Versailles Planning Study

Versailles, KY

Prepared for

City of Versailles

VERSAILLES
est. 1792

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Palmer
ENGINEERING

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CITY OF VERSAILLES
PLANNING STUDY
EXECUTIVE SUMMARY

PURPOSE

Palmer Engineering was retained by the City of Versailles to prepare a planning study to guide the development of the vehicular transportation infrastructure that will be necessary to serve the future growth within the Urban Service Boundary (USB). The planning study consisted of:

1. Recommending functional Roadway Classifications for all roadways within the Urban Service Boundary (USB) based on a system developed specifically for the City of Versailles
2. Provide design criteria for each roadway classification
3. Recommend roadway improvements for the defined study area to accommodate growth for the 20 year planning period and ensure these improvements meet the developed criteria.

TASK A

As a part of the study, Palmer Engineering assessed the existing roadway infrastructure to determine if existing conditions are acceptable. The roadways were assigned to their appropriate classification to help identify potential improvements. The following classifications and design criteria were considered within the urban service boundary:

TABLE 1: DESIGN CRITERIA (Expressway)

Criteria	Expressway	Criteria	Expressway
Design Speed	Min: 50 MPH Preferred: 70 MPH	Shoulder Width, ft	Min: 10' Preferred: 10'
Level of Service (LOS)	Min: LOS D	Superelevation	Max: 8%
Grades Max. Grades based on Terrains: Level, Rolling	50 MPH - 4%, 5% 60 MPH - 3%, 4% 70 MPH - 3%, 4%	Intersection Sight Distance, ft (Left Turn)	50 MPH: Min - 555' 60 MPH: Min - 665' 70 MPH: Min - 775'
Horizontal Curvature, ft (Radius @ emax= 8%)	50 MPH Min. R: 758' 60 MPH Min. R: 1200' 70 MPH Min. R: 1810'	Intersection Sight Distance, ft (Right Turn)	50 MPH: Min - 480' 60 MPH: Min - 575' 70 MPH: Min - 670'
Vertical Curvature, ft (Crest)	50 MPH: 84 60 MPH: 151 70 MPH: 247	Stopping Sight Distance, ft	50 MPH: Min - 425' 60 MPH: Min - 570' 70 MPH: Min - 730'
Vertical Curvature, ft (Sag)	50 MPH: 96 60 MPH: 136 70 MPH: 181	Cross Slope	Min: 0.5% Preferred: 2%
Lane Width, ft	12'	Landscape	None
Clear Zone, ft	Min: 30'	Access Interval	Fully Controlled
ROW, ft	230'		

TABLE 2: DESIGN CRITERIA (Major and Minor Arterial)					
Criteria	**Arterial**		**Criteria**	**Arterial**	
	Major	Minor		Major	Minor
Design Speed	Min: 40 MPH Max: 60 MPH	Min: 40 MPH Max: 60 MPH	Shoulder Width, ft	Min: 2' Preferred: 10'	Min: 2' Preferred: 10'
Level of Service (LOS)	Min: LOS D	Min: LOS D	Superelevation	Max: 8%	Max: 8%
Grades Max. Grades based on Terrains: Level, Rolling	40 MPH - 5%, 6% 50 MPH - 4%, 5% 60 MPH - 3%, 4%	40 MPH - 5%, 6% 50 MPH - 4%, 5% 60 MPH - 3%, 4%	Intersection Sight Distance, ft (Left Turn)	40 MPH: Min - 445' 50 MPH: Min - 555' 60 MPH: Min - 665'	40 MPH: Min - 445' 50 MPH: Min - 555' 60 MPH: Min - 665'
Horizontal Curvature, ft (Radius @ emax= 8%)	40 MPH Min. R: 444' 50 MPH Min. R: 758' 60 MPH Min. R: 1200'	40 MPH Min. R: 444' 50 MPH Min. R: 758' 60 MPH Min. R: 1200'	Intersection Sight Distance, ft (Right Turn)	40 MPH: Min - 385' 50 MPH: Min - 480' 60 MPH: Min - 575'	40 MPH: Min - 385' 50 MPH: Min - 480' 60 MPH: Min - 575'
Vertical Curvature, ft (Crest)	40 MPH: 44 50 MPH: 84 60 MPH: 151	40 MPH: 44 50 MPH: 84 60 MPH: 151	Stopping Sight Distance, ft	40 MPH: Min - 305' 50 MPH: Min - 425' 60 MPH: Min - 570'	40 MPH: Min - 305' 50 MPH: Min - 425' 60 MPH: Min - 570'
Vertical Curvature, ft (Sag)	40 MPH: 64 50 MPH: 96 60 MPH: 136	40 MPH: 64 50 MPH: 96 60 MPH: 136	Lane Width, ft	Min: 11' Preferred: 12'	Min: 11' Preferred: 12'
Access Interval	US 60: Partially & Fully Controlled US 60 Bypass: Fully Controlled Falling Springs: Partially Controlled	250 FT Minimum	Cross Slope	Min: 0.5% Preferred: 2%	Min: 0.5% Preferred: 2%
			Clear Zone, ft	Preferred: 30'	Preferred: 30'
			ROW, ft	150'	105'
			Landscape	Based on Ordinance	Based on Ordinance
			Intersection Control	Signals, TWSC,	Signals, TWSC,

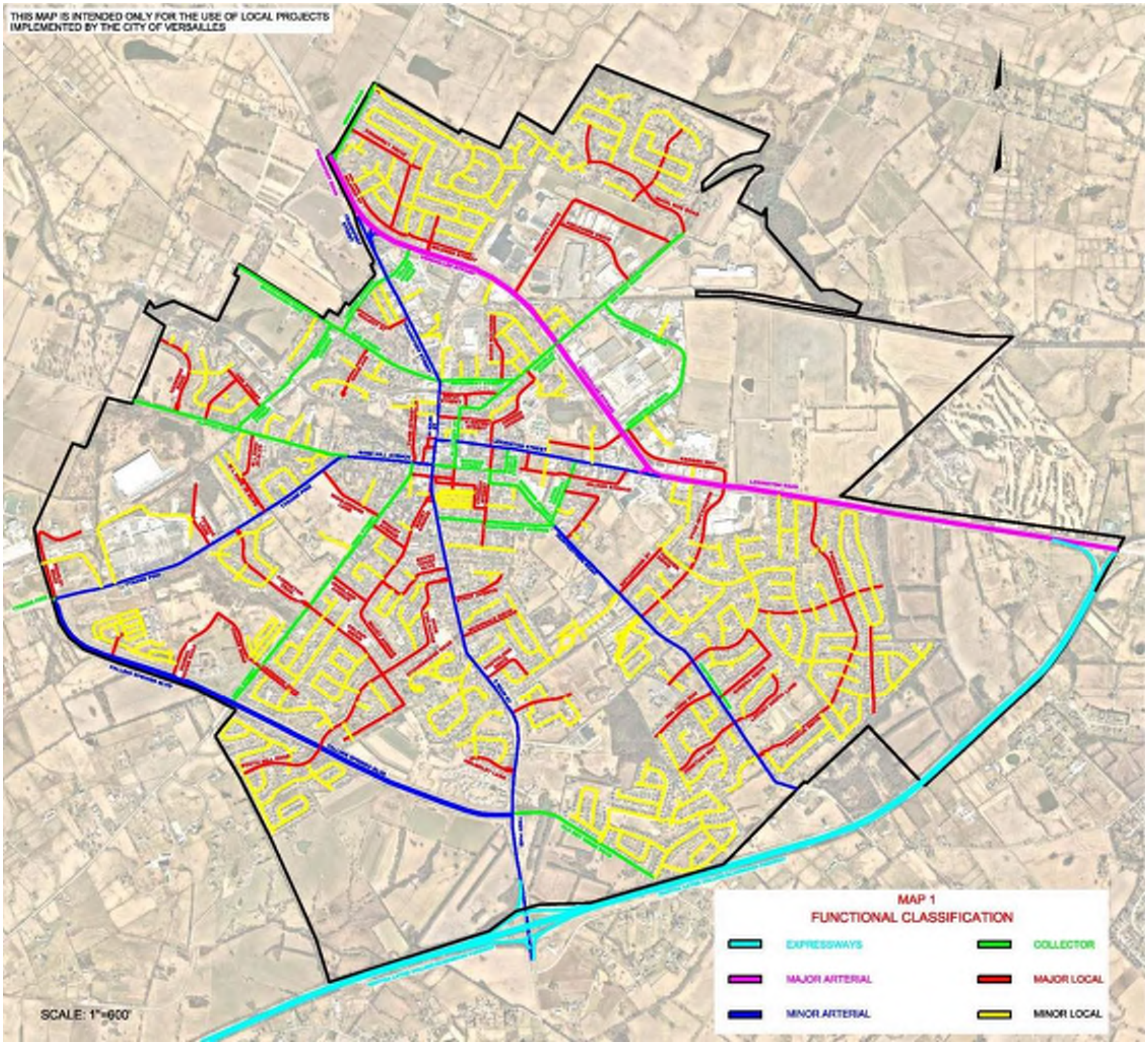
KEY: TWSC - Two Way Stop Control

TABLE 3: DESIGN CRITERIA (Collector and Local)			
Criteria	**Collector**	**Local**	
		Major	Minor
Lane Width, ft	12' Required	12' Required	12' Required
Cross Slope	Min: 0.5% Preferred: 2%	Min: 0.5% Preferred: 2%	Min: 0.5% Preferred: 2%
Curb/Gutter	Required	Required	Required
Sidewalk Width, ft	Min: 5' Preferred: 6'	Min: 5' Preferred: 6'	Min: 5' Preferred: 6'
Utility Strip, ft	Min: 5' Preferred: 6'	Min: 5' Preferred: 6'	Min: 5' Preferred: 6'
ROW, ft	Min: 51'	Min: 51'	Min: 51'
Landscape	Based on Ordinance	Based on Ordinance	Based on Ordinance
Intersection Control	TWSC, Signal	TWSC, AWSC	TWSC, AWSC
Access Interval	250 FT Minimum	250 FT Minimum	250 FT Minimum

KEY:
TWSC - Two Way Stop Control, AWSC - All Way Stop Control, Access Interval applies to Collectors and Locals

Access Interval does not apply to driveways

The roadway classification map (Map 1) classifies each road within the urban service boundary and can be used with the tables above to determine the required criteria.



Map 1: Functional Classification

TASK B

The study area was divided into seven zones based on how the properties are expected to develop according to the City of Versailles' Comprehensive Plan. ***Figure 1*** below provides a visualization of the seven tracts.

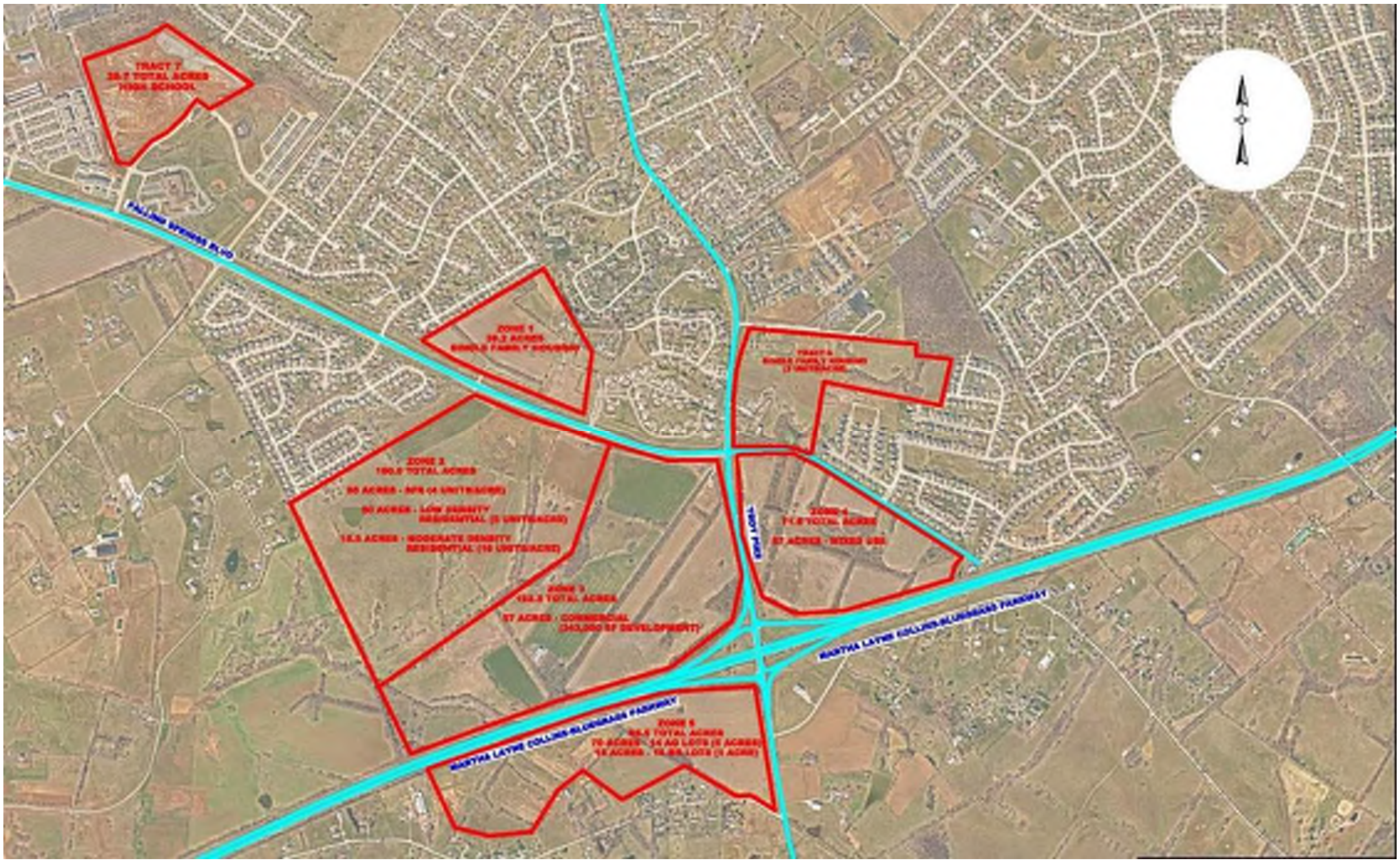


Figure 1: Zones

The Institute of Transportation Engineer's *Trip Generation Manual, 11th* Edition was used to determine the trips expected to be generated by the future land uses on each zone. ***Tables 4*** through ***10*** provide the entering and exiting trips generated for 2023 and 2043.

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 1 (39.2 ACRES)									
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
210	Single-Family Detached Housing	94	0.7	66	17	26%	49	74%
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
210	Single-Family Detached Housing	94	0.94	88	55	63%	33	37%
					72		82	
Clarifications:								
Adena Trace (Versailles) used as sample for single family house density								

Table 4: Zone 1 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 2 (160.5 ACRES)									
ITE Code	Land Use	Sq. Ft./Units	Average Rate	AM Peak	In	%	Out	%
210	Single-Family Detached Housing	237	0.7	*166*	*43*	26%	*123*	74%
210	Single-Family Detached Housing (Low Density)	250	0.7	*175*	*46*	26%	*129*	74%
210	Single-Family Detached Housing (Moderate Density)	248	0.7	*174*	*45*	26%	*129*	74%
					134		***381***	
ITE Code	Land Use	Sq. Ft./Units	Average Rate	PM Peak	In	%	Out	%
210	Single-Family Detached Housing	237	0.94	*223*	*140*	63%	*83*	37%
210	Single-Family Detached Housing (Low Density)	250	0.94	*235*	*148*	63%	*87*	37%
210	Single-Family Detached Housing (Moderate Density)	248	0.94	*233*	*147*	63%	*86*	37%
					435		***256***	
Clarifications:								
Adena Trace (Versailles) used as sample for single family house density								
Wooldridge Apartments used as sample for multi-family housing density								

Table 5: Zone 2 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 3 (162.3 ACRES)									
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
720	Medical- Dental Office Building - Stand Alone	20,000	3.1	62	49	79%	13	21%
820	Shopping Center	160,000	0.84	134	83	62%	51	38%
861	Sporting Goods Superstore	30,000	0.48	14	11	78%	3	22%
863	Electronic Superstore	30,000	0.34	10	7	73%	3	27%
890	Furniture Store	100,000	0.26	26	18	71%	8	29%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
					603		**483**	
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
720	Medical- Dental Office	20,000	3.93	79	24	30%	55	70%
820	Shopping Center	160,000	3.4	544	261	48%	283	52%
861	Sporting Goods Superstore	30,000	2.14	64	29	46%	35	54%
863	Electronic Superstore	30,000	4.25	128	64	50%	64	50%
890	Furniture Store	100,000	0.52	52	24	47%	28	53%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
					759		**765**	
Clarifications:								
20% Assumed to be for green space, roadways, landscape, detention, etc.								

Table 6: Zone 3 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS TRACT 4 (71.6 ACRES)									
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
210	Single-Family Detached Housing	85	0.7	60	16	26%	44	74%
220	Multifamily Housing (Low-Rise)	220	0.4	88	21	24%	67	76%
310	Hotel	100	0.46	46	26	56%	20	44%
710	General Office Building	153,000	1.52	233	205	88%	28	12%
822	Strip Retail Plaza	20,000	2.36	47	28	60%	19	40%
822	Strip Retail Plaza	20,000	2.36	47	28	60%	19	40%
822	Strip Retail Plaza	20,000	2.36	47	28	60%	19	40%
850	Supermarket	80,000	2.86	229	135	59%	94	41%
912	Drive-In Bank	6	8.54	51	31	61%	20	39%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
944	Gasoline/ Service Station	16	10.28	164	82	50%	82	50%
					1232		1009	
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
210	Single-Family Detached Housing	85	0.94	80	50	63%	30	37%
220	Multifamily Housing (Low-Rise)	220	0.51	112	71	63%	41	37%
310	Hotel	130	0.59	77	39	51%	38	49%
710	General Office Building	153,000	1.44	220	37	17%	183	83%
822	Strip Retail Plaza	20,000	6.59	132	66	50%	66	50%
822	Strip Retail Plaza	20,000	6.59	132	66	50%	66	50%
822	Strip Retail Plaza	20,000	6.59	132	66	50%	66	50%
850	Supermarket	80,000	8.95	716	358	50%	358	50%
912	Drive-In Bank	6	27.07	162	79	49%	83	51%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
944	Gasoline/ Service Station	16	13.91	223	112	50%	111	50%
948	Automated Car Wash	5000	14.2	71	36	50%	35	50%
					1440		1479	
Clarifications:								
20% Assumed to be for green space, roadways, landscape, detention, etc.								

Table 7: Zone 4 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 5 (85.5 ACRES)									
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%	
210	Single-Family Detached Housing (AG Lot)	14	0.7	*10*	*3*	26%	*7*	74%	
210	Single-Family Detached Housing (RR Lot)	15	0.7	*11*	*3*	26%	*8*	74%	
					6		***15***		
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%	
210	Single-Family Detached Housing (AG Lot)	14	0.94	*13*	*8*	63%	*5*	37%	
210	Single-Family Detached Housing (RR Lot)	15	0.94	*14*	*9*	63%	*5*	37%	
					17		***10***		
Clarifications:									
Adena Trace (Versailles) used as sample for single family house density									
Wooldridge Apartments used as sample for multi-family housing density									

Table 8: Zone 5 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 6								
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
210	Single-Family Detached Housing	123	0.7	*86*	*22*	26%	*64*	74%
					22		***64***	
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
210	Single-Family Detached Housing	123	0.94	*116*	*73*	63%	*43*	37%
					73		***43***	
Clarifications:								
Adena Trace (Versailles) used as sample for single family house density								

Table 9: Zone 6 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 7 NEW HIGH SCHOOL (1300 STUDENTS)								
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
525	High School	1300	0.52	*676*	*460*	68%	*216*	3200%
					460		***216***	
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
525	High School	1300	0.14	*182*	*87*	48%	*95*	52%
					87		***95***	

Table 10: Zone 7 Land Use and Trip Generation

LEVEL OF SERVICE

Trips were generated for the proposed development and then distributed to the roadway system based on the existing traffic patterns and engineering judgement. The existing traffic volumes were combined with the generated traffic to produce the total expected traffic. The roadway network was analyzed for existing and proposed conditions in the initial year (2023) and design year (2043) using the Highway Capacity Software (HCS). HCS uses traffic volumes and roadway geometry to determine the Level of Service (LOS) for each roadway that experienced traffic growth. Level of Service is a grade scale that uses traffic flow/congestion to determine a grade for the roadway. For the purpose of this study a LOS "C" or better was considered acceptable. The LOS for each roadway is listed in the tables below.

Table 11: 2023 Existing Level Of Service	
Roadway	LOS
Bluegrass Parkway	B
Falling Springs Boulevard	A
Troy Pike (North of Falling Springs Blvd)	C
Troy Pike (South of Falling Springs)	D
Old Dry Ridge Road	A

Table 12: 2023 Build Level Of Service Without Improvements		
Roadway	AM Peak LOS	PM Peak LOS
Bluegrass Parkway	C	C
Falling Springs Boulevard	A	A
Troy Pike (North of Fallings Springs Blvd)	E	E
Troy Pike (South of Falling Springs Blvd)	E	F
Old Dry Ridge Road	E	F

Table 13: 2043 No Build Level Of Service		
Roadway	AM Peak LOS	PM Peak LOS
Bluegrass Parkway	B	B
Falling Springs Boulevard	A	A
Troy Pike (North of Falling Springs Blvd)	C	C
Troy Pike (South of Falling Springs Blvd)	D	D
Old Dry Ridge Road	A	A

Table 14: 2043 Build Level Of Service Without Roadway Improvements		
Roadway	AM Peak LOS	PM Peak LOS
Bluegrass Parkway	D	D
Falling Springs Boulevard	A	A
Troy Pike (North of Falling Springs Blvd)	E	E
Troy Pike (South of Falling Springs Blvd	F	F
Old Dry Ridge Road	E	F

RECOMMENDATIONS

Recommendations were provided for each roadway listed in the previous section. These recommendations included improvements to achieve an acceptable Level of Service as defined in the Roadway Classification Design Criteria.

Innovative intersections provide a safety advantage, increase efficiency, and reduce delay. Innovative intersections to consider are Restricted Crossing U-turn (RCUT), Roundabouts, and Mini Roundabout. Roundabouts improve the overall function of an intersection. They reduce conflict points from 32 to 8 and eliminate the potential for head on collisions. Roundabouts eliminate the need for a traffic signal, resulting in less delay and increased flow. To accommodate future traffic growth and operate more safely and efficiently than existing signals, a roundabout could be constructed at the intersection of Falling Springs Boulevard and KY 33. The figure below displays a dual lane roundabout alternative.

Figure 2: Dual Lane Roundabout

Troy Pike from the Bluegrass Parkway westbound ramps to Edmonds Crossing operates at a LOS "E" or LOS "F" during the 2023 and 2043 build scenarios. To improve the LOS of Troy Pike, two additional through lanes can be constructed along Troy Pike from the Bluegrass Parkway ramps to Edmonds Crossing. To meet the criteria defined for this classification, the multi-use path (MUP) along Troy Pike should be extended from Helmsley Lane to the intersection with Edmonds Crossing. ***Figure 3*** represents the layout of these improvements.

Figure 3: 4-Lane Troy Pike

The HCS analysis provided evidence that no additional changes to the roadway geometry are required along Falling Springs Boulevard to allow the roadway network to operate at an acceptable level of service when the additional traffic for the future developments are added to the background traffic. In order to satisfy the design criteria established for Falling Springs Boulevard, 10 foot paved outside shoulders should be constructed.

Old Dry Ridge Road operates at a LOS “E” or LOS “F” during build conditions. The LOS can be improved by constructing two additional through lanes from Troy Pike to Rose Ridge Road to accommodate for additional traffic traveling to and from the future development in Zone 4. To meet the design criteria established Old Dry Ridge Road should be widened to provide two driving lanes and a 2 foot paved shoulder in each direction. The sidewalk along Old Dry Ridge Road should be replaced with a MUP and extend from Rose Ridge Road to Troy Pike. ***Figure 4*** provides a concept of the recommendations.

Figure 4: 4-Lane Old Dry Ridge Road

Restricted Crossing U-Turn (RCUT) intersections consist of having all side street movements be right turns. Traffic along the primary route is unaffected, but traffic from the secondary route that would turn left or go through the intersection are required to turn right from the side street. These movements travel down the main street until they reach a dedicated turn lane that allows them to make a U-turn. A loon is created on the opposing side of traffic provide additional paved surface to execute the U-turn without leaving the roadway. A RCUT intersection could be constructed at the intersection of Falling Springs Blvd and KY 1964 to accommodate future traffic growth and operate more safely and efficiently than the existing signal. ***Figure 5*** displays a concept of the recommendation. RCUT’s may also be considered for all intersections along Falling Springs Boulevard between Troy Pike and Tyrone Pike depending on the future traffic growth.

Figure 5: RCUT Intersection along Falling Springs Boulevard

To improve safety and the existing signalized intersection, a roundabout can be constructed at the intersection of Falling Springs Boulevard and US 62. ***Figure 6*** displays a concept of the roundabout.

Figure 6: Roundabout at Falling Springs Blvd/US 62

PROJECT COSTS

The project costs provided below are estimates based on 2022 KYTC average unit bid prices. The estimated costs include a 20% contingency. The estimated project costs are provided in the table below. Descriptions of each alternative are provided below the table.

Alternative	Project Cost
A	$1,900,000
B	$5,590,000
C	$945,000
D	$2,159,000

Table 15: Estimated Costs of Roadway Improvements

Alternative A:

- Two additional through lanes along Troy Pike from the westbound Bluegrass Parkway ramps to Edmonds Crossing

Alternative B:

- Widen Old Dry Ridge Road to provide 12 foot driving lanes in each direction with 2 foot shoulders
- Widen Falling Springs Boulevard to provide 10 foot paved shoulders
- Extend MUP along Troy Pike from Helmsley Lane to the intersection with Edmonds Crossing
- Replace the sidewalk along Old Dry Ridge Road with a MUP, from Rose Ridge Road to Troy Pike
- Remove all obstructions within the clear zone of the roadway

Alternative C:

- Two additional through lanes along Old Dry Ridge Road from Troy Pike to Rose Ridge Road

Alternative D:

- Dual lane roundabout at the intersection of Troy Pike and Falling Springs Boulevard
- Roundabout at the intersection of Falling Springs Boulevard and Lawrenceburg Road
- RCUT intersection at the intersection of Falling Springs Boulevard and KY 1964 (Full Resurfacing)

Cost sharing between the developer, local government, and the KYTC should be considered, where appropriate, for the roadway improvement.

IMPROVEMENT PRIORITIZATION

Alternative B can be implemented at the earliest, feasible time as this alternative brings the existing infrastructure to the requirements established in the design criteria. Alternative B consists of the following recommendations.

- Widening of Old Dry Ridge Road to 12 foot driving lanes in each direction with 2 foot shoulders,
- Widening of Falling Springs Blvd to provide 10 foot paved shoulders,
- Extend MUP along Troy Pike from Helmsley Lane to the intersection with Edmonds Crossing,
- Replace the sidewalk along Old Dry Ridge Road with a MUP, from Rose Ridge Road to Troy Pike
- Remove all obstructions within the clear zone of the roadway. This will ensure adequate sight distances at intersections and improve safety for vehicles that exit the roadway

Troy Pike south of Falling Springs Boulevard currently operates as a LOS “D” and can be considered for widening if the desired LOS is a “C” or better. The construction of two additional through lanes should be implemented along Troy Pike north of Falling Springs Boulevard as development access and traffic reaches thresholds that causes the LOS to degrade to a LOS D. This threshold is expected to occur when the road exceeds an average daily traffic (ADT) volume of 10,820 vehicles. The construction of two additional through lanes along Old Dry Ridge Road should be implemented once enough development has occurred that the volumes exceed an ADT of 8,320.

Alternative D and all other RCUT's considered should be implemented once enough development has occurred that the volumes at the intersections reach a point such that the traffic signal begins to function inefficiently or when crash data at these intersections demands that a safety improvement be constructed. Alternative D consists of the following recommendations.

- Dual lane roundabout at the intersection of Troy Pike and Falling Springs
- Roundabout at the intersection of Falling Springs Blvd and Lawrenceburg Road
- R-Cut Intersection at the intersection of Falling Springs Blvd and KY 1964

CITY OF VERSAILLES

PLANNING STUDY

TASK A

VERSAILLES est. 1792

Palmer ENGINEERING

INTRODUCTION

The City of Versailles, being a part of the Lexington Metropolitan Statistical Area (MSA) and being located in proximity to Lexington and Frankfort, Kentucky, anticipates continued growth within its Urban Service Boundary (USB) as defined in the Comprehensive Plan.

In preparing for future growth, the city initiated a planning study to guide the development of the vehicular transportation infrastructure that will be necessary to serve the growth within the USB.

The purpose of Phase 1 of this study is:

- To develop a functional, roadway classification system for the vehicular transportation infrastructure within the USB,
- To describe the functional roadway classifications,
- To classify all roadways within the USB according to the proposed roadway classifications, and
- To define design criteria for each roadway classification

The roadway classification system and design criteria should enable the city and the Planning Commission (and its staff) to direct the design requirements for all new roadway improvements to existing roadways.

Palmer Engineering was selected by the city of Versailles to complete the tasks as outlined. Implementation of the design requirements for each roadway classification will enable the city and the Planning Commission to meet the goals of managing the design of all new roadways and improvements to existing roadways and to ensure the orderly growth of the vehicular transportation infrastructure.

EXISTING CONDITIONS

As part of the study Palmer Engineering assessed the existing roadway infrastructure located within the urban service boundary. To determine if the existing conditions are acceptable the roadways were sorted into their appropriate classification before identifying potential improvements.

CLASSIFICATIONS

The American Association of State Highway and Transportation Officials (AASHTO) describes Functional Classification as the role of each roadway in serving motor-vehicle movements within the overall transportation system and suggests its position within the transportation network and its general role in serving automobile, truck, and transit vehicles. Functional classification groups roadways based on their importance to the network as a whole.

Classifications for roadways include expressways, arterial, collector, and local roads. These basic classifications can further be separated into major and minor as well as urban vs rural based on their traffic volumes, roadway geometrics, and surrounding land uses. For the purpose of this study the following classifications will be considered within the urban service boundary:

Expressway:

- Typically connect urban areas at high speeds (up to 70 mph)
- Are state or federally owned and maintained
- Typically provides four driving lanes minimum
- Provides a median
- Allow limited access to highways
- Allow no at-grade intersections. All interchanges are grade separated.

Image 1 - Bluegrass Parkway

Major Arterial (Principal):

- Carry traffic between other major arterials, minor arterials, and collectors
- Are state owned and maintained
- Speed limits typically do not exceed 55 mph
- Typically provide four lanes with dedicated left turn lanes and right turn lanes
- Are typically controlled access or partially controlled access
- Allow no on street parking except in urban environments where speeds are reduced

Image 2 – Versailles Bypass

Minor Arterial:

- Carry traffic between major arterials, minor arterials, and collectors
- Are state owned and maintained
- Speed limits typically range between 35 mph and 55 mph based on the characteristics of the area
- Typically provide two lanes but may be wider based on traffic volumes; dedicated left turn lanes and right turn lanes may be required based on volumes
- Are typically controlled access or partially controlled access
- Allow no on-street parking except in urban environments where speeds are reduced

Image 3 – KY 33 (Troy Pike)

Collector Road:

- Carry traffic between major arterials, minor arterials, collectors, and local roads
- A portion are locally owned and maintained
- Speed limits typically range between 35 mph and 55 mph depending on roadway characteristics and traffic volumes
- Typically provide two lanes for traffic
- Allow on-street parking in urban areas

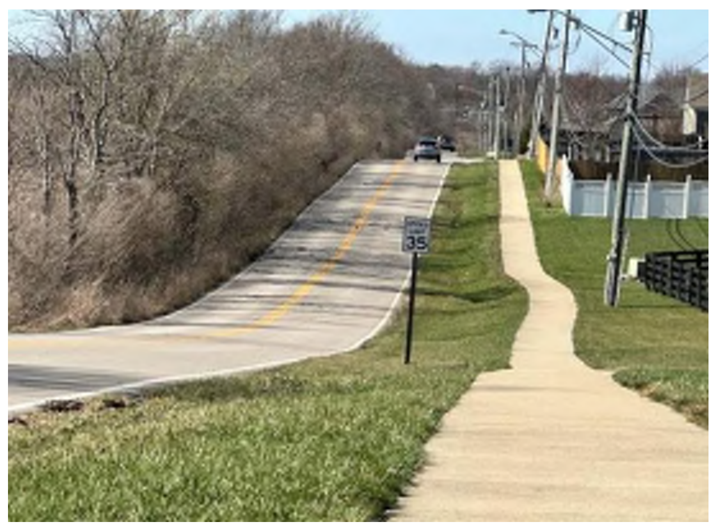


Image 4 – Old Dry Ridge Road

Major Local Road:

- Carry traffic between arterials, collectors, and other local roadways
- Are locally owned and maintained
- Speed limits vary between 15 mph and 35 mph
- Typically two lanes
- On-street parking and driveway access permitted unless restricted by local ordinance

Image 5 – South Hill Road

Minor Local Road:

- Carry traffic between homes and other local roadways
- Are locally owned and maintained
- Speed limits vary between 15 mph and 35 mph
- Typically two lanes
- On-street parking and driveway access permitted unless restricted by local ordinance

Image 6 – Rose Bud Road

The functional classifications will be used in this report to determine minimum design criteria that future roads will be required to meet and that existing roadways may be upgraded in order to meet multiple or all recommended criteria.

The functional classifications discussed in this report and shown on Map 1 of this report are specific to the City of Versailles and should be used only for local projects by the City of Versailles.

DESIGN CRITERIA

Based on guidelines from AASHTO's *A Policy on Geometric Design of Highways and Streets* often referred to as the "Green Book", AASHTO's *Roadside Design Guide*, Kentucky Transportation Cabinet (KYTC) standards, and engineering judgement. The following design criteria were identified for each functional classification:

Major Arterial:

- Design Speed
- Grades
- Horizontal Curvature
- Vertical Curvature
- Intersection Sight Distance
- Stopping Sight Distance
- Lane Widths
- Shoulders

- Cross Slope
- Superelevation
- Clear Zone
- Access Control
- Required Intersection Control

Minor Arterial:

- Design Speed
- Grades
- Horizontal Curvature
- Vertical Curvature
- Intersection Sight Distance
- Stopping Sight Distance
- Lane Widths
- Shoulders
- Cross Slope
- Superelevation
- Clear Zone
- Access Control
- Required Intersection Control

Collectors Roads:

- Roadway width
- Cross Slope
- Curb and gutter
- ROW Widths
- Sidewalk width and location
- Utility strip width and location

Major Local Road:

- Roadway width
- Cross Slope
- Curb and Gutter
- ROW width
- Sidewalk width and location
- Utility Strip width and location

Minor Local Road:

- Roadway width
- Cross Slope
- Curb and Gutter
- ROW width
- Sidewalk width and location
- Utility Strip width and location

DESIGN SPEED

The design speed is a criteria generally established during the roadway design that helps dictate the maximum and minimum considerations for other design criteria including vertical grades, horizontal and vertical curvature, sight distance, etc. The design speed is often coordinated with the speed limit in that the speed limit is often 5 mph less than the design speed of the roadway. This is not a requirement but a common practice.

As stated before the design speed of arterials are typically in the range of 55 mph to 75 mph depending on if the arterial is a major arterial or minor arterial or if the roadway is urban or rural. Collectors will typically have a design speed between 40 mph and 60 mph depending on the specific classification whether the roadway is a major vs minor or urban vs rural. Local roads will typically have a design speed that ranges between 20 mph and 50 mph depending on if the local road is classified as rural or urban.

Generally major classification will have a higher design speed than minor classifications and rural classifications will have higher design speeds than urban classifications. Rural roadways typically are less dense and have fewer access points allowing them to operate with higher speeds than urban roadways.

LEVEL OF SERVICE

Level of Service (LOS) is a qualitative measure used to describe the quality of motor vehicle traffic at intersections or roadway segments. LOS is based on a grade scale from A to F with A being excellent and F being failure. A Level of Service C is desirable, and D is acceptable in an urban setting.

When considering an intersection the Highway Capacity Manual (HCM), defines the level of service in terms of delay (See ***Tables 16*** and ***17***). Delay results in driver discomfort, frustration, fuel consumption, and lost travel time. Delay is caused by a number of factors including traffic signal timing, geometrics, traffic congestion, and accidents at an intersection.

Table 16: Unsignalized Intersections LOS	
Level of Service	Delay (Seconds per vehicle)
A	≤ 10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Table 17: Signalized Intersections LOS	
Level of Service	Delay (Seconds per vehicle)
A	≤ 10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

When considering the level of service of a freeway or multilane highway the HCM determines level of service based on the density, or proximity of one driver to another. Density affects driver's freedom of maneuverability along the roadway and is therefore sensitive to flow rates throughout different levels of flow. Density is measured in passenger cars per mile per lane (pc/mi/ln). Density along freeways and multilane highways is affected by the number of lanes, terrain type, speed, lane width, clearance from edge of travel way, ramp density, traffic volumes, and driver familiarity of the roadway. ***Table 18*** defines the spectrum of density and the associated level of service.

Table 18: Freeway and Multilane Highways LOS	
Level of Service	Density (pc/mi/ln)
A	≤ 11
B	>11 and ≤18
C	>18 and ≤26
D	>26 and ≤35
E	>35 and ≤45
F	>45

Two lane highways are subcategorized into three classes by the HCM. The HCM describes the classes as follows:

- Class I Highways: motorists are expect to travel at relatively high speeds. Two-lane highways that are major intercity routes, primary connectors of major traffic generators, daily commuter routes, or major links in state or nations highway networks are generally assigned Class I. Class I highways serve mostly long-distance trips or provide connections between facilities serving long trips.
- Class II Highways: Motorists do not necessarily expect to travel at high speeds. Two-lane highways that are access routes to Class I facilities, that serve as scenic or recreational routes (not as primary arterials), or that pass through rugged terrain (where high speeds would not be possible) are classified as Class II highways. Class II facilities often serve relatively short trips, or trips for which sightseeing plays a significant role.
- Class III Highways: Class III highways serve moderately developed areas. They may be portions of Class I and Class II highway that pass through small towns or developed recreational areas. Local traffic often mixes with through traffic and the number of unsignalized intersections and driveways is noticeably higher than in rural areas.

Depending on the class of the highway the level of service is determined by one or two of the following three factors:

- Average travel speed, ATS (mph)
- Percent time spent following, PTSF (%)
- Percent of free-flow speed, PFFS (%)

Characteristics of the road that have a significant impact on the level of service of a two lane highway are traffic volumes, speed limit, lane width, shoulder width, access point density, and the amount of passing opportunities. The following table describes the spectrum of level of service for two lane roadways.

Table 19: Two Lane Road LOS				
	Class I		Class II	Class III
LOS	ATS (mph)	PTSF (%)	PTSF (%)	PFFS (%)
A	>55	≤35	≤40	>91.7
B	>55-55	>35-50	>40-55	>83.3-71.7
C	>45-50	>50-65	>55-70	>75-83.3
D	>40-45	>65-80	>70-85	>66.7-75
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

The image below provides a visual representation of the different Levels of Service for intersections and roadways.

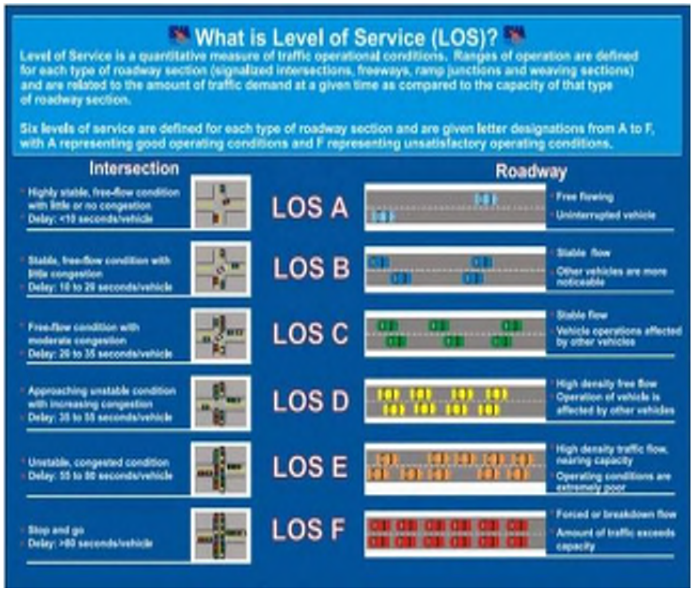


Image 7 – Intersection and Roadway Levels of Service

STOPPING SIGHT DISTANCE

Stopping sight distance is the collective distance travelled to account for the time it takes for a driver to identify the need to stop and begin applying the brakes (brake reaction time) and the distance it takes a vehicle to come to a complete stop (braking distance). Under normal conditions a brake reaction time of 2.5 seconds is acceptable. However, this can be affected by visibility impacts such as fog as well as distractions the driver experiences. The breaking distance can be affected by the condition of the vehicle, the conditions of the roadway i.e. if the pavement is dry or wet, and the grade of the roadway. Roadway vertical grades affect stopping sight distance by adding the effects of gravity. When traveling uphill, gravity assists the vehicle in stopping and therefore a shorter distance is required whereas when travelling downhill gravity opposes the driver's desire to stop and therefore a longer distance is required. ***Table 20*** summarizes the recommended stopping sight distances for level roadways based on the design speed as provided in AASHTO's the Green Book:

Table 20: Stopping Sight Distances (level roads)	
Design Speed (MPH)	Stopping Sight Distance (ft)
15	80
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570

PASSING SIGHT DISTANCE

Most roadways are two lane roadways. Passing zones allow faster travelling drivers to pass slower moving drivers in order to reduce time spent following, which improves level of service, while also reducing potential driver impatience concerns. In order to allow a driver to pass the vehicle in front of them the driver needs to be able to see far enough past the vehicle in front of them to comfortably complete the passing maneuver without interfering with opposing traffic. ***Table 21*** provides the passing sight distance, in feet, recommended by AASHTO's the Green Book:

Table 21: Recommended Passing Sight Distances	
Design Speed (MPH)	Passing Sight Distance (ft)
20	400
25	450
30	500
35	550
40	600
45	700
50	800
55	900
60	1,000

Urban settings generally have less passing zones than rural due to the density of the roadways and frequency of intersections and access points. Drivers will not expect to be given opportunities for passing in these settings. As the table above shows with increase in speeds the required passing sight distance also increases.

INTERSECTION SIGHT DISTANCE

Designing for appropriate intersection sight distance helps ensure that vehicles can safely cross or enter a major roadway from a minor road or driveway. Intersection sight distance requires that vehicles sitting back from the intersection be able to see down the major roadway approaches without any obstructions, horizontal or vertical. Common examples of violations to intersection sight distance are when shrubs and plants are placed near the main roadway and grow tall enough that vehicles on the minor approach cannot see around them to safely pull out. Intersection controls are classified into six cases:

- Case A: Intersection with no control
- Case B: Intersections with stop control on the minor
- Case C: Intersections with yield control on the minors
- Case D: Intersections with traffic signal control
- Case E: Intersections with all-way stop control
- Case F: Left turns from the major road

The most common cases are Case B, D, E, and F. Case D (signalized control) requires that the first stopped vehicle on one approach should be visible to the driver of the first vehicles stopped on every other approach and that left and right turning vehicles should be able to see far enough down the other approaches to safely make their maneuver.

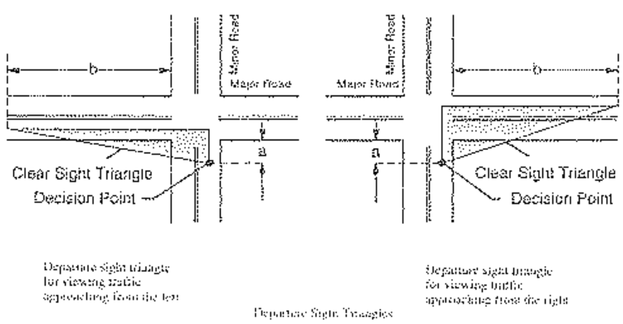


Image 8 – Departure Sight Triangles

Case B (two-way stop controlled) is typically subdivided into left turns from the minor road and right turns from the minor road. For right turning movements the intersection sight distance considers how far to the left (into oncoming traffic) the driver can see before executing a right turn. Left turning intersection sight distance accounts for how far to the right (into oncoming traffic) that the driver can see before executing a left turn onto the main roadway. When both the left and right turning intersection sight distances are provided then adequate sight distance and time for a vehicle to safely cross the major roadway from one minor approach to the other minor approach is generally present. The type of vehicle assumed for the intersection sight distance affects the required sight distance due to the varying acceleration rates between passenger cars to semi-trucks. ***Table 22*** provides the left turning intersection sight distance required for a passenger car at a two-way stop controlled intersection. ***Table 23*** provides the right turn intersection sight distance required for a passenger car to safely execute a right turning maneuver at a two-way stop controlled intersection.

Table 22: Case B (Left Turn) Intersection Sight Distance	
Design Speed (MPH)	Intersection Sight Distance for Passenger Cars (ft)
15	170
20	225
25	280
30	335
35	390
40	445
45	500
50	555
55	610
60	665

Table 23: Case B (Right Turn) Intersection Sight Distance	
Design Speed (MPH)	Intersection Sight Distance for Passenger Cars (ft)
15	145
20	195
25	240
30	290
35	335
40	385
45	430
50	480
55	530
60	575

Case E (All-way stop controlled) suggests that the first vehicles stopped at any approach should be able to see the first vehicles stopped at all other approaches.

Case F (left turn from major road) requires vehicles to be able to see far enough along the opposing traffic lanes to have time to, from a stop, accelerate and complete the turn safely without impacting oncoming traffic. The type of vehicle will have an effect on the intersection sight distance due to the difference in acceleration rates between vehicles such as passenger cars and semi-trucks. Based on equations provided in the AASHTO Green Book ***Table 24*** provides the appropriate intersection sight distance for passenger cars based on the roadway speeds:

Table 24: Case F Intersection Sight Distance	
Design Speed (MPH)	Intersection Sight Distance for Passenger Cars (ft)
15	125
20	165
25	205
30	245
35	285
40	325
45	365
50	405
55	445
60	490

ROADWAY TYPICAL SECTION

The roadway typical section is comprised of many secondary design criteria previously mentioned to include lanes widths, number of lanes, presence of turn lanes and widths, presence and widths of medians, presence and width of shoulders, presence of curb and gutter, presence of utility strips, presence and widths of sidewalks, cross slopes of the roadway, superelevation through horizontal curves, backslopes and foreslopes, and clear zone. How the functional classification affects these design criteria is as follows:

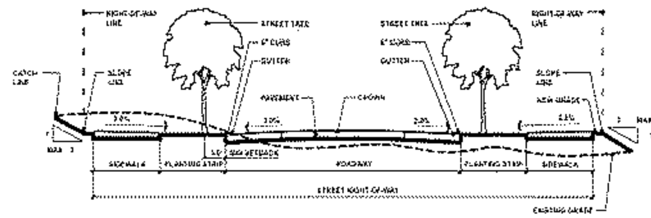


Image 9 – Roadway Typical Section

Lane Widths:

Lane widths directly affect capacity, safety, and driver comfort. The Highway Capacity Manual states that the base condition, the value at which there is no negative impact on capacity or level of service, is twelve foot lanes. As the lanes continue to narrow the impact on the level of service and capacity increase. For all functional classifications the recommended lane width is twelve feet with a minimum lane width of ten feet for any roadways with heavy vehicle traffic, i.e. semi-trucks, buses, etc.

Number of Lanes:

The number of lanes directly affects the capacity of the roadway. Urban roadways will benefit more from multiple lanes than rural roadways due to the density usually accompanying the urban environment. Likewise, the higher the classification of roadway the greater it will benefit from additional lanes due to the higher volumes associated with the higher classification. The recommended number of travel lanes is dependent on the surrounding land use, number of access points to the road, and volume of vehicles using that roadway.

Medians:

Medians come in different forms including depressed medians often seen along rural interstate systems, flush medians which often operate as a two way left turn lane, and raised medians where a concrete island or barrier may separate opposing lanes of travel. Separation, and therefore safety, is a primary benefit of any median, especially wide depressed medians or raised medians. The greatest benefit of a flush median such as a two way left turn lane is the allowance of vehicles to seek refuge prior to turning left and exiting the major roadway or vehicles to enter and wait for a gap when turning left to enter the major roadway. Medians are not typical on local roadways and are generally placed on collectors or arterials when the design considers them necessary and feasible. Urban roadways with many access points benefits from having a two way left turn lane to move vehicles out of the through lane while they wait for a gap to turn left into or out of the minor roadway.

Shoulders:

Shoulders provide a safety benefit to roadway users by giving a space to potentially recover if they leave the travel lane and it can provide a place for refuge, if the shoulder is wide enough. The Highway Capacity Manual assumes a base condition of 6 feet for the outside shoulder, any width less than this condition will affect the capacity and level of service of the roadway. For practicality the recommended minimum shoulder width is two feet, paved or unpaved, to provide a small area for correction. Rural roadways with a lower volumes, local and collectors, operate adequately with small two foot shoulder. Rural major arterials with higher speeds and higher volumes benefit from having a larger shoulder width. The preferred width is 10 feet so that a car can safely pull off of the road for an emergency for rural, high speed roads. Similar to medians, shoulders are often dependent on feasibility and practicality.

Superelevation:

Superelevation or roadway banking refers to the practice of lowering the outside point of pavement through a horizontal curve below the inside point of the curve in order to resist the centrifugal force throughout the curve that would attempt to eject the vehicle from the roadway. In tangent, straight, sections of roadway the road typically has a cross slope of one percent to two percent in order to allow water to drain out of the travel way. In horizontal curves this rate is increased. The superelevation, horizontal radius and design speed directly affect one another. As the design speed increases and superelevation rate increases, the minimum radius will decrease. It is recommended that the maximum superelevation is 8% for all roadways.

Backslopes and Foreslope:

Foreslopes and backslopes are generally considerations for rural roadways where the elevation beyond the roadway varies. If the ground elevation becomes higher than that of the roadway a foreslope is constructed down to a ditch and then a backslope is constructed from the ditch to tie into the higher ground elevation. If the elevation is below the roadway then then a foreslope is constructed to tie into the lower ground elevation. Foreslopes can provide areas of recovery for vehicles that have exited the roadway depending on the angle of the slope. If a foreslope is constructed at a 4:1 (change in four feet horizontally for every change in foot vertically) or less, then the slope is considered recoverable, if the slope is between a 4:1 and a 3:1 then the slope is traversable; and any slope steeper than a 3:1 is non-traversable. A slope being recoverable means that a car can go off the road and then turn back up to reenter the road. Traversable means that the car can travel down the slope safely, without rolling over, but will not be able to reenter the roadway on its own. Non-traversable means that the car has a high likelihood of rolling over and causing injury or a fatality. AASHTO's Roadside Design guide recommends that any slope that is steeper than 3:1 be protected by some type of barrier such as guardrail. The recommended slope of foreslopes for any rural roadway is 4:1 or less; however, if right-of-way or the existing ground does not allow a recoverable slope it is recommended that guardrail, with end treatments, be constructed to protect slopes steeper than 3:1. Backslopes are dependent on stability; however, the less steep the slope the better for stability and maintainability.

Clear zone:

Clear zone is defined by AASHTO's Roadside Design guide as the unobstructed, traversable area beyond the edge of the through traveled way for the recovery of errant vehicles. The clear zone concept is a guidance rather than requirement but is intended to improve safety along roadways. Clear zone recommendations are determined based on the design speed of the roadway, volume of traffic, and steepness of the foreslope or backslope. As the speed or volume increase the recommended clear zone also increases. KYTC has established a maximum clear zone of 30 feet for any road. A minimum clear zone of seven feet is ideal, but the larger clear zone that can be constructed for a road the better the safety for the road.

The Roadside Design guide recommends when an obstacle within clear zone is encountered, such as a tree, the order of preference is to remove the obstacle, if the obstacle cannot be removed then redesign the obstacle, if that is not an option then relocate the obstacle, the next alternative is to shield the obstacle and then finally delineate the obstacle if none of the other options are viable.

Urban, low speed, sections of roadway often provide curb and gutter. When curb and gutter are present the Roadside Design guide recommends that three feet behind the curb be kept free of obstacles.

Curb and Gutter, Utility Strips, and Sidewalks

Curb and Gutter, utility strips, and sidewalks are all design elements that are common in urban settings but are not seen in rural sections as often. Curb and Gutter by design operates well in low speed, urban sections of roadway. Local roads, and low speed urban collectors and arterials are acceptable locations to construct curb and gutter for drainage purposes.

Sidewalks are most common in areas with denser populations. Although they can be found or added in areas that are considered rural the purpose of sidewalks is to provide a designated space for pedestrians to travel separated from the through lane. If the area is a less dense population then pedestrians will be less likely to use the sidewalks for travel. Sidewalks are recommended to be six feet wide but are required by ADA standards (The Americans with Disabilities) to be a minimum of five feet wide. In areas very dense and with expected high use a multi-use path (MUP) should be considered to account for both pedestrian use and bicycle use. Unlike a standard sidewalk the MUP can be concrete or asphalt and will generally be a minimum of 8 feet wide.

Utility strips can be common in urban areas where sidewalks are present. Utility strips are the space that exists between the roadway and the sidewalk and is often where underground or overhead utilities are installed. In addition to providing a designated space for utilities that does not impact the road or sidewalk, it also provides additional separation between vehicular traffic and pedestrian traffic. Utility strips should be considered in areas where sidewalks are located and right-of-way permits the addition. Utility strips should be a minimum of 3 feet wide with a preferred 5 feet wide. A five foot wide strip will allow any above ground utilities, including fire hydrants, to be constructed three feet behind the curb as recommended by the Roadside Design guide.

RIGHT-OF-WAY

Right-of-way is the land owned by the government agency maintaining the roadway; i.e. interstates are owned by FHWA, state routes are owned by KYTC, and local roads will be owned by the county or city in which they are located. When determining the amount of right-of-way that should be maintained or acquired for the roadway it is dependent on the desired typical section of the roadway (lane widths, number of lanes, shoulder if present, utility strips if present, sidewalks if present, median if present).

In rural segments right-of-way should cover, at a minimum, the roadway, any shoulders, roadway ditches, foreslope or backslopes, and any areas that utilities are located.

In urban segments right-of-way should include, at a minimum, the roadway to include shoulders or curb, utility strips if present, ditches, foreslopes or backslopes, and sidewalk if present. Ideally right-of-way would include up to three feet behind the sidewalk for any future construction that may be required in order to provide room to work without accessing private property.

SUMMARY

The City of Versailles desires to enhance its design of new roadways and the design of improvements to existing roadways through the adoption of roadway classifications and design requirements for the various roadway classifications. Palmer Engineering, in concert with the City of Versailles, developed a roadway classification schedule for roadways within the urban service boundary. Each existing roadway within the USB was classified according to the proposed schedule. Descriptions of each roadway classification are provided. Design criteria were developed and recommended for each roadway classification. Adoption and use of the roadway classifications and design criteria will enable the city and the Planning Commission to meet the goals of managing the design of all new roadways and improvements to existing roadways and to ensure the orderly growth of the vehicular transportation infrastructure. Design elements for multi-use trails and paths were not a part of this study.

CITY OF VERSAILLES PLANNING STUDY

TASK B

EXISTING LAND USE

The City of Versailles anticipates substantial development in the area along Troy Pike (KY 33), Falling Springs Blvd (KY 2113), and Old Dry Ridge Rd as defined in the Comprehensive Plan. Currently the land use is agricultural land along these corridors. For the purpose of this study the existing land uses were obtained through observations on site and through the Versailles Zoning Map provided by Woodford County Planning.

PROJECTED GROWTH RATES

To determine the projected traffic growth, KYTC traffic counts were analyzed to determine the historic growth rates in the area. Old Dry Ridge Road is a locally owned road; therefore no data is collected by the KYTC. Based on the rates of the surrounding roads a growth rate of 1.00% was determined to be adequate and potentially conservative. The following roadways were examined and the historical rates are as follows:

KY 33/TROY PIKE (KYTC COUNT STATION – 120A06):

Growth Rate: 0.5%

Year	AADT
1995	3410
1999	8250
2003	10700
2007	9990
2010	10700
2013	8137
2016	10879
2019	10977
2022	11265

Table 25: KY 33 Traffic Counts

BLUEGRASS PARKWAY (KYTC COUNT STATION – 120800):

Growth Rate: 1.25%

Year	AADT	Year	AADT	Year	AADT
1994	15900	2006	21500	2018	18917
1995	14000	2008	16300	2019	18803
1996	11500	2009	16900	2020	13439
1997	13600	2010	17500	2021	18213
1998	16900	2011	17500	2022	19479
2000	20800	2012	17286		
2002	17800	2013	16034		
2003	15900	2014	17622		
2004	16500	2015	17325		

Table 26: Bluegrass Parkway Traffic Counts

FALLING SPRINGS BOULEVARD (KYTC COUNT STATION – 120C11):

Growth Rate: 0.5%

Year	AADT
2005	5460
2006	4080
2007	3650
2011	4860
2013	4980
2016	4958
2019	5123
2022	5290

Table 27: Falling Springs Blvd Traffic Counts

FUTURE LAND USE

The study area was divided into five zones based on how the property is expected to develop according to the City of Versailles' Comprehensive Plan. ***Figure 7*** in the Appendix details the boundaries and sizes of the five zones. Further details on land use are provided in the following paragraphs and in the ***ITE Trip Generation*** section of this report. Land uses were determined using the Comprehensive Plan and verified with the City of Versailles.

Zone 1:

- Located on the North side of Falling Springs Boulevard
- Total Area – 39.2 Acres

- All Single-Family Detached Housing (94 Units)

Image 10: Zone 1

Zone 2:

- Located on the South side of Falling Springs Boulevard
- Total Area – 160.5 acres
- Single Family Residential – 95 Acres (237 Units)
- Low Density Residential – 50 Acres (250 Units)
- Moderate Density Residential – 15.5 Acres (248 Units)

Image 11: Zone 2

Zone 3:

- Located on the South side of Falling Springs Boulevard and the West side of Troy Pike.
- Total Area – 162.3 Acres
- Commercial Use – 57 Acres
- 343,000 Square Feet of commercial development
- Remaining Acreage will remain agricultural usage

Image 12: Zone 3

Zone 4:

- Located on the South Side of Old Dry Ridge Road and the East side of Troy Pike
- Total Area – 71.6 Acres
- Mixed Residential and Commercial use

Image 13: Zone 4

Zone 5:

- Located on the South Side of Bluegrass Parkway and the West Side of KY 33
- Total Area – 85.5 Acres
- Agricultural Lots – 70 Acres (14 Lots)
- Rural Residential Lots – 15 Acres (15 Lots)

Image 14: Zone 5

ITE TRIP GENERATION

The Institute of Transportation Engineer's *Trip Generation Manual, 11th* Edition was used to determine the trips expected to be generated by the future land uses on each zone. The Trip Generation Manual is a nationally recognized resource for estimating the number of vehicles generated by a land use based on data collected from locations across the nation. The tables below represent the expected land uses, acreage, and trip generation for each zone.

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 1 (39.2 ACRES)								
ITE			**Average**					
Code	**Land Use**	**Sq. Ft./Units**	**Rate**	**AM Peak**	**In**	**%**	**Out**	**%**
210	Single-Family Detached Housing	94	0.7	*66*	*17*	26%	*49*	74%
ITE			**Average**					
Code	**Land Use**	**Sq. Ft./Units**	**Rate**	**PM Peak**	**In**	**%**	**Out**	**%**
210	Single-Family Detached Housing	94	0.94	*88*	*55*	63%	*33*	37%
					72		***82***	
Clarifications:								
Adena Trace (Versailles) used as sample for single family house density								

Table 28: Zone 1 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 2 (160.5 ACRES)									
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
210	Single-Family Detached Housing	237	0.7	*166*	*43*	26%	*123*	74%
210	Single-Family Detached Housing (Low Density)	250	0.7	*175*	*46*	26%	*129*	74%
210	Single-Family Detached Housing (Moderate Density)	248	0.7	*174*	*45*	26%	*129*	74%
					134		***381***	
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
210	Single-Family Detached Housing	237	0.94	*223*	*140*	63%	*83*	37%
210	Single-Family Detached Housing (Low Density)	250	0.94	*235*	*148*	63%	*87*	37%
210	Single-Family Detached Housing (Moderate Density)	248	0.94	*233*	*147*	63%	*86*	37%
					435		***256***	
Clarifications:								
Adena Trace (Versailles) used as sample for single family house density								
Wooldridge Apartments used as sample for multi-family housing density								

Table 29: Zone 2 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 3 (162.3 ACRES)								
ITE Code	Land Use	Sq. Ft./Units	Average Rate	AM Peak	In	%	Out	%
720	Medical- Dental Office Building - Stand Alone	20,000	3.1	62	49	79%	13	21%
820	Shopping Center	160,000	0.84	134	83	62%	51	38%
861	Sporting Goods Superstore	30,000	0.48	14	11	78%	3	22%
863	Electronic Superstore	30,000	0.34	10	7	73%	3	27%
890	Furniture Store	100,000	0.26	26	18	71%	8	29%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
					603		483	
ITE Code	Land Use	Sq. Ft./Units	Average Rate	PM Peak	In	%	Out	%
720	Medical- Dental Office	20,000	3.93	79	24	30%	55	70%
820	Shopping Center	160,000	3.4	544	261	48%	283	52%
861	Sporting Goods Superstore	30,000	2.14	64	29	46%	35	54%
863	Electronic Superstore	30,000	4.25	128	64	50%	64	50%
890	Furniture Store	100,000	0.52	52	24	47%	28	53%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
					759		765	
Clarifications:								
20% Assumed to be for green space, roadways, landscape, detention, etc.								

Table 30: Zone 3 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS TRACT 4 (71.6 ACRES)									
ITE Code	Land Use	Sq. Ft./Units	Average Rate	AM Peak	In	%	Out	%
210	Single-Family Detached Housing	85	0.7	60	16	26%	44	74%
220	Multifamily Housing (Low-Rise)	220	0.4	88	21	24%	67	76%
310	Hotel	100	0.46	46	26	56%	20	44%
710	General Office Building	153,000	1.52	233	205	88%	28	12%
822	Strip Retail Plaza	20,000	2.36	47	28	60%	19	40%
822	Strip Retail Plaza	20,000	2.36	47	28	60%	19	40%
822	Strip Retail Plaza	20,000	2.36	47	28	60%	19	40%
850	Supermarket	80,000	2.86	229	135	59%	94	41%
912	Drive-In Bank	6	8.54	51	31	61%	20	39%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
932	High-Turnover (Sit-Down) Restaurant	6,000	9.57	57	31	55%	26	45%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
934	Fast-Food Restaurant with Drive-Through Window	5,000	44.61	223	114	51%	109	49%
944	Gasoline/ Service Station	16	10.28	164	82	50%	82	50%
					1232		1009	

ITE Code	Land Use	Sq. Ft./Units	Average Rate	PM Peak	In	%	Out	%
210	Single-Family Detached Housing	85	0.94	80	50	63%	30	37%
220	Multifamily Housing (Low-Rise)	220	0.51	112	71	63%	41	37%
310	Hotel	130	0.59	77	39	51%	38	49%
710	General Office Building	153,000	1.44	220	37	17%	183	83%
822	Strip Retail Plaza	20,000	6.59	132	66	50%	66	50%
822	Strip Retail Plaza	20,000	6.59	132	66	50%	66	50%
822	Strip Retail Plaza	20,000	6.59	132	66	50%	66	50%
850	Supermarket	80,000	8.95	716	358	50%	358	50%
912	Drive-In Bank	6	27.07	162	79	49%	83	51%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
932	High-Turnover (Sit-Down) Restaurnat	6,000	9.05	54	33	61%	21	39%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
934	Fast-Food Restaurant with Drive-Through Window	5,000	33.03	165	86	52%	79	48%
944	Gasoline/ Service Station	16	13.91	223	112	50%	111	50%
948	Automated Car Wash	5000	14.2	71	36	50%	35	50%
					1440		1479	

Clarifications:
20% Assumed to be for green space, roadways, landscape, detention, etc.

Table 31: Zone 4 Land Use and Trip Generation

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 5 (85.5 ACRES)									
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%	
210	Single-Family Detached Housing (AG Lot)	14	0.7	*10*	*3*	26%	*7*	74%	
210	Single-Family Detached Housing (RR Lot)	15	0.7	*11*	*3*	26%	*8*	74%	
					6		***15***		
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%	
210	Single-Family Detached Housing (AG Lot)	14	0.94	*13*	*8*	63%	*5*	37%	
210	Single-Family Detached Housing (RR Lot)	15	0.94	*14*	*9*	63%	*5*	37%	
					17		***10***		
Clarifications:									
Adena Trace (Versailles) used as sample for single family house density									
Wooldridge Apartments used as sample for multi-family housing density									

Table 32: Zone 5 Land Use and Trip Generation

METHODOLOGY

Using data collected through the KYTC's traffic data system, including average annual daily traffic (AADT) volumes, peak hour volumes along Martha Layne Collins Bluegrass Parkway, Troy Pike, Falling Spring Blvd, and Old Dry Ridge were calculated and verified with turning movement counts. These volumes represent the existing background traffic and are provided in ***Figure 8*** of the Appendix. Background traffic is the traffic that is/will utilize the road without any additional development in the study area.

Trips were generated for the proposed development and then distributed to the roadway system based on the existing traffic patterns and engineering judgment. For the analysis, the study uses traffic volumes from the current year, as well as a future design year in which the traffic volumes were grown at a rate determined by historic traffic counts in the area. The assigned volumes from the proposed development and the background traffic volumes combine to produce the total expected traffic volumes build conditions. The roadway network was analyzed for existing and proposed conditions in both the initial year (2023) and design year (2043). The traffic volumes can be found in the Appendix including 2023 No Build (Fig 8), 2023 Build (Fig 14), 2043 No Build (Fig 15), and 2043 Build (Fig 16) traffic volumes. The No Build scenario is based on existing conditions and assumes that the five zones of land being evaluated are not developed. The growth rate (see ***Tables 25*** through ***27***) applied to the existing traffic volumes to determine the design year No Build conditions considers other developments not considered in this report that will generate traffic through the study area. The Build scenario refers to the traffic volumes that will be present if the five zones are developed and the traffic generated by those developments is added to the background volumes in the study area. ***Tables 28*** through ***32*** provide the traffic volumes that the developments in the five zones will generate that will be added to the background traffic volumes.

Once the traffic volumes are determined for no build and build scenarios for the initial and design year, then Highway Capacity Software (HCS) is utilized to determine the metrics of the roadway, which will be elaborated on in the following section. Highway Capacity Software (HCS) is a comprehensive tool used to analyze roads, including freeways, arterials, and intersections. It uses the US Highway Capacity Manual's methods as its basis. HCS was used to determine the Level of Service (LOS) for each roadway that experienced traffic growth.

HCS ANALYSIS

Level of Service (LOS) is a qualitative measure used to describe the quality of motor vehicle traffic at intersections or roadway segments. LOS is based on a grade scale from A to F with A being excellent and F being failure. The Highway Capacity Manual describes a Level of Service C as being desirable, and LOS D as being acceptable in an urban setting.

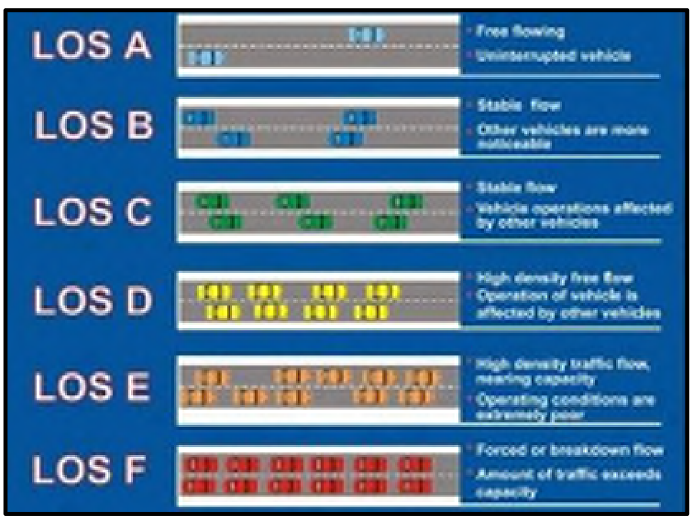


Image 15: LOS Diagram

Level of Service is a common measure of effectiveness used to determine if a roadway functions, or will function, under acceptable conditions. The Level of Service was examined during two peak times (AM and PM) for each of the five zones. Existing conditions were used as a baseline to compare Level of Services. This study assumes that the existing, background, peak hour volume is the same for the AM and PM peak hours. The results from this analysis are represented in ***Tables 33*** through ***36***. These tables assume that no roadway improvements are implemented prior to, during, or after the development of the five zones of land. ***Tables 33*** and ***35*** provide the LOS of the roadways when only the background traffic is using the roadway network while ***Tables 34*** and ***36*** provide the LOS of the roadways after the traffic generated by the developments have been implemented into the roadway network.

Table 33: 2023 Existing Level Of Service	
Roadway	LOS
Bluegrass Parkway	B
Falling Springs Boulevard	A
Troy Pike (North of Falling Springs Blvd)	C
Troy Pike (South of Falling Springs)	D
Old Dry Ridge Road	A

Table 34: 2023 Build Level Of Service		
Roadway	AM Peak LOS	PM Peak LOS
Bluegrass Parkway	C	C
Falling Springs Boulevard	A	A
Troy Pike (North of Fallings Springs Blvd)	E	E
Troy Pike (South of Falling Springs Blvd)	E	F
Old Dry Ridge Road	E	F

Table 35: 2043 No Build Level Of Service		
Roadway	AM Peak LOS	PM Peak LOS
Bluegrass Parkway	B	B
Falling Springs Boulevard	A	A
Troy Pike (North of Falling Springs Blvd)	C	C
Troy Pike (South of Falling Springs Blvd)	D	D
Old Dry Ridge Road	A	A

Table 36: 2043 Build Level Of Service		
Roadway	AM Peak LOS	PM Peak LOS
Bluegrass Parkway	D	D
Falling Springs Boulevard	A	A
Troy Pike (North of Falling Springs Blvd)	E	E
Troy Pike (South of Falling Springs Blvd	E	F
Old Dry Ridge Road	E	F

Troy Pike currently operates as a LOS "C" and Old Dry Ridge Road currently operates as a LOS "A". After the assumed developments are completed Troy Pike and Old Dry Ridge Road degrade to a LOS "E". ***Table 35*** demonstrates that with the growth of the background volumes to the design year, 2043, the studied roadways operate as a LOS "C" or better during the peak hours. ***Table 36*** shows that similar to the 2023 build conditions, Troy Pike and Old Dry Ridge Road degrade to a LOS "E" when the assumed developments are constructed. Proposed improvements to the roadway network to improve the roads to a LOS "C" are provided in the ***Alternatives*** section of this report.

GEOMETRIC DESIGN EVALUATION

Recommended criteria from Task A were used to evaluate the emphasized corridors. Troy Pike, Falling Springs Boulevard, Old Dry Ridge Road, and Bluegrass Parkway were examined to see if existing conditions met all required criteria.

INTERSECTION SIGHT DISTANCE

Two-way stop controlled intersections were analyzed to determine if appropriate intersection sight distances were provided when the intersection was constructed. Left-turn and right-turn intersection sight distances were recommended based on the following tables in the *Geometric Design of Highways and Streets* published by AASHTO:

Table 37: Case B (Left Turn) Intersection Sight Distance	
Design Speed (MPH)	Intersection Sight Distance for Passenger Cars (ft)
35	390
45	500
55	610

Table 38: Case B (Right Turn) Intersection Sight Distance	
Design Speed (MPH)	Intersection Sight Distance for Passenger Cars (ft)
35	335
45	430
55	530

Table 39 represents the results from the intersection sight distance evaluation:

Table 39: Intersection Sight Distance (ISD)			
Major Road	Intersecting Road/Point	RT Turn ISD	LT Turn ISD
Troy Pike	Dry Ridge Road	Tree Located inside Sight Triangle	Sufficient
Falling Springs Blvd	Shire Blvd	Sufficient	Sufficient
Falling Springs Blvd	S Hill Road	Sufficient	Sufficient
Falling Springs Blvd	School House Road	Sufficient	Sufficient
Falling Springs Blvd	Cheney Road	Sufficient	Sufficient
Troy Pike	Southside Elementary School Entrance	Sufficient	Sufficient
Troy Pike	Edmonds Crossing	Sufficient	Sufficient
Troy Pike	Southland Drive	Sufficient	Sufficient

RIGHT OF WAY

In urban segments right-of-way should include the roadway, shoulders and curb, utility strips, ditches, foreslopes and backslopes, and sidewalk if present. Ideally right-of-way would include up to three feet behind the sidewalk for any future construction that may be required.

Troy Pike, Old Dry Ridge Road, Bluegrass Parkway, and Falling Springs Blvd provide adequate right-of-way. Falling Springs Blvd has an acceptable level of service under 2042 build conditions and it is not anticipated that additional through lanes will be required along this corridors and therefore will not need additional right-of-way for construction.

Falling Springs Boulevard currently provides approximately 200 to 275 feet of right-of-way measuring from edge to edge. Approximately 80 feet is provided from the centerline of the roadway as a minimum throughout the corridor.

Troy Pike currently provides approximately 100 to 250 feet of right-of-way measuring from edge to edge. Approximately 50 feet is provided from the centerline of the roadway as a minimum throughout the corridor.

Bluegrass Parkway currently provides approximately 200 to 250 feet of right-of-way measuring from edge to edge. Approximately 100 feet is provided from the centerline of the roadway as a minimum throughout the corridor.

Old Dry Ridge Road provides approximately 52 feet of right-of-way, which is adequate for a two lane roadway. If Old Dry Ridge Road were to be widened to accommodate a large increase in volume caused by a development, then additional right-of-way would need to be secured for additional lanes, sidewalks/ multi-use paths, and clear zone as described in Task A of this report.

TYPICAL SECTION

The following design elements were utilized to evaluate the existing corridors; lane widths, shoulders, curb and gutter, utility strips, and sidewalks.

Lane widths of 12 feet are recommended. Widths of 10 feet are considered the minimum for any roadways needing to accommodate larger vehicles. ***Table 40*** summarizes the lane widths provided by the studied corridors.

Table 40: Existing Lane Widths

Road	Width (Feet)
Bluegrass Parkway	12
Troy Pike	12
Falling Springs Boulevard	12
Old Dry Ridge Road	10

The minimum recommended shoulder width is 2 feet, the preferred width is 10 feet. The table below represents shoulder widths for each roadway: ***Table 41*** summarizes the shoulder widths provided by the studied corridors.

Table 41: Existing Shoulder Widths

Road	Width (Feet)
Bluegrass Parkway	10
Troy Pike	1
Falling Springs Boulevard	2
Old Dry Ridge Road	0

Curb and gutter operates well in low speed, urban sections of roadway. Local roads and low speed urban collectors and arterials are acceptable locations to construct curb and gutter to aid in drainage. None of the listed roads had curb and gutter.

Utility strips and sidewalks are most common in densely populated areas. The recommended sidewalk width is 6 feet and the minimum width is 5 feet. In areas where sidewalk usage is expected to be high, a multi-use path (MUP) should be considered. The MUP can be asphalt or concrete and will generally have a minimum width of 8 feet. ***Table 42*** summarizes the existing sidewalk and multi-use path (MUP) conditions along the studied corridors. Based on existing conditions no additional MUP are recommended. As tracts of land are developed, then the developers should be encouraged to construct sidewalks for developments expected to generate pedestrian foot traffic.

Table 42: Sidewalk/Utility Strip/MUP Widths			
Road	Sidewalk (Feet)	Utility Strip (Feet)	MUP (Feet)
Bluegrass Parkway	No Sidewalk Provided	N/A	None
Troy Pike	5	>30	10
Falling Springs Blvd	No Sidewalk Provided	>50	10
Old Dry Ridge Road	5	>5	None

Troy Pike has a sidewalk the spans from the intersection of Falling Springs Boulevard to downtown Versailles. Old Dry Ridge Road has a sidewalk extending from Cedar Ridge Lane to the signalized intersection at Troy Pike.

Falling Springs Boulevard has a MUP along the length of the roadway. Troy Pike has a Multi-Use Path (MUP) that runs from Falling Springs Boulevard to Helmsley Lane.

ACCESS MANAGEMENT

Access from developments to the Arterials and Collectors discussed (i.e. Falling Springs Blvd, Troy Pike, and Old Dry Ridge Road) should be spaced a minimum of 600 feet, with a desirable distance of 1,200 feet apart from any other access or intersection. The access points along Falling Springs Road and Troy Pike between the Bluegrass Parkway and Falling Springs Blvd meet this recommendation.

Based on construction plans from the KYTC the Bluegrass Parkway, Falling Springs Blvd, and the section of Troy Pike between the Bluegrass Parkway and Falling Springs Blvd have controlled access; therefore, additional access points will not be provided via permits and all access points have already been identified.

The first access points on either side of Old Dry Ridge Road are within 550 feet of the intersection with Troy Pike. When Zone 4 is developed it is recommended that any and all proposed access points to Old Dry Ridge Road be a minimum of 600 feet from any established intersections or access points. It is also recommended that the main access to the development be aligned with Rose Ridge Road.

Troy Pike north of Falling Springs does not provide 600 foot spacing between access points. It is recommended that if any future development is constructed that the access to the development tie into an existing access point and if possible encourage combining existing access points when feasible. This practice will ensure that the number of total access points does not increase or when possible is reduced in this section of the corridor.

LANDSCAPE

All landscaping within right of way should be three feet or less in height as to not obstruct the sight distance of drivers on the roadway or drivers entering the roadway at an intersection or access point. Any landscape with a height greater than three feet should remain towards the edge of the right of way to ensure adequate sight distance is provided.

SETBACK

The recommended setback for residential developments is 30 feet measured from the right-of-way line to the face of the structure. In commercial developments the recommended set back is 60 feet measured from the right-of-way line to the face of the structure.

INNOVATIVE INTERSECTIONS

Historically, innovative intersections have caused discontent due to unfamiliarity, but over time drivers will become more comfortable with the changes. Innovative intersections provide a safety advantage, increase efficiency, and reduce delay. Three innovative intersections to consider are: Restricted Crossing U-Turn (RCUT), Roundabouts, and Mini Roundabout.

Restricted Crossing U-Turn (RCUT):

RCUT intersections consist of having all side street movements be right turns. Traffic that would turn left or go through are required to turn right from the side street. These movements travel down the main street until they reach a dedicated turn lane that allows them to make a U-turn. A loon is created on the opposing side of traffic to allow the cars to enter and exit safely when making the U-turn. ***Exhibit 1*** provides a diagram of an R-Cut intersection.

RCUT's improve safety by reducing the number of conflict points (points where vehicles cross paths) from 32 to 18. Side street movements are required to be right turns only, this will reduce wait times at signals since two movements no longer have green time.

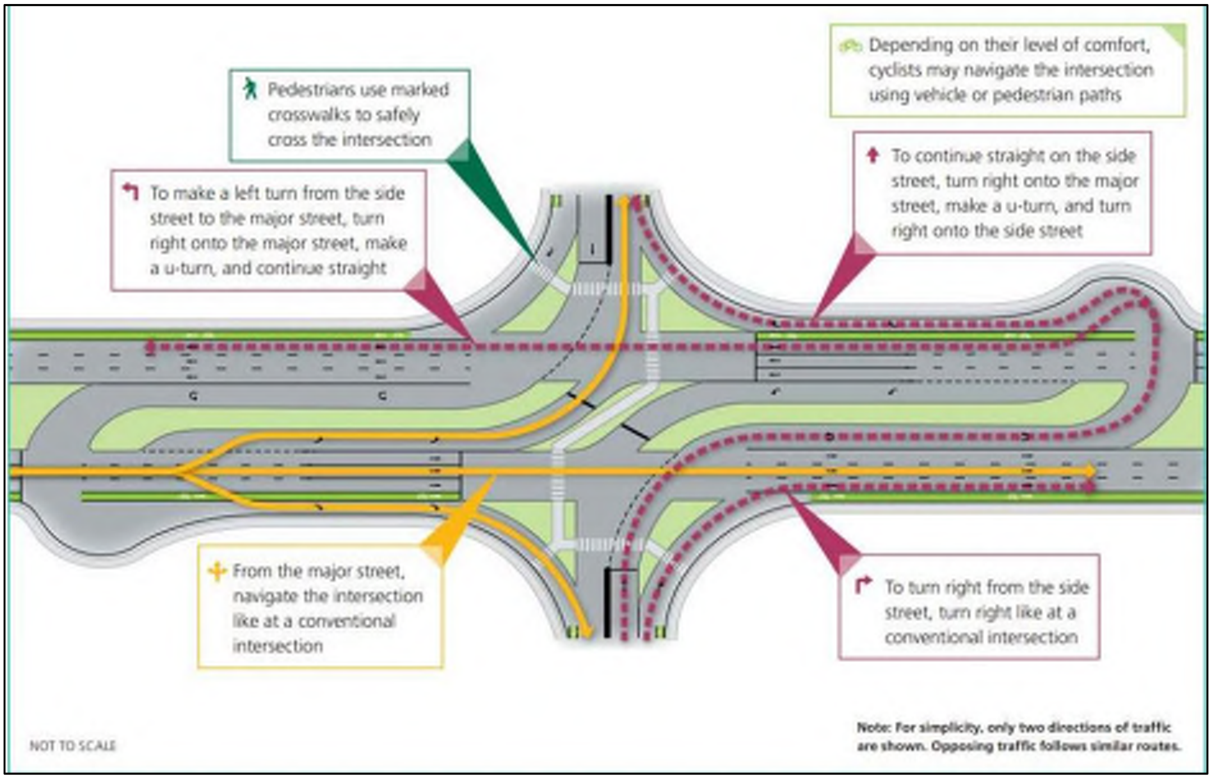


Exhibit 1: RCUT Example (Virginia Department of Transportation, Innovative Intersections and Interchanges)

Roundabout and Mini Roundabout

Roundabouts allow traffic to enter a circular intersection. Cars must yield to traffic already inside the roundabout before entering. Traffic travels in a counterclockwise motion.

Roundabouts and Mini Roundabouts improve the overall function of an intersection. They reduce conflict points from 32 to 8 and eliminate the potential for head on collisions. There are no traffic signals, resulting in less delay and increased flow.

The difference between a roundabout and mini-roundabout is the size of the inscribed diameter, or diameter measuring from the outside of the driving lanes on one side of the circle to the outside of the driving lanes on the other side of the circle. A mini-roundabout will have an inscribed diameter of 90 feet or less. Due to the size of the mini-roundabout all islands, center and splitter, are constructed with mountable curbs so that large vehicles that are unable to navigate the circle, such as semi-trucks and buses, can drive over the center island instead. Mini-roundabouts are intended for low speed, low volume roadways with a small percentage of large vehicles such as in neighborhoods.

ALTERNATIVES

The HCS analysis provided evidence that no additional changes to the roadway geometry are required along Falling Springs Blvd to allow the roadway network to operate at an acceptable level of service when the additional traffic for the future developments are added to the background traffic.

In order to meet the criteria described in Task A of this report the following alternatives should be considered:

Alternative A: Construct two additional through lanes along Troy Pike from the westbound Bluegrass Parkway ramps to Edmonds Crossing. Alternative shown in ***Figure 3*** of the Appendix.

Alternative B: Improve existing roads to meet standards provided in Task A:

- Widen Old Dry Ridge Road to provide 12 foot driving lanes in each direction with 2 foot shoulders
- Widen Falling Springs Boulevard to provide 10 foot paved shoulders
- Extend MUP along Troy Pike from Helmsley Lane to the intersection with Edmonds Crossing
- Replace the sidewalk along Old Dry Ridge Road with a MUP, from Rose Ridge Road to Troy Pike.
- Remove all obstructions within the clear zone of the roadway. This will ensure adequate sight distances at intersections and improve safety for vehicles that exit the roadway

Alternative C: Construct two additional through lanes along Old Dry Ridge Road from Troy Pike to Rose Ridge Road to accommodate for additional traffic traveling to and from the future development in Zone 4. Alternative shown in ***Figure 4*** of the Appendix.

Alternative D: Construct innovative intersections to accommodate for future traffic growth that operate more safely and efficiently than the existing signals. This includes the following:

- Dual lane roundabout at the intersection of Troy Pike and Falling Springs (***Figure 2*** in the Appendix)
- Roundabout at the intersection of Falling Springs Blvd and Lawrenceburg Road (***Figure 6*** in the Appendix)
- R-Cut Intersection at the intersection of Falling Springs Blvd and KY 1964 (***Figure 5*** in the Appendix)

Two additional through lanes along Troy Pike will improve the LOS from a LOS "E" to a LOS "B" for Troy Pike north of Falling Springs Boulevard and to a LOS "C" for Troy Pike south of Falling Springs Boulevard under full build conditions. Troy Pike has sufficient ROW to construct two additional lanes extending from the Bluegrass Parkway ramps to Edmonds Crossing.

Alternative B will allow existing roadways to meet the standards presented in Task A of this report. Falling Springs Boulevard has sufficient ROW for the recommended shoulder width of 10'.

Two additional through lanes on Old Dry Ridge Road will improve the LOS from a LOS "E" to a LOS "C" for full build conditions. Old Dry Ridge Road has sufficient ROW to construct two additional lanes. ROW or temporary easements may be required in order to construct the four lanes and MUP along Old Dry Ridge Road between Troy Pike and Rose Ridge Road.

Regarding Alternative D, innovative intersections will decrease delays, increase safety, and increase efficiency. Innovative intersection designs were provided for three different intersections; the signalized intersection of Falling Springs

Boulevard at Troy Pike, the signalized intersection of Falling Springs Boulevard at McCowans Ferry Road (KY 1964), and the signalized intersection of Falling Springs Boulevard at US 62 (Lawrenceburg Road). Roundabouts will increase the capacity of the intersection and significantly increase safety. Roundabouts force drivers to reduce speed and angles vehicles entering the roundabout in such a way as to reduce the likelihood of a severe (injury or fatal) crash. The RCUT intersection will reduce delay and congestion for through traffic on the major road and will reduce crashes, especially severe crashes, by requiring vehicles turning from the minor street to make a right turn.

PROJECT COSTS

The project costs provided below are estimates based on 2022 KYTC average bid prices. The estimated costs include a 20% contingency. The estimated project costs for each alternative are as follows:

- **Alternative A - $1,900,000**
- **Alternative B – $5,590,000**
  - **12' lanes Old Dry Ridge Road - $314,000**
  - **10' shoulders Falling Springs Blvd - $4,933,000**
  - **Troy Pike MUP - $167,000**
  - **Old Dry Ridge Road MUP - $176,000**
- **Alternative C - $945,000**
- **Alternative D**
  - **Roundabout Troy Pike/Falling Springs Blvd-$714,000**
  - **Roundabout US 62/Falling Springs Blvd - $555,000**
  - **Falling Springs Blvd RCUT (Full Resurfacing)-$890,000**

Alternative B can be implemented at the earliest, feasible time as this alternative brings the existing infrastructure to the requirements established in Task A of this report.

Troy Pike south of Falling Springs Blvd currently operates as a LOS "D" and can be considered for widening if the desired LOS is a "C" or better. Alternative A should be implemented along Troy Pike north of Falling Springs Blvd once enough development has occurred that the volumes along Troy Pike exceed an ADT (average daily traffic) of 10,820.

Alternative C should be implemented once enough development has occurred that the volumes along Old Dry Ridge Road exceed an ADT (average daily traffic) of 8,320.

Alternative D should be implemented once enough development has occurred that the volumes at the intersections reach a point such that the traffic signal begins to function inefficiently or when crash data at these intersections demands that a safety improvement be constructed.

SENSITIVITY ANALYSIS

In addition to the five zones of land identified in this study additional developments are anticipated in the area that will have a direct impact on the traffic volumes in the study area. The Legends of Versailles, Rose Ridge, Edmonds Crossing, and a new high school are examples of anticipated or approved developments in this area. The growth rate of the background traffic is expected to help capture the impact of these other developments, but in order to verify that the roadway network can handle potential volume increases a sensitivity analysis was performed on the network assuming the proposed recommendations are implemented. These improvements include the widening of Troy Pike to four lanes between the westbound ramps of the Bluegrass Parkway and Edmonds Crossing and widening Old Dry Ridge to a four lane roadway between Troy Pike and Rose Ridge Road/ expected entrance to zone 4.

A sensitivity study involves raising the traffic volumes by arbitrary percentages until the analysis reveals that the roadway degrades below an acceptable level. ***Table 43*** and ***44*** summarize the percentage that traffic would be required to increase for the roadways to degrade to a LOS "D" for both the initial year (2023) and design year (2043) respectively. The analysis reveals that Falling Springs Blvd and Troy Pike can experience significant increases in traffic and will continue to operate under acceptable levels of service. The Bluegrass Parkway already operated as a LOS "D" during the design year and near a LOS "D" under initial year conditions. Old Dry Ridge Road can experience some growth under initial conditions but operates near a LOS "D" under design year conditions.

Table 43: 2023 Build Percent Traffic Growth to Obtain LOS "D"		
Roadway	AM Percent Growth	PM Percent Growth
Bluegrass Parkway	17%	1%
Falling Springs Boulevard	286%	240%
Troy Pike (North of Falling Springs)	86%	59%
Troy Pike (South of Falling Springs Blvd)	49%	21%
Old Dry Ridge Road	28%	7%

Table 44: 2043 Build Percent Traffic Growth to Obtain LOS "D"		
Roadway	AM Percent Growth	PM Percent Growth
Bluegrass Parkway	0%	0%
Falling Springs Boulevard	266%	224%
Troy Pike (North of Falling Springs)	78%	53%
Troy Pike (South of Falling Springs Blvd)	43%	17%
Old Dry Ridge Road	26%	5%

CITY OF VERSAILLES
PLANNING STUDY
MEMORANDUM

MEMORANDUM

This document is intended to serve as a memorandum to the Versailles Planning Study Task B report. This memo addresses previously omitted developments in the studied area and to provide amendments to the previous report.

The new high school and undeveloped land north of Old Dry Ridge Road were not originally a part of the planning study, but have been included in this memo along with the appropriate traffic analysis. The additional traffic growth was added and revised results tables included. Two additional zones were created and the boundaries are shown in **Figure 17** and **Figure 18** in the Appendix.

The land use of the area north of Old Dry Ridge Road is residential and was verified by the City of Versailles. All 41.9 acres were considered to be Single Family Residential Housing. Other nearby areas were observed to determine the density of housing. After observations, 3 units per acre was determined to be the average. This value was used with the ITE Trip Generation Manual to estimate the number of vehicles generated by the additional housing. The table below represents the expected land use, acreage, and trip generation for zone 6.

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS ZONE 6 (41.9 ACRES)								
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
210	Single-Family Detached Housing	123	0.7	*86*	*22*	26%	*64*	74%
					22		***64***	
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
210	Single-Family Detached Housing	123	0.94	*116*	*73*	63%	*43*	37%
					73		***43***	
Clarifications:								
Adena Trace (Versailles) used as sample for single family house density								
Wooldridge Apartments used as sample for multi-family housing density								

Table 45: Zone 6 Land Use and Trip Generation

The ITE trip generation manual was also used to determine the traffic growth for the new high school. The traffic projections for the new high school were obtained by using the current student enrollment count with the ITE trip generation manual. ***Table 45*** represents the land use and trip generation for zone 7.

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS TRACT 7 NEW HIGH SCHOOL (1300 STUDENTS)								
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
525	High School	1300	0.52	*676*	*460*	68%	*216*	32%
					460		***216***	
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
525	High School	1300	0.14	*182*	*87*	48%	*95*	52%
					87		***95***	

Table 46: Zone 7 Land Use and Trip Generation

The trips that were generated by additional housing and the new high school were distributed to the roadway system based on the existing traffic patterns and engineering judgement. The trip distribution is shown in ***Figure 17*** and ***Figure 18*** attached in the Appendix. The additional traffic is then added onto ***Figure 14*** (2023 Build) and ***Figure 16*** (2043 Build) from the Task B Versailles Planning Study report. The updated 2023 Build and 2043 Build figures are attached (***Figure 19*** and ***Figure 20***).

With the build scenario volumes updated, HCS was used to determine the Level of Service (LOS) for each corridor. The LOS are listed in the tables below. These values were calculated based on the assumption that no roadway improvements are implemented.

Table 47: 2023 Build Level Of Service		
Roadway	AM Peak LOS	PM Peak LOS
Falling Springs Boulevard	A	A
Troy Pike (North of Fallings Springs Blvd)	E	E
Troy Pike (South of Falling Springs Blvd)	E	F
Old Dry Ridge Road	E	F

Table 48: 2043 Build Level Of Service		
Roadway	AM Peak LOS	PM Peak LOS
Falling Springs Boulevard	A	A
Troy Pike (North of Falling Springs Blvd)	E	E
Troy Pike (South of Falling Springs Blvd	F	F
Old Dry Ridge Road	E	F

All LOS stays the same with the additions of the zone 6 and zone 7 except for the 2043 Build PM peak LOS for Troy Pike South of Falling Springs Blvd. This LOS degrades from a LOS “E” to a LOS “F”. The LOS was also analyzed assuming the alternatives presented in Task B of the Versailles Planning Study were applied. These improvements include constructing two additional through lanes along Troy Pike and Old Dry Ridge Road. ***Tables 49*** and ***50*** display what the LOS would be if the alternatives were constructed.

Table 49: 2023 Build With Alternatives Level Of Service

Roadway	AM Peak LOS	PM Peak LOS
Troy Pike (North of Fallings Springs Blvd)	B	B
Troy Pike (South of Falling Springs Blvd)	C	C
Old Dry Ridge Road	C	C

Table 50: 2043 Build With Alternatives Level Of Service

Roadway	AM Peak LOS	PM Peak LOS
Troy Pike (North of Fallings Springs Blvd)	B	B
Troy Pike (South of Falling Springs Blvd)	C	C
Old Dry Ridge Road	C	C

With the construction of the alternatives, the LOS improves to meet the requirements outlined in Task A. All roadways would operate at a LOS “C” or better.

EDMONDS CROSSING/MARSAILLES CONNECTOR

The Edmonds Crossing/Marsailles Road connector will provide direct access from Troy Pike (KY 33) to US 60. The majority of traffic that will access this connector will be traveling to and from commercial properties along US 60. The southwest quadrant of the study area will be where the majority of trips to Edmonds Crossing will originate. Edmonds Crossing will relocate traffic along High Street and various other connector roads. Based on county land use and engineering judgement, approximately 450 total trips will be redirected along Edmonds Crossing. Considering existing connectivity and usage, the traffic that will access Edmonds Crossing likely already exists along Troy Pike. Based on the recommendations from Task B, KY 33 will have enough capacity to accommodate redirected traffic caused by the connectivity of Edmonds Crossing.

VERSAILLES PLANNING STUDY - LAND USE ASSUMPTIONS EDMONDS CROSSING									
ITE			Average						
Code	Land Use	Sq. Ft./Units	Rate	AM Peak	In	%	Out	%
850	Supermarket	200,000	2.86	*572*	*149*	26%	*423*	74%
ITE			Average					
Code	Land Use	Sq. Ft./Units	Rate	PM Peak	In	%	Out	%
850	Supermarket	200,000	8.95	*1790*	*1128*	63%	*662*	37%
					1277		***1085***	

Table 51: Edmonds Crossing Land Use and Trip Generation

APPENDIX

EXHIBIT 1: DESIGN CRITERIA (Expressway)			
Criteria	**Expressway**	**Criteria**	**Expressway**
Design Speed	Min: 50 MPH Preferred: 70 MPH	Shoulder Width, ft	Min: 10' Preferred: 10'
Level of Service (LOS)	Min: LOS D	Superelevation	Max: 8%
Grades Max. Grades based on Terrains: Level, Rolling	50 MPH - 4%, 5% 60 MPH - 3%, 4% 70 MPH - 3%, 4%	Intersection Sight Distance, ft (Left Turn)	50 MPH: Min - 555' 60 MPH: Min - 665' 70 MPH: Min - 775'
Horizontal Curvature, ft (Radius @ emax= 8%)	50 MPH Min. R: 758' 60 MPH Min. R: 1200' 70 MPH Min. R: 1810'	Intersection Sight Distance, ft (Right Turn)	50 MPH: Min - 480' 60 MPH: Min - 575' 70 MPH: Min - 670'
Vertical Curvature, ft (Crest)	50 MPH: 84 60 MPH: 151 70 MPH: 247	Stopping Sight Distance, ft	50 MPH: Min - 425' 60 MPH: Min - 570' 70 MPH: Min - 730'
Vertical Curvature, ft (Sag)	50 MPH: 96 60 MPH: 136 70 MPH: 181	Cross Slope	Min: 0.5% Preferred: 2%
Lane Width, ft	12'	Landscape	None
Clear Zone, ft	Min: 30'	Access Interval	Fully Controlled
ROW, ft	230'		

EXHIBIT 2: DESIGN CRITERIA (Major and Minor Arterial)					
Criteria	**Arterial**		**Criteria**	**Arterial**	
	Major	Minor		Major	Minor
Design Speed	Min: 40 MPH Max: 60 MPH	Min: 40 MPH Max: 60 MPH	Shoulder Width, ft	Min: 2' Preferred: 10'	Min: 2' Preferred: 10'
Level of Service (LOS)	Min: LOS D	Min: LOS D	Superelevation	Max: 8%	Max: 8%
Grades Max. Grades based on Terrains: Level, Rolling	40 MPH - 5%, 6% 50 MPH - 4%, 5% 60 MPH - 3%, 4%	40 MPH - 5%, 6% 50 MPH - 4%, 5% 60 MPH - 3%, 4%	Intersection Sight Distance, ft (Left Turn)	40 MPH: Min - 445' 50 MPH: Min - 555' 60 MPH: Min - 665'	40 MPH: Min - 445' 50 MPH: Min - 555' 60 MPH: Min - 665'
Horizontal Curvature, ft (Radius @ emax= 8%)	40 MPH Min. R: 444' 50 MPH Min. R: 758' 60 MPH Min. R: 1200'	40 MPH Min. R: 444' 50 MPH Min. R: 758' 60 MPH Min. R: 1200'	Intersection Sight Distance, ft (Right Turn)	40 MPH: Min - 385' 50 MPH: Min - 480' 60 MPH: Min - 575'	40 MPH: Min - 385' 50 MPH: Min - 480' 60 MPH: Min - 575'
Vertical Curvature, ft (Crest)	40 MPH: 44 50 MPH: 84 60 MPH: 151	40 MPH: 44 50 MPH: 84 60 MPH: 151	Stopping Sight Distance, ft	40 MPH: Min - 305' 50 MPH: Min - 425' 60 MPH: Min - 570'	40 MPH: Min - 305' 50 MPH: Min - 425' 60 MPH: Min - 570'
Vertical Curvature, ft (Sag)	40 MPH: 64 50 MPH: 96 60 MPH: 136	40 MPH: 64 50 MPH: 96 60 MPH: 136	Lane Width, ft	Min: 11' Preferred: 12'	Min: 11' Preferred: 12'
Access Interval	US 60: Partially & Fully Controlled US 60 Bypass: Fully Controlled Falling Springs: Partially Controlled	250 FT Minimum	Cross Slope	Min: 0.5% Preferred: 2%	Min: 0.5% Preferred: 2%
			Clear Zone, ft	Preferred: 30'	Preferred: 30'
			ROW, ft	150'	105'
			Landscape	Based on Ordinance	Based on Ordinance
			Intersection Control	Signals, TWSC,	Signals, TWSC,

KEY
TWSC - Two Way Stop Control

EXHIBIT 3: DESIGN CRITERIA (Collector and Local)

Criteria	Collector	Local	
		Major	Minor
Lane Width, ft	12' Required	12' Required	12' Required
Cross Slope	Min: 0.5% Preferred: 2%	Min: 0.5% Preferred: 2%	Min: 0.5% Preferred: 2%
Curb/Gutter	Required	Required	Required
Sidewalk Width, ft	Min: 5' Preferred: 6'	Min: 5' Preferred: 6'	Min: 5' Preferred: 6'
Utility Strip, ft	Min: 5' Preferred: 6'	Min: 5' Preferred: 6'	Min: 5' Preferred: 6'
ROW, ft	Min: 51'	Min: 51'	Min: 51'
Landscape	Based on Ordinance	Based on Ordinance	Based on Ordinance
Intersection Control	TWSC, Signal	TWSC, AWSC	TWSC, AWSC
Access Interval	250 FT Minimum	250 FT Minimum	250 FT Minimum

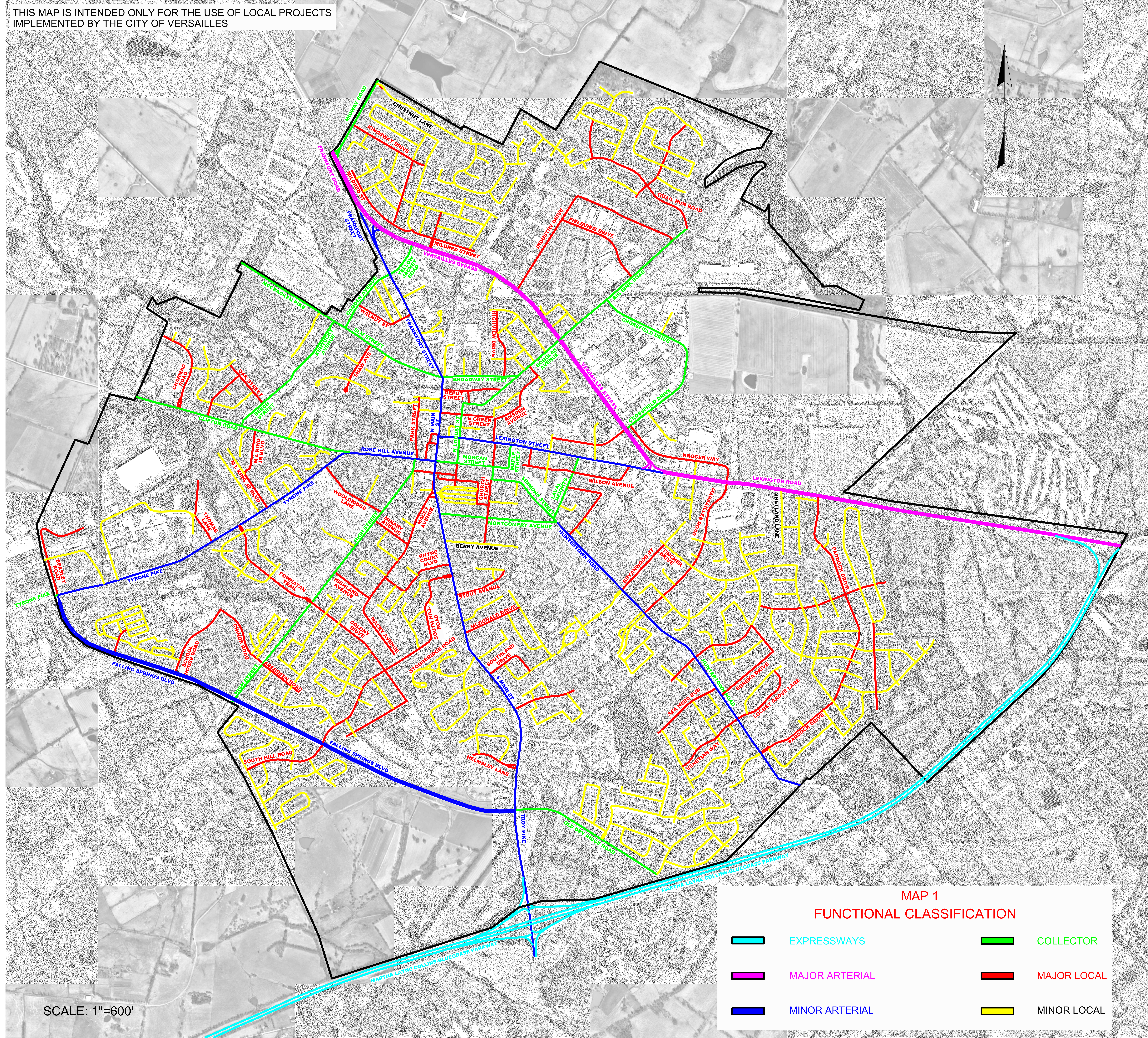
KEY

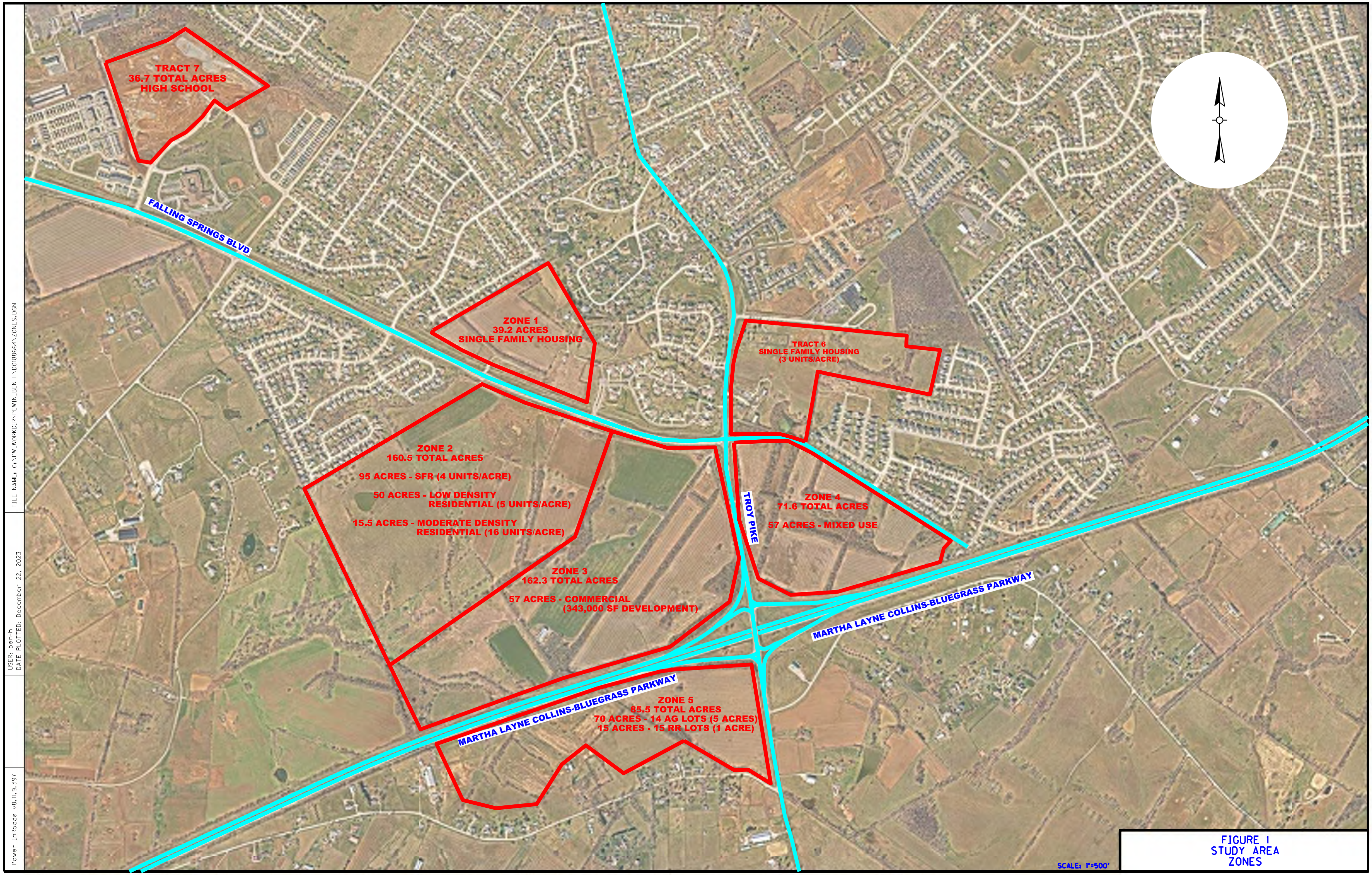
TWSC - Two Way Stop Control

AWSC - All Way Stop Control

Access Interval applies to Collectors and Locals

Access Interval does not apply to driveways


THIS MAP IS INTENDED ONLY FOR THE USE OF LOCAL PROJECTS
IMPLEMENTED BY THE CITY OF VERSAILLES
MAP 1
FUNCTIONAL CLASSIFICATION
EXPRESSWAYS
MAJOR ARTERIAL
MINOR ARTERIAL
COLLECTOR
MAJOR LOCAL
MINOR LOCAL
SCALE: 1"=600'
MIDWAY ROAD
CHESTNUT LANE
KINGSWAY DRIVE
FRANKFORT ROAD
MILDRED ST
FRANKFORT STREET
MILDRED STREET
VERSAILLES BYPASS
QUAIL RUN ROAD
INDUSTRY DRIVE
FIELDVIEW DRIVE
BIG SINK ROAD
CROSSFIELD DRIVE
YELLOW JACKET ROAD
MCCRACKEN PIKE
CAMDEN AVENUE
WALNUT ST
ELM STREET
KENTUCKY AVENUE
SHAW AVE
HIGHVIEW DRIVE
DOUGLAS AVENUE
BROADWAY STREET
OAK STREET
CHARMAC ROAD
BEECH STREET
CLIFTON ROAD
DEPOT STREET
PARK STREET
N MAIN ST
N LOCUST ST
E GREEN STREET
AMSDEN AVENUE
LEXINGTON STREET
ROSE HILL AVENUE
MORGAN STREET
MAPLE STREET
KROGER WAY
LEXINGTON ROAD
M L KING JR BLVD
TYRONE PIKE
WOOLDRIDGE LANE
CHURCH STREET
SIMMONS STREET
WILSON AVENUE
MARSAILLES ROAD
SHETLAND LANE
THOMAS LANE
MINARY AVENUE
MACEY AVENUE
MONTGOMERY AVENUE
HUNTERTOWN ROAD
PADDOCK DRIVE
BERRY AVENUE
RHYNE COURT BLVD
BRYANWOOD ST
TINCHER DRIVE
BEASLEY ROAD
POWHATAN TRAIL
HIGHLAND AVENUE
HIGH STREET
STOUT AVENUE
SOUTHSIDE HILL
COLONY DRIVE
MACEY AVENUE
MCDONALD DRIVE
CHINOE ROAD
SCHOOL HOUSE ROAD
STOURBRIDGE ROAD
SOUTHLAND DRIVE
FALLING SPRINGS BLVD
ABERDEEN ROAD
S MAIN ST
SEA HERO RUN
EUREKA DRIVE
LOCUST GROVE LANE
VENETIAN WAY
SOUTH HILL ROAD
HELMSLEY LANE
TROY PIKE
OLD DRY RIDGE ROAD
MARTHA LAYNE COLLINS-BLUEGRASS PARKWAY


TRACT 7
36.7 TOTAL ACRES
HIGH SCHOOL
FALLING SPRINGS BLVD
ZONE 1
39.2 ACRES
SINGLE FAMILY HOUSING
TRACT 6
SINGLE FAMILY HOUSING
(3 UNITS/ACRE)
ZONE 2
160.5 TOTAL ACRES
95 ACRES - SFR (4 UNITS/ACRE)
50 ACRES - LOW DENSITY RESIDENTIAL (5 UNITS/ACRE)
15.5 ACRES - MODERATE DENSITY RESIDENTIAL (16 UNITS/ACRE)
TROY PIKE
ZONE 4
71.6 TOTAL ACRES
57 ACRES - MIXED USE
ZONE 3
162.3 TOTAL ACRES
57 ACRES - COMMERCIAL (343,000 SF DEVELOPMENT)
MARTHA LAYNE COLLINS-BLUEGRASS PARKWAY
MARTHA LAYNE COLLINS-BLUEGRASS PARKWAY
ZONE 5
85.5 TOTAL ACRES
70 ACRES - 14 AG LOTS (5 ACRES)
15 ACRES - 15 RR LOTS (1 ACRE)
SCALE: 1"=500'
FIGURE 1
STUDY AREA
ZONES
DATE PLOTTED: December 22, 2023

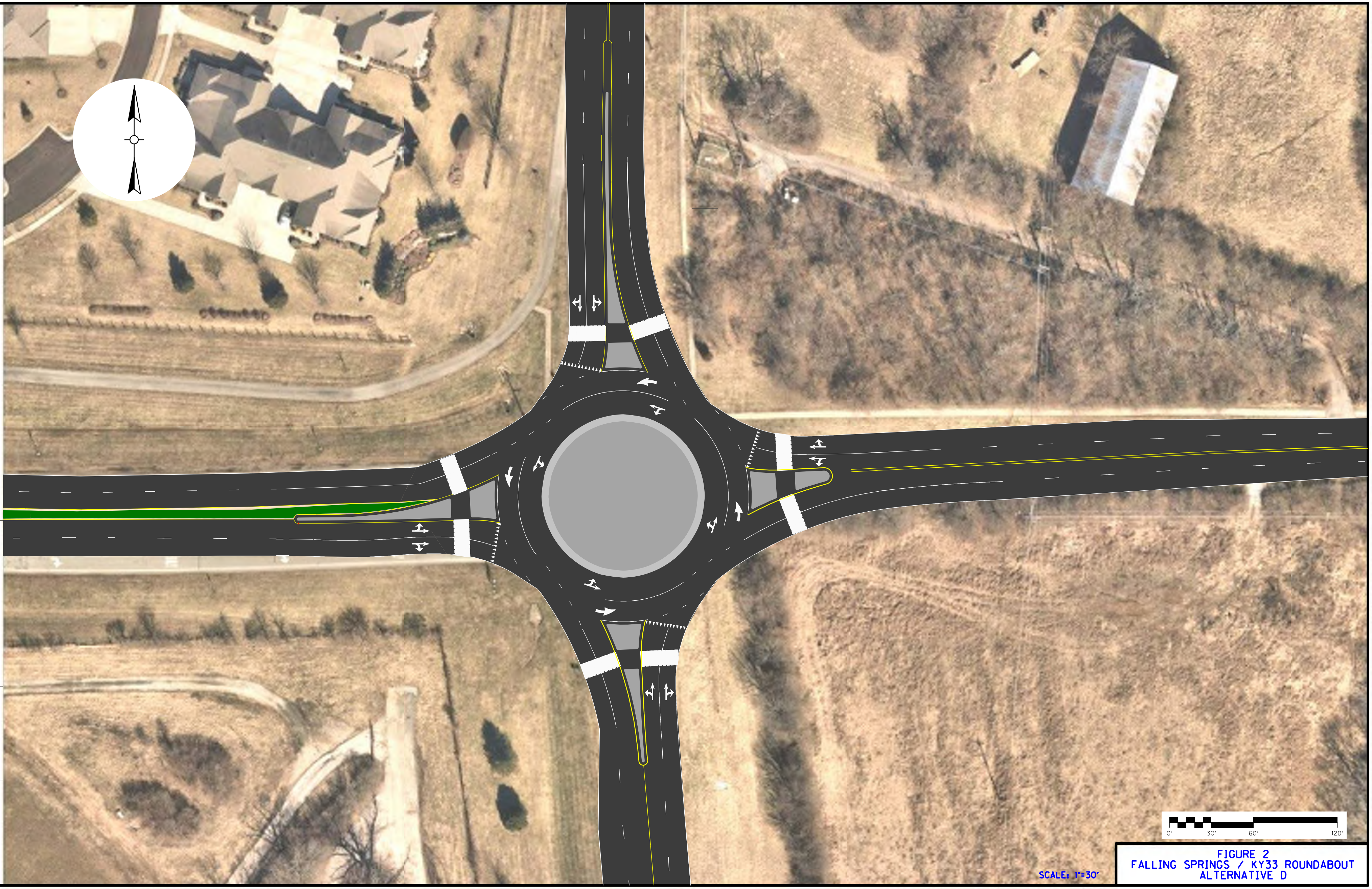


FIGURE 2
FALLING SPRINGS / KY33 ROUNDABOUT
ALTERNATIVE D

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 12_FALLING SPRINGS AND TROY RA.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 15_WIDENING TROY PIKE.DGN

USER: ben-h
DATE PLOTTED: December 22, 2023

E-SHEET NAME:

Power InRoads v8.11.9.397

SCALE: 1"=70'

FIGURE 3
WIDENING TROY PIKE (KY 33)
ALTERNATIVE A

FIGURE 4
OLD DRY RIDGE ROAD WIDENING
ALTERNATIVE C

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 14_OLD DRY RIDGE WIDENING.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

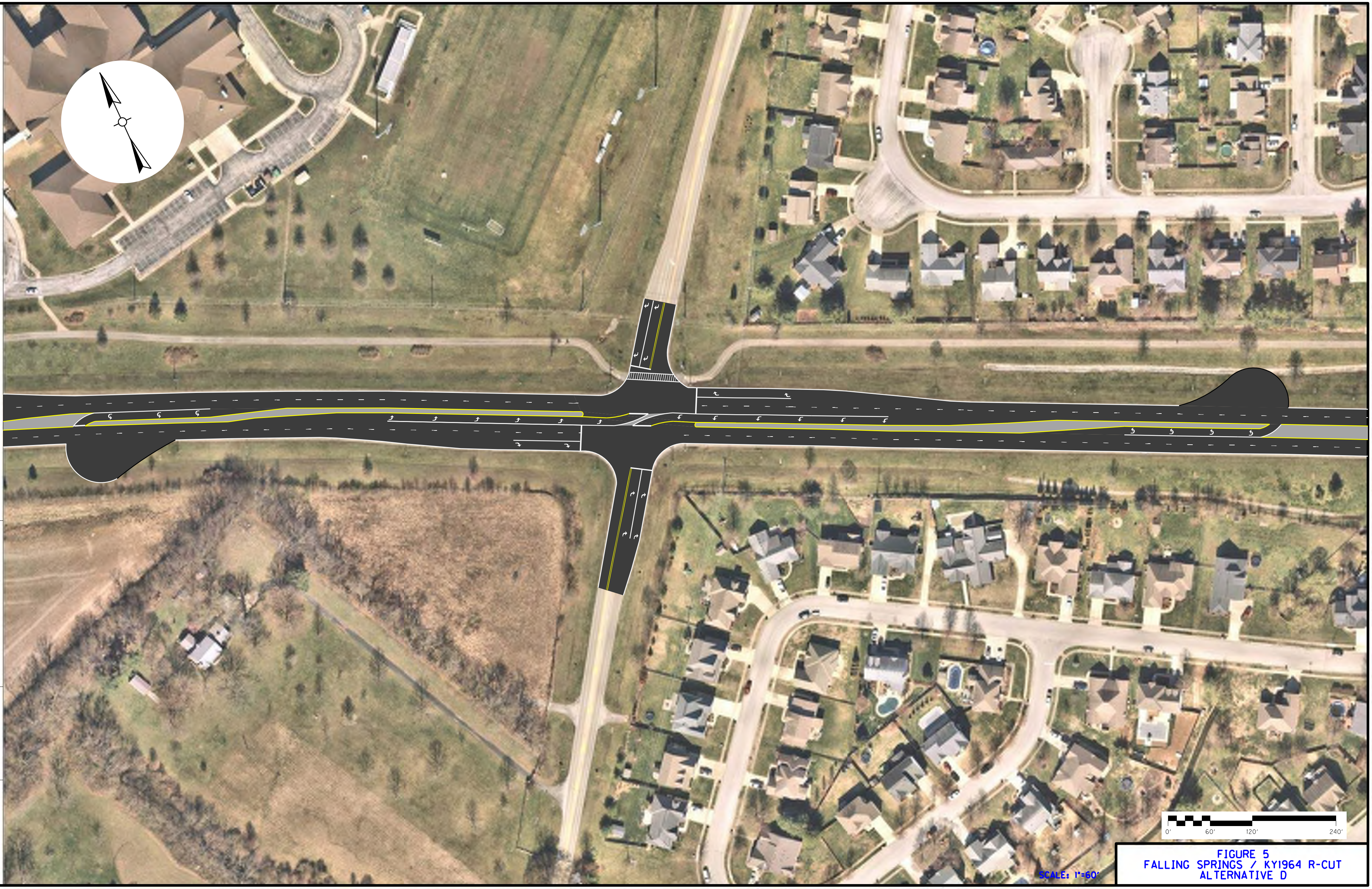


FIGURE 5
FALLING SPRINGS / KY1964 R-CUT
ALTERNATIVE D

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 13_FALLING SPRINGS RCUT.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

FIGURE 6
ROUNDABOUT AT FALLING SPRINGS/US62
ALTERNATIVE D

Power InRoads v8.11.9.397

E-SHEET NAME:

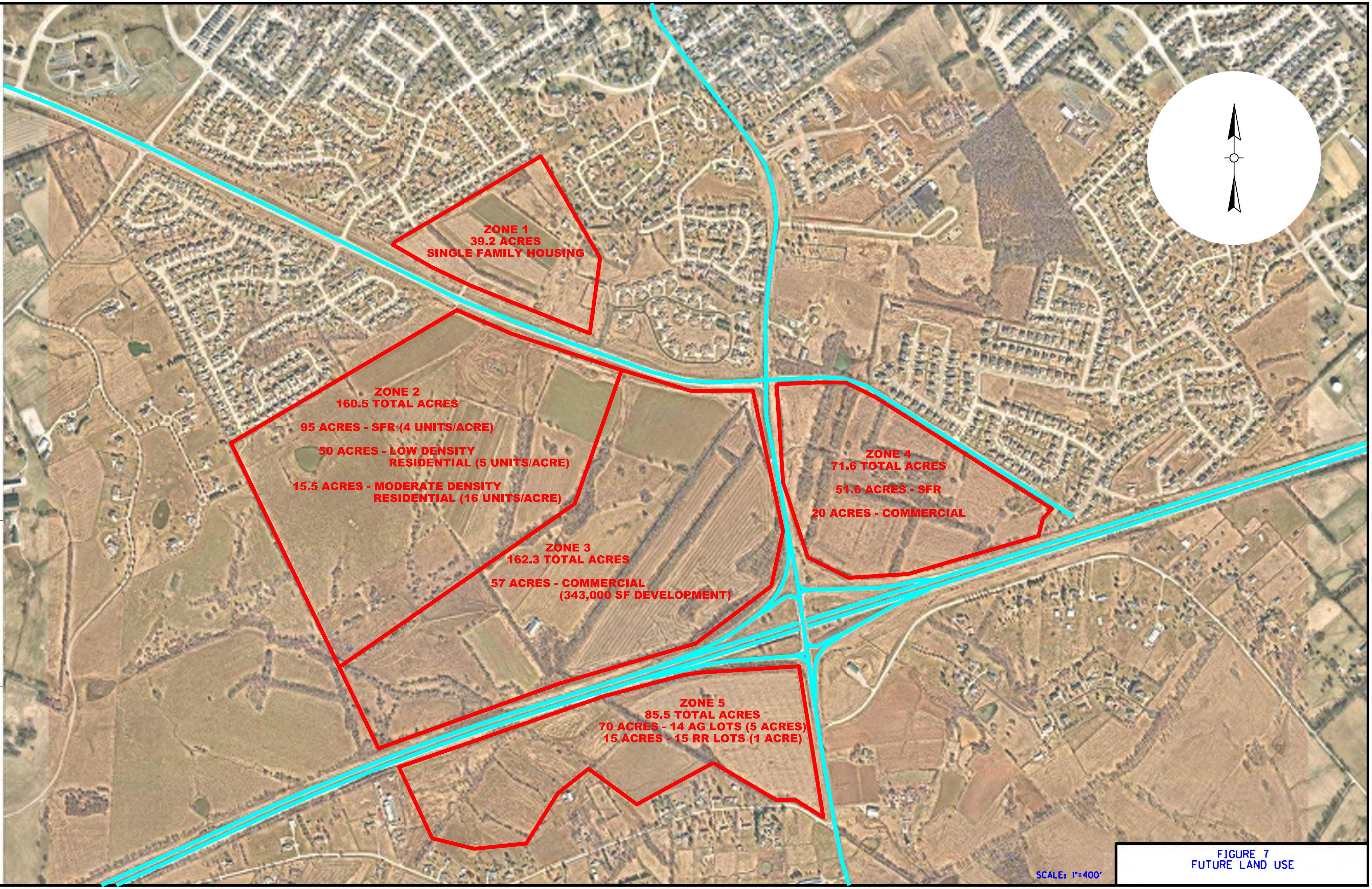


FIGURE 7
FUTURE LAND USE

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 01_LAND USE.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

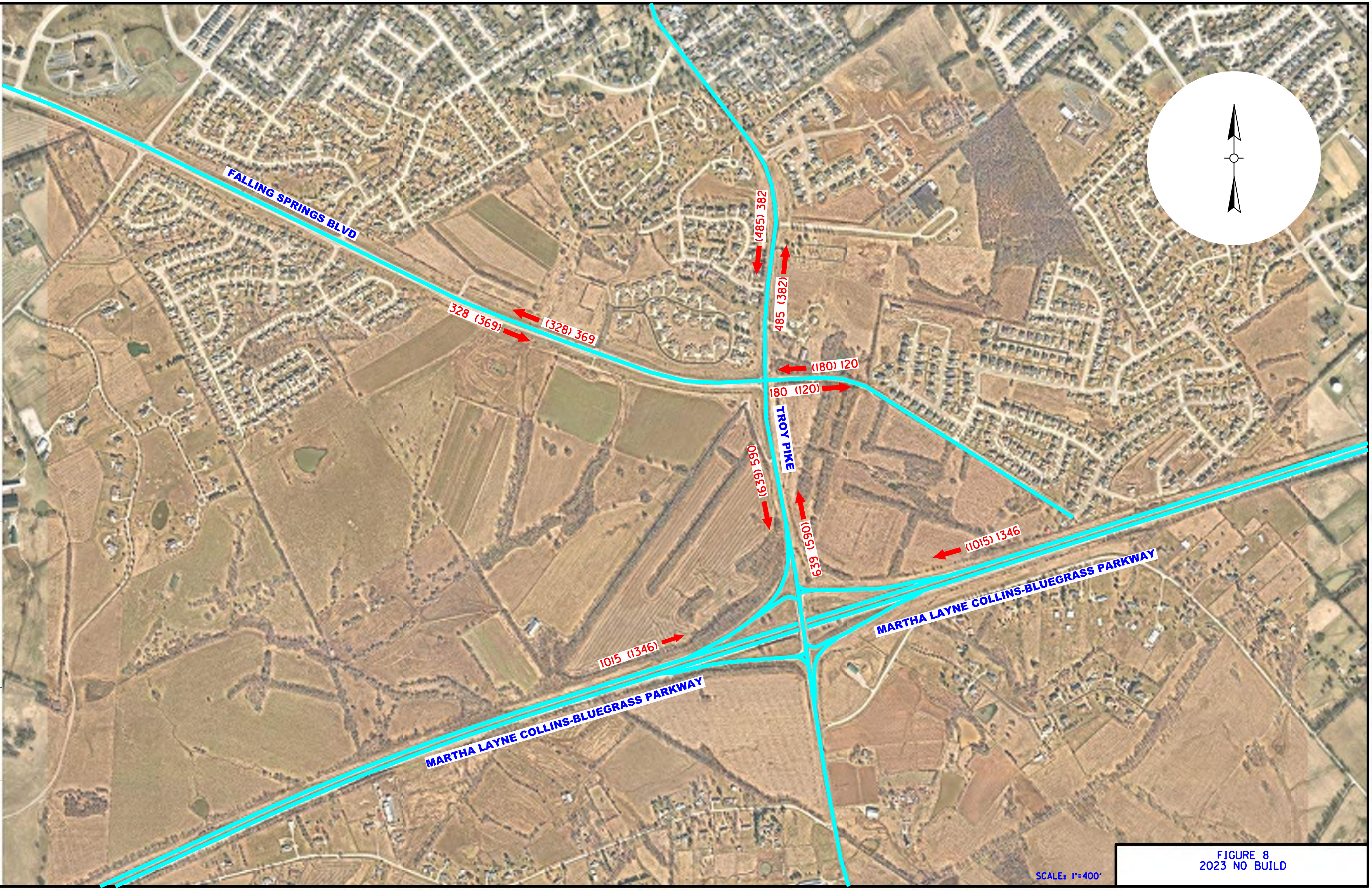


FIGURE 8
2023 NO BUILD

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 02.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

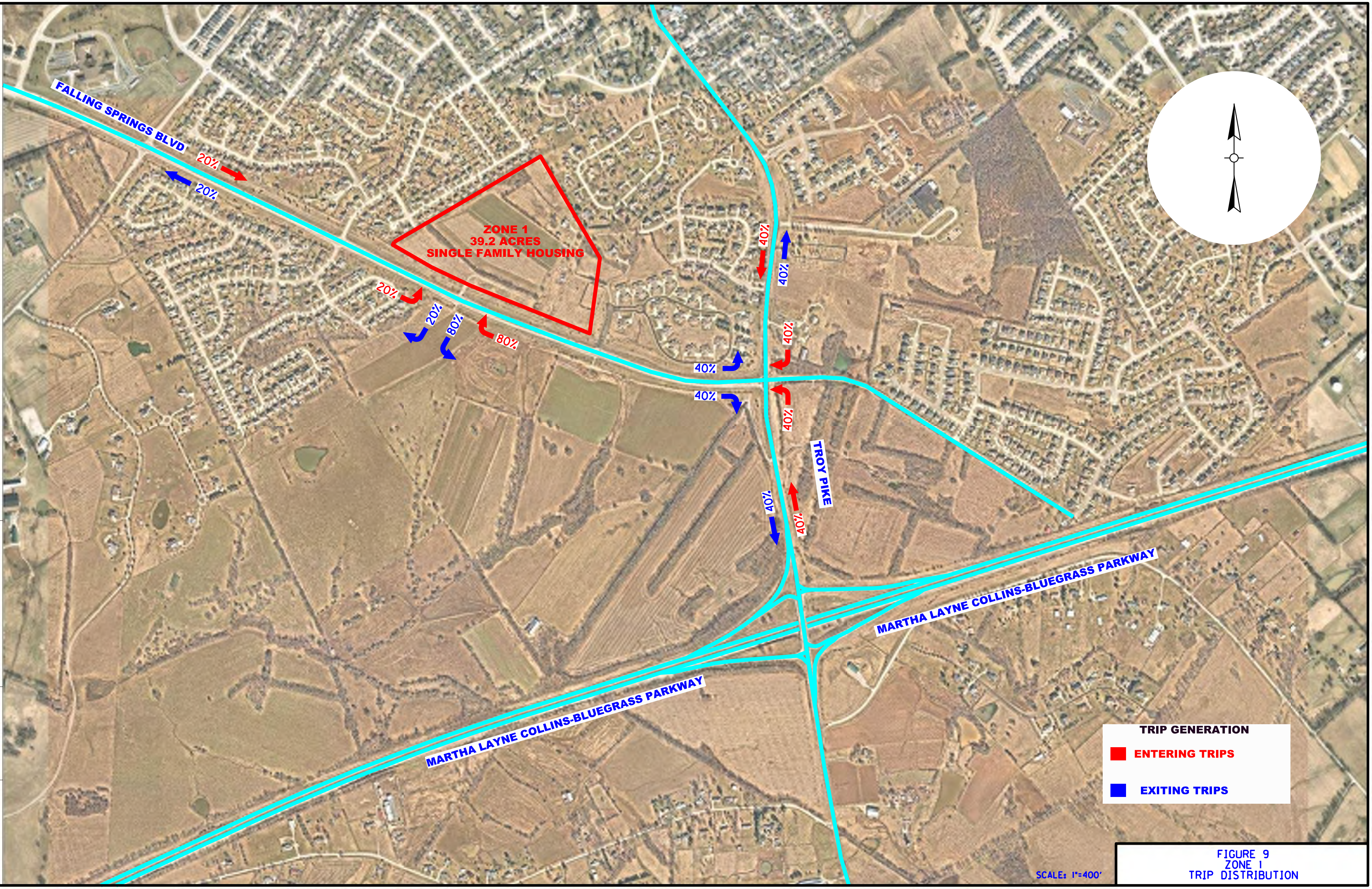


FIGURE 9
ZONE 1
TRIP DISTRIBUTION

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 03.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

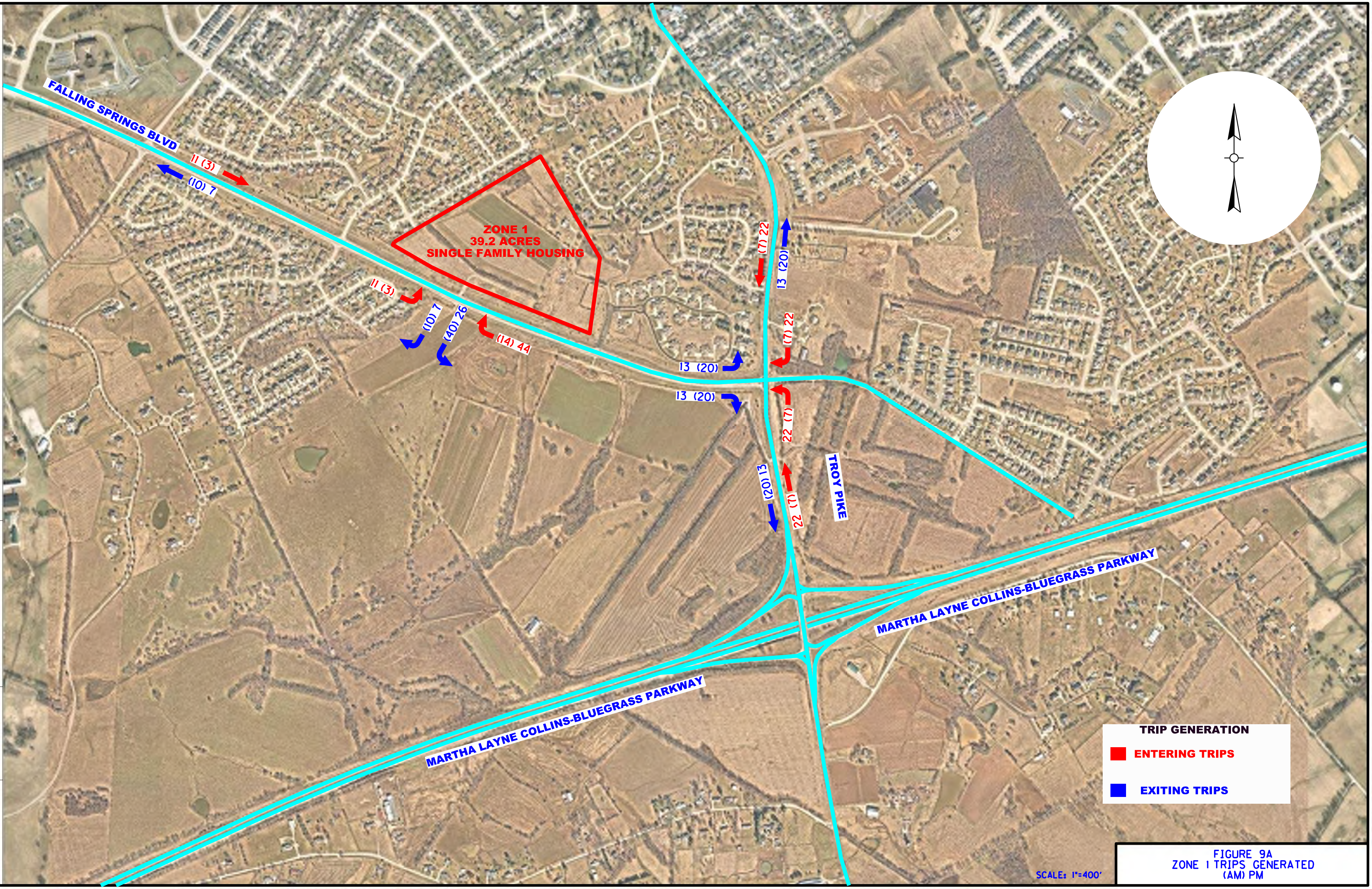


FIGURE 9A
ZONE 1 TRIPS GENERATED
(AM) PM

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 03A.DGN

USER: ben-h
DATE PLOTTED: December 22, 2023

E-SHEET NAME:

Power InRoads v8.11.9.397

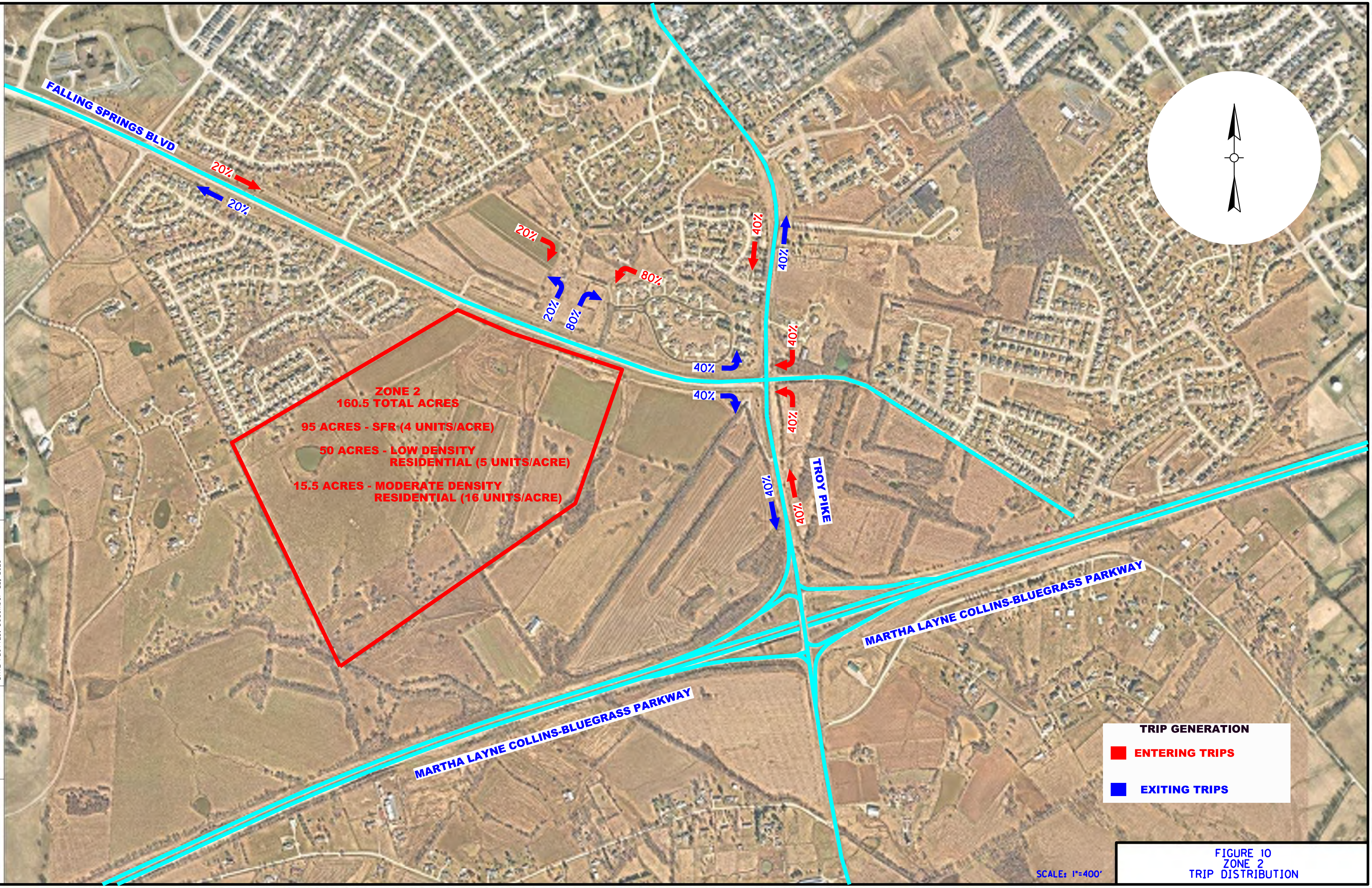


FIGURE 10
ZONE 2
TRIP DISTRIBUTION

FILE NAME: C:\PW_WORKDIR\PEWIN.BEN-H\D0152506\FIGURE 04.DGN

USER: ben-h
DATE PLOTTED: December 22, 2023

E-SHEET NAME:

Power InRoads v8.11.9.397

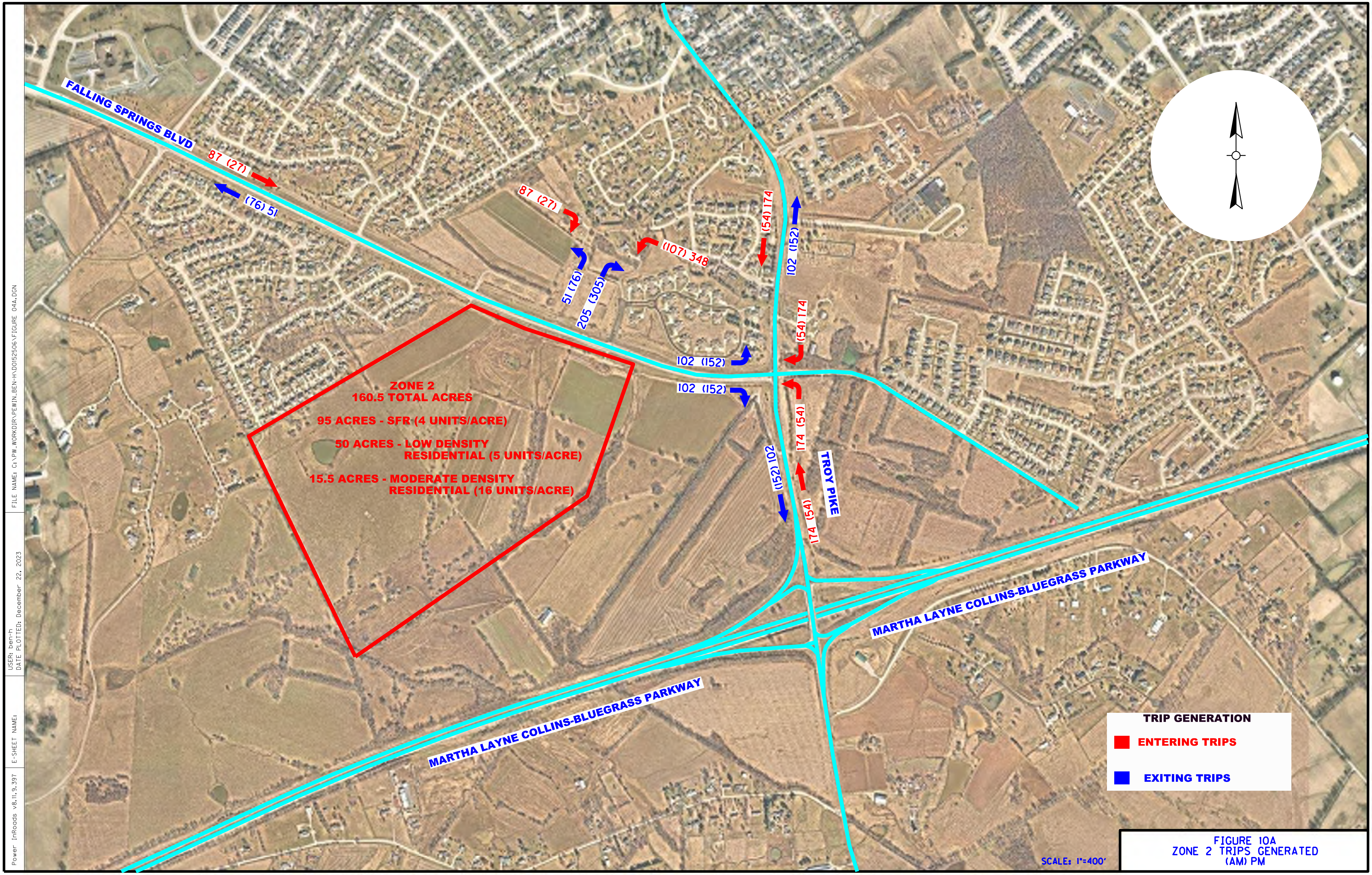


FIGURE 10A
ZONE 2 TRIPS GENERATED
(AM) PM

FILE NAME: C:\PW_WORKDIR\PEWIN.BEN-H\D0152506\FIGURE 04A.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

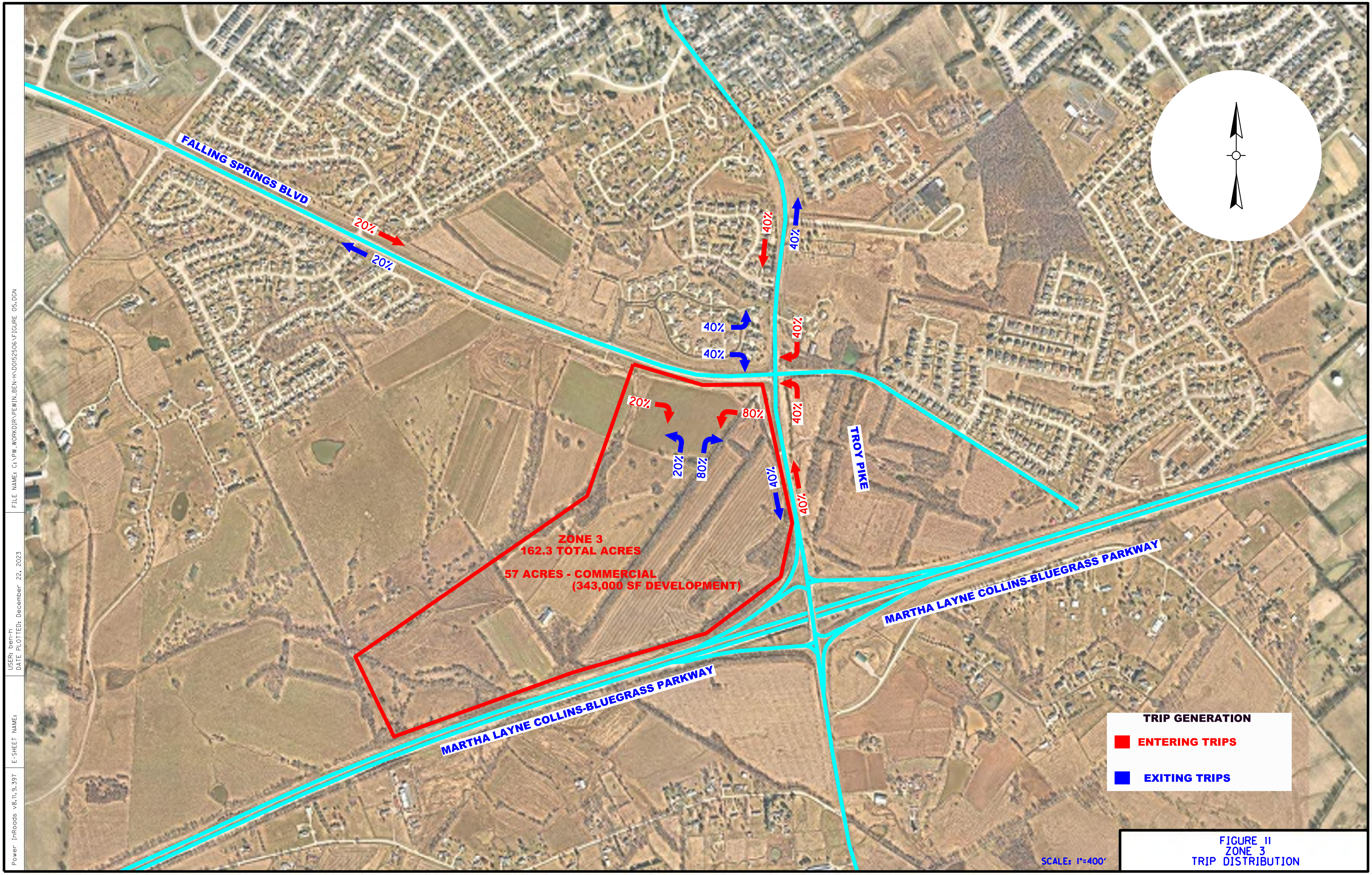


FIGURE 11
ZONE 3
TRIP DISTRIBUTION

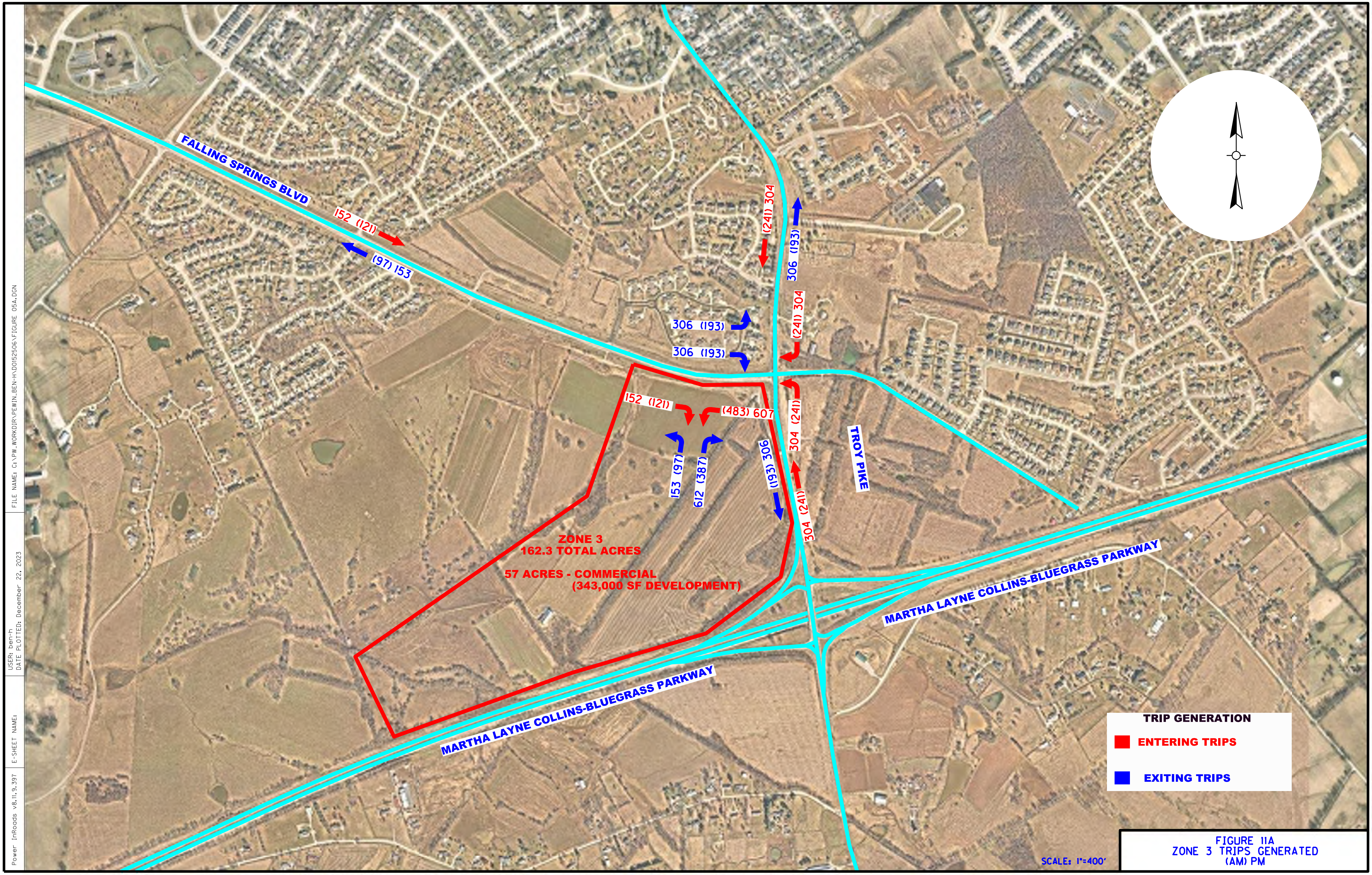


FIGURE 11A
ZONE 3 TRIPS GENERATED
(AM) PM

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 05A.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

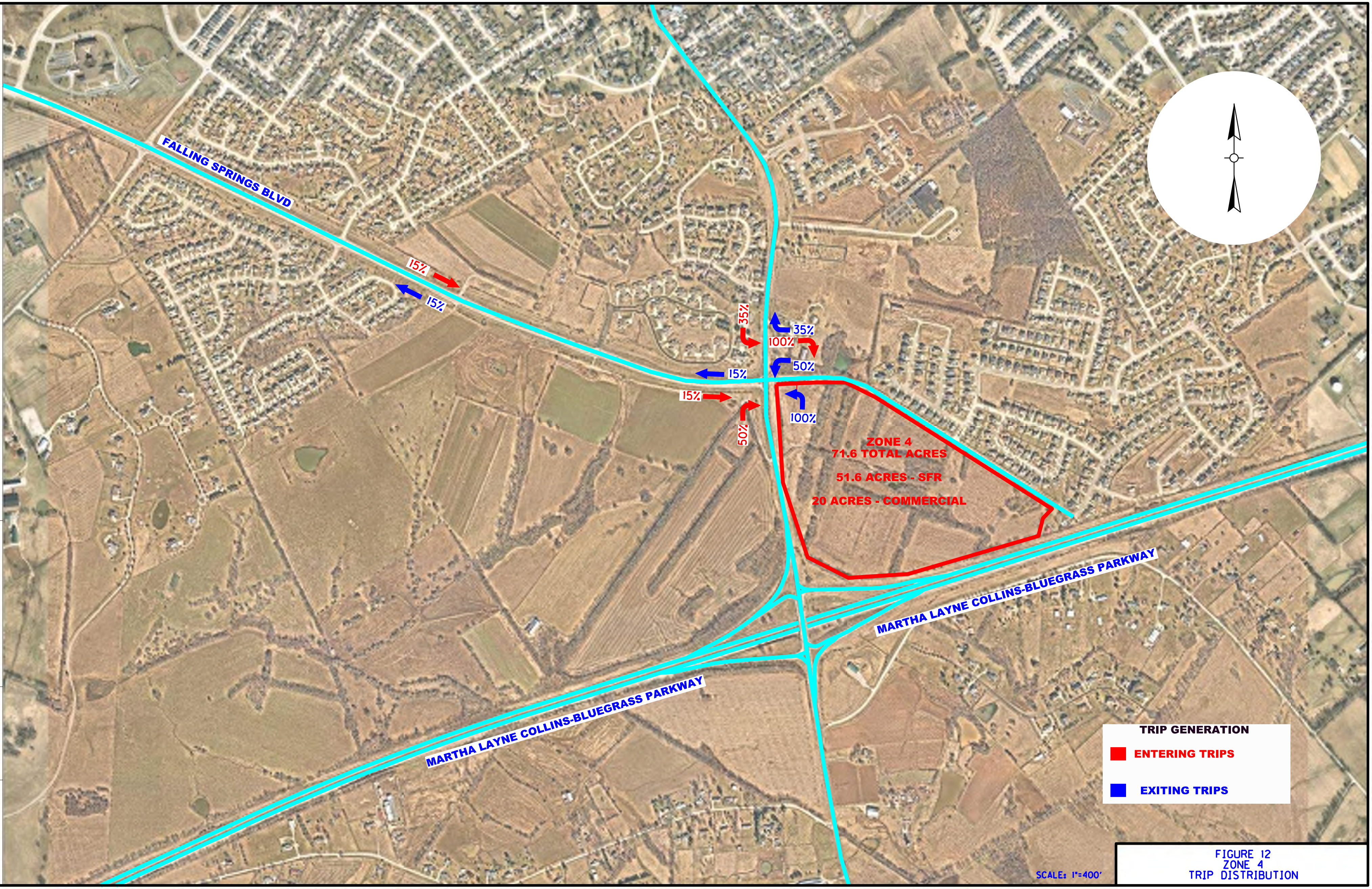


FIGURE 12
ZONE 4
TRIP DISTRIBUTION

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 06.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

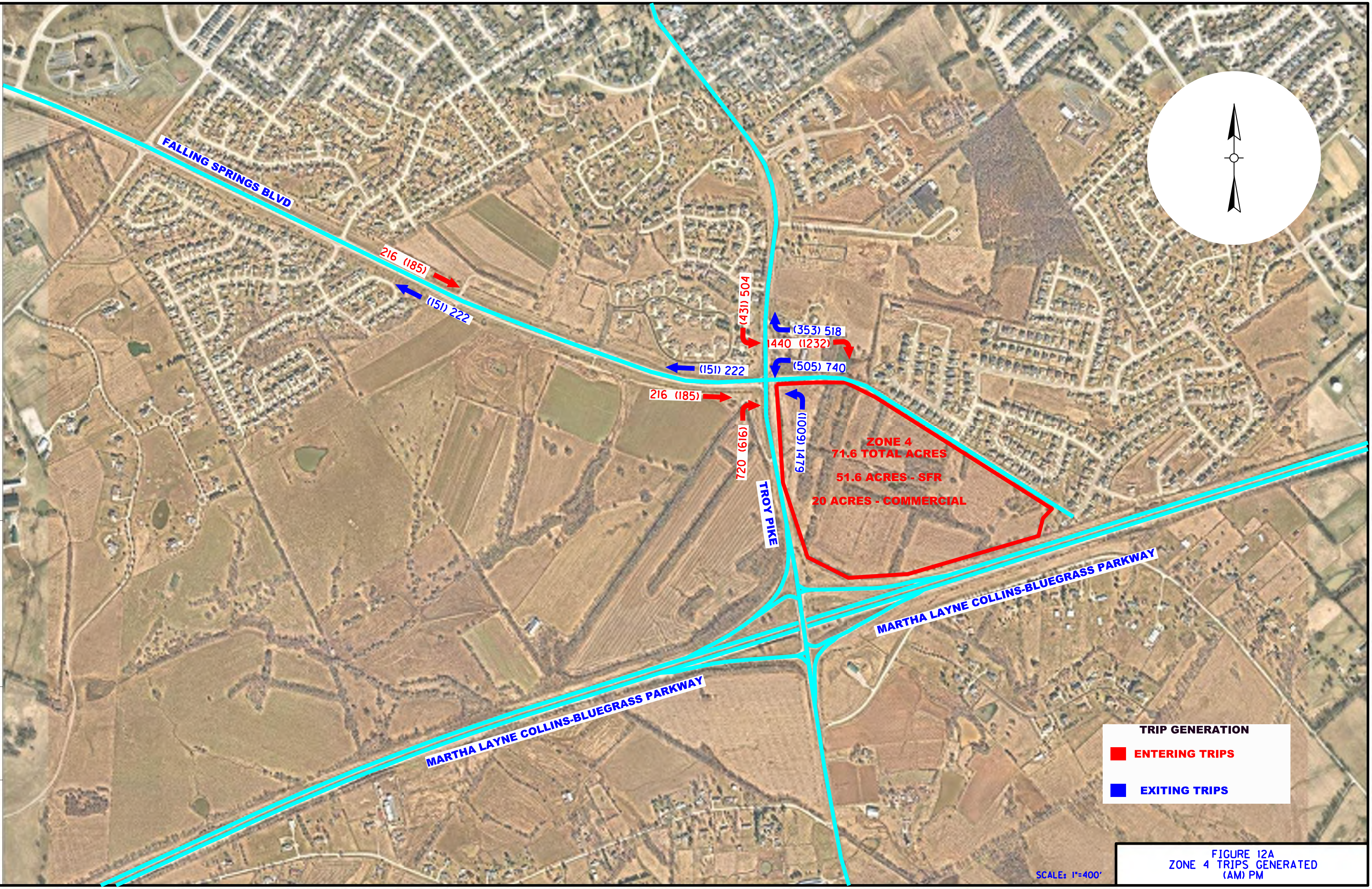


FIGURE 12A
ZONE 4 TRIPS GENERATED
(AM) PM

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 06A.DGN
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DATE PLOTTED: December 22, 2023
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Power InRoads v8.11.9.397

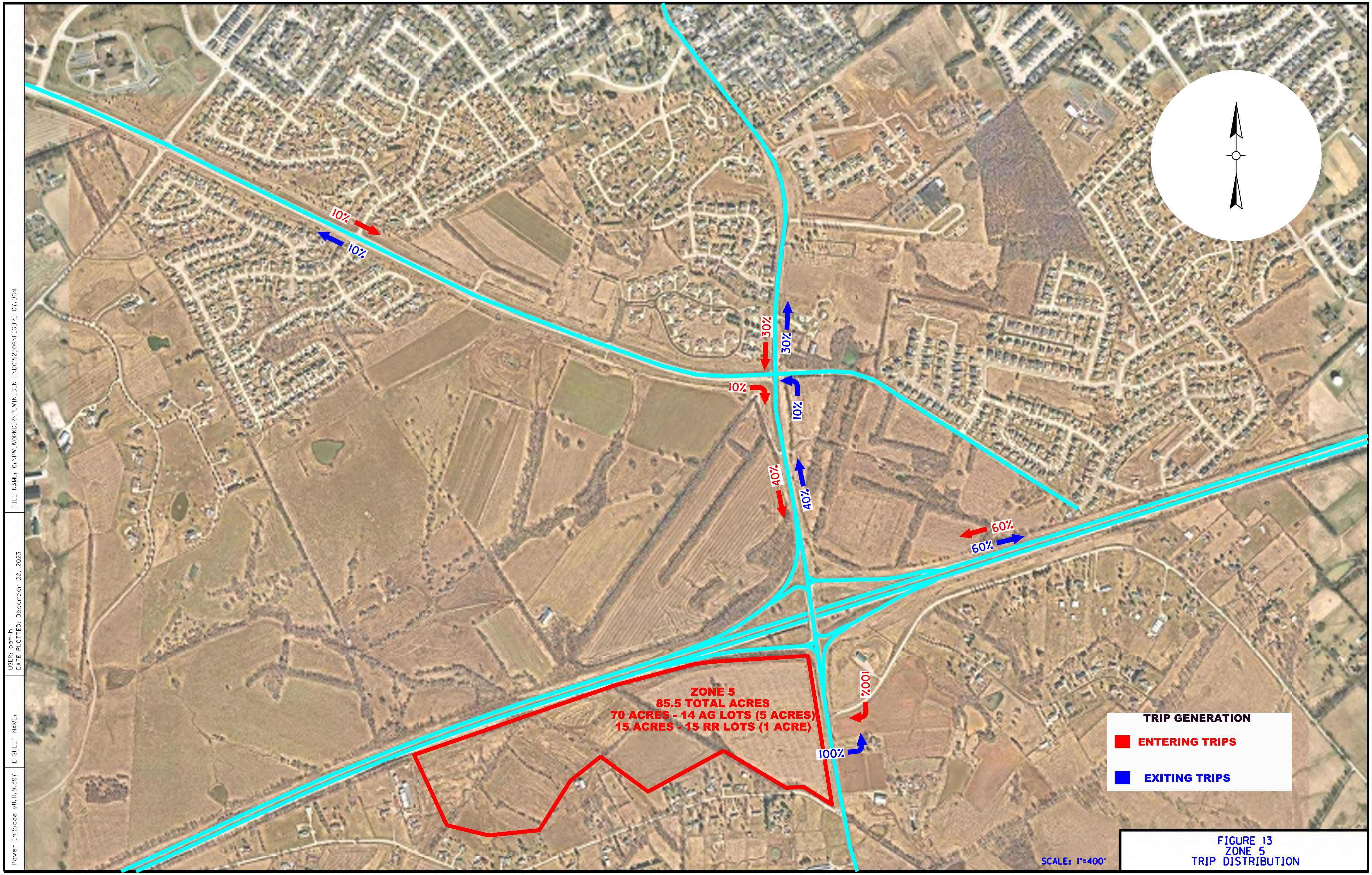


FIGURE 13
ZONE 5
TRIP DISTRIBUTION

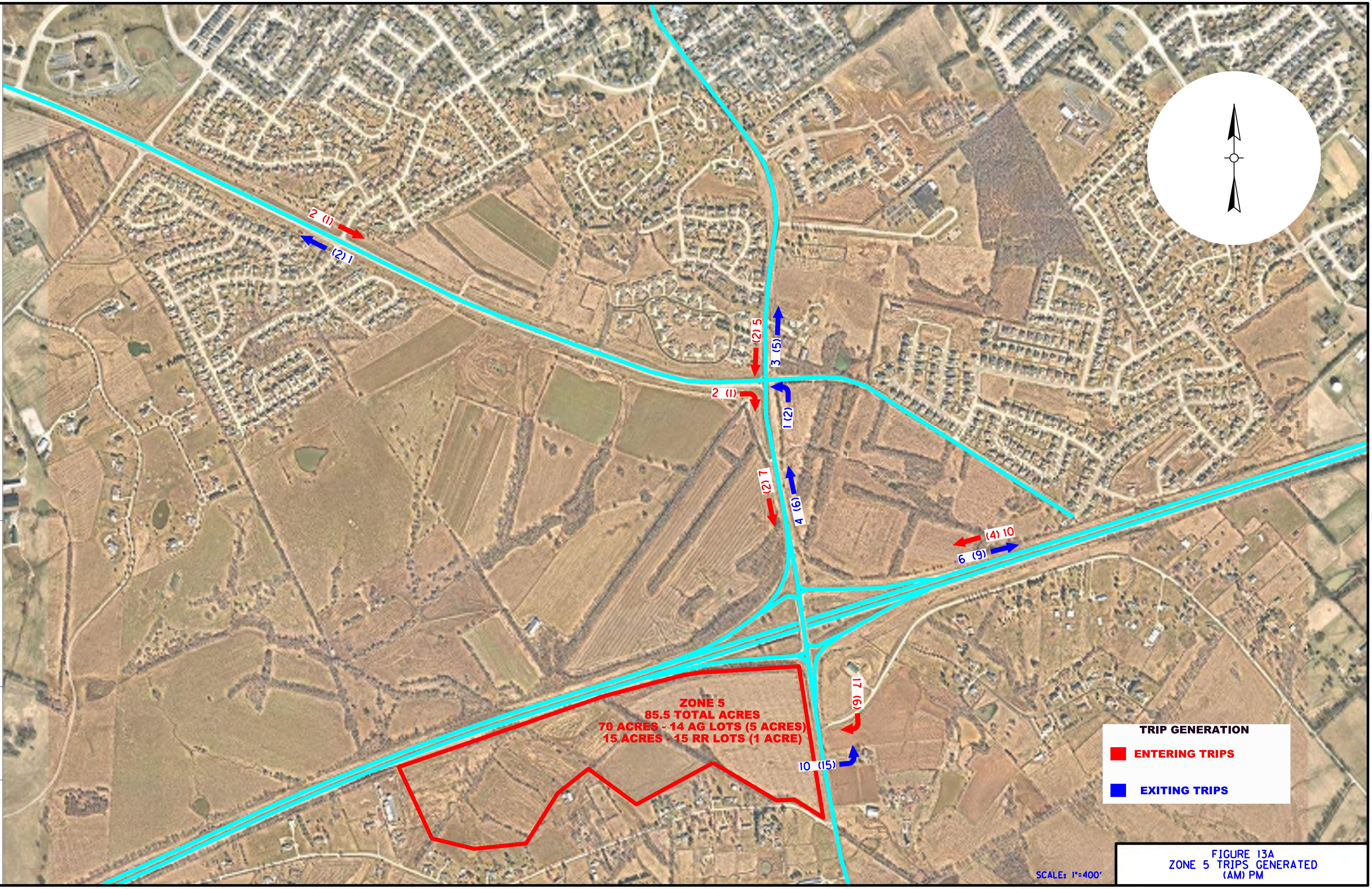


FIGURE 13A
ZONE 5 TRIPS GENERATED
(AM) PM

Power InRoads v8.11.9.397 | E-SHEET NAME: | USER: ben-h DATE PLOTTED: December 22, 2023 | FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 07A.DGN

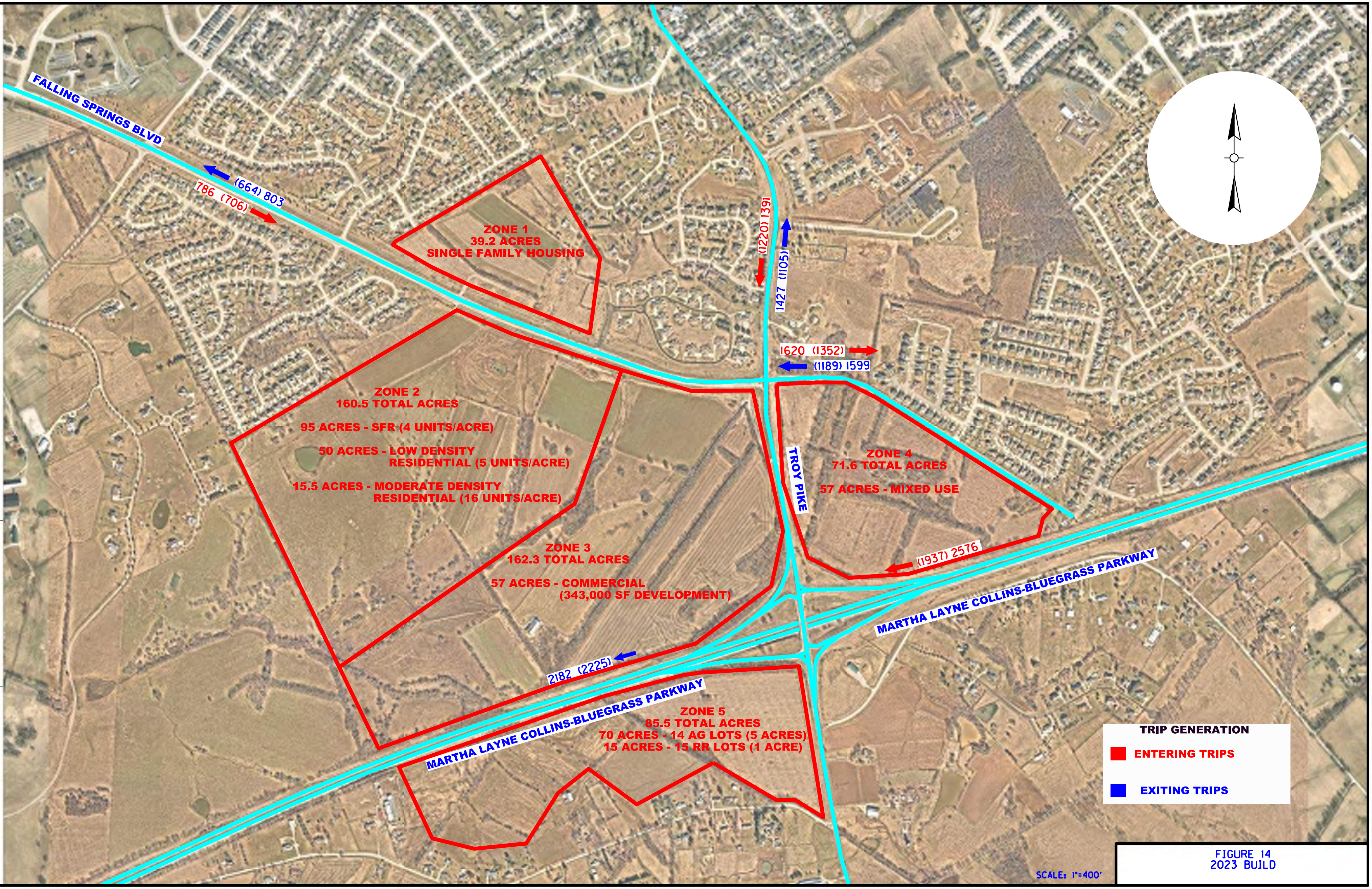


FIGURE 14
2023 BUILD

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 08.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

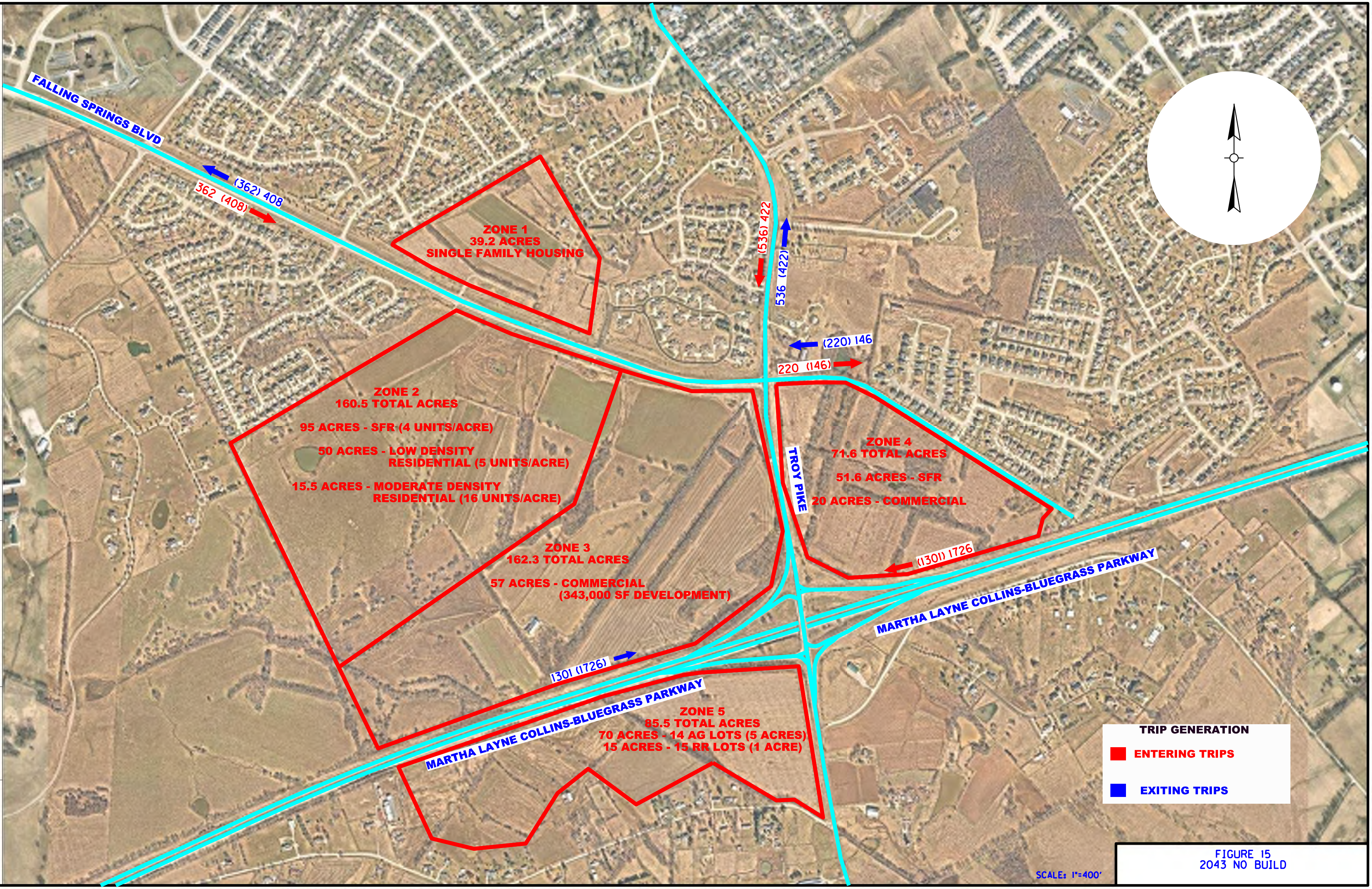


FIGURE 15
2043 NO BUILD

Power InRoads v8.11.9.397 | E-SHEET NAME: | USER: ben-h DATE PLOTTED: December 22, 2023 | FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0152506\FIGURE 09.DGN

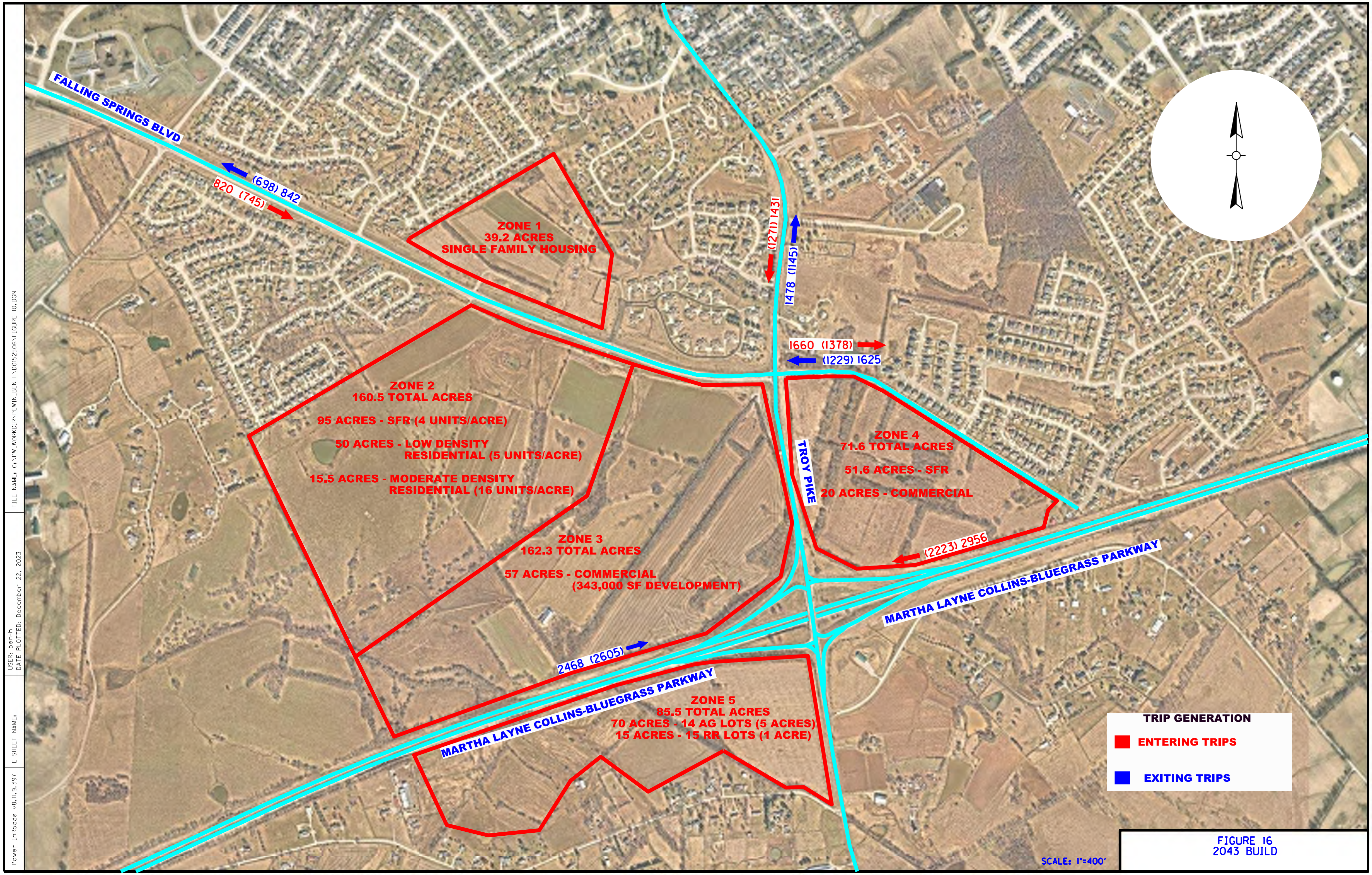


FIGURE 16
2043 BUILD

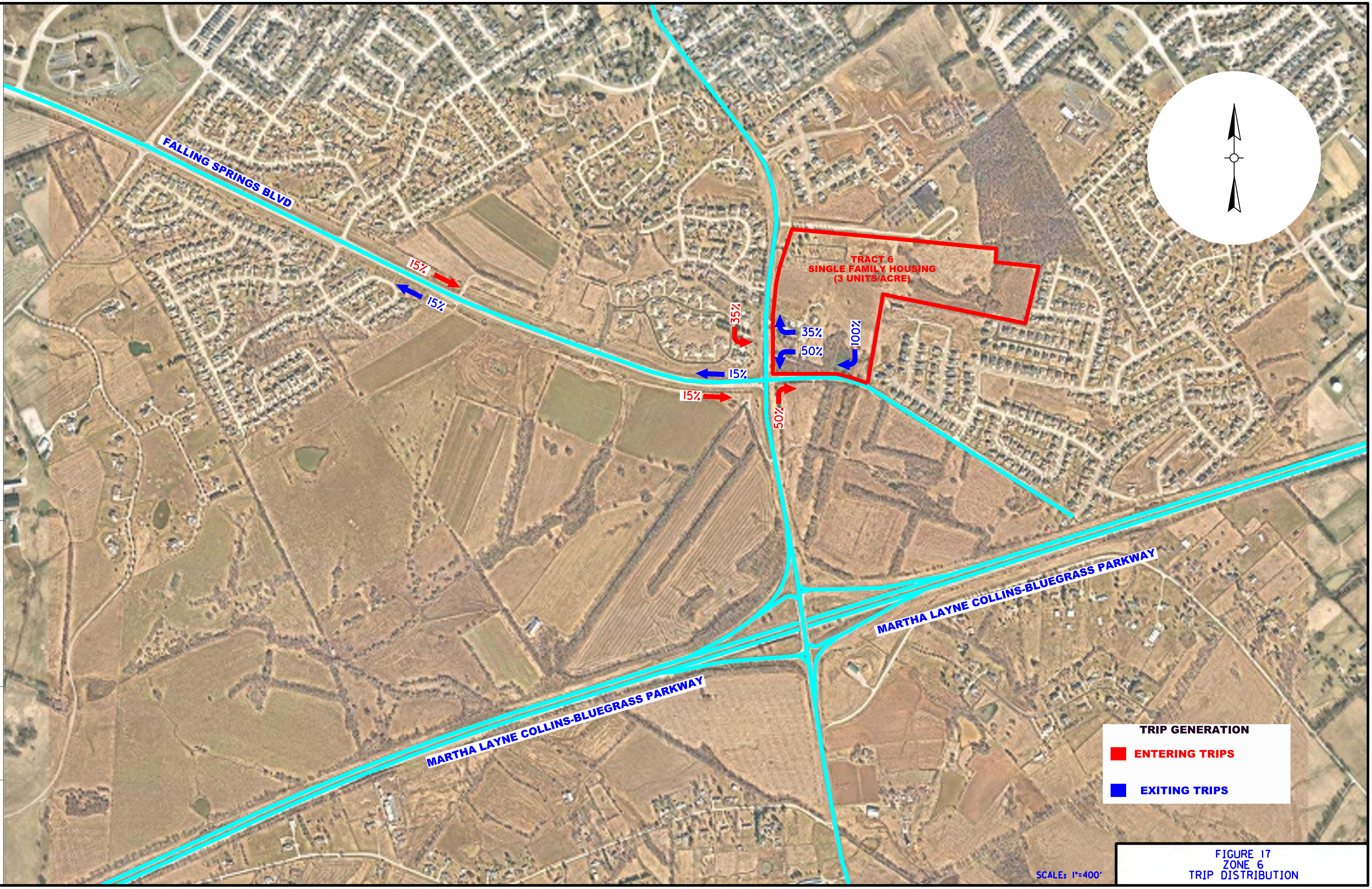


FIGURE 17
ZONE 6
TRIP DISTRIBUTION

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0185188\FIGURE 08.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

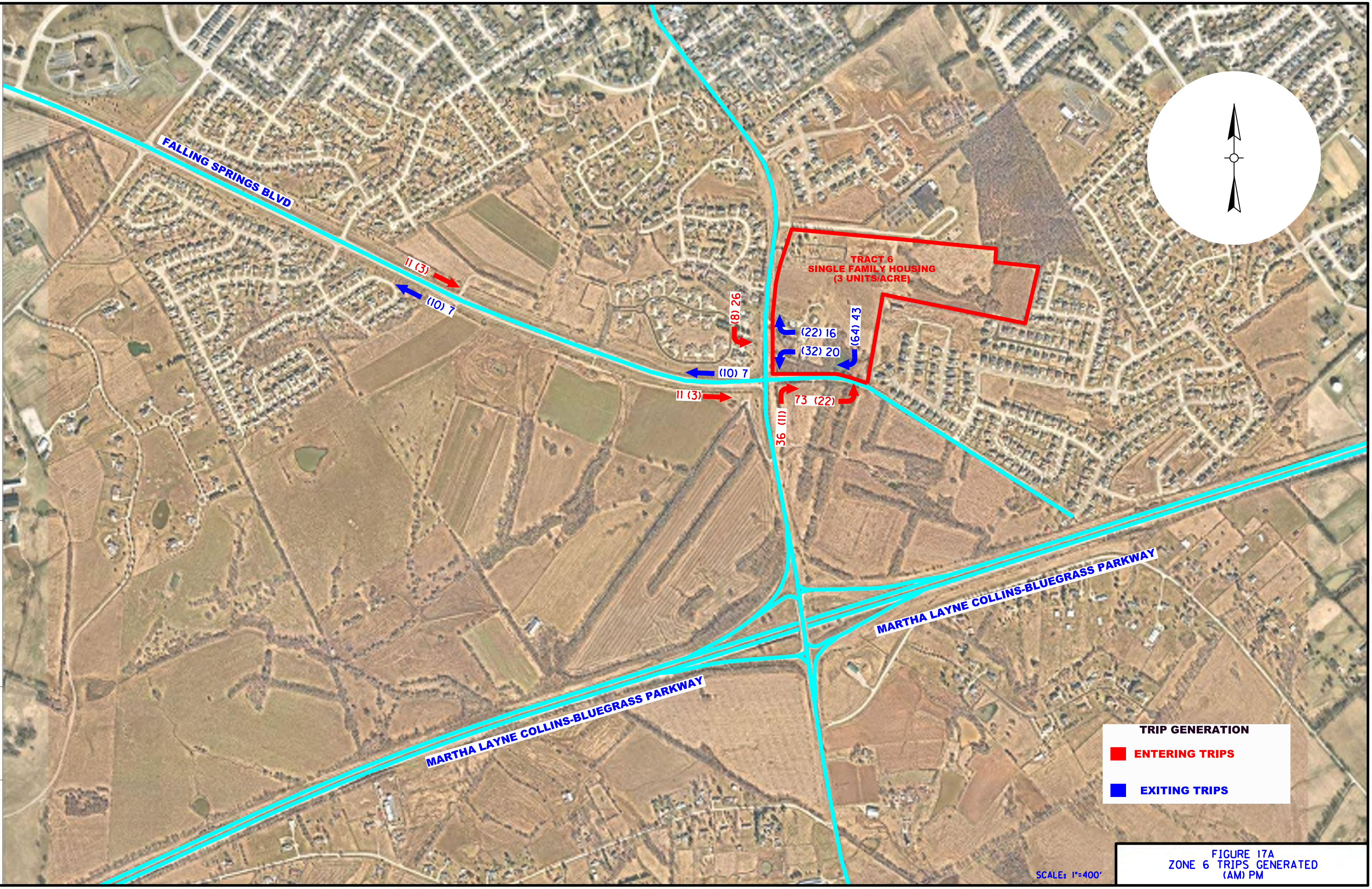


FIGURE 17A
ZONE 6 TRIPS GENERATED
(AM) PM

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0185188\FIGURE 08A.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

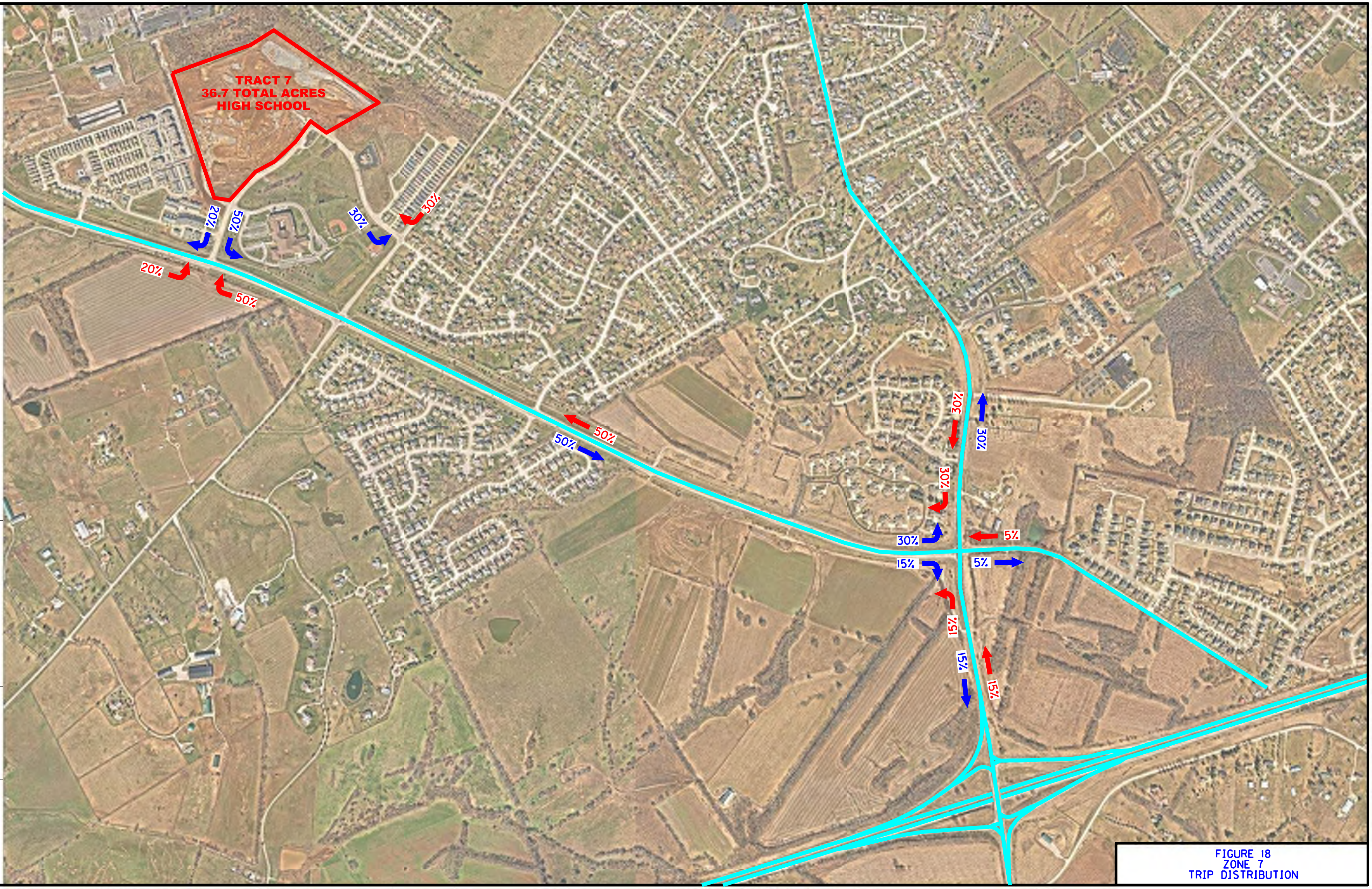


FIGURE 18
ZONE 7
TRIP DISTRIBUTION

FILE NAME: C:\PW_WORKDIR\PEWIN_BEN-H\D0185188\FIGURE 09.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
E-SHEET NAME:
Power InRoads v8.11.9.397

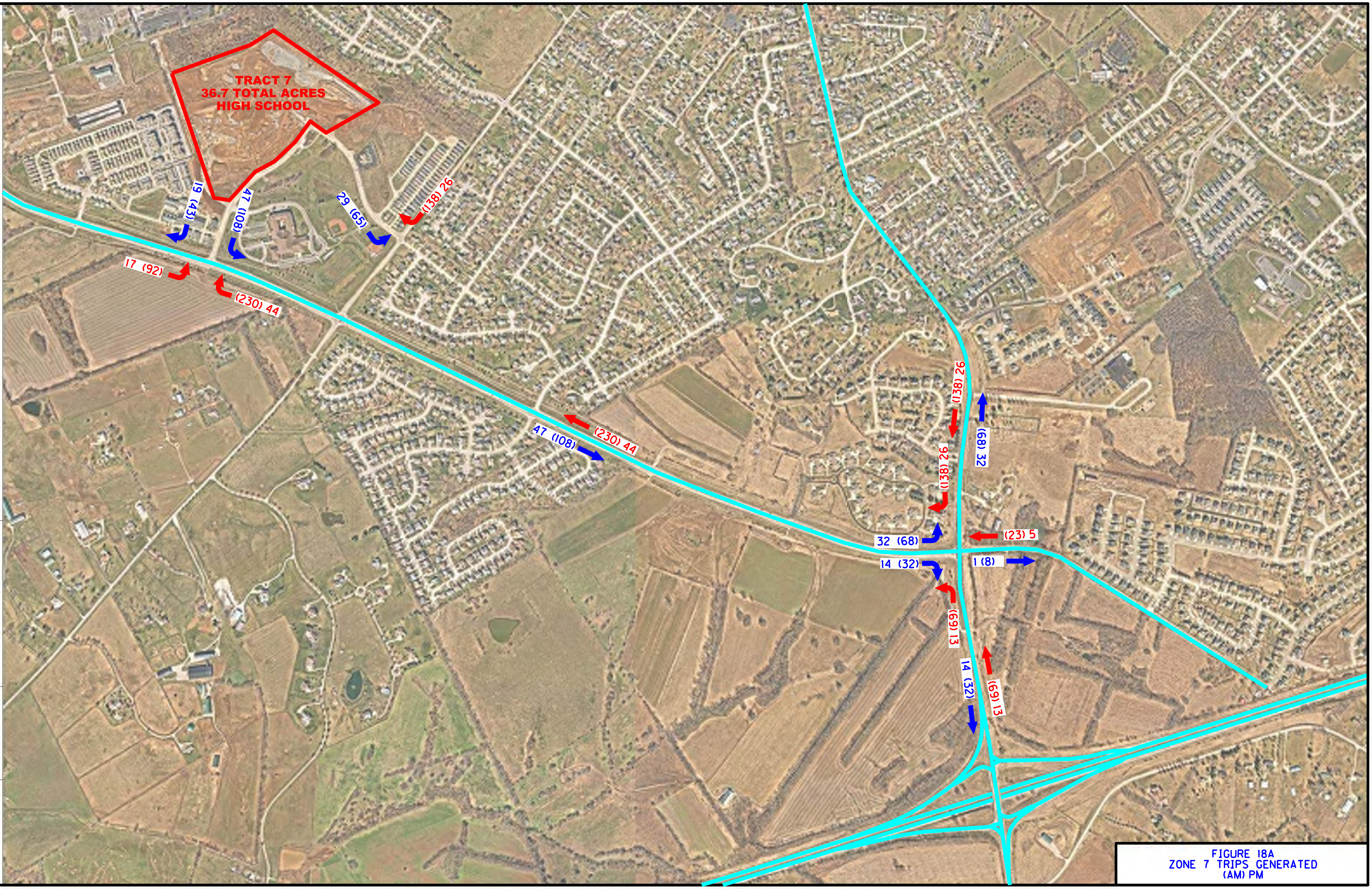
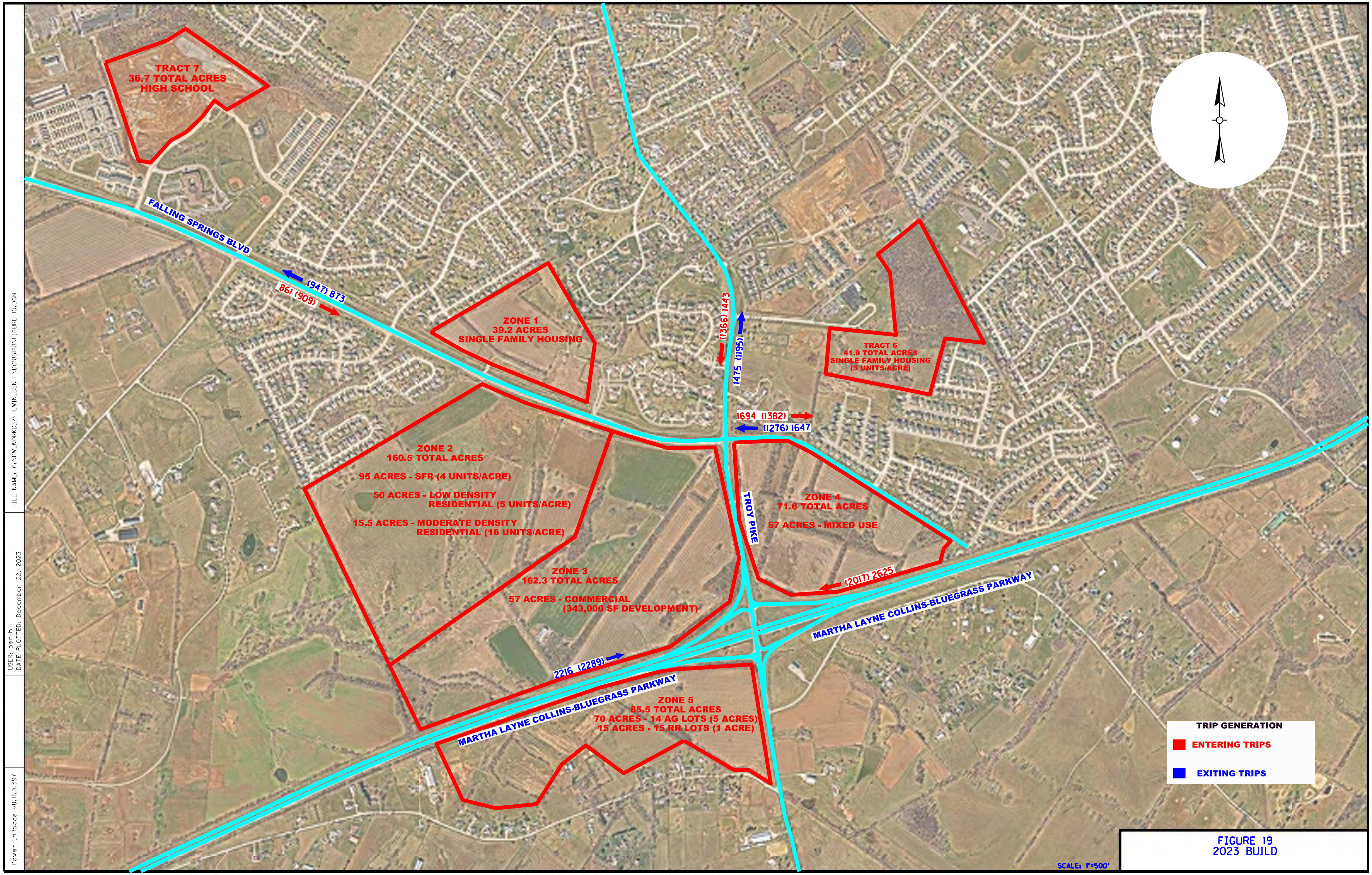


FIGURE 18A
ZONE 7 TRIPS GENERATED
(AM) PM


TRACT 7
36.7 TOTAL ACRES
HIGH SCHOOL
FALLING SPRINGS BLVD
(947) 873
861 (909)
ZONE 1
39.2 ACRES
SINGLE FAMILY HOUSING
(1366) 1443
1475 (1195)
TRACT 6
41.9 TOTAL ACRES
SINGLE FAMILY HOUSING
(3 UNITS/ACRE)
1694 (1382)
(1276) 1647
ZONE 2
160.5 TOTAL ACRES
95 ACRES - SFR (4 UNITS/ACRE)
50 ACRES - LOW DENSITY RESIDENTIAL (5 UNITS/ACRE)
15.5 ACRES - MODERATE DENSITY RESIDENTIAL (16 UNITS/ACRE)
TROY PIKE
ZONE 4
71.6 TOTAL ACRES
57 ACRES - MIXED USE
ZONE 3
162.3 TOTAL ACRES
57 ACRES - COMMERCIAL
(343,000 SF DEVELOPMENT)
(2017) 2625
MARTHA LAYNE COLLINS-BLUEGRASS PARKWAY
2216 (2289)
MARTHA LAYNE COLLINS-BLUEGRASS PARKWAY
ZONE 5
85.5 TOTAL ACRES
70 ACRES - 14 AG LOTS (5 ACRES)
15 ACRES - 15 RR LOTS (1 ACRE)
TRIP GENERATION
ENTERING TRIPS
EXITING TRIPS
SCALE: 1"=500'
FIGURE 19
2023 BUILD
FILE NAME: c:\PW_WORKDIR\PEWIN_BEN-H\D0185188\FIGURE 10.DGN
USER: ben-h
DATE PLOTTED: December 22, 2023
Power InRoods v8.11.9.397

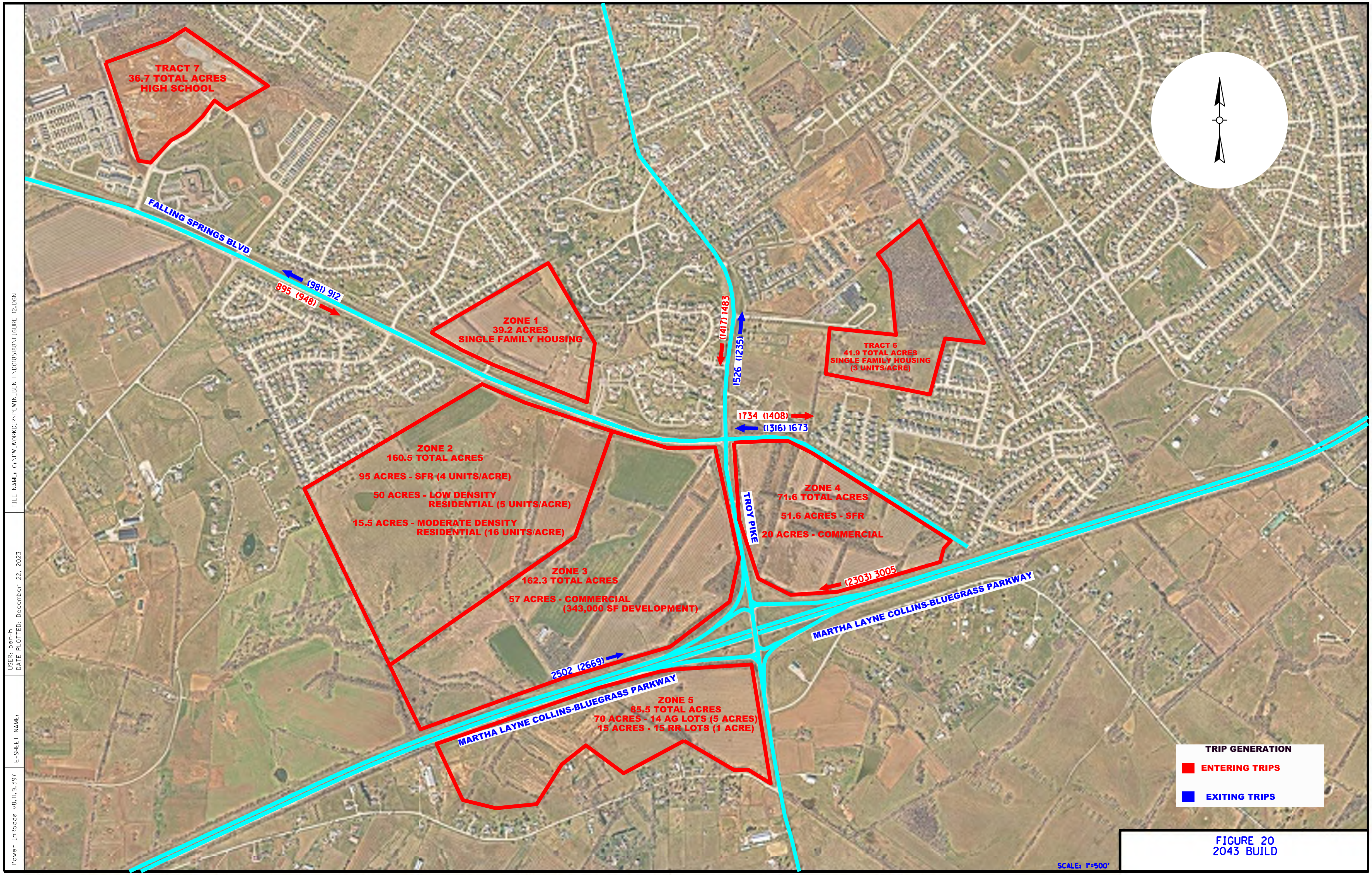
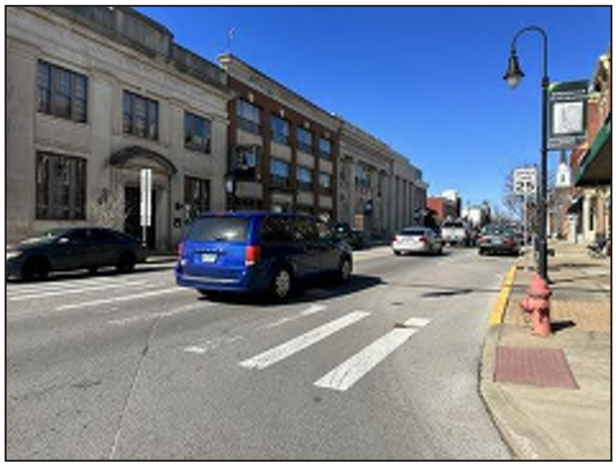


FIGURE 20
2043 BUILD



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