

SIMONSON

# TRAFFIC IMPACT STUDY

## MAGNOLIA GREEN

Chesterfield County, Virginia

Volume I  
August 1991

Prepared for

**Chesterfield Land Associates  
A Virginia General Partnership**

Prepared by

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**Chapter 1**  
**INTRODUCTION**

## Chapter 1

# INTRODUCTION

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A proposed mixed use development is being planned in western Chesterfield County, Virginia, by Chesterfield Land Associates, a Virginia General Partnership. This proposed major mixed-use development, Magnolia Green, represents the community concept used successfully at Barometrically, Woodlake, and elsewhere. Situated ideally near Route 360 (Hull Street Road) and the proposed extension of Powhite Parkway, Magnolia Green provides a unique setting for both residential and business land uses. Magnolia Green is to be developed according to a Master Plan designed by The Planning & Design Collaborative, Inc., (PDC) to guide the development of a high quality, balanced, and ecologically sensitive new community.

The site, consisting of approximately 3,893 acres, is formed primarily by the watersheds and tributaries of Horsepen and Blackman Creeks. These water areas not only will provide welcome amenities such as lakes and parks for the project--additionally, they will prove beneficial to the overall water quality within the Swift Creek Reservoir. In addition to natural amenities, location is another major quality which makes Magnolia Green an attractive site for a new community. The partially completed Powhite Parkway is a major regional roadway facility connecting the three major metropolitan areas--Richmond, Henrico County, and Chesterfield County--via the interstate system. Powhite Parkway is proposed to be extended south, intersecting Route 360 in the vicinity of the site. The availability of this four-lane, limited access highway is an important part of the Master Plan and a key element in the Chesterfield County Thoroughfare Plan. Powhite Parkway Extension is a major component of the roadway network proposed in the Master Plan, providing another regional access route to the site in addition to Route 360.

Although the existing roadway system can accommodate additional traffic from a substantial amount of new development, it is anticipated that the combined impact of full development of the Master Plan and growth in traffic from other developments would overburden the capacity of the existing roadway network. Thus, the purpose of this study is to:

1. Determine the anticipated traffic generation which will result from development of the site;
2. Evaluate the ability of the adjacent roadways to accommodate the additional traffic volumes; and,

3. Recommend appropriate solutions to mitigate traffic impact on the existing and proposed adjacent highway network resulting from the development and the projected growth in the area by the buildout year.

### **Site Location**

Magnolia Green consists of approximately 4,000 acres located along Route 360 (Hull Street Road) in the vicinity of the proposed Powhite Parkway Extension (Figure 1-1). Magnolia Green is bounded on the west by Moseley Road, on the east by Otterdale Road, and on the south by Route 360.

Direct access to the site will be via two (2) proposed interchanges on Powhite Parkway, two connections at Woolridge and Otterdale Roads, and several access points on Route 360.

### **Scope of Study**

The purpose of this study is to evaluate the impact of traffic generated by full development of Magnolia Green on the existing and proposed adjacent highway network. The scope of the study involved the compilation of available data relative to the immediate environs of the site. It was necessary to analyze a number of interrelated elements in order to assess the traffic needs of the development, as well as the expected impact on the abutting roadways. The following elements were investigated and are discussed in a subsequent chapter of this report:

- Site and Planned Development Characteristics;
- Existing Roadway Characteristics;
- Existing and Planned Transportation System;
- Site Traffic Estimation;
- Anticipated Site Traffic Distribution Patterns;
- Projected Background Traffic Volumes;
- Combined Traffic Volumes;
- Transportation System Capacity Evaluation; and,
- Conclusions and Recommendations.

Information was gathered from Chesterfield County to identify planned development and anticipated growth in the study area. This information is reflected in the background traffic projections.

### **Site and Planned Development Characteristics**

The following is a summary of the proposed land use and access plans for the proposed Magnolia Green.

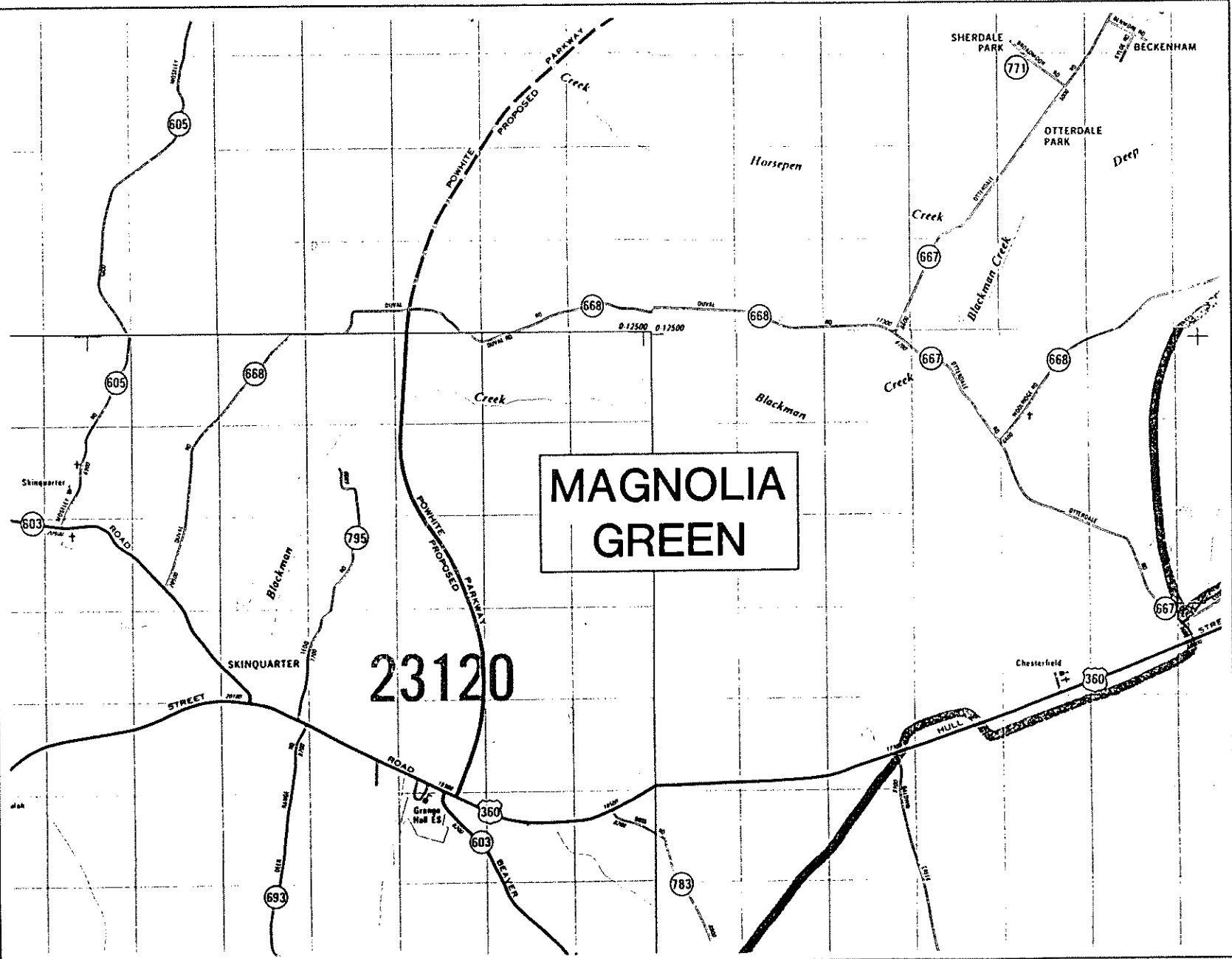
SITE VICINITY MAP

MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA



WILBUR SMITH ASSOCIATES

FIGURE #1-1





Proposed Land Use - Magnolia Green is to be located on a 3,892-acre tract of land along the north side of Route 360 in the vicinity of the proposed Powhite Parkway Extension. The development will ultimately consist of the following:

<u>LAND USE</u>	<u>SIZE</u>
Residential	
Single Family	4,055 Units ✓
Multi-family	1,035 Units ✓
Retail	552,000 S.F. ✓
Office	<del>1,910,000 S.F.</del> ✓ <i>Trip gen table shows only 910,000</i>
Office/Warehouse	320,000 S.F. ✓
Activity Centers	80,000 S.F. ✓

It is anticipated that Magnolia Green will be developed in various phases throughout a 20-year buildout period. The projected phasing schedule utilized in this study was developed by PDC, Inc., in conjunction with the developer, and is included in Appendix A.

Proposed Site Access Plan - A key factor in the successful development of Magnolia Green is viable access systems. These systems, pedestrian as well as vehicular, provide essential links within a community, but also play a role in a network extending the community beyond the limits of the site. The Master Plan process included extensive study of the Chesterfield County Thoroughfare Plan to incorporate Magnolia Green access systems into the Plan's roadway network.

The extension of Powhite Parkway through the site is an important part of the Master Plan and a key element in the County's transportation plan. The County's Transportation Plan proposes the extension of Powhite Parkway from the north at Coalfield Road to run southward in the vicinity of the project site. This roadway is categorized as a limited access highway with a right-of-way requirement of 200 feet. In the vicinity of the project site, the County's Plan designated the intersections of Powhite Parkway Extension with Genito and Duval Roads and Route 360 as potential interchange locations.

To complement the Transportation Plan, the Master Plan proposes the dedication of more than 100 acres in rights-of-way and interchanges on site. An alignment was established that alleviated the negative impacts of a 200' right-of-way required for Powhite Parkway through the center of a residential community while maintaining the County's proposed interchange on Route 360. The master plan recommends




moving the proposed Duval interchange to the site's main parkway to avoid negative impact on the existing residents along Duval Road. The access plan in Figure 1-2 illustrates the Powhite Parkway alignment as well as some 18 miles of new roads to be constructed on site and their relationship with and responsiveness to the County's proposed Thoroughfare Plan. For purpose of this study, site roadway segments have been named to provide ease of reference.

A second element in the access plan is the parkway loop proposed south of Blackman Creek. The parkway loop in Woodlake has proved itself as a powerful organizing and marketing element. Residents like the simplicity of this access scheme. The Master Plan illustrates this loop south of Blackman Creek, shows how residential and other tracts may be accessed from it, and demonstrates how it works with and complements the County's proposed thoroughfare plan such as provision of major east/west and north/south connectors for local traffic through Loop Road "A" and Site Road "G".

It is envisioned that this project's "front door" logically will be Route 360 for the initial phases, and emphasis has been placed on the connector from Route 360 to the loop. It is further envisioned that the expansion and development of the access plan can work as a function of the demands that traffic and growth dictate. The traffic study will be an ongoing project acting as a barometer, guiding the development and construction of the access system during each phase of the project.

SITE ACCESS PLAN

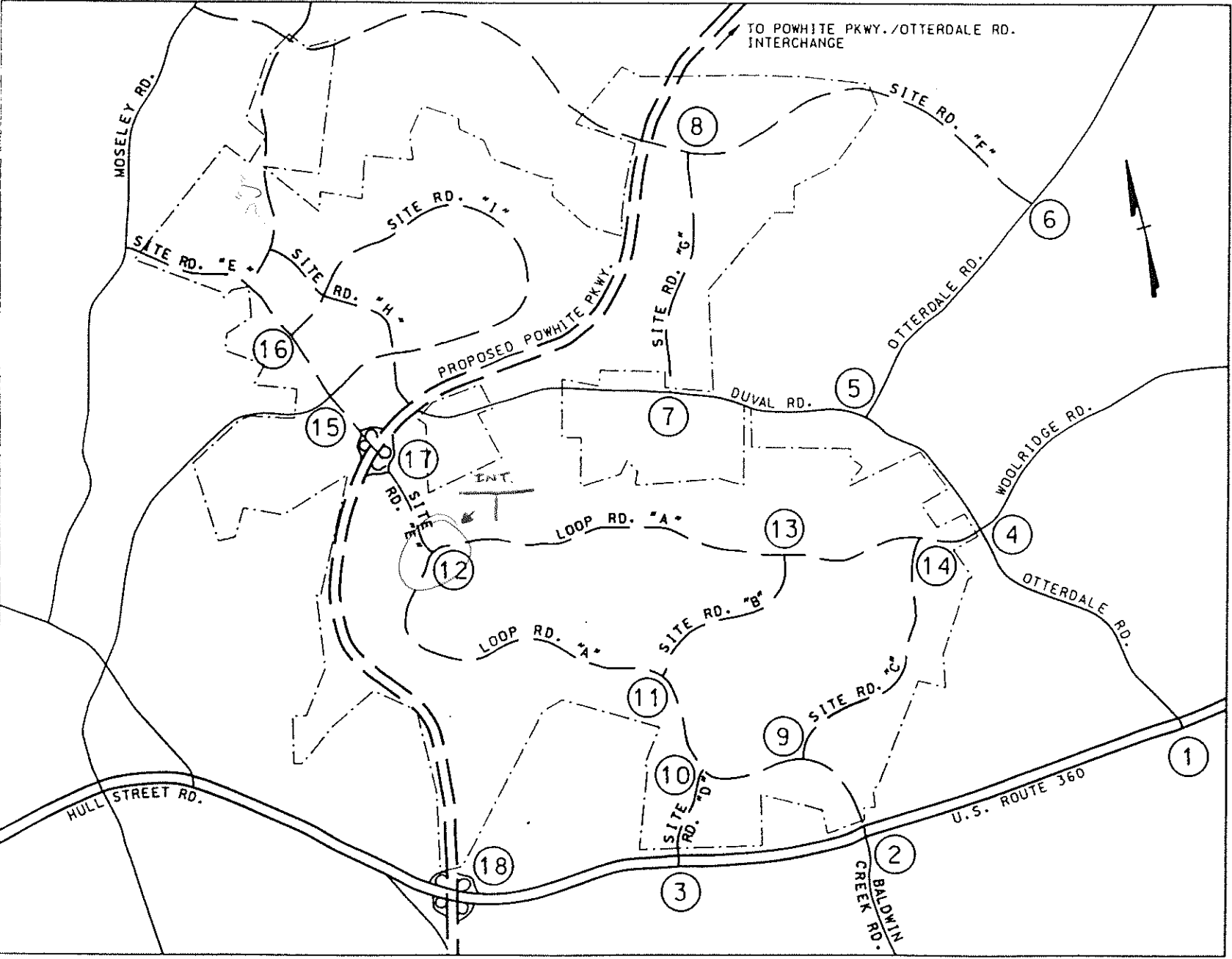
MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

- LEGEND:
-  PROPOSED ROADWAY
  -  EXISTING ROADWAY
  -  STUDY LOCATIONS



WILBUR SMITH ASSOCIATES

FIGURE #1-2



**Chapter 2**

**EXISTING AND PLANNED TRANSPORTATION SYSTEM**

## Chapter 2

# EXISTING AND PLANNED TRANSPORTATION SYSTEM

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The existing and planned roadway systems in the area of Magnolia Green encompass a broad range of roadway types and services. Facilities representing each of the three (3) functional classifications are planned to be presented as follows: Route 360 is the regional primary highway; Woolridge, Otterdale, and Duval Roads are local service secondary roadways with planned improvements to serve as major arterial roadways; and, the proposed extension of Powhite Parkway will be a high-speed, limited-access highway.

The major roadways within the study area of this project are summarized in Table 2-1. The following are brief descriptions of existing roadway characteristics and any projected future roadway improvements for the system. For the purpose of this study, it is assumed that the roadway improvements described below will occur by the buildout time frame of this project.

### Route 360

In the vicinity of the site, Route 360 is a four-lane divided major arterial facility, with a capacity of 37,000 vehicles per day. The current (1989) Virginia Department of Transportation (VDOT) counts show a daily volume of 19,830 on the segment between Route 288 and Skinquarter Road. West of Skinquarter Road, 1989 counts show a daily volume of 10,235. In contrast, the commercially developed segment between City of Richmond and Route 288 was counted at 36,700 vehicles. The Chesterfield County Thoroughfare Plan assigned Route 360 as a major arterial with a right-of-way classification of 120 to 200 feet. The projected (year 2010) daily background traffic volume in the vicinity of the site is 21,000 vehicles, based on the County transportation planning modeling of County-wide planned land uses. Based on this projection, Route 360 will have excess capacity to accommodate a significant portion of Magnolia Green traffic in addition to the projected background traffic volumes.

*4 lane divided, signals > 2 miles apart*

### Woolridge Road

Woolridge Road is an existing two-lane, undivided roadway running in the north/south direction in the vicinity of the site. In its present configuration, Woolridge Road runs from Duval Road northward to terminate at Genito Road. With Woolridge Road characteristics, it is anticipated that a capacity of 15,000 vehicles per day can be obtained without major improvements.

*Capacity of 4 lane divided is only 25,600 with signals less than two miles apart.*

*Capacity of two-lane undivided - 29,200*

Table 2-1

**EXISTING ROADWAY FACILITIES**

**Magnolia Green  
Chesterfield County, Virginia**

<u>FACILITY SEGMENT</u>	<u>PAVEMENT SECTION</u> <sup>(1)</sup>	<u>24-HOUR COUNT</u>	
Route 360			1990
East of Skinquarter Road	4-D	19,830	13,280
West of Skinquarter Road	4-D	10,000	12,490
Woolridge Road	2-U	300	405 ('91)
Otterdale Road	2-U	500	586 ('91)
Duval Road	2-U	300	240 ('91)

- (1) 4-D = Denotes 4-lane divided facilities.  
    2-U = Denotes 2-lane undivided facilities.
- (2) VDOT Traffic Counts (1989).
- (3) Sample peak-hour count projections (1989).

Wilbur Smith Associates (WSA) conducted sample peak-hour counts on Woolridge Road in 1989. Projections from the peak-hour counts yield an existing count of approximately 300 vehicles per day on Woolridge Road. County projections for Woolridge Road are 4,000 vehicles per day in the year 2010. With these projections, Woolridge Road will have the capacity to handle a significant amount of additional traffic.

The County's Transportation Plan proposes Woolridge Road to extend northward to connect with Colonial Highway in the vicinity of Midlothian Turnpike. An interchange is proposed where Woolridge Road and Powhite Parkway Extension intersect. The Thoroughfare Plan proposes Woolridge Road to be a major arterial running in the northeast direction of the County roadway network.

### **Otterdale Road**

Existing roadway characteristics of Otterdale Road are similar to Woolridge Road with the exception that Otterdale is a longer roadway facility. The existing configuration of Otterdale Road includes a roadway segment from Route 360 running in the northwest direction to Duval Road and diverging northward from Duval Road to Midlothian Turnpike. Its two-lane capacity will be approximately 15,000 vehicles per day with a current average daily traffic (ADT) estimation of 500 vehicles. This number is projected by Chesterfield County to increase to 8,000 vehicles per day after 20 years, which indicates that Otterdale Road will have excess capacity to handle additional traffic. These projections assume the roadway network alignments depicted in the Thoroughfare Plan. The Thoroughfare Plan proposes Otterdale Road to be a major arterial facility serving as a connector for traffic north of Midlothian Turnpike and south of Route 360.

29,200

### **Duval Road**

From Woolridge Road toward the west, Otterdale Road becomes Duval Road running through the Magnolia Green property west boundary line. Again, Duval Road is similar to Woolridge and Otterdale Roads in roadway characteristics. Duval Road is a two-lane, undivided road, sparsely populated, running in the east/west direction from Otterdale road, forming a semi-circle with its connection at Skinquarter Road.

Peak-hour counts conducted by WSA in 1989 revealed that Duval Road has similar traffic volumes as Woolridge Road with a projected ADT of approximately 300 vehicles per day. The County's projection for Duval Road in the year 2010 is 4,000 vehicle trips per day. As in the case of Woolridge and Otterdale Roads, Duval Road in its present configuration will have excess capacity to handle additional traffic. Duval Road is proposed to be a major east/west arterial roadway on the Thoroughfare Plan.

**Chapter 3**  
**TRAFFIC PROJECTIONS**



## Chapter 3

# TRAFFIC PROJECTIONS

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An evaluation of anticipated traffic impact on the adjacent roadway network requires an estimation of site-generated traffic volumes, which then are superimposed on the projected future local traffic volumes. These combined volumes are used to test the adequacy of the adjacent roadway network. This chapter summarizes the methodologies used to determine the projected traffic volumes. Due to the scale of this project, the site is divided into two areas, with Area 1 comprising the site area south of Blackman Creek and Area 2 comprising the site area north of the creek (see Figure 3-1).

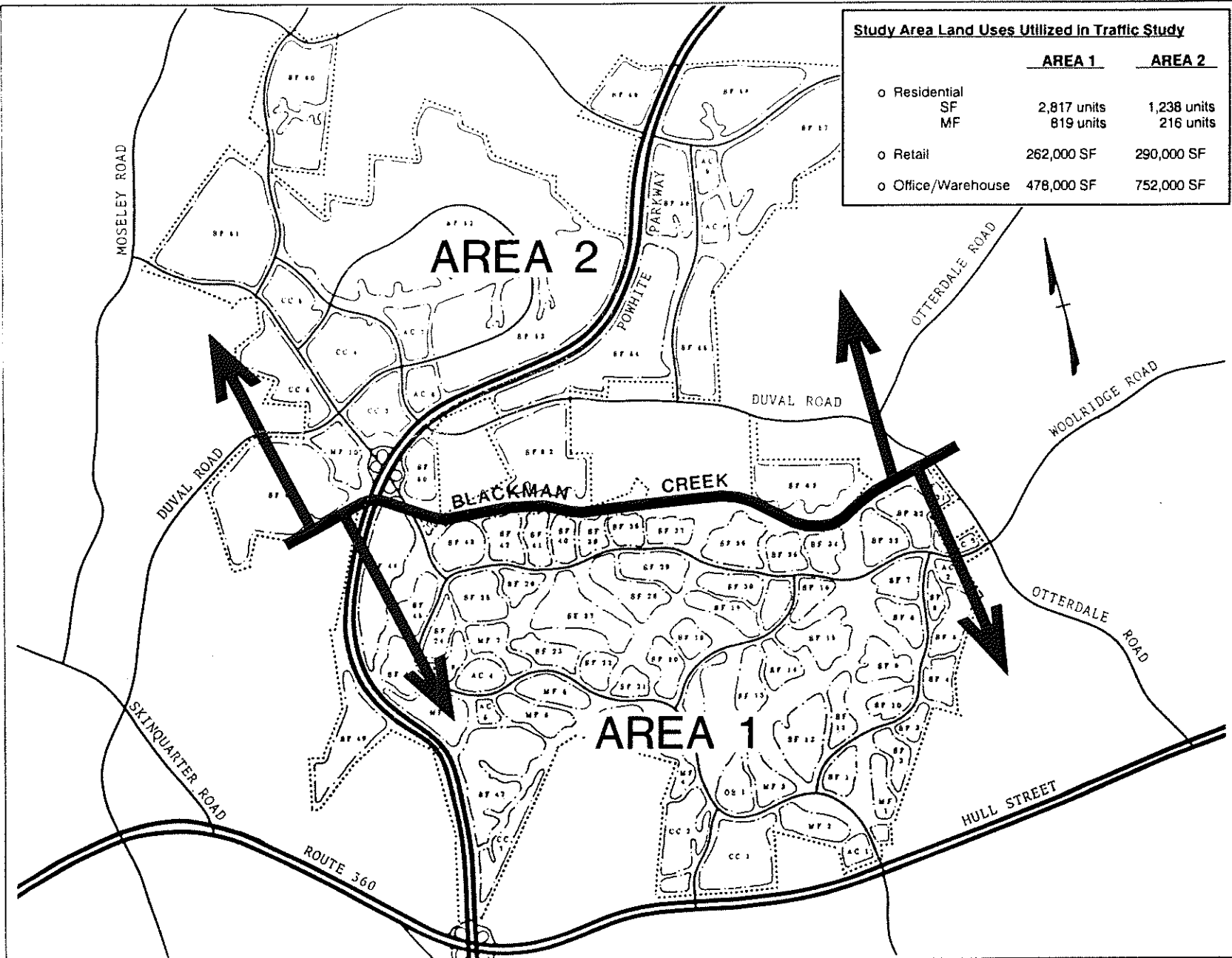
### Site Traffic Estimation

Traffic impact is determined by estimating the total number of daily vehicle trips as well as the number of peak-hour vehicle trips. Estimates of traffic volumes anticipated to be generated by Magnolia Green were calculated by applying regression equations to the land use types and sizes proposed for the development. Trip generation equations used for Magnolia Green are those published in the Institute of Transportation Engineers' (ITE) Trip Generation, 5th Edition. Magnolia Green is anticipated to consist of a mixture of land uses, including office, residential, and retail. The following summarizes the methodologies of internal and external trip generation for Magnolia Green.

External Trip Generation - It should be noted that for retail establishments, a percentage of these trips are "captured" or "passby", while others are "new" or "primary" vehicle trips. Facilities such as retail establishments, certain types of restaurants, banks, and convenience markets attract traffic from the passing stream of traffic. When this phenomenon occurs, there are three categories of trips involved:

- primary or new trips;
- diverted linked trips; and,
- passby trips.

A diverted linked trip, or passby trip, is one in which the shopping destination is a secondary part of the primary trip, such as work-to-shopping-to-home. The diverted linked trip involves a route diversion from one roadway to another to reach a retail facility.



**Study Area Land Uses Utilized in Traffic Study**

	AREA 1	AREA 2
o Residential		
SF	2,817 units	1,238 units
MF	819 units	216 units
o Retail	262,000 SF	290,000 SF
o Office/Warehouse	478,000 SF	752,000 SF

**STUDY AREA DESIGNATION**

MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

NOTE:  
AREA 1 DESIGNATES SITE AREA SOUTH OF BLACKMAN CREEK.  
AREA 2 DESIGNATES SITE AREA NORTH OF BLACKMAN CREEK.



WILBUR SMITH ASSOCIATES

FIGURE #3-1

No pass-by used. OK

The passby trips come directly from the traffic stream passing the facility on the adjacent street system (e.g., Powhite Parkway, Route 360) and do not require a diversion from another roadway. Data from 45 retail centers were gathered by the Institute of Transportation Engineers (ITE) to quantify the passby trips for the average P.M. peak conditions. According to this data base, illustrated in the ITE Trip Generation, 5th Edition, each retail development of 200,000 square feet will have a passby percentage of 35%. This means that 35% of the evening peak-hour shopping center-oriented vehicle trips already are on the adjacent roadway system. However, this study will not directly utilize a passby adjustment, thereby reflecting a conservative approach (i.e., higher site traffic assignment onto adjacent roadways).

Another phenomenon associated with a planned development such as Magnolia Green is the "capture" of site traffic between interrelated land uses, such as residential, retail, office, and recreational. For Magnolia Green, the majority of the neighborhood retail land uses will serve the proposed 5,000 residential units within the site. Thus, a portion of traffic anticipated to be generated by the retail land uses already will be onsite and will be generated under the residential usage.

Based on issues discussed above, the Chesterfield County Transportation Department recommended the percentage trip reductions shown in Table 3-1. These percentage reductions were based on County experience from other developments in Chesterfield County. The land uses utilized in this table are those proposed by the Master Plan, with the exception of several activity centers located on the site. These centers will contain the project's amenities, including clubhouses and recreational facilities. In addition, the residential land uses reflect the maximum residential units to be developed on site. It is anticipated that this figure will decrease somewhat due to several land parcels designated as potential school sites, and thus may not be developed as residential land uses. Therefore, the land uses utilized in this study will provide a "worst case" scenario. Table 3-1 summarizes the projected external site traffic anticipated to be generated by Magnolia Green. Based on the land uses listed in Table 3-1, it is estimated that approximately 65,853 daily trips from Magnolia Green will be assigned onto the adjacent off-site roadway network. This is approximately a 20% reduction in the total trips anticipated to be generated by the land uses, with the exception of several activity centers.

Another way to quantify this trip reduction is to look at the components of the daily residential trips. Based on past data, a single-family residential unit will generate approximately 10 vehicle trip ends per day. The 10 daily trips generally consist of the following trip purposes: work, personal business, school, recreation, social, shopping, and other miscellaneous purposes. Data from a 1985 survey of the Richmond regional area yield the results shown in Appendix Table B-1.

All uses should be totalled, and then trip generation. Capture rate for High (15%)

Table 3-1  
LAND USE AND TRIP GENERATION  
Individual Usage W/ Trip Reduction  
Magnolia Green

	AREA I	AREA II	TOTAL
SF	2,817	1,238	4,055
MF	819	216	1,035
Retail	262k	299k	562k
Office	478k	432k	910k
Office/Warehouse	0	320k	320k

LAND USE	ITE LAND USE CODE	UNIT OF MEASUREMENT	TOTAL 24-HOUR TRIPS	AM PEAK HOUR					PM PEAK HOUR					
				Total AM Trips	Entering Trips		Exiting Trips		Total PM Trips	Entering Trips		Exiting Trips		
					%	Number	%	Number		%	Number	%	Number	
<b>AREA 1:</b>														
Residential -														
Single Family	210	2,817 Units (7.93)	22,335	1,458	26	379	74	1,079	2,193 ✓	65	1,425	35	768	
Multi Family	230	819 Units (6.49)	5,319	406	24	97	76	309	449 ✓	64	287	36	162	
Subtotal		3,636 Units	27,654	1,864		476		1,388	2,642		1,712		930	
Subtotal (w/ 10% Capture)			2,889	1,678		428		1,249	2,378		1,541		837	
Retail	820	12,000 SF	1,878	47	63	30	37	17	170 ✓	50	85	50	85	
Retail	820	250,000 SF	12,530	279	63	176	37	103	1,176 ✓	50	588	50	588	
Subtotal		262,000 SF	14,408	326		206		120	1,346		673		673	
Subtotal (w/ 35% Capture)			9,365	212		134		78	1,211		437		437	
Office	710	478,000 SF	4,579	644	89	573	11	71	589 ✓	17	100	83	489	
Office/Warehouse														
Office - 30%	710	0 SF	0	0	89	0	11	0	0	17	0	83	0	
Warehouse - 70%	150	0 SF	0	0	72	0	28	0	0	35	0	65	0	
Subtotal		478,000 SF	4,579	644		573		71	589		100		489	
Subtotal (w/ 10% Capture)			4,121	580		516		64	530		90		440	
<b>AREA 1 TOTAL</b>			<b>38,375</b>	<b>2,469</b>		<b>1,078</b>		<b>1,391</b>	<b>4,119</b>		<b>2,068</b>		<b>1,715</b>	

10

15% for retail.

Table 3-1 (cont.)

LAND USE AND TRIP GENERATION  
Individual Usage W/ Trip Reduction  
Magnolia Green

39,479  
35  
TOT RPT

LAND USE	ITE LAND USE CODE	UNIT OF MEASUREMENT	TOTAL 24-HOUR TRIPS	AM PEAK HOUR					PM PEAK HOUR					
				Total AM Trips	Entering Trips		Exiting Trips		Total PM Trips	Entering Trips		Exiting Trips		
					%	Number	%	Number		%	Number	%	Number	
<b>AREA 2:</b>														
Residential -														
Single Family	210	1,238 Units	10,474	715	26	186	74	529	1,045 ✓	65	679	35	366	
Multi-Family	230	216 Units	1,359	109	24	26	76	83	130 ✓	64	83	36	47	
Subtotal		1,454 Units	11,833	824		212		612	1,175		762		413	
Subtotal (w/ 10% Capture)			10,650	742		191		551	1,058		686		372	
Retail	820	250,000 SF	12,530	279	63	176	37	103	1,176 ✓	50	588	50	588	
Retail	820	40,000 SF	3,986	95	63	60	37	35	366 ✓	50	183	50	183	
Subtotal		290,000 SF	16,516	374		236		138	1,542		771		771	
Subtotal (w/ 35% Capture)			10,735	243		153		90	1,002		501		501	
Office	710	432,000 SF	4,242	595	89	530	11	65	546 ✓	17	93	83	453	
Office/Warehouse														
Office - 30%	710	96,000 SF	1,361	185	89	165	11	20	180 ✓	17	31	83	149	
Warehouse - 70%	150	224,000 SF	1,167	165	72	119	28	46	184 ✓	35	64	65	120	
Subtotal		752,000 SF	6,770	945		814		131	910		188		722	
Subtotal (w/ 10% Capture)			6,093	851		733		118	819		169		650	
<b>AREA 2 TOTAL</b>			<b>27,478</b>	<b>1,835</b>		<b>1,077</b>		<b>758</b>	<b>2,879</b>		<b>1,356</b>		<b>1,523</b>	
<b>AREA 1 &amp; 2 TOTAL</b>			<b>65,853</b>	<b>4,304</b>		<b>2,155</b>		<b>2,150</b>	<b>6,998</b>		<b>3,424</b>		<b>3,237</b>	

- Notes: 1. Traffic generation based on ITE 5th Edition Trip Generation.  
 2. Tracts SF 47 and CC 7 are excluded from this trip table due to access issues.  
 3. The following commercial usages are excluded from this trip table per Chesterfield Co.'s concurrence:  
 o Tracts: AC 3, AC 4, AC 6, and AC 9.

Based on the characteristics of land uses proposed to be developed in Magnolia Green, WSA assigned a portion of each trip purpose to two (2) categories--internal to Magnolia Green or external to Magnolia Green (Table 3-2). Internal to Magnolia Green trips are those "captured" or which interact within the boundaries of Magnolia Green. External to Magnolia Green trips are those that will travel beyond the site onto the adjacent off-site roadway network. It is estimated that approximately 48% of residential trips generated by Magnolia Green will remain onsite on an average day. This is due to the inherent characteristics of a major mixed-use community. Due to the significant size of Magnolia Green and the fact that alternate destinations (work, shopping, home, etc.) are substantial distances from Magnolia Green, many residents probably will elect to work and shop within the community.

Magnolia Green is planned so that the land uses complement one another. There will be special amenities within the project site, such as retail and recreational facilities that will be utilized by many of the residents of Magnolia Green. In addition, the significant retail, office, and office/warehouse uses in the project will provide a good source of employment opportunities for Magnolia Green residents, thus maintaining some of the residential work trips onsite. If the trip-end assignments of Table 3-2 are used, the internal and external traffic allocations are similar to those shown in Appendix Table B-2, which indicates approximately 30% of site traffic (including those generated by activity centers) will be internal or "captured" on the site. This percentage of capture is not unreasonable based on data from other studies.

Data from other studies have indicated that a "planned unit development" such as Magnolia Green can have "captured" trips in the 50% range. The Brandermill PUD Traffic Generation Study, prepared by JHK and Associates, determined capture rates for trips between retail/residential and office/residential land uses. The study determined that over 45% of daily and peak-hour trips were captured within the current Brandermill development. These findings are documented in the ITE Trip Generation, 5th Edition, and are included in Appendix B.

In compliance with Chesterfield County's direction, this study utilizes the external trip generation shown on Table 3-1 to determine the external roadway improvement required by the traffic demands of Magnolia Green and the growth in background traffic.

Internal Trip Generation - As mentioned previously, Table 3-1 reflects approximately 20% overall trip reduction instead of 30% as shown in Appendix Table B-2, due to the omission of activity centers. To account for the additional internal trips on the internal roadway network, capacity analyses of these internal intersections will be analyzed with a 20% increase in the projected external site traffic. This will provide an additional safety measure to ensure that the site roads will not be underdesigned.

Table 3-2

ESTIMATED DAILY RESIDENTIAL TRIP ENDS  
Magnolia Green, Chesterfield County

TRIP PURPOSE (1)	TRIP ENDS		
	TOTAL TRIP ENDS (2)	INTERNAL TO MAGNOLIA GREEN	EXTERNAL TO MAGNOLIA GREEN
● Work	2.6	0.8	1.8
● Personal Business	1.3	0.6	0.7
● School	1.2	1.0	0.2
● Recreation	1.0	0.6	0.4
● Social	0.9	0.6	0.3
● Shopping - Convenience	1.0	0.9	0.1
● Shopping - G.A.F.	0.6	0.1	0.5
● Miscellaneous	1.4	0.2	1.2
	10.0	4.8	5.2

(1) SOURCE: Trip purpose by percent, from "Major Thoroughfare Plan  
Richmond Regional Area, 1985 Update and Plan Evaluation".

(2) Daily trip ends of the average 10.0 trips per day per dwelling unit.

MG2

It is anticipated that increasing the projected external trips by 20% will be more than adequate to account for internal traffic on all internal roadway links. The basis of this conclusion is the travel characteristics of these internal trips. The increase in traffic projections is to account for internal to internal trips such as home to neighborhood shopping, home to recreation, work to recreation, and home to social purposes.

Thus, it is reasonable to assume that the travel patterns for these trips will be in areas adjacent to each other instead of distributed throughout the internal roadway network. For example, a home to recreation purpose trip likely will not travel through the whole roadway network to recreational facilities on the other side of the development if there are adjacent recreational facilities. In addition, the majority of these type trips likely will be generated during off-peak hours when there will be less traffic on the site roads. Therefore, by increasing the internal traffic on all internal roadway links by 20%, this study assumes that the adjusted internal traffic more than adequately can account for any internal to internal trip activities.

### **Anticipated Site Traffic Distribution Patterns**

Directional distribution analysis for Magnolia Green was performed in 1989 and was approved by the Chesterfield County Transportation Department. This document is included in Appendix C. A summary of the three major land-use directional distributions is shown in Table 3-3. The majority of traffic is anticipated to be attracted to and from the east (inclusive of Otterdale and Woolridge Roads and Route 360).

These distributions will be used to assign traffic to the key intersections of the surrounding roadway network, based on location of each land use. Intersection distribution assignments are shown on Figures 3-2 to 3-7 for each of the major land use categories and in Areas 1 and 2.

### **Projected Site Traffic Volumes**

Based on distribution percentages shown in previous figures, site traffic is assigned onto the internal and external roadway systems. These site traffic volumes reflect the adjusted traffic, as shown in Table 3-1. Figures 3-8 and 3-9 summarize the site traffic assignment. Traffic assigned to internal study location numbers 8, 9, 10, 11, 12, 13, 14, 15, and 16 (shown on Figure 1-2) will be increased 20% to reflect the internal to internal traffic activities prior to performance of capacity analysis.



Table 3-3

DIRECTIONAL SITE TRAFFIC DISTRIBUTION  
Magnolia Green Development

LAND USE	NORTH	SOUTH	EAST			WEST
	Powhite Pkwy	Powhite Pkwy	Woolridge Rd	Otterdale Rd	Rte 360	Rte 360
AREA 1 ✓						
Office	34	4	8	8	44	2 ✓
Retail	23	7	20	13	35	2 ✓
Residential	35	4	8	8	44	1 ✓
AREA 2 ✓						
Office	40	4	5	11	38	2 ✓
Retail	30	7	15	18	28	2 ✓
Residential	28	4	5	23	39	1 ✓

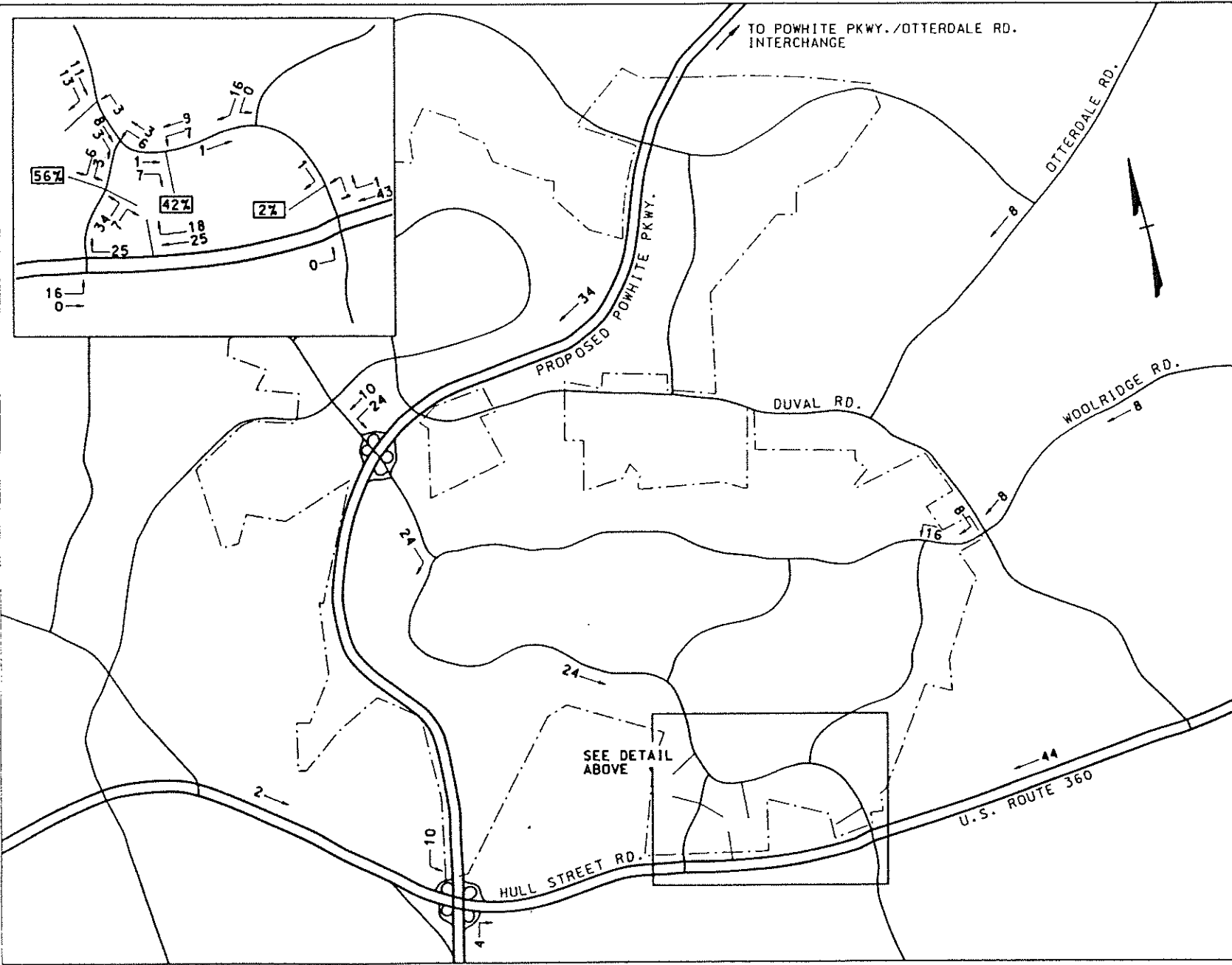
NOTE: Area 1 is south of Blackman Creek.  
Area 2 is north of Blackman Creek.

SOURCE: Based on census data provided by Richmond Regional Planning District Commission (RRPDC), Chesterfield County Planning Department and Land Design Research (LDR).

8-14-91







PERCENT ENTERING SITE  
TRAFFIC DISTRIBUTION  
AREA #1 - OFFICE

MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

OK  
S

- NOTES:
1. AREA 1 DESIGNATES SITE AREA SOUTH OF BLACKMAN CREEK.
  2. ASSUME PERCENT EXITING SITE TRAFFIC EQUALS PERCENT ENTERING SITE TRAFFIC.



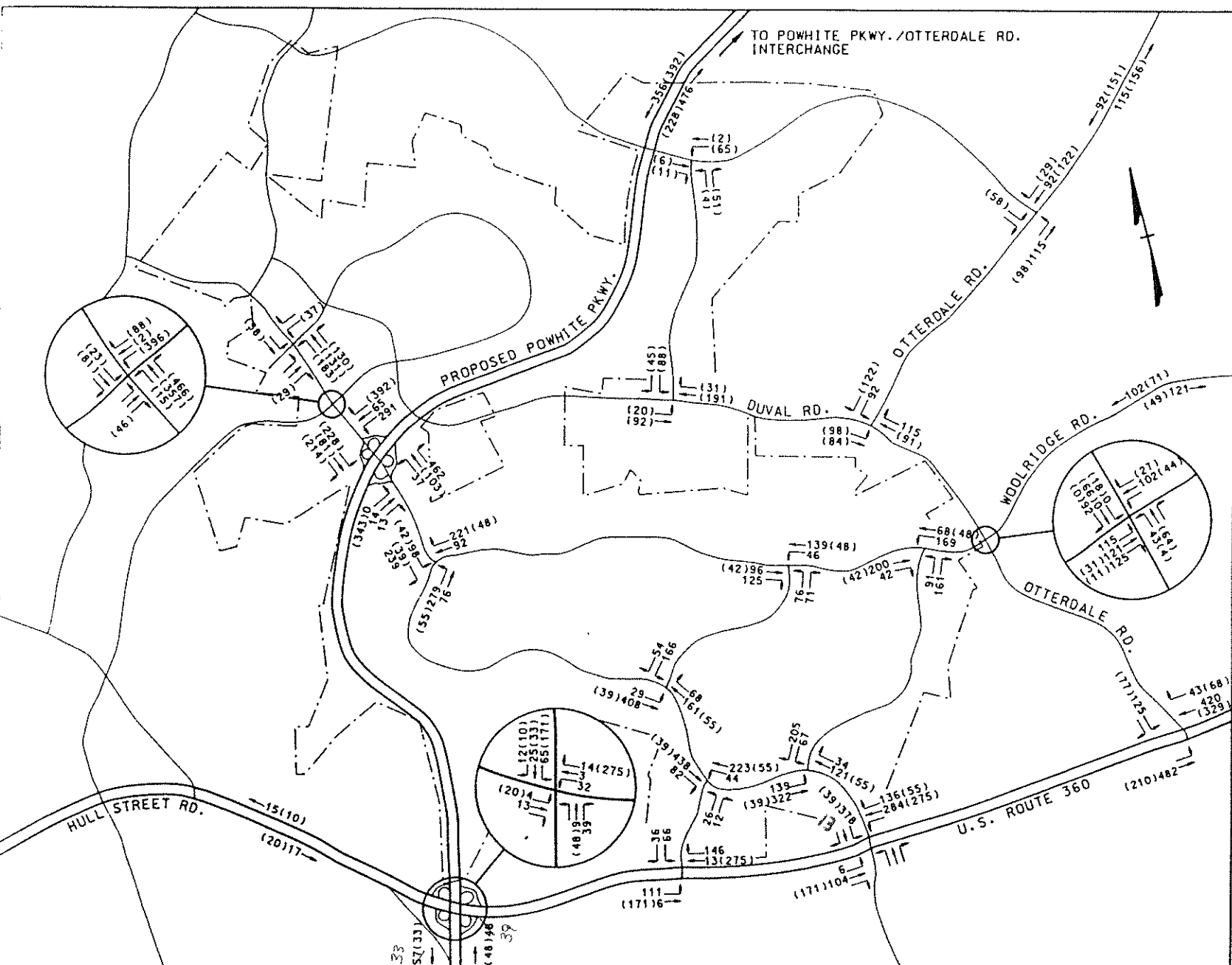
WILBUR SMITH ASSOCIATES

FIGURE #3-4









PROJECTED SITE  
 TRAFFIC VOLUMES  
 AM PEAK HOUR - 2010

MAGNOLIA GREEN  
 CHESTERFIELD CO.  
 VIRGINIA

OK

LEGEND:  
 OO = AREA 1 TOTAL AM  
 (OO) = AREA 2 TOTAL AM



WILBUR SMITH ASSOCIATES

FIGURE #3-8



PROJECTED SITE  
TRAFFIC VOLUMES  
PM PEAK HOUR - 2010

MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

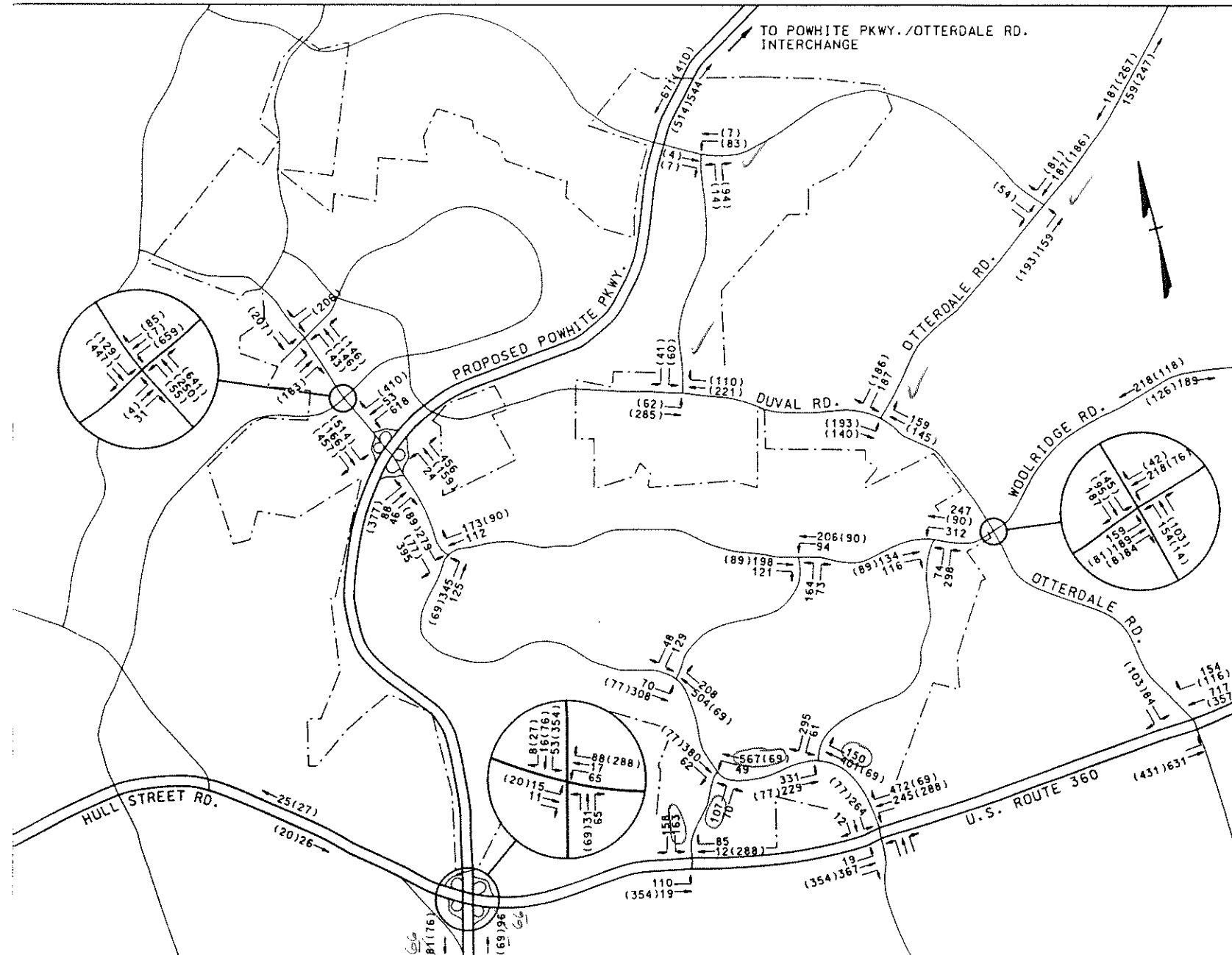
OK

LEGEND:  
00 = AREA 1 TOTAL PM  
(00) = AREA 2 TOTAL PM



WILBUR SMITH ASSOCIATES

FIGURE #3-9



### **Projected Background Traffic Volumes**

For purposes of this traffic study, it is anticipated that full development of Magnolia Green will be carried out in several phases and completed by the year 2010. To evaluate the impact of the development on the surrounding roadway network, it is necessary to determine background (non-site) traffic for the year 2010.

Currently, Chesterfield County has a transportation model of the County-wide roadway network and planned land uses. Utilizing this model, Chesterfield County has provided a set of background traffic projections on the adjacent roadway system. These projections show the projected ADT on Route 460, Powhite Parkway Extension, and Otterdale, Duval, and Woolridge Roads, and are summarized in Figure 3-10. These background projections are based on the site being vacant.

WSA converted these ADT projections into peak-hour turning movements by using the following County assumptions:

D = 10%; and,  
K = 40/60% split.

To maintain consistency in carrying the background traffic through the roadway network, certain roadway segments require slight variances from the above assumptions. Figures 3-11 and 3-12 summarize the projected 2010 background traffic on the area roadway network during peak hours which is the result of a joint effort between WSA and Chesterfield County Transportation Department. It is anticipated that these projections are somewhat on the high side, specifically the roadway segment extending from Woolridge Road to west of the proposed interchange on Site Road "E". Again, this provides a conservative measure in designing the roadway systems.

### **Combined Traffic Volumes**

To determine total traffic demand in the study area at full development of Magnolia Green, it is necessary to superimpose site and non-site traffic projections. These projections then will be used to test the adequacy of the existing and proposed roadway network in accommodating both Magnolia Green traffic and traffic from other local developments. Figures 3-13 and 3-14 depict the total traffic demand in 2010 for the study site.

PROJECTED BACKGROUND  
TRAFFIC VOLUMES  
AVERAGE DAILY  
TRAFFIC - 2010

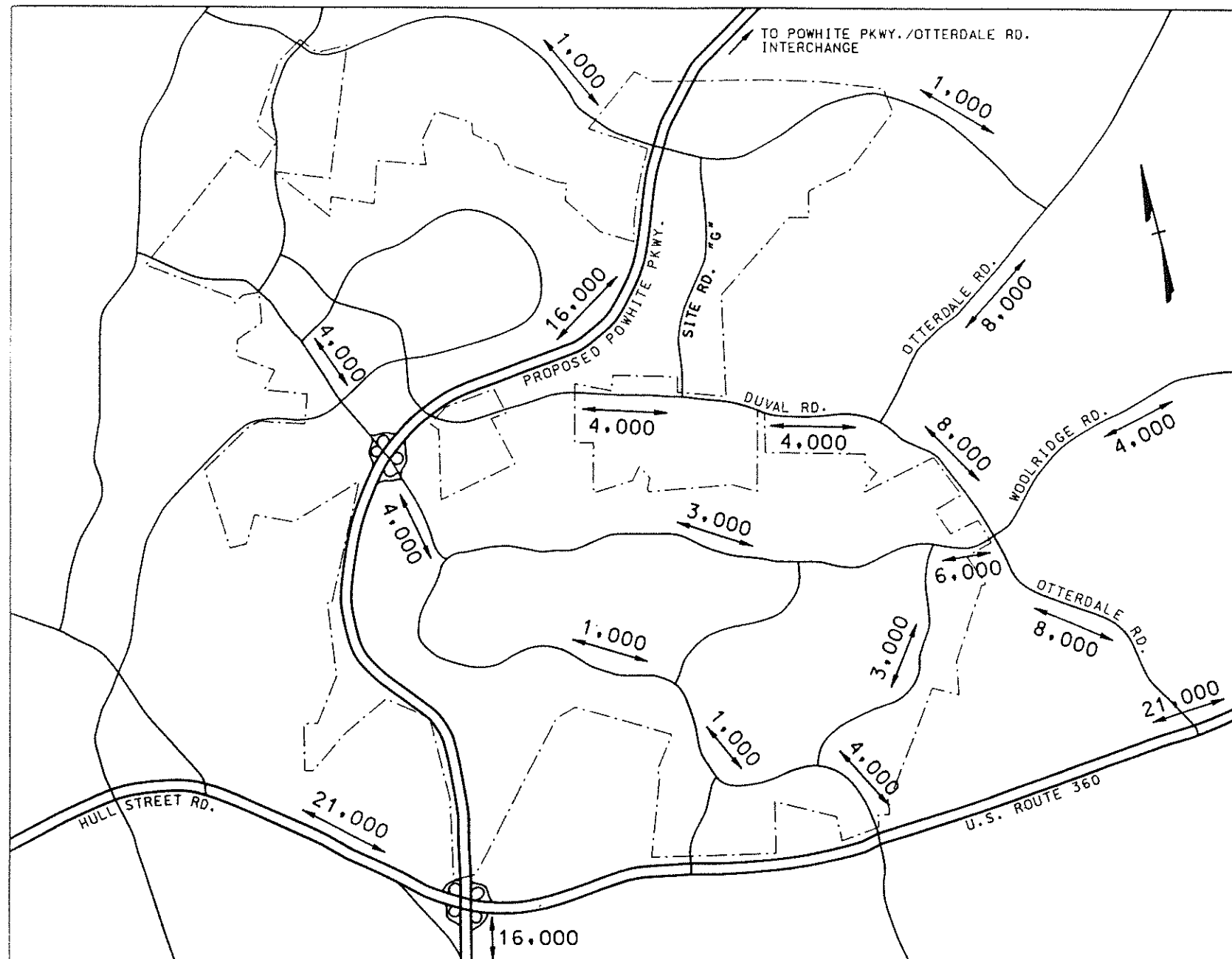
MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

OK



WILBUR SMITH ASSOCIATES

FIGURE #3-10



PROJECTED BACKGROUND  
TRAFFIC VOLUMES  
AM PEAK HOUR - 2010

MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

OK

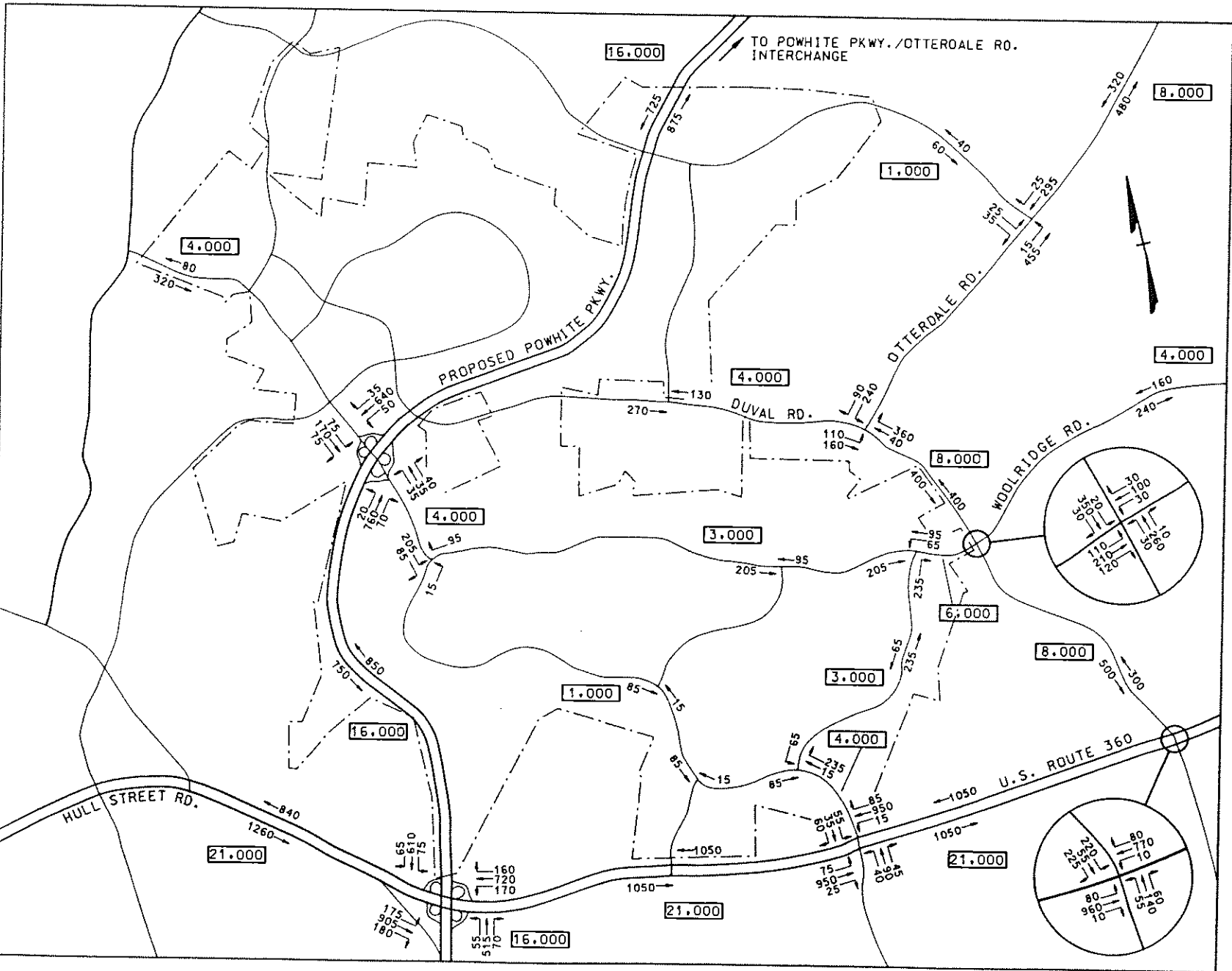
LEGEND:

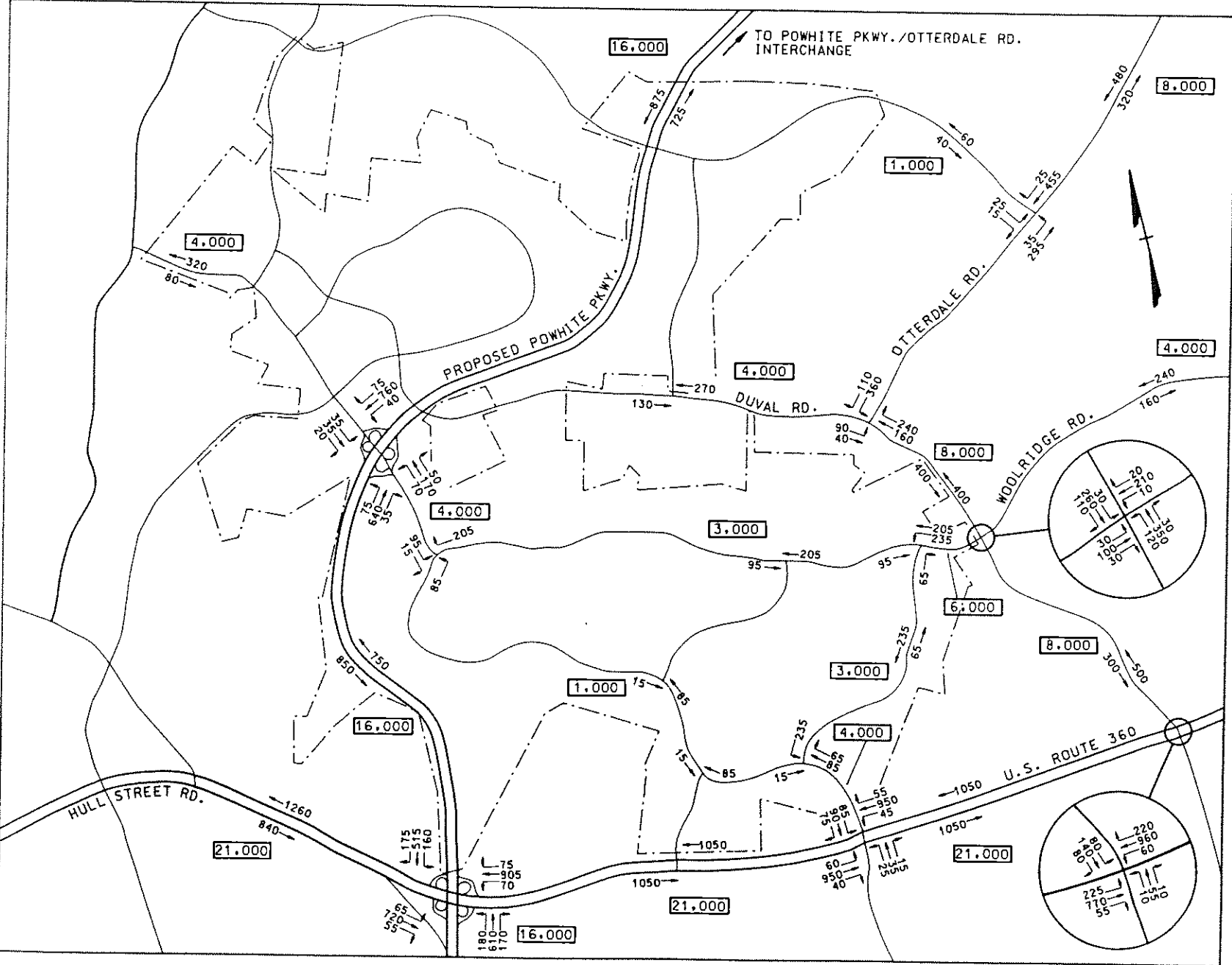
1,000 = PROJECTED ADT



WILBUR SMITH ASSOCIATES

FIGURE #3-11





PROJECTED BACKGROUND  
TRAFFIC VOLUMES  
PM PEAK HOUR - 2010

MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

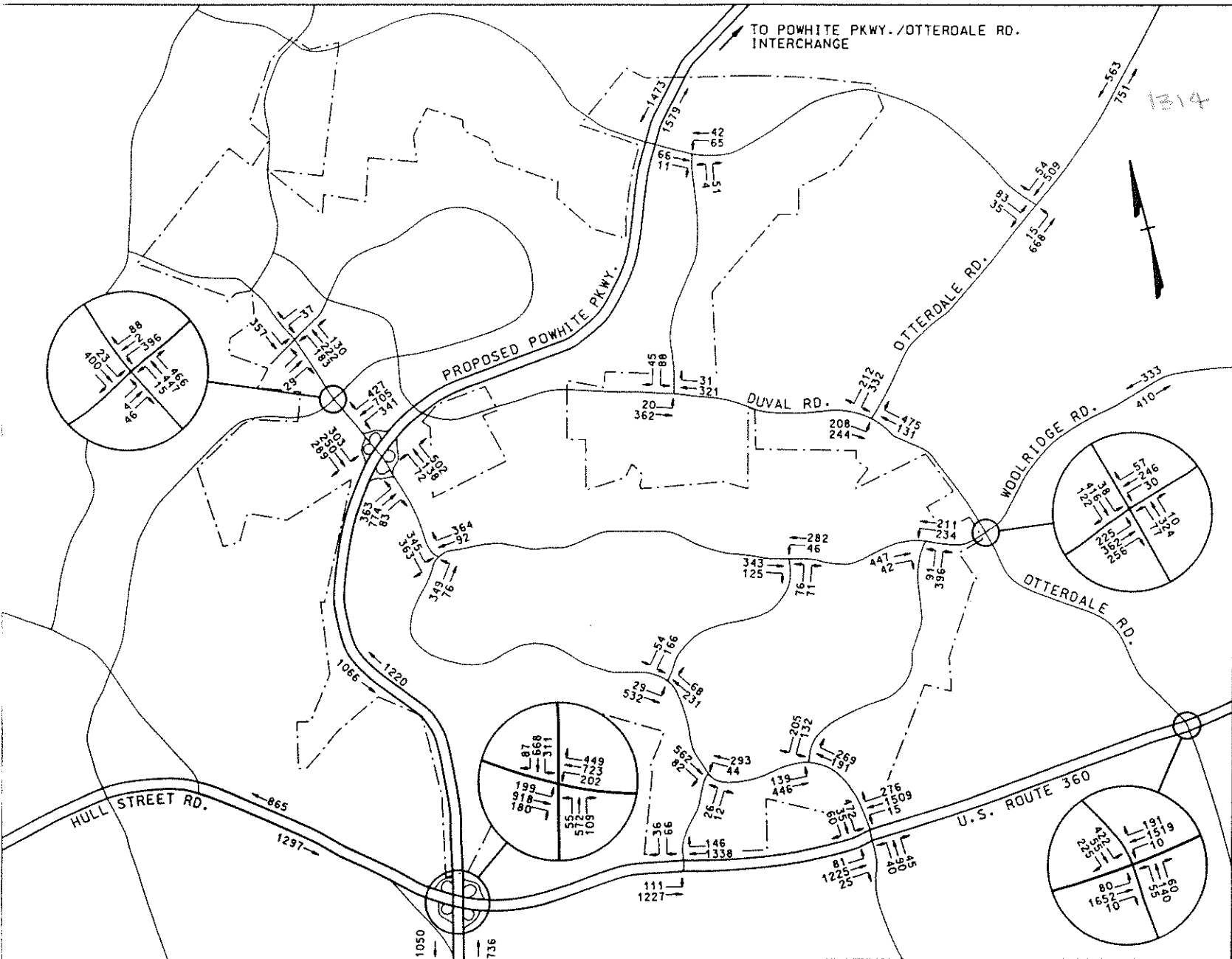
OK

LEGEND:  
[1,000] = PROJECTED ADT



WILBUR SMITH ASSOCIATES

FIGURE #3-12



PROJECTED TOTAL  
TRAFFIC VOLUMES  
AM PEAK HOUR - 2010

MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

OK  
/



WILBUR SMITH ASSOCIATES

FIGURE #3-13



**Chapter 4**

**TRANSPORTATION CAPACITY SYSTEM EVALUATION**



## Chapter 4

# TRANSPORTATION SYSTEM CAPACITY EVALUATION

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To determine the operating conditions of the internal and external roadway networks, capacity analysis was performed for the study locations based on planned and proposed roadway networks. Site traffic assigned to the roadway network was superimposed upon year 2010 background traffic to derive the total year 2010 traffic demand. These volumes then were used to analyze traffic conditions at key intersections.

Traffic conditions for the year 2010 were determined based on the recommended roadway characteristics shown on Figure 4-1. Roadway improvements shown on Figure 4-1 provide a solution to mitigate both local and site traffic projected for the year 2010, based on total traffic demand. This study will not address the sole impact of Magnolia Green traffic on the adjacent roadway network without background traffic. The roadway assumptions utilized for this study include the following:

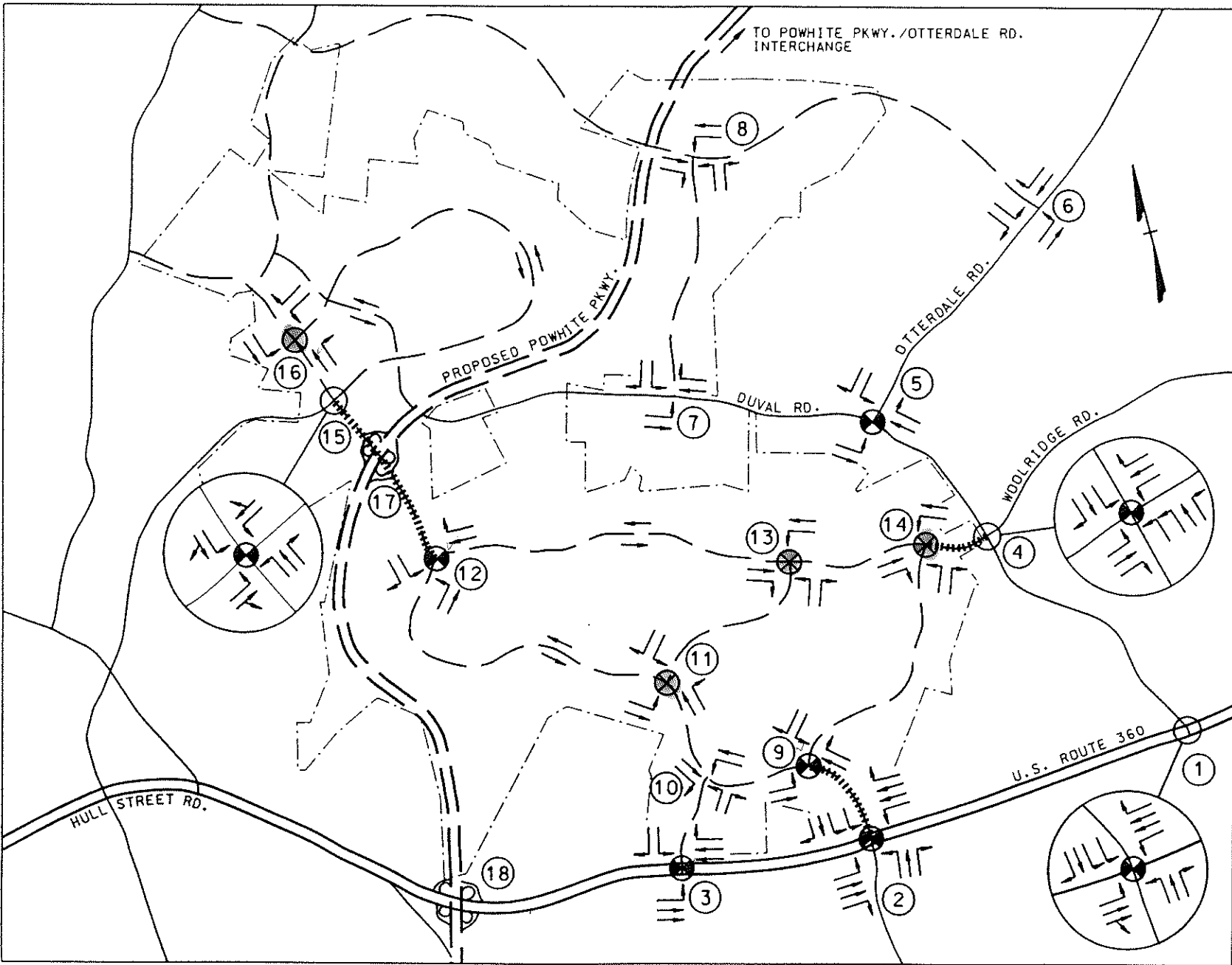
### Off-Site Improvements

- Construction of Powhite Parkway Extension through Magnolia Green;
- Construction of grade-separated access points on Powhite Parkway Extension at Route 360 and at Site Road "E";
- Construction of northern connection (Site Road "F" to Otterdale Road);
- Construction of turning lanes on Otterdale, Duval and Woolridge Roads, and Route 360; and,
- Construction of off-site traffic signals at the intersection of Route 360/Otterdale Road (Study Location 1) and Duval/Otterdale Roads (Study Location 5).

### On-Site Improvements

- Construction of the on-site roadway network shown on Figure 4-1; and,
- Construction of traffic signals at Study Locations 2, 3, 4, 9, 12, 15, and other potential internal intersections as needed in the future.








Based on the above roadway improvements, capacity analysis was performed to determine operating conditions of the roadway network when Magnolia Green is fully developed. The capacity analysis techniques outlined in the 1985 Highway Capacity Manual (HCM) were used to analyze the adequacy of the roadway network. This procedure provides a quantified level of service (LOS) which describes traffic conditions for different critical lane volumes. The service conditions are defined by the letters "A" through "F", with "A" being excellent (no delay) traffic conditions, and "F" equating to congested, unstable traffic flow with excessive driver delay. These levels of service are defined in Table 4-1.



RECOMMENDED ROADWAY  
GEOMETRICS - 2010

MAGNOLIA GREEN  
CHESTERFIELD CO.  
VIRGINIA

LEGEND:

-  PROPOSED SIGNALIZED INTERSECTION
-  POTENTIAL SIGNALIZED INTERSECTION
-  RECOMMENDED TRAFFIC LANE
-  PROPOSED ROADWAY
-  EXISTING ROADWAY
-  4-LANE SITE ROAD
-  STUDY LOCATIONS



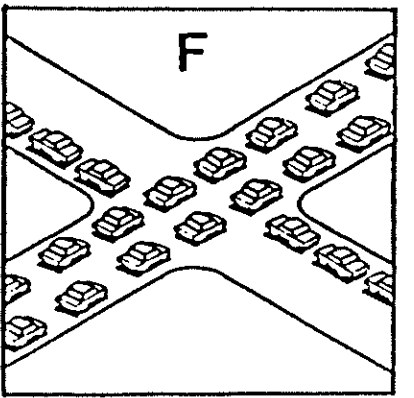
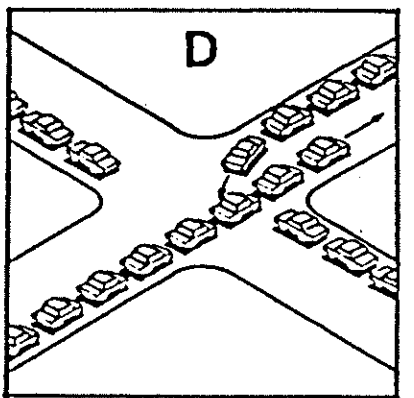
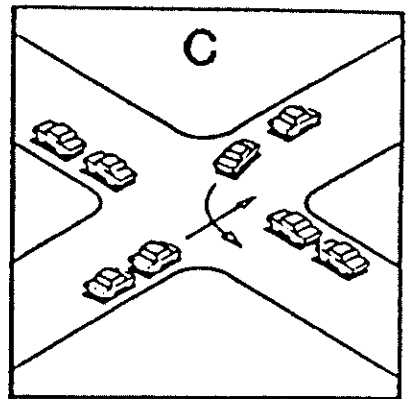
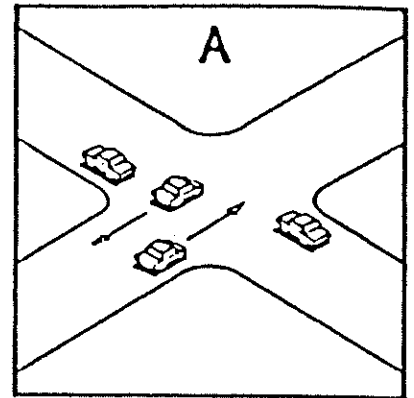
WILBUR SMITH ASSOCIATES

FIGURE #4-1

Table 4-1

# LEVEL OF SERVICE DEFINITIONS

L.O.S.	ROADWAY SEGMENTS OR CONTROLLED ACCESS HIGHWAYS	INTERSECTIONS
A	Free flow, low traffic density.	No vehicle waits longer than one signal indication.
B	Delay is not unreasonable, stable traffic flow.	On a rare occasion motorists wait through more than one signal indication.
C	Stable condition, movements somewhat restricted due to higher volumes, but not objectionable for motorists.	Intermittently drivers wait through more than one signal indication, and occasionally backups may develop behind left turning vehicles, traffic flow still stable and acceptable.
D	Movements more restricted, queues and delays may occur during short peaks, but lower demands occur often enough to permit clearing, thus preventing excessive backups.	Delays at intersections may become extensive with some, especially left-turning vehicles waiting two or more signal indications, but enough cycles with lower demand occur to permit periodic clearance, thus preventing excessive back-ups.
E	Actual capacity of the roadway involves delay to all motorists due to congestion.	Very long queues may create lengthy delays, especially for left turning vehicles.
F	Forced flow with demand volumes greater than capacity resulting in complete congestion. Volumes drop to zero in extreme cases.	Backups from locations downstream restrict or prevent movement of vehicles out of approach creating a storage area during part or all of an hour.



SOURCE: A Policy on Design of Design of Urban Highways and Arterial Streets - AASHTO, 1973 based upon material published in Highway Capacity Manual, National Academy of Sciences, 1965.

A computer software package, Highway Capacity Software (HCS), Release 1.5, was utilized in the analysis to determine the existing operating capacity of the proposed Powhite Parkway Extension interchanges and the intersections located on Route 360, Woolridge, Duval, and Genito Roads in the vicinity of the site. This methodology, based on the 1985 HCM, provides overall intersection LOS, delay, and volume-capacity ratios, as well as traffic lane movements (left, through, and right turns), and volume-capacity (v/c) ratios. At capacity, the v/c ratio would equal 1.00. In addition, HCS will indicate the capacity of the interchange by determining the weaving speed of the loops on the interchange.

### **Signalized Intersection Analysis**

Evaluation of projected traffic volumes shown on Figures 3-13 and 3-14 indicate that the following intersections are prime candidates for implementation of signalization to provide adequate capacity:

- Study Location #1 - Route 360/Otterdale Road;
- Study Location #2 - Route 360/Loop Road "A";
- Study Location #3 - Route 360/Site Road "D";
- Study Location #4 - Loop Road "A"/Woolridge Road;
- Study Location #5 - Otterdale Road/Duval Road;
- Study Location #9 - Loop Road "A"/Site Road "C";
- Study Location #12 - Loop Road "A"/Site Road "E";
- Study Location #15 - Site Road "E"/Site Road "I";
- Study Location #17 - Powhite Parkway Extension/Route 360; and,
- Study Location #18 - Powhite Parkway Extension/Site Road "E".

Table 4-2 summarizes capacity analysis for the above locations with the assumption that these intersections will be signalized at full development. Roadway geometrics assumed in the analysis are those shown on Figure 4-1. Appendix D includes capacity analysis worksheets for signalized study locations.

It is anticipated that all of the above intersections will operate with acceptable levels of service (LOS) at full development of Magnolia Green and other projects. Most of the intersections will operate with a desirable "C" LOS if the roadway improvements shown on Figure 4-1 are implemented.

### **Unsignalized Intersection Analysis**

Other internal/external intersections which will not require signalization are Location numbers 6, 7, 8, and 9. Intersection numbers 10, 11, 12, 13, 14, and 16 are potential sites for traffic signalization to provide additional roadway capacity. However, it should be noted that these intersections were analyzed on the assumptions that they are isolated intersections where there are no

Table 4-2

**SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY – 2010**

**Magnolia Green  
Chesterfield County, Virginia**

STUDY LOCATION NO.	INTERSECTION NAME	A M P E A K		P M P E A K	
		(1) LOS	(2) Delay	(1) LOS	(2) Delay
<b>RECOMMENDED</b>	<b>SIGNALIZATION</b>				
1	Hull St. (Rte. 360) – Otterdale Rd.	D	36.2	D	28.7
2	Hull St. (Rte. 360) – Loop Rd. "A"	D	25.6	D	30.3
3	Hull St. (Rte. 360) – Site Rd. "D"	B	9.3	B	11.2
4	Loop Rd. "A" – Woolridge/Otterdale Rds.	C	22.4	D	30.9
5	Duval Rd. – Otterdale Rd.	C	15.2	C	16.3
9	Loop Rd. "A" – Site Rd. "C"/South Location (*)	B	10.5	D	27.2
12	Loop Rd. "A" – Site Rd. "E" (*)	C	19.5	C	21.1
15	Site Rd. "E" – Site Rd. "I"/South Location (*)	C	18.3	B	13.8
<b>POTENTIAL</b>	<b>SIGNALIZATION</b>				
10	Loop Rd. "A" – Site Rd. "D" (*)	C	21.9	B	14.9
11	Loop Rd. "A" – Site Rd. "B"/South Location (*)	B	13.6	C	18.9
13	Loop Rd. "A" – Site Rd. "B"/North Location (*)	B	11.3	B	12.9
14	Loop Rd. "A" – Site Rd. "C"/North Location (*)	C	16.7	C	18.3

(1) LOS = Level of Service.

(2) Delay indicates the average number of seconds a vehicle may wait at a traffic signal, measured in seconds/vehicle.

(\*) Denotes internal site intersections analyzed with an increase of 20% for site traffic shown on Figures 3-8 and 3-9.

NOTE: Capacity analysis based on roadway geometrics shown on Figure 4-1. Worksheets for capacity analysis include in Appendix D.

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"gaps" in the traffic flow provided by adjacent signalized intersections. Thus, with the proposed signalized intersections nearby, additional gaps will be created and improve the operating conditions of these unsignalized intersections. Table 4-3 summarizes the unsignalized capacity analysis. Worksheets are included in Appendix E.

### **Weaving Analysis**

Based on the Thoroughfare Plan, the master plan of Magnolia Green proposes two (2) interchanges on Powhite Parkway in the vicinity of the site. These interchanges are Study Locations #17 and #18. For the purpose of this study, it is assumed that these interchanges will have full cloverleaf configurations to provide optimum capacity. The Master Plan has accounted for this configuration in its site plan layout.

Weaving analyses were utilized to determine the design constraints imposed on these interchanges by the projected volumes. To accommodate the projected site and background traffic, minimum weaving lengths of 800 feet between the loops will be required to maintain acceptable LOS. Table 4-4 provides a summary of the weaving analysis. Appendix F provides capacity worksheets for the weaving analysis.

Table 4-3

UNSIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY -- 2010

Magnolia Green  
Chesterfield County, Virginia

STUDY LOCATION NO.	LOCATION	A M P E A K		P M P E A K	
		(1) LOS	(2) Reserve Capacity	(1) LOS	(2) Reserve Capacity
6	Otterdale Rd. - Site Rd. *F*				
	Eastbound Left	E	7	F	- 38
	Eastbound Right	A	737	A	601
	Northbound Left	A	573	B	324
7	Duval Rd. - Site Rd. *G*				
	Southbound Left	D	124	E	41
	Southbound Right	A	743	A	633
	Eastbound Left	A	655	A	418
8	Site Rd. *G* - Site Rd. *F* (*)				
	Northbound Left	A	575	A	536
	Northbound Right	A	834	A	805
	Westbound Left	A	905	A	883
10	Loop Rd. *A* - Site Rd. *D* (*)				
	Northbound Left	E	83	F	- 88
	Northbound Right	A	668	A	642
	Westbound Left	B	399	A	468
11	Loop Rd. *A* - Site Rd. *C*/South Location (*)				
	Westbound Left	F	- 101	F	- 141
	Westbound Right	A	718	A	449
	Southbound Left	A	635	D	170
13	Loop Rd. *A* - Site Rd. *B*/North Location (*)				
	Northbound Left	E	71	F	153
	Northbound Right	A	619	A	584
	Westbound Left	A	484	B	373
14	Loop Rd. *A* - Site Rd. *C*/North Location (*)				
	Northbound Left	F	- 68	F	- 104
	Northbound Right	C	208	A	207
	Westbound Left	C	216	F	- 189

Table 4-3 (cont.)

UNSIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY – 2010

Magnolia Green  
Chesterfield County, Virginia

STUDY LOCATION NO.	LOCATION	A M P E A K		P M P E A K	
		(1) LOS	(2) Reserve Capacity	(1) LOS	(2) Reserve Capacity
16	Site Rd. 'I' – Site Rd. 'E'/North Location (*)				
	Eastbound Left	E	51	E	97
	Eastbound Through	E	69	D	126
	Eastbound Right	A	601	A	578
	Westbound Left	E	7	F	-218
	Westbound Through	E	79	D	146
	Westbound Right	A	653	A	643
	Eastbound Left	A	453	A	441
	Northbound Left	A	440	A	637

(1) LOS = Level of Service.

(2) Reserve capacity at an unsignalized intersection represents the number of available gaps.

(\*) Denotes internal site intersections analyzed with an increase of 20% for site traffic shown on Figures 3-8 and 3-9.

NOTE: Capacity analysis based on roadway geometrics shown on Figure 4-1. Worksheets for capacity analysis include in Appendix E.

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Table 4-4

## INTERCHANGE WEAVE ANALYSIS SUMMARY 2010

Magnolia Green  
Chesterfield County, Virginia

STUDY LOCATION	WEAVE SECTION	MINIMUM LENGTH (FT)	AM		PEAK		PM		PEAK
			(1) Sw	(2) LOS	(3) Snw	(2) LOS	(1) Sw	(2) LOS	(3) Snw
17	Powhite Parkway/ Site Road "E":								
	o Powhite Pkwy NB	950	47	C	53	C	39	D	47
	o Powhite Pkwy SB	800	50	B	56	B	43	D	49
	o Site Rd "E" EB	800	49	C	51	C	46	C	51
	o Site Rd "E" WB	1100	47	C	50	D	40	D	42
18	Powhite Parkway/ Route 360:								
	o Powhite Pkwy NB	800	54	B	60	A	52	B	59
	o Powhite Pkwy SB	900	49	C	55	B	44	D	50
	o Route 360 EB	800	45	C	51	C	47	D	54
	o Route 360 WB	800	53	B	59	B	51	D	58

(1) Sw = Represents the speed of the weaving vehicles in MPH.

(2) LOS = Level of Service.

(3) Sw = Represents the speed of the non-weaving vehicles in MPH.

NOTE: Capacity analysis based on roadway geometrics shown on Figure 4-1.

Worksheets for capacity analysis include in Appendix F.

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**Chapter 5**

**CONCLUSIONS AND RECOMMENDATIONS**

## Chapter 5

# CONCLUSIONS AND RECOMMENDATIONS

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Continuing growth in Chesterfield County for the past several decades has significantly increased traffic along the major roadway corridors. This is exemplified by the construction of Route 288 and Powhite Parkway. It is anticipated that traffic will continue to increase as further development occurs and residential, industrial, commercial, and recreational opportunities are offered in Chesterfield County. Thus, the assumption that Powhite Parkway will be extended in the future is not unrealistic. For Magnolia Green to be developed to its fullest potential, it is critical that Powhite Parkway Extension be constructed.

The intent of this study is to address the long-term traffic impact of Magnolia Green on the existing and proposed roadway systems, including Powhite Parkway Extension. For the purpose of this study, Powhite Parkway Extension will have been constructed by the time Magnolia Green is fully developed. It is not the intent of this study to determine how the proposed roadway improvements will be implemented. Rather, the roadway improvements shown within the study, including Powhite Parkway Extension, form a solution that will assist in mitigating the projected Magnolia Green and background traffic in the year 2010.

Due to the mixture of residential, office, and retail land uses, traffic from Magnolia Green is anticipated to have similar impact on the adjacent roadway network in both A.M. and P.M. peak-hour conditions. Analysis of the peak period conditions at full development reveal the following.

### **Powhite Parkway Extension**

To accommodate the projected site and background traffic anticipated to use Powhite Parkway, the intersections at Site Road "E" and Route 360 will require grade separation. To provide optimum capacity, it is recommended that the interchanges will have the full cloverleaf configuration with the minimal spacing between loop gores of 800 feet. It is anticipated that construction of these interchanges will not be necessary until the last phases of the project.

## **Route 360**

The new traffic anticipated to be attracted to Magnolia Green is not expected to require the upgrade of Route 360 to a six-lane facility. If the recommended turning lanes and traffic signalization shown on Figure 4-1 are implemented, traffic both from Magnolia Green and local developments is not anticipated to create unacceptable operating conditions on Route 360.

## **Otterdale Road, Woolridge and Duval Roads**

Although Magnolia Green is anticipated to generate a significant amount of off-site traffic, the numerous access points provided by the Master Plan reduce the problem of any one road having to accommodate all of the site traffic. With these diverse access systems, the amount of site traffic and projected local traffic assigned onto Otterdale, Woolridge, and Duval Roads will not necessitate these roads to be four-lane facilities. County projections for the background traffic on these roads indicate excess capacity for a substantial amount of additional traffic.

Signalization will be required at the intersection of Otterdale/Duval Roads, and Woolridge/Otterdale Roads/Loop Road "A" will be required to maintain desirable operating conditions. In addition, turning lanes will need to be provided. Again, these improvements likely will not be required during the initial phases of the project.

## **Site Roads**

The proposed on-site roadway system will adequately provide capacity for both projected site and background traffic. The site road system will consist mainly of two-lane roadways. The sections of roads which would require four lanes are minimal as shown on Figure 4-1. These are the following roadway segments:

- o Loop Road "A" - between Study Locations 2 and 9;
- o Loop Road "A" - between Study Locations 4 and 14;
- o Site Road "E" - between Study Locations 12 and 17; and,
- o Site Road "E" - between Study Locations 15 and 17.

Signalization is recommended at Study Locations 2, 3, 4, 9, and 12. Locations 11, 13, and 14 are potential locations for signalization should traffic warrant it at full development. However, it should be noted that Study Location 14 is in close proximity to Study Location 4; thus careful evaluation should be made to ensure adequate storage capacity between the two intersections should signalization be implemented.

## **Conclusions**

While the proposed Magnolia Green is expected to add a substantial amount of traffic to the roadway systems, it will not significantly affect operating conditions if the proposed roadway improvements shown on Figure 4-1 are implemented. Signalization of two main entrances to the site on Route 360 will be required prior to full development to maintain desirable LOS. Implementation of the proposed roadway improvement plan will assure safe and convenient travel for patrons and residents of Magnolia Green as well as other users of the surrounding roadway network.

These roadway improvements will require a phasing analysis to determine when each improvement is necessary during the project life-span. However, with a project of this size, it is difficult to project with any great accuracy when the construction of land uses will occur. Market conditions will govern when these development phases occur. It is recommended that an initial Phase I analysis be conducted at this time to provide a guideline for roadway improvements during the first phase of Magnolia Green. Updates to this traffic study should be performed periodically throughout the life-span of the project to verify the various assumptions used in this study. These updated analyses will provide the County and the developer with another opportunity to evaluate the proposed roadway improvements and to ascertain that those improvements are necessary to meet projected needs, or if additional improvements are required, when more data are available.

