



MEMORANDUM

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DATE: November 25, 2008

SUBJECT: White's Ford Park – Traffic Impact Analysis

INTRODUCTION

This memorandum presents the findings of a traffic impact analysis for the proposed White's Ford Park located in Loudoun County, Virginia. This study is prepared in conjunction with the Special Exception and Commission Permit applications for the development of the approximately 275-acre site, identified as tax map number /31/////////5/.

SITE LOCATION

The site is located north and south of Hibler Road (Route 656), south of Spinks Ferry Road (Route 657), east of Limestone School Road (Route 661), and west of the Potomac River as shown in Figure 1. The proposed development is located in the vicinity of James Monroe Highway (US Route 15). The study area extends along Hibler Road and Limestone School Road, from US Route 15 in the west to Hibler Road's termination in the east.

SITE DESCRIPTION

The project site consists of approximately 275 acres currently zoned as Agricultural Rural - 1 (AR-1). A parcel map, obtained from the Loudoun County website with the current zoning, is shown in Figure 2. The proposed park will be owned and maintained by the Northern Virginia Regional Park Authority (NVRPA). The proposed plan calls for a regional park to be developed in two phases with the following uses as illustrated in Figure 3 and summarized in the documents provided by the NVRPA included in the Technical Appendix:

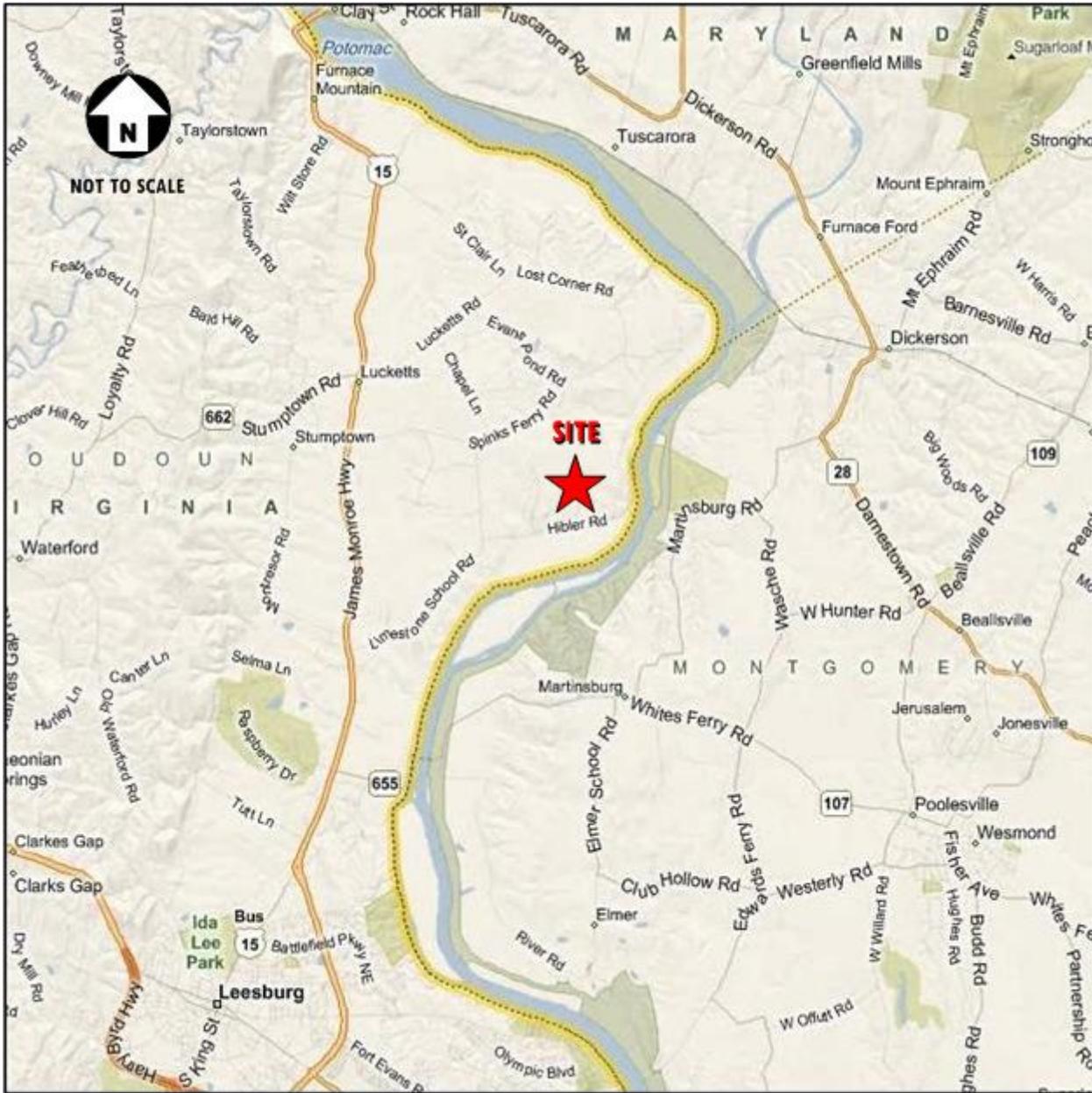


Figure 1: Site Location Map

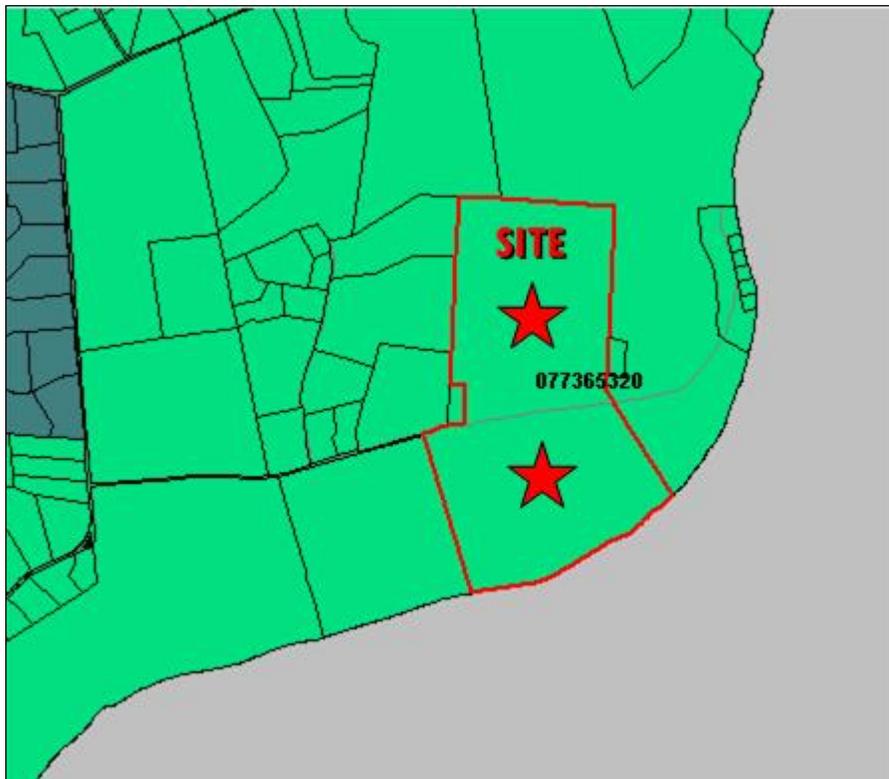


Figure 2: Parcel Map with Current Zoning (AR-1)

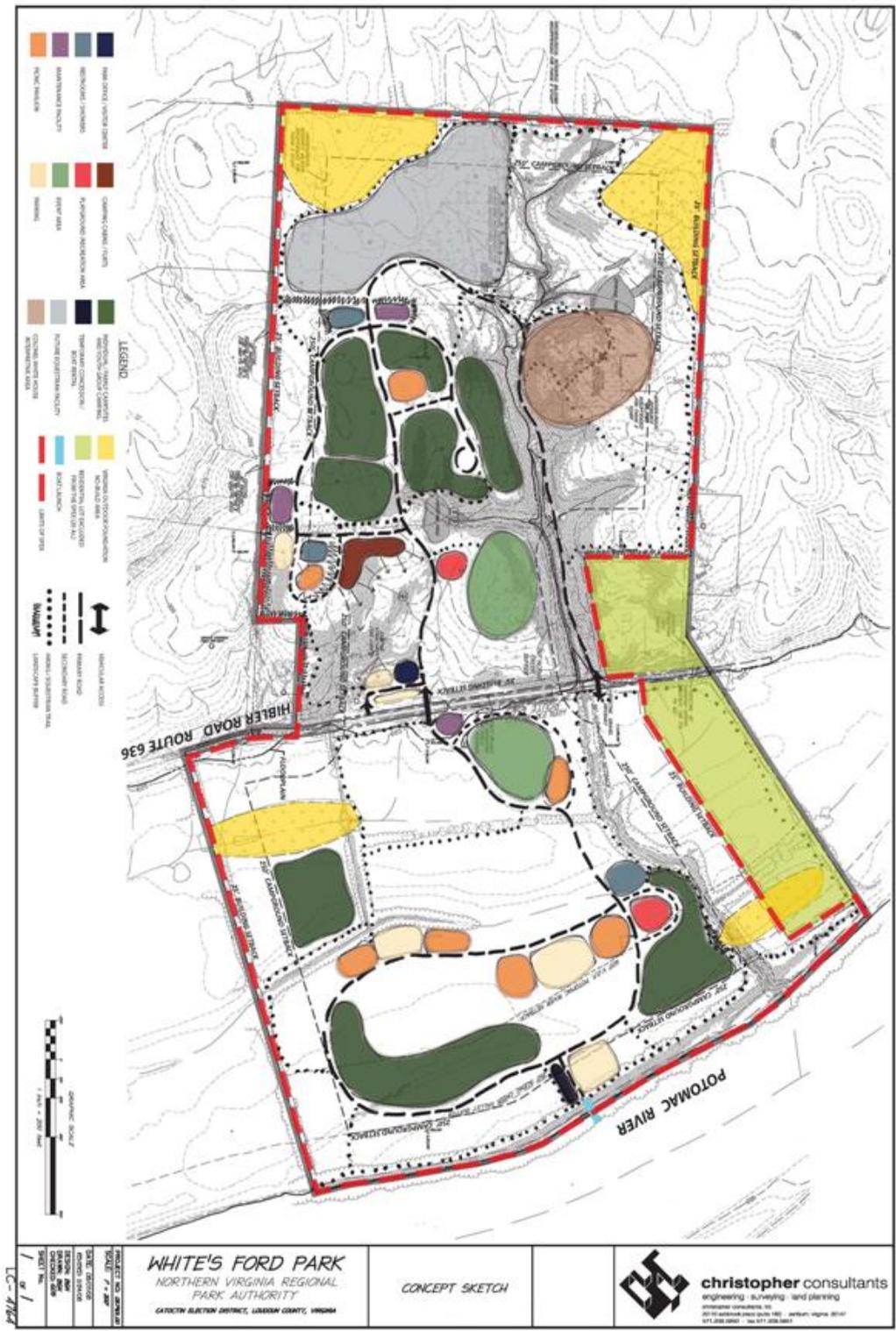


Figure 3: Proposed Concept Plan

1. Phase I (2015):

- A boat launch with gravel access drive from Hibler Road and a supporting temporary facility of no more than 300 square feet from which kayaks, canoes and john boats could be rented and concessions could be sold.
- Two 100-person picnic shelters
- Group camping
- Special events – annual youth group camporee
- General park visitation – shoreline fishing, trails, open play areas, interpretive markers, individual picnics
- Tenant in existing home – 4 maximum residents
- Family camping – includes campsites for tents and pop-ups, no recreational vehicles (RVs) or 5th-wheel trailers, and several camping cabins

2. Phase II (beyond 2015):

- Historic site – operation of Colonel White house as interpretive center
- Equestrian trail-riding facility – riding ring, stables, and hiking and equestrian trails
- Special events – annual group campout

It should be noted that the proposed development plan will not change the current zoning (AR-1) and many of the uses envisioned are permitted by-right under the classification of a regional park with passive recreational uses. A Commission Permit is required for the park and an application is forthcoming. The boat ramp, which will be erected in the floodplain, and the camping facilities will require a Special Exception and a Minor Special Exception, respectively.

It is anticipated that the proposed park will have one full-time, year-round employee and one or two seasonal part-time employees once Phase I is completed. At this time, the additional recreational activities and the build-out year for Phase II are not finally determined. However, no additional staffing and traffic are anticipated after Phase II is completed. The additional recreational activities and uses planned in Phase II will complement the proposed uses in Phase I.

SITE ACCESS

Immediate access to the site will be provided from Hibler Road. Regional access is expected from the north and south using US Route 15 and will approach the site using Limestone School Road.

SCOPE OF STUDY

The following tasks were completed as part of this analysis in accordance with direction received from Loudoun County staff in a scoping meeting held on October 29, 2008. A copy of the scoping document summarizing the parameters and assumptions used in this memorandum is included in the Technical Appendix.

- Field reconnaissance was performed in the vicinity of the site to collect information related to existing traffic controls, roadway geometry, traffic flow characteristics, and safety issues.
- Existing traffic counts were conducted in November 2008 at the intersection of US Route 15 and Limestone School Road per Loudoun County's request during the weekday morning and afternoon peak periods.
- Future without development traffic volumes were estimated based on a 3% inherent growth rate compounded annually over a seven-year period on US Route 15 to account for regional development within the study area. Historical traffic data was limited for Limestone School Road and Hibler Road, but the available data indicates minimal growth. Therefore, no annual growth was considered on those two roads.
- Site traffic volumes were calculated based on the methodology outlined in the Institute of Transportation Engineers' (ITE) Trip Generation, 7th Edition publication and NVRPA daily estimations.
- Intersection capacity analyses were performed at the intersection of US Route 15 and Limestone School Road during the weekday morning and afternoon peak hours using *Synchro, version 6.0* based on the Highway Capacity Manual (HCM 2000) methodology. Traffic analyses were performed for the existing conditions (2008), future conditions without development (2015), and future conditions with development (2015). No analysis was performed for the first phase build-out plus ten years (2025) as agreed upon at the scoping meeting.

Sources of data for this study include the Virginia Department of Transportation (VDOT), Loudoun County, and the office files and field reconnaissance efforts of Gorove/Slade Associates, Inc.

EXISTING CONDITIONS (2008)

Existing Roadway Network

A description of the major roadways within the vicinity of the proposed White's Ford Park is presented below. The existing lane configurations and traffic controls at the intersection of US Route 15 and Limestone School Road are shown in Figure A located at the end of this document.

- **US Route 15 (James Monroe Highway)** – is a two-lane, rural highway that crosses the Potomac River to the north at the Point of Rocks Bridge connecting Virginia and Maryland. In that it contains the next bridge opportunity to cross the Potomac west of the Capital Beltway, US Route 15 serves heavy commuter traffic during peak periods. The intersection of US Route 15 and Limestone School Road, which will be the main access point to the property, was recently improved by VDOT to include a 300 foot southbound left turn bay and a continuous northbound paved shoulder to facilitate right turns. Published historical traffic count data from VDOT showed that US Route 15 carried approximately 21,000 vehicles per day in 2007 within the vicinity of the project site.
- **Limestone School Road (Route 661)** – is a two-lane, 20-foot-wide, unpaved rural road with no shoulders between US Route 15, Hibler Road, and Spinks Ferry Road. Published historical traffic count data from VDOT showed that Limestone School Road carried approximately 520 vehicles per day in 2007, based on 2005 traffic counts, within the vicinity of the project site.
- **Hibler Road (Route 656)** – is a two-lane, 20-foot-wide, unpaved rural road with no shoulders between Limestone School Road and its existing terminus. Hibler Road ends approximately 1.5 miles from its intersection with Limestone School Road, just beyond the proposed site. Published historical traffic count data from VDOT reported that Hibler Road carried approximately 150 vehicles per day in 2007, based on 2002 traffic counts, within the vicinity of the project site.

A field reconnaissance was performed in the vicinity of the site to collect information related to the existing roadway geometry, traffic flow characteristics, and safety issues at the intersections of Limestone School Road with US Route 15 and with Hibler Road. Figures 4A and 4B illustrate the existing roadway geometry at the study intersections.

As mentioned above, Limestone School Road and Hibler Road, within the vicinity of the project site, are two-lane, 20-foot-wide, unpaved rural roads with no shoulders. The unpaved road surface is consistent with the rural character of the surrounding farms and residences, and limits operating speeds in essence acting as traffic calming. Additionally, the Loudoun County Revised General Plan states that “protecting the rural character and scenic quality of rural roads is fundamental to the rural strategy” (Revised General Plan, Chapter 7). The intersection of Limestone School Road and Hibler Road is unsignalized with a stop control on the Hibler Road approach. No safety concerns were observed.

US Route 15 is a two-lane, rural highway that carries traffic north-south in the northern part of Loudoun County. The intersection of US Route 15 and Limestone School Road is unsignalized with a stop control on the Limestone School Road approach. US Route 15 serves heavy commuter traffic flows between Virginia and Maryland. During peak periods, there is extended delay for vehicles turning onto US Route 15 because there are fewer gaps in the traffic stream as a result of the commuter flows. There were no other safety issues identified at this intersection.



Figure 4A: Intersection of US Route 15 and Limestone School Road

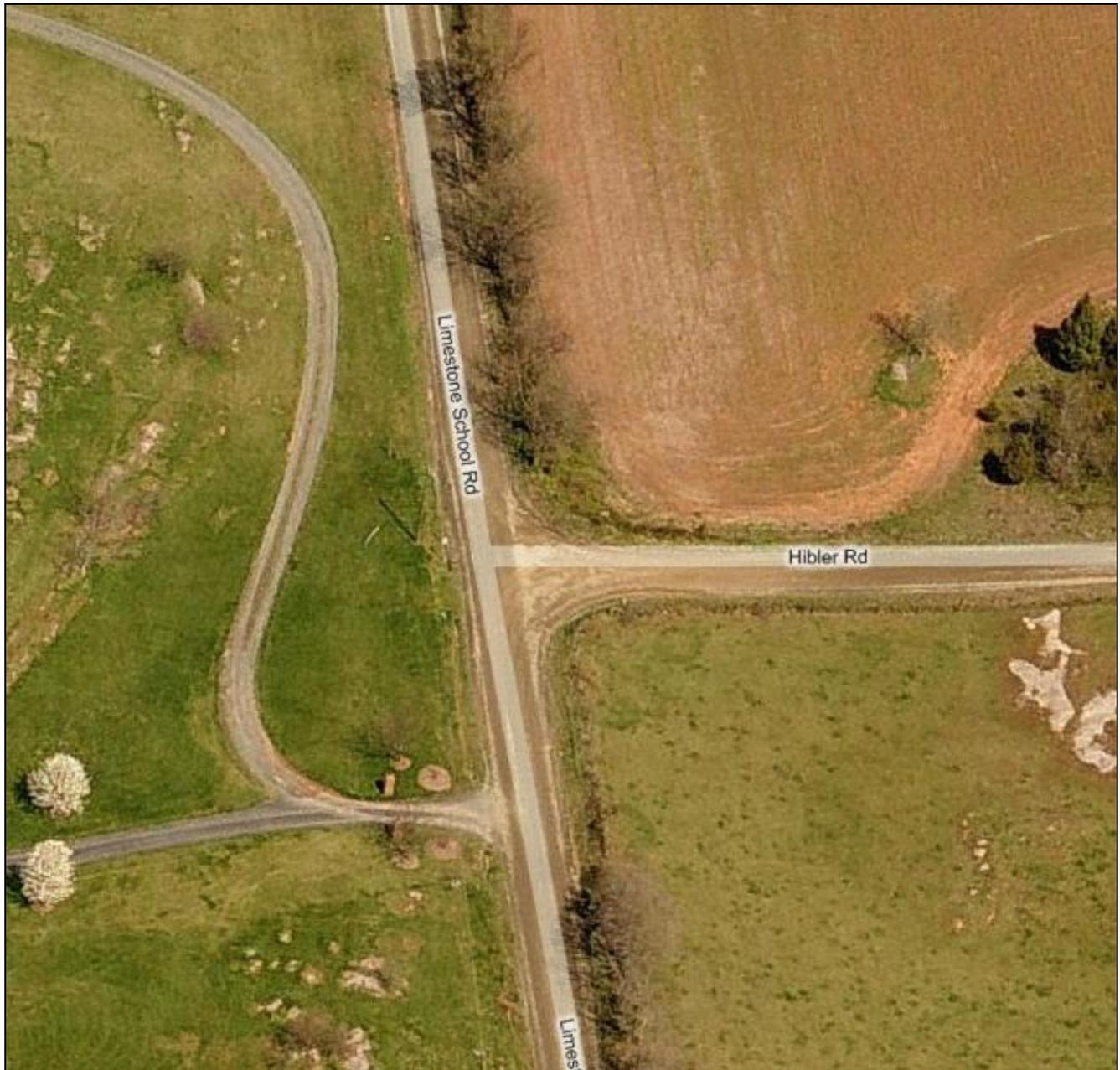


Figure 4B: Intersection of Limestone School Road and Hibler Road

Existing Traffic Volumes

In order to determine the weekday peak hour turning movement volumes, traffic counts were conducted at the intersection of US Route 15 and Limestone School Road per Loudoun County’s request. The traffic counts were conducted on Tuesday, November 11, 2008 from 6:00 AM to 9:00 AM and from 4:00 PM to 7:00 PM. It should be noted that November 11th was a federal holiday, but not a school holiday. Therefore, spot counts were conducted on Tuesday, November 18, 2008 during the morning and afternoon peak hours to adjust the traffic volumes taken on November 11th in order to reflect actual traffic conditions during a typical weekday. Analysis of the existing traffic data determined the following peak hours:

- AM Peak Hour = 7:00 AM to 8:00 AM
- PM Peak Hour = 5:00 PM to 6:00 PM

The existing peak hour traffic volumes at the intersection of US Route 15 and Limestone School Road are shown in Figure A. The existing counts are included in the Technical Appendix.

Existing Conditions Capacity Analysis

Capacity analysis was performed at the intersection of US Route 15 and Limestone School Road for the existing conditions during the weekday morning and afternoon peak hours. *Synchro*, version 6.0 was used to analyze the study intersection based on the Highway Capacity Manual (HCM 2000) methodology. Existing peak hour factors were used for the analysis of current conditions. The results of the existing intersection capacity analysis are presented in Table 1, and are expressed in terms of level of service (LOS) and delay (seconds per vehicle) per approach. The detailed results of the intersection capacity analysis and a description of the difference in LOS and delays are included in the Technical Appendix. Figure A illustrates the results graphically.

Table 1: Existing (2008) Intersection Capacity Analysis

Intersection (Approach/Movement)	Existing Conditions (2008)			
	AM Peak Hour		PM Peak Hour	
	LOS	Delay	LOS	Delay
<i>US Route 15 and Limestone School Road</i>				
Overall Intersection (Unsignalized)	N/A	N/A	N/A	N/A
Westbound Approach	F	55.6	F	60.2
Southbound Left Turn Movement	A	8.4	B	11.1

Note: N/A – Not Available.

According to the Loudoun County Facilities and Standards Manual (F.S.M.) Traffic Study Guidelines, a minimum approach and overall LOS ‘D’ shall apply at each intersection for each phase up to and including build-out. Based on these guidelines, the intersection of US Route 15 and Limestone School Road currently operates at unacceptable conditions in the westbound approach during the weekday morning and afternoon peak hours. No mitigation measures are recommended under this scenario since there are no proffered roadway improvements at this intersection.

FUTURE CONDITIONS WITHOUT DEVELOPMENT (2015)

Inherent Growth

As agreed upon at the scoping meeting, future traffic conditions were projected for the period up to and including the first phase (2015) of the proposed White's Ford Park development. Typically, future traffic volumes are projected by increasing existing traffic volumes to the build-out year using a growth rate based on historical traffic growth. According to VDOT's Annual Average Daily Traffic (AADT) volumes, the inherent growth rate on US Route 15 was approximately three percent (3%) per year from 2001 to 2007. This inherent growth rate was compounded annually over a seven-year period and added to the existing through volumes on US Route 15 to account for regional increase in traffic due to background growth and development outside of the study area. Historical traffic data was limited for Limestone School Road and Hibler Road, but the available data indicated minimal growth. Therefore, no annual growth was considered on these two roads.

Other Nearby Approved Background Developments

Based on the Loudoun County's 2007 Annual Growth Summary, the following approved residential projects were located in the Route 15 North Planning Subarea as shown in Figure 5:

1. Churchill Downs
2. Elysian Heights
3. Historic Selma Estates
4. Lee's Crossing
5. Raspberry Falls (Moorlands, Plains of Raspberry)
6. Waterford Ridge

It should be noted that these approved developments will have direct access from major roads, such as US Route 15. The trips generated by these background sites will not travel within the immediate vicinity of the proposed White's Ford Park. Therefore, the trips associated with the approved residential projects listed above were not considered in this traffic analysis.

Future Volumes without Development

The existing traffic and inherent regional growth were combined to estimate the future volumes without development as illustrated in Figure A.

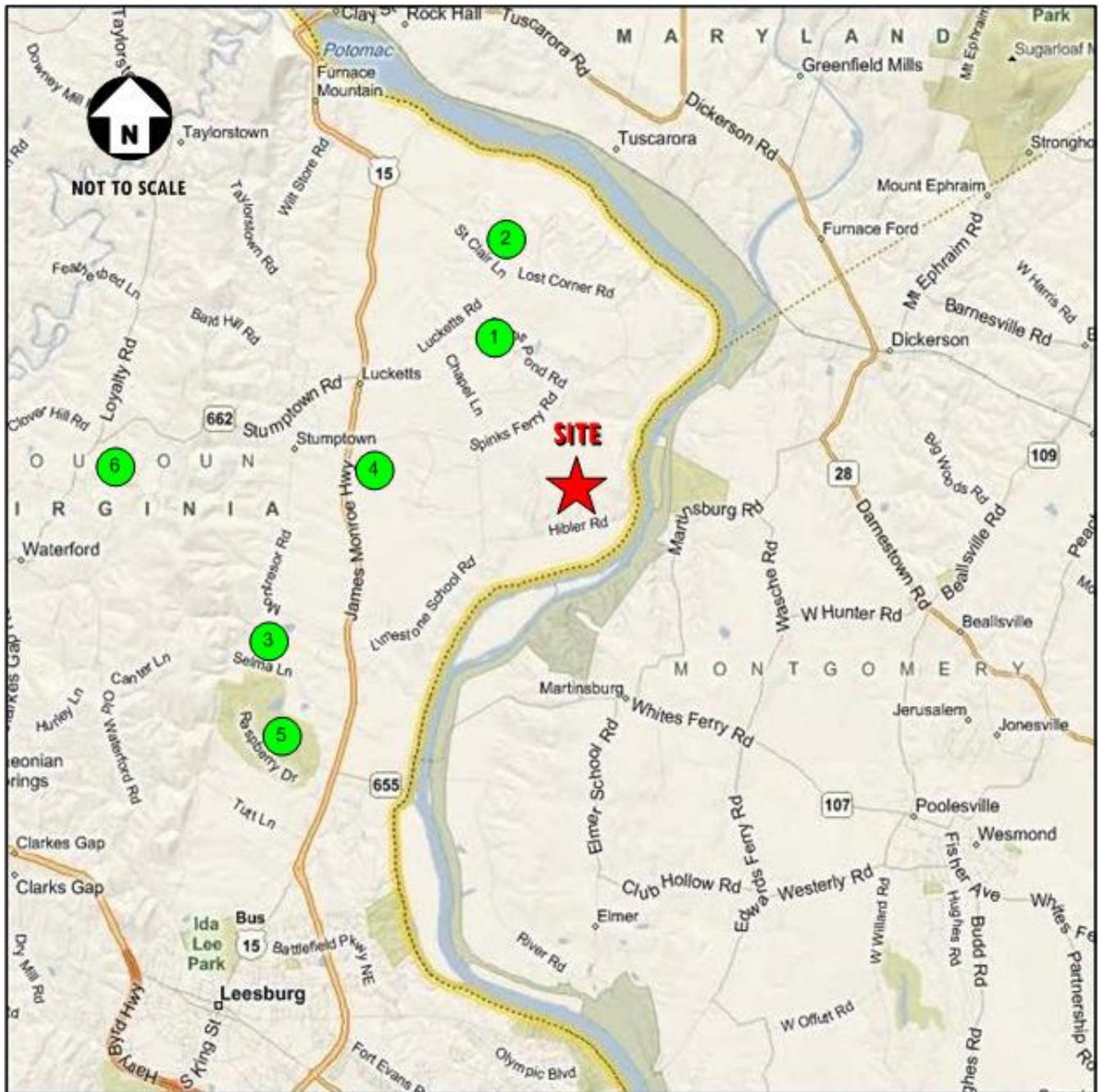


Figure 5: Location of Approved Background Developments

Future Conditions without Development Capacity Analysis

Capacity analysis was performed at the intersection of US Route 15 and Limestone School Road for the future conditions without development during the weekday morning and afternoon peak hours. Default parameters were considered for the analysis of future traffic scenarios. The results of the intersection capacity analysis for the future conditions without development are presented in Table 2. The detailed analysis worksheets are included in the Technical Appendix. Figure A illustrates the results graphically.

Table 2: Future Conditions without Development (2015) Intersection Capacity Analysis

Intersection (Approach/Movement)	Future Conditions without Development (2015)			
	AM Peak Hour		PM Peak Hour	
	LOS	Delay	LOS	Delay
<i>US Route 15 and Limestone School Road</i>				
Overall Intersection (Unsignalized)	N/A	N/A	N/A	N/A
Westbound Approach	F	132.7	F	121.8
Southbound Left Turn Movement	A	8.6	B	12.9

Note: N/A – Not Available.

Based on Loudoun County’s LOS criteria, the intersection of US Route 15 and Limestone School Road will continue to operate at unacceptable levels of service in the westbound approach during the weekday morning and afternoon peak hours under the future conditions without development. No mitigation measures are recommended under this scenario since there are no proffered roadway improvements at this intersection.

FUTURE CONDITIONS WITH DEVELOPMENT (2015)

Trip Generation

The trip generation associated with the proposed White's Ford Park was estimated based on the following methodologies:

1. ITE Methodology

In order to calculate the trip generation for the proposed park, the Institute of Transportation Engineers' (ITE) Trip Generation, 7th Edition publication was used to determine the trips into and out of the subject property. For the purpose of this analysis, the projected number of employees obtained from NVRPA was used to estimate the trips generated by the proposed development. It should be noted that the ITE publication recommended caution using its average rates since data is very limited for the regional park land use. The size of the property (in acres) was also considered, but the trip generation estimates were not representative of the anticipated attendance or the rural character of the proposed park. Table 3 shows the weekday and weekend projected trips associated with the proposed White's Ford Park based on the ITE methodology.

Table 3: Proposed Trip Generation based on ITE Methodology

Land Use	ITE Code	Size	----- Week day -----							----- Weekend -----							
			AM Peak Hour			PM Peak Hour			Daily	Saturday Peak Hour			Daily	Sunday Peak Hour			Daily
			In	Out	Total	In	Out	Total	Total	In	Out	Total	Total	In	Out	Total	Total
Regional Park	417	2 Employees	9	6	15	12	14	26	160	17	17	34	257	14	27	41	326

Source: Institute of Transportation Engineers (ITE) Trip Generation, 7th Edition publication.

2. NVRPA Daily Estimations

Table 4A summarizes the trips associated with the proposed park according to the NVRPA daily estimations. It should be noted that no trip synergy among the recreational uses was considered in this analysis to represent the worst-case scenario. Table 4B shows the trips generated by the proposed White's Ford Park using the traffic distribution presented in Table 3.

Table 4A: Proposed Trip Generation based on NVRPA Daily Estimations

Recreational Use	Weekend	
	Anticipated Peak Daily Attendance	Vehicles per Day (VPD)
BY-RIGHT USES		
Picnic Shelters	200	100
Special Events	300	75
General Park Visitation	50	25
Tenant*	4	10
<i>TOTAL BY-RIGHT TRIPS</i>	<i>554</i>	<i>210</i>
SPECIAL EXCEPTION (SPEX) USES		
Boat Launch Ramp	20	40
Group Camping	100	25
Family Camping	240	60
<i>TOTAL SPECIAL EXCEPTION TRIPS</i>	<i>360</i>	<i>125</i>
TOTAL TRIPS (BY-RIGHT + SPEX TRIPS)	914	335
% OF SPEX TRIPS	39%	37%

Note: * The VPD for tenant were calculated using the ITE publication for 1 single family detached house (average rate = 10.10 for Saturday)

Table 4B: Proposed Trip Generation

Land Use	----- Week day -----							----- Weekend -----							
	AM Peak Hour			PM Peak Hour			Daily Total	Saturday Peak Hour			Daily Total	Sunday Peak Hour			Daily Total
	In	Out	Total	In	Out	Total		In	Out	Total		In	Out	Total	
Proposed Park	10	6	16	13	14	27	165	18	17	35	265	15	28	43	335

According to the trip generation estimates presented in Tables 3 and 4A, the proposed White's Ford Park will generate up to 335 new weekend daily trips. A negligible difference between the two methodologies was observed. The proposed development will experience the peak usage during the weekends, outside of the peak commuter hours now seen on US Route 15. The proposed park will have a minimal traffic impact within the study area, particularly during weekday commuter peaks.

It should be noted that a trip generation comparison between the approved and proposed uses was not included in this document. The project site has a Virginia Outdoors Foundation (VOF) easement that restricts the amount of development in the subject property. At this time, the amount of approved development is not fully determined.

Trip Distribution

Existing traffic patterns and the proposed land uses were taken into consideration when distributing trips to and from the subject site. Table 5 presents the direction of approach for the proposed development, which is also shown in Figure A. The peak hour site trips are shown in Figure A.

Table 5: Trip Distribution

Roadway Link	Trip Distribution
To/From North on US Route 15	25%
To/From South on US Route 15	75%
TOTAL	100%

Future Volumes with Development

The proposed site trips shown in Table 4B were added to the future volumes without development in order to determine the future volumes with development as shown in Figure A.

Future Conditions with Development Capacity Analysis

Capacity analysis was performed at the intersection of US Route 15 and Limestone School Road for the future conditions with development during the weekday morning and afternoon peak hours. As mentioned in the previous scenario, default parameters were considered for the analysis of future traffic scenarios. The results of the intersection capacity analysis for the future conditions with development are presented in Table 6. The detailed analysis worksheets are included in the Technical Appendix. Figure A illustrates the results graphically.

Table 6: Future Conditions with Development (2015) Intersection Capacity Analysis

Intersection (Approach/Movement)	Future Conditions with Development (2015)			
	AM Peak Hour		PM Peak Hour	
	<i>LOS</i>	<i>Delay</i>	<i>LOS</i>	<i>Delay</i>
<i>US Route 15 and Limestone School Road</i>				
Overall Intersection (Unsignalized)	N/A	N/A	N/A	N/A
Westbound Approach	F	150.7	F	168.4
Southbound Left Turn Movement	A	8.7	B	13.1

Note: N/A – Not Available.

Based on Loudoun County guidelines, the intersection of US Route 15 and Limestone School Road will continue to operate at unacceptable levels of service in the westbound approach during the weekday morning and afternoon peak hours under the future conditions with development. No mitigation measures are recommended under this scenario since there are no proffered roadway improvements at this intersection. It should be noted that the site generated trips would contribute less than 1% of the total traffic projected at this intersection.

WARRANT ANALYSIS

Per Loudoun County's request, a right-turn lane warrant analysis was performed at the intersection of US Route 15 and Limestone School Road to determine whether a right turn bay would be warranted at the northbound approach based on the guidelines and procedures outlined in the VDOT's Road Design Manual. It should be noted that this publication states that the turn lane warrants "are guidelines to be used as an aid in selecting the appropriate treatments for turn movements" on two- and four-lane highways. It also states that the selection of turn lane treatments depends on other factors than just the warrant criteria, such as the amount of available right-of-way. Based on VDOT's Road Design Manual, a right turn taper would be needed at the study intersection. Currently, there is a continuous northbound paved shoulder on US Route 15 within the vicinity of the study area that facilitates right turns at its intersection with Limestone School Road.

In that the westbound approach of the US Route 15 and Limestone School Road intersection operates at a failing level of service during existing and future conditions both with and without development, traffic signal warrants were analyzed. Based on the methodology outlined in the Manual on Traffic Signal Design (MTSD), the analysis results showed that a traffic signal would not be warranted. The turn lane and traffic signal warrant analysis worksheets are included in the Technical Appendix.

CONCLUSIONS

This memorandum presented the findings of a traffic impact analysis for the proposed White's Ford Park located in Loudoun County, Virginia. This study is prepared in conjunction with the Special Exception and Commission Permit applications for the development of the approximately 275-acre site. The site is located north and south of Hibler Road (Route 656), south of Spinks Ferry Road (Route 657), east of Limestone School Road (Route 661), and west of the Potomac River. The proposed development is located in the vicinity of James Monroe Highway (US Route 15).

The project site consists of approximately 275 acres currently zoned as AR-1. The proposed park will be owned and maintained by NVRPA. The proposed plan calls for a regional park to be developed in two phases (2015 and beyond 2015). The proposed development plan will not change the current zoning and many of the uses envisioned are permitted by-right under the classification of a regional park with passive recreational uses. A Commission Permit is required for the park and an application is forthcoming. The boat ramp, which will be erected in the floodplain, and the camping facilities will require a Special Exception and a Minor Special Exception, respectively. Local access to the site will be provided via Hibler Road.

It is anticipated that the proposed park will have one full-time, year-round employee and one or two seasonal part-time employees once Phase I is completed. At this time, the additional recreational activities and the build-out year for Phase II are not finally determined. However, no additional staffing and traffic

are anticipated after Phase II is completed. The additional recreational activities and uses planned in Phase II will complement the proposed uses in Phase I.

According to the Loudoun County's *Facilities and Standards Manual Traffic Study Guidelines*, a minimum approach and overall level of service 'D' shall apply at each intersection for each phase up to and including build-out. Based on these guidelines, the analysis presented in this memorandum supports the following major conclusions:

- Limestone School Road and Hibler Road are two-lane, 20-foot-wide, unpaved rural roads with no shoulders within the vicinity of the project site. The unpaved road surface is consistent with the rural character of the surrounding farms and residences, and limits operating speeds in essence acting as traffic calming. Additionally, the Loudoun County Revised General Plan states that "protecting the rural character and scenic quality of rural roads is fundamental to the rural strategy" (Revised General Plan, Chapter 7).
- The intersection of Limestone School Road and Hibler Road is unsignalized with a stop control on the Hibler Road approach. No safety concerns were observed.
- US Route 15 is a two-lane, rural highway that carries commuter traffic between Maryland and Virginia during weekday peak periods.
- The intersection of US Route 15 and Limestone School Road is unsignalized with a stop control on the Limestone School Road approach. During peak periods, there is extended delay for vehicles turning onto US Route 15 because there are fewer gaps in the traffic stream as a result of the commuter flows. There were no other safety issues identified at this intersection.
- The proposed park will generate approximately 20 weekday morning peak hour trips, about 30 weekday afternoon peak hour trips, around 165 weekday daily trips, approximately 265 Saturday daily trips, and about 335 Sunday daily trips.
- The proposed development will experience the peak usage during the weekends, outside of the peak commuter hours now seen on US Route 15.
- The intersection of US Route 15 and Limestone School Road currently operates and will continue to operate at unacceptable levels of service in the westbound approach during the weekday morning and afternoon peak hours. No mitigation measures are recommended under existing and future traffic scenarios since there are no proffered roadway improvements at this intersection. It should be noted that the site generated trips would contribute less than 1% of the total traffic projected at this intersection.
- Based on the warrant analysis results, a right turn lane and a traffic signal are not warranted at the intersection of US Route 15 and Limestone School Road.
- The proposed park will have a minimal traffic impact within the study area.



<p><i>Existing (2008)</i></p>	<p>Existing Lane Configuration</p>	<p>Existing Volumes</p>	<p>Existing Peak Hour Level of Service</p>	<p>Site Generated Peak Hour Volumes</p>
<p><i>Without Development (2015)</i></p>	<p>Recommended Improvements</p> <p>NO MITIGATION RECOMMENDED</p>	<p>Volumes without Development</p>	<p>Level of Service without Development</p>	<p>Site Trip Distribution</p>
<p><i>With Development (2015)</i></p>	<p>Recommended Improvements</p> <p>NO MITIGATION RECOMMENDED</p>	<p>Volumes with Development</p>	<p>Level of Service with Development</p>	

Figure A - Summary of Traffic Impact Analysis Results

Note: XXYY = AM/PM Weekday Peak Hours

FILE PATH:
DATE LAST MODIFIED:

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NVRPA Documents

**WHITE'S FORD REGIONAL PARK
EXPECTED TRAFFIC GENERATION**

9/30/08

Phase I

Timetable for development - within 5 years, beginning 2010

Number of employees:

Initially there would be no on-site staff. One or two staff members from Temple Hall Farm Regional Park, located 3 miles away on Limestone School Rd., would patrol the park and perform minor maintenance (i.e., trash pickup) about once/week.

Boat launch entrance to be gated, similar to Bull Run Marina Regional Park in Fairfax County. While currently unstaffed, park patrons wishing to launch watercraft may purchase a season pass and gate key. Those wishing to hike the trails or fish from the shore may park in the lot across and up the road from the boat launch and walk down, keeping in mind that all patrons must be out of the park by dark. Bull Run Marina has about 250 season pass holders.

When Phase I is completed, anticipated staffing is 1 full-time year round employee and one or two seasonal part time.

- Boat Launch - kayaks, canoes and john boats:
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – Daylight hours only
 - Season – year-round, with peak usage March – October
 - Anticipated Launches Per Day – Mon. through Fri. 2/day, Sat./Sun. 20/day
 - Estimated Maximum VPD = 40 (20 vehicles x 2 trips (one in, one out). Assumes 1 vehicle per launch.

- Picnic Shelters – Two 100-person rental shelters:
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – Daylight hours only
 - Season – March through October
 - Anticipated Visitors – 200 total
 - Estimated Maximum VPD = 100 (200/4 vehicles x 2 trips (one in, one out). Assumes average of 4 passengers per vehicle.

- Group Camping:
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – 24 hour
 - Season – March through October
 - Anticipated Visitors – Minimum group size 30, maximum 100
 - Estimated Maximum VPD = 25 (100/4 vehicles). Assumes average of 4 passengers per vehicle, one trip/day since overnight.

- Events:
 - Annual youth group camporee-
 - Anticipated Visitors – Maximum of 300 participants likely no more than twice per year.
 - Estimated Maximum VPD = 75 (300/4 passengers/vehicle). Assumes average of 4 passengers per vehicle with overnight stay and only one trip per day.
- General Park Visitation:
 - Shoreline fishing, trails, open play areas, interpretive markers, individual picnics
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – Daylight hours only
 - Season – year-round, with peak usage March – October
 - Anticipated Visitors Per Day - Mon. through Fri. 10/day, Sat./Sun. 50/day
 - Estimated Maximum VPD = 25 (50/4 x 2 trips per day). Assumes average of 4 passengers per vehicle
- Tenant in Col. White house: 4 max. residents (3 BR, 2 BA)
- Family Camping:
 - Includes campsites for tents and pop-ups, no RVs or 5th-wheel trailers, and several camping cabins.
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – 24 hour
 - Season – March through October
 - Anticipated Visitors – Minimum 25 sites, maximum 60 sites. 4 people/site, one trip/day/site
 - Estimated Maximum VPD = 60. Assumes one vehicle per campsite/cabin with overnight stay and only one trip per day.

Phase II

Timetable for development – beyond 2015 TBD.

- Historic Site:
 - Operation of Col. White house as interpretive center. Same visitation as for camping, boating, etc., no separate vehicle trips.
- Special Events:
 - Annual group campout? unknown at this time.
- Equestrian Trail-Riding Facility: TBD. Resident horse program, no trailers. Visits associated with camping so no additional vehicle trips.

APPENDIX B

Traffic Impact Analysis Scoping Document

- General park visitation – shoreline fishing, trails, open play areas, interpretive markers, individual picnics
- Tenant in Colonel White House – 4 maximum residents
- Family camping – includes campsites for tents and pop-ups, no recreational vehicles (RVs) or 5th-wheel trailers, and several camping cabins

2. **Phase II (beyond 2015):**

- Historic site – operation of Colonel White house as interpretive center
- Equestrian trail-riding facility – riding ring, stables, and hiking and equestrian trails
- Special events – annual group campout

It should be noted that the proposed development plan will not change the current zoning (AR-1) and many of the uses envisioned are permitted by-right under the classification of a regional park with passive recreational uses. A Commission Permit is required for the park and an application is forthcoming. The boat ramp, which will be erected in the floodplain, and the camping facilities will require a Special Exception and a Minor Special exception, respectively. It is anticipated that the proposed park will have one full-time, year-round employee and one or two seasonal part-time employees once Phase I is completed. No additional staffing is anticipated after Phase II is completed.

Site Access: Access to the site will be provided via Hibler Road.

Study Area: The study area will extend along Hibler Road and Limestone School Road, from James Monroe Highway (US Route 15) in the west to Hibler Road's dead end in the east. Hibler Road dead ends approximately 1.5 miles from its intersection with Limestone School Road, just beyond the proposed site. According to the scoping meeting, a description of the geometric characteristics and safety issues at the following intersections and roadway segments will be included in the technical memorandum:

- James Monroe Highway (US Route 15) and Limestone School Road (Route 661)
- Limestone School Road (Route 661) and Hibler Road (Route 656)

Traffic Counts: Per Loudoun County's request, traffic counts will be conducted at the intersection of US Route 15 and Limestone School Road during a typical weekday from 6:00 AM to 9:00 AM and from 4:00 PM to 7:00 PM.

Inherent Growth: Based on the Virginia Department of Transportation (VDOT) Annual Average Daily Traffic (AADT) volumes, the inherent growth rate on US Route 15 was approximately three percent (3%) per year from 2001 to 2007. Historical traffic data was limited for Limestone School Road and Hibler Road. Therefore, no annual growth will be considered on these two roads.

Background Traffic Projections: As agreed upon at the scoping meeting, future traffic conditions will be projected for the period up to the first phase of development (2015). Based on the Loudoun County’s 2007 Annual Growth Summary, the following approved residential projects were located in the Route 15 North Planning Subarea as shown in Figure 3:

1. Churchill Downs
2. Elysian Heights
3. Historic Selma Estates
4. Lee’s Crossing
5. Raspberry Falls (Moorlands, Plains of Raspberry)
6. Waterford Ridge

It should be noted that these approved developments will have direct access from major roads, such as US Route 15. The trips generated by these background sites will not travel within the immediate vicinity of the proposed White’s Ford Park. Therefore, none of the approved sites listed above will be considered in the traffic analysis. However, the annual 3% growth rate on US Route 15 will account for the possible impact of these approved residential projects along this major road.

Trip Generation: The trip generation associated with the proposed park was estimated based on the following methodologies:

1. ITE Methodology

In order to calculate the trip generation for the proposed park, the Institute of Transportation Engineers’ (ITE) *Trip Generation, 7th Edition* publication was used to determine the trips into and out of the subject property. For the purpose of this analysis, the projected number of employees obtained from the NVRPA was used to estimate the trips generated by the proposed development. It should be noted that the ITE publication recommended caution using its average rates since data was very limited for the regional park land use. The size of the property (in acres) was also considered, but the trip generation estimates were not representative of the anticipated attendance or the rural character of the proposed park. Table 1 shows the weekday and weekend projected trips associated with the proposed White’s Ford Park based on the ITE methodology.

Table 1: Proposed Trip Generation based on ITE Methodology

Land Use	ITE Code	Size	----- Week day -----							----- Weekend -----							
			AM Peak Hour			PM Peak Hour			Daily	Saturday Peak Hour			Daily	Sunday Peak Hour			Daily
			In	Out	Total	In	Out	Total	Total	In	Out	Total	Total	In	Out	Total	Total
Regional Park	417	2 Employees	9	6	15	12	14	26	160	17	17	34	257	14	27	41	326

Source: Institute of Transportation Engineers (ITE) *Trip Generation, 7th edition* publication.

2. NVRPA Daily Estimations

Table 2A summarizes the trips associated with the proposed park according to the NVRPA daily estimations. It should be noted that no trip synergy among the recreational uses was considered in this analysis to represent the worst-case scenario. Table 2B shows the trips generated by the proposed White's Ford Park using the traffic distribution presented in Table 1.

Table 2A: Proposed Trip Generation based on NVRPA Daily Estimations

Recreational Use	Weekend	
	Anticipated Peak Daily Attendance	Vehicles per Day (VPD)
BY-RIGHT USES		
Picnic Shelters	200	100
Special Events	300	75
General Park Visitation	50	25
Tenant*	4	10
<i>TOTAL BY-RIGHT TRIPS</i>	<i>554</i>	<i>210</i>
SPECIAL EXCEPTION (SPEX) USES		
Boat Launch Ramp	20	40
Group Camping	100	25
Family Camping	240	60
<i>TOTAL SPECIAL EXCEPTION TRIPS</i>	<i>360</i>	<i>125</i>
TOTAL TRIPS (BY-RIGHT + SPEX TRIPS)	914	335
% OF SPEX TRIPS	39%	37%

Note: * The VPD for tenant were calculated using the ITE publication for 1 single family detached house (average rate = 10.10 for Saturday)

Table 2B: Proposed Trip Generation

Land Use	----- Week day -----							----- Weekend -----							
	AM Peak Hour			PM Peak Hour			Daily Total	Saturday Peak Hour			Daily Total	Sunday Peak Hour			Daily Total
	In	Out	Total	In	Out	Total		In	Out	Total		In	Out	Total	
Proposed Park	10	6	16	13	14	27	165	18	17	35	265	15	28	43	335

According to the trip generation estimates presented in Tables 1 and 2A, the proposed White's Ford Park will generate up to 335 new weekend daily trips. A negligible difference between the two methodologies was observed. The proposed development will experience the peak usage during the weekends. The proposed park will have a minimal traffic impact within the study area during weekdays and weekends.

Site Area and Trip Distribution: Existing traffic patterns and the proposed land uses will be taken into consideration when distributing trips to and from the subject site.

WHITE'S FORD PARK – TRAFFIC IMPACT ASSESSMENT SCOPE
 November 11, 2008
 Page 5

Traffic Capacity Analysis: As agreed upon at the scoping meeting, we will analyze the intersection of US Route 15 and Limestone School Road for the weekday AM and PM commuter peak hours. For the analysis, we will use *Synchro version 6.0*, with results based on the Highway Capacity Manual (HCM 2000). Existing peak hour factors will be used for the analysis of current conditions. Default parameters will be considered for the analysis of future scenarios. Delays and levels of service (LOS) will be reported for the following traffic conditions during the weekday AM and PM peak hours:

- Existing conditions (2008),
- Future conditions without the proposed development (2015), and
- Future conditions with the proposed development (2015).

It should be noted that no analysis will be performed for the first phase build-out plus ten years (2025) as agreed upon at the scoping meeting. According to Loudoun County's transportation guidelines, a minimum approach and overall LOS 'D' at each intersection shall apply for each phase up to and including build-out.

Recommendations: Based on the traffic analysis, we will recommend mitigation measures per Loudoun County's guidelines, if needed and warranted.

Please review the traffic impact assessment scope described above for the proposed White's Ford Park and sign for agreement and approval to continue with the analysis.

Loudoun County Representative Signature/Date:

Sam R. Phillips 11/12/08

Note - Be sure and clarify regarding the post 2015 situation (no analysis) as well as the existing land use's C UOE easement/ regarding the trip generation comparison to existing/approved uses.

Thanks, SP

Traffic Consultant's Representative Signature/Date:

[Signature]

11/11/08

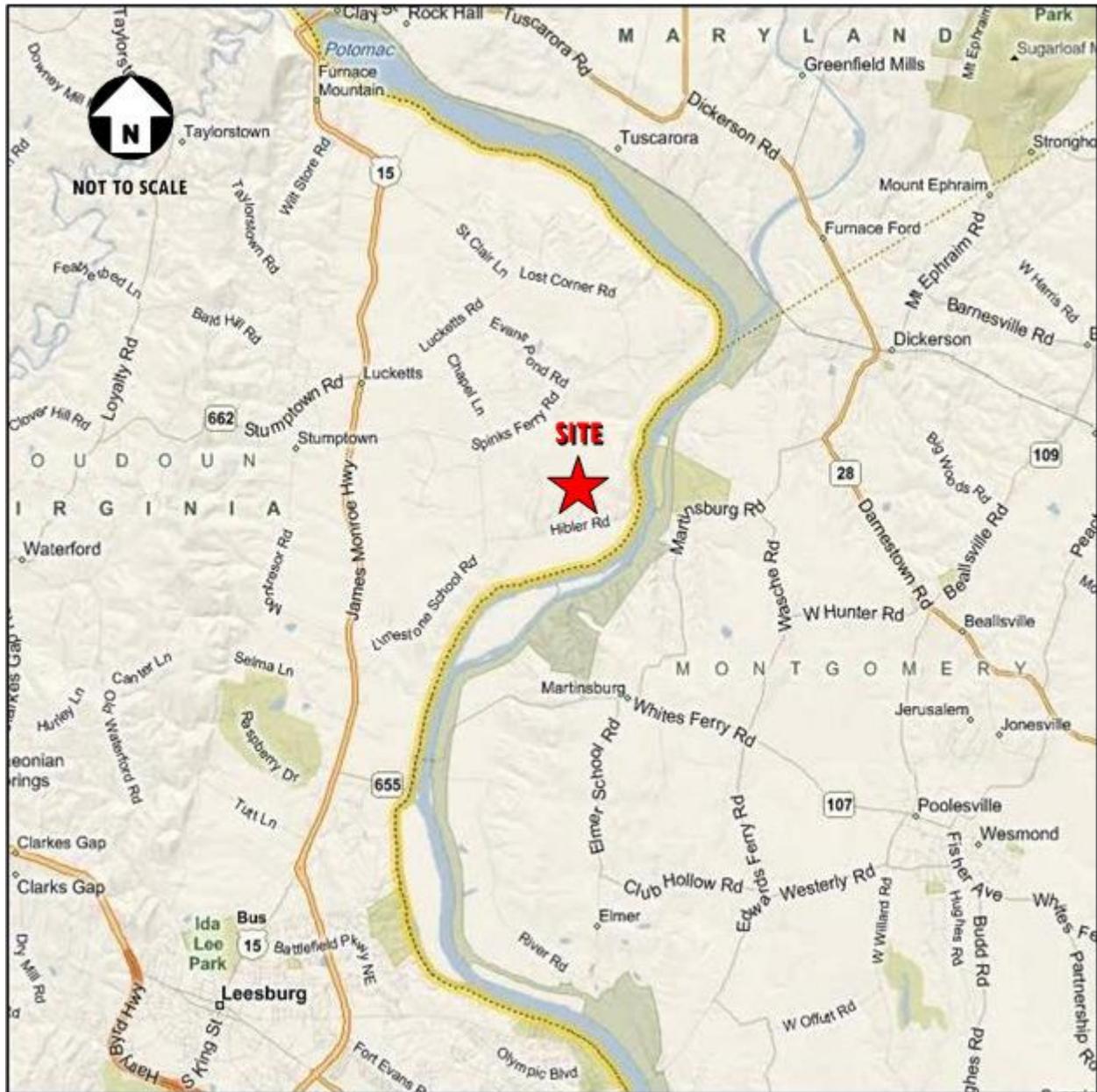
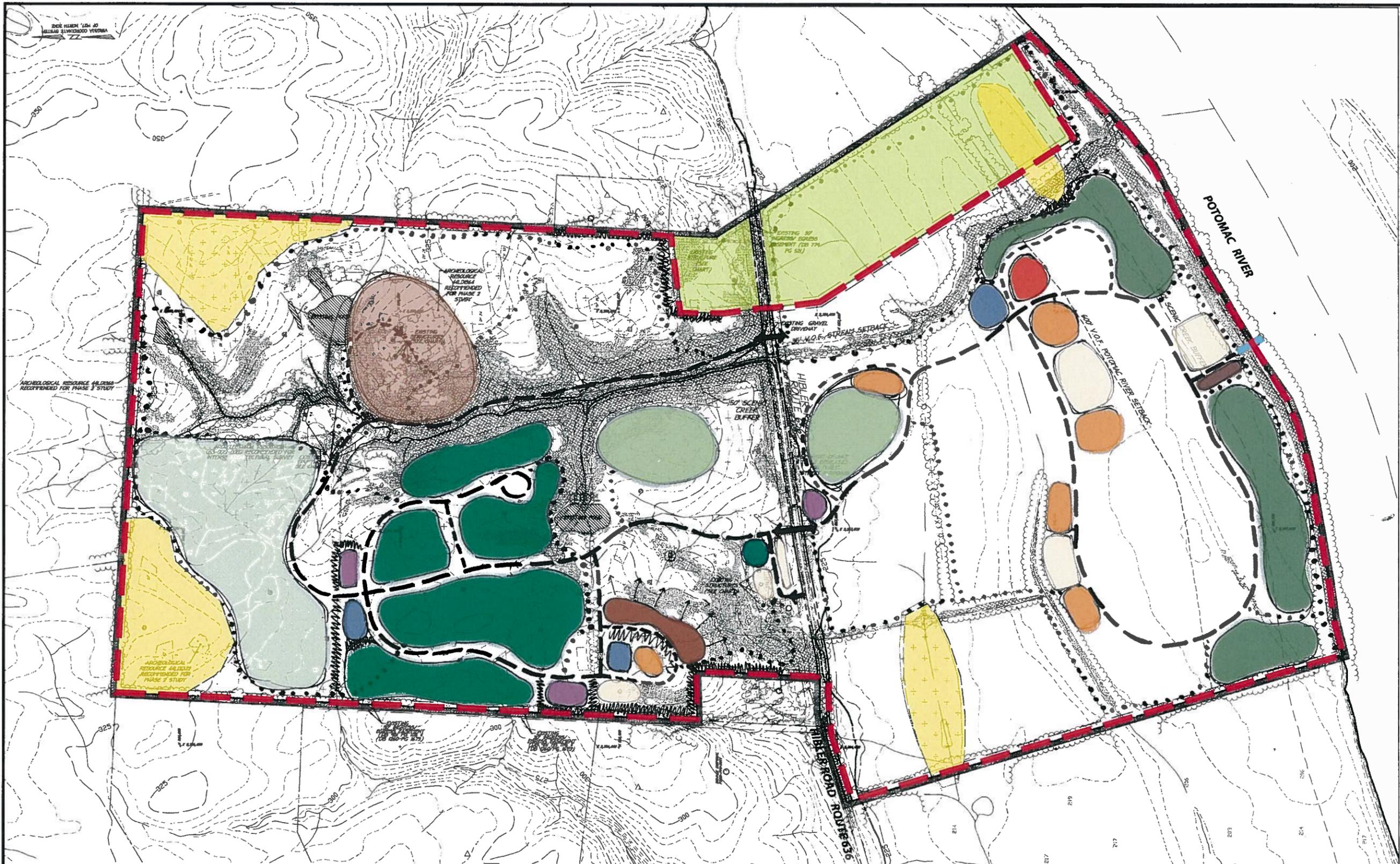
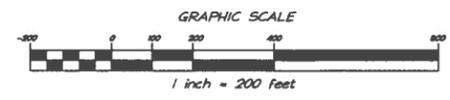


Figure 1: Site Location Map



LEGEND

- | | | | | | | | | | |
|--|------------------------------|--|------------------------------|--|------------------------------------|--|--|--|---------------------------|
| | PARK OFFICE / VISITOR CENTER | | CAMPING CABINS / YURTS | | YOUTH GROUP CAMPING | | COLONEL WHITE HOUSE / HISTORIC MUSEUM | | VEHICULAR ACCESS |
| | RESTROOMS / SHOWERS | | PLAYGROUND / RECREATION AREA | | INDIVIDUAL / FAMILY CAMPSITES | | VIRGINIA OUTDOOR FOUNDATION NO-BUILD AREA | | PRIMARY ROAD |
| | MAINTENANCE FACILITY | | EVENT AREA | | TEMPORARY CONCESSION / BOAT RENTAL | | RESIDENTIAL LOT EXCLUDED FROM THE SPEX (20 AC) | | SECONDARY ROAD |
| | PICNIC PAVILION | | PARKING | | BOAT LAUNCH | | LIMITS OF SPEX | | HIKING / EQUESTRIAN TRAIL |
| | | | | | | | | | LANDSCAPE BUFFER |



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 571.208.5550 · fax 571.208.5951



CONCEPT SKETCH

WHITE'S FORD PARK
 NORTHERN VIRGINIA REGIONAL
 PARK AUTHORITY
 CATOCTIN ELECTRIC DISTRICT, LAUDON COUNTY, VIRGINIA

PROJECT NO: 087901.00
 SCALE: 1" = 200'

DATE: 08/05/08

DESIGN: BGV
 DRAWN: BGV
 CHECKED: GDS

SHEET No.

1 OF 1

LC-4764

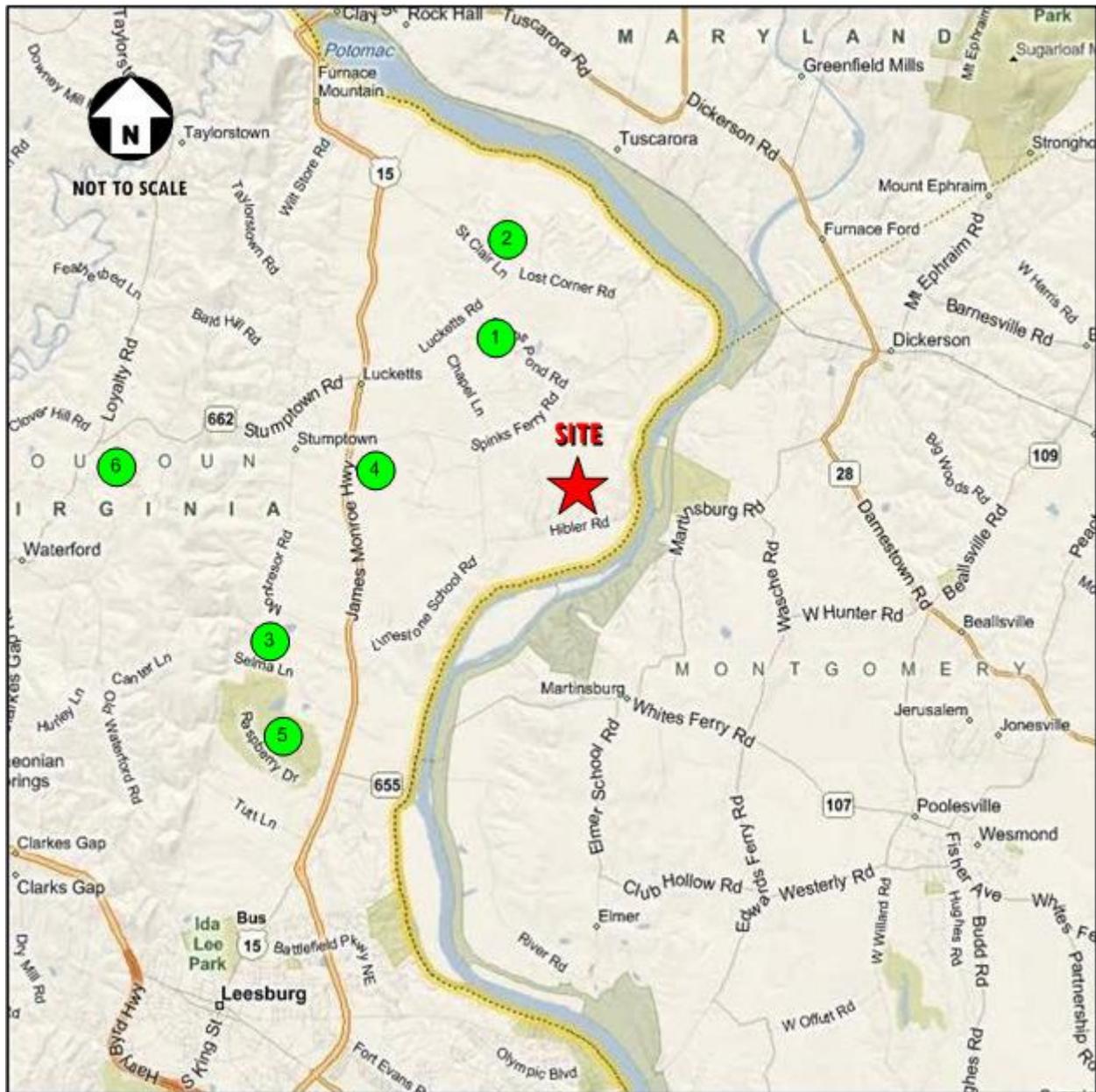


Figure 3: Location of Approved Background Developments

NVRPA DOCUMENTS

**WHITE'S FORD REGIONAL PARK
EXPECTED TRAFFIC GENERATION**

9/30/08

Phase I

Timetable for development - within 5 years, beginning 2010

Number of employees:

Initially there would be no on-site staff. One or two staff members from Temple Hall Farm Regional Park, located 3 miles away on Limestone School Rd., would patrol the park and perform minor maintenance (i.e., trash pickup) about once/week.

Boat launch entrance to be gated, similar to Bull Run Marina Regional Park in Fairfax County. While currently unstaffed, park patrons wishing to launch watercraft may purchase a season pass and gate key. Those wishing to hike the trails or fish from the shore may park in the lot across and up the road from the boat launch and walk down, keeping in mind that all patrons must be out of the park by dark. Bull Run Marina has about 250 season pass holders.

When Phase I is completed, anticipated staffing is 1 full-time year round employee and one or two seasonal part time.

- Boat Launch - kayaks, canoes and john boats:
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – Daylight hours only
 - Season – year-round, with peak usage March – October
 - Anticipated Launches Per Day – Mon. through Fri. 2/day, Sat./Sun. 20/day
 - Estimated Maximum VPD = 40 (20 vehicles x 2 trips (one in, one out). Assumes 1 vehicle per launch.

- Picnic Shelters – Two 100-person rental shelters:
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – Daylight hours only
 - Season – March through October
 - Anticipated Visitors – 200 total
 - Estimated Maximum VPD = 100 (200/4 vehicles x 2 trips (one in, one out). Assumes average of 4 passengers per vehicle.

- Group Camping:
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – 24 hour
 - Season – March through October
 - Anticipated Visitors – Minimum group size 30, maximum 100
 - Estimated Maximum VPD = 25 (100/4 vehicles). Assumes average of 4 passengers per vehicle, one trip/day since overnight.

- Events:
 - Annual youth group camporee-
 - Anticipated Visitors – Maximum of 300 participants likely no more than twice per year.
 - Estimated Maximum VPD = 75 (300/4 passengers/vehicle). Assumes average of 4 passengers per vehicle with overnight stay and only one trip per day.
- General Park Visitation:
 - Shoreline fishing, trails, open play areas, interpretive markers, individual picnics
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – Daylight hours only
 - Season – year-round, with peak usage March – October
 - Anticipated Visitors Per Day - Mon. through Fri. 10/day, Sat./Sun. 50/day
 - Estimated Maximum VPD = 25 (50/4 x 2 trips per day). Assumes average of 4 passengers per vehicle
- Tenant in Col. White house: 4 max. residents (3 BR, 2 BA)
- Family Camping:
 - Includes campsites for tents and pop-ups, no RVs or 5th-wheel trailers, and several camping cabins.
 - Days of Week – Daily, with peak usage on Saturday and Sunday
 - Hours of Operation – 24 hour
 - Season – March through October
 - Anticipated Visitors – Minimum 25 sites, maximum 60 sites. 4 people/site, one trip/day/site
 - Estimated Maximum VPD = 60. Assumes one vehicle per campsite/cabin with overnight stay and only one trip per day.

Phase II

Timetable for development – beyond 2015 TBD.

- Historic Site:
 - Operation of Col. White house as interpretive center. Same visitation as for camping, boating, etc., no separate vehicle trips.
- Special Events:
 - Annual group campout? unknown at this time.
- Equestrian Trail-Riding Facility: TBD. Resident horse program, no trailers. Visits associated with camping so no additional vehicle trips.

APPENDIX C

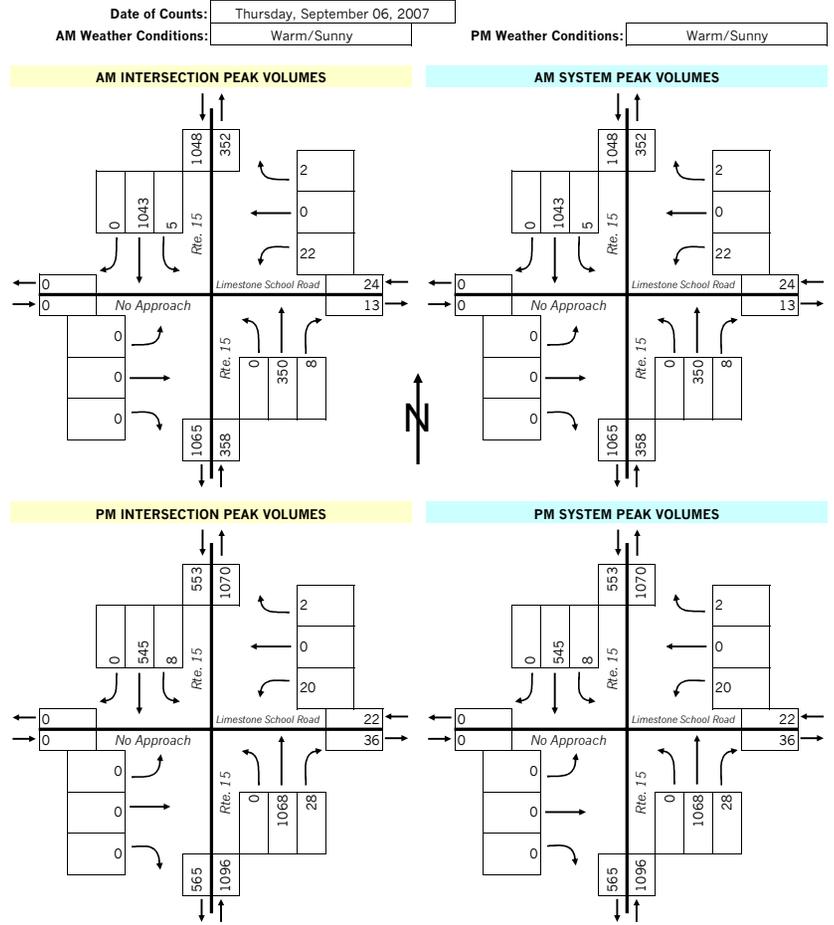
Existing Traffic Volumes & Count Sheets (2008)

Gorove/Slade Associates

Project Name :	White's Ford Park
Project # :	1795-003
Location :	Loudoun County, VA
Data Source:	Gorove/Slade Associates

Intersection:		Route 15 at Limestone School Road															
AM PEAK	Direction: Roadway: Movement:	Southbound Rte. 15				Westbound Limestone School Road				Northbound Rte. 15				Eastbound No Approach			
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds
6:00 AM to 6:15 AM		0	187	0	0	0	0	1	0	3	52	0	0				
6:15 AM to 6:30 AM		0	219	2	0	0	0	4	0	2	61	0	0				
6:30 AM to 6:45 AM		0	249	0	0	0	0	3	0	2	58	0	0				
6:45 AM to 7:00 AM		0	228	0	0	1	0	2	0	1	76	0	1				
7:00 AM to 7:15 AM		0	243	1	0	1	0	6	0	4	85	0	0				
7:15 AM to 7:30 AM		0	263	0	0	0	0	5	0	0	100	0	0				
7:30 AM to 7:45 AM		0	266	2	0	0	0	4	0	1	86	0	0				
7:45 AM to 8:00 AM		0	271	2	0	1	0	7	0	3	79	0	0				
8:00 AM to 8:15 AM		0	199	1	0	0	0	4	0	4	85	0	0				
8:15 AM to 8:30 AM		0	286	0	0	1	0	6	0	6	107	0	0				
8:30 AM to 8:45 AM		0	200	0	0	0	0	4	0	5	102	0	0				
8:45 AM to 9:00 AM		0	171	1	0	2	0	6	0	8	94	0	0				
PM PEAK	Direction: Roadway: Movement:	Southbound Rte. 15				Westbound Limestone School Road				Northbound Rte. 15				Eastbound No Approach			
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds
4:00 PM to 4:15 PM		0	111	0	1	0	0	5	0	3	262	0	0				
4:15 PM to 4:30 PM		0	129	0	0	1	0	5	0	6	233	0	0				
4:30 PM to 4:45 PM		0	119	0	0	2	0	4	0	3	285	0	0				
4:45 PM to 5:00 PM		0	111	1	2	0	0	2	0	2	246	0	0				
5:00 PM to 5:15 PM		0	140	1	0	0	0	3	0	6	261	0	0				
5:15 PM to 5:30 PM		0	135	2	0	2	0	8	0	10	279	0	0				
5:30 PM to 5:45 PM		0	147	5	0	0	0	5	0	8	263	0	0				
5:45 PM to 6:00 PM		0	123	0	0	0	0	4	0	4	265	0	0				
6:00 PM to 6:15 PM		0	126	0	0	0	0	4	0	2	228	0	0				
6:15 PM to 6:30 PM		0	89	1	0	0	0	1	0	5	204	0	0				
6:30 PM to 6:45 PM		0	91	0	0	0	0	2	0	0	182	0	0				
6:45 PM to 7:00 PM		0	98	1	0	0	0	0	0	3	157	0	0				
PEAK HOURS	Direction: Roadway: Movement:	Southbound Rte. 15				Westbound Limestone School Road				Northbound Rte. 15				Eastbound No Approach			
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds
AM INTERSECTION PEAK HOUR 7:00 AM to 8:00 AM		0	1043	5	0	2	0	22	0	8	350	0	0	0	0	0	0
PM INTERSECTION PEAK HOUR 5:00 PM to 6:00 PM		0	545	8	0	2	0	20	0	28	1068	0	0	0	0	0	0
AM SYSTEM PEAK HOUR 7:00 AM to 8:00 AM		0	1043	5	0	2	0	22	0	8	350	0	0	0	0	0	0
PM SYSTEM PEAK HOUR 5:00 PM to 6:00 PM		0	545	8	0	2	0	20	0	28	1068	0	0	0	0	0	0
PEAK HOUR FACTORS		Southbound Rte. 15				Westbound Limestone School Road				Northbound Rte. 15				Eastbound No Approach			
FACTORS		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds
AM PEAK HOUR		0.00	0.96	0.63	N/A	0.50	0.00	0.79	N/A	0.50	0.88	0.00	N/A	0.00	0.00	0.00	N/A
PM PEAK HOUR		0.00	0.93	0.40	N/A	0.25	0.00	0.63	N/A	0.70	0.96	0.00	N/A	0.00	0.00	0.00	N/A
Overall AM PEAK HOUR FACTOR		= 0.97															
Overall PM PEAK HOUR FACTOR		= 0.96															
Total AM Intersection Volume:		3874				Total PM Intersection Volume:				4398							

Raw Volumes

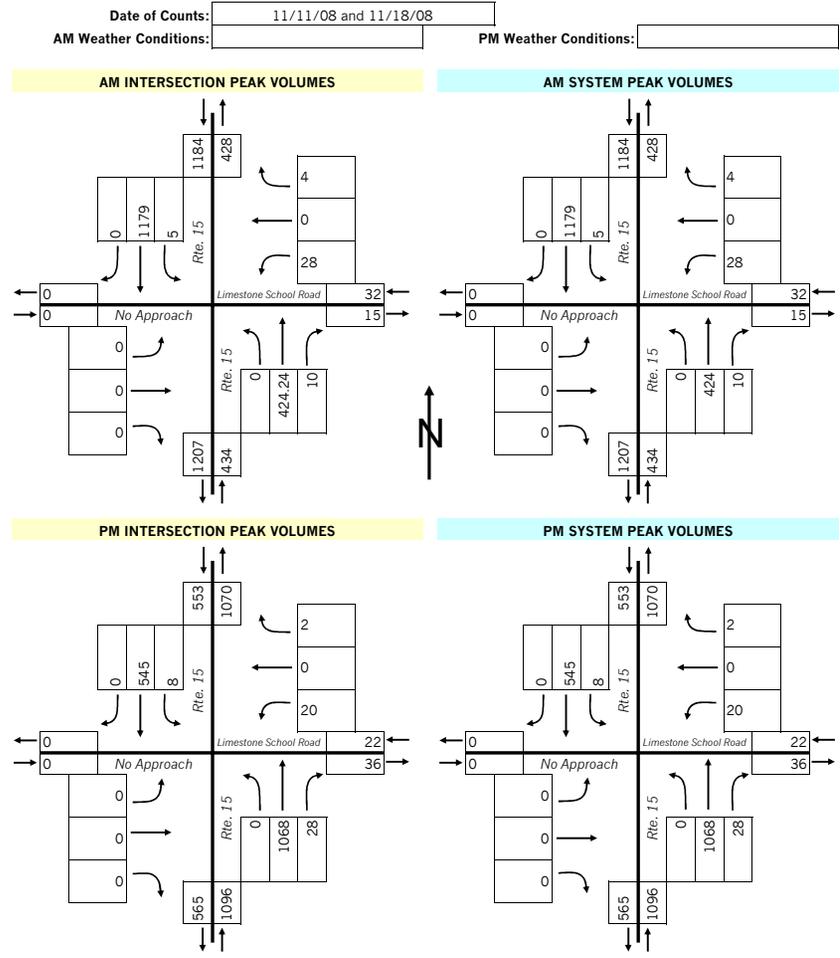


Gorove/Slade Associates

Project Name :	White's Ford Park
Project Number:	1795-003
Location:	Loudoun County, VA
Data Source:	Gorove/Slade Associates

Adjusted Volumes

Intersection:		Route 15 at Limestone School Road															
AM PEAK	Direction: Roadway: Movement:	Southbound				Westbound				Northbound				Eastbound			
		Rte. 15				Limestone School Road				Rte. 15				No Approach			
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds
6:00 AM to 6:15 AM		0	211	0	0	0	0	1	0	4	63	0	0				
6:15 AM to 6:30 AM		0	248	2	0	0	0	5	0	3	74	0	0				
6:30 AM to 6:45 AM		0	281	0	0	0	0	4	0	3	70	0	0				
6:45 AM to 7:00 AM		0	258	0	0	2	0	3	0	1	92	0	1				
7:00 AM to 7:15 AM		0	275	1	0	2	0	8	0	5	103	0	0				
7:15 AM to 7:30 AM		0	297	0	0	0	0	6	0	0	121	0	0				
7:30 AM to 7:45 AM		0	301	2	0	0	0	5	0	1	104	0	0				
7:45 AM to 8:00 AM		0	306	2	0	2	0	9	0	4	96	0	0				
8:00 AM to 8:15 AM		0	225	1	0	0	0	5	0	5	103	0	0				
8:15 AM to 8:30 AM		0	323	0	0	2	0	8	0	8	130	0	0				
8:30 AM to 8:45 AM		0	226	0	0	0	0	5	0	6	124	0	0				
8:45 AM to 9:00 AM		0	193	1	0	4	0	8	0	10	114	0	0				
PM PEAK	Direction: Roadway: Movement:	Southbound				Westbound				Northbound				Eastbound			
		Rte. 15				Limestone School Road				Rte. 15				No Approach			
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds
4:00 PM to 4:15 PM		0	111	0	1	0	0	5	0	3	262	0	0				
4:15 PM to 4:30 PM		0	129	0	0	1	0	5	0	6	233	0	0				
4:30 PM to 4:45 PM		0	119	0	0	2	0	4	0	3	285	0	0				
4:45 PM to 5:00 PM		0	111	1	2	0	0	2	0	2	246	0	0				
5:00 PM to 5:15 PM		0	140	1	0	0	0	3	0	6	261	0	0				
5:15 PM to 5:30 PM		0	135	2	0	2	0	8	0	10	279	0	0				
5:30 PM to 5:45 PM		0	147	5	0	0	0	5	0	8	263	0	0				
5:45 PM to 6:00 PM		0	123	0	0	0	0	4	0	4	265	0	0				
6:00 PM to 6:15 PM		0	126	0	0	0	0	4	0	2	228	0	0				
6:15 PM to 6:30 PM		0	89	1	0	0	0	1	0	5	204	0	0				
6:30 PM to 6:45 PM		0	91	0	0	0	0	2	0	0	182	0	0				
6:45 PM to 7:00 PM		0	98	1	0	0	0	0	0	3	157	0	0				
PEAK HOURS	Direction: Roadway: Movement:	Southbound				Westbound				Northbound				Eastbound			
		Rte. 15				Limestone School Road				Rte. 15				No Approach			
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds
AM INTERSECTION PEAK HOUR																	
7:00 AM to 8:00 AM		0	1179	5	0	4	0	28	0	10	424	0	0	0	0	0	0
PM INTERSECTION PEAK HOUR																	
5:00 PM to 6:00 PM		0	545	8	0	2	0	20	0	28	1068	0	0	0	0	0	0
AM SYSTEM PEAK HOUR																	
7:00 AM to 8:00 AM		0	1179	5	0	4	0	28	0	10	424	0	0	0	0	0	0
PM SYSTEM PEAK HOUR																	
5:00 PM to 6:00 PM		0	545	8	0	2	0	20	0	28	1068	0	0	0	0	0	0
PEAK HOUR FACTORS	FACTORS	Southbound				Westbound				Northbound				Eastbound			
		Rte. 15				Limestone School Road				Rte. 15				No Approach			
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds
AM PEAK HOUR		0.00	0.96	0.63	N/A	0.50	0.00	0.79	N/A	0.50	0.88	0.00	N/A	0.00	0.00	0.00	N/A
PM PEAK HOUR		0.00	0.93	0.40	N/A	0.25	0.00	0.63	N/A	0.70	0.96	0.00	N/A	0.00	0.00	0.00	N/A
Overall AM PEAK HOUR FACTOR		= 0.97								Overall PM PEAK HOUR FACTOR							
Total AM Intersection Volume:		4476								Total PM Intersection Volume:							
		3698								4398							



APPENDIX D

Level of Service Definitions

LEVEL OF SERVICE DEFINITIONS

All capacity analyses are based on the procedures specified by the Transportation Research Board, Special Report 209: *Highway Capacity Manual (HCM)*, 2000. Levels of service (LOS) range from A to F. A brief description of each level of service for signalized and unsignalized intersections is provided below.

Signalized Intersections: Level of service is based upon the traffic volume present in each lane on the roadway, the capacity of each lane at the intersection and the delay associated with each directional movement. The levels of service for signalized intersections are defined below:

- Level of Service A describes operations with very low average delay per vehicle, i.e., less than 10.0 seconds. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop. Short signal cycle lengths may also contribute to low delay.
- Level of Service B describes operations with average delay in the range of 10.1 to 20.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.
- Level of Service C describes operations with delay in the range of 20.1 to 35.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level although many still pass through the intersection without stopping. This is generally considered the lower end of the range of the acceptable level of service in rural areas.
- Level of Service D describes operations with delay in the range of 35.1 to 55.0 seconds per vehicle. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, and/or high traffic volumes as compared to the roadway capacity. Many vehicles are required to stop and the number of vehicles that do not have to stop declines. Individual signal cycle failures, where all waiting vehicles do not clear the intersection during a single green time, are noticeable. This is generally considered the lower end of the range of the acceptable level of service in urban areas.
- Level of Service E describes operations with delay in the range of 55.1 to 80.0 seconds per vehicle. These higher delay values generally indicate poor progression, long cycle lengths, and high traffic volumes. Individual cycle failures are frequent occurrences. LOS E has been set as the limit of acceptable conditions.
- Level of Service F describes operations with average delay in excess of 80.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with over-saturation, i.e., when traffic arrives at a flow rate that exceeds the capacity of the intersection.

It may also occur at high volumes with many individual cycle failures. Poor progression and long cycle lengths may also contribute to such delays.

Unsignalized Intersections: At an unsignalized intersection, the major street through traffic and right turns are assumed to operate unimpeded and therefore receive no level of service rating. The level of service for the minor street and the major street left turn traffic is dependent on the volume and capacity of the available lanes, and, the number and frequency of acceptable gaps in the major street traffic to make a conflicting turn. The level of service grade is provided for each conflicting movement at an unsignalized intersection and is based on the total average delay experienced by each vehicle. The delay includes the time it takes a vehicle to move from the back of a queue through the intersection.

The unsignalized intersection level of service analysis does not account for variations in driver behavior or the effects of nearby traffic signals. Therefore, the results from this analysis usually indicates worse levels of service than may be experienced in the field. The unsignalized intersection level of service descriptions are provided below:

- Level of Service A. Describes operations where there is very little to no conflicting traffic for a minor side street movement, i.e., an average total delay of less than 10.0 seconds per vehicle.
- Level of Service B. Describes operations with average total delay in the range of 10.1 to 15.0 seconds per vehicle.
- Level of Service C. Describes operations with average total delay in the range of 15.1 to 25.0 second per vehicle.
- Level of Service D. Describes operations with average total delay in the range of 25.1 to 35.0 seconds per vehicle.
- Level of Service E. Describes operations with average total delay in the range of 35.1 to 50.0 seconds per vehicle.
- Level of Service F. Describes operations with average total delay of 50 seconds per vehicle. LOS F exists when there are insufficient gaps of suitable size to allow a side street demand to cross safely through or enter a major street traffic stream. This level of service is generally evident from extremely long total delays experienced by side street traffic and by queuing on the minor approaches. It is important to note that LOS F may not always result in long queues but may result in adjustments to normal driver behavior.

APPENDIX E

Intersection Capacity Analysis Results – Existing Conditions (2008)



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙		↔		↙	↗
Sign Control	Stop		Free		Free	Free
Grade	0%		0%			0%
Volume (veh/h)	28	4	424	10	5	1179
Peak Hour Factor	0.79	0.50	0.88	0.50	0.63	0.96
Hourly flow rate (vph)	35	8	482	20	8	1228
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1736	492			502	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1736	492			502	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	63	99			99	
cM capacity (veh/h)	95	577			1063	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	43	502	8	1228
Volume Left	35	0	8	0
Volume Right	8	20	0	0
cSH	113	1700	1063	1700
Volume to Capacity	0.39	0.30	0.01	0.72
Queue Length 95th (ft)	40	0	1	0
Control Delay (s)	55.6	0.0	8.4	0.0
Lane LOS	F		A	
Approach Delay (s)	55.6	0.0	0.1	
Approach LOS	F			

Intersection Summary			
Average Delay		1.4	
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)		15	



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙		↘		↙	↘
Sign Control	Stop		Free		Free	Free
Grade	0%		0%			0%
Volume (veh/h)	20	2	1068	28	8	545
Peak Hour Factor	0.63	0.25	0.96	0.70	0.40	0.93
Hourly flow rate (vph)	32	8	1112	40	20	586
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1759	1132			1152	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1759	1132			1152	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	65	97			97	
cM capacity (veh/h)	90	247			606	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	40	1152	20	586
Volume Left	32	0	20	0
Volume Right	8	40	0	0
cSH	103	1700	606	1700
Volume to Capacity	0.38	0.68	0.03	0.34
Queue Length 95th (ft)	39	0	3	0
Control Delay (s)	60.2	0.0	11.1	0.0
Lane LOS	F		B	
Approach Delay (s)	60.2	0.0	0.4	
Approach LOS	F			

Intersection Summary			
Average Delay		1.5	
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)		15	

APPENDIX F

Intersection Capacity Analysis Results – Future Conditions without
Development (2015)



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙		↘		↙	↘
Sign Control	Stop		Free		Free	Free
Grade	0%		0%		0%	0%
Volume (veh/h)	28	4	522	10	5	1450
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	4	567	11	5	1576
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2160	573			578	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2160	573			578	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	41	99			99	
cM capacity (veh/h)	52	519			995	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	35	578	5	1576
Volume Left	30	0	5	0
Volume Right	4	11	0	0
cSH	59	1700	995	1700
Volume to Capacity	0.59	0.34	0.01	0.93
Queue Length 95th (ft)	61	0	0	0
Control Delay (s)	132.7	0.0	8.6	0.0
Lane LOS	F		A	
Approach Delay (s)	132.7	0.0	0.0	
Approach LOS	F			

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)		15	



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙		↘		↙	↘
Sign Control	Stop		Free		Free	Free
Grade	0%		0%			0%
Volume (veh/h)	20	2	1314	28	8	670
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	2	1428	30	9	728
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2189	1443			1459	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2189	1443			1459	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	56	99			98	
cM capacity (veh/h)	49	162			463	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	24	1459	9	728
Volume Left	22	0	9	0
Volume Right	2	30	0	0
cSH	52	1700	463	1700
Volume to Capacity	0.46	0.86	0.02	0.43
Queue Length 95th (ft)	43	0	1	0
Control Delay (s)	121.8	0.0	12.9	0.0
Lane LOS	F		B	
Approach Delay (s)	121.8	0.0	0.2	
Approach LOS	F			

Intersection Summary			
Average Delay		1.4	
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)		15	

APPENDIX G

Intersection Capacity Analysis Results – Future Conditions with Development (2015)



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙		↔		↙	↗
Sign Control	Stop		Free		Free	Free
Grade	0%		0%			0%
Volume (veh/h)	32	6	522	17	8	1450
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	7	567	18	9	1576
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2170	577			586	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2170	577			586	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	32	99			99	
cM capacity (veh/h)	51	516			989	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	41	586	9	1576
Volume Left	35	0	9	0
Volume Right	7	18	0	0
cSH	59	1700	989	1700
Volume to Capacity	0.69	0.34	0.01	0.93
Queue Length 95th (ft)	74	0	1	0
Control Delay (s)	150.7	0.0	8.7	0.0
Lane LOS	F		A	
Approach Delay (s)	150.7	0.0	0.0	
Approach LOS	F			

Intersection Summary			
Average Delay		2.8	
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)		15	



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙		↔		↘	↗
Sign Control	Stop		Free		Free	Free
Grade	0%		0%			0%
Volume (veh/h)	30	6	1314	38	11	670
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	7	1428	41	12	728
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2201	1449			1470	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2201	1449			1470	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	32	96			97	
cM capacity (veh/h)	48	161			459	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	39	1470	12	728
Volume Left	33	0	12	0
Volume Right	7	41	0	0
cSH	54	1700	459	1700
Volume to Capacity	0.72	0.86	0.03	0.43
Queue Length 95th (ft)	75	0	2	0
Control Delay (s)	168.4	0.0	13.1	0.0
Lane LOS	F		B	
Approach Delay (s)	168.4	0.0	0.2	
Approach LOS	F			

Intersection Summary			
Average Delay		3.0	
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)		15	

APPENDIX H

Warrant Analysis Results

Right Turn Lane Warrant Analysis

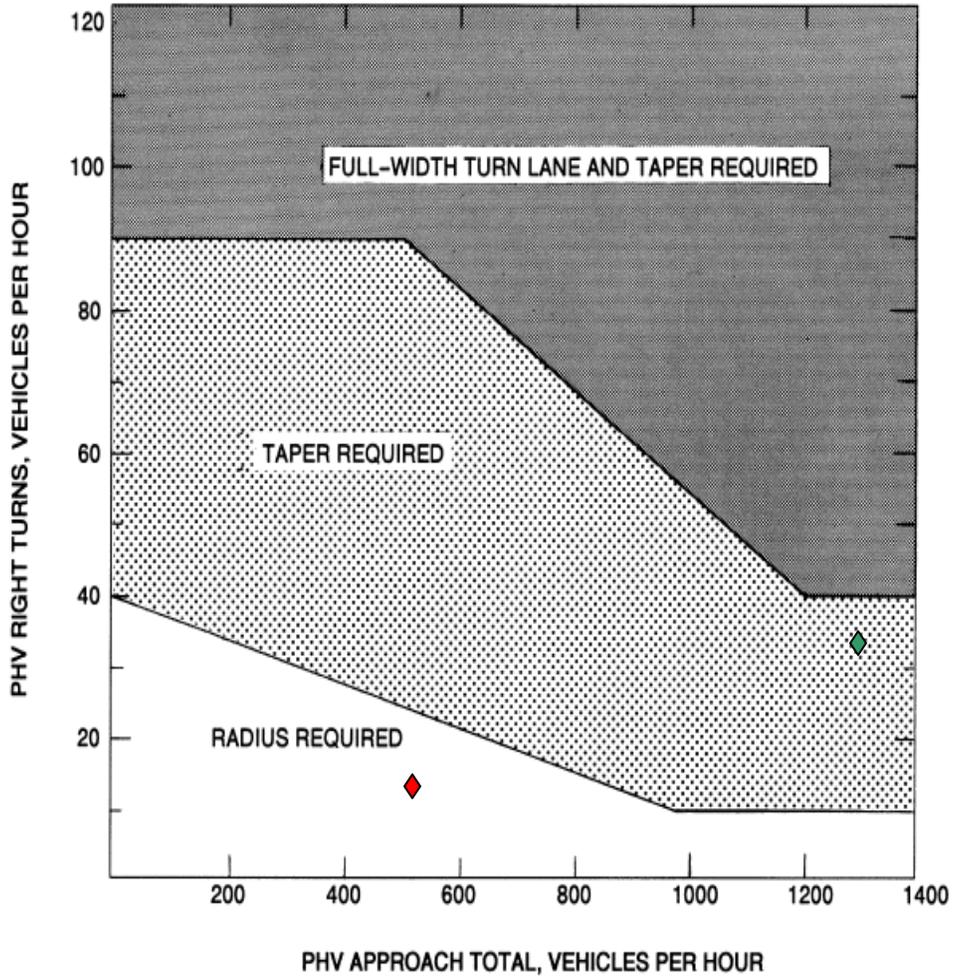
US Route 15 and Limestone School Road

AM Peak Hour

Right Turn Volume = 17 veh/hour
Approach Volume = 539 veh/hour

PM Peak Hour

Right Turn Volume = 38 veh/hour
Approach Volume = 1352 veh/hour



Right turn lane not warranted, but taper required.

TRAFFIC SIGNAL WARRANTS - US ROUTE 15 AND LIMESTONE SCHOOL ROAD

(Based on Estimated Average Daily Traffic - See Note 2)

URBAN _____	RURAL _____ X _____																												
1. Minimum Vehicular Urban Rural Not Satisfied	Minimum Required Estimated Average Daily Traffic <i>Vehicles per day on major Street (total of both approaches)</i>																												
<i>Number of lanes for moving traffic on each approach</i> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Major Street</th> <th style="width: 50%;">Minor Street</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2 or more</td> <td>1</td> </tr> <tr> <td>2 or more</td> <td>2 or more</td> </tr> <tr> <td>1</td> <td>2 or more</td> </tr> </tbody> </table>	Major Street	Minor Street	1	1	2 or more	1	2 or more	2 or more	1	2 or more	<i>Vehicles per day on higher-volume minor street (one direction only)</i>																		
Major Street	Minor Street																												
1	1																												
2 or more	1																												
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	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Urban</th> <th style="width: 25%;">Rural</th> <th style="width: 25%;">Actual</th> <th style="width: 25%;"></th> </tr> </thead> <tbody> <tr> <td>8,000</td> <td>5,600</td> <td style="color: red;">20,520</td> <td>Urban</td> </tr> <tr> <td>9,600</td> <td>6,720</td> <td style="color: red;">0</td> <td>Rural</td> </tr> <tr> <td>9,600</td> <td>6,720</td> <td style="color: red;">0</td> <td>Actual</td> </tr> <tr> <td>8,000</td> <td>5,600</td> <td style="color: red;">0</td> <td>Urban</td> </tr> <tr> <td></td> <td></td> <td></td> <td>Rural</td> </tr> <tr> <td></td> <td></td> <td></td> <td>Actual</td> </tr> </tbody> </table>	Urban	Rural	Actual		8,000	5,600	20,520	Urban	9,600	6,720	0	Rural	9,600	6,720	0	Actual	8,000	5,600	0	Urban				Rural				Actual
Urban	Rural	Actual																											
8,000	5,600	20,520	Urban																										
9,600	6,720	0	Rural																										
9,600	6,720	0	Actual																										
8,000	5,600	0	Urban																										
			Rural																										
			Actual																										
2. Interruption of Continuous Traffic Urban Rural Not Satisfied	<i>Vehicles per day on major Street (total of both approaches)</i>																												
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Urban	Rural	Actual																											
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14,400	10,080	0	Actual																										
12,000	8,400	0	Urban																										
			Rural																										
			Actual																										
3. Combination Urban Rural Not Satisfied	<i>Must satisfy 80% of Warrants 1 and 2</i>																												
Note: 1. Left turn movements from the major street may be included with minor street volumes if a separate signal phase is to be provided for the left-turn movement. 2. To be used only for NEW INTERSECTIONS or other locations where actual traffic volumes cannot be counted.																													

* Form is based on the sample form found in the Manual on Traffic Signal Design (MTSD) page 20.