

**Traffic Impact Analysis  
Rappahannock Landing Apartments  
Stafford County, Virginia**

**Table of Contents**

Executive Summary.....	3
Introduction .....	5
Background Information.....	5
Existing Roadway Network.....	7
Existing Intersection Characteristics.....	7
Data Collection.....	10
Information from VDOT .....	10
Traffic Forecast and Background Traffic .....	11
Proposed Development (Rappahannock Landing Apartments).....	14
Site Trip Generation.....	14
Capacity Analysis .....	15
Capacity Analysis – Existing Conditions (2018).....	16
Capacity Analysis Comparison – No Build vs Build Out Conditions (Year 2022) .....	18
Capacity Analysis Comparison – No Build vs Build Out Conditions (Year 2028) .....	22
Crash Data Evaluation .....	27
Other Modes of Transportation .....	28
Walking Facilities .....	28
Bicycle Facilities.....	29
Transit Facilities .....	29
Conclusions .....	29

### **List of Figures**

Figure 1. Site location.....	5
Figure 2. Site access points.....	6
Figure 3. Aerial of Warrenton Road & Short Street/Hotel Entrance .....	8
Figure 4. Aerial of Warrenton Road & Olde Forge Drive .....	9
Figure 5. Aerial of Warrenton Road & Solomon Drive/Lendall Lane.....	10

### **List of Tables**

Table 1. Trip Generation for Background Developments.....	13
Table 2: Rappahannock Landing Apartments Trip Generation .....	14
Table 3: HCM Level of Service Criteria .....	15
Table 4: Existing Conditions (2018) Capacity Analysis – Warrenton Road and Short Street.....	16
Table 5: Existing Conditions (2018) Capacity Analysis – Warrenton Road and Olde Forge Drive.....	17
Table 6: Existing Conditions (2018) Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane .....	17
Table 7: 2022 AM Peak Hour Capacity Analysis – Warrenton Road and Short Street.....	18
Table 8: 2022 PM Peak Hour Capacity Analysis – Warrenton Road and Short Street .....	19
Table 9: 2022 AM Peak Hour Capacity Analysis – Warrenton Road and Olde Forge Drive.....	19
Table 10: 2022 PM Peak Hour Capacity Analysis – Warrenton Road and Olde Forge Drive .....	20
Table 11: 2022 AM Peak Hour Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane .....	21
Table 12: 2022 PM Peak Hour Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane .....	22
Table 13: 2028 AM Peak Hour Capacity Analysis – Warrenton Road and Short Street.....	23
Table 14: 2028 PM Peak Hour Capacity Analysis – Warrenton Road and Short Street .....	23
Table 15: 2028 AM Peak Hour Capacity Analysis – Warrenton Road and Olde Forge Drive.....	24
Table 16: 2028 PM Peak Hour Capacity Analysis – Warrenton Road and Olde Forge Drive .....	25
Table 17: 2028 AM Peak Hour Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane .....	26
Table 18: 2028 PM Peak Hour Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane.....	27
Table 19: Crash Data – Warrenton Road and Short Street .....	28
Table 20: Crash Data – Warrenton Road and Olde Forge Drive .....	28

## **Appendixes**

Appendix A: VDOT Approved Pre-Scope of Work Meeting Form

Appendix B: Raw Traffic Data

Appendix C: U.S. 17 Corridor Study Performed by VDOT

Appendix D: Traffic Volume Figures

Appendix E: Existing Conditions (2018) Capacity Analysis

Appendix F: No Build and Build (2022) Capacity Analysis

Appendix G: No Build and Build (2028) Capacity Analysis

## **Executive Summary**

- The purpose of this study is to determine the impact to the existing roadway network in the vicinity of the proposed Rappahannock Landing Apartments. This proposed development will consist of 324 apartment units.
- The overall Rappahannock Landing Development currently consists of the following sections:
  - Section 1 (Condos) - This project was approved in 2010 and the construction has been completed.
  - Section 2 (Townhomes) - This project was approved in 2015 and it is currently under construction.
  - Section 3 (Townhomes) - This project was approved in 2015 and it is currently under construction.
  - Section 4 (Townhomes) - This project was approved in 2017 and it is currently under construction.
  - Section 5 (Apartments) - This project is currently under development.
- The following intersections were evaluated in this Traffic Impact Assessment:
  1. Warrenton Road and Short Street (Signalized Intersection)
  2. Warrenton Road and Olde Forge Drive (Unsignalized Intersection)
  3. Warrenton Road and Solomon Drive/Lendall Lane
- The proposed development is expected to generate 108 trips (28 in and 80 out) during the morning peak hour and 137 trips (84 in and 53 out) during the evening peak hour.
- For purposes of this analysis, it is anticipated that the proposed Rappahannock Landing Apartments will be constructed by the year 2022. The following scenarios will be evaluated as part of this study:
  - Existing conditions (2018)
  - The build out year without the proposed development (background) (2022 No Build)
  - The build out year with the proposed development (2022 Build)
  - The build out year without the proposed development (background) (2028 No Build)
  - The build out year with the proposed development (2028 Build)
- VDOT has currently completed a corridor improvement study for US Route 17 using the STARS program. The project limits are from I-95 to Route 1001 (Washington Street). The study provides recommendations to alleviate traffic congestion and improve safety along the corridor. General information from this study will be included and evaluated as part of this analysis.

- The VDOT US Route 17 corridor improvement study mentioned above includes improvements to the Warrenton Road/Short Street and Warrenton Road/Olde Forge Drive intersections. For the purpose of this study it was assumed that the existing traffic signal at the intersection of Warrenton Road/Short Street will be relocated to the intersection of Warrenton Road/Olde Forge Drive by the build out year (2022). It was also assumed that a raised median will be installed along Warrenton Road within the intersection of Warrenton Road/Short Street by the build out year (2022). Both of these improvements are discussed in the VDOT US Route 17 corridor improvement study.
- The proposed Rappahannock Landing Apartments Development was found to present minor increases of delay and/or changes in Levels of Service on the existing roadway network during the 2022 & 2028 no Build and Build conditions.
- The minor increases and/or changes can be mitigated by adjusting/optimizing the traffic signal timings to accommodate future traffic demand. Traffic signal timing evaluations are recommended once the proposed development is constructed by the year 2022.
- It is also recommended to coordinate with VDOT regarding the progress and timetable for the proposed improvements along Warrenton Road.
- The proposed Rappahannock Landing Apartments Development is not expected to adversely impact the existing roadway network with or without the proposed VDOT improvements.

## **Introduction**

This report summarizes the findings of the traffic impact analysis performed by Bowman Consulting Group (BCG) for the proposed development (Rappahannock Landing Apartments) located in Stafford County, Virginia on Tax Map 53, Parcel 1E. The site consists of 25.53 acres and is currently zoned R-1. The developer is seeking rezoning to UD-3 in order to develop 324 apartment units.

The purpose of this analysis is to determine the potential impact (if any) to the existing traffic operations within the surrounding roadway network caused by the proposed development. This analysis has been coordinated with VDOT and Stafford County. The Pre-Scope of Work Meeting Form which includes the agreement of the major components of this study can be found in **Appendix A**.

## **Background Information**

The proposed site is located on the south east quadrant of the I-95/US 17 interchange. The proposed Rappahannock Landing Apartments is one of the sections for the overall Rappahannock Landing Development in this quadrant. **Figure 1**, depicts the site location.



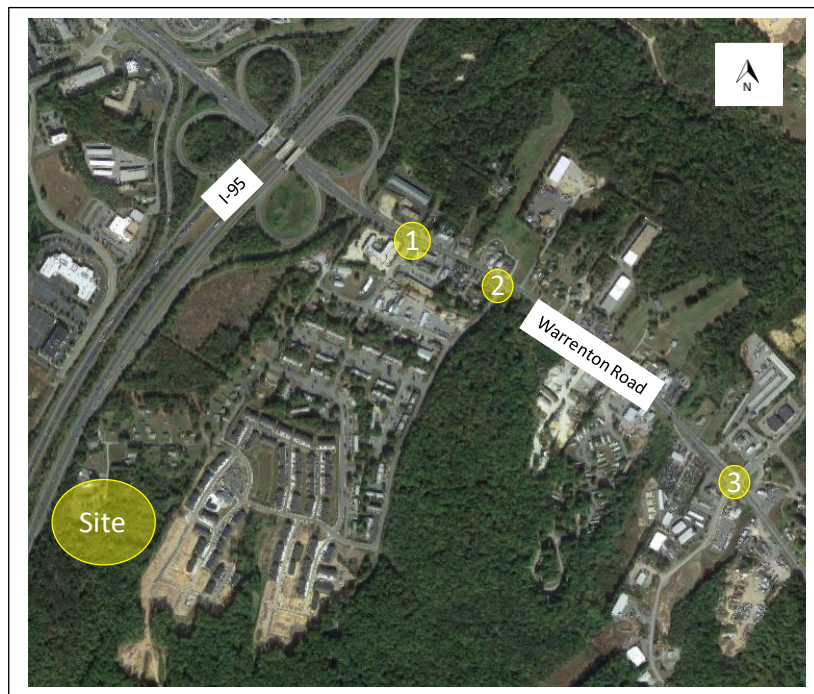
**Figure 1. Site location.**



The overall Rappahannock Landing Development currently consists of the following sections:

- Section 1 (Condos) - This project was approved in 2010 and the construction has been completed.
- Section 2 (Townhomes) - This project was approved in 2015 and it is currently under construction.
- Section 3 (Townhomes) - This project was approved in 2015 and it is currently under construction.
- Section 4 (Townhomes) - This project was approved in 2017 and it is currently under construction.
- Section 5 (Apartments) - This project is currently under development.

Access to the site is currently provided via two existing local roadways (Short Street & Olde Forge Drive) that intersect Warrenton Road (US 17). **Figure 2** depicts the existing access points for the proposed site.



**Figure 2. Site access points.**

For purposes of this analysis, the following three (3) intersections will be analyzed in this report:

1. Warrenton Road (Route 17) and Short Street/Hotel Entrance (Signalized Intersection)
2. Warrenton Road (Route 17) and Olde Forge Drive (Unsignalized Intersection)
3. Warrenton Road (Route 17) and Solomon Drive/Lendall Lane (Signalized Intersection)

To assess the traffic operations at these intersections, the following tasks were undertaken:

- Field inspections were conducted to obtain an inventory of existing roadway geometry, traffic control, and location of adjacent intersections.
- Turning movement counts were obtained from VDOT for the morning and evening peak periods. These counts will be used to identify peak hours, determine traffic patterns, and evaluate intersection Levels of Service.
- Capacity analyses were prepared to determine existing and projected Levels of Service (LOS) and maximum queue lengths.

### **Existing Roadway Network**

Warrenton Road (US 17) within the identified study area is a four-lane undivided roadway with a mix of auxiliary lanes and a center two-way left turn lane. Route 17 is identified as a principle arterial roadway on VDOT's 2014 Functional Classification Map. It has an east-west alignment within the study area with a posted speed limit of 45 miles per hour.

Short Street (Route 1034) within the identified study area is a two-lane undivided roadway identified as a major collector roadway on VDOT's 2014 Functional Classification Map. Short Street has a north-south alignment with the intersection of Route 17 and an east-west alignment with the intersection of Musselman Road. Short Street has a posted speed limit of 25 miles per hour.

Olde Forge Drive (Route 1580) within the identified study area is a two-lane undivided roadway identified as a local street on VDOT's 2014 Functional Classification Map. Olde Foge Drive has a north-south alignment with a posted speed limit of 25 miles per hour. It is median divided only at the intersection with Warrenton Road (Route 17).

Solomon Drive (Route 1001) within the identified study area is a two-lane undivided roadway identified as a local street on VDOT's 2014 Functional Classification Map. Solomon Drive has a north-south alignment and does not have a posted speed limit. Solomon Drive is a newly constructed roadway serving parcels which are largely undeveloped.

Lendall Lane (Route 1015) within the identified study area is a two-lane undivided roadway identified as a local street on VDOT's 2014 Functional Classification Map. Lendall Lane has a north-south alignment with a posted speed limit of 30 miles per hour.

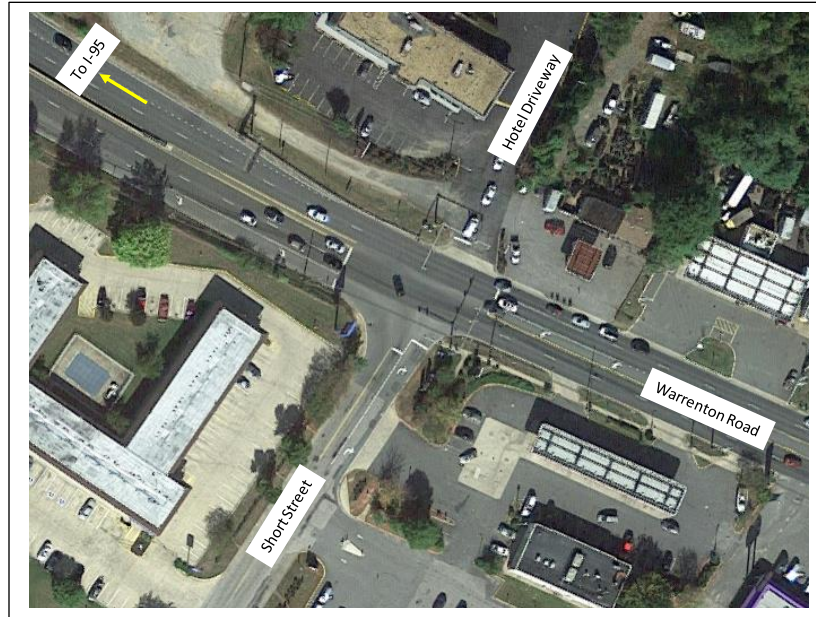
### **Existing Intersection Characteristics**

#### **Intersection of Warrenton Road (US 17) and Short Street/Hotel Entrance**

This intersection is currently a four legged signalized intersection where Short Street has a north-south alignment and Warrenton Road (Route 17) has an east-west alignment as shown in **Figure 3**. The fourth leg of this intersection is a private parking lot entrance which serves a hotel.







**Figure 3. Aerial of Warrenton Road & Short Street/Hotel Entrance**

The eastbound approach consists of one shared left-through lane, one through lane and one exclusive right turn lane with 150 feet of storage. The northbound approach consists of one shared left-through lane and one exclusive right turn lane with 150 feet of storage. The westbound approach consists of one exclusive left turn lane with 175 feet of storage, one through lane and one shared through-right turn lane. The southbound approach consists of one shared left-through-right lane.

#### Intersection of Warrenton Road (US 17) and Olde Forge Drive

This intersection is currently a three legged unsignalized intersection where Olde Forge Drive has a north-south alignment and Warrenton Road (Route 17) has an east-west alignment as shown in **Figure 4**. Olde Forge Drive operates as stop controlled while Warrenton Road (Route 17) is free flowing.

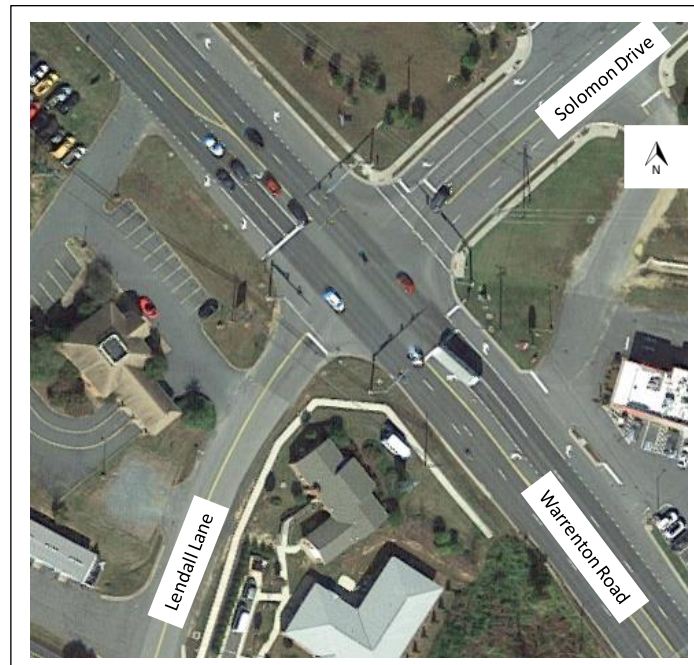


**Figure 4. Aerial of Warrenton Road & Olde Forge Drive**

The eastbound approach consists of a center dual left turn lane, a through lane and a shared through-right turn lane. The northbound approach consists of a divided median with one right turn lane and one left turn lane. The westbound approach consists of a center dual left turn lane and two through lanes. The outer most through lane also serves as a way for motorists to access private driveways to the north of Warrenton Road as a right turn lane is not provided. Note that there is a private driveway which provides a fourth leg to this intersection. This private driveway is not included in this analysis as the existing traffic volumes for this driveway are minimal.

#### Intersection of Warrenton Road (US 17) and Solomon Drive/Lendall Lane

This intersection is currently a four legged signalized intersection where Solomon Drive and Lendall Lane have a north-south alignment and Warrenton Road (Route 17) has an east-west alignment as shown in **Figure 5**.



**Figure 5. Aerial of Warrenton Road & Solomon Drive/Lendall Lane**

The eastbound approach consists of an exclusive left turn lane with 50 feet of storage and a 75-foot taper, two through lanes and an exclusive right turn lane with 50 feet of storage and a 120 foot taper. The northbound approach consists one shared left-through-right lane. The westbound approach consists of one exclusive left turn lane with 100 feet of storage and a 100-foot taper, two through lanes and one exclusive right turn lane with 325 feet of storage. The southbound approach consists of one exclusive left turn lane with 140 feet of storage and 100-foot taper, one through lane and one exclusive right turn lane with 140 feet of storage.

### **Data Collection**

Field inspections were conducted to obtain an inventory of existing roadway geometry, traffic control, and location of adjacent intersections.

Turning movement counts for the morning and evening peak periods were provided by VDOT for the US Route 17 corridor. These counts were used to identify peak hours, determine traffic patterns, and evaluate intersection Levels of Service. The 2017 traffic counts are included in **Appendix B**.

### **Information from VDOT**

VDOT has completed a corridor study along US 17 from I-95 to Route 1 through the STARS program. The program objective is to develop solutions to improve traffic congestion and safety issues that can be programmed in the VDOT Six-Year Improvement Plan.

The results of the study were presented to the public at a Citizen Information Meeting on May 10, 2017. The improvements presented still need to be prioritized and the study needs to be finalized.

The study is proposing the following improvements along Warrenton Road (Route 17):

#### Intersection of Warrenton Road and Short Street

- Install a raised median to prohibit left turns from the side streets.
- Remove existing traffic signal

#### Intersection of Warrenton Road and Olde Forge Drive

- Install a new traffic signal
- Provide dedicated left turn lanes for traffic along Warrenton Road.
- Install a right turn lane to access Olde Forge Drive.
- Realign RV Parkway with Olde Forge Drive.

The study at this point indicates cost estimates and a timeframe for construction (4 years). It is our understanding that the majority of these recommendations will be completed by others (except the realignment of the RV Parkway with Olde Forge Drive).

For purposes of this analysis, it was assumed that the improvements mentioned above for the intersection of Warrenton Road/Short Street will be completed by the build out year (2022). All trip distributions and capacity analyses for years 2022 and 2028 within this report were conducted with these improvements.

The corridor study information can be found in **Appendix C**.

#### **Traffic Forecast and Background Traffic**

For purposes of this analysis, it is anticipated that the proposed Rappahannock Landing Apartments 5 will be constructed by the year 2022. The following scenarios will be evaluated as part of this analysis:

- Existing conditions (2018)
- The build out year without the proposed development (background) (2022 No Build)
- The build out year with the proposed development (2022 Build)
- The build out year without the proposed development (background) (2028 No Build)
- The build out year with the proposed development (2028 Build)

Three steps were considered on the traffic forecast (background traffic) evaluation.

The first step was to determine a background growth rate applicable for the area. A growth rate of 2.0% was used for traffic along US Route 17. This growth rate was only applied to through

movements along Route 17 as there is no commercial or residential development within this area which this growth rate would apply.

The traffic counts provided by VDOT completed in 2017. These counts were projected to 2018 using a 2% growth rate for through movements along Route 17. The 2018 traffic volumes (Existing) are summarized and depicted in **Exhibit 1 of Appendix D**. Please note that these volumes have been redistributed to account for the roadway improvements mentioned previously. These newly distributed existing traffic volumes are summarized and depicted in **Exhibit 2 of Appendix D**.

The 2018 traffic volumes were then projected using the 2% growth rate to the year 2022 and 2028 to develop the No-Build conditions.

The second step was to consider the status of the Rappahannock Landing development at the time the traffic counts were conducted (2017). At this time, the following sections of Rappahannock Landing had been constructed:

- Section 1 – 100% Constructed/Occupied
- Section 2 – 40% Constructed/Occupied
- Section 3 – 40% Constructed/Occupied
- Section 4 – 0% Constructed/Occupied

Since sections 2 through 4 are not 100% constructed/occupied, a trip generation was conducted for these sections to identify trips that were not captured during the traffic counts. The trips generated by background developments as shown in **Table 1** are summarized and depicted in **Exhibit 5 of Appendix D**.

**Table 1** below summarizes the trip generation which has been completed for Rappahannock Landing sections 2-4. With 40% of sections 2 and 3 of Rappahannock Landing having been established prior to when the existing traffic counts were conducted, only 60% of the trips generated by these sections are being added to the existing traffic counts.



**Table 1. Trip Generation for Background Developments**

Land Use	Size	Units	Land Use Code	Weekday						
				AM Peak Hour			PM Peak Hour			Average Daily Trips
				In	Out	Total	In	Out	Total	
<b>Rappahannock Landing - Section 2</b>										
Townhomes	131 D.U.		220	14	48	62	47	28	75	949
60% Generated Trips				8	29	37	28	17	45	569
<b>Rappahannock Landing - Section 3</b>										
Townhomes	154 D.U.		220	17	55	72	55	32	87	1,123
60% Generated Trips				10	33	43	33	19	52	674
<b>Rappahannock Landing - Section 4</b>										
Townhomes	276 D.U.		220	29	96	125	92	54	146	2,046
<b>Total Trips From Other Planned Developments<sup>(2)</sup></b>				<b>47</b>	<b>158</b>	<b>205</b>	<b>153</b>	<b>90</b>	<b>243</b>	<b>3,289</b>

Notes: (1) Based on the Institute of Transportation Engineers Trip Generation, 10th Edition.

(2) Total includes 60% of Rappahannock Landing Section 2 & 3 trip generation.

The arrival/departure trip distribution was prepared based on existing roadway traffic patterns and in coordination with VDOT and the County (See Scope of work). Generally, it is expected that 75% of the traffic will be generated to/from the west of the Rappahannock Landing Site while 25% of the traffic will be generated to/from the east. The arrival/departure rates are depicted on **Exhibit 4 in Appendix D**.

The third step was to identify nearby developments within VDOT’s LandTrack System that are projected to be completed within the near future. The following projects and respective traffic impact assessments were found in the system.

- Westlake Traffic Impact Study prepared by Wells + Associates (4/13/17)
- Traffic Analysis For McDonald’s at Retail Buildings At Stafford Lakes prepared by DRW Consultants, LLC (11/16/14)
- Proposed Grocery Store on Warrenton Road Traffic Impact Study by Kimley-Horn (9/17/15).

Although these studies are located along the US 17 corridor, they are located west of the I-95/US 17 interchange and would not be applicable for this analysis. Therefore, background traffic from these developments will not be considered in this analysis.

The only background projects applicable for this analysis are Rappahannock Landing Sections 2-4. The traffic forecast for these sections of Rappahannock Landing are accounted for in step two.

The No Build traffic volumes plus the background traffic are depicted on **Exhibits 7 and 9 in Appendix D**. These volumes create the total no build conditions for years 2022 and 2028.



**Proposed Development (Rappahannock Landing Apartments)**

The Applicant, Breeden Company, is proposing to develop section 5 of the Rappahannock Landing development with a residential land use. The proposed development will consist of the following land use:

- 324 Apartment Units

**Site Trip Generation**

A trip generation for the proposed development is shown in **Table 2** and depicted on **Exhibit 6** in **Appendix D**. The Institute of Transportation Engineers (ITE) *Trip Generation Manual, 10th edition* was used to determine the number of trips generated by the land use (Multifamily Housing (Mid-Rise), land use code 221). The average weekday morning and evening peak hour trips were determined along with the average daily trips.

**Table 2: Rappahannock Landing Apartments Trip Generation**

Land Use	Size	Units	Land Use Code	Weekday						
				AM Peak Hour			PM Peak Hour			Average Daily Trips
				In	Out	Total	In	Out	Total	
<b>Rappahannock Landing - Section 5</b>										
Apartments	324	D.U.	221	28	80	108	84	53	137	1,764
<b>Total Trips</b>				<b>28</b>	<b>80</b>	<b>108</b>	<b>84</b>	<b>53</b>	<b>137</b>	<b>1,764</b>

Notes: (1) Based on the Institute of Transportation Engineers Trip Generation, 10th Edition.

These traffic volumes were then distributed to the roadway system in accordance with a site traffic distribution pattern developed based on a review of traffic patterns in the area. For purposes of this study, it was determined that 75% of the site generated trips will travel to/from the west along Warrenton Road with 25% of the site generated trips traveling to/from the east.

With Olde Forge Drive serving as the main entrance for the Rappahannock Landing Apartments development, it was determined that 95% of the traffic leaving the development will use Olde Forge Drive (future signalized intersection) to access Warrenton Road. These trips will access Olde Forge Drive by navigating through previously developed sections of Rappahannock Landing. The remaining 5% of the traffic leaving the development will use Short Street (future unsignalized intersection) to access Warrenton Road.

It was also determined that 75% of the trips entering the site will use Short Street while 25% of the trips entering the site will use Olde Forge Drive. This is due to 75% of the trips coming from the west as these trips will arrive at the unsignalized Short Street before approaching the signalized Olde Forge Drive. This assumption will allow drivers to avoid the Olde Forge traffic signal and take a free-flowing right turn onto Short Street to access the development.

With the large number of incoming trips using Short Street and Olde Forge Drive, Rappahannock Landing Apartments is prepared to install guide signs in the area to facilitate and provide guidance to the development. The site generated trip distribution is depicted on **Exhibit 3** and **Exhibit 4** in **Appendix D**.

The projected 2022 and 2028 Build conditions (including the morning and evening trip volumes for the Rappahannock Landing Apartments) are depicted on **Exhibit 8** and **Exhibit 10** in **Appendix D**.

The 2022 and 2028 build scenarios were created using the 2022 and 2028 No Build traffic volumes plus the traffic volumes from the Rappahannock Landing Apartments.

**Capacity Analysis**

The three previously mentioned study intersections were analyzed for each scenario using the 2016 Highway Capacity Manual (HCM) methodologies using the computer software package Synchro 10 with Sim Traffic. The analysis uses capacity, Level of Service, and control delay as the criteria for the performance of the intersections.

Capacity, as defined by the HCM, is a measure of the maximum number of vehicles in an hour that can travel through an intersection or section of roadway under typical conditions. Level of Service (LOS) is a marker of the driving conditions and perception of drivers while traveling during the given time period. LOS ranges from LOS “A” which represents free flow conditions, to LOS “F” which represents breakdown conditions. **Table 3** shows the LOS for intersections as defined by the HCM.

**Table 3: HCM Level of Service Criteria**

Unsignalized Intersections		Signalized Intersections	
Level of Service	Average Control Delay (sec/veh)	Level of Service	Average Control Delay (sec/veh)
A	≤10	A	≤10
B	>10-15	B	>10-20
C	>15-25	C	>20-35
D	>25-35	D	>35-55
E	>35-50	E	>55-80
F	≥50	F	≥80

Typically, LOS “A” through “D” is considered acceptable, while LOS “E” and “F” are considered failing or unacceptable. Control delay is a measure of the total amount of delay experienced by an individual vehicle and includes delay related to deceleration, queue delay, stopped delay, and acceleration. **Table 3** displays the amount of control delay (in seconds per vehicle) that corresponds to the LOS for signalized and unsignalized intersections.

Capacity analyses were completed for the above referenced study intersections during the No Build conditions and the Build conditions.

**Capacity Analysis – Existing Conditions (2018)**

Intersection of Warrenton Road and Short Street

Based on the results of the capacity analysis, the intersection of Warrenton Road and Short Street is projected to experience acceptable overall levels of service during the morning and evening peak hours. All turning movements and approaches currently operate at acceptable levels of service “D” or better. The results are summarized in **Table 4**. The capacity analysis results are included in **Appendix E**.

**Table 4: Existing Conditions (2018) Capacity Analysis – Warrenton Road and Short Street**

INTERSECTION			AM Peak			PM Peak		
			Conditions			Conditions		
Approach	Movement	DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
		NB	LT	41.5	D	114.0	41.0	D
R	36.7		D	26.0	37.0	D	27.0	
Approach	40.8		D		40.4	D		
SB	LTR	47.9	D	29.0	46.1	D	35.0	
EB	LT	16.9	B	233.0	25.5	C	233.0	
	T	16.9	B	256.0	25.5	C	388.0	
	R	8.0	A	136.0	9.2	A	74.0	
	Approach	16.5	B		24.1	C		
WB	L	3.0	A	21.0	4.0	A	42.0	
	T	3.4	A	163.0	2.4	A	84.0	
	TR	3.4	A	125.0	2.4	A	205.0	
	Approach	3.4	A		2.4	A		
<b>OVERALL</b>		<b>11.7</b>	<b>B</b>		<b>16.6</b>	<b>B</b>		

\*Extracted from SimTraffic simulation software

Intersection of Warrenton Road and Olde Forge Drive

Based on the results of the capacity analysis, the unsignalized intersection of Warrenton Road and Olde Forge Drive is projected to experience acceptable overall levels of service during the morning and evening peak hours. All turning movements and approaches currently operate at acceptable levels of service “B” or better.

The results are summarized in **Table 5**. The capacity analysis results are included in **Appendix E**.

**Table 5: Existing Conditions (2018) Capacity Analysis – Warrenton Road and Olde Forge Drive**

INTERSECTION			AM Peak			PM Peak		
			Conditions			Conditions		
Approach	Movement	DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
		<b>Intersection #2: Warrenton Road (Route 17) &amp; Olde Forge Drive (2018 Existing Conditions)</b>	NB	L	10.9	B		13.9
R	-			A	30.0	-	A	53.0
Approach	10.9		B		13.9	B		
EB	T		-	A	54.0	-	A	
	TR		-	A		-	A	
	Approach		-	A		-	A	
WB	L	10.7	B	53.0	13.4	B	51.0	
	T	-	A		-	A		
	Approach	0.2	A		0.6	A		

\*Extracted from SimTraffic simulation software

Intersection of Warrenton Road and Solomon Drive/Lendall Lane

Based on the results of the capacity analysis, the intersection of Warrenton Road and Solomon Drive/Lendall Lane is expected to experience acceptable overall levels of service during the morning and evening peak hours. All turning movements and approaches currently operate at acceptable levels of service “D” or better.

The results are summarized in **Table 6**. The capacity analysis results are included in **Appendix E**.

**Table 6: Existing Conditions (2018) Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane**

INTERSECTION			AM Peak			PM Peak		
			Conditions			Conditions		
Approach	Movement	DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
		<b>Intersection #3: Warrenton Road &amp; Solomon Drive/Lendall Lane (2018 Existing Conditions)</b>	NB	LTR	42.3	D	72.0	43.9
SB	L		42.3	D	72.0	43.1	D	49.0
	T		40.0	D	52.0	41.2	D	
	R		40.2	D	46.0	41.2	D	52.0
	Approach		41.1	D		42.2	D	
EB	L		22.2	C	88.0	1.3	A	68.0
	T		12.0	B	45.0	9.3	A	105.0
	R		10.0	B		8.6	A	15.0
WB	Approach		12.8	B		9.1	A	
	L		11.8	B	6.0	14.7	B	6.0
	T		25.7	C	178.0	16.5	B	211.0
	R		12.6	B		9.7	A	
Approach			25.1	C		16.4	B	
<b>OVERALL</b>			<b>20.5</b>	<b>C</b>		<b>13.9</b>	<b>B</b>	

\*Extracted from SimTraffic simulation software

### Capacity Analysis Comparison – No Build vs Build Out Conditions (Year 2022)

Capacity Analyses were conducted for the No Build and Build conditions (year 2022). The primary purpose for this approach was to compare the results in order to identify areas impacted by the proposed development.

#### Intersection of Warrenton Road and Short Street

Based on the results of the capacity analysis during the morning peak hour, the intersection of Warrenton Road and Short Street is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “C” or better during the morning peak hour for the no build and build out conditions. The results are summarized in **Table 7**. The capacity analysis results are included in **Appendix F**.

**Table 7: 2022 AM Peak Hour Capacity Analysis – Warrenton Road and Short Street**

INTERSECTION			AM Peak (No Build)			AM Peak (Build Out)		
			Conditions			Conditions		
<b>Intersection #1:</b> Warrenton Road (Route 17) & Short Street/Hotel Entrance (2022 No Build vs. Build Out AM Conditions)	Approach	Movement	DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*
	NB	R	17.9	C	22.0	18.1	C	80.0
	SB	R	9.8	A	25.0	10.0	A	28.0
	EB	T	-	A	121.0	-	A	245.0
		R	-	A		-	A	
	WB	Approach	-	A		-	A	
		T	-	A		-	A	
		TR	-	A		-	A	
	Approach	-	A		-	A		

\*Extracted from SimTraffic simulation software

Based on the results of the capacity analysis during the evening peak hour, the intersection of Warrenton Road and Short Street is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “C” or better during the evening peak hour for the no build and build out conditions. The results are summarized in **Table 8**. The capacity analysis results are included in **Appendix F**.

**Table 8: 2022 PM Peak Hour Capacity Analysis – Warrenton Road and Short Street**

INTERSECTION			PM Peak (No Build)			PM Peak (Build Out)		
			Conditions			Conditions		
			DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*
<b>Intersection #1:</b> Warrenton Road (Route 17) & Short Street/Hotel Entrance (2022 No Build vs. Build Out PM Conditions)	Approach	Movement						
	NB	R	24.4	C	63.0	24.7	C	41.0
	SB	R	11.4	B	28.0	11.6	B	48.0
	EB	T	-	A	305.0	-	A	369.0
		R	-	A	307.0	-	A	333.0
	WB	Approach	-	A		-	A	
		T	-	A		-	A	
		TR	-	A		-	A	
		Approach	-	A		-	A	

\*Extracted from SimTraffic simulation software

Based on the capacity analyses for the 2022 No Build and Build conditions, the intersection of Warrenton Road and Short Street is not expected to experience a significant increase in delay from the proposed development. The overall level of service did not change for the morning or evening peak hour when comparing the no build and build out condition.

Intersection of Warrenton Road and Olde Forge Drive

Based on the results of the capacity analysis during the morning peak hour, the intersection of Warrenton Road and Olde Forge Drive is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “D” or better during the morning peak hour for the no build and build out conditions. The results are summarized in **Table 9**. The capacity analysis results are included in **Appendix F**.

**Table 9: 2022 AM Peak Hour Capacity Analysis – Warrenton Road and Olde Forge Drive**

INTERSECTION			AM Peak (No Build)			AM Peak (Build Out)		
			Conditions			Conditions		
			DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*
<b>Intersection #2:</b> Warrenton Road (Route 17) & Olde Forge Drive (2022 No Build vs. Build Out AM Conditions)	Approach	Movement						
	NB	L	29.2	C	137.0	32.4	C	234.0
		R	23.2	C	51.0	23.6	C	73.0
		Approach	27.9	C		30.5	C	
	EB	L	13.9	B		14.7	B	
		T	31.3	C	352.0	35.9	D	364.0
		TR	31.3	C	352.0	35.9	D	357.0
	WB	Approach	31.3	C		35.9	D	
		L	12.0	B	90.0	13.8	B	219.0
		T	5.1	A	228.0	5.0	A	398.0
	Approach	5.4	A		5.3	A		
	<b>OVERALL</b>		<b>19.1</b>	<b>B</b>		<b>21.5</b>	<b>C</b>	

\*Extracted from SimTraffic simulation software



Based on the results of the capacity analysis during the evening peak hour, the intersection of Warrenton Road and Olde Forge Drive is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “D” or better during the evening peak hour for the no build and build out conditions. The results are summarized in **Table 10**. The capacity analysis results are included in **Appendix F**.

**Table 10: 2022 PM Peak Hour Capacity Analysis – Warrenton Road and Olde Forge Drive**

INTERSECTION			PM Peak (No Build)			PM Peak (Build Out)			
			Conditions			Conditions			
			DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
<b>Intersection #2:</b> Warrenton Road (Route 17) & Olde Forge Drive (2022 No Build vs. Build Out PM Conditions)	Approach	L	44.5	D	189.0	48.3	D	246.0	
		R	35.2	D	30.0	35.3	D	175.0	
		Approach	42.4	D		45.5	D		
	EB	L	11.6	B	31.0	11.6	B		
		T	50.7	D	380.0	51.2	D	385.0	
		TR	50.7	D	366.0	51.2	D	368.0	
	WB	Approach	50.6	D		51.0	D		
		L	25.8	C	116.0	30.7	C	112.0	
		T	8.0	A	72.0	8.0	A	250.0	
	Approach			9.3	A		9.9	A	
	<b>OVERALL</b>			<b>33.8</b>	<b>C</b>		<b>34.5</b>	<b>C</b>	

\*Extracted from SimTraffic simulation software

Based on the capacity analyses for the 2022 No Build and Build conditions, the intersection of Warrenton Road and Short Street is not expected to experience a significant increase in delay from the proposed development. During the morning peak hour the intersection will experience an increase in overall delay of 2.4 seconds between the no build and build conditions. During the evening peak hour the intersection will experience an increase in overall delay of 0.7 seconds between the no build and build conditions. While the overall level of service did not change for the evening peak hour, the morning peak hour experienced a change in the overall level of service from “B” to “C”. While this change should be noted, with a change in delay of less than one second drivers will not experience a change in service while using the intersection. This level of service change can be mitigated by optimizing/adjusting the traffic signal timings in the future.

Intersection of Warrenton Road and Solomon Drive/Lendall Lane

Based on the results of the capacity analysis during the morning peak hour, the intersection of Warrenton Road and Solomon Drive/Lendall Lane is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “D” or better during the morning peak hour for the no build and build out conditions. The results are summarized in **Table 11**. The capacity analysis results are included in **Appendix F**.

**Table 11: 2022 AM Peak Hour Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane**

INTERSECTION			AM Peak (No Build)			AM Peak (Build Out)			
			Conditions			Conditions			
			DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
<b>Intersection #3:</b> Warrenton Road & Solomon Drive/Lendall Lane (2022 No Build vs. Build Out AM Conditions)	Approach	Movement							
	NB	LTR	44.8	D	54.0	44.8	D	91.0	
	SB	L	43.1	D	149.0	43.1	D	58.0	
		T	40	D	262.0	40.0	D	30.0	
		R	40.2	D	164.0	40.2	D	72.0	
		Approach	41.4	D		41.4	D		
	EB	L	30.4	C	195.0	32.0	C	81.0	
		T	3.2	A	206.0	3.0	A	248.0	
		R	7.6	A		7.6	A	74.0	
		Approach	5.1	A		5.1	A		
	WB	L	9.8	A	18.0	10.0	B	129.0	
		T	19.6	B	273.0	19.7	B	242.0	
		R	9.1	A		9.1	A	24.0	
		Approach	19.2	B		19.3	B		
	<b>OVERALL</b>			<b>14.0</b>	<b>B</b>		<b>14.0</b>	<b>B</b>	

\*Extracted from SimTraffic simulation software

Based on the results of the capacity analysis during the evening peak hour, the intersection of Warrenton Road and Solomon Drive/Lendall Lane is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “D” or better during the evening peak hour for the no build and build out conditions except for the northbound approach. This approach operates at a level of service “E” for both the no build and build conditions. This failing level of service can be mitigated by optimizing/adjusting the traffic signal timings in the future along with adding auxiliary lanes for the approach. The results are summarized in **Table 12**. The capacity analysis results are included in **Appendix F**.

**Table 12: 2022 PM Peak Hour Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane**

INTERSECTION			PM Peak (No Build)			PM Peak (Build Out)			
			Conditions			Conditions			
			DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
<b>Intersection #3:</b> Warrenton Road & Solomon Drive/Lendall Lane (2022 No Build vs. Build Out PM Conditions)	Approach	Movement							
	NB	LTR	63	E	96.0	65.6	E	195.0	
	SB	L	51.5	D	49.0	51.5	D	93.0	
		T	48.0	D	31.0	48.0	D	30.0	
		R	47.8	D	66.0	47.8	D	53.0	
		Approach	49.8	D		49.8	D		
	EB	L	8.6	A	44.0	8.7	A	44.0	
		T	23.3	C	141.0	23.6	C	216.0	
		R	6.5	A	74.0	6.4	A		
		Approach	22.8	C		23.1	C		
	WB	L	18.4	B	18.0	18.7	B	18.0	
		T	14.1	B	223.0	14.2	B	288.0	
		R	7.2	A	1.0	7.1	A	285.0	
		Approach	14.0	B		14.1	B		
	<b>OVERALL</b>			<b>21.2</b>	<b>C</b>		<b>21.4</b>	<b>C</b>	

\*Extracted from SimTraffic simulation software

Based on the capacity analyses for the 2022 No Build and Build conditions, the intersection of Warrenton Road and Solomon Drive/Lendall Lane is not expected to experience a significant increase in delay from the proposed development. During the morning hour the intersection will experience no change in overall delay between the no build and build conditions. During the evening peak hour, the intersection will experience an increase in overall delay of 0.2 seconds. The overall level of service did not change for the morning or evening peak hour when comparing the no build and build out condition.

### Capacity Analysis Comparison – No Build vs Build Out Conditions (Year 2028)

Capacity Analyses were conducted for the No Build and Build conditions (year 2028). The primary purpose for this approach was to compare the results in order to identify areas impacted by the proposed development.

#### Intersection of Warrenton Road and Short Street

Based on the results of the capacity analysis during the morning peak hour, the intersection of Warrenton Road and Short Street is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “C” or better during the morning peak hour for the no build and build out conditions. The results are summarized in **Table 13**. The capacity analysis results are included in **Appendix G**.

**Table 13: 2028 AM Peak Hour Capacity Analysis – Warrenton Road and Short Street**

INTERSECTION			AM Peak (No Build)			AM Peak (Build Out)		
			Conditions			Conditions		
Intersection #1: Warrenton Road (Route 17) & Short Street/Hotel Entrance (2028 No Build vs. Build Out AM Conditions)	Approach	Movement	DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*
	NB	R	20.0	C	110.0	20.2	C	61.0
	SB	R	10.0	B	28.0	10.4	B	
	EB	T	-	A	282.0	-	A	370.0
		R	-	A	235.0	-	A	267.0
		Approach	-	A		-	A	
	WB	T	-	A		-	A	
		TR	-	A		-	A	
		Approach	-	A		-	A	

\*Extracted from SimTraffic simulation software

Based on the results of the capacity analysis during the evening peak hour, the intersection of Warrenton Road and Short Street is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “D” or better during the evening peak hour for the no build and build out conditions. The results are summarized in **Table 14**. The capacity analysis results are included in **Appendix G**.

**Table 14: 2028 PM Peak Hour Capacity Analysis – Warrenton Road and Short Street**

INTERSECTION			PM Peak (No Build)			PM Peak (Build Out)		
			Conditions			Conditions		
Intersection #1: Warrenton Road (Route 17) & Short Street/Hotel Entrance (2028 No Build vs. Build Out PM Conditions)	Approach	Movement	DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*
	NB	R	29.4	D	44.0	29.9	D	147.0
	SB	R	11.9	B	28.0	12.2	B	28.0
	EB	T	-	A	370.0	-	A	342.0
		R	-	A	353.0	-	A	341.0
		Approach	-	A		-	A	
	WB	T	-	A		-	A	
		TR	-	A		-	A	
		Approach	-	A		-	A	

\*Extracted from SimTraffic simulation software

Based on the capacity analyses for the 2028 No Build and Build conditions, the intersection of Warrenton Road and Short Street is not expected to experience an increase in delay from the proposed development. The overall level of service did not change for the morning or evening peak hour when comparing the no build and build out conditions.

Intersection of Warrenton Road and Olde Forge Drive

Based on the results of the capacity analysis during the morning peak hour, the intersection of Warrenton Road and Olde Forge Drive is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “D” or better during the morning peak hour for the no build and build out conditions. The results are summarized in **Table 15**. The capacity analysis results are included in **Appendix G**.

**Table 15: 2028 AM Peak Hour Capacity Analysis – Warrenton Road and Olde Forge Drive**

INTERSECTION			AM Peak (No Build)			AM Peak (Build Out)			
			Conditions			Conditions			
			DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
<u>Intersection #2:</u> Warrenton Road (Route 17) & Olde Forge Drive (2028 No Build vs. Build Out AM Conditions)	Approach	Movement							
	NB		L	37.0	D	225.0	41.7	D	200.0
			R	28.3	C	175.0	28.4	C	74.0
			Approach	35.2	D		38.9	D	
	EB		L	12.5	B		12.5	B	
			T	31.6	C	360.0	31.9	C	383.0
			TR	31.6	C	358.0	31.9	C	357.0
			Approach	31.6	C		31.9	C	
	WB		L	11.8	B	72.0	18.4	B	52.0
			T	4.2	A	404.0	4.2	A	328.0
			Approach	4.4	A		4.7	A	
	<b>OVERALL</b>			<b>19.3</b>	<b>B</b>		<b>20.2</b>	<b>C</b>	

\*Extracted from SimTraffic simulation software

Based on the results of the capacity analysis during the evening peak hour, the intersection of Warrenton Road and Olde Forge Drive is projected to experience overall acceptable levels of service “D” during the no build and build out conditions.

Multiple turning movements during the build and build out scenarios are expected to operate at an unacceptable level of service “E” during the evening peak hour. These turning movements all experience an unacceptable level of service and long delays during the no build and build out conditions. The main cause of these delays is due to the planned growth in the area projected to 2028. These unacceptable levels of service can be mitigated by optimizing/adjusting the traffic signal timings and/or intersection geometry in the future. The results are summarized in **Table 16**. The capacity analysis results are included in **Appendix G**.

**Table 16: 2028 PM Peak Hour Capacity Analysis – Warrenton Road and Olde Forge Drive**

INTERSECTION			PM Peak (No Build)			PM Peak (Build Out)			
			Conditions			Conditions			
<p style="text-align: center;"><b>Intersection #2:</b>  Warrenton Road (Route 17) &amp; Olde Forge Drive  (2028 No Build vs. Build Out PM Conditions)</p>	Approach	Movement	DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
	NB		L	64.5	E	168.0	68.6	E	307.0
			R	53.7	D	30.0	54.3	D	175.0
			Approach	62.1	E		65.5	E	
	EB		L	13.3	B	31.0	13.7	B	30
			T	58.4	E	359.0	62.5	E	360.0
			TR	58.4	E	360.0	62.5	E	362.0
			Approach	58.4	E		62.3	E	
	WB		L	62.4	E	184.0	70.6	E	224.0
			T	11.4	B	565.0	11.4	B	681.0
			Approach	14.7	B		16.0	B	
<b>OVERALL</b>			<b>41.2</b>	<b>D</b>		<b>44.2</b>	<b>D</b>		

\*Extracted from SimTraffic simulation software

Based on the capacity analyses for the 2028 No Build and Build conditions, the intersection of Warrenton Road and Short Street is not expected to experience a significant increase in overall delay from the proposed development. The overall level of service did not change for the morning or evening peak hour when comparing the no build and build out conditions.

Intersection of Warrenton Road and Solomon Drive/Lendall Lane

Based on the results of the capacity analysis during the morning peak hour, the intersection of Warrenton Road and Solomon Drive/Lendall Lane is projected to experience overall acceptable levels of service during the no build and build out conditions.

All turning movements and approaches are expected to operate at acceptable levels of service “D” or better during the morning peak hour for the no build and build out conditions. The results are summarized in **Table 17**. The capacity analysis results are included in **Appendix G**.



**Table 17: 2028 AM Peak Hour Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane**

INTERSECTION			AM Peak (No Build)			AM Peak (Build Out)		
			Conditions			Conditions		
Approach	Movement	DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*	
<b>Intersection #3:</b> Warrenton Road & Solomon Drive/Lendall Lane (2028 No Build vs. Build Out AM Conditions)	NB	LTR	51.7	D	94.0	51.7	D	92.0
	SB	L	46.6	D	71.0	46.6	D	71.0
		T	42.9	D	28.0	42.9	D	
		R	43.0	D	72.0	43.0	D	95.0
		Approach	44.5	D		44.5	D	
	EB	L	36.1	D	129.0	36.2	D	67.0
		T	3	A	153.0	3.3	A	345.0
		R	6.9	A		6.9	A	
		Approach	5.1	A		5.3	A	
	WB	L	10.9	B	18.0	11.3	B	16.0
		T	20.7	C	363.0	20.9	C	354.0
		R	8.2	A	3.0	8.2	A	2.0
		Approach	20.3	C		20.5	C	
	<b>OVERALL</b>		<b>14.6</b>	<b>B</b>		<b>14.8</b>	<b>B</b>	

\*Extracted from SimTraffic simulation software

Based on the results of the capacity analysis during the evening peak hour, the intersection of Warrenton Road and Solomon Drive/Lendall Lane is projected to experience overall acceptable levels of service during the no build and build out conditions.

Eastbound and westbound turning movements and approaches are expected to operate at acceptable levels of service “D” or better during the evening peak hour for the no build and build out conditions. While these approaches are expected to operate at acceptable levels of service, the northbound and southbound approaches are expected to operate at unacceptable levels of service during the no build and build out conditions. These failing levels of service can be mitigated by optimizing/adjusting the traffic signal timings in the future along with adding auxiliary lanes for the approaches. The results are summarized in **Table 18**. The capacity analysis results are included in **Appendix G**.

**Table 18: 2028 PM Peak Hour Capacity Analysis – Warrenton Road and Solomon Drive/Lendall Lane**

INTERSECTION			PM Peak (No Build)			PM Peak (Build Out)		
			Conditions			Conditions		
			DELAY (S)	LOS	Maximum Queue (ft)*	DELAY (S)	LOS	Maximum Queue (ft)*
<b>Intersection #3:</b> Warrenton Road & Solomon Drive/Lendall Lane (2028 No Build vs. Build Out PM Conditions)	Approach	Movement						
	NB	LTR	98.5	F	158.0	95.8	F	140.0
	SB	L	89.6	F	66.0	89.6	F	72.0
		T	77.4	E		77.4	E	50.0
		R	77.0	E	71.0	77.0	E	45.0
		Approach	83.7	F		83.7	E	
	EB	L	10.0	B	21.0	10.4	B	44.0
		T	22.8	C	54.0	23.4	C	60.0
		R	5.5	A		5.5	A	6.0
		Approach	22.4	C		23.0	C	
	WB	L	28.1	C	14.0	29.1	C	18.0
		T	13.5	B	240.0	13.7	B	216.0
		R	6.4	A	2.0	6.4	A	1.0
		Approach	13.4	B		13.7	B	
	<b>OVERALL</b>			<b>22.2</b>	<b>C</b>		<b>22.5</b>	<b>C</b>

\*Extracted from SimTraffic simulation software

Based on the capacity analyses for the 2028 No Build and Build conditions, the intersection of Warrenton Road and Solomon Drive/Lendall Lane is not expected to experience a significant increase in overall delay from the proposed development. During the morning hour the intersection will experience an increase in overall delay of 0.2 second between the no build and build conditions. During the evening peak hour, the intersection will experience an increase in overall delay of 0.3 seconds. The overall level of service did not change for the morning or evening peak hour when comparing the no build and build out conditions.

### Crash Data Evaluation

Crash data was extracted from the Tableau VDOT database for the two (2) intersections of the which serve as the main entrances for the proposed development (Warrenton Road/Short Street and Warrenton Road/Olde Forge Drive). Crash data was extracted for the past three years (2015-2017).

#### Intersection of Warrenton Road and Short Street

The crash data extracted from the Tableau VDOT database for the intersection of Warrenton Road and Short Street is summarized in **Table 19**. Although this intersection does not meet the threshold of 5 crashes per year; it is recommended that VDOT and/or county monitor or further evaluate the roadway conditions since the majority of crashes are of angle type. This crash data should be accounted for when considering the proposed improvements as outlined in the US Route 17 study performed by VDOT.

**Table 19: Crash Data – Warrenton Road and Short Street**

<b>Crash Data (2015-2017)</b>			
Warrenton Road (Route 17) & Short Street			
Collision Type	Year		
	2015	2016	2017
Rear End			
Angle	3		3
Side Sw ipe	1		
Fixed Object		1	
Other			
<b>Total</b>	<b>4</b>	<b>1</b>	<b>3</b>

Intersection of Warrenton Road and Olde Forge Drive

The crash data extracted from the Tableau VDOT database for the intersection of Warrenton Road and Olde Forge Drive is summarized in **Table 20**. This intersection does not meet the threshold of 5 crashes per year and it does not appear that any crash patterns exist for this intersection.

**Table 20: Crash Data – Warrenton Road and Olde Forge Drive**

<b>Crash Data (2015-2017)</b>			
Warrenton Road (Route 17) & Olde Forge Drive			
Collision Type	Year		
	2015	2016	2017
Rear End			
Angle			
Side Sw ipe	1		1
Fixed Object			
Other		1	
<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Other Modes of Transportation**

This study also reviews the potential for walking, bicycling, and transit trips to and from the area.

**Walking Facilities**

Currently there are no sidewalks along Short Street and Olde Forge Drive in the vicinity of the site. There are sidewalks along the frontage of certain commercial parcels along Warrenton Road, but there is not a continuous pedestrian facility which is adjacent to Warrenton Road. Walking facilities are provided within other sections of Rappahannock Landing, but these facilities halt as they leave the development as there are no other continuous facilities provided in the area. The

proposed Rappahannock Landing Apartments is expected to be consistent with walking facilities within previously approved Rappahannock Landing sections. Given the residential nature of the development and the lack of sidewalks on existing streets in the area to provide pedestrian connections, it is unlikely that a significant number of trips would be made via walking. Therefore, no reductions in site generated trips were taken in this analysis for walking.

### **Bicycle Facilities**

Currently, there are no bicycle facilities on any of the roadways in the vicinity of the site. The Stafford County Comprehensive Plan makes no mention of adding bicycling facilities to any of those roadways. While bicycling trips are possible, without bicycle facilities it is unlikely that a significant portion of the site trips would be made via bicycle. Therefore, no reductions in site generated trips were taken in this analysis for bicycling.

### **Transit Facilities**

Fredericksburg Regional Transit (FRED) provides bus service along Warrenton Road (Route 17), with a bus stop at Olde Forge Drive. Without sidewalks to connect from the proposed development to the transit stop at the intersection of Warrenton Road and Olde Forge Drive, it is unlikely that a significant portion of the site trips would be made via transit. It is recommended that the County coordinate with FRED to provide a bus route to serve existing and proposed residential units in the Rappahannock Landing development. Therefore, no reductions in site generated trips were taken in this analysis for transit. It is recommended that the County coordinate with FRED to have a formal transit stop constructed at the intersection of Olde Forge Drive and Warrenton Road to promote the use of this transit stop.

### **Conclusions**

- The proposed development is expected to generate 108 trips (28 in and 80 out) during the morning peak hour and 137 trips (84 in and 53 out) during the evening peak hour.
- The proposed Rappahannock Landing Apartments Development was found to present minor increases of delay and/or changes in Levels of Service on the existing roadway network during the 2022 & 2028 build out conditions.
- The minor increases and/or changes can be mitigated by adjusting/optimizing the traffic signal timings to accommodate future traffic demand. Traffic signal timing evaluations and adjustments are recommended once the proposed development is constructed by the year 2022.
- The proposed Rappahannock Landing Apartments development is not expected to adversely impact the existing roadway network with the proposed VDOT improvements.

**Appendix A: VDOT Approved Pre-Scope of Work Meeting Form**

**Appendix B: Raw Traffic Data**



**Appendix C: U.S. 17 Corridor Study Performed by VDOT**

**Appendix D: Traffic Volume Figures**

**Appendix E: Existing Conditions (2018) Capacity Analysis**

**Appendix F: No Build and Build (2022) Capacity Analysis**

**Appendix G: No Build and Build (2028) Capacity Analysis**