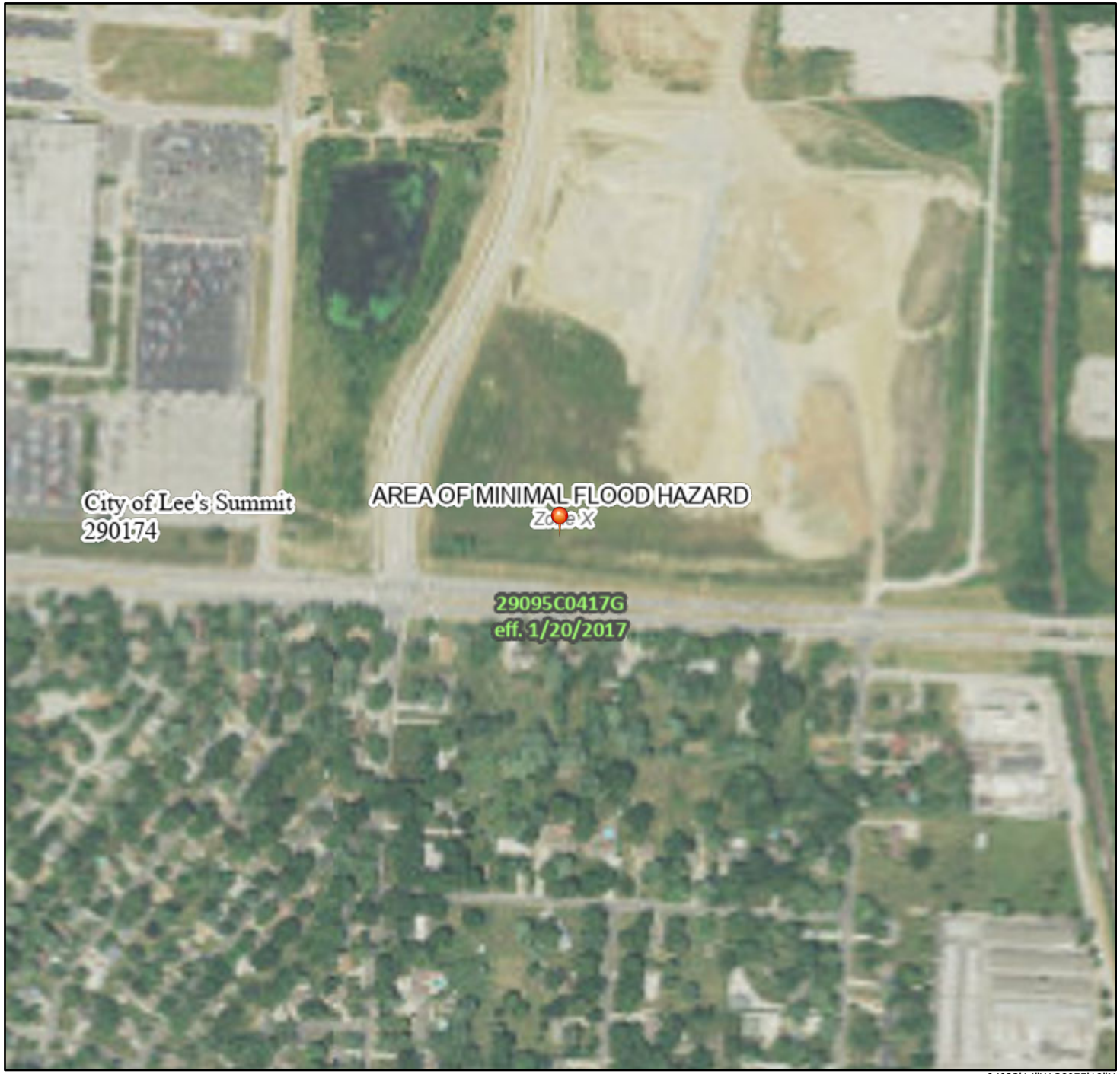
FIGURES

520 NW Chipman Rd.
Lee Summit, MO
Legend
520 NW Chipman Rd
NW Donovan Rd
NW Ward Rd
NW Ward Rd
NW Donovan Rd
PROPOSED SITE
NW Chipman Rd
NW Chipman Rd
NW Chipman Rd
N
Google Earth
500 ft

National Flood Hazard Layer FIRMette

FEMA

94°23'51"W 38°55'47"N



94°23'14"W 38°55'19"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

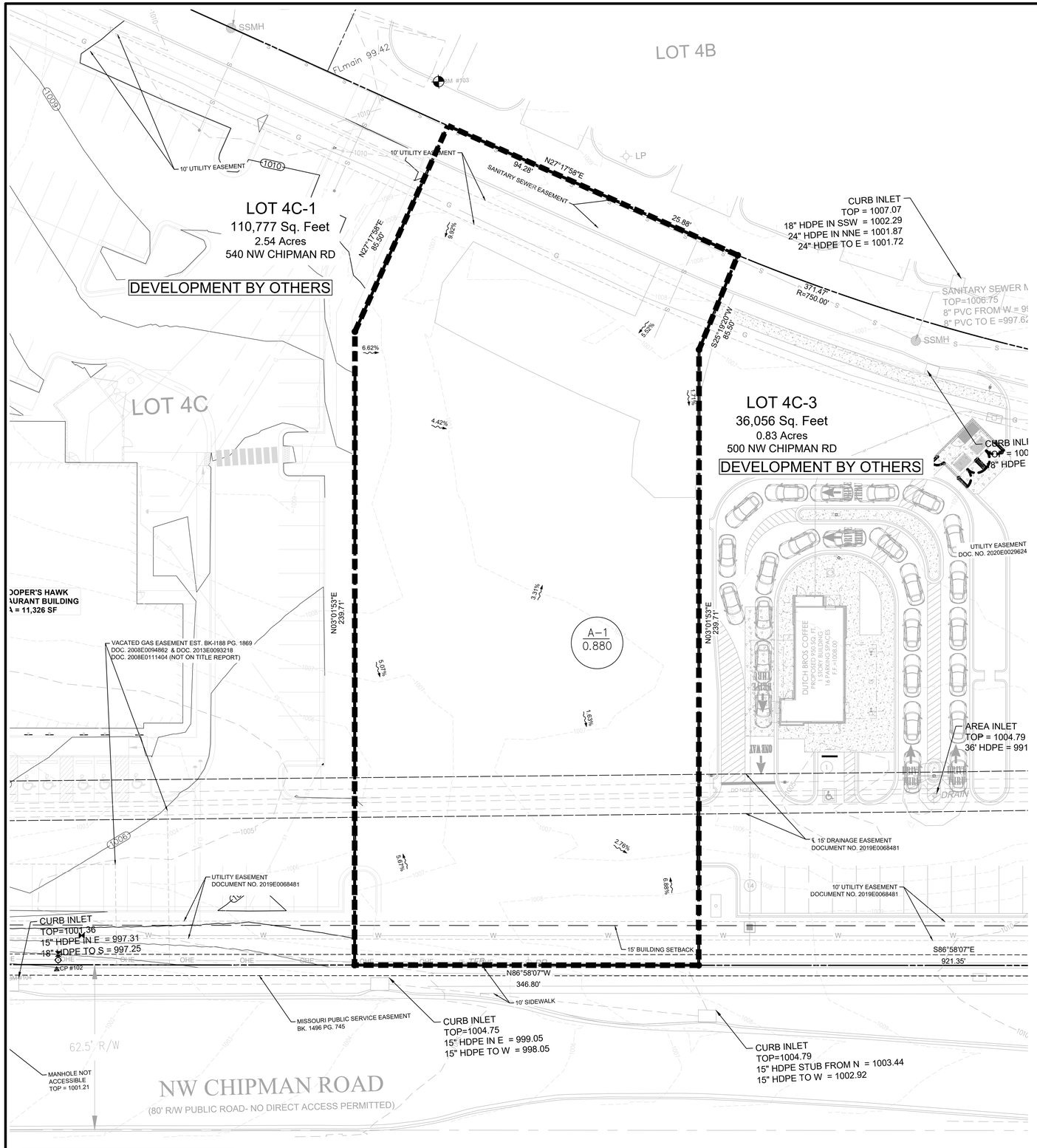
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/26/2021 at 12:21 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



DRAINAGE LEGEND

DIRECTION OF FLOW	5.06%
DRAIANGE AREA BOUNDARY	
DRAINAGE AREA IDENTIFIER	A-1 / 2.246 — I.D. / area (acres)
EXISTING CONTOURS	882

EXISTING LEGEND

PROPERTY LINE	
STORM DROP INLET	DRAIN
STORM MANHOLE	STMH
LIGHT POLE	LP
COMMUNICATION MANHOLE	UMH
POWER POLE	PP
LIGHT POLE	LP
COMMUNICATION MANHOLE	UMH
GOOGLE FIBER VAULT	FVT
FIRE HYDRANT	FH
WATER VALVE	WV
SANITARY SEWER MANHOLE	SSMH
SPRINKLER CONTROL VALVE	SCV
TRAFFIC CONTROL VAULT	TJB
COMMUNICATION MARKER	T
POWER POLE	PP
UNDERGROUND GAS LINE	G
SANITARY SEWER LINE	S
STORM SEWER LINE	
OVERHEAD POWER LINE	OHP

20 0 20 40
SCALE: 1 INCH = 20 FT

BENCHMARKS

No. 103	CONTROL/ TBM (1005943.8164, 2822115.1076)	ELEV: 1010.04'
No. 104	CONTROL/ TBM (1005935.3569, 2821932.3569)	ELEV: 1000.36'

EXISTING IMPERVIOUS AREA CALCULATIONS

EXISTING IMPERVIOUS AREA = 0.113 AC (12.84%)

EXISTING OPEN SPACE AREA = 0.767 AC (87.16%)

Pre-Development Conditions												
Drainage Area	Acres	Time of Concentration (Min)	Runoff Coefficient C	5 Year Intensity (In/Hr)	5 Year Runoff (cfs)	10 Year Intensity (In/Hr)	10 Year Runoff (cfs)	25 Year Intensity (In/Hr)	25 Year Runoff (cfs)	50 Year Intensity (In/Hr)	50 Year Runoff (cfs)	100 Year Intensity (In/Hr)	100 Year Runoff (cfs)
A-1	0.880	5.00	0.38	7.18	2.40	8.34	2.79	9.98	3.34	11.30	3.78	12.60	4.21

Runoff coefficient per Section 5602.3.C of Design and construction manual

C=0.3 + 0.6 x I

C=0.3 + 0.6 x 0.1284

C=0.38

CALCULATIONS PER CITY OF LEE'S SUMMIT DESIGN AND CONSTRUCTION MANUAL

Know what's **below.** **Call** before you dig.

THE LOCATION OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. CONTRACTOR AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTORS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

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MDPR Firm Registration No. 2018010514
5601 DEMOCRACY DRIVE, SUITE 205, PLANO, TX 75024
Phone: (972) 497-2990
www.bowman.com

REVISIONS

REVISION	DESCRIPTION	DATE

EXISTING DRAINAGE AREA MAP

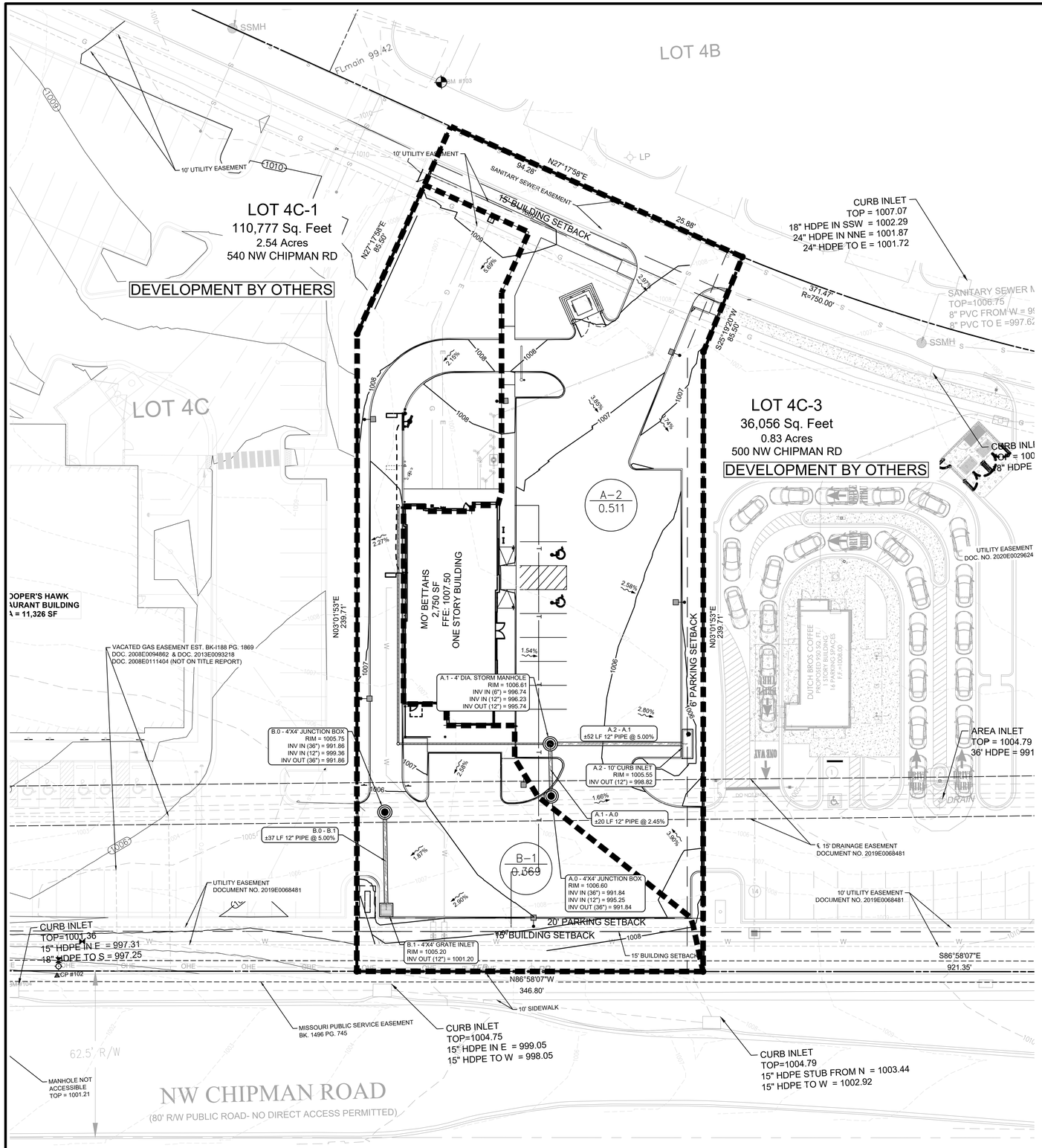
MO' BETTAHS
520 NW CHIPMAN RD
LEE'S SUMMIT, MO 64086

STATE OF MISSOURI
KOFI ADDO-NYARKO
NUMBER PE-2021015534
PROFESSIONAL ENGINEER
1/25/22

DESIGN	DRAWN	CHKD
BB	BB	KAN

JOB No. 070460-01-001

SHEET C4.0



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DRAINAGE LEGEND

- DIRECTION OF FLOW — 5.06%
- DRAIANGE AREA BOUNDARY
- DRAINAGE AREA IDENTIFIER — A–1 / 2.246 — I.D. / area (acres)
- EXISTING CONTOURS — 882

EXISTING LEGEND

PROPERTY LINE	
STORM DROP INLET	DRAIN
STORM MANHOLE	STMH
LIGHT POLE	LP
COMMUNICATION MANHOLE	UMH
POWER POLE	PP
LIGHT POLE	LP
COMMUNICATION MANHOLE	UMH
GOOGLE FIBER VAULT	FVT
FIRE HYDRANT	FH
WATER VALVE	WV
SANITARY SEWER MANHOLE	SSMH
SPRINKLER CONTROL VALVE	SCV
TRAFFIC CONTROL VAULT	TJB
COMMUNICATION MARKER	T
POWER POLE	PP
UNDERGROUND GAS LINE	G
SANITARY SEWER LINE	S
STORM SEWER LINE	
OVERHEAD POWER LINE	OHP

PROPOSED IMPERVIOUS AREA CALCULATIONS

PROPOSED IMPERVIOUS AREA	= 0.588 AC (66.94%)
PROPOSED OPEN SPACE AREA	= 0.290 AC (33.06%)
NET OPEN SPACE DECREASE	=0.109 AC

INLET CAPACITY CALCULATIONS

A.2 CURB INLET

$Qi = Co \times h \times L\ (2\ g \times do)^{0.5}$
$Qi = 0.67 \times 0.83 \times 10(\ 2 \times 32.2 \times 0.75)^{0.5}$
$Qi = 38.65\ CFS$

B.1 GRATE INLET

$Qi = Co \times h \times L\ (2\ g \times do)^{0.5}$
$Qi = 0.67 \times 0.83 \times 16(\ 2 \times 32.2 \times 0.75)^{0.5}$
$Qi = 61.84\ CFS$

PIPE SIZING CALCULATIONS

A.2 - A.1

$D = [(Qn) / (K_Q \times So^{0.5})]^{0.375}$
$D = [(4.51x0.01) / (0.46(0.05)^{0.5}]^{0.375}$
$D = 0.73\ FT = 8.8\ IN$
USE 12IN PIPE

B.0 - B.1

$D = [(Qn) / (K_Q \times So^{0.5})]^{0.375}$
$D = [(3.25x0.01) / (0.46(0.05)^{0.5}]^{0.375}$
$D = 0.32\ FT = 3.8\ IN$
USE 12IN PIPE

Post-Development Conditions

Drainage Area	Acres	Time of Concentration (Min)	Runoff Coefficient C	5 Year Intensity (In/Hr)	5 Year Runoff (cfs)	10 Year Intensity (In/Hr)	10 Year Runoff (cfs)	25 Year Intensity (In/Hr)	25 Year Runoff (cfs)	50 Year Intensity (In/Hr)	50 Year Runoff (cfs)	100 Year Intensity (In/Hr)	100 Year Runoff (cfs)
A-2	0.511	5.00	0.70	7.18	2.57	8.34	2.98	9.98	3.57	11.30	4.04	12.60	4.51
B-1	0.369	5.00	0.70	7.18	1.85	8.34	2.15	9.98	2.58	11.30	2.92	12.60	3.25
				5 Year Runoff Total	**4.42**	**10 Year Runoff Total**	**5.14**	**25 Year Runoff Total**	**6.15**	**50 Year Runoff Total**	**6.96**	**100 Year Runoff Total**	**7.76**

Runoff coefficient per Section 5602.3.C of Design and construction manual
C=0.3 + 0.6 x I
C=0.3 + 0.6 x 0.6694
C=0.70

CALCULATIONS PER CITY OF LEE'S SUMMIT DESIGN AND CONSTRUCTION MANUAL

DIFFERENCE IN RUNOFF (EXISTING VS PROPOSED)					
5 Year Runoff (cfs)	10 Year Runoff (cfs)	25 Year Runoff (cfs)	50 Year Runoff (cfs)	100 Year Runoff	Net Change
2.02	2.35	2.81	3.18	3.55	Increase

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DESIGN	DRAWN	CHKD
BB	BB	KAN

JOB No. 070460-01-001

SHEET C4.1

APPENDIX B

PEAK FLOW CALCULATIONS

Pre-Development Conditions													
Drainage Area	Acres	Time of Concentration (Min)	Runoff Coefficient C	5 Year Intensity (In/Hr)	5 Year Runoff (cfs)	10 Year Intensity (In/Hr)	10 Year Runoff (cfs)	25 Year Intensity (In/Hr)	25 Year Runoff (cfs)	50 Year Intensity (In/Hr)	50 Year Runoff (cfs)	100 Year Intensity (In/Hr)	100 Year Runoff (cfs)
A-1	0.880	5.00	0.38	7.18	2.40	8.34	2.79	9.98	3.34	11.30	3.78	12.60	4.21

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C=0.3 + 0.6 x 0.1284
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A-2	0.511	5.00	0.70	7.18	2.57	8.34	2.98	9.98	3.57	11.30	4.04	12.60	4.51
B-1	0.369	5.00	0.70	7.18	1.85	8.34	2.15	9.98	2.58	11.30	2.92	12.60	3.25
				5 Year Runoff Total	**4.42**	**10 Year Runoff Total**	**5.14**	**25 Year Runoff Total**	**6.15**	**50 Year Runoff Total**	**6.96**	**100 Year Runoff Total**	**7.76**

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DIFFERENCE IN RUNOFF (EXISTING VS PROPOSED)					
5 Year Runoff (cfs)	10 Year Runoff (cfs)	25 Year Runoff (cfs)	50 Year Runoff (cfs)	100 Year Runoff	Net Change
2.02	2.35	2.81	3.18	0.29	Increase