BRASS LANTERN STATION SUBDIVISION

KNOX COUNTY, TENNESSEE

TRAFFIC IMPACT STUDY

Prepared for

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TABLE OF CONTENTS

INTRODUCTION 1
Project Description 1
Site Location 1
LOCAL AND REGIONAL ACCESS 4
Local Access 4
Regional Access 4
EXISTING TRAFFIC CONDITIONS 5
Existing Traffic Control 5
Existing Traffic Volumes 5
Existing Capacity and Level of Service 5
BACKGROUND TRAFFIC CONDITIONS 8
Background Traffic Volumes 8
Background Capacity and Level of Service 8
PROJECT IMPACTS 10
Trip Generation 10
Trip Distribution and Assignment 10
Project Traffic Volumes 10
Total Projected Traffic Volumes 13
Projected Capacity and Level of Service 13
Sight Distance 13
Site Access 13
RECOMMENDATIONS 16
CONCLUSION 16
APPENDIX 17

LIST OF FIGURES

Figure 1: Proposed Site Plan..... 2
Figure 2: Vicinity Map..... 3
Figure 3: 2006 Existing Traffic..... 6
Figure 4: 2010 Background Traffic……....9
Figure 5: Distribution and Assignment…….11
Figure 6: Project Trips……..12
Figure 7: 2010 Projected Traffic……...14

LIST OF TABLES

Table 1: Unsignalized LOS Description……..……..……7
Table 2: 2006 Existing Capacity and Level of Service……...…….…..9
Table 3: 2010 Background Capacity and Level of Service……...……...…...…..8
Table 4: Trip Generation.....…..…….…10
Table 5: 2010 Projected Capacity and Level of Service…….……..15
Table 6: Summary of Capacity and Level of Service…….……..15

INTRODUCTION

Wilbur Smith Associates (WSA) is pleased to submit this report to address the impact and access of a proposed residential development located on Sands Lane in northwest Knox County. The basis for this study required the collection of traffic data, generation of anticipated traffic volumes from the proposed site and development of projected traffic volumes from normal growth and from the potential site. Analysis of the resulting traffic projections was conducted to determine the capacity and levels of service for the study intersections and site access. This study will develop measures necessary to mitigate traffic impacts including improved roadway geometrics and traffic control devices within the environs of the proposed residential development.

According to the Knoxville-Knox County Metropolitan Planning Commission's (MPC) Administrative Rules and Procedures, the proposed residential development site is identified for a Level 1 Traffic Impact Study. WSA discussed with Knox County Department of Engineering and Public Works to define the study area and address specific concerns relative to the proposed residential development. Therefore, this study will address the anticipated traffic impacts of the proposed residential development site access to Sands Lane and the intersection of Sands Lane and Bakertown Road.

Project Description

The proposed project is a second phase of a residential development. The initial phase of 43 single-family units is beginning construction and the second phase concept for 127 units is being submitted for MPC approval. The proposed site, the initial phase and the current proposed phase, is a total of approximately 60 acres. The site access will be from the extension of Aitree Lane from the initial phase, intersecting Ashridge Road and Sands Lane to the west. Ashridge Road would access 170 single-family units. Figure 1 shows the proposed site plan.

Site Location

The location of the proposed site is in northwest Knox County, west of Sands Lane and north of Bakertown Road and Middlebrook Pike. Figure 2 illustrates this location relative to local and regional transportation facilities.

SITE PLAN
Brass Lantern Station

Figure 1

VICINITY MAP
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Figure 2

LOCAL AND REGIONAL ACCESS

The proposed development will add trips to both the local and regional facilities. Intersections between these facilities will be evaluated to determine the development's impact upon them. A brief description of these facilities is provided in the section.

Local Access

Local access is from Airtree Lane and Ashridge Road to Sands Lane and Bakertown Road. Sands Lane averages 22-feet in width at its intersection at Bakertown Road. Bakertown Road is a minor collector roadway averaging 21 feet wide and extends from its intersection at Sands Lane to the west to Joe Hinton Road. Joe Hinton Road is a minor collector facility averaging 18 feet in width and has a 2005 average daily traffic (ADT) volume of approximately 6,020 vehicles per day (vpd). From Bakertown Road, Joe Hinton Road extends south to Middlebrook Pike. At Joe Hinton Road, Bakertown Road turns to the north continuing to Ball Camp Pike.

Regional Access

To the south, Middlebrook Pike (S.R. 169) is a four-lane divided arterial. Site access is a proposed residential street at a median opening. Middlebrook Pike is an east and west facility extending between Pellissippi Parkway (S.R. 162) to the west and Alcoa Highway (U.S. 129) to the east, near the Knoxville CBD. The 2005 average weekday traffic (AWT) for Middlebrook Pike is approximately 26,390 vpd.

To the west is Pellissippi Parkway extending northwest and southeast. Pellissippi Parkway has a 2005 ADT of approximately 45,180 vpd. This facility becomes Interstate 140 to the south and is designated as part of the federal interstate system. To the south, Pellissippi Parkway intersects Interstate 40/75 and terminates at Alcoa Highway (U.S. 129), providing an essential link to the Knoxville Airport and the Cities of Maryville and Alcoa. Turning north on Alcoa Highway leads back to Knoxville just west of the central business district.

Interstate 40, south of the proposed site, is accessible by Pellissippi Parkway; Cedar Bluff Road; North Gallaher View Road, west of the site; Vanosdale Road to Kingstown Pike (U.S. 11/70) in West Hills to the east; and University Avenue at the terminus of Middlebrook Pike, also to the east. Interstate 40 is an east and west facility extending between Nashville, Tennessee and Asheville, North Carolina. The approximate 2005 ADT for I-40/75 between Pellissippi Parkway (I-140) and the West Hills interchange is 149,150 vpd. To the east, I-75 turns north to Lexington, Kentucky, and to the west, I-75 turns south to Chattanooga, Tennessee.

EXISTING TRAFFIC CONDITIONS

Existing Traffic Control

The Sands Lane and Bakertown Road approaches are STOP controlled providing a multi-way STOP intersection. Sands Lane and Bakertown Road have posted speed limits of 30mph.

Existing Traffic Volumes

Peak-hour turning movement counts (TMC) were conducted by WSA in August of 2006 for the intersection of Sands Lane and Bakertown Road. Figure 3 illustrates the resulting intersection turning movements for the 2006 AM and PM peaks. The peak hours were found between 7:30-8:30 AM and 3:00-4:00 PM.

Existing Capacity and Level of Service

In order to evaluate the current operations of the traffic control devices, capacity and level of service were calculated using the **2000 Highway Capacity Manual, Special Report 209** published by the Transportation Research Board (TRB). Signalized and unsignalized intersections are evaluated based on estimated intersection delays, which may be related to level of service (LOS).

Level of service and capacity are the measurements of an intersection's ability to accommodate traffic volumes. Levels of service for intersections range from A to F. LOS A is the best, and LOS F is failing. For signalized intersections, a LOS of A has an average estimated intersection delay of less than 10 seconds, and LOS F has an estimated delay of greater than 80 seconds. A LOS of C and D are typical design values. Within urban areas, a LOS D, delay between 35 and 55 seconds, is considered acceptable by the Institute of Transportation Engineers (ITE) for signalized intersections.

Unsignalized intersections levels of service have lower thresholds of delays. A LOS of F exceeds estimated delays of 50 seconds. For urban arterials, minor approaches may frequently experience levels of service E. A full level of service description for unsignalized intersections is presented in Tables 1.

The LOS for the intersection of Bakertown Road and Sands Lane was found to be very good. The analyses conducted for the AM and PM peak hour is presented in Table 2.

2006 EXISTING TRAFFIC
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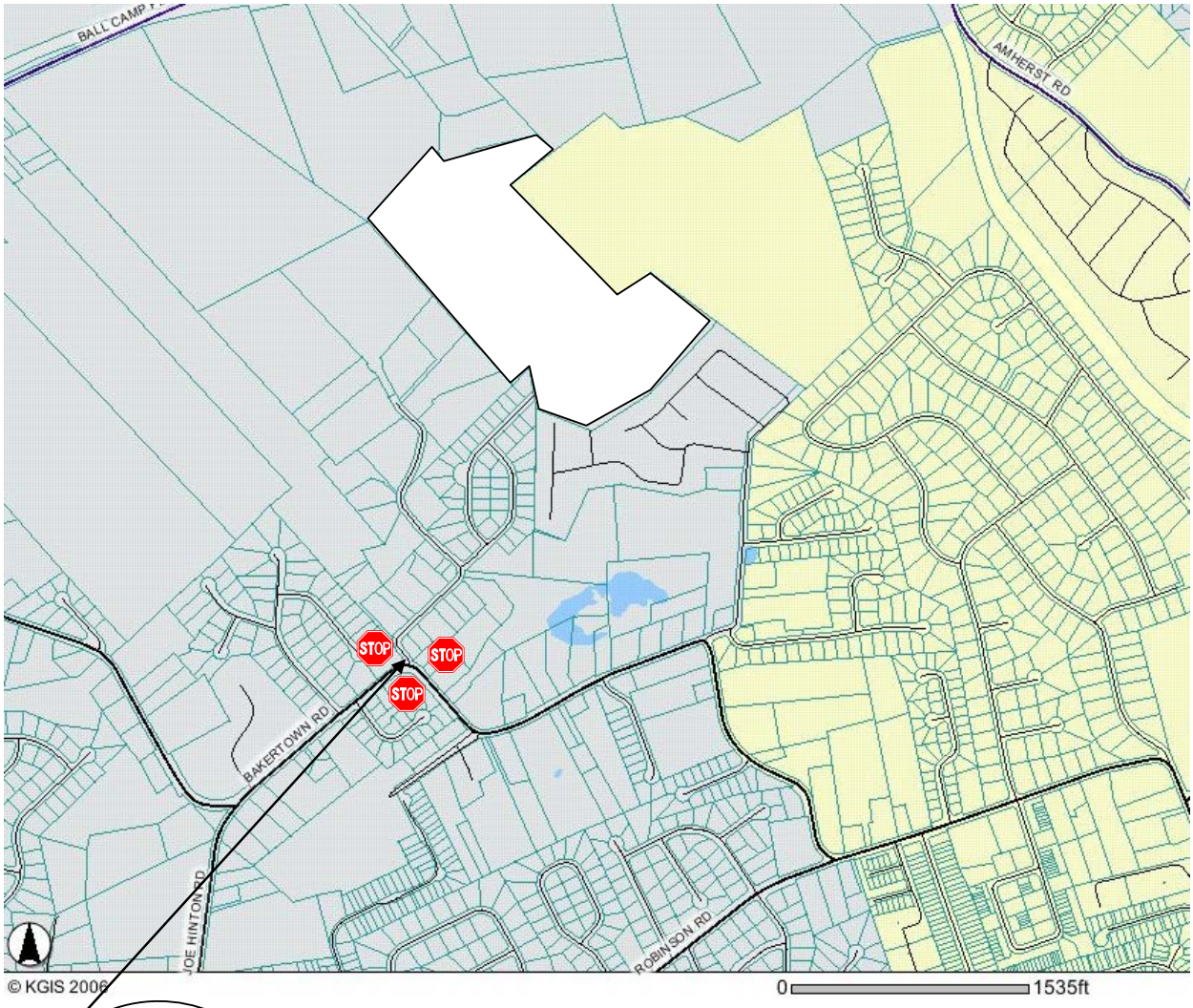

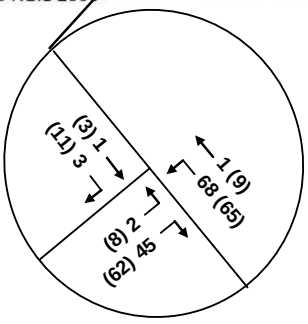

LEGEND
XXX AM PEAK
(XXX) PM PEAK

Figure 3

Table 1
LEVEL-OF-SERVICE (LOS) DESCRIPTION
FOR TWO-WAY STOP INTERSECTIONS

Level of Service	Average Control Delay per Vehicle (seconds)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤ 25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	> 50.0

SOURCE: **Highway Capacity Manual, TRB Special Report 209**

Table 2
LEVEL-OF-SERVICE (LOS) DESCRIPTION
FOR SIGNALIZED INTERSECTIONS

TABLE 2
2006 TRAFFIC
CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL/ APPROACH	PEAK PERIOD	V/C	2006 TRAFFIC	
				DELAY	LOS
Bakertown Road and Sands Lane	STOP EB	AM	_	6.70	A
		PM	_	7.02	A
	STOP NB	AM	_	7.62	A
		PM		7.84	
	STOP SB	AM	_	6.64	A
		PM	_	6.79	A
INTERSECTION DELAY		AM		7.23	A
INTERSECTION LOS		PM		7.38	A

Note: Average vehicle delay estimated in seconds, STOP control analyses presented by total minor approaches.

BACKGROUND TRAFFIC CONDITIONS

Background traffic is traffic that can be anticipated regardless of the proposed development. Traffic within the study area should continue to grow due to other developments as well as the continued growth within the surrounding area. This background traffic must be analyzed and evaluated for the purpose of establishing a baseline. In addition, the background traffic reflects the historical traffic volumes in the area of the proposed development.

Background Traffic Volumes

An average growth rate was determined using historical ADT traffic data over the past few years. The increased ADT indicated that an annual growth rate of 4-percent may be expected for the area. For study purposes, target year 2010 was analyzed. Therefore, using a 4.0-percent compounded growth rate, the study intersections reflect a 17.0-percent growth. Figure 4 illustrates the traffic volumes with the appropriately applied growth factor.

Background Capacity and Level of Service

Analysis was performed with the grown traffic volumes and is displayed in Table 3. The levels of service are measured to be acceptable for the unsignalized study intersection of Bakertown Road and Sands Lane with background conditions.

TABLE 3
2010 BACKGROUND TRAFFIC
CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL/ APPROACH	PEAK PERIOD	V/C	2010 BACKGROUND TRAFFIC	
				DELAY	LOS
Bakertown Road and Sands Lane	STOP EB	AM	_	6.77	A
		PM	_	7.16	A
	STOP NB	AM	_	7.73	A
		PM		8.00	A
	STOP SB	AM	_	6.63	A
		PM	_	6.86	A
INTERSECTION DELAY		AM		7.31	A
INTERSECTION LOS		PM		7.53	A

Note: Average vehicle delay estimated in seconds, STOP control analyses presented by total minor approaches.

2010 BACKGROUND TRAFFIC
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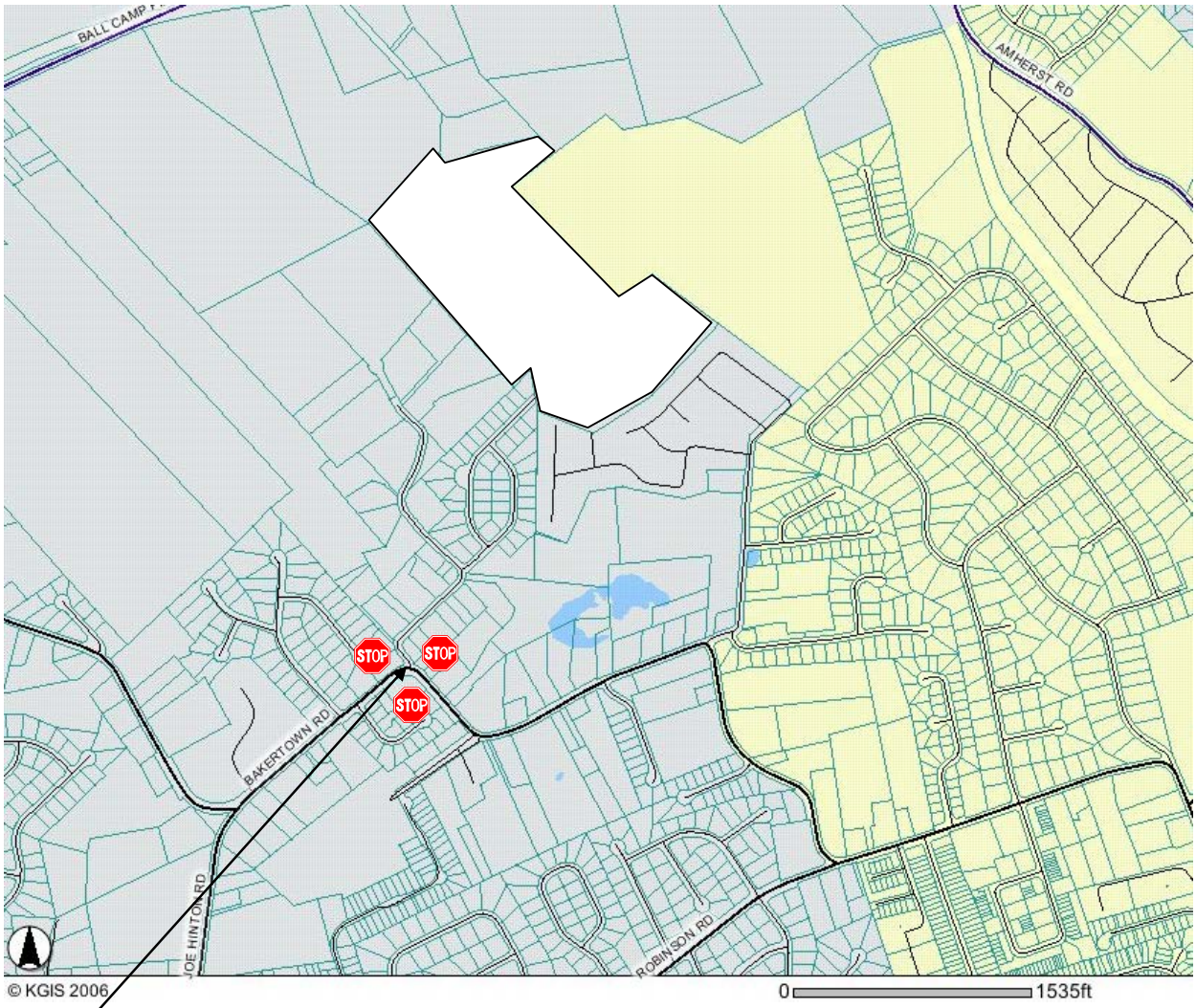

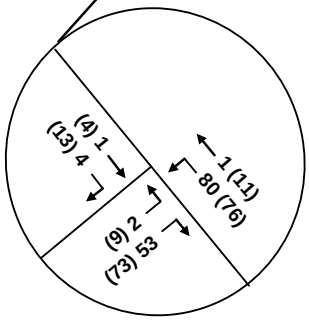

LEGEND
XXX AM PEAK
(XXX) PM PEAK

Figure 4

PROJECT IMPACTS

Project conditions are developed by generating traffic based on the proposed land uses, distributing the trips to the transportation network, and again conducting analyses for capacity and level of service.

Trip Generation

Project traffic was determined using the publication, **Trip Generation, 7th Edition**. This reference is published by the Institute of Transportation Engineers (ITE) and represents national data collected for many different land uses including industrial, residential and commercial uses. **Trip Generation** is an essential tool in calculating the traffic, which may be generated by a proposed development. The study will generate traffic for 170 single-family residential units. From the trip generation calculations, the proposed site may generate approximately 1,690 daily trips. Table 4 presents the trip generation of this proposed site.

TABLE 4
TRIP GENERATION

LAND USE	L.U.C.	Units	DAILY TRIPS	AM PEAK ENTER	AM PEAK EXIT	PM PEAK ENTER	PM PEAK EXIT
Single Family	210	170	1,694	32	96	111	62

Trip Distribution and Assignment

Using the turning-movement counts for the study intersections, trips are distributed to the adjacent streets with 75-percent of the generated trips distributed southwest and 25-percent assigned east on Bakertown Road. Figure 5 illustrates the traffic distribution and assignment.

Project Traffic Volumes

By multiplying the trips generated by the distribution percentages, the project traffic volumes were determined. Figure 6 illustrates the resulting project traffic volumes associated with the proposed project.

DISTRIBUTION AND ASSIGNMENT
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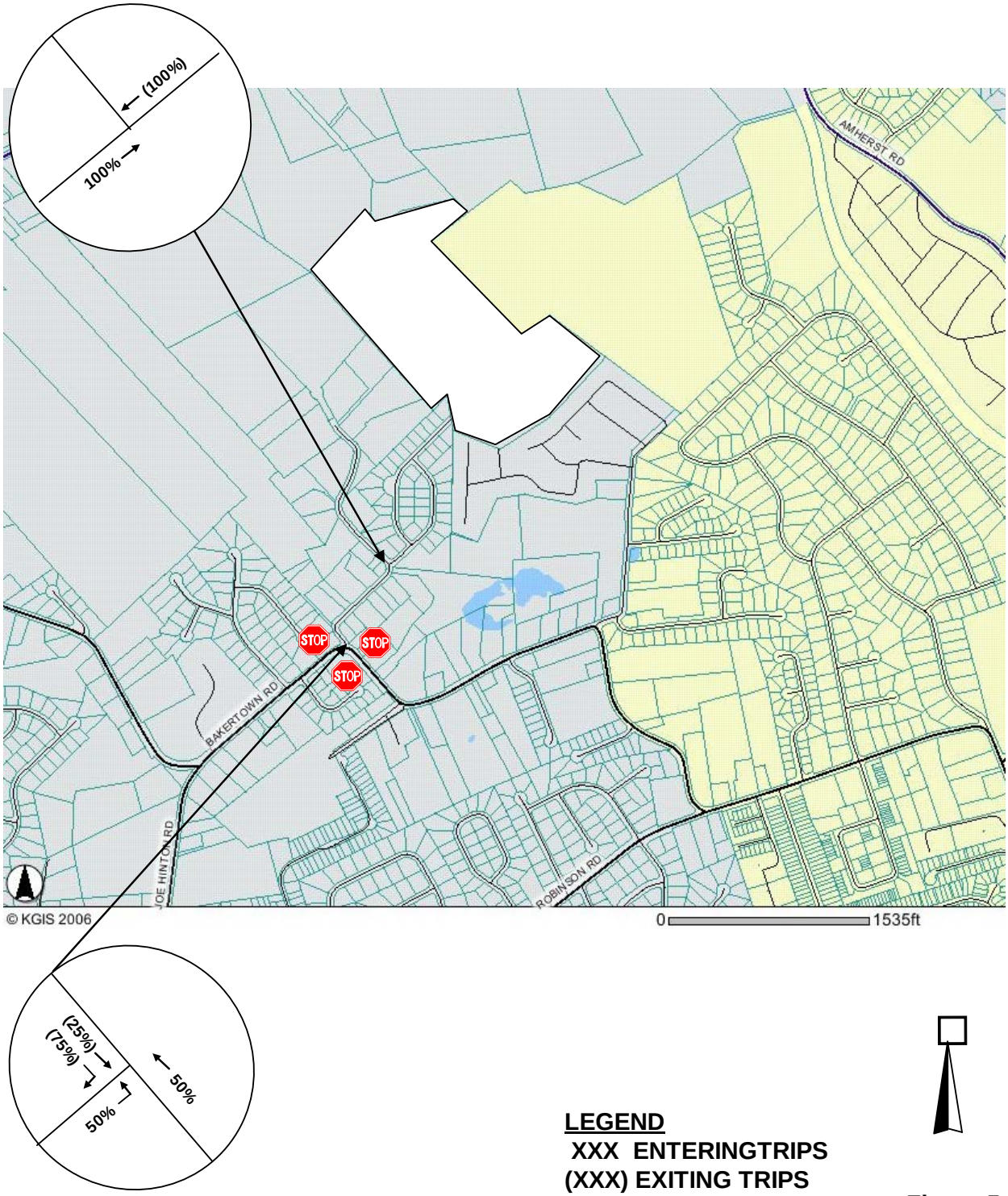

LEGEND
XXX ENTERINGTRIPS
(XXX) EXITING TRIPS

Figure 5

PROJECT TRIPS
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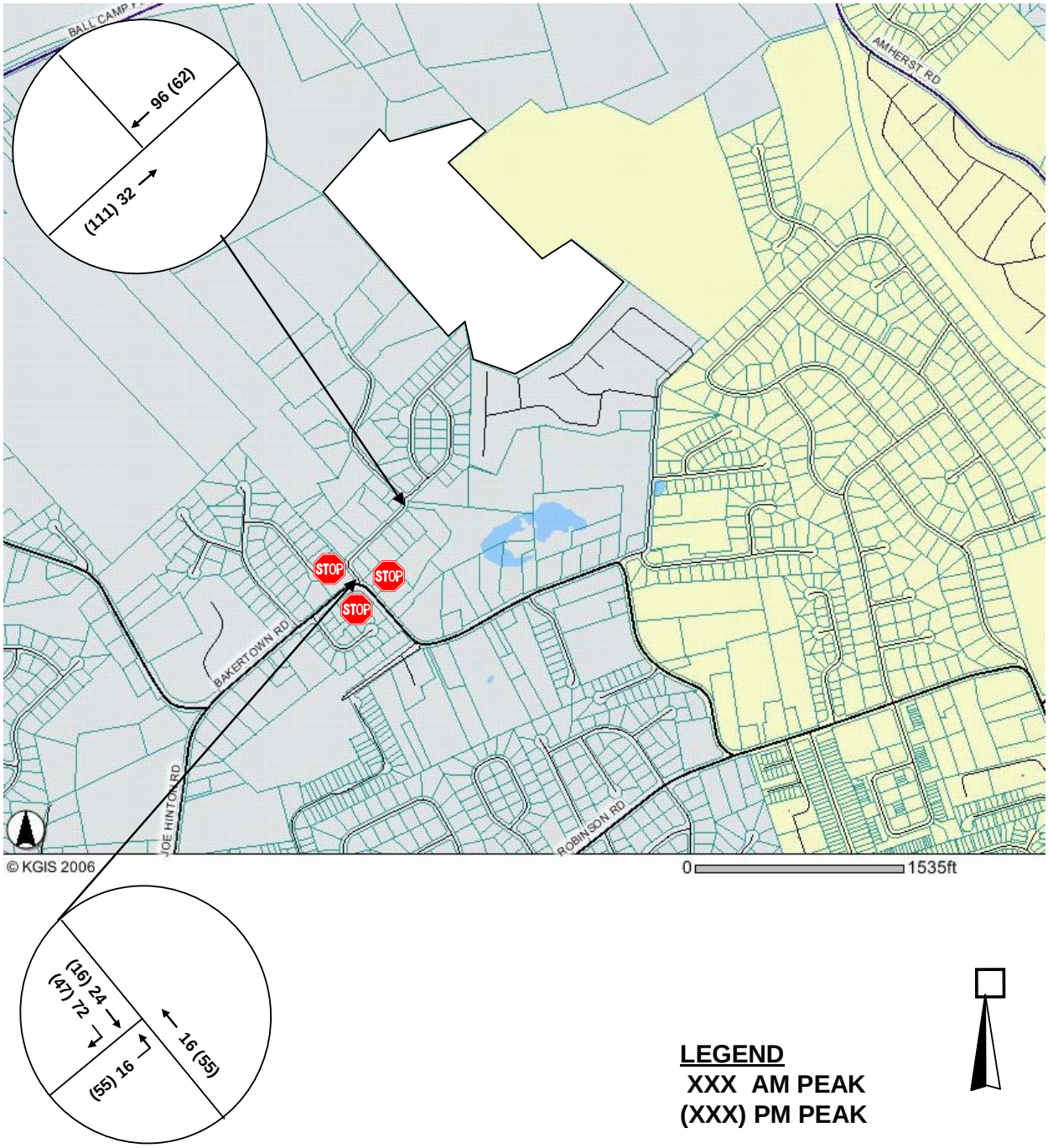

LEGEND
XXX AM PEAK
(XXX) PM PEAK

Figure 6

Total Projected Traffic Volumes

Background and project traffic volumes were added together to develop post-development traffic volumes for the year 2010. Figure 7 illustrates this 2010 projection. Using this projection, mitigation measures including traffic control devices and roadway and intersection geometry can be evaluated. With the low projected traffic volumes, auxiliary lanes for the study intersection would not be required to access the site.

Projected Capacity and Level of Service

The projected traffic was analyzed to evaluate the site impact on the unsignalized study intersections. The summarized analysis is shown in Table 5 and summarized in Table 6. The analyses determined that the intersections accessing this site would continue to operate at very good levels of service.

Sight Distance

The project is proposed to access Sands Lane. The road's speed limit is currently posted for 30mph adjacent to the site. Stopping 15-foot from the edge of pavement, measured sight distance for the proposed subdivision street access is approximately 400 feet looking left and right. The required distance is 200 feet to meet the minimum stopping sight-distance for American Association of State Highway and Transportation Officials (AASHTO) and 300 feet to meet the Knox County minimum corner sight-distance standard. The proposed site access, therefore, meets both criteria to be acceptable for safe operations.

Site Access

Access to the site using Ashridge Road is an extension from a horizontal curve and essentially creates a T-type intersection with Sands Lane to the north being the minor leg or approach. However, the proposed alignment is less than desirable for a T intersection. The adjacent property and unavailable right of way currently precludes a straight alignment between Sands Lane and Ashridge Road; therefore, when right of way becomes available or a southern approach is developed, the intersection should be improved for the through movement between Sands Lane and Ashridge Road. However, until this alignment can be achieved, the intersection of Ashridge Road with Sands Road can operate at an acceptable LOS and with acceptable sight-distance for safe ingress and egress

Current MPC policy requires multiple accesses for residential development in excess of 150 residential units; however, a second access is not currently possible due to available roadway frontage, which is limited to the current proposed access. A stubbed street, however, may be provided for a future connection with an adjacent property, which could become a second access to the subdivision.

2010 PROJECTED TRAFFIC
Brass Lantern Station

LEGEND
XXX AM PEAK
(XXX) PM PEAK

Figure 7

TABLE 5
2010 PROJECTED TRAFFIC
CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL/ APPROACH	PEAK PERIOD	V/C	2010 PROJECTED TRAFFIC	
				DELAY	LOS
Bakertown Road and Sands Lane	STOP EB	AM	_	7.35	A
		PM	_	8.57	A
	STOP NB	AM	_	8.00	A
		PM	_	8.97	A
	STOP SB	AM	_	7.23	A
		PM	_	7.65	A
	INTERSECTION DELAY AND LOS	AM		7.54	A
		PM		8.53	A
Sands Lane and Development Access	STOP EB	AM	0.00	7.40	A
		PM	0.02	7.40	A
	STOP SB	AM	0.01	9.90	A
		PM	0.03	11.00	B
	APPROACH DELAY AND LOS	AM		9.9	A
		PM		11.0	B

Note: Average vehicle delay estimated in seconds, STOP control analyses presented by total minor approaches.

TABLE 6
SUMMARY
CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL/ APPROACH	PEAK PERIOD	V/C	2006 TRAFFIC		2010 BACKGROUND TRAFFIC		2010 PROJECTED TRAFFIC SITE ACCESS)	
				DELAY	LOS	DELAY	LOS	DELAY	LOS
Bakertown Road and Sands Lane	STOP EB	AM	_	6.70	A	6.77	A	7.35	A
		PM	_	7.02	A	7.16	A	8.57	A
	STOP NB	AM	_	7.62	A	7.73	A	8.00	A
		PM	_	7.84		8.00	A	8.97	A
	STOP SB	AM	_	6.64	A	6.63	A	7.23	A
		PM	_	6.79	A	6.86	A	7.65	A
Sands Lane and Development Access	STOP EB	AM	0.00					7.40	A
		PM	0.02					7.40	A
	STOP SB	AM	0.01					9.90	A
		PM	0.03					11.00	B

Note: Average vehicle delay estimated in seconds, STOP control analyses presented by total minor approaches

RECOMMENDATIONS

The analyses conducted and the review of the traffic volumes identified the following recommendations:

- Minimize landscaping, using low growing vegetation, and signing at the proposed street accesses to insure that safe sight distance is maintained.
- Use a minimum intersection radius of 30-foot for the efficient and safe ingress and egress of the site.
- Provide a stub street to an adjacent property for a future second access to the site.
- Consider in the future, when R.O.W is available and/or a southern approach is developed, the improved alignment for the through movement between Sands Lane and Ashridge Road
- Intersection design should conform to the recommended standards and practices of the American Association of State Highway and Transportation Officials, the Institute of Transportation Engineers, and the Knox County Department of Engineering and Public Works.

CONCLUSION

The study of this proposed residential development evaluated the projected traffic conditions. Background traffic was determined using a 4.0-percent compounded growth rate until the year 2010. Traffic associated with the proposed project was then generated and distributed to the proposed site access. Using the identified turning movements for the projected traffic conditions, unsignalized capacity and level of service analyses were conducted using the **2000 Highway Capacity Manual**. Unsignalized levels of service were found to be acceptable for the existing and background traffic conditions with and without the proposed development for the study intersections.

The sight distance for the Ashridge Road is be adequate based on field measurements for a posted speed limit of 30-mph. With the recommendations of this report, the efficient and safe flow of traffic should be maintained.

APPENDIX

Trip Generation

HCS Unsignalized Analyses

Traffic Counts