WELLS + ASSOCIATES

KNOWLEDGE FARMS

TRAFFIC IMPACT ANALYSIS

August 18, 2021

Revised December 8, 2021

KNOWLEDGE FARMS

Traffic Impact Analysis

Frederick County, Maryland

August 18, 2021
Revised December 8, 2021

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KNOWLEDGE FARMS

Section 1
INTRODUCTION

PURPOSE

This report presents the results of a Traffic Impact Analysis (TIA) for the Knowledge Farms property located in the Urbana area of Frederick County, Maryland. The subject site is located on the west side of Worthington Boulevard (MD Route 355) with site access provided via Thornapple Drive opposite Campus Drive, as shown on Figure 1-1.

This report has been revised based on comments provided by Frederick County, received on October 5, 2021. A point-by-point response follows this report and has been incorporated into this revised TIA.

The Applicant, JPB Partners, proposes a concept development plan that would include up to 220 attached residential dwelling units, which is expected to serve senior adults, and up to 50,000 SF of commercial uses, in addition to the approved 35,000 SF of existing office space.

This traffic study follows the methodology for traffic impact analyses in Frederick County as outlined in the *Guidelines for the Preparation of Traffic Impact Analyses for Development Applications*, adopted September 6, 2011.

For purposes of this traffic study, the background conditions of the project were assumed by year 2026 based on previously approved projects. This report analyzes existing 2021 conditions and forecasted no-build (background) and build (total future) conditions in year 2026 to coincide with the preliminary plan approval. All future conditions include regional growth in through traffic and pipeline development traffic consistent with the scoping agreement. Each of these conditions were analyzed for the weekday AM and PM peak hours.

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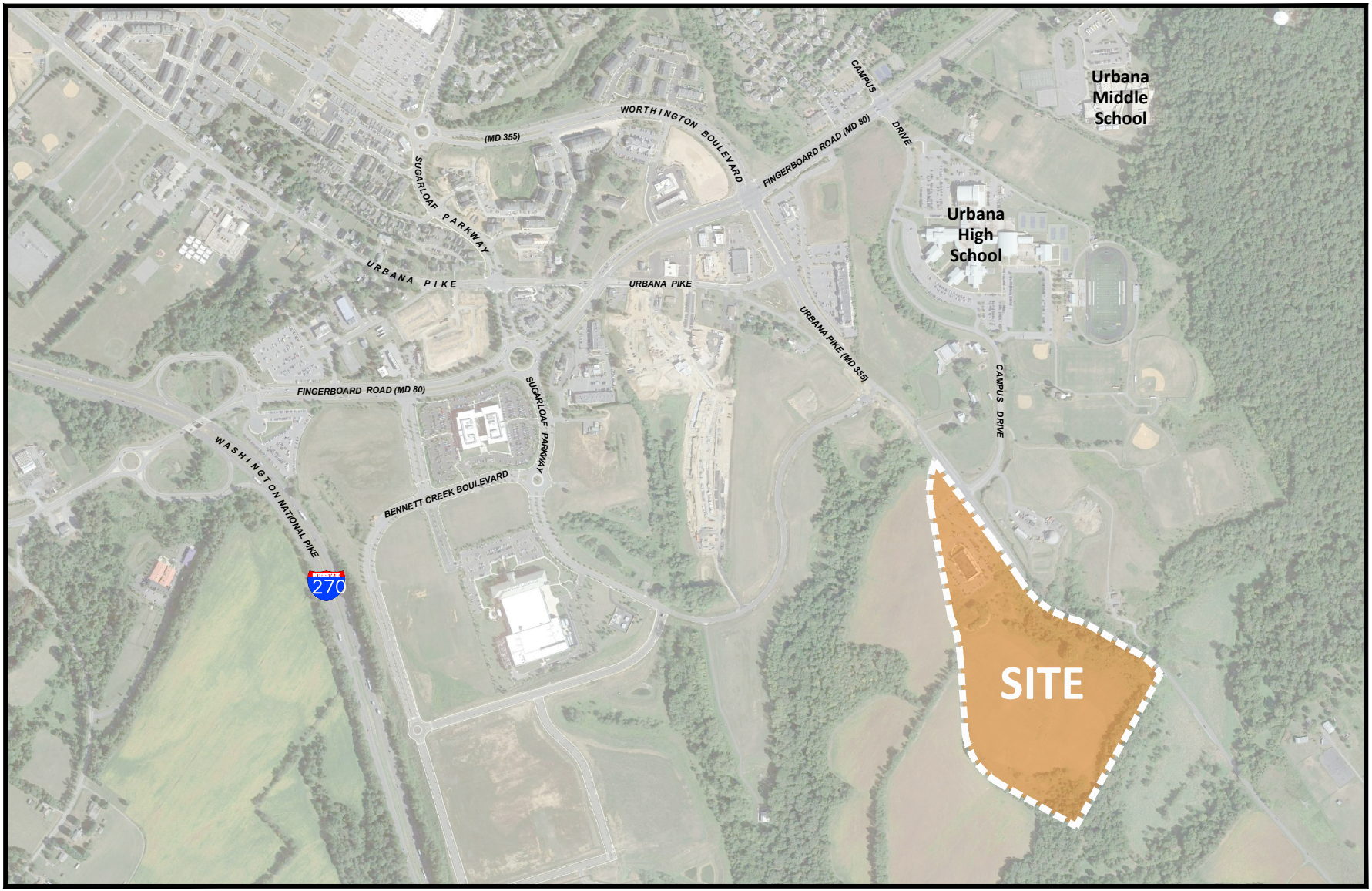

Figure 1-1
Site Location

NORTH

Knowledge Farms
Frederick County, Maryland

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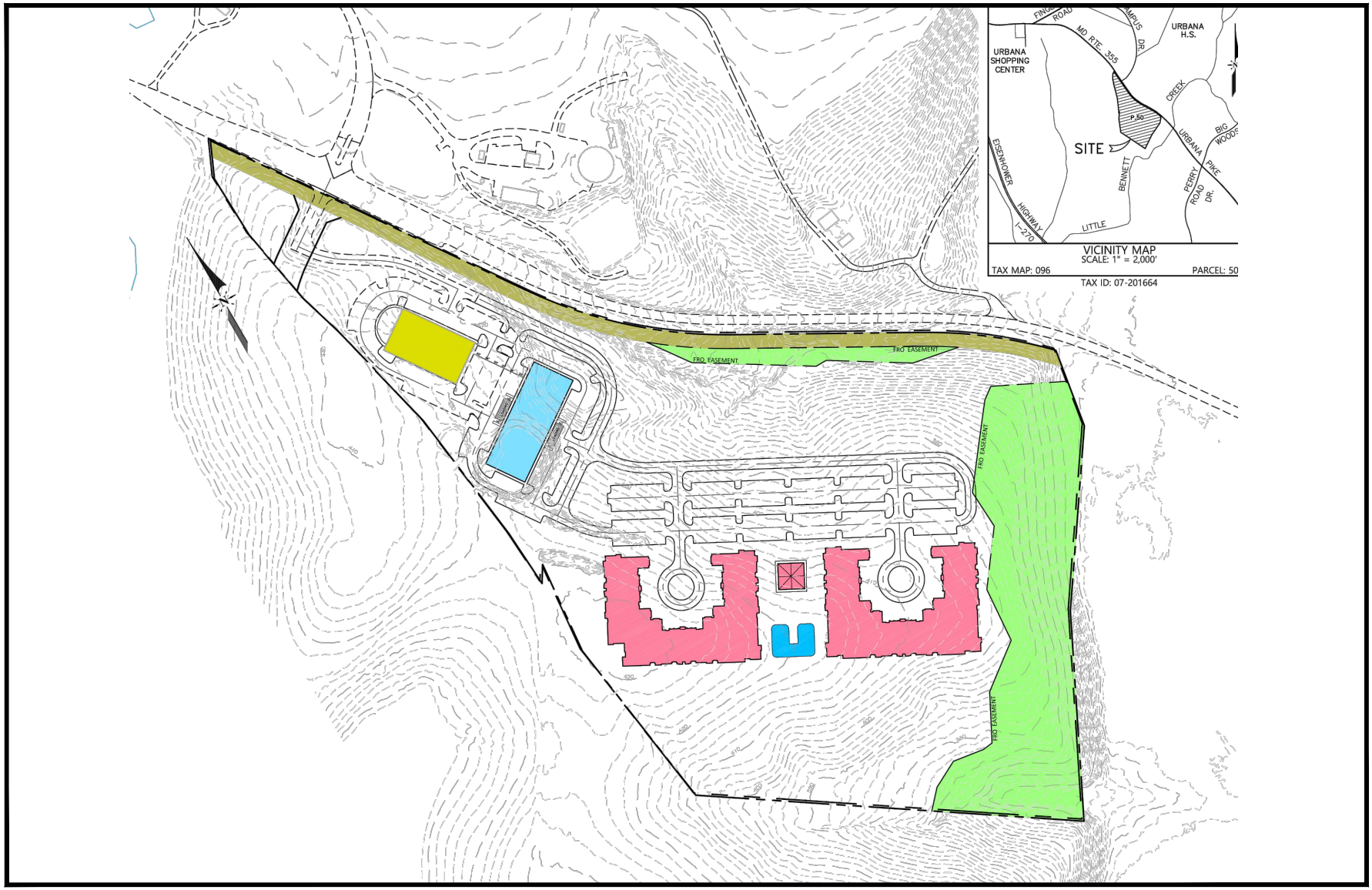

Plan Provided By: Terra Solutions Engineering, LLC

Figure 1-2
Concept Plan

Knowledge Farms
Frederick County, Maryland

Tasks undertaken in this study included the following:

1. A field reconnaissance of existing roadway and intersection geometrics, traffic controls, traffic signal phasings/timings, and speed limits.
2. Discussions with Frederick County Staff to identify the scope of the traffic study (See Appendix A) and compile background information.
3. Counts of existing traffic for nine (9) intersections were collected from previously prepared traffic studies by W+A and others and augmented with recently collected traffic data in 2021.
4. Analysis of existing 2021 levels of service.
5. Projections of no-build (background) future traffic volumes for 2026 that include existing traffic counts, pipeline development, and background traffic growth (for no-build conditions).
6. Calculation of no-build (background) conditions levels of service based on the background future traffic forecasts 2026 conditions, planned traffic controls and intersection geometrics to include planned area road improvements.
7. Estimation of the number of AM and PM peak hour vehicle-trips expected to be generated by the proposed development program with each phase of development based on Institute of Transportation Engineers (ITE) trip generation rates (10^{th} Edition).
8. Assignment of site generated traffic based on directional distributions identified during the scoping process.
9. Development of traffic forecasts for build (total future) conditions buildout in 2026.
10. Calculation of total future levels of service at each key intersection based on the total future traffic forecasts, traffic controls, and intersection geometrics for buildout in 2026.
11. Preparation of capacity, roundabout, and queuing analyses based on the requirements and procedures set forth in the County's Guidelines and APFO.
12. Identification of locations where mitigation is required as a result of the impact to the road network that would be realized as a result of the proposed development.

Sources of data for this analysis include: vehicular traffic counts conducted by Wells + Associates, Frederick County, previously prepared traffic studies by W+A and others, and the Institute of Transportation Engineers (ITE).

Section 2
BACKGROUND INFORMATION

OVERVIEW

This section discusses the traffic study scope and methodology, project impact area, and adequacy standards. It also includes a summary of the site development concept and access.

TRAFFIC STUDY SCOPE AND METHODOLOGY

This traffic study is prepared in accordance with the *Guidelines for the Preparation of Traffic Impact Analyses for Development Applications, adopted September 6, 2011 and the County's APFO for roads.* The traffic study scope was established through correspondence with County staff and takes into account the applicable APFO requirements. (See Appendix A)

PROJECT IMPACT AREA

Based on discussions with County staff through the scoping process, nine (9) existing off-site intersections were identified to be included in the analyses. The study intersections are listed below and are depicted on Figure 2-1.

1. Fingerboard Road (MD Route 80) / Urbana Pike
2. Fingerboard Road (MD Route 80) / Worthington Boulevard (MD Route 355)
3. Fingerboard Road (MD Route 80) / Campus Drive
4. Worthington Boulevard (MD Route 355) / Urbana Pike / Plaza Drive
5. Worthington Boulevard (MD Route 355) / Sugarloaf Parkway
6. Fingerboard Road (MD Route 80) / Sugarloaf Parkway
7. Worthington Boulevard (MD Route 355) / Campus Drive / Thornapple Drive
8. Fingerboard Road (MD Route 80) / I-270 NB Ramps
9. Urbana Pike (MD Route 355) / Urbana Parkway

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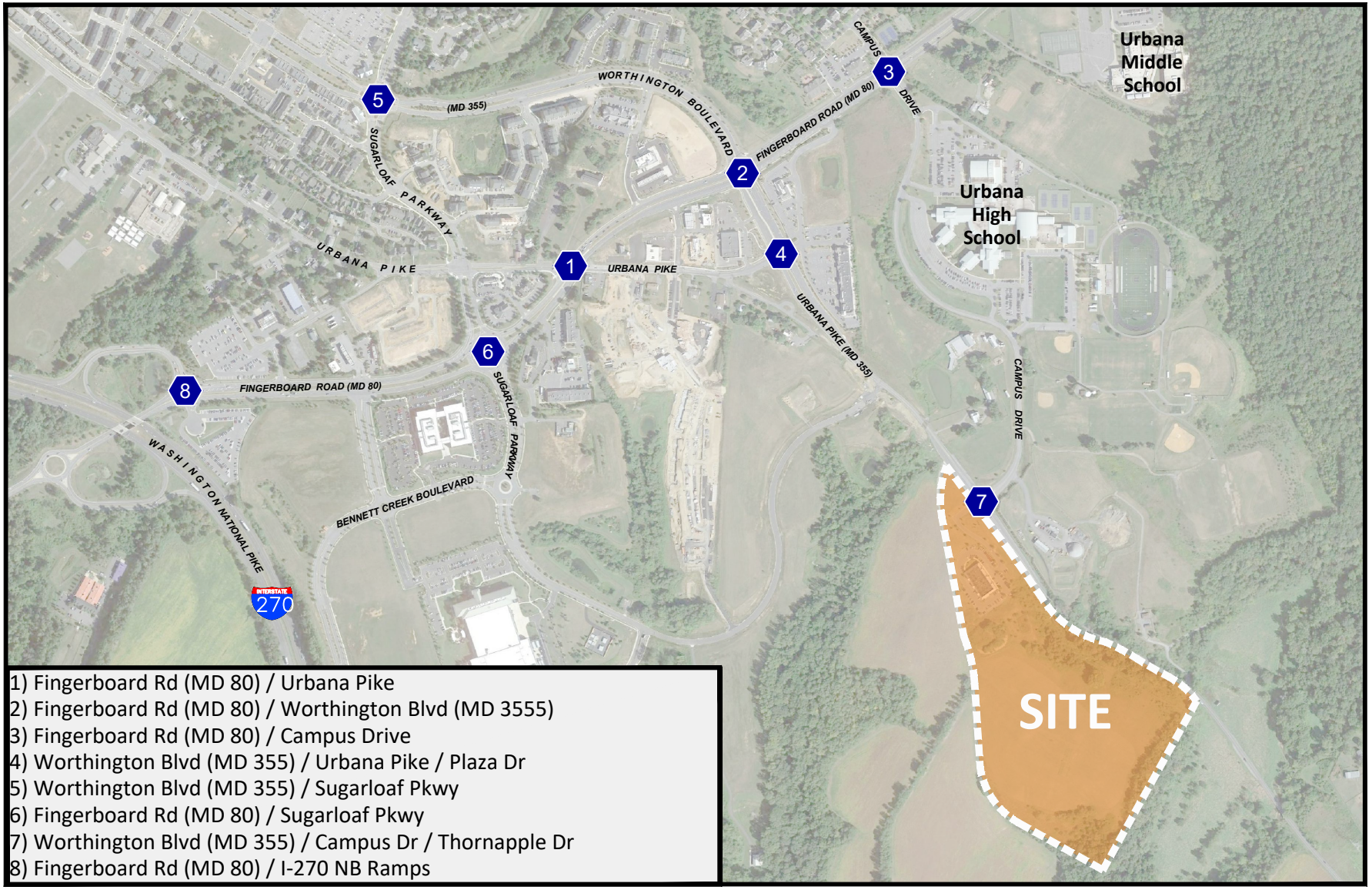

Figure 2-1
Study Intersections

Study Intersection

NORTH

Knowledge Farms
Frederick County, Maryland

ADEQUACY STANDARDS

The Knowledge Farms site is located in the Urbana Planning Region of Frederick County which has the following required tests for adequacy per the County's guidelines and APFO:

Signalized Intersections

The Critical Lane Volume (CLV) standard is used to analyze signalized intersections and, in this policy area, the maximum allowable CLV is 1,600 (or Level of Service (LOS "E"), according to the current Adequate Public Facilities Ordinance (APFO). Site traffic impacts must be mitigated in cases where the existing or projected critical lane volume exceeds this standard.

Unsignalized Intersections

The Highway Capacity Manual (HCM) methodology is used to analyze unsignalized stop-controlled intersections in accordance with Frederick County guidelines. The standard threshold for capacity for turning movements at unsignalized intersections is LOS "E".

Roundabouts

Roundabouts are analyzed using the Sidra analysis technique in accordance with Frederick County and SHA standards. The threshold for adequacy is LOS "E" or approximately a 0.85 volume-to-capacity (v/c) ratio for the critical approach within the roundabout.

PUBLIC ROAD NETWORK

Primary regional access to the site is provided from Interstate 270 and MD Route 355 to the west and MD Route 80 adjacent to the site. Direct access would be provided from Thornapple Drive. The site is currently served by a single driveway located on MD Route 355. Existing intersection lane use and traffic control at key intersections in the site vicinity are shown on Figure 2-2.

MD Route 80 (Fingerboard Road) is an east-west, four lane roadway from the I-270 southbound ramps east to Campus Drive where the second eastbound lane becomes a right turn lane and one lane continues in the eastbound direction. In the westbound direction, MD Route 80 is a two-lane roadway from Ijamsville Road where it transitions to two westbound lanes through Royal Crest Circle and then back down to a single westbound lane before widening back to two westbound lanes before Carriage Hill Drive. This roadway has a posted speed limit of 40 mph with a school speed limit of 35 miles per hour when lights are flashing and is defined as a Minor Arterial in the Urbana Region Plan.

Urbana Pike is a north-south, two-lane roadway in the study area with a posted speed limit of 30 mph north of MD Route 80. South of Worthington Boulevard, Urbana Pike becomes MD 355 with a posted speed limit of 35 mph.

MD Route 355 relocated (Worthington Boulevard) is a north-south, four-lane roadway in the vicinity of the site north of MD 80 with a posted speed limit of 35 mph. MD Route 355 relocated is classified as a Minor Arterial in the Urbana Region Plan.

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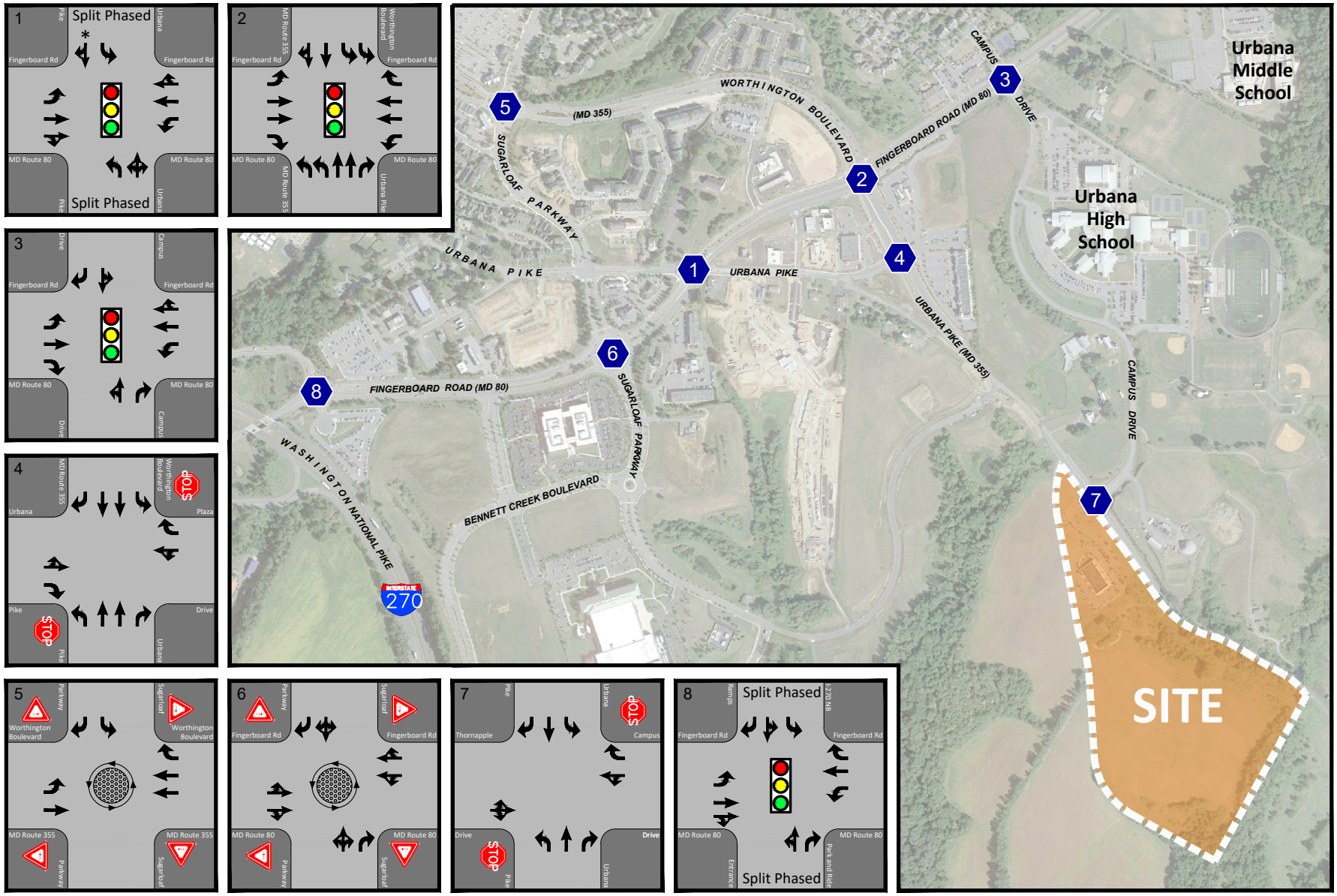

Figure 2-2
Existing Conditions Lane Use & Traffic Controls

*Short Free-Flow Right Turn Lane Analyzed as Shared Through-Right

Represents One Travel Lane
Signalized Intersection
Stop Sign

NORTH

Knowledge Farms
Frederick County, Maryland

DEVELOPMENT CONCEPT

Proposed Program. The development is planned to consist of 220 attached residential dwelling units, which is expected to serve senior adults, and up to 50,000 SF of commercial use, in addition to the approved 35,000 SF of existing office use.

SITE ACCESS CONCEPT

The proposed plan includes primary site access via Thornapple Drive opposite of Campus Drive as shown on concept plan exhibit on Figure 1-2.

The applicant is aware that a future traffic signal is planned at this intersection, assuming warrants for signalization are met and it is reviewed and approved by SHA.

As requested by Frederick County, Peak hour traffic signal warrants were assessed at the MD 355/Thornapple Drive/Campus Drive intersection for existing conditions. The results are summarized and detailed in Appendix I, and indicate that peak hour warrants are not met under existing conditions.

SECTION 3
EXISTING CONDITIONS ANALYSIS

OVERVIEW

This section presents an assessment of existing baseline traffic conditions within the study area. It describes the existing traffic data and capacity analyses for 2021 conditions.

EXISTING TRAFFIC COUNTS

Overview. The weekday AM and PM peak hour vehicular, pedestrian, and bicycle counts were collected from previously traffic studies prepared by Wells + Associates and others at the following intersections from 2018 and 2021:

1. Fingerboard Road (MD Route 80) / Urbana Pike **[Signal]**
2. Fingerboard Road (MD Route 80) / Worthington Boulevard (MD Route 355) **[Signal]**
3. Fingerboard Road (MD Route 80) / Campus Drive **[Signal]**
4. Worthington Boulevard (MD Route 355) / Urbana Pike / Plaza Drive **[TWSC]**
5. Worthington Boulevard (MD Route 355) / Sugarloaf Parkway **[Roundabout]**
6. Fingerboard Road (MD Route 80) / Sugarloaf Parkway **[Roundabout]**
7. Worthington Boulevard (MD Route 355) / Campus Drive / Thornapple Drive **[TWSC]**
8. Worthington Boulevard (MD Route 355) / I-270 NB Ramps **[Signal]**
9. Worthington Boulevard (MD Route 355) / Urbana Parkway* **[TWSC]**

*Traffic count collected on Tuesday, November 16, 2021.

The traffic count information is presented in Appendix B.

Peak Hours. The AM and PM peak hour traffic counts were identified at each of the study intersections for use in the traffic analyses and are shown on Figure 3-1.

The existing 2018 traffic data was adjusted for 2021 conditions by applying a 1.0 percent per year compounded growth rate to the through traffic movements along MD Route 80 and MD Route 355.

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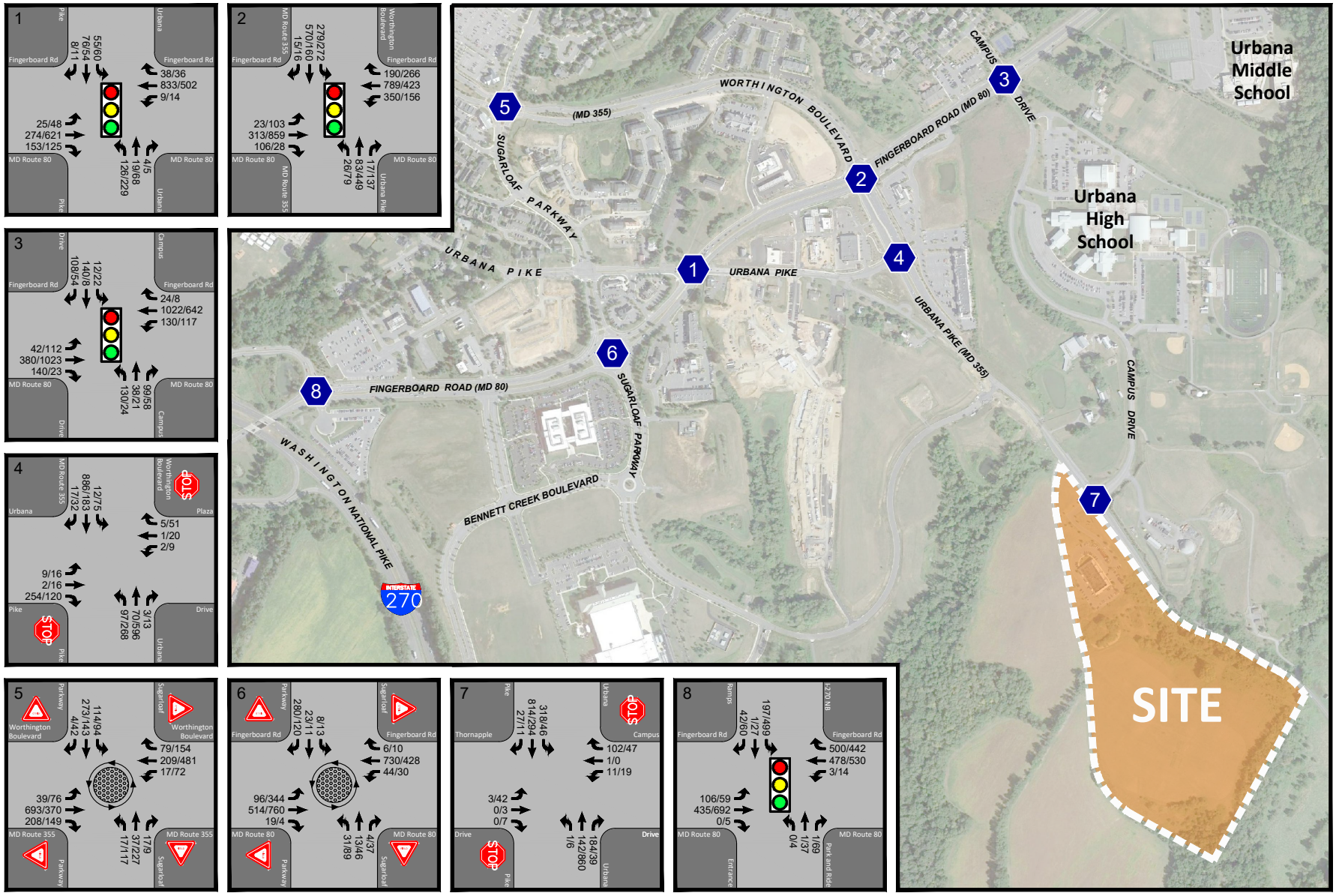

Figure 3-1
Existing Weekday AM and PM Peak Hour Traffic Volumes

AM PEAK HOUR
PM PEAK HOUR
000 / 000

NORTH

Knowledge Farms
Frederick County, Maryland

EXISTING LEVELS OF SERVICE

Existing peak hour levels of service were estimated at the study off-site intersections based on the existing lane usage and traffic control shown on Figure 2-2, the existing vehicular traffic counts shown on Figure 3-1, and the Critical Lane Volume (CLV), Highway Capacity Manual (HCM) and SIDRA analyses tools. For signalized intersections, queues were estimated using the SHA Queue Analysis procedure.

The results are presented in the Appendix, are summarized in Tables 3-1 through 3-4, and indicate the following:

Signalized Intersections: Critical Lane Volumes (Table 3-1)

- All the signalized intersections operate with CLV's less than 1,600 under existing conditions. The highest CLVs were calculated at the MD 80 / Campus Drive intersection with 927 CLV during the AM peak hour and 1,209 CLV during the PM peak hour.

Unsignalized Intersections: Highway Capacity Manual (Table 3-2)

- Intersection 4: MD 355 / Urbana Pike
  - All lane groups operate with levels of service "E" or better during both the AM and PM peak hours.
- Intersection 7: MD 355 / Campus Drive / Thornapple Drive
  - All lane groups operate with levels of service "E" or better during both the AM and PM peak hours with the exception of the shared eastbound left-through-right movement that operates beyond capacity at LOS "F" during both the AM and PM peak hours.
- Intersection 9: MD 355 / Urbana Parkway
  - All lane groups operate with levels of service "E" or better during both the AM and PM peak hours.

Roundabouts: SIDRA Volume-to-Capacity Ratios (Table 3-3)

- All approaches at each of the existing roundabouts currently operate with volume-to-capacity (v/c) ratios less than 0.85 during both the AM and PM peak hours.

Queuing Analysis (Table 3-4)

- The results of the queuing analysis indicate that all the existing queues are adequately accommodated within the existing turn lane bays.

Table 3-1
Knowledge Farms
Critical Lane Volume (CLV) Analyses Summary

Intersection	Existing Conditions		Background Future 2026		Total Future Buildout: 2026		Net Difference BG vs. Buildout	
	AM LOS(CLV)	PM LOS(CLV)	AM LOS(CLV)	PM LOS(CLV)	AM LOS(CLV)	PM LOS(CLV)	AM CLV	PM CLV
01. MD 80 / Urbana Pike	A (677)	A (670)	A (995)	B (1116)	B (1014)	C (1170)	+19	+54
02. MD 80 / MD 355 (Worthington Boulevard)	A (860)	B (1038)	C (1236)	D (1417)	C (1279)	E (1467)	+43	+50
03. MD 80 / Campus Drive	A (927)	C (1209)	C (1269)	C (1221)	C (1289)	C (1247)	+20	+26
07. MD 355 / Campus Drive - Signal installed for all future conditions.	**Unsignalized**		A (816)	C (1209)	A (887)	D (1367)	+71	+158
08. MD 80 / I-270 NB Ramps	A (704)	A (960)	B (1117)	E (1477)	C (1152)	E (1549)	+35	+72
With Improvements - Restripe WB approach to provide 2 through lanes	-	-	A (785)	C (1246)	A (814)	C (1272)	+29	+26

Table 3-2
Knowledge Farms
HCM Unsignalized Capacity Analyses Summary

Intersection	Lane Group	Existing Conditions AM LOS(Delay) (sec/veh)	Existing Conditions PM LOS(Delay) (sec/veh)	Background Future 2026 AM LOS(Delay) (sec/veh)	Background Future 2026 PM LOS(Delay) (sec/veh)	Total Future Buildout: 2026 AM LOS(Delay) (sec/veh)	Total Future Buildout: 2026 PM LOS(Delay) (sec/veh)	Net Difference BG vs. Buildout AM Delay (sec/veh)	Net Difference BG vs. Buildout PM Delay (sec/veh)
04. MD 355 / Urbana Pike									
* indicates very high delay in Synchro analysis	EBTL	B (11.1)	C (21.6)	B (12.8)	F (749)	C (15.4)	F (*)	+2.6	*
	EBR	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	0	0
	WBTL	C (16.7)	E (44.5)	D (30.6)	F (1597.1)	F (51.2)	F (*)	+20.6	*
	WBR	A (8.5)	B (10.8)	A (9.2)	B (12.6)	A (9.4)	B (13.3)	+0.2	+0.7
	NBL	B (10.1)	A (8.5)	B (12.7)	B (10.1)	B (14.4)	B (11)	+1.7	+0.9
	NBT	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	0	0
	NBR	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	0	0
	SBL	A (7.4)	A (9.3)	A (7.9)	B (10.9)	A (8.1)	B (11.5)	+0.2	+0.6
	SBT	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	0	0
	SBR	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	0	0
07. MD 355 / Campus Drive									
- Signal installed for all future conditions.	EBLTR	F (88.1)	F (65.4)	**Signal Installed**				**N/A**	
	WBTL	C (18.2)	C (26)						
	WBR	A (0)	A (0)						
	NBL	A (9.8)	A (7.9)						
	NBT	A (0)	A (0)						
	NBR	A (0)	A (0)						
	SBL	A (9.2)	B (10.5)						
	SBT	A (0)	A (0)						
	SBR	A (0)	A (0)						
09. MD 355 / Urbana Parkway									
	EBL	D (31.7)	C (19.6)	F (70.5)	E (45.1)	F (86.8)	F (69.2)		
	EBR	B (13.4)	A (9.6)	C (16.9)	B (10.9)	C (17.7)	B (11.7)		
	SBT	B (11)	A (8.2)	B (13.7)	A (9.3)	B (14.3)	A (10)		
	SBTR	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)		
	NBL	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)		
	NBT	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)		

Table 3-3
Knowledge Farms
SIDRA Roundabout Capacity Analyses Summary

Intersection		Existing Conditions		Background Future 2026		Total Future Buildout: 2026		Net Difference BG vs. Buildout	
		AM v/c	PM v/c	AM v/c	PM v/c	AM v/c	PM v/c	AM v/c	PM v/c
05. MD 355 / Sugarloaf Parkway									
- Greatest v/c for each approach	EB	0.672	0.396	1.351	1.010	1.365	1.020	+0.014	+0.01
	WB	0.173	0.511	0.535	1.000	0.541	1.017	+0.006	+0.017
	NB	0.070	0.279	0.103	0.500	0.104	0.502	+0.001	+0.002
	SB	0.248	0.242	0.617	0.524	0.623	0.525	+0.006	+0.001
06. MD 80 / Sugarloaf Parkway									
- Additional EB & WB lanes installed (By Others)	EB	0.339	0.583	0.602	0.730	0.631	0.754	+0.029	+0.024
	WB	0.452	0.396	0.663	0.658	0.681	0.702	+0.018	+0.044
- Greatest v/c for each approach	NB	0.071	0.321	0.148	0.776	0.154	0.806	+0.006	+0.03
	SB	0.182	0.078	0.254	0.294	0.254	0.294	0	0

Table 3-4A
Knowledge Farms
Queue Analyses Summary (Intersection 1-4)

Intersection	Lane Group	Turn Lane Storage (ft)	Existing Conditions AM 95th %ile Queue (ft)	Existing Conditions PM 95th %ile Queue (ft)	Lane Group	Turn Lane Storage (ft)	Background Future 2026 AM 95th %ile Queue (ft)	Background Future 2026 PM 95th %ile Queue (ft)	Total Future Buildout: 2026 AM 95th %ile Queue (ft)	Total Future Buildout: 2026 PM 95th %ile Queue (ft)
01. MD 80 / Urbana Pike										
SHA Queue Analysis Method for all conditions.	EBL	225	29	56	EBL	225	29	56	29	56
	EBTR	-	274	479	EBTR	-	563	864	597	893
	WBL	100	11	16	WBL	100	14	25	14	25
	WBTR	-	559	345	WBTR	-	866	653	874	668
	NBLTR	-	104	211	NBLTR	-	148	307	164	340
	SBL	200	64	70	SBL	200	64	70	64	70
	SBTR	-	98	76	SBTR	-	117	107	117	107
02. MD 80 / MD 355 (Worthington Boulevard)										
SHA Queue Analysis Method for all conditions.	EBL	525	27	120	EBL	525	198	198	198	198
	EBT	-	201	551	EBTR	-	299	584	308	591
	EBR	720	105	0						
	WBL	500	408	182	WBL	500	**660**	371	**660**	371
	WBT	-	506	271	WBT	-	234	194	234	194
	WBR	400	26	120	WBR	400	0	0	0	0
	NBL	500	18	55	NBL	500	50	125	58	141
	NBT	-	53	288	NBT	-	162	403	169	418
	NBR	500	0	0	NBR	500	0	0	0	0
	SBL	325	195	190	SBL	325	**365**	**394**	**365**	**394**
	SBTR	-	375	113	SBTR	-	613	373	624	383
03. MD 80 / Campus Drive										
SHA Queue Analysis Method for all conditions.	EBL	250	49	131	EBL	250	62	134	62	134
	EBT	-	443	1194	EBT	-	415	1013	429	1043
	EBR	-	12	0	EBR	-	83	0	83	0
	WBL	325	152	137	WBL	325	243	202	243	202
	WBTR	-	671	417	WBTR	-	1031	646	1054	665
	NBTL	-	196	53	NBTL	-	250	200	250	200
Proposed improvement includes separate northbound left and through lanes.					**NBL** **NBT**	**-** **135**	**204** **46**	**169** **30**	**204** **46**	**169** **30**
	NBR	135	0	0	NBR	135	0	0	0	0
	SBTL	-	177	35	SBTL	-	182	39	182	39
	SBR	100	77	0	SBR	100	79	0	79	0
04. MD 355 / Urbana Pike										
- HCM Queue for all conditions.	EBTL	-	32	41	EBTL	-	53	566	77	ERR
	EBR	150	0	0	EBR	150	0	0	0	0
	WBTL	-	1	24	WBTL	-	2	126	3	ERR
	WBR	-	0	7	WBR	-	0	9	0	9
	NBL	350	11	21	NBL	350	26	40	36	54
	NBT	-	0	0	NBT	-	0	0	0	0
	NBR	425	0	0	NBR	425	0	0	0	0
	SBL	150	1	7	SBL	150	1	10	1	11
	SBT	-	0	0	SBT	-	0	0	0	0
	SBR	350	0	0	SBR	350	0	0	0	0

Table 3-4B
Knowledge Farms
Queue Analyses Summary (Intersection 5-9)

Intersection	Lane Group	Turn Lane Storage (ft)	Existing Conditions AM 95th %ile Queue (ft)	Existing Conditions PM 95th %ile Queue (ft)	Lane Group	Turn Lane Storage (ft)	Background Future 2026 AM 95th %ile Queue (ft)	Background Future 2026 PM 95th %ile Queue (ft)	Total Future Buildout: 2026 AM 95th %ile Queue (ft)	Total Future Buildout: 2026 PM 95th %ile Queue (ft)
05. MD 355 / Sugarloaf Parkway										
- SIDRA Queue for all conditions.	EB	-	95	34	EB	-	2167	575	2252	617
- Greatest queue for each approach	WB	-	12	54	WB	-	58	508	59	573
	NB	-	5	21	NB	-	7	43	7	43
	SB	-	19	18	SB	-	69	46	70	46
06. MD 80 / Sugarloaf Parkway										
- SIDRA Queue for all conditions.	EB	-	41	104	EB	-	82	138	91	154
- Greatest queue for each approach	WB	-	60	44	WB	-	92	82	98	94
	NB	-	5	24	NB	-	10	78	10	84
	SB	-	4	2	SB	-	6	4	6	4
07. MD 355 / Campus Drive										
- Signal installed (By Others) for all future conditions.	EBLTR		5	53	EBTL		50	104	131	272
					EBR	100	6	0	1	5
- HCM Queue for existing conditions.	WBTL		22	16	WBTL		49	74	49	74
- SHA Queue Analysis Method for all future conditions.	WBR	150	0	0	WBR	150	0	23	0	23
	NBL	250	0	0	NBL	250	7	20	21	32
	NBT		0	0	NBT		501	1197	501	1197
	NBR	400	0	0	NBR	400	216	15	216	15
	SBL	425	30	6	SBL	425	371	54	371	54
	SBT		0	0	SBT		619	371	619	371
	SBR		0	0	SBR	375	15	0	61	0
08. MD 80 / I-270 NB Ramps										
SHA Queue Analysis Method for all conditions.	EBL	150	124	69	EBL	150	124	69	124	69
	EBT	-	508	807	EBT	-	1182	1647	1244	1701
	EBTR	-	447	447	EBTR	-	909	909	939	939
	WBL	350	4	16	WBL	350	4	16	4	16
	WBT	-	558	618	WBT	-	917	1126	958	1210
	WBR	950	445	166	WBR	950	484	745	484	745
	NBR	100	0	64	NBR	100	0	64	0	64
	NBTL	-	1	48	NBTL	-	1	48	1	48
	SBL	1000	230	582	SBL	1000	435	742	435	742
	SBTL	-	139	368	SBTL	-	262	464	262	464
	SBR	180	0	1	SBR	180	0	2	0	2
09. MD 355 / Urbana Parkway										
- HCM Queue for all conditions.	EBL	1730	1	11	EBL	1730	3	28	3	41
	EBR	1730	9	2	EBR	1730	12	3	13	4
	SBT	-	0	0	SBT	-	0	0	0	0
	SBTR	910	0	0	SBTR	910	0	0	0	0
	NBL	830	3	3	NBL	830	5	4	5	4
	NBT	-	0	0	NBT	-	0	0	0	0

SECTION 4
PLANNED ROAD NETWORK, PIPELINE DEVELOPMENT AND BACKGROUND TRAFFIC GROWTH

OVERVIEW

This section presents the planned and programmed transportation improvements, pipeline projects summary, and background traffic growth.

PLANNED/PROGRAMMED TRANSPORTATION IMPROVEMENTS

Several transportation improvements were identified as being planned within the study area as identified below. Since the Applicant will be contributing towards existing escrow accounts for these improvements, all improvements were assumed to be in place for the future analyses as shown on Figure 5-2:

Worthington Boulevard (MD Route 355) / Campus Drive / Thornapple Drive

- Additional eastbound egress lane for a total of two eastbound approach lanes.
- Additional southbound through lane for a total of two southbound through lanes.
- Traffic signal installed. Cycle lengths of 120 seconds during both the AM and PM peak hours were assumed.

PIPELINE PROJECTS

As identified by County staff, there are seven (7) approved pipeline developments located in the site vicinity, as outlined below, and shown on Figure 4-1:

- Monocacy Land Company (Urbana Properties) is a large mixed-use residential, commercial, retail, and active adult development generally located between I-270 and MD Route 355 on the north and south sides of Fingerboard Road (MD Route 80). Only trips for approved but unbuilt portions of the development plan were included in the traffic forecasts since currently built development is represented in the 2018 traffic count data. Traffic assignments for the remaining uses were developed based on previously approved traffic studies in the area.

- Landsdale is an approved 1,100 dwelling unit active adult residential community with approximately 410 dwelling units currently completed. Only trips for approved but unbuilt dwelling units were included in the traffic forecasts as the already completed units are represented in the 2018 traffic count data. Trip assignments for this development were taken from the recent Monrovia Town Center TIA prepared by Frederick County.

- Urbana Commons is an approved mixed-use office, retail and restaurant development. Traffic assignments for this site were taken from recently approved traffic studies in the area.

- Knowledge Farms is approved for Research and Development uses. Traffic assignments for the remaining 140,000 SF of Research and Development density were taken from recently approved traffic studies in the area.

- Urbana Village Center is an approved retail center and traffic assignments were taken from recently approved traffic studies in the area.

- Sugarloaf Elementary School is a 725-student public elementary school currently under construction. Traffic assignments were taken from recently approved traffic studies in the area.

- YMCA development is an approved YMCA facility consisting of up to 100,000 SF gross floor area and a medical office building of up to 40,000 SF. Traffic assignments were taken from the recent Urbana YMCA traffic study prepared by Wells + Associates.

Individual pipeline traffic assignments are provided in the appendix and the overall pipeline assignments are depicted on Figure 4-2. These projects were assumed to be fully built and occupied for all future analyses.

PIPELINE VEHICLE TRIP GENERATION ANALYSIS

The number of new vehicle trips and the site trip assignments expected to be generated by the approved pipeline developments were taken from other recently approved traffic studies in the area or estimated based on the standard rates and equations published by the Institute of Transportation Engineers (ITE) where not available.

As shown on Table 4-1, these pipeline projects would generate 4,235 AM peak hour trips (2,679 in and 1,556 out) and 5,924 PM peak hour trips (1,818 in and 2,794 out). These projects were assumed to be fully developed for all future conditions.

BACKGROUND TRAFFIC GROWTH

A growth rate of one (1.0) percent was identified by the County for use in the study (See Scoping Agreement, Appendix A) and was applied to all the through traffic movements along corridors within the study area for eight (8) years from 2018 through 2026 for buildout conditions analyses. Background traffic growth is depicted on Figure 4-3.

Table 4-1
Knowledge Farms
Pipeline Trip Generation Summary

Pipeline Developments				AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total	ADT Total
Monocacy Land Company (Urbana Properties)	Note 1			1,673	665	2,338	873	1,766	2,639	23,106
Landsdale Phase 1										
Active-Adult Detached Homes		800	D.U.	143	427	570	430	253	683	7,043
Approx 165 D.U. Completed	Note 1	(165)	D.U.	(29)	(89)	(118)	(89)	(52)	(141)	(1,453)
Remaining to be Constructed		**635**	**D.U.**	**114**	**338**	**452**	**341**	**201**	**542**	**5,590**
Active-Adult Attached Homes		300	D.U.	21	103	124	99	49	148	1,673
Approx 245 D.U. Completed	Note 1	(245)	D.U.	(17)	(84)	(101)	(81)	(40)	(121)	(1,366)
Remaining to be Constructed		**55**	**D.U.**	**4**	**19**	**23**	**18**	**9**	**27**	**307**
Landsdale: Subtotal New Trips		**690**	**D.U.**	**118**	**357**	**475**	**359**	**210**	**569**	**5,897**
Urbana Commons	Note 2			162	120	282	123	134	257	3,748
Knowledge Farms (Research & Development)	Note 2	140,000	SF	152	31	183	26	150	176	1,329
Urbana Village Center	Note 2			113	74	187	223	241	464	3,865
Sugarloaf Elementary School	Note 3	725	Students	262	224	486	60	64	124	1,361
Urbana YMCA and Medical Office Building										
YMCA (Recreational Community Center)	Note 4	100,000	D.U.	122	63	185	115	130	245	2,788
Medical Office Building	Note 5	40,000	D.U.	77	22	99	39	99	1,450	1,450
Urbana YMCA and Medical Office: Subtotal New Trips		**140,000**	**D.U.**	**199**	**85**	**284**	**154**	**229**	**1,695**	**4,238**
Subtotal All Pipeline Developments				**2,679**	**1,556**	**4,235**	**1,818**	**2,794**	**5,924**	**43,544**

Notes: (1) Includes only remaining approved but unbuilt uses.
(2) Trip generation taken from other recently approved traffic studies.
(3) Trip generation based on ITE's 10th Edition Trip Generation Manual. ITE LUC 520 used.
(4) Trip generation based on ITE's 10th Edition Trip Generation Manual. ITE LUC 495 used for Recreational Community Center.
(5) Trip generation based on ITE's 10th Edition Trip Generation Manual. ITE LUC 720 used for Medical Office Building.

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Figure 4-1
Pipeline Development Locations

NORTH

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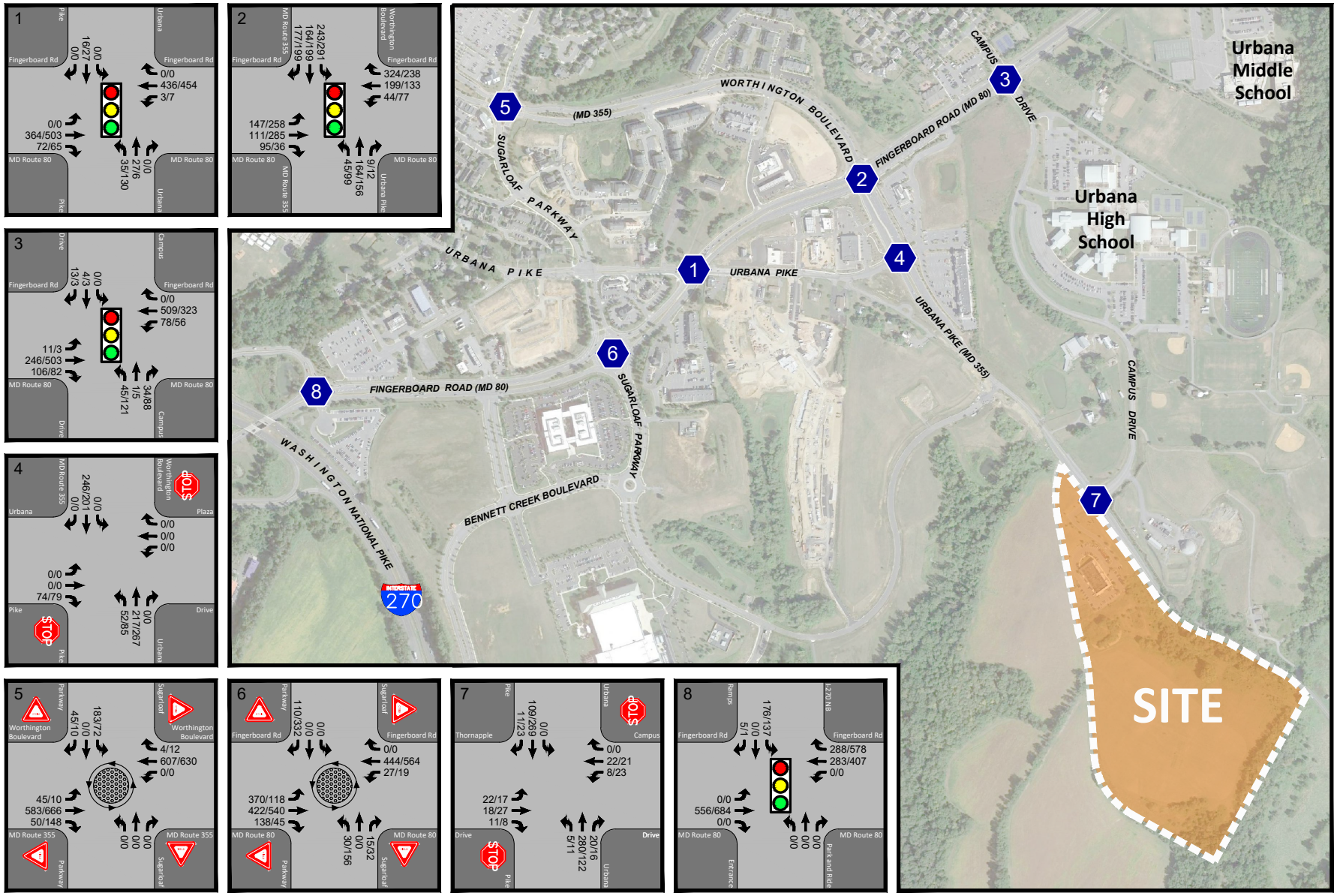

Figure 4-2
Combined Pipeline Development Traffic Assignments

AM PEAK HOUR
PM PEAK HOUR
000 / 000

NORTH

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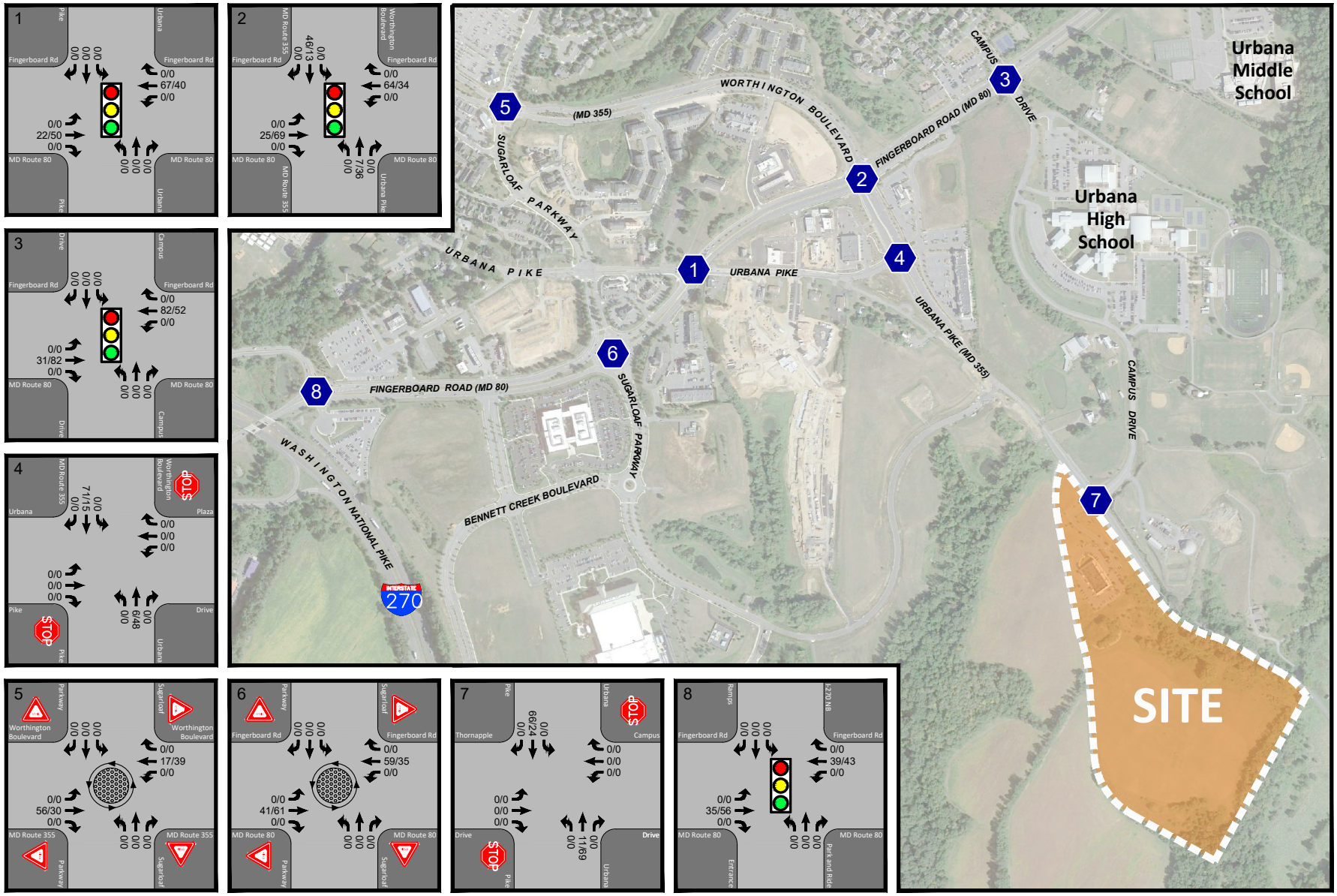

Figure 4-3
2018-2026 Regional Growth in Through Traffic
(1.0% Per Year, Compounded Annually)

AM PEAK HOUR
PM PEAK HOUR
000 / 000

NORTH
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Frederick County, Maryland

SECTION 5
ANALYSIS OF NO-BUILD (BACKGROUND) FUTURE CONDITIONS WITHOUT THE PROPOSED DEVELOPMENT

OVERVIEW

For the purposes of setting horizon years for this analysis, it was assumed that the Knowledge Farms property would be fully constructed by year 2026 (Full Buildout). To develop future traffic forecasts without the proposed development (no-build conditions) in year 2026, a composite of existing traffic, increases in traffic associated with regional growth, and increases in traffic associated with other approved but not yet constructed (pipeline) developments was used.

NO-BUILD (BACKGROUND) TRAFFIC FORECASTS

Traffic forecasts for no-build conditions in 2026 (Figure 5-1) were prepared by combining the existing traffic counts shown on Figure 3-1 with the pipeline development traffic shown on Figure 4-2 and the regional growth in through traffic shown on Figure 4-3.

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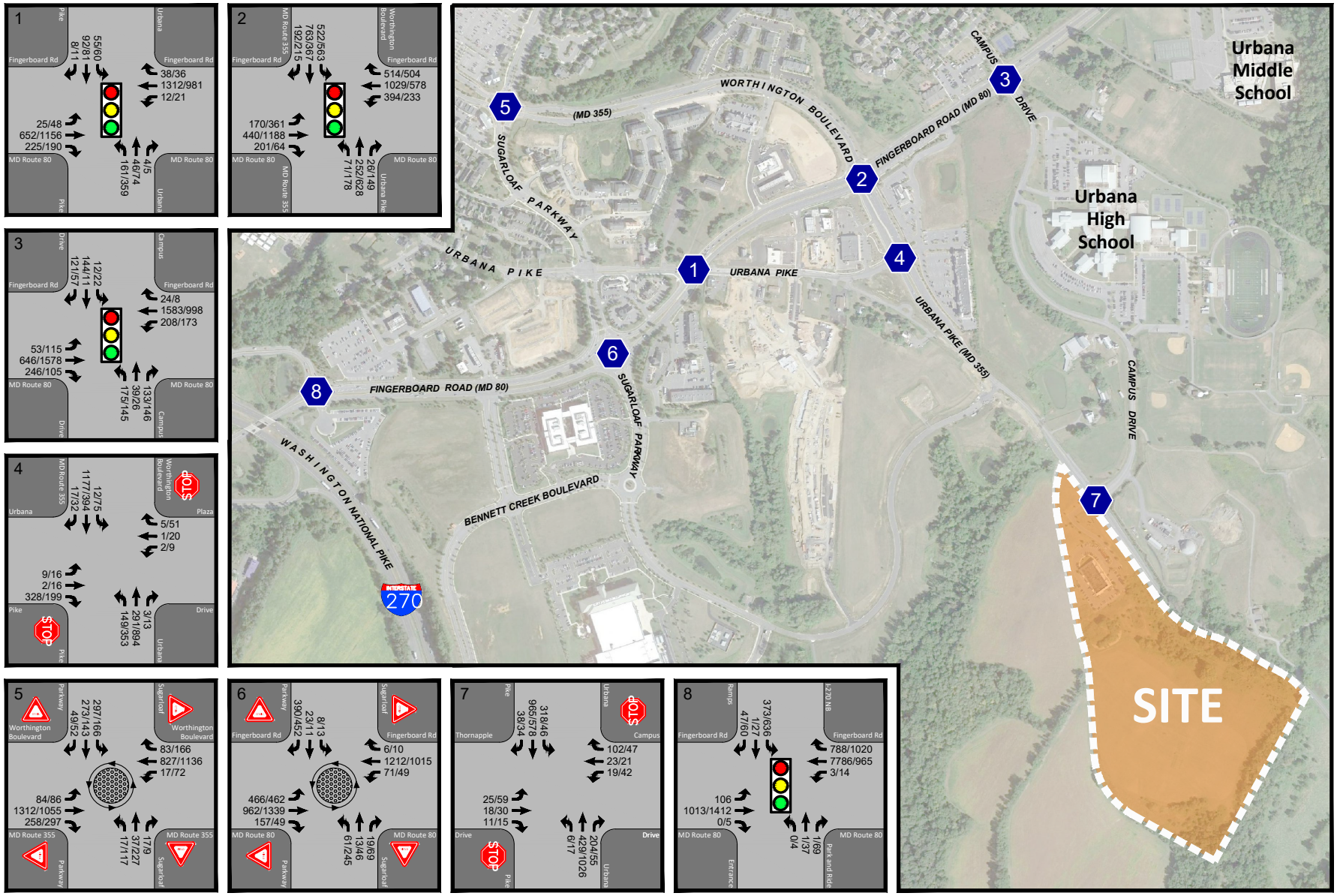

Figure 5-1
2026 No Build (Background) Future Traffic Forecasts
(Fig. 3-1 + Fig. 4-2 + Fig. 4-3)

AM PEAK HOUR
PM PEAK HOUR
000 / 000

NORTH
Knowledge Farms
Frederick County, Maryland

NO-BUILD (BACKGROUND) LEVELS OF SERVICE

Future levels of service for 2026 no-build (background) conditions, without development of the subject site, were estimated at the eight (8) key intersections in the study area based on the traffic forecasts shown on Figures 5-1, the future lane use and traffic control shown on Figure 5-2, and the Critical Lane Volume (CLV), Highway Capacity Manual (HCM) and SIDRA analyses tools. For signalized intersections, queues were estimated using the SHA Queue Analysis procedure.

The results are presented in the Appendix, are summarized in Tables 3-1 through 3-4, and indicate the following:

Signalized Intersections: Critical Lane Volumes (Table 3-1)

2026 No-Build (Background)

- All the signalized intersections would operate with CLV's less than 1,600 during both the AM and PM peak hours. The highest CLVs were calculated at the MD 80 / Campus Drive intersection with 1,269 CLV during the AM peak hour and at the MD 80 / I-270 NB Ramps with 1,477 CLV during the PM peak hour.

Unsignalized Intersections: Highway Capacity Manual (Table 3-2)

2026 No-Build (Background)

- Intersection 4: MD 355 / Urbana Pike
  - Consistent with 2021 no-build conditions, all lane groups would operate at level of service "E" or better during both the AM and PM peak hours with the exception of the stop-controlled eastbound shared through-left and westbound shared through-left movements that are expected to operate beyond capacity at level of service "F" during the PM peak hour.

- Intersection 9: MD 355 / Urbana Parkway
  - All lane groups operate with levels of service "E" or better during both the AM and PM peak hours with the exception of the stop-controlled eastbound left turn movement, which is expected to operate beyond capacity at level of service "F" during the AM peak hour.

Roundabouts: SIDRA Volume-to-Capacity Ratios (Table 3-3)

2026 No-Build (Background)

- Intersection 5: MD 355 / Sugarloaf Parkway
  - The roundabout is expected to operate beyond capacity during both the AM and PM peak hours with one or more approaches realizing v/c ratios in excess of 0.85.

Queuing Analysis (Table 3-4)

2026 No-Build (Background)

- The results of the queuing analysis indicate that all of the forecasted queues would be adequately accommodated within the existing or planned turn lane bays with the following exceptions:
    - Intersection 2: MD 80 / Worthington Boulevard (MD 355)
        - The westbound left turn movement queue is expected to exceed the available storage length by approximately 160 feet (or seven vehicles) during the AM peak hour.
        - The southbound left turn movement queue is expected to exceed the available storage length by approximately 40 feet (or two vehicles) during the AM peak hour and approximately 69 feet (or three vehicles) during the PM peak hour.

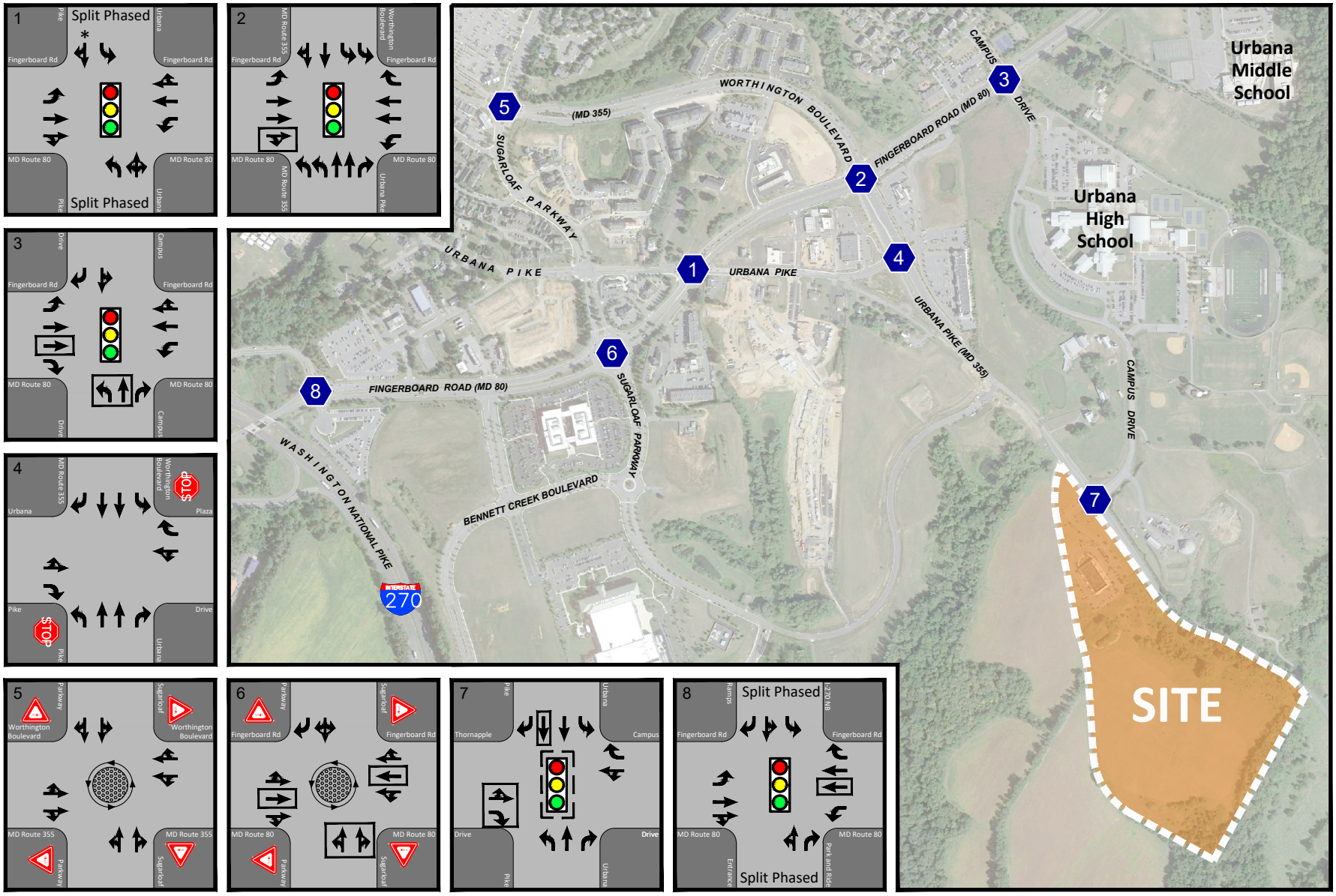

Figure 5-2
Build (Total Future) Proposed Conditions Lane Use & Traffic Controls

*Short Free-Flow Right Turn Lane Analyzed as Shared Through-Right

Planned improvements (By Others)

Proposed improvements (By Applicant)

Represents One Travel Lane

Signalized Intersection

Stop Sign

NORTH

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SECTION 6
TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

OVERVIEW

This section summarizes the vehicle trip generation for currently proposed conditions and traffic distribution analyses for the site development.

SITE TRIP GENERATION ANALYSIS

The number of vehicle trips expected to be generated by the proposed development were calculated using the rates and/or equations published in the Institute of Transportation Engineers' Trip Generation Manual, 10th Edition. A summary of the trip generation estimates is provided on table 6-1 and is discussed below.

Proposed Program. The proposed development plan includes 220 attached residential dwelling units that is expected to generate 75 AM peak hour trips (25 in and 50 out), 89 PM peak hour trips (54 in and 35 out), and 1,126 daily (24-hour) trips.

The proposed development plan also includes commercial use of up to 50,000 SF that is expected to generate 121 AM peak hour trips (94 in and 27 out), 172 PM peak hour trips (48 in and 124 out), and 1,834 daily (24-hour) trips.

Therefore, the overall proposed development, excluding the existing and approved 35,000 SF office building, is expected to generate 196 AM peak hour trips (119 in and 77 out), 261 PM peak hour trips (102 in and 159 out), and 2,960 daily (24-hour) trips at buildout.

Table 6-1

Knowledge Farms

Trip Generation Comparison [1]

Development/Land Use	ITE Land Use Code	Size	Units	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total	ADT
Existing/Approved Conditions										
(The site is approved for up to 140,000 SF of Office uses, 35,000 SF of which is built)										
Existing Office Building		35,000	SF							
Remaining Approved but Unbuilt Office		105,000	SF							
Subtotal Existing/Approved Office	ITE 710	140,000	SF	137	22	159	25	132	157	1,471
Proposed Site Development Plan										
Existing Office Building	ITE 710	35,000	SF	52	8	60	7	35	42	384
Proposed Residential Use [2]	ITE 252	220	DU	25	50	75	54	35	89	1,126
Proposed Commercial Use [3] [4]	ITE 720	50,000	SF	94	27	121	48	124	172	1,834
Subtotal Existing with Proposed				171	85	256	109	194	303	3,344
Total New (35,000 SF Existing Excluded)				119	77	196	102	159	261	2,960
Net Additional Site Trips: Proposed vs. Approved				34	63	97	84	62	146	1,873

Notes:

(1) Based on rates and equations from ITE's Trip Generation, 10th Edition.

(2) ITE Land Use, Senior Adult Housing - Multifamily (252), was used to determine vehicle trips for residential use.

(3) ITE Land Use, Medical-Dental Office Building (720), was used to determine vehicle trips for commercial use.

(4) Land Use Subcategory, Stand-Alone, was used for Medical-Dental Office Building.

FUTURE ROAD NETWORK AND SITE ACCESS FOR PROPOSED CONDITIONS

The proposed development areas for the Knowledge Farms property would be accessed based on the site layout shown on Figure 1-2. For purposes of this traffic study, all access to the facility was assumed to occur via Intersection 7 (Worthington Boulevard / Campus Drive).

TRIP DISTRIBUTION

The new trips were assigned to the public road network based on the future road network that includes planned improvements by others. Overall directional distributions were established during the scoping process as shown in Appendix and summarized below for site-generated trips:

The following trip distributions were used in this traffic study:

To/From	Percentage
MD 80: West of Urbana Pike	45 percent
MD 80: East of Campus Drive	30 percent
MD 355/Urbana Pike: North of MD 80	15 percent
MD 355: South of Campus Drive	10 percent
TOTAL	**100 percent**

The total site-generated trips shown in Table 6-1 were assigned to the future roadway network for each phase of development based on the overall trip distributions shown above and assigned through each of the study intersections to and from the site. The site trips for the Knowledge Farms property are shown on Figure 6-1. Detailed traffic distributions are provided in the Appendix.

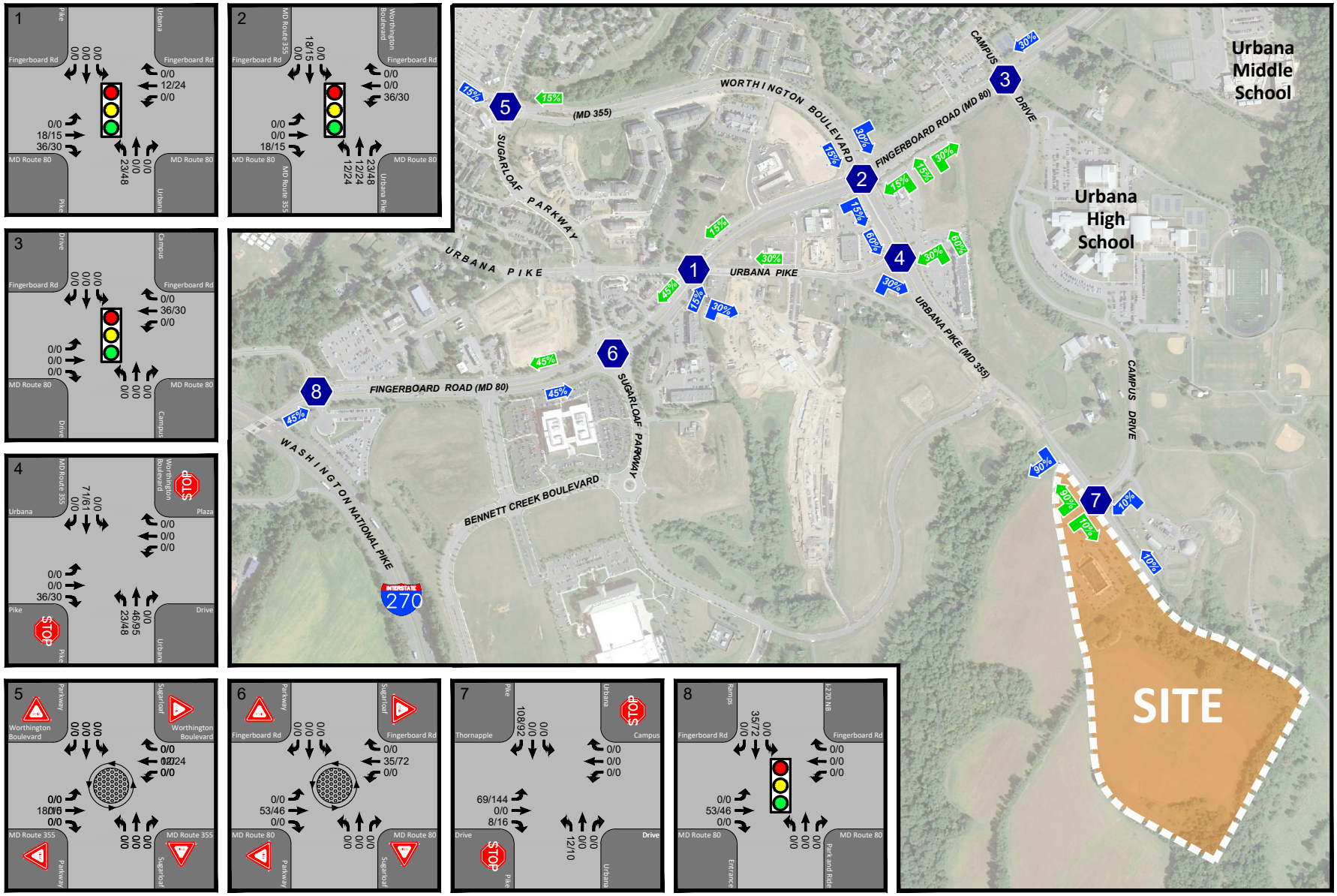

Figure 6-1
Total Proposed Site Traffic Assignments at Buildout
(220 DU Senior Adult Housing & 50,000 SF Medical/Dental Office Building)

Knowledge Farms
Frederick County, Maryland

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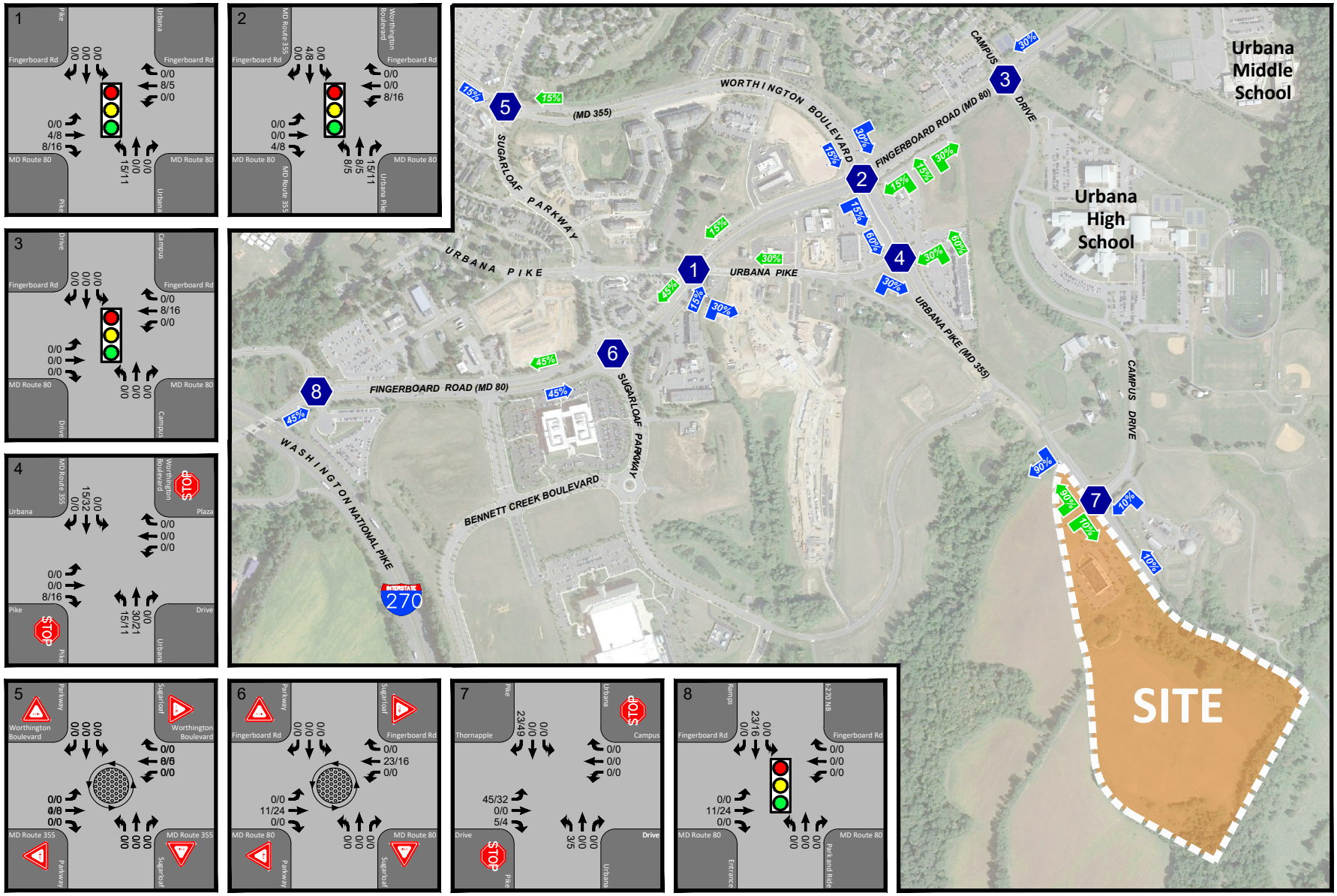

Figure 6-1A

Senior Adult Housing - Proposed Site Traffic Assignments
(200 DU Proposed Senior Adult Housing- Attached)

XX% Outbound Distribution

XX% Inbound Distribution

AM PEAK HOUR
PM PEAK HOUR
000 / 000

NORTH

Knowledge Farms
Frederick County, Maryland

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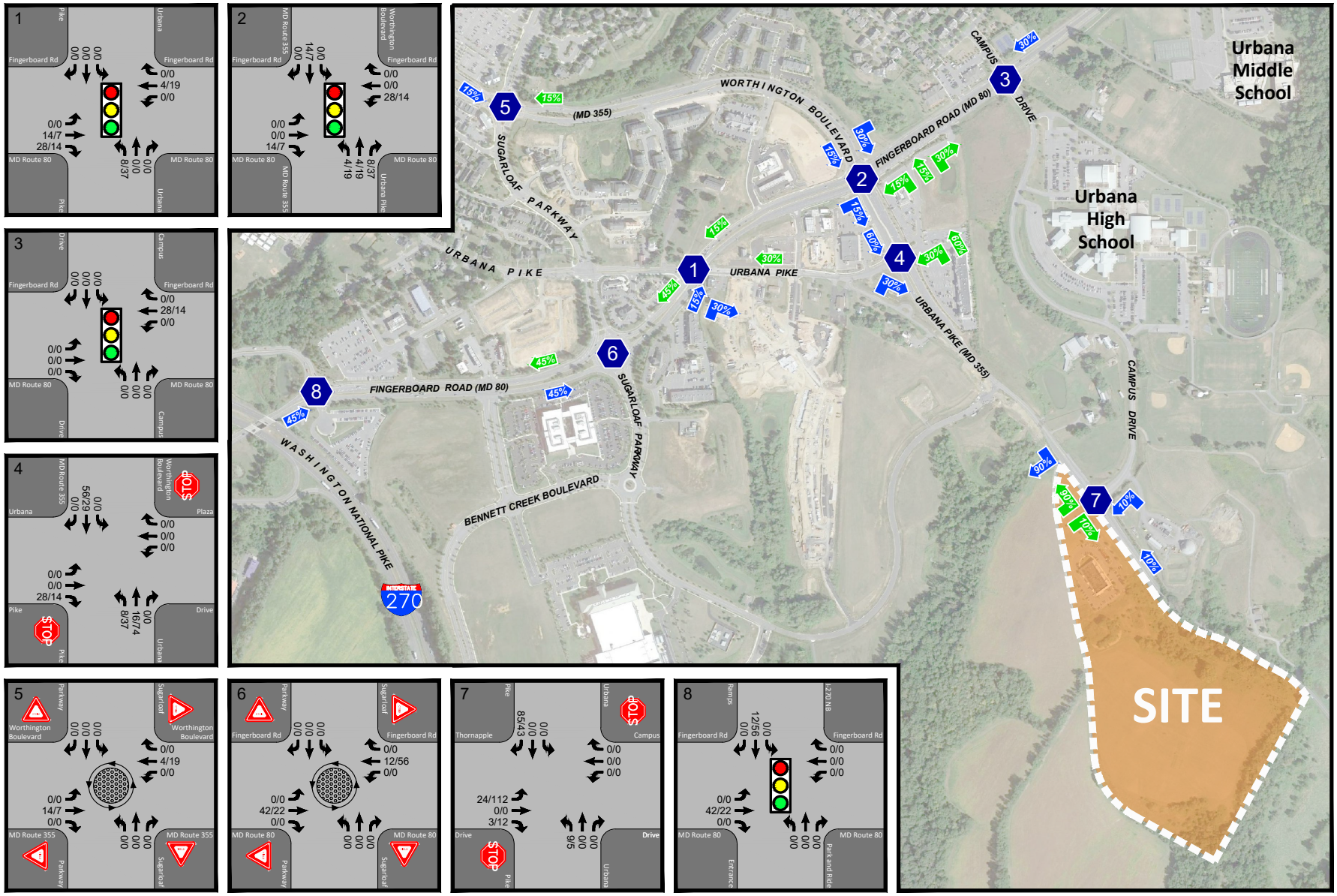

Figure 6-1B

Medical/Dental Office - Proposed Site Trips

(50,000 SF Proposed Medical/Dental Office Building)

XX% Outbound Distribution

XX% Inbound Distribution

AM PEAK HOUR / PM PEAK HOUR

000 / 000

NORTH

Knowledge Farms

Frederick County, Maryland

SECTION 7
ANALYSIS OF BUILD (TOTAL FUTURE) CONDITIONS WITH THE PROPOSED DEVELOPMENT

OVERVIEW

This section presents an assessment of total future build conditions for the Knowledge Farms development and the anticipated traffic mitigation requirements to accommodate the new site-generated vehicle trips.

BUILD (TOTAL FUTURE) CONDITIONS TRAFFIC FORECASTS

The traffic forecasts for proposed conditions at buildout shown on Figure 7-1 were prepared by adding the total site traffic at buildout of all the proposed uses for Knowledge Farm shown on Figure 6-1 to the 2026 background future traffic forecasts shown on Figure 5-1.

PROPOSED CONDITIONS INTERSECTION LEVELS OF SERVICE

Future levels of service for 2026 build (total future) conditions, with the development of the subject site, were estimated at the eight (8) key intersections in the study area based on the traffic forecasts shown on Figures 7-1, the future lane use and traffic control shown on Figure 5-2, and the Critical Lane Volume (CLV), Highway Capacity Manual (HCM) and SIDRA analyses tools. For signalized intersections, queues were estimated using the SHA Queue Analysis procedure.

The results are presented in the Appendix, are summarized in Tables 3-1 through 3-4, and indicate the following:

Signalized Intersections: Critical Lane Volumes (Table 3-1)

2026 Build (Buildout Total Future)

- Consistent with 2026 no-build (background) conditions, all of the signalized intersections would continue to operate with CLV's less than 1,600 during both the AM and PM peak hours. The highest CLVs were calculated at the MD 80 / Campus Drive intersection with 1,289 CLV during the AM peak hour and at the MD 80 / I-270 NB Ramps with 1,520 CLV during the PM peak hour.

Unsignalized Intersections: Highway Capacity Manual (Table 3-2)

2026 Build (Total Future)

- Intersection 4: MD 355 / Urbana Pike
  - All lane groups would operate at level of service "E" or better during both the AM and PM peak hours with the exception of two movements. The stop-controlled eastbound shared through-left during the PM peak hour and westbound shared through-left movements during the AM and PM peak hour are expected to operate beyond capacity at level of service "F".
- Intersection 9: MD 355 / Urbana Parkway
  - All lane groups operate with levels of service "E" or better during both the AM and PM peak hours with the exception of the stop-controlled eastbound left turn movement, which is expected to operate beyond capacity at level of service "F" during the AM and PM peak hours.

Roundabouts: SIDRA Volume-to-Capacity Ratios (Table 3-3)

2026 Build (Total Future)

- Intersection 5: MD 355 / Sugarloaf Parkway
  - Consistent with 2026 no-build (background) conditions, the roundabout is expected to operate beyond capacity during both the AM and PM peak hours with one or more approaches realizing v/c ratios in excess of 0.85.

Queuing Analysis (Table 3-4)

2026 Build (Buildout Total Future)

- The results of the queuing analysis are generally consistent with the 2026 no-build (background) analyses and indicate that all the forecasted queues would be adequately accommodated within the existing or planned turn lane bays with the following exceptions:
  - Intersection 2: MD 80 / Worthington Boulevard (MD 355)
    - The westbound left turn movement queue is expected to exceed the available storage length by approximately 160 feet (or seven vehicles) during the AM peak hour.
    - The southbound left turn movement queue is expected to exceed the available storage length by approximately 40 feet (or 2 vehicles) during the AM peak hour and by approximately 69 feet (or 3 vehicles) during the PM peak hour.

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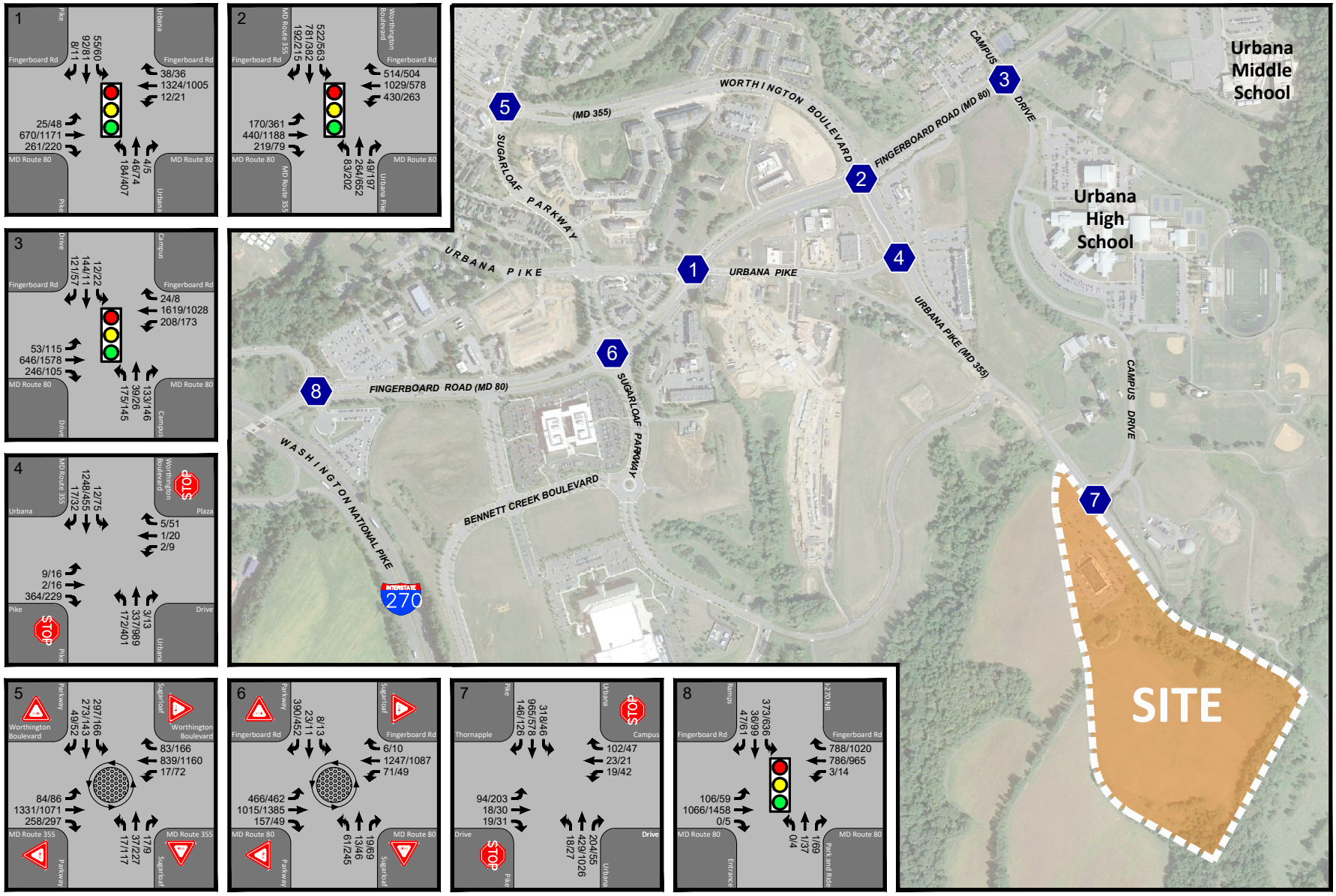

Figure 7-1

2026 Buildout Build Conditions Total Future Traffic Forecasts

(Fig. 5-1 + Fig. 6-1)

AM PEAK HOUR

PM PEAK HOUR

000 / 000

NORTH

Knowledge Farms

Frederick County, Maryland

Section 8
DEVELOPMENT IMPACT AND PROPOSED IMPROVEMENTS

Intersections Where Mitigation Is Triggered

2. MD 80/ Worthington Boulevard (MD 355)
    - The westbound left turn movement queue is expected to exceed the available storage length by approximately 160 feet (or 7 vehicles) during the AM peak hour.
        - It is noted that no site traffic is expected to make a westbound left turn movement at this intersection given the site location and expected travel routes to and from the site. Therefore, additional mitigation is not recommended at this location.
    - The southbound left turn movement queue is expected to exceed the available storage length by approximately 40 feet (or 2 vehicles) during the AM peak hour and by approximately 69 feet (or 3 vehicles) during the PM peak hour.
5. Worthington Boulevard (MD 355) / Sugarloaf Parkway
    - The roundabout is expected to operate with v/c ratios in excess of 0.85 for no-build and build conditions with the full buildout of the site.
7. Worthington Boulevard (MD 355) / Campus Drive
    - All lane groups operate with levels of service "E" or better during both the AM and PM peak hours with the exception of the shared eastbound left-through-right movement that operates beyond capacity at LOS "F" during both the AM and PM peak hours.
9. Worthington Boulevard (MD 355) / Urbana Parkway
    - The westbound left turn movement would operate at level of service "F" during both the AM and PM peak hour. Given the relatively low volume of peak hour trips (2 AM/34 PM), and that separate left and right turn lanes are provided, no additional mitigation is recommended at this location.

Proposed Mitigation Measures

- The extension of the southbound left turn lane at MD 355 is included in the planned improvements at Intersection 2. Given impact of the proposed development at this intersection where mitigation is triggered, the applicant may contribute an appropriate pro-rata share contribution, as determined by the County Traffic Engineer.
- Given the minimal impact of the proposed development at the roundabout (Intersection 5) where mitigation is triggered, the applicant may contribute an appropriate pro-rata share contribution, as determined by the County Traffic Engineer, to planned improvements at the roundabout.
- Based on the existing conditions at the MD 355 / Campus Drive unsignalized intersection,

it is anticipated that the proposed development would likely trigger warrants for signalization. Thus, the applicant would install a new traffic signal if warranted and approved by SHA.

- The restriping of the westbound approach to provide two (2) through lanes is included in the planned improvements at the MD 80 / I-270 northbound ramps (Intersection 8). Given the impact of the proposed development at this intersection where mitigation is triggered, the applicant may contribute an appropriate pro-rate share contribution, as determined by the County Traffic Engineer.

These mitigation measures will be finalized in coordination with Frederick County as part of the Adequate Public Facilities Ordinance (APFO) test.

Section 9
CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this study are as follows:

1. The subject site is located on the west side of Worthington Boulevard (MD Route 355) with site access provided at Thornapple Drive opposite Campus Drive.
2. The Applicant, JPB Partners, proposes a concept development plan that would include up to 220 attached residential dwelling units, which is expected to serve senior adults, and up to 50,000 SF of commercial uses, in addition to the approved 35,000 SF of existing office space.
3. All the study intersections currently operate within the applicable standards (at acceptable levels of service) during both the AM and PM peak hours with the exception of the MD 355 / Campus Drive / Knowledge Farms unsignalized intersection (Intersection 7) that currently experiences a level of service "F" for one lane group during the AM and PM peak hour.
4. Under 2026 no-build (background) conditions that include pipeline development and planned area road improvements, all of the study intersections are expected to operate within the applicable standards (at acceptable levels of service) during both the AM and PM peak hours with the exception of the Urbana Pike and Urbana Parkway unsignalized intersections on MD 355 and MD 355 / Sugarloaf Parkway roundabout that would both operate with levels of service beyond the acceptable standards during the AM and/or PM peak hour.
5. The proposed residential use is expected to generate 75 AM peak hour trips (25 in and 50 out), 89 PM peak hour trips (54 in and 35 out), and 1,126 daily (24-hour) trips. The proposed commercial use is expected to generate 121 AM peak hour trips (94 in and 27 out), 172 PM peak hour trips (48 in and 124 out), and 1,834 daily (24-hour) trips. *Therefore, the overall proposed development, excluding the existing and approved 35,000 SF office building, is expected to generate 196 AM peak hour trips (119 in and 77 out), 261 PM peak hour trips (102 in and 159 out), and 2,960 daily (24-hour) trips at buildout.*
6. Under 2026 buildout (total future) conditions, all of the study intersections are expected to operate within the applicable standards (at acceptable levels of service) during both the AM and PM peak hours with the exception of the Urbana Pike and Urbana Parkway unsignalized intersections on MD 355, the MD 355 / Sugarloaf Parkway roundabout, and MD 80 / MD 355 signalized intersection.
7. The applicant proposes to contribute an appropriate pro-rata share contribution for planned improvements as determined by the County Traffic Engineer. These measures will be coordinated with Frederick County at part of the Adequate Public Facilities Ordinance (APFO) test.
8. The MD 355 / Campus Drive / Thornapple Drive intersection is currently controlled by a stop sign and does not meet peak hour traffic signal warrants. It is anticipated that the

proposed development would likely trigger warrants for signalization at this intersection and the applicant would install a new traffic signal as part of the proposed mitigation measures. A new traffic signal and turn lanes were identified in previously prepared studies and would be required assuming warrants for signalization are met.

9. The applicant will construct a 10’ wide shared use path along the MD 355 property frontage to comply with the 2018 Bikeways and Trails Plan.

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WELLS + ASSOCIATES

MEMORANDUM

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Tysons, VA 22102
703-917-6620
WellsandAssociates.com

To: Mark Mishler
Transportation Engineering Supervisor
Division of Planning & Permitting

Cc: Mike Kalinock, JPB Partners
Chad Tyler
Gerald Lee Miller, JR., PE, Terra Solutions Engineering, Inc.

From: Michael J. Workosky, PTP, TOPS, TSOS
Christine G. Bairan, EIT
Wells + Associates, Inc.

Date: December 8, 2021

Re: Knowledge Farms Traffic Impact Analysis
Response Frederick County Comments;
Frederick County, Maryland

Introduction

This memorandum summarizes the comments and responses related to the traffic impact analysis for the proposed Knowledge Farms Development located in Frederick County, Maryland. It is based on the traffic report dated August 18, 2021 and the comments received on October 5, 2021.

A point-by-point response is provided below. All comments were incorporated into the revised traffic impact analysis.

Frederick County Comments

Comment 1: Please review and ensure proposed commercial SF and residential units match in TIA and justification letter. TIA page 1 references 220 detached senior and TIA Page 9 notes 225 detached senior adult.

Response 1: *This has been revised in the updated report.*

Comment 2: Revise TIA and justification letter to reflect generalized uses (220 residential units and 50,000 SF commercial). The TIA will still apply the trip intensity reflected in the revised scope and TIA Table 6-1 on page

Response 2: *This has been revised in the updated report. The TIA analyzes 220 residential dwelling units and 50,000 SF of commercial use.*

Comment 3: TIA page 4, consider removing conceptual plan (Figure 1-2) or revising to reflect a new layout based on other planning comments to ensure it more accurately reflects design standards. It may not be essential for the TIA.

Response 3: *The conceptual plan (Figure 1-2) has been included in the revised report for reference purposes only. The design comments and concept plan are discussed later in this document.*

Comment 4: TIA page 9: is the traffic signal at Thornapple/Campus/355 warranted now?

Response 4: *We evaluated the peak hour warrants at the MD 355/Thornapple Drive/Campus Drive intersection under existing conditions. The results indicate that no warrants are currently met and are summarized and detailed in Appendix I.*

Comment 5: Further discussion and analysis required on site access regarding peak hour left turn storage length (203 left turns on MD 355), only 115' of stacking with current entrance, and 92 site generated peak hour trips from MD 355 that need to turn left into the proposed site with a 120 second cycle (TIA page 17). Current data indicates a need for approximately 350' of storage. The egress left turn queue will prevent ingress left turns and result in potential back up onto MD 355. Please provide potential signal layout design that will work to resolve these issues (ingress thru, ingress left, egress left, egress thru/right). Consider recommending site entrance relocation to the west so it can allow for more storage.

Response 5: *A preliminary layout has been prepared and attached for discussion purposes. It provides separate lanes for inbound and outbound traffic at the MD 355 intersection and site driveway. These modifications would allow inbound traffic to use a separate left turn lane with a bypass lane for other traffic and reduce the queuing potential at this location.*

Comment 6: Page 10 references 1.0 growth rate, please replace revised scope that reflects this change.

Response 6: *This has been revised in the updated scope.*

Comment 7: Page 17 under PIPELINE PROJECTS, please revise "City Staff" to "County Staff".

Response 7: *This has been revised in the updated report.*

Comment 8: TIA page 19, table 4-1, notes 2 and 3 below table are shown but not referenced in the table. Only 1, 4, 5,6, 7 are used. Consider removing and renumbering.

Response 8: *This has been revised in the updated report.*

Comment 9: TIA Page 20, Figure 4-1 please remove #3 reference to Monrovia Town Center in legend and figure.

Response 9: *This has been revised in the updated graphics.*

Comment 10: Please add a missing intersection MD 355/Urbana Parkway (newly constructed just north of site intersection). New count will be necessary, no adjustments required for pandemic or growth.

Response 10: *Counts were collected for the MD 355/Urbana Parkway intersection on Tuesday, November 16, 2021. Adjustments were not applied for COVID-19 or annual growth. The MD 355/Urbana Parkway intersection was analyzed for existing, future background, and total future conditions.*

Comment 11: TIA page 26, no mitigation is recommended for Intersection 2, westbound left turn movement queue, where it is unable to accommodate 7 am peak vehicles. Please provide further clarification or provide mitigation.

Response 11: *It is noted that no site traffic is expected to make a westbound left turn movement at this intersection given the site location and expected travel routes to and from the site. The future background and total future forecasts remain the same since there are no site trips making a westbound left turn. Therefore, additional mitigation is not proposed at this location.*

Comment 12: TIA page 29, table 6-1; please revise senior adult housing to 220 residential units and medical/dental to generic commercial. Rezoning cannot approved specific uses just general

uses. Use appropriate trip generations but generalize the terminology. Additionally, please remove Note 2 referencing the Self Storage.

Response 12: *This has been revised in the updated report.*

Comment 13: Please confirm Intersection 3 analysis. No site traffic appears to generate on the eastbound movement from background/pipeline to site build out even though 30 percent of the trips route this direction 1578 and 1578, per discussion.

Response 13: *This has been revised in the updated report. 30% of the outbound site traffic will go eastbound at Intersection 3.*

Comment 14: TIA page 36, note 6 (intersection 4), "it is noted that no site traffic is expected to use MD 355/Urbana Pike"....90 percent of the trips route through this intersection (remove/revise/etc).

Response 14: *This has been revised in the updated report. The sentence has been removed.*

Comment 15: As discussed, please generalize Note 7 regarding escrow contributions. This is rezoning and not APFO. Keep first sentence and last sentence.

Response 15: *This has been revised in the updated report.*

Comment 16: Was an additional site access considered? Full or RIRO anywhere along the property frontage?

Response 16: *An additional site access was considered but due to potential topographic challenges and forest conservation issues, it is not being pursued at this time.*

Comment 17: TIA Page 37, consider adding Note 9 referencing the applicant will construct a 10' wide shared use path along MD 355 frontage to comply with 2018 Bikeways and Trails Plan.

Response 17: *This has been revised in the updated report.*

Questions regarding this document should be directed to Wells + Associates.

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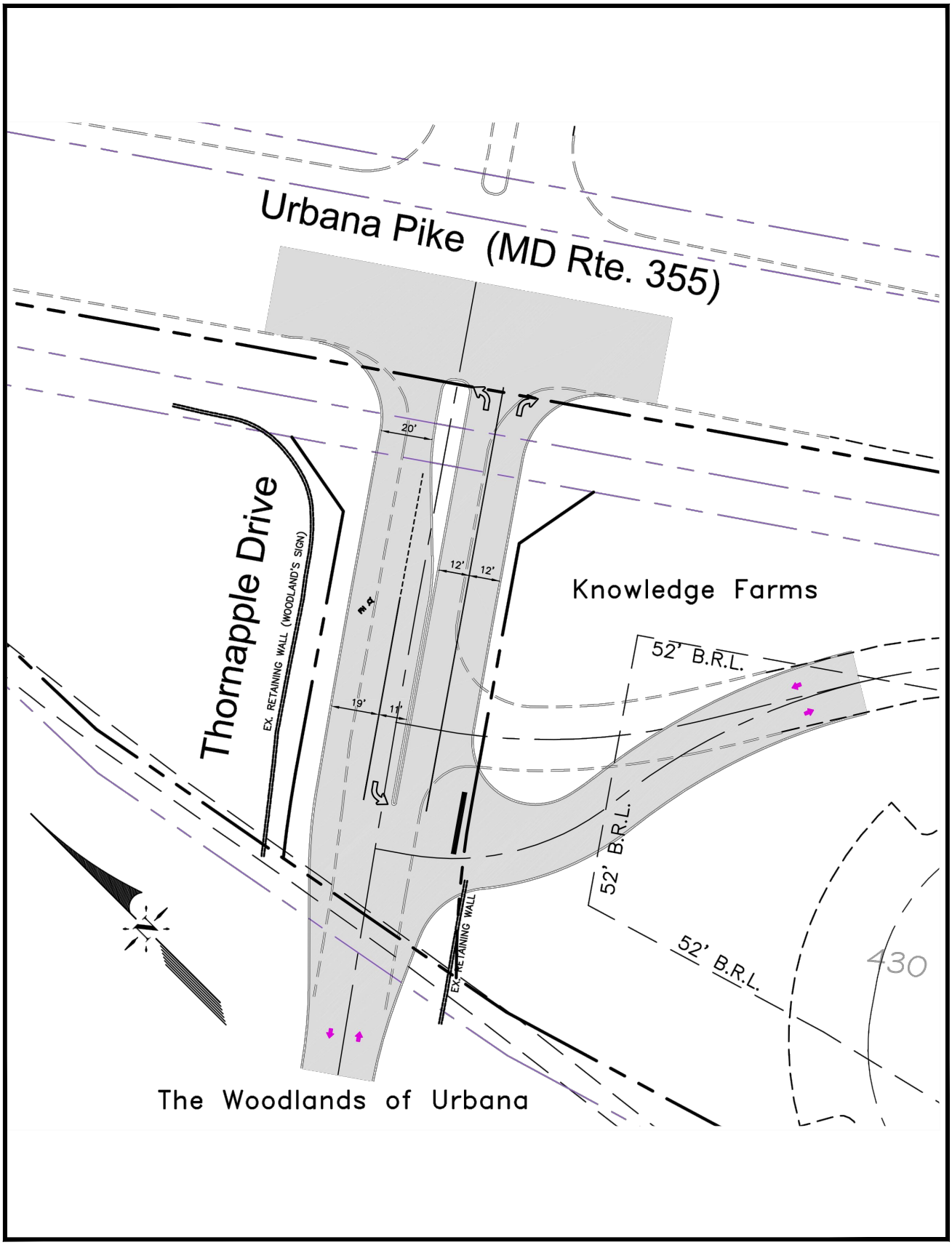

Provided by Terra Solutions Engineering

Attachment 1
Conceptual Access Plan

NORTH

Knowledge Farms
Frederick County, Maryland