Traffic Impact Study for the Woodland Preserve

Marple Township, Delaware County, PA

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Executive Summary

The applicant proposes to construct Woodland Preserve, an age-restricted, continuing care retirement community, to be located between Palmers Mill Road (S.R. 1022) and Paxon Hollow Road, south of the Paxon Hollow Country Club, in Marple Township, Delaware County, Pennsylvania. The development is proposed to consist of approximately 575 residential dwelling units (including 325 age-restricted units, 200 assisted living units, and 50 beds within a skilled care facility), a 7,000 square foot clubhouse, and ancillary retail/service/entertainment uses, which are only to be utilized by the residents. Residents will also enjoy golf cart access to travel to adjacent properties, and bus/shuttle service will be offered for local/regional travel. Access to the site is proposed via three gated driveways, with two along Palmers Mill Road (S.R. 1022) and one along Paxon Hollow Road.

The scope of this traffic study includes an evaluation of the existing 2015 weekday morning and weekday afternoon peak hours, as well as the future 2025 build-out year, both without and with the development at the following study intersections:

- Cedar Grove Road (S.R. 1024) and Martins Run
- Newtown Street Road (S.R. 0252) and Cedar Grove Road (S.R. 1024)
- Newtown Street Road (S.R. 0252) and Palmers Mill Road (S.R. 1022)
- Palmers Mill Road (S.R. 1022) and Martins Run
- Palmers Mill Road (S.R. 1022) and Paxon Hollow Road
- Sproul Road (S.R. 0320) and Paxon Hollow Road (S.R. 1022)
- Palmers Mill Road (S.R. 1022) and Proposed Site Access (West of Martins Run)
- Palmers Mill Road (S.R. 1022) and Proposed Site Access (East of Martins Run)
- Paxon Hollow Road and Proposed Site Access

The trip generation for the proposed development is based on data contained in the Institute of Transportation Engineers (ITE) publication, *ITE Trip Generation, 9th Edition* for Continuing Care Retirement Community (LUC 255). Accordingly, the proposed development will result in approximately 98 "new" trips (inbound and outbound) during the weekday morning peak hour and 106 "new" trips (inbound and outbound) during the weekday afternoon peak hour.

Site Accesses

The following site access designs are proposed to serve the development:

Palmers Mill Road (S.R. 1022) and Proposed Site Access (West of Martins Run)

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is <u>not</u> warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is <u>not</u> warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.
- Provide adequate sight distance based on PennDOT guidelines, as described herein.

Palmers Mill Road (S.R. 1022) and Proposed Site Access (East of Martins Run)

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is not warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.
- Provide adequate sight distance based on PennDOT guidelines, as described herein.

Paxon Hollow Road and Proposed Site Access

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is not warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.
- Provide adequate sight distance based on PennDOT guidelines, as described herein.

The traffic analyses contained herein reveal that efficient access to and from the proposed development is provided, and furthermore, site-generated traffic is accommodated at the off-site study intersections. The evaluation of traffic conditions associated with the proposed continuing care retirement community reveals that the development has a negligible traffic impact at the off-site study intersections, and that the site accesses will operate at highly acceptable conditions.

Introduction

The applicant proposes to construct Woodland Preserve, an age-restricted, continuing care retirement community, to be located between Palmers Mill Road (S.R. 1022) and Paxon Hollow Road, south of the Paxon Hollow Country Club, in Marple Township, Delaware County, Pennsylvania (**Figure 1**). The development is proposed to consist of approximately 575 residential dwelling units (including 325 age-restricted units, 200 assisted living units, and 50 beds within a skilled care facility), a 7,000 square foot clubhouse, and ancillary retail/service/entertainment uses, which are only to be utilized by the residents. Residents will also enjoy golf cart access to travel to adjacent properties, and bus/shuttle service will be offered for local travel. Access to the site is proposed via three gated driveways, with two along Palmers Mill Road (S.R. 1022) and one along Paxon Hollow Road. The site plan is shown in **Figure 2**.

The purpose of this traffic study is to present an evaluation of the incremental traffic impacts of the proposed development within the study area in Marple Township, as well as to provide recommendations regarding the proposed site access designs in order to provide efficient access to the site.

Manual turning movement traffic counts were completed at six intersections in October 2015 during the weekday morning peak period (7:00 AM to 9:00 AM) and the weekday afternoon peak period (4:00 PM to 6:00 PM). In order to assess the existing traffic conditions, these existing traffic volumes were subjected to detailed capacity/level-of-service and queuing analysis, in accordance with accepted methodologies, for the highest peak hour during each peak period, which serves as the basis for this evaluation.

Next, future traffic volumes without the proposed Woodland Preserve community were projected utilizing an annual traffic growth rate to account for regional traffic growth. The future traffic volumes were projected to the future 2025 build-out year at each of the study intersections. The future traffic volumes without the proposed development were then subjected to detailed capacity/level-of-service and queuing analysis.

Finally, the traffic generated by the proposed Woodland Preserve community was established based on data compiled by the Institute of Transportation Engineers, and assigned to the roadway network and site accesses. The site-generated traffic volumes were then added to future without-development traffic volumes, and subjected to detailed capacity/level-of-service and queuing analysis to assess the future traffic conditions with the development.

Existing Transportation Setting & Conditions

The proposed age-restricted residential development will be located between Palmers Mill Road (S.R. 1022) and Paxon Hollow Road, south of the Paxon Hollow Country Club, in Marple Township, Delaware County, Pennsylvania (Figure 1). The existing roadways and intersections in the vicinity of the site, which comprise the study area roadway network, are described in this section.

Roadway Characteristics

The characteristics of the study roadways surrounding the proposed age-restricted residential development are described below in **Table 1**.

Table 1. Existing Roadway Characteristics

Roadway		Average Daily Traffic Volumes (vehicles per day)[1]	Roadway Classification		Travel Lanes (per direction)	Speed Limit (mph)
			Smart Transportation[2]	PennDOT[3]		
Sproul Road (S.R. 0320)	North of S.R. 1022	19,900	Regional Arterial	Urban Principal Arterial	2	40
	South of S.R. 1022	31,200				
Cedar Grove Road (S.R. 1024)		3,000	Neighborhood Collector	Urban Minor Collector	1	25
Newtown Street Road (S.R. 0252)		16,700	Community Arterial	Urban Principal Arterial	1	35-45
Palmers Mill Road (S.R. 1022 west of Paxon Hollow Road)		2,600	Neighborhood Collector	Urban Minor Collector	1	25
Paxon Hollow Road (S.R. 1022 – east of Palmers Mill Road)		2,600[4]	Local Road	Local Road	1	25
Martins Run		N/A	Local Road	Local Road	1	25

1 – Current average daily traffic volume data provided on PennDOT's iTMS website (rounded).
2 – Based on Table 5.1 – Roadway Categories in the PennDOT publication, *Smart Transportation Guidebook*.
3 – Based on the roadway classifications provided on PennDOT's Internet Traffic Monitoring System (iTMS) website.
4 – The ADT along the local section of Paxon Hollow Road, south of Palmers Mill Road, is less than 200 vehicles per day according to PennDOT's iTMS website.

The following key intersections in the vicinity of the site comprise the study area:

- Cedar Grove Road (S.R. 1024) and Martins Run
- Newtown Street Road (S.R. 0252) and Cedar Grove Road (S.R. 1024)
- Newtown Street Road (S.R. 0252) and Palmers Mill Road (S.R. 1022)
- Palmers Mill Road (S.R. 1022) and Martins Run
- Palmers Mill Road (S.R. 1022) and Paxon Hollow Road

- Sproul Road (S.R. 0320) and Paxon Hollow Road (S.R. 1022)
- Palmers Mill Road (S.R. 1022) and Proposed Site Access (West of Martins Run)
- Palmers Mill Road (S.R. 1022) and Proposed Site Access (East of Martins Run)
- Paxon Hollow Road and Proposed Site Access

The existing characteristics of the study intersections, including field sketches and traffic signal permit plans, are provided in **Appendix A**.

Transit Services

Transit services are currently provided in the surrounding area. SEPTA Bus Route 118 travels along S.R. 0252, with stops located at the intersection with Cedar Grove Road (S.R. 1024) and at the intersection with Springton Mews Circle, in the vicinity of the study area. Additionally, Bus Routes 112 and 115 begin service at the Delaware County Community College, located just north of Cedar Grove Road (S.R. 1024), and connects with West Chester Pike (S.R. 0003). Bus Routes 107 begins service along Lawrence Road and connects with S.R. 0320, south of Reed Road. Bus Route 126 also begins service along Lawrence Road, continues east through Lawrence Park and the Lawrence Park Industrial Center, and connects with West Chester Pike (S.R. 0003) via Glendale Road.

The proposed development will provide residents with bus/shuttle service for local travel.

Pedestrian Facilities

There are limited existing pedestrian facilities within the majority of the surrounding study area. Sidewalk is present along Paxon Hollow Road (S.R. 1022), from the Paxon Hollow Middle School to Sproul Road (S.R. 0320). Sidewalk is also present at the signalized intersection of Sproul Road (S.R. 0320) and Paxon Hollow Road (S.R. 1022), along the east side of Sproul Road (S.R. 0320) and along both Paxon Hollow Road (S.R. 1022) approaches.

At the intersection of Sproul Road (S.R. 0320) and Paxon Hollow Road (S.R. 1022), crosswalks, pedestrian signals and pedestrian push buttons are provided along several approaches (refer to Appendix B for further detail).

Traffic Count Data

Manual turning movement traffic counts were completed at six off-site intersections in October 2015 during the weekday morning peak period (7:00 AM to 9:00 AM) and the weekday afternoon peak period (4:00 PM to 6:00 PM). The results of these traffic counts are tabulated by 15-minute intervals in **Appendix B**. The four highest consecutive 15-minute peak intervals during these traffic count periods constitute the peak hours that are the basis of this traffic analysis. The traffic counts for each peak hour are illustrated in **Figure 3A.**

Capacity/Level-of-Service Analysis

The peak hour traffic volumes were analyzed to determine the existing operating conditions in accordance with the standard techniques contained in the *Highway Capacity Manual (2010)*. These standard capacity/level-of-service analysis techniques, which calculate total control delay, are more thoroughly described in **Appendix C** for both signalized and unsignalized intersections, as well as the correlation between average total control delay and the respective level-of-service (LOS) criteria for each intersection type. The results of the capacity/level-of-service analyses are illustrated in **Figure 3B** for the existing peak hour traffic conditions, and the detailed capacity/level-of-service analysis worksheets are contained in **Appendix D**. Specific details regarding the analysis results and traffic operations are provided later in this report.

Site Characteristics

This section presents the details regarding the proposed site, including the incremental increase in traffic volumes generated by the development during the peak hours and the distribution of this site traffic to the study area roadways, as well as the proposed site access configuration, traffic control, and sight distance requirements.

Trip Generation

Traffic volumes generated by the proposed development were prepared based on trip generation data compiled from numerous studies contained in the Institute of Transportation Engineers (ITE) publication, *Trip Generation, 9th Edition*. **Table 2** presents the anticipated vehicular trip generation for the proposed development.

Table 2. Vehicular Trip Generation

Land Use	Size	Daily	Weekday Morning Peak Hour			Weekday Afternoon Peak Hour		
			In	Out	Total	In	Out	Total
Woodland Preserve[1]	575 Units	1,871	64	34	98	41	65	106

1 – ITE Land Use Code 255 for Continuing Care Retirement Community.

ITE describes the Continuing Care Retirement Community (CCRC) land use as a self-contained village that combines aspects of independent living with increased care which allows residents to live in one community as their medical needs change due to the variety of housing options that are available (senior adult attached, senior adult detached, congregate care, assisted living, and skilled nursing care). These communities may also contain additional/ancillary services such as medical, dining, recreational and some limited, supporting retail facilities for the use of residents.

It is noted that McMahon completed trip generation counts during the weekday morning and weekday afternoon peak periods at the nearby Wesley Enhanced Living Community located along Halcyon Drive, which intersects Martins Run, just north of Palmers Mill Road (S.R. 1022). This community is also classified as a Continuing Care Retirement Community (CCRC) with 253 residential dwelling units (163 independent living apartments, 30 personal care studios, and 60 beds within a skilled care facility). The operations anticipated for the Woodland Preserve Age-Restricted Residential Community will be similar to those of the Wesley Enhanced Living Community. The trip generation counts revealed that the Wesley Enhancing Living Community generated traffic at a lower rate than ITE Land Use 255 for Continuing Care Retirement Community (CCRC). The site-specific trip generation data, collected through the trip generation counts, has not been used for the traffic analyses contained in this study, but rather, the more conservative ITE trip generation data was utilized, as presented above in Table 2.

The trip generation projections utilized in the traffic analyses provide a conservative evaluation as:

- the ITE trip generation rates yield higher projections than an actual, local CCRC, as noted above;
- the proposed CCRC will provide shuttle services to local establishments and reduce the need for individual trips; and
- the proposed CCRC will provide many ancillary services reducing the need for residents to leave the community on a daily basis.

Trip Distribution and Assignment

Site-generated traffic will approach and depart the site via different routes depending on factors such as the existing traffic patterns, location of major roadways, and the location of the development's site accesses. The distribution percentages for the anticipated directions of approach and departure are illustrated in **Figure 4A**, while the application of the percentages in Figure 4A to the new trips contained above in Table 2 for the weekday morning and weekday afternoon peak hours are illustrated in **Figure 4B**. With three accesses serving the community, site-generated traffic will be dispersed throughout the surrounding roadway network, thereby minimizing traffic impacts.

Site Access Configuration and Traffic Control

As noted, access to the site is proposed via three gated driveways, with two along Palmers Mill Road (S.R. 1022) and one along Paxon Hollow Road. One driveway is to be located along Palmers Mill Road (S.R. 1022), approximately 425 feet west of Martins Run. The second driveway is to be located along Palmers Mill Road (S.R. 1022) as well, approximately 650 feet east of Martins Run. The third driveway is to be located along Paxon Hollow Road, approximately 75 feet east of western Trout Run Drive intersection. The site access locations are based on December 21, 2015 *Overall Land Development/Phase Plan, "Woodland Preserve" For Stephen & Dolores Sudhop, Palmers Mill Road and Paxon Hollow Road* prepared by Herbert E. MacCombie Jr, P.E. Consulting Engineers and Surveyors, Inc. of Broomall, PA.

The recommendations for the proposed access designs, including auxiliary turn lanes, traffic control, and geometric design, are based on industry accepted criteria and guidelines. Specifically, the need for left- and right-turn deceleration lanes is based on the current PennDOT guidelines in accordance with *Publication 46, Chapter 11 – Traffic Studies*. The various warrant/guideline analysis worksheets are contained in **Appendix E**. It is noted that in some instances, PennDOT will require separate left-turn and right-turn deceleration lanes at site access intersections to age-restricted communities. However, based on the relatively low traffic volumes along Palmers Mill Road (2,600 ADT) and Paxon Hollow Road (160 ADT south of Palmers Mill Road), adequate sight distance (for entering traffic), limited site frontage, impacts to adjacent properties, and the overall character of the roadway and area, auxiliary lanes are no recommended at this time. PennDOT will ultimately determine if auxiliary lanes will be required during the Highway Occupancy Permit (HOP) review process.

Additionally, the geometric design of the proposed site accesses were preliminarily evaluated based on guidelines contained in the *Pennsylvania Code, Chapter 441, Access to and Occupancy of Highways by Driveways and Local Roads*, as well as local PennDOT District policies.

Based on the results of this evaluation, the following access configurations and traffic controls are recommended, subject to the detailed engineering of the site accesses:

Palmers Mill Road (S.R. 1022) and Proposed Site Access (West of Martins Run)

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is not warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.

Palmers Mill Road (S.R. 1022) and Proposed Site Access (East of Martins Run)

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is not warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.

Paxon Hollow Road and Proposed Site Access

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is not warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.

It is our understanding that the primary access road will be constructed as part of the initial project phase to serve the first 54 units to be constructed. As the project continues, the remaining roadway network and accesses will be constructed to serve the remaining units and amenities to be built. Provided that an emergency access is constructed along with the initial roadway, the phasing of the roadway infrastructure/accesses will be adequate.

Sight Distance

Sight distance field measurements and an evaluation were performed for the three driveways proposed along Palmers Mill Road (S.R. 1022) and Paxon Hollow Road. Generally, the posted speed limit, roadway grades and profiles, and the number of travel lanes play a role in determining if safe sight distances are available for egress and ingress at each driveway. The existing sight distances at the proposed access locations were measured and compared to PennDOT's requirements, which are contained in the PennDOT publication *Pennsylvania Code, Chapter 441, Access to and Occupancy of Highways by Driveways and Local Roads*. **Table 3** summarizes the available sight distance measurements, as well as the required PennDOT sight distances.

Table 3. Sight Distance Evaluation

Palmers Mill Road (S.R. 1022) and Proposed Site Access (West of Martins Run)

Movement	Direction	Posted Speed(mph)	Approximate Grade	PennDOT Requirements[1] (feet) Based on Posted Speed	Available Sight Distance (feet)
Exiting	Looking Left	25	+2.7%	250′	257′/450′+[2]
	Looking Right	25	-1.7%	195′	432′
Left turn Entering	Looking Ahead From the Rear	25	+2.7%	190′	550′
		25	-1.7%	165′	407′

1 – Based on PennDOT desirable requirements based on the posted speed in accordance with Pennsylvania Code, Title 67, Transportation, Chapter 441.8.h.1.
2 – Cutting back the embankment will increase the sight distance to approximately 450 feet (to the adjacent intersection located at the horizontal curve along Palmers Mill Road) for exiting looking to the left.

Palmers Mill Road (S.R. 1022) and Proposed Site Access (East of Martins Run)

Movement	Direction	Posted Speed (mph)	Approximate Grade	PennDOT Requirements[1] (feet) Based on Posted Speed	Available Sight Distance (feet)
Exiting	Looking Left	25	-3.7%	250′	143′/288′[2]
	Looking Right	25	+2.4%	273′	600′
Left turn Entering	Looking Ahead From the Rear	25	-3.7%	190′	450′
		25	+2.4%	156′	550′

1 – Based on PennDOT desirable requirements based on the posted speed in accordance with Pennsylvania Code, Title 67, Transportation, Chapter 441.8.h.1.
2 – Clearing vegetation and cutting back the embankment will increase the available sight distance from 143 feet to approximately 288 feet for exiting looking to the left.

Paxon Hollow Road and Proposed Site Access

Movement	Direction	Posted Speed (mph)	Approximate Grade	PennDOT Requirements[1] (feet) Based on Posted Speed	Available Sight Distance (feet)
Exiting	Looking Left	25	+0.6%	250′ / 177′[2]	217′
	Looking Right	25	+5.4%	195′	186′/196′[3]
Left turn Entering	Looking Ahead From the Rear	25	+0.6%	190′	252′
		25	+5.4%	151′	425′

1 – Based on PennDOT desirable requirements based on the posted speed in accordance with Pennsylvania Code, Title 67, Transportation, Chapter 441.8.h.1.
2 – Based on PennDOT minimum requirements based on the posted speed in accordance with Pennsylvania Code, Title 67, Transportation, Chapter 441.8.h.2.iv. The available sight distance measurements exceeds the minimum required sight distance.
3 – Sight distance is limited due to a utility pole located adjacent to the proposed site access. Relocation of the utility pole will increase sight distance to an estimated 196 feet for exiting looking to the right. Sight distance is still further limited due to the horizontal curve along Paxon Hollow Road.

As shown in Table 3 above, the available sight distance measurements exceed PennDOT's desirable sight distance requirements for all movements at each of the proposed accesses. Proper landscaping must be maintained along the site frontage along Palmers Mill Road (S.R. 1022) and Paxon Hollow Road as well as cutting back of the embankment along the site frontage (in some cases) for provision of adequate sight distance according to the above tables. Furthermore, the available sight distance at the site accesses should be verified during the detailed engineering of the site access design. The PennDOT M-950S forms are completed and provided in **Appendix F** for all three site accesses.

Future 2025 Build-Out Year Traffic Conditions

This section presents the future build-out year traffic conditions, both without and with the proposed development, which is anticipated to be completed in 2025. The future 2025 build-out year without-development traffic volumes were estimated by increasing the existing 2015 traffic volumes to account for regional and local growth, as described below. The incremental increase due to the anticipated trip generation for the site was then added, resulting in the future 2025 build-out year with-development traffic volumes.

Future 2025 Without-Development Traffic Volumes

To account for regional traffic growth, the existing traffic volumes were increased by an annual traffic growth rate of 0.41 percent per year compounded for ten year, or 4.18 percent total. This growth rate is consistent with the traffic growth rate recommended by the PennDOT Bureau of Planning and Research *Growth Factors for August 2015 to July 2016* for similar roadways in Delaware County. The growth rate table is provided in **Appendix G**.

To account for local traffic growth, the following developments were identified and included in the future traffic volume projections based on discussions with Marple Township and Upper Providence Township officials, as well as our knowledge of the area:

- *Cardinal Crossings* – consisting of 318 townhouse units, a 130-room hotel, a 55,000 multiplex, an 80,000 recreation center, 100,000 square feet of office space, 690,000 square feet of retail and a convenience market with 16 fueling positions, to be located along PA Route 320, south of Reed Road.

- *Marple Associates* – consisting of 260,000 square foot retail, a drive-in bank, a fitness center, daycare, a 40,000 square foot office, and 150 townhouse units, to be located on the southwest quadrant of the Interstate 476/PA Route 3 interchange.

- *Crozer Cancer Center* – consisting of 58,000 square foot medical office building will replace a 56,000 square foot grocery store, to be located along Lawrence Road, near West Chester Pike.

- *Ravenscliff Phase III, IV and V* – consisting of 380 townhouse units (138 units during Phase III and 242 units during Phases IV and V), to be located along State Road and Marple Woods Drive.

These developments were assumed in recently completed traffic studies and were utilized in the traffic volume forecasts. The trip generation and distributions utilized in the Traffic Impact Study for the Cardinal Crossing project were assumed for this analysis. The trip assignments for each of the other developments are provided in **Appendix H**. The total background growth was added to the existing 2015 traffic volumes, and the resultant future 2025 build-out year peak hour traffic volumes are illustrated in **Figure 5A** for the weekday morning and weekday afternoon peak hours.

Future 2025 With-Development Traffic Volumes

The site-generated traffic volumes, as shown in Figure 4B, were added to the future 2025 without-development traffic volumes, resulting in the future 2025 build-out year with-development peak hour traffic volumes illustrated in **Figure 5B** for the weekday morning and weekday afternoon peak hours. Detailed spreadsheets summarizing the without-development regional growth and the site trip assignments for each intersection are provided in **Appendix I.**

Capacity/Level-of-Service Analysis

The future 2025 build-out year peak hour traffic volumes, as illustrated in Figures 5A and 5B, were then subjected to detailed capacity/level-of-service analysis. The results of the traffic analyses are illustrated in **Figures 5C and 5D**, and the detailed capacity/level-of-service analysis worksheets are provided in **Appendices J and K.** Specific details regarding the analysis results and traffic operations are provided later in this report.

Capacity/Level-of-Service and Queuing Analyses

This section presents a detailed summary of the traffic analysis results for the existing and future 2025 traffic conditions, both without and with the proposed Woodland Preserve community, for the two peak hours at the study intersections and site accesses.

Cedar Grove Road (S.R. 1024) and Martins Run

Under existing conditions, this unsignalized intersection currently operates at highly acceptable LOS A overall and highly acceptable LOS A for all movements during both the weekday morning and weekday afternoon peak hours. Under the future 2025 conditions, both without and with the proposed development, the intersection will continue to operate at the same levels-of-service as under existing conditions.

Newtown Street Road (S.R. 0252) and Cedar Grove Road (S.R. 1024)

Under existing conditions, this unsignalized intersection currently operates at acceptable LOS D or better overall during both the weekday morning and weekday afternoon peak hours. The westbound Cedar Grove Road (S.R. 1024) approach operates with delay (LOS F) during both peak hours. It is noted that this unsignalized intersection warrants a traffic signal under existing conditions through satisfaction of Warrant 2 – Four-Hour Vehicular Warrant and Warrant 3 – Peak Hour Warrant. The traffic signal warrant worksheets are provided in **Appendix L**.

Under future without-development conditions, this unsignalized intersection will operate with delay overall (LOS E) during both the weekday morning and weekday afternoon peak hours in the future 2025 conditions. The westbound Palmers Mill Road (S.R. 1022) approach will continue to operate with delay (LOS F) during both peak hours.

Under future with-development conditions, this unsignalized intersection will continue to operate with delay overall (LOS E) during both the weekday morning and weekday afternoon peak hours in the future 2025 conditions. The westbound Palmers Mill Road (S.R. 1022) approach will continue to operate with delay (LOS F) during both peak hours. The overall intersection delay between without- and with-development conditions will only increase by a negligible 3.7 seconds during both the weekday morning and the weekday afternoon peak hours. Based on PennDOT's overall intersection mitigation criteria, there is no traffic impact at the intersection with the proposed development since the increases in overall intersection delays are ten (10) seconds or less during both peak hours. Further, the additional site-generated traffic at this intersection will comprise only one percent of the total traffic volume at the intersection.

Newtown Street Road (S.R. 0252) and Palmers Mill Road (S.R. 1022)

Under existing conditions, this unsignalized intersection currently operates at acceptable LOS C or better overall during both the weekday morning and weekday afternoon peak hours. The westbound Palmers Mill Road (S.R. 1022) approach operates with delay (LOS F) during both peak hours. It is noted that this unsignalized intersection warrants a traffic signal under existing conditions through satisfaction of Warrant 2 – Four-Hour Vehicular Warrant and Warrant 3 – Peak Hour Warrant. The traffic signal warrant worksheets are provided in Appendix M.

Under future without-development conditions, this unsignalized intersection will operate at acceptable LOS D or better overall during both the weekday morning and weekday afternoon peak hours in the future 2025 conditions. The westbound Palmers Mill Road (S.R. 1022) approach will continue to operate with delay (LOS F) during both peak hours.

Under future with-development conditions, this unsignalized intersection will operate at acceptable LOS D overall during the weekday morning peak hour and with some delay (LOS E) overall during the weekday afternoon peak hour in the future 2025 conditions. The westbound Palmers Mill Road (S.R. 1022) approach will continue to operate with delay (LOS F) during both peak hours. The overall intersection delay between without- and with-development conditions will increase by a negligible 4.2 seconds during the weekday morning peak hour, and 10.0 seconds during the weekday afternoon peak hour. Based on PennDOT's overall intersection mitigation criteria, there is no traffic impact at the intersection with the proposed development since the increases in overall intersection delays are ten (10) seconds or less during both peak hours. Further, the additional site-generated traffic at this intersection will comprise only one percent of the total traffic volume at the intersection and will be insignificant.

Palmers Mill Road (S.R. 1022) and Martins Run

Under existing conditions, this unsignalized intersection currently operates at highly acceptable LOS A overall and highly acceptable LOS B or better for all movements during both the weekday morning and weekday afternoon peak hours. Under the future 2025 conditions, both without and with the proposed development, the intersection will continue to operate at the same levels-of-service as under existing conditions.

Palmers Mill Road (S.R. 1022) and Paxon Hollow Road

Under existing conditions, this unsignalized intersection currently operates at highly acceptable LOS A overall and highly acceptable LOS B or better for all movements during both the weekday morning and weekday afternoon peak hours. Under the future 2025 conditions, both without and with the proposed development, the intersection will continue to operate at the same levels-of-service as under existing conditions.

Sproul Road (S.R. 0320) and Paxon Hollow Road (S.R. 1022)

Under existing conditions, this signalized intersection currently operates at acceptable LOS D or better overall during both the weekday morning and weekday afternoon peak hours. All movements currently operate at acceptable LOS D or better during both peak hours, with two exceptions. During the weekday afternoon peak hour, the eastbound Paxon Hollow Road right-turn and the northbound Sproul Road (S.R. 0320) left-turn movements operate with delay (LOS E and F, respectively).

Under future without-development conditions, with optimized signal timings, this signalized intersection will operate at acceptable LOS C overall during the weekday morning peak hour and with delay (LOS F) overall during the weekday afternoon peak hour. All movements operating with delay under existing conditions will continue to operate with similar delay in the future 2025 no-build conditions, with one exception. The southbound through and shared through/right-turn lanes will function with delay (LOS F) during the weekday afternoon peak hour.

Under future with-development conditions, this signalized intersection will continue operate at acceptable LOS C overall during the weekday morning peak hour and with the same overall delay (LOS F) during the weekday afternoon peak hour. All movements operating with acceptable levels of service (LOS D or better) under the future without-development conditions will continue to function acceptably in the future 2025 conditions. The proposed development traffic, which will represent less than two percent of the overall intersection traffic results in no significant traffic impact at this intersection.

Palmers Mill Road (S.R. 1022) and Proposed Site Access (West of Martins Run)

With the recommended design configuration and relatively low site traffic volumes, this unsignalized site access will operate at highly acceptable LOS A overall and by movement, during both peak hours in the future 2025 conditions.

Palmers Mill Road (S.R. 1022) and Proposed Site Access (East of Martins Run)

With the recommended design configuration and relatively low site traffic volumes, this unsignalized site access will operate at highly acceptable LOS A overall and by movement, during both peak hours in the future 2025 conditions.

Paxon Hollow Road and Proposed Site Access

With the recommended design configuration and relatively low site traffic volumes, this unsignalized site access will operate at highly acceptable LOS A overall and by movement, during both peak hours in the future 2025 conditions.

Queuing Analysis

Queuing analysis was completed utilizing Synchro 8 traffic analysis software to determine the adequacy of the proposed intersection spacing between the site accesses and adjacent intersections in the future with the proposed development. Based on the results of the queuing analysis and with the proposed site access designs, as outlined previously, the queues are accommodated within the proposed intersection spacing.

Conclusions

Based on the results of the traffic analyses, efficient access to and from the proposed development will be provided, and furthermore, site-generated traffic is accommodated/mitigated at the off-site study intersections. The evaluation of traffic operating conditions associated with the proposed Woodland Preserve community reveals that the development will have no significant traffic impact at the off-site study intersections based on PennDOT mitigation criteria, and that the site accesses will operate at highly acceptable conditions.

Site Accesses

The following site access designs are proposed to serve the community:

Palmers Mill Road (S.R. 1022) and Proposed Site Access (West of Martins Run)

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is not warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.
- Provide adequate sight distance based on PennDOT guidelines, as described herein.

Palmers Mill Road (S.R. 1022) and Proposed Site Access (East of Martins Run)

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is not warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.
- Provide adequate sight distance based on PennDOT guidelines, as described herein.

Paxon Hollow Road and Proposed Site Access

- The access will be classified as a low volume driveway, per PennDOT criteria.
- A left-turn lane is not warranted based on PennDOT traffic volume guidelines.
- A right-turn deceleration lane is not warranted based on PennDOT traffic volume guidelines.
- Provide one ingress lane and one egress lane for the access.
- Provide stop control, via installation of a stop sign, for the access approach.
- Provide adequate sight distance based on PennDOT guidelines, as described herein.

It is our understanding that the primary access road will be constructed as part of the initial project phase to serve the first 54 units to be constructed. As the project continues, the remaining roadway network and accesses will be constructed to serve the remaining units and amenities to be built. Provided that an emergency access is constructed along with the initial roadway, the phasing of the roadway infrastructure/accesses will be adequate.

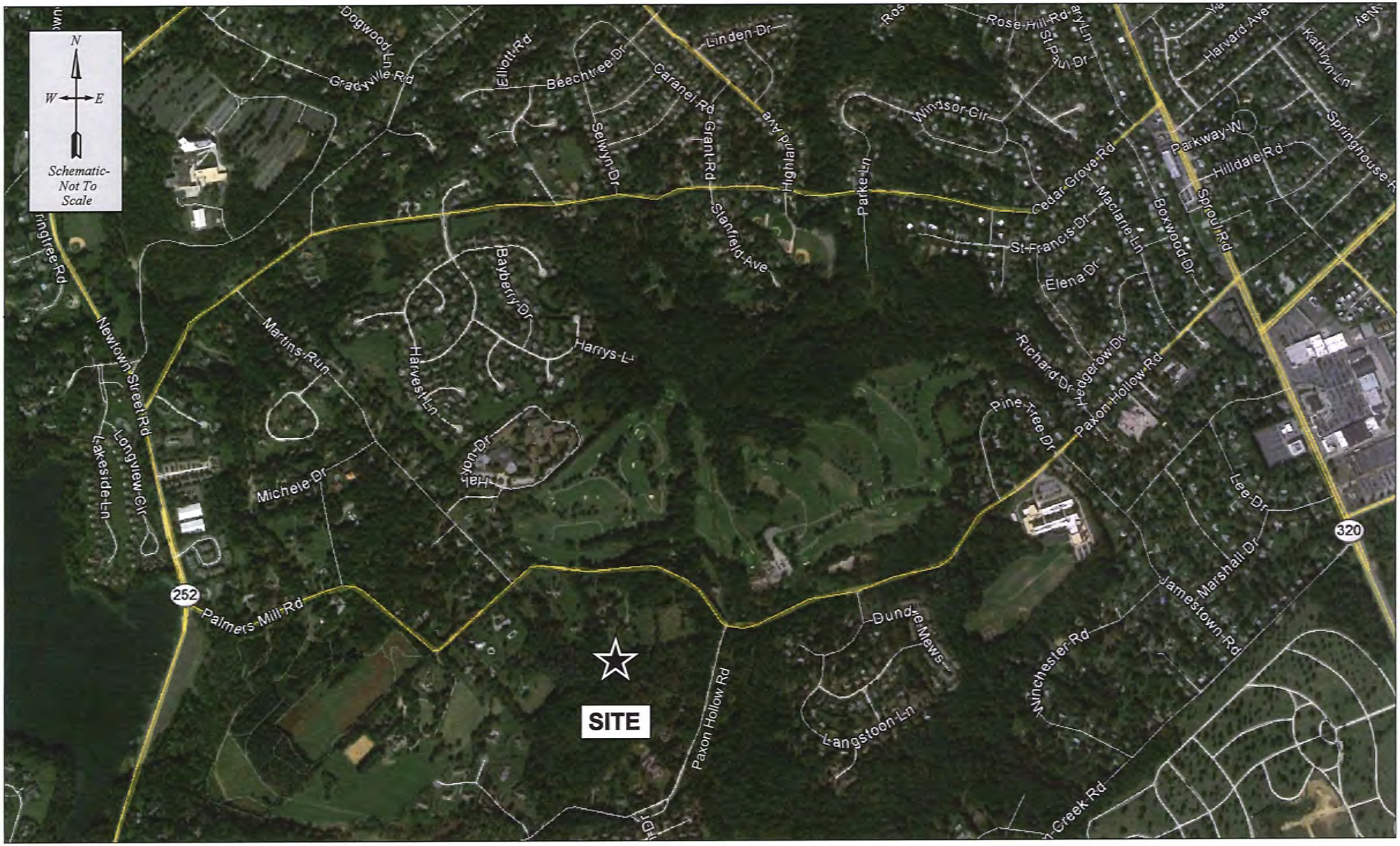

FIGURE 1

Site Location Map

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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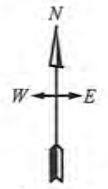

Schematic-
Not To
Scale

FIGURE 2

Site Plan

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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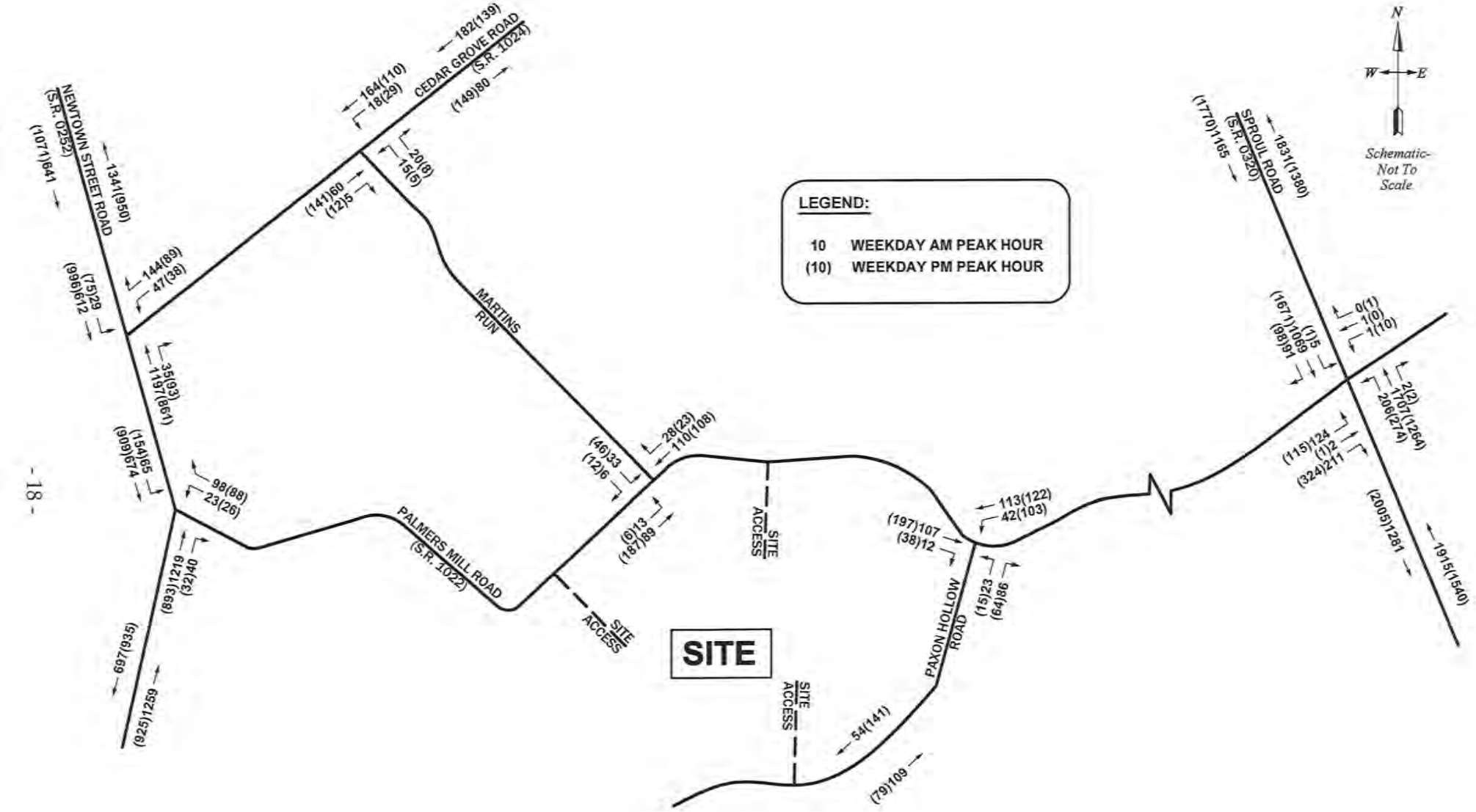

FIGURE 3A

2015 Existing Weekday Peak Hour Traffic Volumes

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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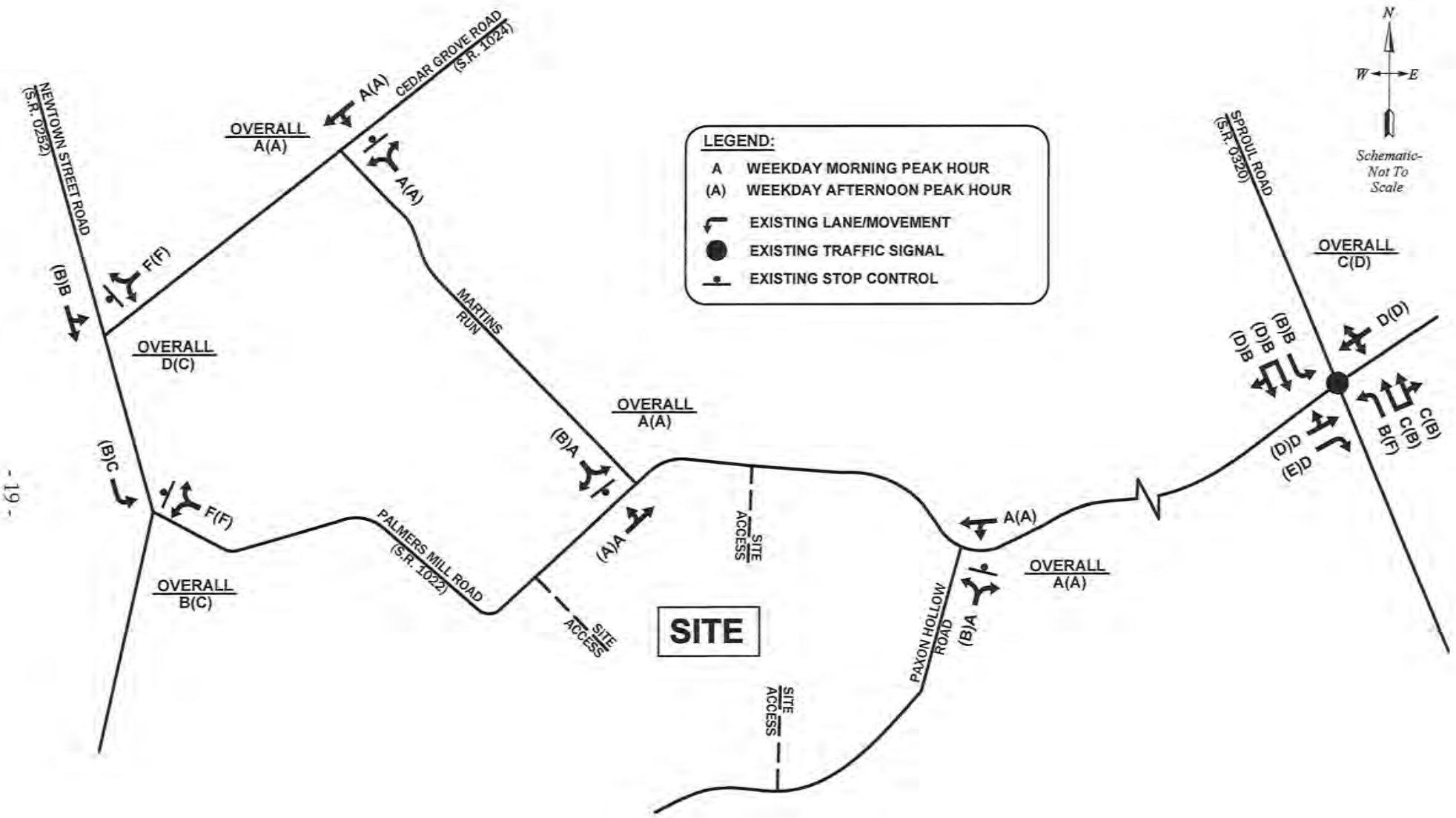

FIGURE 3B

2015 Existing Weekday Peak Hour Levels of Service

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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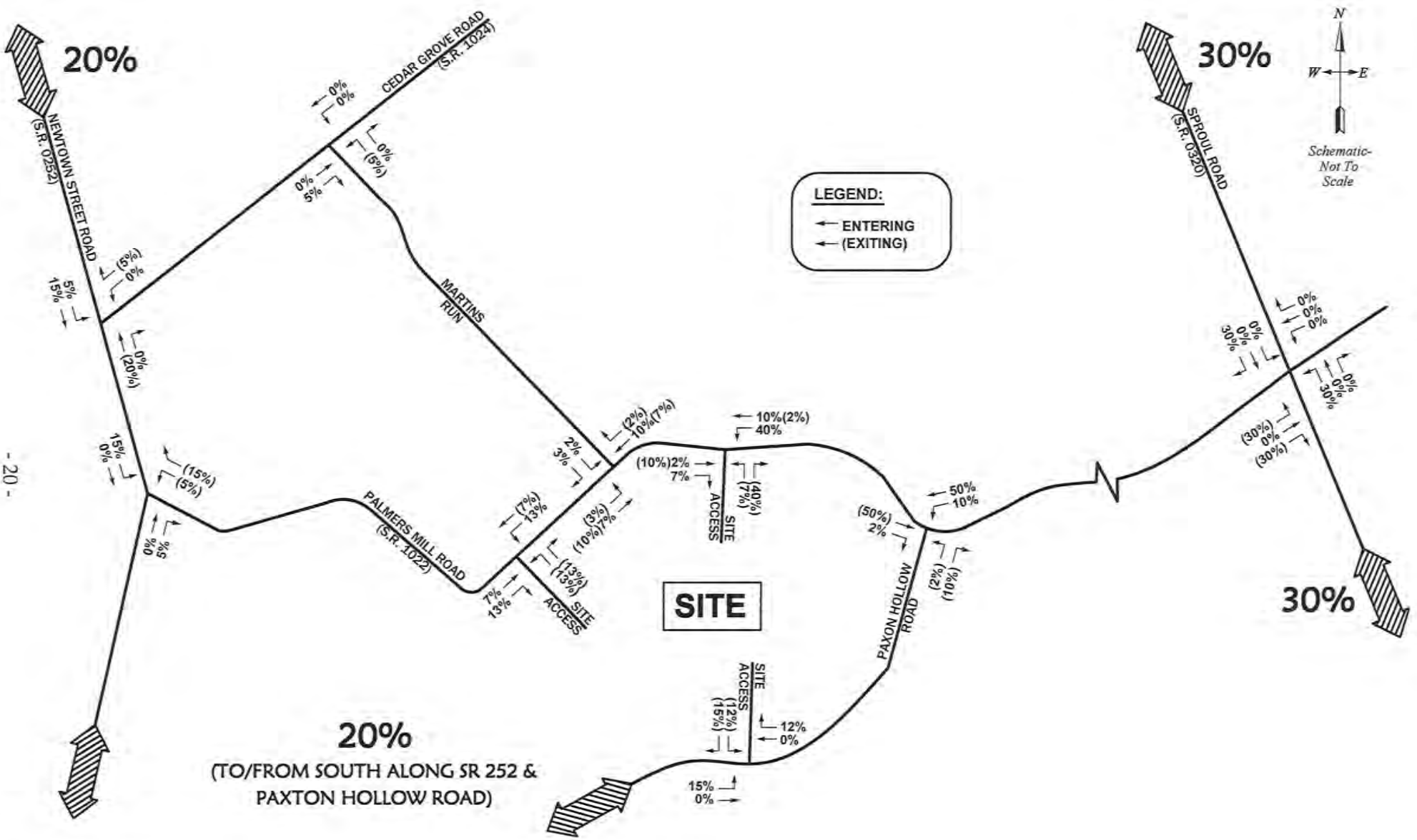

FIGURE 4A

New Site Trip Distributions

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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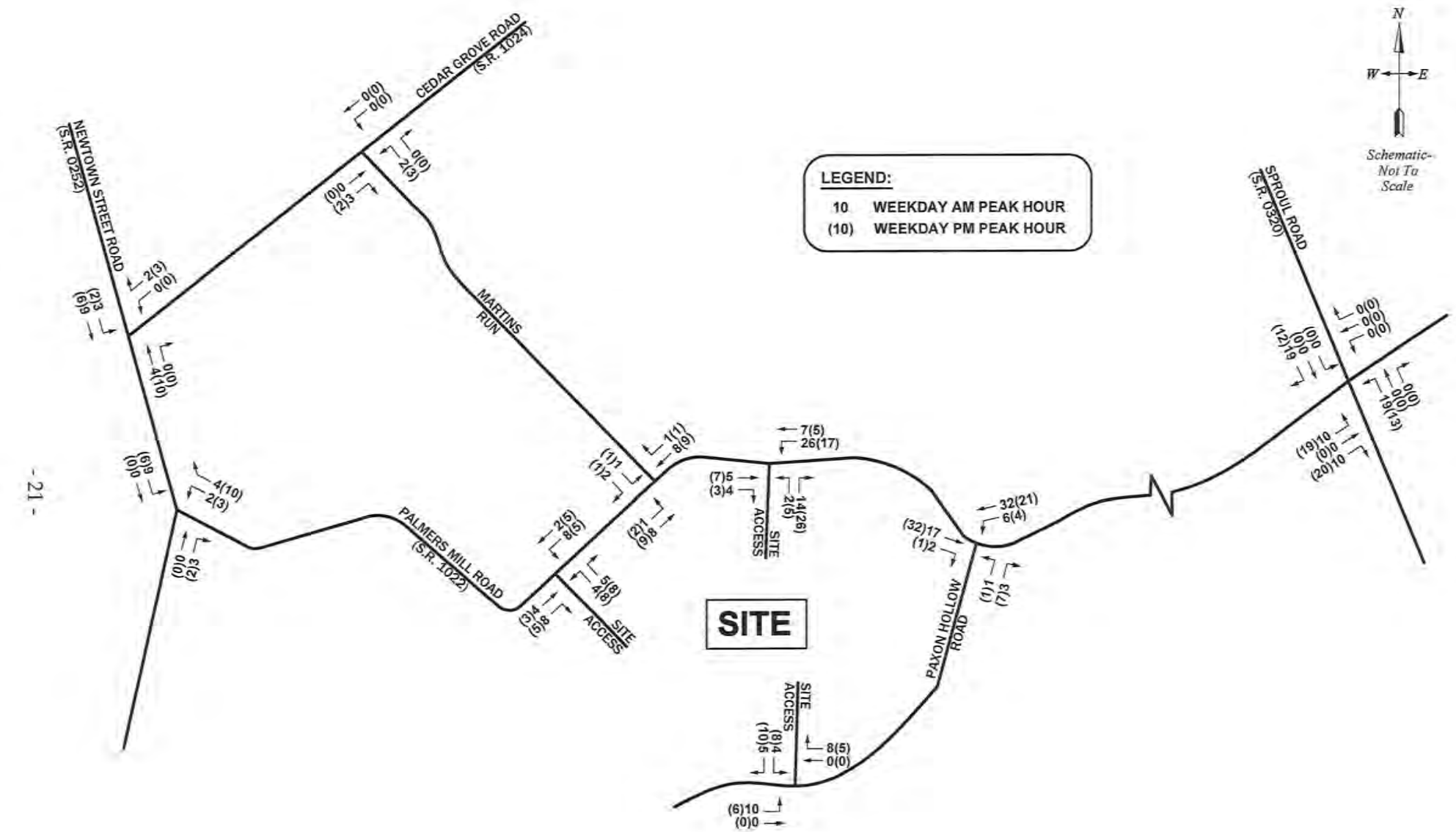

FIGURE 4B

New Site Trip Assignments

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

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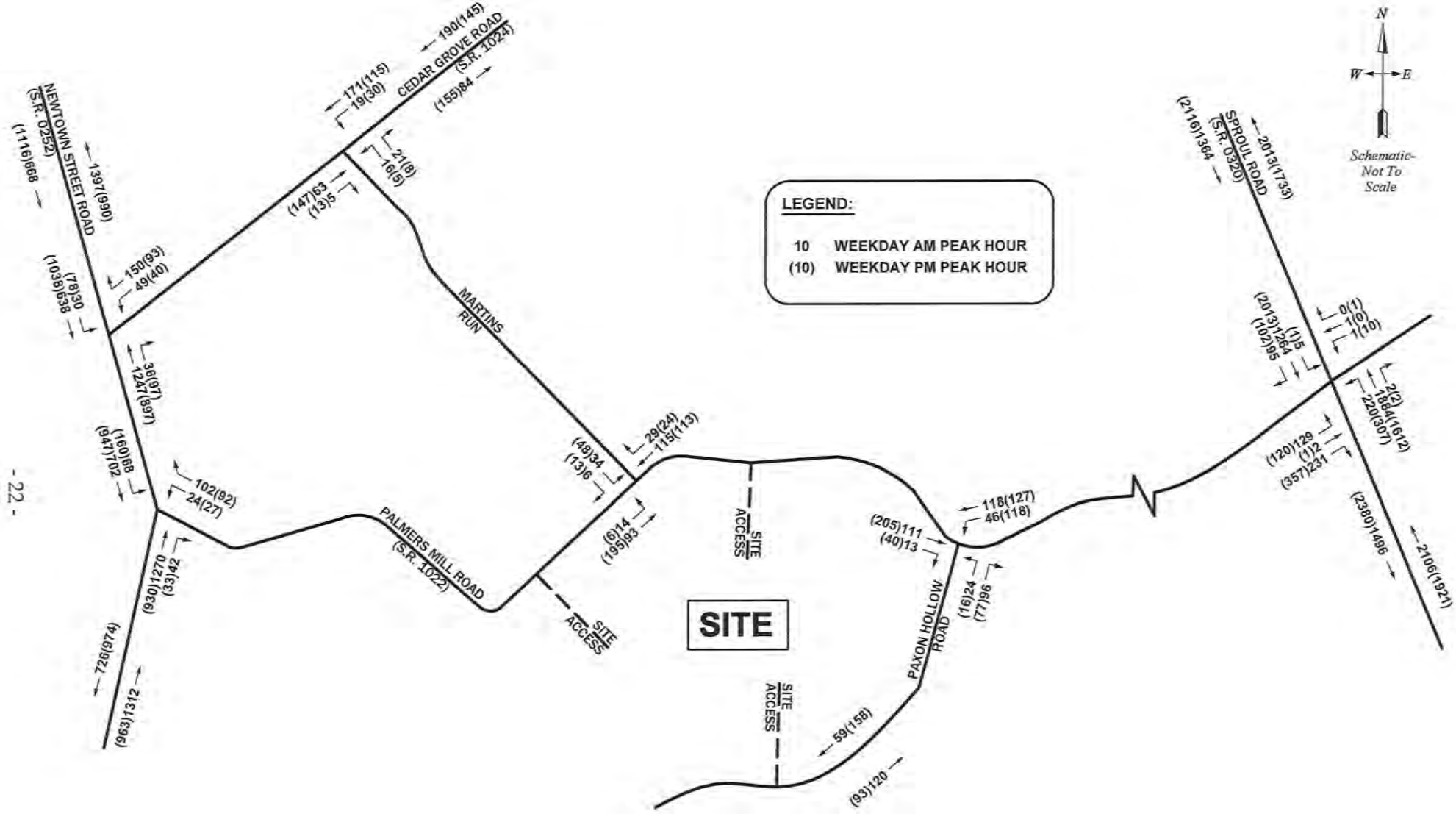

FIGURE 5A

2025 Future Weekday Peak Hour Traffic Volumes without Development

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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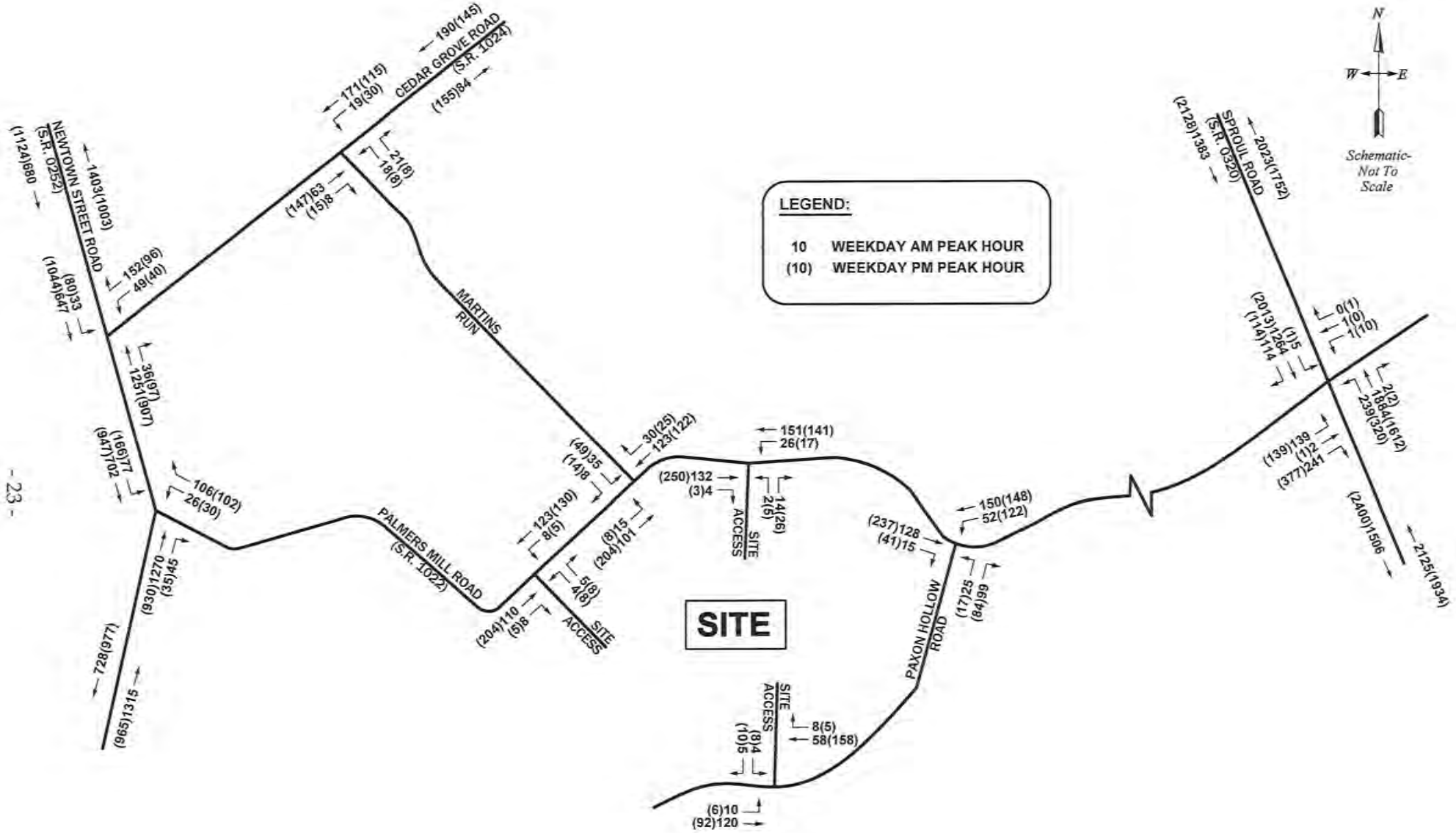

FIGURE 5B

2025 Future Weekday Peak Hour Traffic Volumes with Development

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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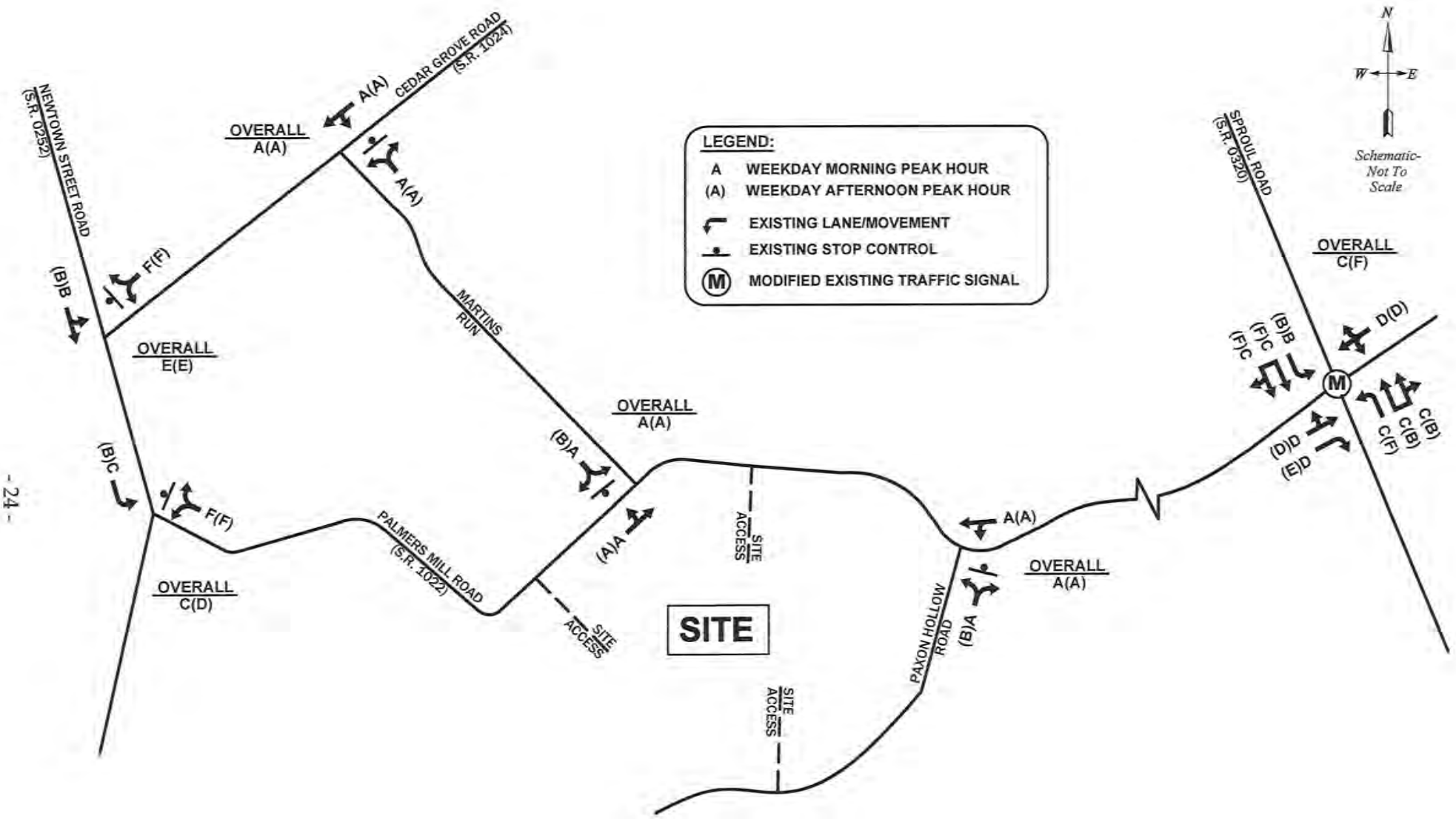

FIGURE 5C

2025 Future Weekday Peak Hour Levels of Service without Development

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

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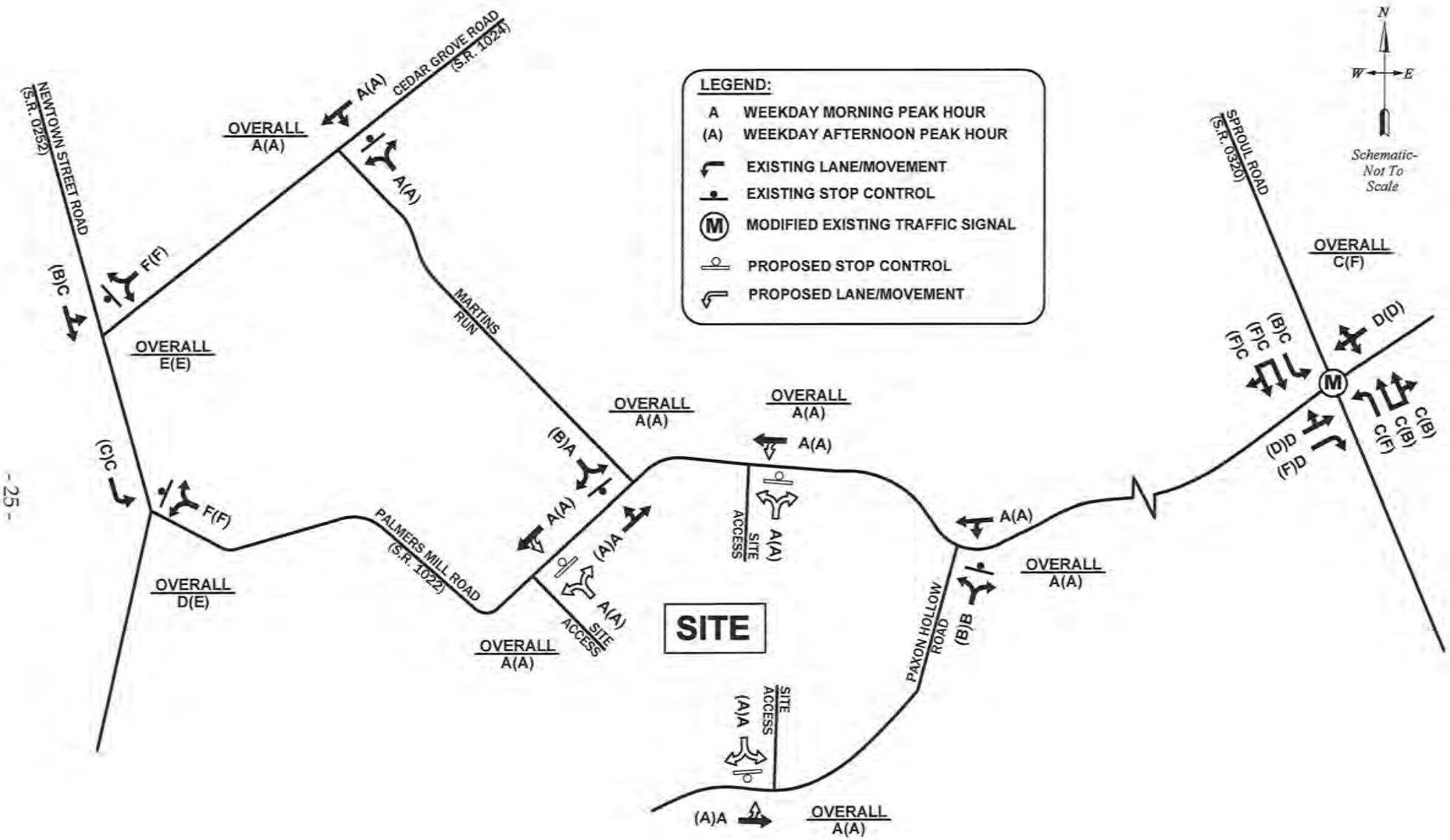

FIGURE 5D

2025 Future Weekday Peak Hour Levels of Service with Development

WOODLAND PRESERVE

MARPLE TOWNSHIP, DELAWARE COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

(12/8/2015) I:\eng\815641 - Marple Age-Restricted\Dwg\Figures\Figure 5D.dwg