MONTGOMERY
COUNTY, VIRGINIA

Rezoning Application Form

Rezoning, Conditional Zoning, Proffer Amendment

Montgomery County, Virginia
755 Roanoke St. Suite 2A, Christiansburg, VA 24073
540-394-2148 | mcplan@montgomerycountyva.gov

Application Request: *(Please check one)* ☐ Conditional Rezoning ☑ Rezoning ☐ Amend Proffers

Applicant Information: (PLEASE PRINT – if additional owners, please attach additional sheets)

Owner of Record (attach separate page for add'l owners): SHAH Development, LLC	Address: P.O. Box 1499, Christiansburg, VA 24068
Telephone: (540) 381-8429	Email: kconner@shahllc.com

Applicant Name: Owner Contract Purchaser/Lessee SHAH Development, LLC	Address: P.O. Box 1499, Christiansburg, VA 24068
Telephone: **(540) 381-8429**	Email: kconner@shahllc.com

Representative Name and Company: Foresight Design Services	Address: 1260 Radford Street, Christiansburg, VA 24073
Telephone: (540) 381-6011	Email: info@foresightdesignservices.com

Property Description:

Location or Address: *(Describe in relation to nearest intersection)* Property lies east of the intersection of Houchins Road and Crosscreek Drive		
Parcel ID Number(s): 018437, 018441	Acreage: 26.718 total (21.148 RM/5.57 C-1	Existing Zoning: M1/C1
Comprehensive Plan Designation: Urban Expansion Area	Existing Use: Vacant Lot/ Wooded area	

Description of Request: (Please provide additional information on attached sheet if necessary)

Proposed Zoning (Include Acreage): PUD-RES
Proposed Use: Single Famly Homes, Townhomes and Duplex

I certify that the information supplied on this application and on the attachments provided (maps or other information) is accurate and true to the best of my knowledge. In addition, I hereby grant permission to the agents and employees of Montgomery County and State of Virginia to enter the above property for the purposes of processing and reviewing the above application.

If signing on behalf of a Corporation, Partnership, or LLC, please specify your title with the entity and provide documentation clarifying your authority to sign on behalf of the entity.

Owner 1 Signature — Date: 10-27-23

Owner 2 Signature (for add'l owners please attach separate sheet) — Date

Applicant Signature — Date: 10-27-23

Representative/Agent Signature — Date

WALNUT RIDGE

REZONING APPLICATION TO PUD-RES

Located in:

Montgomery County, Virginia

Project Number: 3246.0

Date: November 1, 2023

FORESIGHT
DESIGN SERVICES
1260 Radford Street · Christiansburg, Virginia 24073
540.381.6011 office · 540.381.2773 fax
www.foresightdesignservices.com

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REZONING APPLICATION JUSTIFICATION

Rezoning Justification

The applicant for rezoning shall provide a statement of justification to address the following items in the application materials to demonstrate what impact the proposed request will have on the County's resources and how the request complies with Montgomery County's Comprehensive Plan.

Section 10-54(1)(k)(4), Montgomery County Zoning Ordinance

4. Zoning Map Amendments. If the application is for a reclassification of property to a different zoning district classification on the Zoning Map, the applicant shall address all the following in its statement of justification or plat unless not applicable. The Planning Commission shall give reasonable consideration to the following matters:

a. Whether the proposed zoning district classification is consistent with the Comprehensive Plan.
   Response: PUD-RES is consistent with the Urban Expansion designation for the Comprehensive Plan. Urban Expansion per the Comprehensive Plan is for the development of residential and non-residential projects. In particular, the providing of multiple potential housing types close to the existing Industrial Park and the Interstate Interchange is an ideal proposal for efficient/sustainable development of a parcel designated as Urban Expansion.

b. Whether there are any changed or changing conditions in the area affected that make the proposed rezoning appropriate.
   Response: With Phase III of Walnut Creek approved and ready to build, the current site will compliment Walnut Creek and provide further expansion with additional residential housing in this area.

c. Whether the range of uses in the proposed zoning district classification are compatible with the uses permitted on other property in the immediate vicinity.
   Response: The PUD-RES zoning for residential is similar to the adjacent Walnut Creek Planned Unit Development. We are adding the option of developing some duplex house types to provide a different housing option for people who want to live in the area.

d. Whether adequate utility, sewer and water, transportation, school and other facilities exist or can be provided to serve the uses that would be permitted on the property if it were rezoned.
   Response: All utility, water, sewer, transportation and schools are available for the proposed rezoned property.

e. The effect of the proposed rezoning on the County's ground water supply.
   Response: There are no effects to ground water sources.

f. The effect of uses allowed by the proposed rezoning on the structural capacity of the soils.
Response: There is no expected impact on the structural capacity of the soils on site.

g. The impact that the uses that would be permitted if the property were rezoned will have upon the volume of vehicular and pedestrian traffic and traffic safety in the vicinity and whether the proposed rezoning uses sufficient measures to mitigate the impact of through construction traffic on existing neighborhoods and school areas.
Response: A full traffic impact analysis has been performed and is in the appendices of this rezoning. The TIA has been previously submitted to VDOT and was approved by them. It should be noted that with the current zoning of the large majority of the parcel as M1 – Manufacturing that the proposed residential scale traffic of the rezoning is more compatible with the existing street network and existing traffic on Houchins Road. An unknown M1-Manufacturing by right user could contribute negatively to the existing pedestrian and automobile traffic network.

h. Whether a reasonably viable economic use of the subject property exists under the current zoning.
Response: The current zoning does provide for industrial use of the existing site; however, to match the adjacent growth of the area and the increase in housing along Houchins Road, the residential aspect of the proposed rezoning compliments the Urban Expansion as well as ties into the existing nearby subdivisions. The existing residential traffic on Houchins Road as well as the topography of the subject property does not economically lend itself to an industrial use.

i. The effect of the proposed rezoning on environmentally sensitive land or natural features, wildlife habitat, vegetation, water quality and air quality.
Response: The proposed subdivision will replace a majority of existing wooded area and will have construction activity that will create noise, air pollutants from construction equipment, and removed trees and vegetation from the area. However, once the subdivision is complete, stormwater bioretention facilities will preserve the water quality, street trees and buffer trees will be planted to restore some of the possible habitat lost as well as help with air quality. As much of the existing woods on the north end of the property as possible will be preserved.

j. Whether the proposed rezoning encourages economic development activities in areas designated by the Comprehensive Plan and provides desirable employment and enlarges the tax base.
Response: The proposed rezoning will provide residential housing per the Urban Expansion area designated in the Comprehensive Plan. This will help to increase the population and taxbase and provide residential housing for a workforce to be close to jobs and transportation infrastructure.

k. Whether the proposed rezoning considers the needs of agriculture, industry, and businesses in future growth.
Response: The proposed rezoning seeks to match the trend of residential housing in the expansion area that will provide additional growth for businesses in the area.

l. Whether the proposed rezoning considers the current and future requirements of the community as to land for various purposes as determined by population and economic studies.
Response: Per the Comprehensive Plan, the urban expansion need for the area is residential and nonresidential. The zoning for this area is typically either industrial or residential along the Town of Christiansburg corporate line. Therefore, by providing residential housing the current and future requirements of the urban expansion area are met.

m. Whether the proposed rezoning encourages the conservation of properties and their values and the encouragement of the most appropriate use of land throughout the County.
Response: The proposed rezoning tends to focus on the appropriate use for expansion and growth in this area of Montgomery County per the Comprehensive Plan. Providing additional housing within the urban expansion area will serve to lessen the pressure for development in areas of the County that are more rural in nature and lack services such as water and sewer.

n. Whether the proposed rezoning considers trends of growth or changes, employment, and economic factors, the need for housing, probable future economic and population growth of the county.
Response: This rezoning considers growth of the area and the needs for residential housing to help with population growth in Montgomery County.

o. The effect of the proposed rezoning on the provision of moderate housing by enhancing opportunities for all qualified residents of Montgomery County.
Response: The proposed townhome development will provide housing opportunities for residents of Montgomery County and in particular the added housing capacity serves to provide movement among all different economic categories through 2nd or 3rd order impacts.

p. The effect of the rezoning on natural, scenic, archaeological, or historic features of significant importance.
Response: No known features will be impacted.

Comprehensive Plan Justification

Introduction:

Any development within Montgomery County is viewed by the Board of Supervisors, Planning Commission, County Staff, and Citizens through the prism of the comprehensive plan. The following narrative and analysis will address points within the comprehensive plan and discuss how the proposed use aligns with the vision, goals, and objectives of the comprehensive plan. Please note that below are excerpts from the adopted 2025 Comprehensive Plan and one should refer to the Plan for the full text.

The subject property is identified in the Comprehensive Plan as part of the Urban Expansion Area. The text below is from the Comprehensive Plan, with the bold text demonstrating how the proposal meets the guidelines. Additional comprehensive references are included within the narrative.

Overview:

The project proposes to allow for 26.718 acres of land to be developed into residential housing located north of the Town of Christiansburg Industrial Park near the Walnut Creek Subdivision area in Montgomery County. The entirety of the 26.718 acres is vacant and wooded terrain which is located along Houchins Road. The western area is bounded by Houchins Road and Industrial areas of the Town as well as the Walnut Creek Subdivision. To the north are residential properties, the east by woods, and the south is the corporate limits for the Town as well as industrial properties. The subdivision will consist of a mixture of townhomes, single family residences, and possibly duplexes. The subdivision will also be provided with recreational open space amenities, bus access, sidewalks, trails, private roadways as well as utilities infrastructure and stormwater management facilities. Stormwater management will be achieved through the use of an onsite detention facility. Stormwater quality will be handled by the dedication of open space on the site, bio retention cells, and the purchase of nutrient credits.

Policy Chapters:

Planning and Land Use

PLU 1.8.3 Urban Expansion Area Land Use:

a. Urban Expansion Areas are the preferred location for new residential and nonresidential development occurring in the unincorporated areas of Montgomery County.
   Discussion – This proposed rezoning will meet the preferred location for residential development.

PLU 1.8.5 Urban Expansion Area Facilities and Utilities:

a. Urban Expansion Areas are or will be served by public sewer and water services provided by the County or by the towns and the city, by mutual agreement.
   Discussion – The subdivision will be connected to both water and sewer services through coordination efforts with the Town and Christiansburg and the Montgomery County PSA.

Conclusion:

The Walnut Ridge Subdivision fits within the Comprehensive Plan for Montgomery County's Urban Expansion Areas by providing residential housing with utilities from both the County and Town.

Rezoning Narrative

Section 1: Project Background

Rezoning Request:

The property owner, Shah Development, requests to rezone property identified as Tax Parcel Numbers 080-A-44 and 080-A-46 to PUD-RES for the development of Walnut Ridge. Currently, the property is zoned Manufacturing (M1), with a small portion of the site zoned Conservation (C1). Note that this portion of the property was brought into the County from the Town. Originally 5.57 acres of land zoned I-2 was shifted from the Town to the County. However, this shift automatically rezoned the property from General Industrial I-2 to Conservation (C1) per county code. Though zoned C1 after the shift, the original property zoning is consistent with the Urban Expansion.

The rezoning request will propose a mixture of townhomes, single family residences, and possibly duplexes. In addition to residential housing, the project includes construction of new private roads, sidewalks, trails, utility infrastructure, stormwater management facilities, and recreational amenities.

The subject property is identified in the Comprehensive Plan as a future land use of Urban Expansion as well as the property is located adjacent to the corporate limits of the Town of Christiansburg. The property rezoning would support the Comprehensive Plan for expansion and provide residential housing to the area.

Zoning Details:

- Area: Approximately 26.718 acres total
- Address: Houchins Road, Christiansburg, VA
- Parcel ID: 018437 and 018441
- Tax Parcel Numbers: 080-A-44 and 080-A-46
- Magisterial District: Shawsville
- Current Zoning: M1/C1

- Maximum Density: (gross density of 12 townhomes per acre for the area designated as RM-1 Base district and gross density of 5 units per acre for the area designated as R3 Compact Base District) -- See Concept Plan
- Future Land Use: Urban Expansion Area
- Flood Zone: Entire property is located outside of the FEMA 100-year flood zone
- Open Space: See Open Space/Landscaping/Buffer Yard Plan

Property History:
In 2021, the property was purchased by Shah Development, which was owned by the Sawyers Family who own and operate Sawyers Bus Sales.

Existing Property Conditions:
As can be seen in the following photographs, the existing property is vacant wooded land though zoned M1/C1, it has not been developed. The majority of the site is wooded and is in close proximity to the Town of Christiansburg corporate limits and nearby residential developments, such as Walnut Creek. The property contains rolling topography that can easily accommodate residential development.

The Town of Christiansburg corporate limits makes up the southern property boundary. Undeveloped agricultural lands adjoin the property to the east. Residential homes and farmland are located to the north. Houchins Road along with industrial and residential development form the western property boundary.

PHOTOS

Proposed Entrance Facing South on Houchins.

Proposed Entrance Facing North on Houchins.

Internal wooded areas of site.

Internal timber areas previously cut.

Drainage swale near northeast corner of property.

View of entrance to Walnut Creek Subdivision from northwest end of property.

Section 2: Walnut Ridge PUD-RES Narrative

Rezoning Narrative

Walnut Ridge consists of a mixed residential development that includes single-family detached homes, two-family dwellings (duplexes), and single family attached (townhomes), as well as roads, sidewalks, trails, recreation areas, and open space to serve the residents of the development.

The requested PUD-RES rezoning will provide the flexibility needed to create a development that contains several different housing types, which will help Montgomery County achieve its long-term goals related to land development and housing. This PUD-RES rezoning includes a concept plan that depicts the location, quantity, and layout of the various elements to be included in Walnut Ridge.

Voluntary proffers are also included in this rezoning request to mitigate any impacts that are directly related to the development. The proffers are included as an exhibit.

The flexibility provided for in the PUD-RES zoning district allows this type of mixed residential development to occur, which results in a higher-quality neighborhood than could be typically built using traditional zoning districts.

Utilities

Public water and sewer are available to serve the property and there are capacity and connections available to serve the development. Each residential lot will be connected to the public water and sewer system. The water and sewer systems will be designed and built to Montgomery County PSA standards. The property owner will be responsible for all costs associated with the design and construction of the water and sewer infrastructure.

The Montgomery County Public Service Authority has verified that the existing water and sewer system has the capacity and connections for the development. A copy of the PSA letter has been included as an exhibit.

Section 4: The Preserve at Walnut Springs Concept Plan Details

Concept Plan
Two concept plans have been provided for the Walnut Ridge PUD-RES illustrating the alternative development of the R3 Compact base zoning district area. Once approved by the Montgomery County Board of Supervisors, Walnut Ridge will be developed in general conformance with the Concept Plan and this narrative.

Land Uses and Land Development Standards
Walnut Ridge will include a variety of housing types and two base zoning districts, as follows:

Lot Type/ Use	Base Zoning District
Duplex/ Single-family Lots	R-3 Compact
Townhome Lots	RM-1

Specific modifications to the base zoning districts are included in this narrative.

Trash Collection
Each single-family home, duplex dwelling, and townhome will have trash cans for weekly roadside collection.

Parking
Overall, there will be a minimum of 2 parking spaces per duplex, single-family home, and townhome in Walnut Ridge.

Open Space
Open space for the project will include various sidewalk/trail options, landscaped areas, stormwater management facilities, active open space, active recreation space, and other undeveloped property. Outdoor open space that connects people with nature and natural systems is important for mental and physical health reasons, especially for children. Many studies have shown how interacting with the natural environment positively impacts depression, anxiety, ADHD, low self-esteem, and other physical illnesses and mental health disorders in children and adults.

The entrance into the property will include landscaped areas with an attractive monument sign. This beautified entrance will help not only provide a sense of place for the development, but also enhance the experience of driving down Houchins Road.

The areas designated as Duplex/Single-Family Homes depicted on the Concept Plan shall be based on the R-3 Compact District, with the following modifications:

Sec. 10-26. - R-3 Residential District: Compact

(1) *Purpose.* The R-3 Residential District is intended to accommodate moderate density suburban residential uses to be served by public water and sewer facilities. The regulations for this district are designed to stabilize and protect the essential characteristics of the district, to promote and encourage, insofar as compatible with the intensity of land use, a suitable environment for family life, and to permit certain compatible commercial uses of a character unlikely to develop general concentration of traffic, crowds of customers and general outdoor advertising.

To these ends, retail activity is sharply limited and this district is protected against encroachment of general commercial or industrial uses. Although this district is basically residential in character, certain compatible public and semipublic uses are permitted in the district.

~~(2) *Qualifying lands.* Lands qualifying for inclusion in the R-3 zoning district shall be R-3 Residential on the date of adoption of this chapter and other lands within areas mapped as residential transition, village, village expansion, urban development area, or urban expansion in the comprehensive plan. The minimum area required to create a district shall be two (2) acres of total contiguous land.~~

~~(3) *Uses permitted by right.* All uses as identified in Sec. 10-35 – PUD-RES, subject to compliance with all approved plans and permits, development standards and performance standards contained in this chapter, and with all other applicable regulations:~~

(4) *Lot requirements.*

(a) *Minimum lot area* (also refer to "lot coverage"). Five thousand (5,000) square feet.

(b) *Lot access.* Lots shall be accessed from a private street internal to the development.

(c) *Maximum lot coverage.* Lot coverage shall not exceed thirty (30) percent of gross site area. Impervious surfaces shall not exceed fifty (50) percent of gross site area.

(d) *Minimum width.* Fifty (50) feet at the setback line of front yard.

(e) *Maximum length/width ratio.* Five to one (5:1) for any lot less than two (2) acres.

(5) *Building requirements.*

(a) *Minimum yards.*

1. *Front.* Ten (10) feet.
2. *Side.* Five (5) feet for each principal structure. **For two family structures, the common or party line setback is Zero (0) feet, as the two structures are attached along one wall.**
3. *Rear.* Twenty-five (25) feet.
4. *Accessory buildings.* Ten (10) feet to any side or rear lot line.
5. ***Yard lighting.*** **Each single-family home lot shall have a low level, eight (8) feet maximum height front yard for security purposes. There shall be no street lighting.**

(b) *Maximum building height.* Up to thirty-five (35) feet in height from grade, except that:

1. The height limit for dwellings may be increased up to ten (10) feet, provided that there are two (2) side yards for each permitted use, each of which is fifteen (15) feet or more, plus one (1) foot or more of side yard for each additional foot of building height over thirty-five (35) feet.
2. ~~A public or semipublic building such as a school, church, library or hospital may be erected to a height of sixty (60) feet from grade, provided that required front, side and rear yards shall be increased one (1) foot for each foot in height over thirty-five (35) feet.~~
3. No accessory building which is within ten (10) feet of any party lot line shall be more than one (1) story high. All accessory buildings shall be less than the main building in height.

(6) *Use limitations.*

(a) *Public water and wastewater service.* Public water and wastewater services are required for all development in any R-3 district established after the date of adoption of this chapter.

~~(b) *Keeping and raising horses and ponies.* ***Shall not be permitted in the R-3 Compact District.***~~

~~1. Horses and ponies may only be kept for personal enjoyment and not for commercial purposes;~~

~~2. A minimum of five (5) acres of open or forestal land is available for the horses and ponies; and~~

~~3. No more than two (2) horses and ponies collectively (being one (1) horse and one (1) pony, two (2) horses, or two (2) ponies) shall be permitted per each five (5) acres with a maximum of four (4) horses and ponies collectively for parcels of land of ten (10) acres or more.~~

~~(7) *Compact development option.* The purpose of the compact development option is to provide flexibility in site design in order to encourage:~~

~~• Natural resource preservation.~~

- Pedestrian-friendly streetscapes.
- Cost-efficiency in providing infrastructure.
- Appropriate design solutions for unique site conditions.
- Transit-supportive design.

(8) *Streets.*

1. Public streets. New streets as part of the compact development option shall be public and designed and constructed in accordance with the minimum standards of the Virginia Department of Transportation, except that the surface pavement layer shall be asphalt concrete.
2. Private streets. The board of supervisors may permit construction of private streets so long as such streets are not likely to inhibit future development of adjacent land consistent with the standards set forth in Section 8-152.
3. Street patterns shall form a broadly rectilinear network, with variations as needed for topographic, environmental and other design considerations, in accordance with the minimum standards required by VDOT.
4. Streets shall be designed to:
    a. Parallel and preserve existing fence lines, tree lines, hedgerows, stone walls and watercourses; and
    b. Minimize alteration of natural, cultural or historic site features; and
    c. Promote pedestrian movement.
5. All streets shall be designed to promote pedestrian circulation. Pedestrian circulation shall be designed with respect to topography, integration with surrounding streets, connection to existing or future pedestrian ways and transit stops, interior circulation and the separation of pedestrians from vehicles. Sidewalks, informal walkways and footpaths shall be no less than five (5) feet wide. Paths in open space shall be constructed using mulch or stone. The compact development option shall create a completely linked neighborhood of walkways connecting all uses with parks and other open space areas.

(9) *Maximum density.* The density of development under the compact development option shall be no greater than five (5) dwelling units per gross acre.

The areas designated as ~~Duplexes~~, Townhomes, ~~and Multifamily (apartments)~~ on the Concept Plan shall be based on the RM-1 District, with the following modifications:

Sec. 10-27. - RM-1 Multiple-Family Residential District.

(1) *Purpose.* The regulations set forth in this section, or set forth elsewhere in this chapter when referred to in this section, are the regulations in the Multiple-Family Residential, RM-1 district. This district provides for multiple-family residences and is for the purpose of accommodating the construction of townhouse developments ~~and garden-type apartments~~ in appropriate locations in order to provide convenient and compact residential neighborhoods, efficient provision of public facilities and services, and a range of housing prices, including moderate[ly] priced housing.

~~(2) *Qualifying lands.* Lands qualifying for inclusion in the RM-1 zoning district shall be RM-1 Residential on the date of adoption of this chapter and other lands within areas mapped as urban expansion, village, village expansion, or urban development area in the comprehensive plan. The minimum area required to create a district is one (1) acre of total contiguous land.~~

~~(3) *Uses permitted by right.* All uses as identified in Sec. 10-35 – PUD-RES, subject to compliance with all approved plans and permits, development standards and performance standards contained in this chapter, and with all other applicable regulations:~~

(4) *Lot requirements.*

(a) *Minimum lot area.*

~~1. *For homes:* Five thousand (5,000) square feet minimum lot area. Fifty (50) feet minimum lot width.~~

2. *For single-family attached (townhouse) units:* Two thousand (2,000) square feet minimum lot area. Sixteen (16) feet minimum lot width.

~~3. *For all other uses:* Six thousand (6,000) square feet minimum lot area.~~

(b) *Lot access.* Lots shall be accessed from a road in the Virginia Department of Transportation (VDOT) system or from a hard-surfaced road designed by a professional engineer to accommodate projected volumes, loads and vehicle types and approved by the zoning administrator.

(c) *Maximum lot coverage.*

1. Forty (40) percent of gross site area.
2. Gross development density of single-family attached units shall not exceed twelve (12) dwellings per acre;

~~3. Gross development density of multifamily units shall not exceed twelve (12) dwellings per acre;~~

4. Impervious surfaces shall not exceed eighty (80) percent of the gross site area.

(d) *Minimum width.* ~~Sixty-four (64) feet at the setback line of the front yard for multifamily structures;~~ sixteen (16) feet for townhouse units**.**

(5) *Building requirements.*

(a) *Minimum yards.*

1. *Front.* Twenty (20) feet.
2. *Side.* Twenty (20) feet.
   a. Between townhouse groups: Ten (10) feet.
   b. Between end townhouse unit and lot line: Twenty (20) feet.
   c. ~~Between multifamily structures: Fifteen (15) feet.~~
   d. ~~Between multifamily structures and the lot line: Twenty-five (25) feet~~.

   All required side yard dimensions in between townhouse groups ~~and between multifamily structures~~ set forth above are the minimum dimensions that must be clear of other structures such as air handling units and storage units, so as to allow passage of emergency vehicles.
3. *Rear.* Twenty-five (25) feet.
4. *Accessory buildings.* Ten (10) feet to any side or rear lot line.

(b) *Maximum building height.* Thirty-five (35) feet in height from grade, except that:

1. The height limit for dwellings may be increased up to ten (10) feet, provided that there are two (2) side yards for each permitted use, each of which is fifteen (15) feet or more, plus one (1) foot or more of side yard for each additional foot of building height over thirty-five (35) feet.
2. ~~A public or semipublic building such as a school, church, library or hospital may be erected to a height of sixty (60) feet from grade, provided that required front, side and rear yards shall be increased one (1) foot for each foot in height over thirty-five (35) feet.~~
3. No accessory building which is within ten (10) feet of any party lot line shall be more than one (1) story high. All accessory buildings shall be less than the main building in height.

(c) *Groups of single-family attached dwellings (townhouses).* No more than eight (8) and not less than three (3) single-family attached dwellings (townhouses) shall be included in one (1) connected group.

(6) *Use limitations.*

(a) *Public water and wastewater service.* Public water and wastewater services are required for all development in the RM-1 district.

APPENDICES

APPENDIX A: VOLUNTARY PROFFERS

Walnut Ridge PUD-RES
PROFFER STATEMENT

November 1, 2023

Proffer Statement for the Rezoning Application for Tax Parcels 080-A 44 and 080-A-46 (the "Property") from Industrial Manufacturing (M-1)/Conservation (C-1) to Planned Unit Development - Residential (PUD-RES).

Pursuant to Section 10-54(1) of the Montgomery County Zoning Ordinance, the Owner hereby voluntarily proffers that the Property which is the subject of this Rezoning Application will be developed in accordance with the following conditions, if and only if, approval is granted, and the property is rezoned as requested. This Proffer Statement shall replace in its entirety any Proffer Statement previously approved for the Property. The Applicant, the Owners, their Successors and Assigns, voluntary proffer the following conditions for the Property as follows:

1. Conceptual Layout
   The Property shall be developed in general conformance with the Concept Plan prepared by Foresight Design Services, dated November 1, 2023 (the "Concept Plan").
2. Utilities
   The Property shall be served by Town of Christiansburg Public Water and Montgomery County Public Service Authority sanitary sewer.
3. Property Management
   A property management company and/or homeowner's association shall maintain all community owned grounds, including but not limited to landscaped areas, recreational areas, parking and paved areas, sidewalks, and stormwater management areas.
4. Bus Shelter
   Bus shelter shall be a minimum of 5' X 10' in size, constructed of durable, architecturally sound materials that will withstand continual exposure to the elements along Houchins Road. Specific locations, style, and size to be determined in conjunction with the final site plan and coordinated with Montgomery County Public School staff. Coordination with VDOT will be required to provide suitable bus access to the shelter.
5. Exterior Lighting
   Each single-family detached home lot and each dwelling unit of a two family dwelling shall have a low level, eight (8) feet maximum height front yard light for security purposes. There shall be no street lighting in front of single family and two family homes. End units of townhouse groupings shall have a low level, eight (8) feet maximum height yard light. There shall be no street lighting in front of townhouses. Apartment parking area lighting shall be designed at or below an average 2.0 foot candle horizontal illuminance level with a uniformity ratio that will not exceed 15:1.

-Signature Page to Follow-

I (we) hereby proffer that the development of the subject property of this application shall be in strict accordance with the conditions set forth in this submission.

SHAH Development, LLC

By:_____
Name: David Hagan
its:_____

Commonwealth of Virginia
County of Montgomery

The foregoing instrument was acknowledged before me this _____ day of _____

_____
Notary Public (Seal)

My commission expires _____

APPENDIX B: EXISTING CONDITIONS

GENERAL NOTES:

1. OWNER/DEVELOPER: SHAH DEVELOPMENT LLC
   P.O. BOX 1499
   CHRISTIANSBURG, VA. 24068
   PROJECT LOCATION: UNADDRESSED PARCEL
   CHRISTIANSBURG, VA. 24068

2. TAX PARCEL NUMBER: 80–(A)–46 ; 500–(A)–13A
   * ALL WORK PROPOSED IN THESE PLANS IS TO BE DONE WITHIN THE ABOVE LISTED TAX PARCEL, EASEMENTS OBTAINED, OR PUBLIC RIGHTS–OF–WAY.

3. ZONING DISTRICT: EXISTING C–1 / M–1
   PROPOSED PUD–RES
   BASE ZONING DISTRICTS:
   RM–1 – 2.48 ACRES
   R–3 COMPACT – 24.11 ACRES

4. SETBACKS:
   EXISTING RM–1 BASE DISTRICT:
   FRONT= 25'
   REAR= 30'
   SIDE= 25' (15' BETWEEN TOWNHOUSE GROUPS)
   PROPOSED PUD–RES (RM–1 BASE DISTRICT):
   FRONT= 20'
   REAR= 25'
   SIDE= 20' (10' BETWEEN TOWNHOUSE GROUPS)

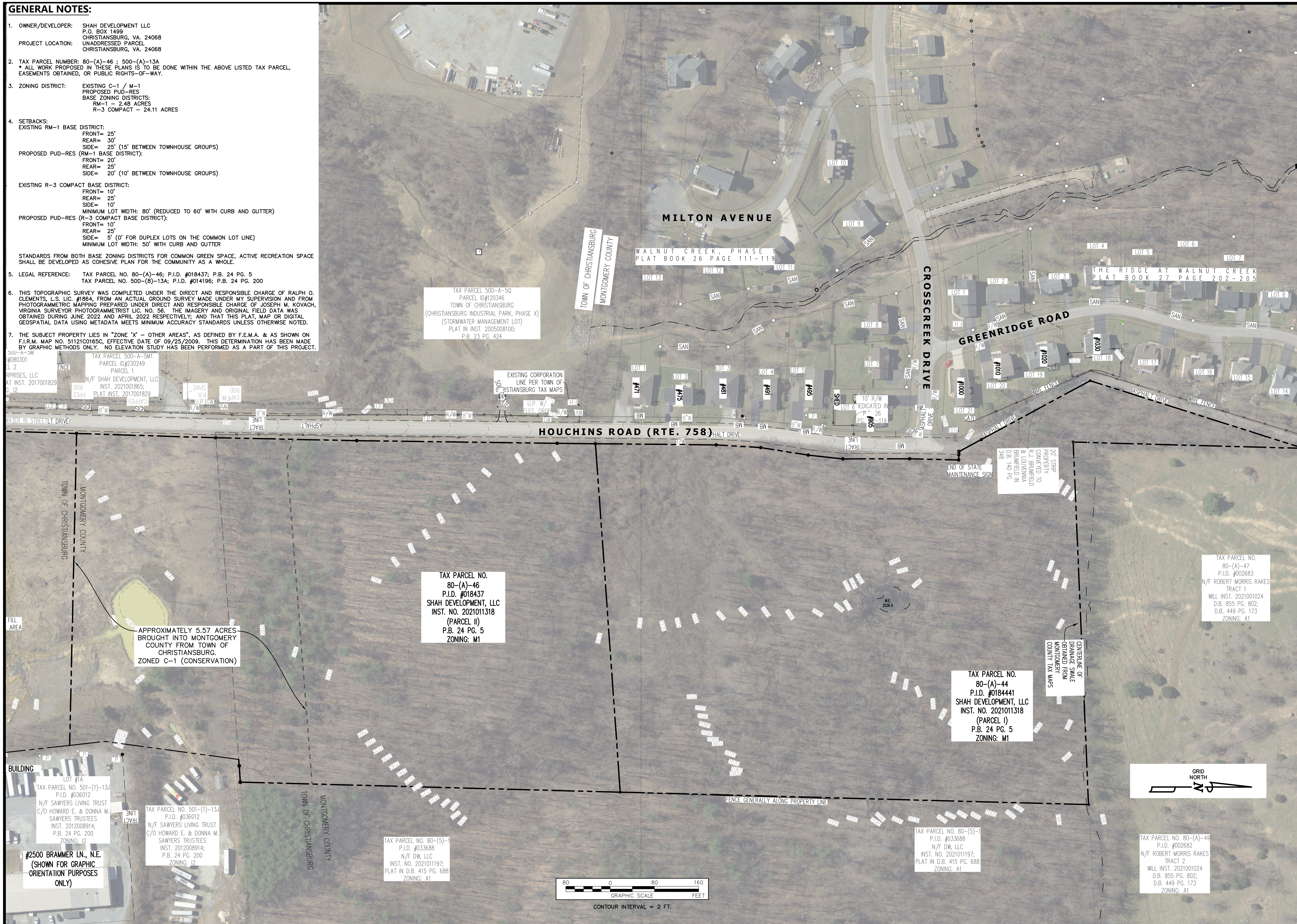
   EXISTING R–3 COMPACT BASE DISTRICT:
   FRONT= 10'
   REAR= 25'
   SIDE= 10'
   MINIMUM LOT WIDTH: 80' (REDUCED TO 60' WITH CURB AND GUTTER)
   PROPOSED PUD–RES (R–3 COMPACT BASE DISTRICT):
   FRONT= 10'
   REAR= 25'
   SIDE= 5' (0' FOR DUPLEX LOTS ON THE COMMON LOT LINE)
   MINIMUM LOT WIDTH: 50' WITH CURB AND GUTTER

   STANDARDS FROM BOTH BASE ZONING DISTRICTS FOR COMMON GREEN SPACE, ACTIVE RECREATION SPACE SHALL BE DEVELOPED AS COHESIVE PLAN FOR THE COMMUNITY AS A WHOLE.

5. LEGAL REFERENCE: TAX PARCEL NO. 80–(A)–46; P.I.D. #018437; P.B. 24 PG. 5
   TAX PARCEL NO. 500–(8)–13A; P.I.D. #014196; P.B. 24 PG. 200

6. THIS TOPOGRAPHIC SURVEY WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF RALPH O. CLEMENTS, L.S. LIC. #1864, FROM AN ACTUAL GROUND SURVEY MADE UNDER MY SUPERVISION AND FROM PHOTOGRAMMETRIC MAPPING PREPARED UNDER DIRECT AND RESPONSIBLE CHARGE OF JOSEPH M. KOVACH, VIRGINIA SURVEYOR PHOTOGRAMMETRIST LIC. NO. 56. THE IMAGERY AND ORIGINAL FIELD DATA WAS OBTAINED DURING JUNE 2022 AND APRIL 2022 RESPECTIVELY; AND THAT THIS PLAT, MAP OR DIGITAL GEOSPATIAL DATA USING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED.

7. THE SUBJECT PROPERTY LIES IN "ZONE 'X' – OTHER AREAS", AS DEFINED BY F.E.M.A. & AS SHOWN ON F.I.R.M. MAP NO. 51121C0165C, EFFECTIVE DATE OF 09/25/2009. THIS DETERMINATION HAS BEEN MADE BY GRAPHIC METHODS ONLY. NO ELEVATION STUDY HAS BEEN PERFORMED AS A PART OF THIS PROJECT.



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WALNUT RIDGE

MONTGOMERY COUNTY, VIRGINIA

REVISIONS

NO.	COMMENTS	DATE

PROJECT TEAM

PIC	JOHN T. NEEL, PE
PM	JOHN T. NEEL, PE
DESIGN	SEC

ISSUE DATE
11/01/2023

FDS JOB NO.
3246

SHEET TITLE
EXISTING CONDITIONS

SHEET NUMBER
1 OF 1

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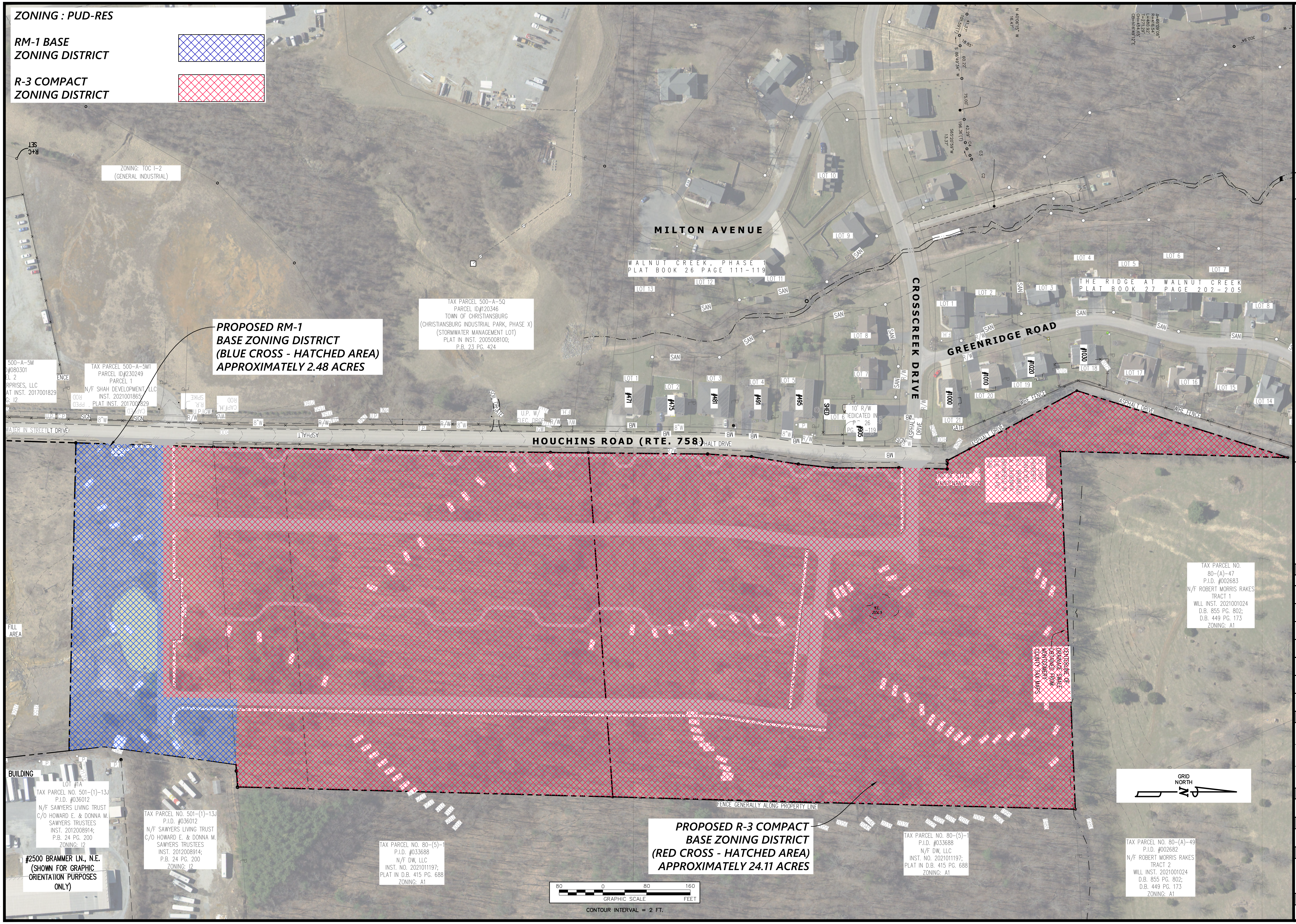
Existing Conditions, 11/01/2023 3:30:45 PM, Scaldwell, AutoCAD PDF (General Documentation).pc3, 1:1

APPENDIX C: CONCEPT PLANS


ZONING : PUD-RES
RM-1 BASE ZONING DISTRICT
R-3 COMPACT ZONING DISTRICT
ZONING: TOC I-2 (GENERAL INDUSTRIAL)
MILTON AVENUE
WALNUT CREEK, PHASE 1 PLAT BOOK 26 PAGE 111-119
THE RIDGE AT WALNUT CREEK PLAT BOOK 27 PAGE 202-205
CROSSCREEK DRIVE
GREENRIDGE ROAD
TAX PARCEL 500-A-5Q
PARCEL ID#120346
TOWN OF CHRISTIANSBURG
(CHRISTIANSBURG INDUSTRIAL PARK, PHASE X)
(STORMWATER MANAGEMENT LOT)
PLAT IN INST. 2005008100;
P.B. 23 PG. 424
PROPOSED RM-1 BASE ZONING DISTRICT (BLUE CROSS - HATCHED AREA) APPROXIMATELY 2.48 ACRES
TAX PARCEL 500-A-5M1
PARCEL ID#230249
PARCEL 1
N/F SHAH DEVELOPMENT, LLC
INST. 2021001865
PLAT INST. 2017001829
HOUCHINS ROAD (RTE. 758)
TAX PARCEL NO. 80-(A)-47
P.I.D. #002683
N/F ROBERT MORRIS RAKES
TRACT 1
WILL INST. 2021001024
D.B. 855 PG. 802;
D.B. 449 PG. 173
ZONING: A1
GRID NORTH
FENCE GENERALLY ALONG PROPERTY LINE
LOT #1A
TAX PARCEL NO. 501-(1)-13J
P.I.D. #036012
N/F SAWYERS LIVING TRUST
C/O HOWARD E. & DONNA M. SAWYERS TRUSTEES
INST. 2012008914;
P.B. 24 PG. 200
ZONING: I2
#2500 BRAMMER LN., N.E. (SHOWN FOR GRAPHIC ORIENTATION PURPOSES ONLY)
TAX PARCEL NO. 80-(5)-1
P.I.D. #033688
N/F DW, LLC
INST. NO. 2021011197;
PLAT IN D.B. 415 PG. 688
ZONING: A1
PROPOSED R-3 COMPACT BASE ZONING DISTRICT (RED CROSS - HATCHED AREA) APPROXIMATELY 24.11 ACRES
TAX PARCEL NO. 80-(A)-49
P.I.D. #002682
N/F ROBERT MORRIS RAKES
TRACT 2
WILL INST. 2021001024
D.B. 855 PG. 802;
D.B. 449 PG. 173
ZONING: A1
GRAPHIC SCALE
CONTOUR INTERVAL = 2 FT.

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WALNUT RIDGE

MONTGOMERY COUNTY, VIRGINIA

REVISIONS

NO.	COMMENTS	DATE

PROJECT TEAM

PIC	JOHN T. NEEL, PE
PM	JOHN T. NEEL, PE
DESIGN	SEC

ISSUE DATE
11/01/2023

FDS JOB NO.
3246

SHEET TITLE
PROPOSED ZONING MAP

SHEET NUMBER
1 OF 1

GENERAL NOTES:

1. OWNER/DEVELOPER: SHAH DEVELOPMENT LLC
   P.O. BOX 1499
   CHRISTIANSBURG, VA. 24068
   PROJECT LOCATION: UNADDRESSED PARCEL
   CHRISTIANSBURG, VA. 24068

2. TAX PARCEL NUMBER: 80–(A)–46 ; 500–(A)–13A
   * ALL WORK PROPOSED IN THESE PLANS IS TO BE DONE WITHIN THE ABOVE LISTED TAX PARCEL, EASEMENTS OBTAINED, OR PUBLIC RIGHTS–OF–WAY.

3. ZONING DISTRICT: EXISTING C–1 / M–1
   PROPOSED PUD–RES
   BASE ZONING DISTRICTS:
   RM–1 – 2.48 ACRES
   R–3 COMPACT – 24.11 ACRES

4. SETBACKS:
   EXISTING RM–1 BASE DISTRICT:
   FRONT= 25'
   REAR= 30'
   SIDE= 25' (15' BETWEEN TOWNHOUSE GROUPS)
   PROPOSED PUD–RES (RM–1 BASE DISTRICT):
   FRONT= 20'
   REAR= 25'
   SIDE= 20' (10' BETWEEN TOWNHOUSE GROUPS)

   EXISTING R–3 COMPACT BASE DISTRICT:
   FRONT= 10'
   REAR= 25'
   SIDE= 10'
   MINIMUM LOT WIDTH: 80' (REDUCED TO 60' WITH CURB AND GUTTER)
   PROPOSED PUD–RES (R–3 COMPACT BASE DISTRICT):
   FRONT= 10'
   REAR= 25'
   SIDE= 5' (0' FOR DUPLEX LOTS ON THE COMMON LOT LINE)
   MINIMUM LOT WIDTH: 50' WITH CURB AND GUTTER

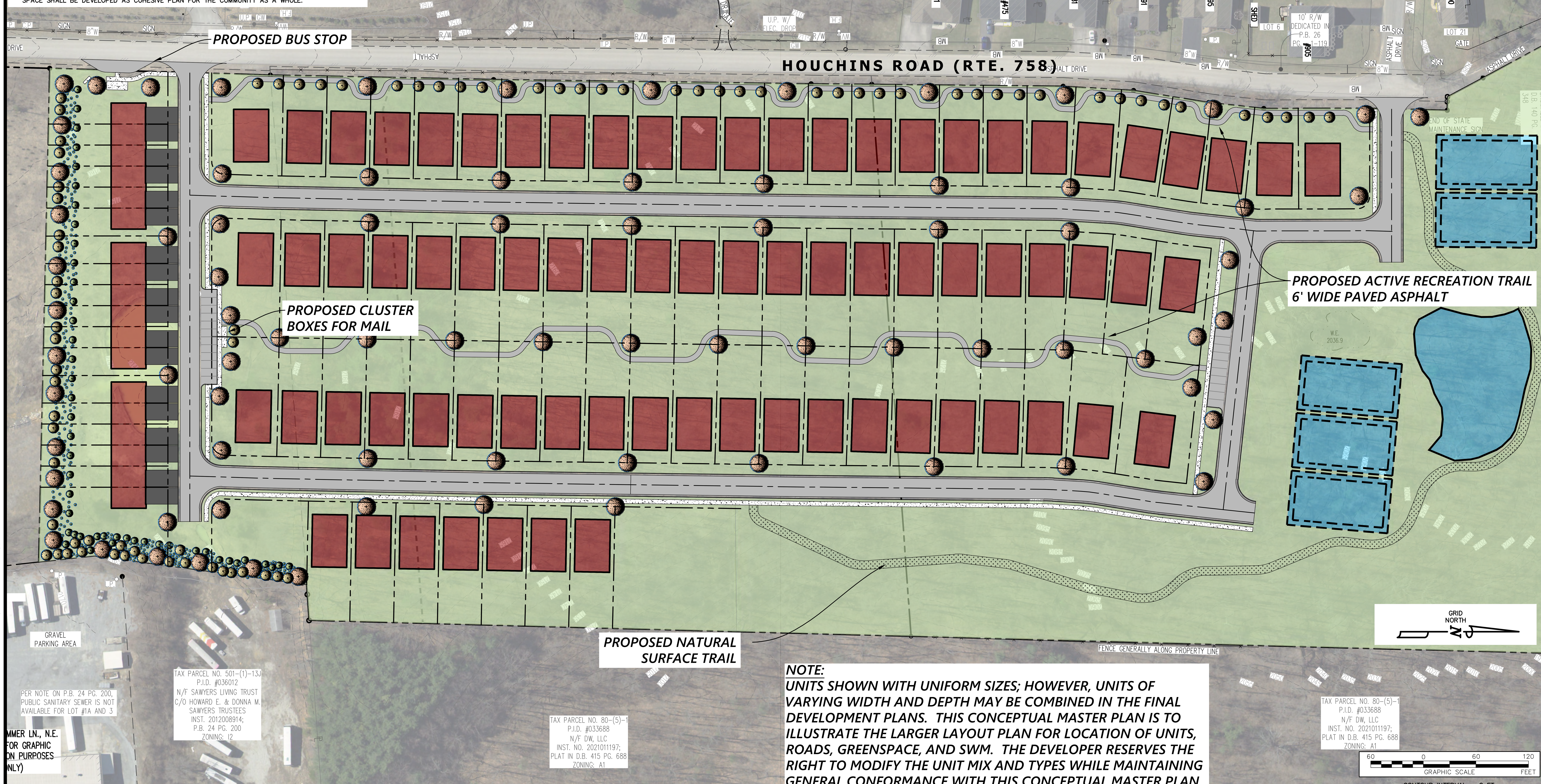
   STANDARDS FROM BOTH BASE ZONING DISTRICTS FOR COMMON GREEN SPACE, ACTIVE RECREATION SPACE SHALL BE DEVELOPED AS COHESIVE PLAN FOR THE COMMUNITY AS A WHOLE.

5. LEGAL REFERENCE: TAX PARCEL NO. 80–(A)–46; P.I.D. #018437; P.B. 24 PG. 5
   TAX PARCEL NO. 500–(8)–13A; P.I.D. #014196; P.B. 24 PG. 200

6. ZONING/PLANNING AREAS
   TOTAL PROJECT/PARCEL AREA: 26.643 ACRES
   TOTAL DISTURBED AREA: 22.90 ACRES
   MINIMUM LOT AREA ALLOWED: 5,000 SF (R–3 COMPACT) : 2,000 SF (RM–1)
   MINIMUM LOT WIDTH ALLOWED: 50 FEET (R–3) COMPACT : 16 FEET (RM–1)
   MAXIMUM IMPERVIOUS AREA: 60% (15.99 ACRES)
   COMMON GREENSPACE REQUIRED: 4.00 ACRES (15% OF GROSS ACREAGE OF TRACT)
   PROPOSED USE: DWELLING, SINGLE–FAMILY DETACHED
   DWELLING, SINGLE–FAMILY ATTACHED (TOWNHOUSE)
   MAXIMUM ALLOWED UNITS: 5 SINGLE FAMILY DETACHED UNITS PER ACRE
   12 SINGLE FAMILY ATTACHED UNITS PER ACRE

   BUILDING HEIGHT: LESS THAN 35 FEET AT GRADE
   PARKING REQUIRED: 2.0 SPACES PER UNIT SINGLE FAMILY ATTACHED
   2.0 SPACES PER UNIT SINGLE FAMILY DETACHED

7. LOT ARRANGEMENTS ARE CONCEPTUAL IN NATURE AND SUBJECT TO MINOR CHANGES WHILE CONFORMING TO PUD–RES (RM–1) AND PUD–RES (R–3 COMPACT) STANDARDS.



NOTE:
UNITS SHOWN WITH UNIFORM SIZES; HOWEVER, UNITS OF VARYING WIDTH AND DEPTH MAY BE COMBINED IN THE FINAL DEVELOPMENT PLANS. THIS CONCEPTUAL MASTER PLAN IS TO ILLUSTRATE THE LARGER LAYOUT PLAN FOR LOCATION OF UNITS, ROADS, GREENSPACE, AND SWM. THE DEVELOPER RESERVES THE RIGHT TO MODIFY THE UNIT MIX AND TYPES WHILE MAINTAINING GENERAL CONFORMANCE WITH THIS CONCEPTUAL MASTER PLAN.

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WALNUT RIDGE
MONTGOMERY COUNTY, VIRGINIA

REVISIONS

NO.	COMMENTS	DATE

PROJECT TEAM
PIC: JOHN T. NEEL, PE
PM: JOHN T. NEEL, PE
DESIGN: SEC

ISSUE DATE: 11/01/2023
FDS JOB NO.: 3246
SHEET TITLE: CONCEPT PLAN
SHEET NUMBER: 1 OF 1

GENERAL NOTES:

1. OWNER/DEVELOPER: SHAH DEVELOPMENT LLC
   P.O. BOX 1499
   CHRISTIANSBURG, VA. 24068
   PROJECT LOCATION: UNADDRESSED PARCEL
   CHRISTIANSBURG, VA. 24068

2. TAX PARCEL NUMBER: 80-(A)-46 ; 500-(A)-13A
   * ALL WORK PROPOSED IN THESE PLANS IS TO BE DONE WITHIN THE ABOVE LISTED TAX PARCEL, EASEMENTS OBTAINED, OR PUBLIC RIGHTS-OF-WAY.

3. ZONING DISTRICT: EXISTING C-1 / M-1
   PROPOSED PUD-RES
   BASE ZONING DISTRICTS:
   RM-1 – 2.48 ACRES
   R-3 COMPACT – 24.11 ACRES

4. SETBACKS:
   EXISTING RM-1 BASE DISTRICT:
   FRONT= 25'
   REAR= 30'
   SIDE= 25' (15' BETWEEN TOWNHOUSE GROUPS)
   PROPOSED PUD-RES (RM-1 BASE DISTRICT):
   FRONT= 20'
   REAR= 25'
   SIDE= 20' (10' BETWEEN TOWNHOUSE GROUPS)

   EXISTING R-3 COMPACT BASE DISTRICT:
   FRONT= 10'
   REAR= 25'
   SIDE= 10'
   MINIMUM LOT WIDTH: 80' (REDUCED TO 60' WITH CURB AND GUTTER)
   PROPOSED PUD-RES (R-3 COMPACT BASE DISTRICT):
   FRONT= 10'
   REAR= 25'
   SIDE= 5' (0' FOR DUPLEX LOTS ON THE COMMON LOT LINE)
   MINIMUM LOT WIDTH: 50' WITH CURB AND GUTTER

   STANDARDS FROM BOTH BASE ZONING DISTRICTS FOR COMMON GREEN SPACE, ACTIVE RECREATION SPACE SHALL BE DEVELOPED AS COHESIVE PLAN FOR THE COMMUNITY AS A WHOLE.

5. LEGAL REFERENCE: TAX PARCEL NO. 80-(A)-46; P.I.D. #018437; P.B. 24 PG. 5
   TAX PARCEL NO. 500-(8)-13A; P.I.D. #014196; P.B. 24 PG. 200

6. ZONING/PLANNING AREAS

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TOTAL DISTURBED AREA:	22.90 ACRES
MINIMUM LOT AREA ALLOWED:	5,000 SF (R-3 COMPACT) : 2,000 SF (RM-1)
MINIMUM LOT WIDTH ALLOWED:	50 FEET (R-3) COMPACT : 16 FEET (RM-1)
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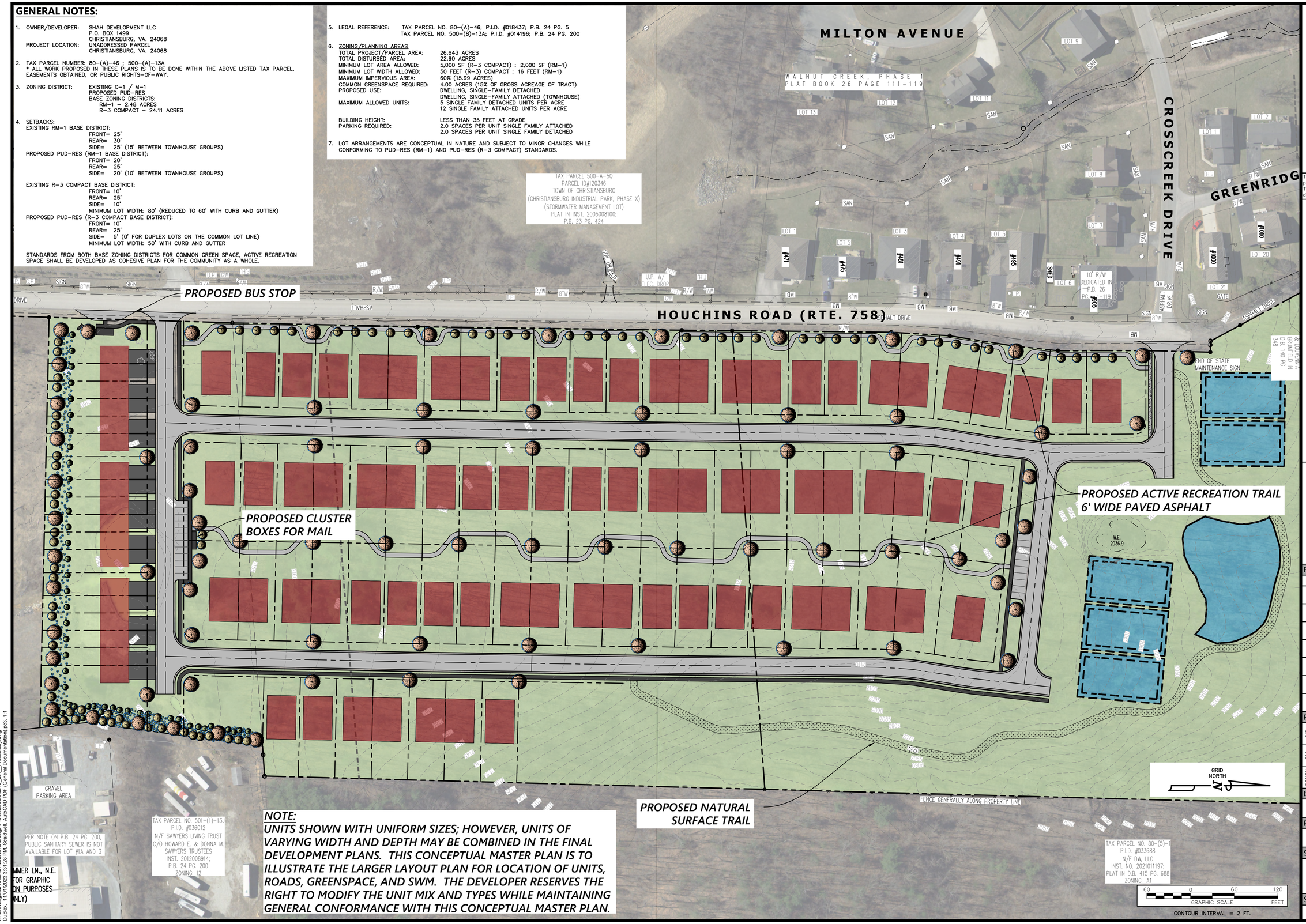
COMMON GREENSPACE REQUIRED:	4.00 ACRES (15% OF GROSS ACREAGE OF TRACT)
PROPOSED USE:	DWELLING, SINGLE-FAMILY DETACHED DWELLING, SINGLE-FAMILY ATTACHED (TOWNHOUSE)
MAXIMUM ALLOWED UNITS:	5 SINGLE FAMILY DETACHED UNITS PER ACRE 12 SINGLE FAMILY ATTACHED UNITS PER ACRE
BUILDING HEIGHT:	LESS THAN 35 FEET AT GRADE
PARKING REQUIRED:	2.0 SPACES PER UNIT SINGLE FAMILY ATTACHED 2.0 SPACES PER UNIT SINGLE FAMILY DETACHED

7. LOT ARRANGEMENTS ARE CONCEPTUAL IN NATURE AND SUBJECT TO MINOR CHANGES WHILE CONFORMING TO PUD-RES (RM-1) AND PUD-RES (R-3 COMPACT) STANDARDS.



NOTE:
UNITS SHOWN WITH UNIFORM SIZES; HOWEVER, UNITS OF VARYING WIDTH AND DEPTH MAY BE COMBINED IN THE FINAL DEVELOPMENT PLANS. THIS CONCEPTUAL MASTER PLAN IS TO ILLUSTRATE THE LARGER LAYOUT PLAN FOR LOCATION OF UNITS, ROADS, GREENSPACE, AND SWM. THE DEVELOPER RESERVES THE RIGHT TO MODIFY THE UNIT MIX AND TYPES WHILE MAINTAINING GENERAL CONFORMANCE WITH THIS CONCEPTUAL MASTER PLAN.

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MONTGOMERY COUNTY, VIRGINIA

REVISIONS

NO.	COMMENTS	DATE

PROJECT TEAM

PIC	JOHN T. NEEL, PE
PM	JOHN T. NEEL, PE
DESIGN	SEC

ISSUE DATE: 11/01/2023

FDS JOB NO.: 3246

SHEET TITLE: DUPLEX / SINGLE FAMILY OPTION

SHEET NUMBER: 1 OF 1

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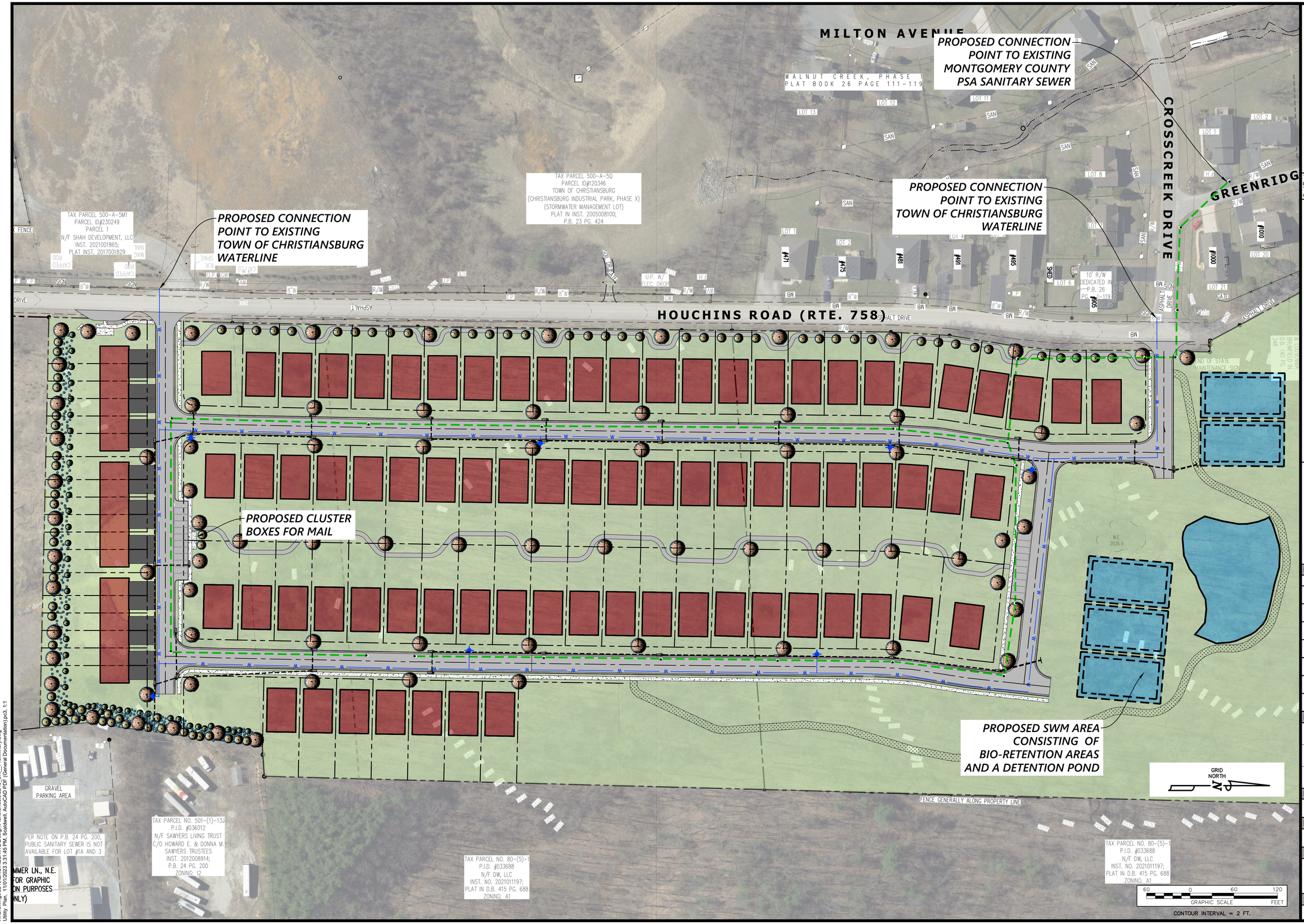
APPENDIX D: UTILITIES AND SWM PLAN



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REVISIONS

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PROJECT TEAM

PIC	JOHN T. NEEL, PE
PM	JOHN T. NEEL, PE
DESIGN	SEC

ISSUE DATE

11/01/2023

FDS JOB NO.

3246

SHEET TITLE

UTILITY AND SWM PLAN

SHEET NUMBER

1 OF 1

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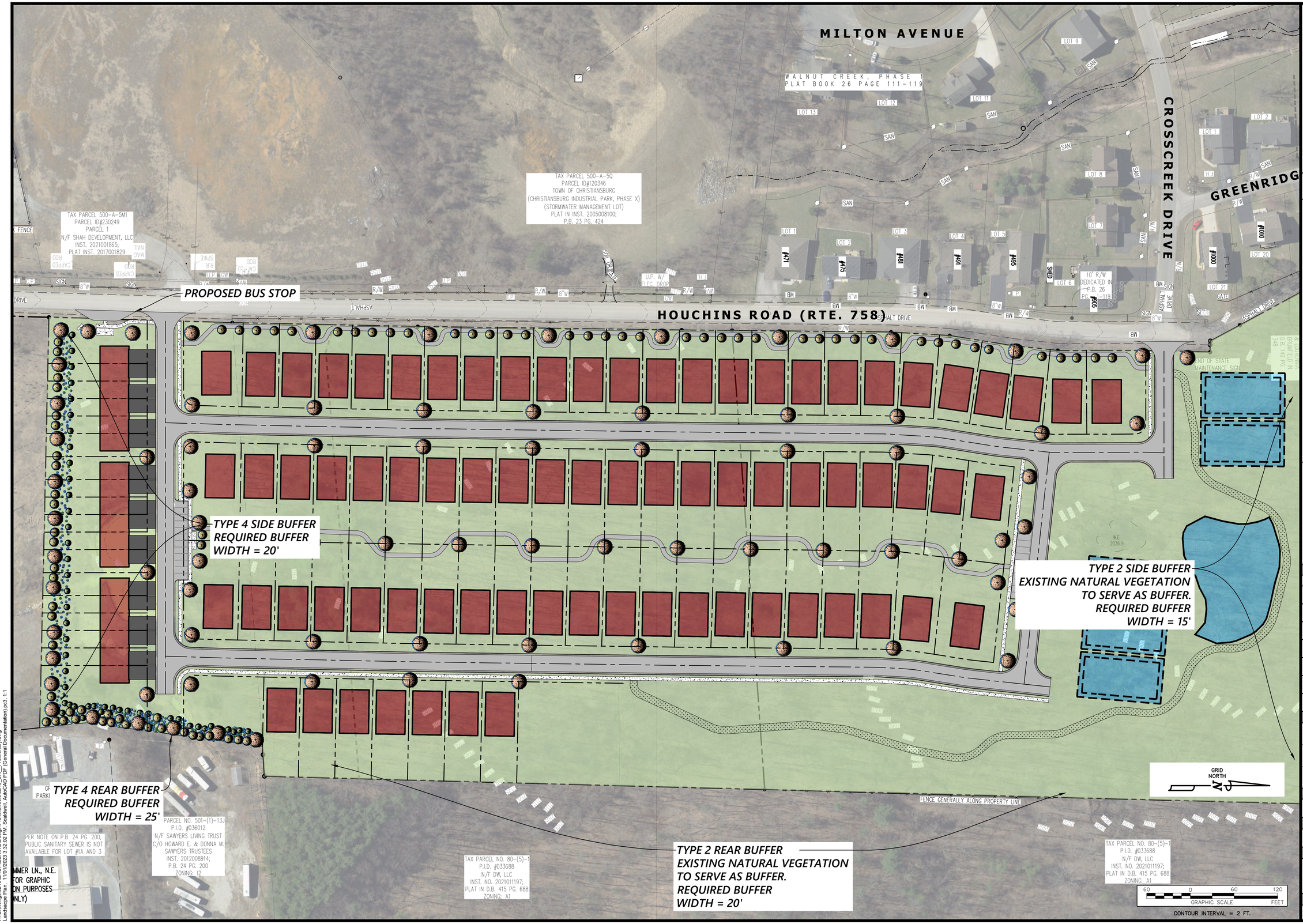
APPENDIX E: LANDSCAPE AND BUFFER PLAN



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PM	JOHN T. NEEL, PE
DESIGN	SEC

ISSUE DATE

11/01/2023

FDS JOB NO.

3246

SHEET TITLE

LANDSCAPING AND BUFFER PLAN

SHEET NUMBER

1 OF 1

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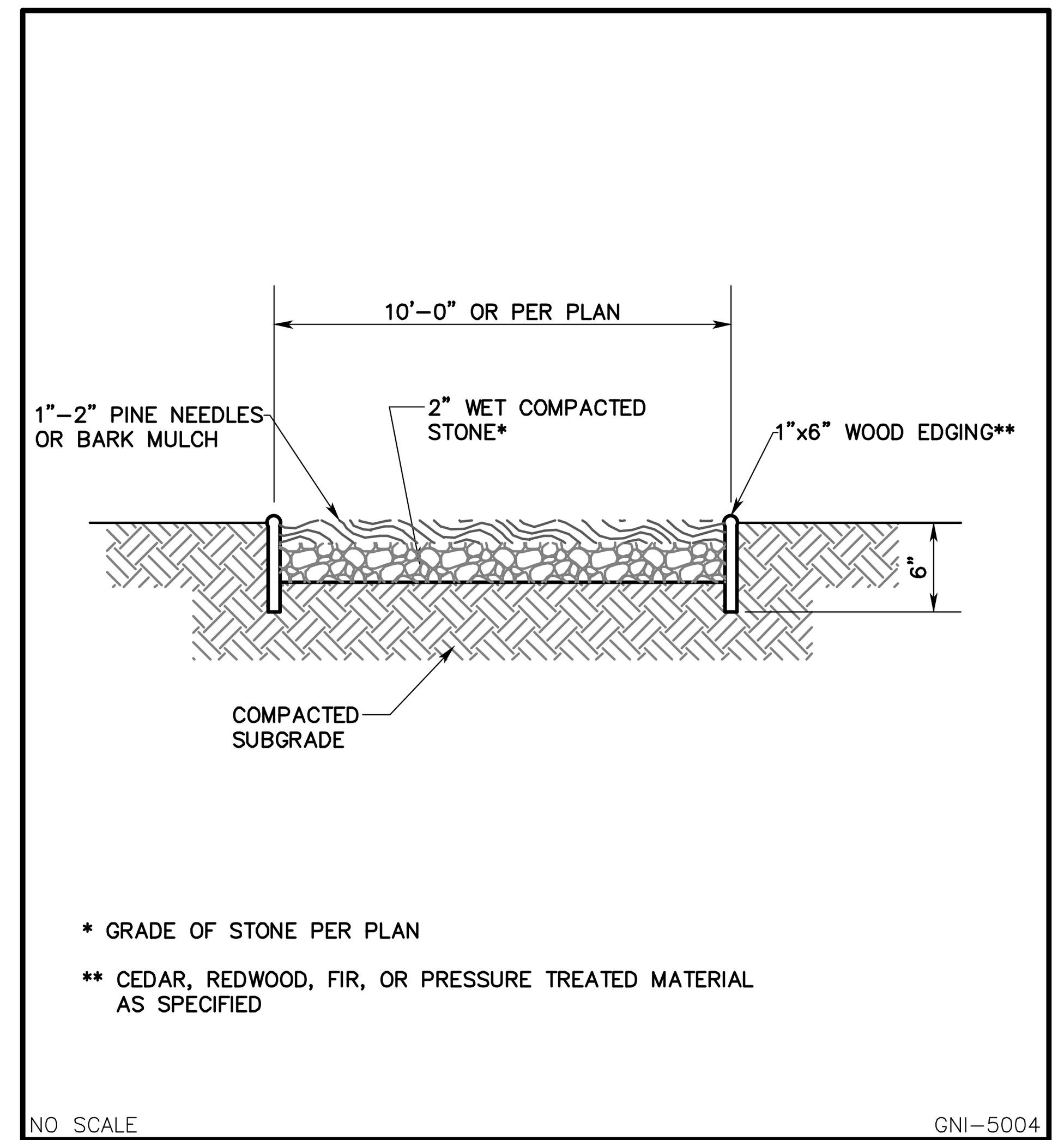
Landscape Plan, 11/01/2023 3:30:26 PM, Scattered, AutoCAD PDF (Content Documentation).pc3, 1:1

** SPECIFIC DESIGNED AMENITIES WITHIN THE RECREATIONAL AREA TO BE DETERMINED AT THE TIME OF SITE PLAN AND CONSTRUCTION AND SHALL MEET OR EXCEED RM-1 AND R-3 COMPACT ZONING REQUIREMENTS.

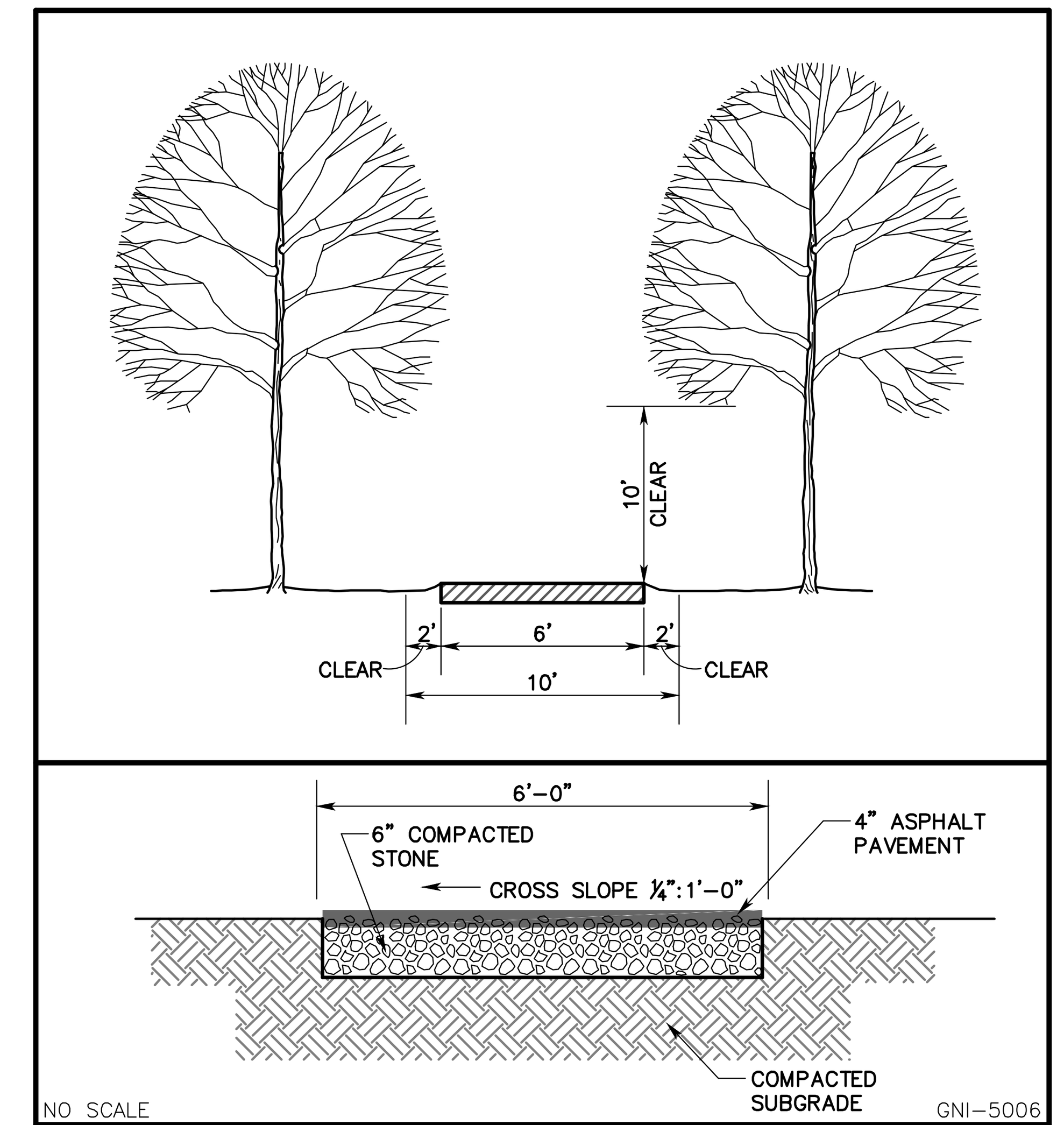
RM-1 BASE ZONING DISTRICT REQUIREMENTS:
MINIMUM GREEN SPACE.
FIFTEEN (15) PERCENT OF THE GROSS ACREAGE OF THE TRACT SHALL BE RESERVED AS COMMON GREEN SPACE, DEVELOPED AS ACTIVE RECREATION AND/OR PASSIVE PARK USE.
ALL SUCH GREEN SPACE LOTS SHALL HAVE A LENGTH/WIDTH RATIO OF NO LESS THAN FIVE TO ONE (5:1).
ACTIVE RECREATION SPACE SHALL BE SUITABLY GRADED AND EQUIPPED FOR ACTIVE RECREATIONAL FACILITIES TO SERVE THE RESIDENTS OF THE DEVELOPMENT. PASSIVE PARK SPACE SHALL BE DESIGNED TO PRESERVE IMPORTANT SITE AMENITIES AND ENVIRONMENTALLY SENSITIVE AREAS.
MULTIFAMILY AND SINGLE-FAMILY ATTACHED DEVELOPMENTS OF MORE THAN TWENTY (20) INDIVIDUAL UNITS SHALL CREATE AN ACTIVE RECREATION AREA OF NO LESS THAN TEN THOUSAND (10,000) SQUARE FEET IN AREA AND INCORPORATE A PLAYGROUND AND ITEMS SUCH AS TOT LOTS, SCHOOL BUS SHELTERS AND OTHER COMMUNITY FACILITIES DEEMED APPROPRIATE BY THE ZONING ADMINISTRATOR AT TIME OF SITE PLAN REVIEW.

R-3 COMPACT BASE ZONING DISTRICT:
MINIMUM REQUIRED OPEN SPACE. A MINIMUM OF TWENTY-FIVE (25) PERCENT OF THE GROSS AREA PARENT TRACT SHALL BE SET ASIDE AS OPEN SPACE. AT LEAST ONE (1) AREA OF SUCH REQUIRED OPEN SPACE IN ANY COMPACT DEVELOPMENT SHALL BE FIVE THOUSAND (5,000) SQUARE FEET. OPEN SPACE MAY INCLUDE ACTIVE OR PASSIVE RECREATIONAL USES, AND MAY BE HELD IN EITHER PUBLIC OR PRIVATE OWNERSHIP. IF HELD IN PRIVATE OWNERSHIP THE OPEN SPACE SHALL BE HELD BY A HOMEOWNER'S ASSOCIATION OR OTHER FORM OF COMMON INTEREST PRIVATE OWNERSHIP COMPARABLE TO A HOMEOWNER'S ASSOCIATION ACCEPTABLE TO THE ZONING ADMINISTRATOR. OPEN SPACE ESTABLISHED FOR PURPOSES OF MEETING THE REQUIREMENTS OF THIS PROVISION SHALL BE RESTRICTED FROM ANY FUTURE DEVELOPMENT BY THE ESTABLISHMENT OF PERMANENT CONSERVATION EASEMENTS HELD IN PERPETUITY BY A PUBLIC OR PRIVATE ENTITY ACCEPTABLE TO THE COUNTY. ACCESSORY STRUCTURES SUCH AS PICNIC SHELTERS, BALL FIELDS, NATURE TRAILS AND OTHER SIMILAR RECREATIONAL AMENITIES SHALL BE PERMITTED WITHIN THE OPEN SPACE AND MAINTAINED BY THE APPROPRIATE OWNER.

FOR THE PURPOSES OF THIS ARTICLE, THE FOLLOWING ITEMS SHALL QUALIFY AS OPEN SPACE: NATURAL AREAS INCLUDING ENVIRONMENTAL CORRIDORS, GREENWAYS, PROTECTED NATURAL AREAS AND RESERVES; PARKS, SQUARES, GREENS AND PLAZAS; STREAMS, PONDS, AND OTHER WATER BODIES; STORMWATER DETENTION/RETENTION FACILITIES; ACCESSORY PARKING AREAS OR LOTS LOCATED WITHIN PUBLIC PARKS OR PUBLICLY ACCESSIBLE NATURAL AREAS; RECREATIONAL FACILITIES, SUCH AS BALLFIELDS, PLAYGROUNDS.

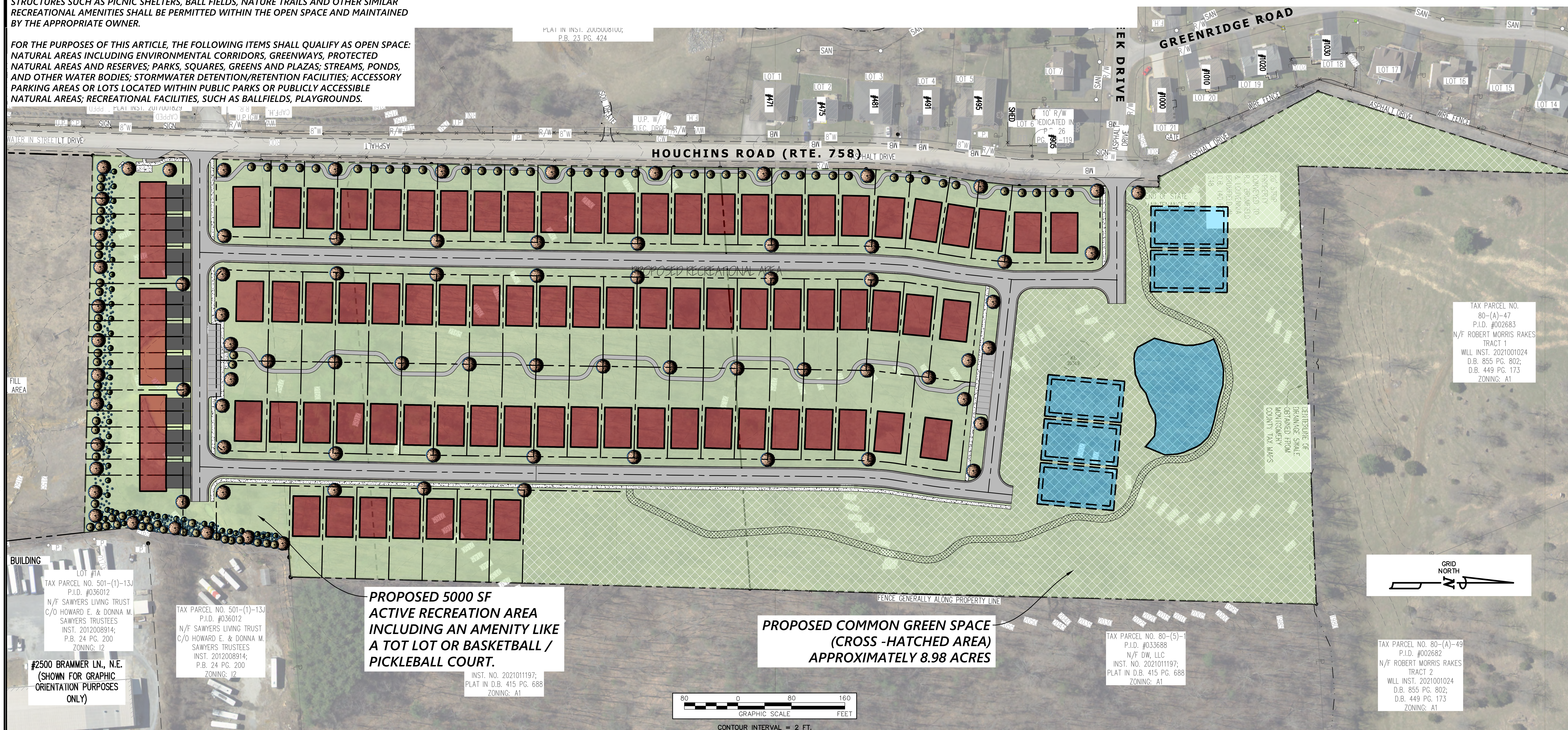


MULCHED PEDESTRIAN PATH



BIKE AND PEDESTRIAN TRAIL

PROPOSED PUD-RES
COMMON SPACE : 8.97 ACRES
COMMON GREEN SPACE EASEMENT: 16,575 SF
ACTIVE RECREATION: 21,575 SF (INCLUDES BUS SHELTER, TRAILS, & RECREATION AMENITY AREA)



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WALNUT RIDGE
MONTGOMERY COUNTY, VIRGINIA

REVISIONS

NO.	COMMENTS	DATE

PROJECT TEAM

PIC	JOHN T. NEEL, PE
PM	JOHN T. NEEL, PE
DESIGN	SEC

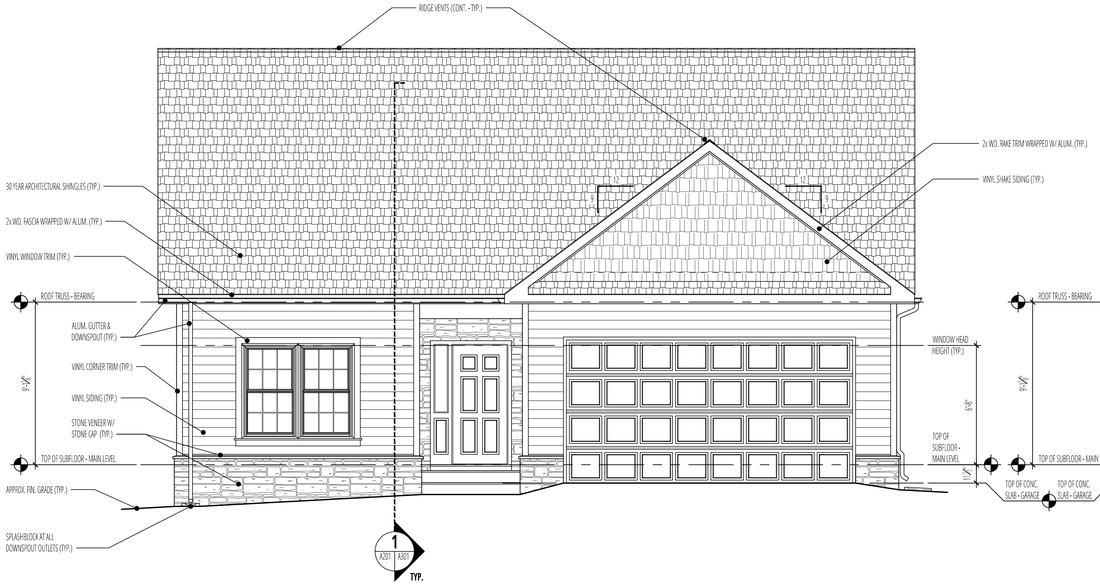
ISSUE DATE
11/01/2023

FDS JOB NO.
3246

SHEET TITLE
COMMON GREEN SPACE

SHEET NUMBER
1 OF 1

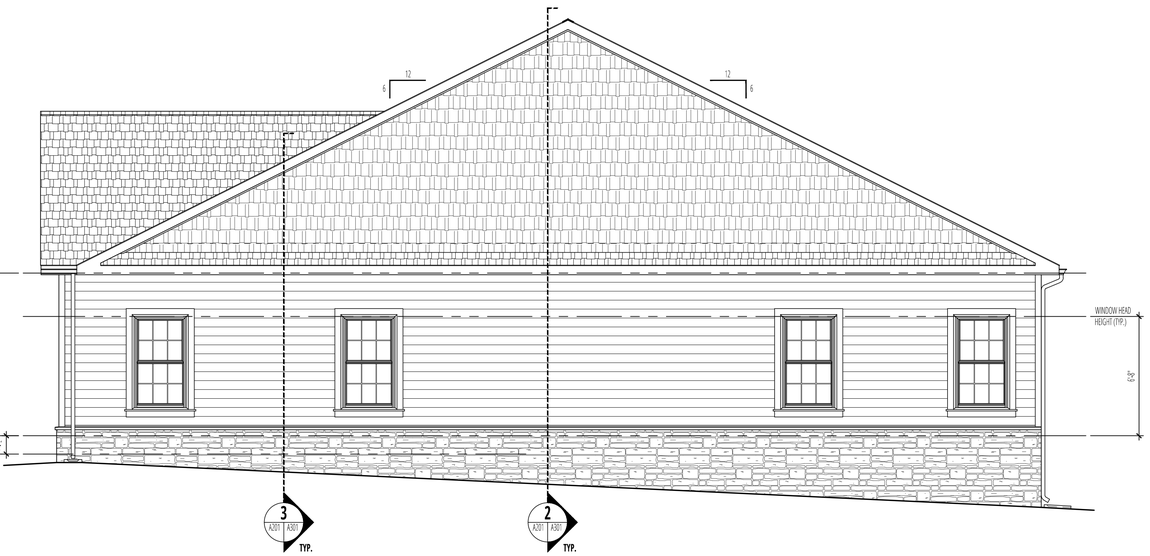
APPENDIX F: BUILDING ELEVATIONS



A EXTERIOR ELEVATION - FRONT - STONE VENEER - OPTION 'A'

A101 | A201

SCALE: 1/4" = 1'-0"



B EXTERIOR ELEVATION - RIGHT SIDE - STONE VENEER - OPTION 'A'

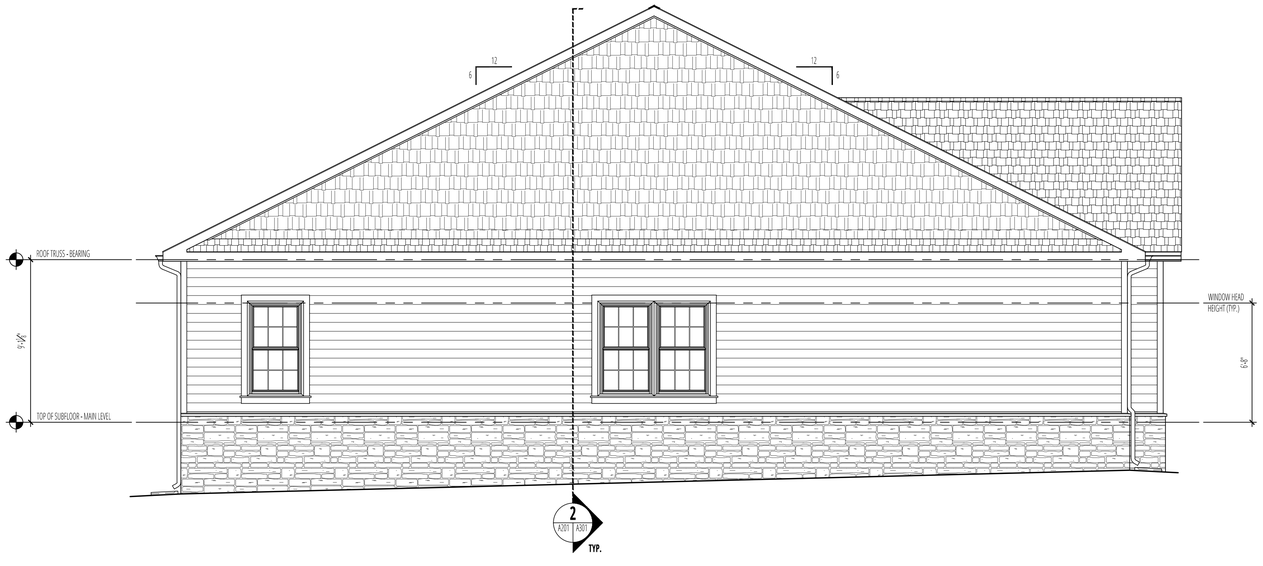
A101 | A201

SCALE: 1/4" = 1'-0"

C EXTERIOR ELEVATION - REAR - STONE VENEER - OPTION 'A'

A101 | A201

SCALE: 1/4" = 1'-0"



D EXTERIOR ELEVATION - LEFT SIDE - STONE VENEER - OPTION 'A'

A101 | A201

SCALE: 1/4" = 1'-0"

shah DEVELOPMENT LLC

SHAH DEVELOPMENT, LLC

180 TEEL STREET
CHRISTIANSBURG, VA 24073
(540) 260-9939
mneeble@shelor.com

MICHAEL W. NEEBLE, AIA

NEW RESIDENCE AT POINT PLEASANT

THE CHARLESTON - B (GARAGE FRONT RIGHT)

NEW PLEASANT WAY, SALEM, VIRGINIA

EXTERIOR ELEVATIONS - STONE VENEER - OPTION 'A'

Revisions

Project No.	22-019b
Date	08/09/2022
Design	SHAH
Drawing	MWN
Check	MWN
File	22-019b - A201-A204 . DWG

A201

APPENDIX G: PSA SEWER AVAILABILITY LETTER

MONTGOMERY COUNTY
PUBLIC SERVICE AUTHORITY

Government Center
Suite 2I
755 Roanoke Street
Christiansburg, VA 24073-3185

March 21, 2023

John Neel
Gay and Neel, Inc
1260 Radford Street
Christiansburg, Virginia 24073

RE: Availability Letter
Residential Subdivision
Houchens Road
Parcel ID 018441,018437,014196
Sewer

Dear Mr. Neel:

Public sanitary sewer can be made available to this proposed residential development along Houchens Road, Parcel ID 018441,018437,014196.

Sanitary sewer service may be provided by a public sewer extension to a point adjacent to all units of this proposed development from the public sewer main located in the Walnut Creek Subdivision. You must verify that there is a minimum of two feet of fall from the building service elevation to the top of the sewer main. If adequate vertical separation does not exist, you will be required to install a public sewer pump station and force main per PSA standards. The owner would be required to obtain public easements for all portions of the sewer line extension in private property. The sewer facility fee is $3,000.00 per each residential unit. There is also a $750.00 pump station fee for each unit.

The sewer facilities must be designed to PSA standards by an engineer and approved by the PSA prior to construction. The owner would be required to obtain public easements for all portions of the sewer line extension in private property. The owner would be responsible for the cost of the sewer line extensions, public easements, highway permits, and any other associated requirements. These designs should be incorporated into the site development plans for this development and submitted to the PSA for review. Payment of twenty-five percent of the water sewer facility fees for all units of the development would be required prior to approval of the site plan.

Please be advised that all PSA sewer systems have a fixed number of available connections. Connections are reserved by payment of facility and connection fees, provided service is currently available to the subject property.

Also, be advised that this development must also meet all Montgomery County Planning and Zoning Department requirements. The availability of sanitary sewer facilities does not by itself authorize the development of this property.

This letter and stated fees are only valid to April 1, 2024.

If you have questions or need additional clarification on the above information, please contact me at 381-1997.

Sincerely,

Charles E. Campbell
PSA Director

cc: Montgomery Co. Planning Dept.

APPENDIX H: TRAFFIC IMPACT ANALYSIS

Traffic Impact Analysis

Houchins Road Townhomes

Montgomery County, Virginia

March 2023

Prepared for:

Foresight Design Services

1260 Radford Street

Christiansburg, VA 24073

GOROVE SLADE

Transportation Planners and Engineers

Prepared by:

GOROVE SLADE
Transportation Planners and Engineers

4114 Legato Road	225 Reinekers Lane	1140 Connecticut Ave NW	4951 Lake Brook Drive
Suite 650	Suite 750	Suite 600	Suite 250
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T 703.787.9595	T 703.721.3044	T 202.296.8625	T 804.362.0578

www.goroveslade.com

TRAFFIC IMPACT ANALYSIS

To:	Jesse Miller, P.E.	VDOT
Cc:	Brea Hopkins	Montgomery County
	John Neel, P.E.	Foresight Design Services
From:	Michael Bailey, P.E., RSP$_1$	
Date:	March 2023	
Subject:	Houchins Road Townhomes – Montgomery County, VA	

Introduction

Shah Development is proposing to construct a townhome neighborhood with 171 single-family attached homes on the east side of Houchins Road. The proposed access plan includes two full-movement driveways on Houchins Road. The site is expected to be built-out by 2027.

This Traffic Impact Analysis (TIA) was developed in accordance with Virginia Department of Transportation (VDOT), Montgomery County TIA guidelines, and our TIA scope meeting. A copy of the TIA scoping document is included in the Appendix.

Scope of the Analysis

The objective of this analysis is to identify potential impacts to the transportation network due to the proposed convenience store. Based on the TIA scoping meeting, the following scenarios were analyzed:

- Existing (2023) Conditions
- No-Build (2027) Conditions
- Build (2027) Conditions

The weekday AM and PM peak hours were studied for the following intersections:

- Roanoke Street (U.S. 11 / U.S. 460 BUS) at Houchins Road / Bristol Drive
- Houchins Road at South Site Driveway
- Houchins Road at Crosscreek Drive / North Site Driveway

Figure 1 shows the site location and study intersections and the site plan is shown in Figure 2.

Figure 1: Site Location and Study Intersections

Figure 2: Preliminary Site Plan (Prepared by Gress Engineering for informational purposes only)

Existing Conditions

Existing Roadway Network

A description of the major roadways within the study area is shown in Table 1 and the existing lane configuration is shown in Figure 3.

Table 1: Existing Roadway Network

Roadway	RTE #	VDOT Classification	Legal/Design Speed Limit (mph)	AADT* (vpd)
Roanoke Street	U.S. 11 / U.S. 460 BUS	Principal Arterial	35 mph	15,000
Houchins Road	758	Local Roadway	25 mph	860
Bristol Drive	n/a	Local Roadway	25 mph	n/a
Crosscreek Drive	n/a	Local Roadway	25 mph	760
* VDOT 2021 ADT Traffic Data				

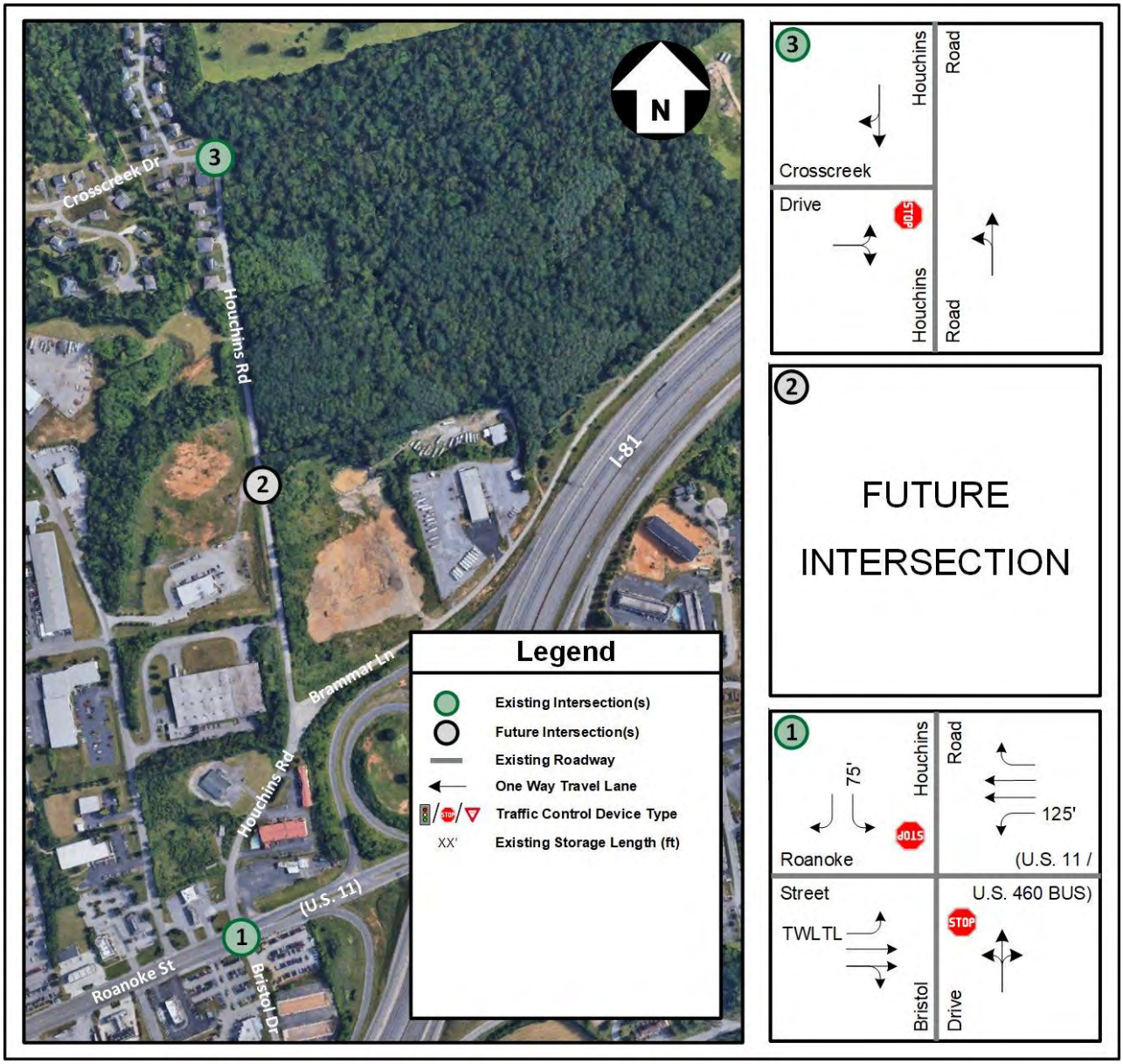

Figure 3: Existing Lane Configuration

Existing (2023) Traffic Volumes

The weekday AM peak hour (7:00 to 9:00 AM) and PM (4:00 to 6:00 PM) turning movement counts were conducted by Burns Services Inc. during the week of November 28th at the following intersections:

- Roanoke Street (U.S. 11 / U.S. 460 BUS) at Houchins Road / Bristol Drive
- Houchins Road at Crosscreek Drive / North Site Driveway

Through movements were increased to balance traffic volumes between intersections. The peak hour traffic volumes are shown in Figure 4 and the count data is included in the Appendix.

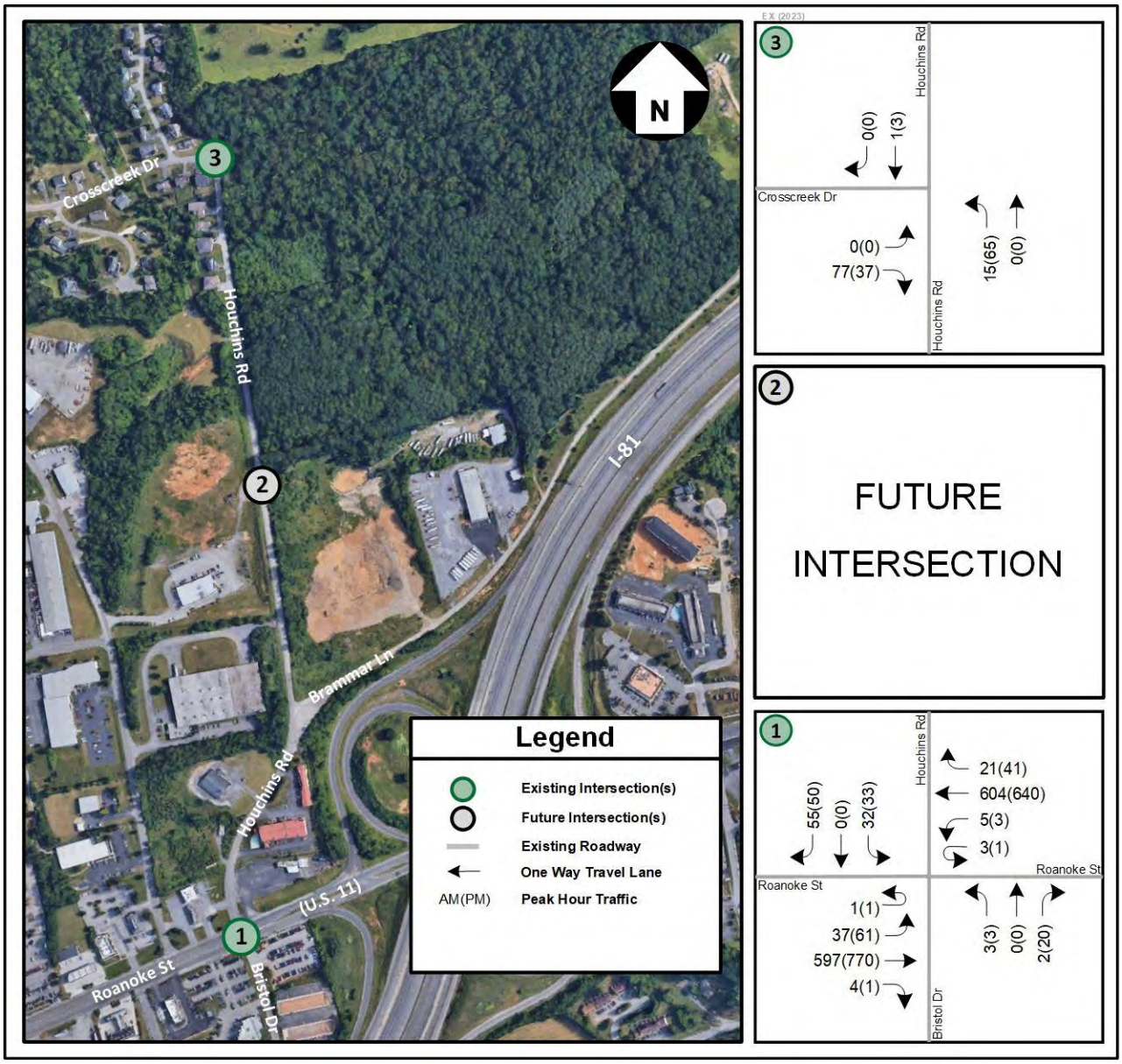

Figure 4: Existing (2023) Peak Hour Traffic Volumes

No-Build Conditions

Background Improvements

Based on the scoping meeting, no background improvements were included in this analysis.

Background Developments

Based on the scoping meeting, one approved development was identified within the vicinity of the site to be included in this analysis. The existing Walnut Creek neighborhood, located along Crosscreek Drive, is approved for the development of an additional 22 single-family detached homes and 145 single-family attached units. The anticipated development traffic is included under No-Build (2027) conditions, and the trip generation is shown in Table 2. Figure 5 shows the anticipated site trip volumes, which were based on the following regional distribution:

- 75% to / from the west on Roanoke Street
- 25% to / from the east on Roanoke Street

Table 2: ITE Trip Generation – Walnut Creek Residential – Typical Weekday – 11th Edition

Land Use	ITE Code	Size Units	------ Weekday ------						
			AM Peak Hour			*PM Peak Hour*			*Weekday*
			In	Out	Total	In	Out	Total	Total
Single-Family Detached Housing	210	22 d.u.	5	14	19	15	9	24	252
Single-Family Attached Housing	215	145 d.u.	17	53	70	49	34	83	1,054
Total Site Trips			**22**	**67**	**89**	**64**	**43**	**107**	**1,306**

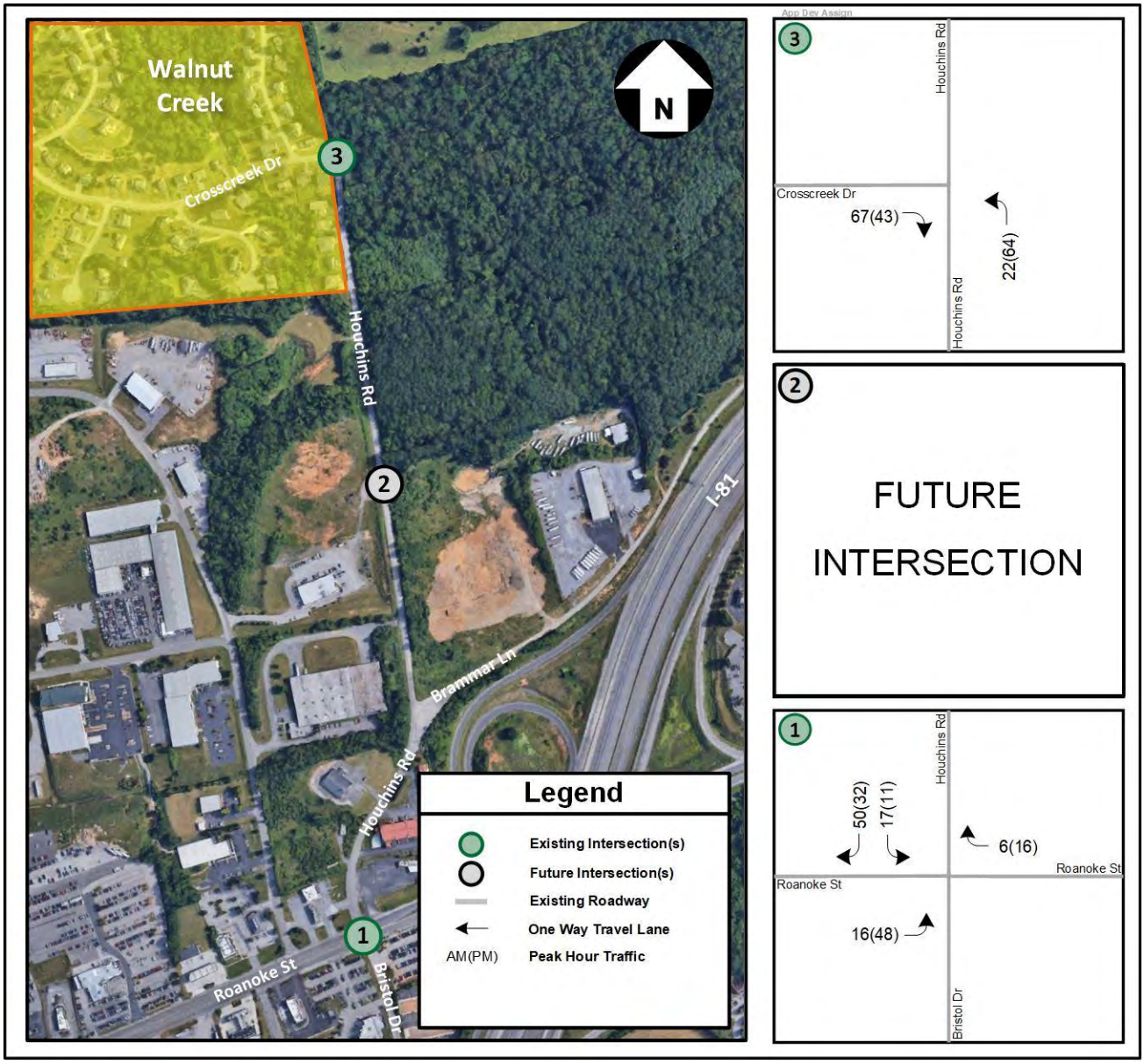

Figure 5: Walnut Creek Site Trips

Regional Traffic Growth

Future traffic volumes were estimated by increasing the existing traffic volumes to the build-out year using an annual growth rate and adding the trips generated by the background development. The no-build peak hour traffic volumes were estimated by applying an annual background growth rate of 1.0% for four years. Figure 6 shows the No-Build (2027) peak hour traffic volumes.

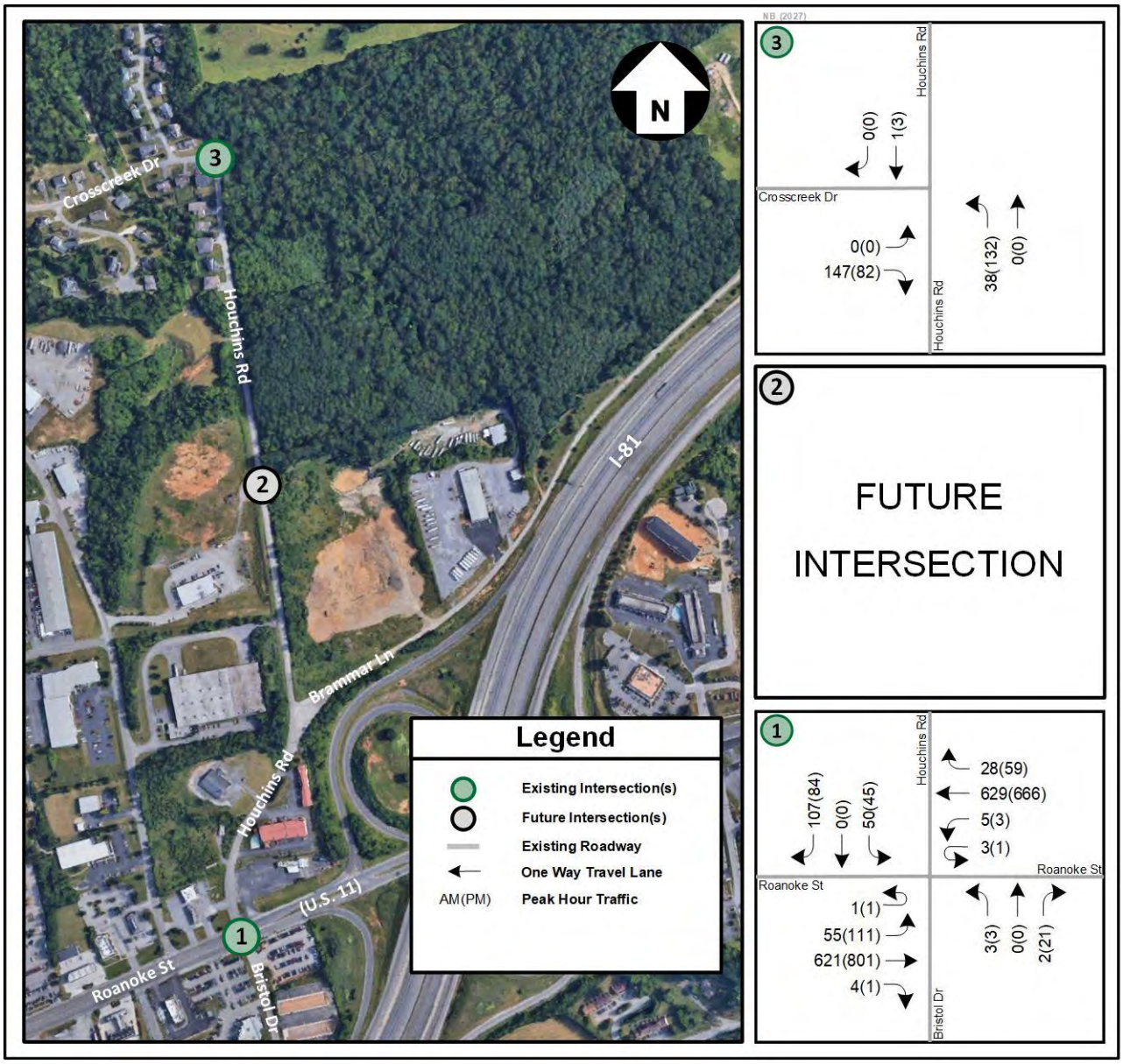

Figure 6: No-Build (2027) Peak Hour Traffic Volumes

Build Conditions

Site Generated Trips

Table 3 shows the trip potential of the proposed store based on the 11th Edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.

Table 3: ITE Trip Generation – Houchins Road Townhomes – Typical Weekday – 11th Edition

Land Use	ITE Code	Size Units	------ Weekday ------						
			AM Peak Hour			*PM Peak Hour*			*Weekday*
			In	Out	Total	In	Out	Total	Total
Single-Family Attached Housing	215	171 d.u.	21	62	83	58	41	99	1,254

Primary Site Trip Distribution

The site trip distribution was based on existing traffic patterns. The following regional distribution was applied to the site trips:

- 75% to / from the west on Roanoke Street
- 25% to / from the east on Roanoke Street

Figure 7 shows the regional site trip distribution and Figure 8 site trip assignment.

Figure 7: Primary Site Trip Distribution

Figure 8: Primary Site Trip Assignment

Build (2027) Traffic Volumes

The build traffic volumes were estimated by adding the no-build traffic volumes (Figure 6) and the site trip assignment (Figure 8). Figure 9 shows the Build (2027) peak hour traffic volumes.

Figure 9: Build (2027) Peak Hour Traffic Volumes

Turn Lane Warrant Analysis

The need for turn lanes was evaluated at the site driveways under Build (2027) conditions. The results of the turn lane warrant analysis are summarized in Table 4.

Table 4: Right-Turn Lane Warrant Analysis (2-Lane)

Study Scenario	Approach Volume	Right Turn Volume	Minimum Right Turn Taper Threshold	Minimum Right Turn Full Lane Threshold	Treatment
INT 2 - NBR - Build 2027 AM Peak	59	16	64	110	Not Warranted
INT 2 - NBR - Build 2027 PM Peak	190	44	51	93	Not Warranted
INT 3 - NBR - Build 2027 AM Peak	43	5	66	112	Not Warranted
INT 3 - NBR - Build 2027 PM Peak	146	14	55	99	Not Warranted

Based on the turn lane warrant analysis, no turn lanes are warranted at the proposed site driveways.

Capacity Analysis

Capacity analysis was performed at the study intersections during the weekday AM and PM peak hours under all analysis scenarios. Synchro, Version 11 was used to analyze the study intersections based on the Highway Capacity Manual (HCM methodology and includes level of service (LOS), delay, and queue lengths for the turning movements analyzed. SimTraffic queues were based on the maximum of an average of 10 microsimulation runs. The queueing analysis results are summarized in the tables below and the Synchro / SimTraffic output reports are included in the appendix. A future peak hour factor (PHF) of 0.92 was used only if the existing PHF was less than 0.92, otherwise the existing PHF was used.

For unsignalized intersections, the average delays for the minor street movements are described as short delays (less than 25 seconds), moderate delays (between 25 and 50 seconds), and long delays (greater than 50 seconds). It is common for side street movements to experience long delays during the peak hours at intersections with major thoroughfares.

Table 5 shows the LOS, average delays, and queue lengths for the signalized intersection of Roanoke Street (U.S. 11 / U.S. 460 BUS) at Houchins Road / Bristol Drive.

Table 5: Level-of-Service Summary for Roanoke Street at Houchins Road / Bristol Drive

Scenario	Intersection (Movement)	Effective Storage Length (ft.) [1]	AM Peak Hour				PM Peak Hour			
			LOS	Delay (sec/veh)	95th % Queue (ft.)	Ave. Max Queue (ft.) [2]	LOS	Delay (sec/veh)	95th % Queue (ft.)	Ave. Max Queue (ft.) [2]
			Synchro			SimTraffic	Synchro			SimTraffic
Existing (2023) Conditions	**Roanoke Street (U.S. 11) [E/W] at Houchins Road / Bristol Drive [N/S]**									
	Overall Intersection (TWSC)									
	Eastbound Approach									
	Eastbound U/Left		A	9.2	3	88	A	9.8	8	96
	Eastbound Thru/Right									
	Westbound Approach									
	Westbound U/Left	125	A	9.8	0	28	B	10.9	0	23
	Westbound Thru									
	Westbound Right									
	Northbound Approach		***C***	***21.2***			***C***	***17.3***		
	Northbound Left/Thru/Right		C	21.2	3	32	C	17.3	8	41
	Southbound Approach		***C***	***18.2***			***D***	***32.1***		
	Southbound Left	75	D	31.0	18	58	F	63.8	40	54
	Southbound Right		B	10.8	8	71	B	11.2	8	47
No-Build (2027) Conditions	**Roanoke Street (U.S. 11) [E/W] at Houchins Road / Bristol Drive [N/S]**									
	Overall Intersection (TWSC)									
	Eastbound Approach									
	Eastbound U/Left		A	9.4	5	119	B	10.2	13	118
	Eastbound Thru/Right									
	Westbound Approach									
	Westbound U/Left	125	A	10	0	24	B	10.9	0	27
	Westbound Thru									
	Westbound Right									
	Northbound Approach		***D***	***25.5***			***C***	***19.9***		
	Northbound Left/Thru/Right		D	25.5	3	2	C	19.9	8	41
	Southbound Approach		***C***	***21.6***			***F***	***50.4***		
	Southbound Left	75	E	43.3	38	30	F	122.8	75	70
	Southbound Right		B	11.5	15	63	B	11.6	13	128
Build (2027) Conditions	**Roanoke Street (U.S. 11) [E/W] at Houchins Road / Bristol Drive [N/S]**									
	Overall Intersection (TWSC)									
	Eastbound Approach									
	Eastbound U/Left		A	9.5	8	152	B	10.6	20	128
	Eastbound Thru/Right									
	Westbound Approach									
	Westbound U/Left	125	A	10	0	25	B	10.9	0	20
	Westbound Thru									
	Westbound Right									
	Northbound Approach		***D***	***29.2***			***C***	***24.1***		
	Northbound Left/Thru/Right		D	29.2	3	34	C	24.1	10	2
	Southbound Approach		***D***	***25.5***			***F***	***98.6***		
	Southbound Left	75	F	57	60	74	F	279.6	128	7
	Southbound Right		B	12.2	25	172	B	12.1	18	47

Capacity analysis shows that the minor street left-turn movement currently operates with moderate delays during the AM peak hour and with long delays during the PM peak hour. Under no-build conditions, the minor street left-turn movement is expected to continue operating with moderate delays during the AM peak hour and with long delays during the PM peak hour. Under build conditions, the minor street left-turn movement is expected to operate with long delays during the AM and PM peak hours. It is common for side street movements and left turns to experience long delays during the peak hours at intersections with major thoroughfares. No improvements are warranted or recommended at this intersection upon build-out of the proposed site.

Table 6 shows the LOS, average delays, and queue lengths for the unsignalized intersection of Houchins Road at the proposed South Site Driveway.

Table 6: Level-of-Service Summary for Houchins Road at South Site Driveway

Scenario	Intersection (Movement)	AM Peak Hour				PM Peak Hour			
		LOS	Delay (sec/veh)	95th % Queue (ft.)	Ave. Max Queue (ft.) [2]	LOS	Delay (sec/veh)	95th % Queue (ft.)	Ave. Max Queue (ft.) [2]
		Synchro			SimTraffic	Synchro			SimTraffic
Build (2027) Conditions	**Houchins Road [N/S] at South Site Driveway [E/W] Overall Intersection (TWSC)**								
	Westbound Approach	***B***	***10.1***			***B***	***10.4***		
	Westbound Left/Right	B	10.1	5	56	B	10.4	5	57
	Northbound Approach								
	Northbound Thru/Right								
	Southbound Approach								
	Southbound Left/Thru								

Capacity analysis shows that under build conditions, the minor street left-turn movement is expected to operate with short delays and queue lengths of three vehicles or less during the AM and PM peak hours. No improvements are warranted or recommended at the build-out of the proposed site.

Table 7 shows the LOS, average delays, and queue lengths for the unsignalized intersection of Houchins Road at Crosscreek Drive / North Site Driveway.

Table 7: Level-of-Service Summary for Houchins Road at Crosscreek Drive / North Site Driveway

Scenario	Intersection (Movement)	AM Peak Hour				PM Peak Hour			
		LOS	Delay (sec/veh)	95th % Queue (ft.)	Ave. Max Queue (ft.) [2]	LOS	Delay (sec/veh)	95th % Queue (ft.)	Ave. Max Queue (ft.) [2]
		Synchro			SimTraffic	Synchro			SimTraffic
Existing (2023) Conditions	**Houchins Road [N/S] at Crosscreek Drive [E/W] Overall Intersection (TWSC)**								
	Eastbound Approach								
	Eastbound Left/Right	A	8.7	8	47	A	8.5	3	31
	Northbound Approach								
	Northbound Left/Thru	A	7.2	0	0	A	7.3	3	0
	Southbound Approach								
	Southbound Thru/Right								
No-Build (2027) Conditions	**Houchins Road [N/S] at Crosscreek Drive [E/W] Overall Intersection (TWSC)**								
	Eastbound Approach								
	Eastbound Left/Right	A	8.9	13	51	A	8.6	8	47
	Northbound Approach								
	Northbound Left/Thru	A	7.3	3	0	A	7.4	8	3
	Southbound Approach								
	Southbound Thru/Right								
Build (2027) Conditions	**Houchins Road [N/S] at Crosscreek Drive / North Site Driveway [E/W] Overall Intersection (TWSC)**								
	Eastbound Approach	***A***	***8.9***			***A***	***8.6***		
	Eastbound Left/Thru/Right	A	8.9	13	70	A	8.6	8	53
	Westbound Approach	***B***	***10.5***			***B***	***12.0***		
	Westbound Left/Thru/Right	B	10.5	3	29	B	12.0	3	33
	Northbound Approach								
	Northbound Left/Thru/Right	A	7.3	3	0	A	7.4	8	6
	Southbound Approach								
	Southbound Left/Thru/Right								

Capacity analysis shows that the minor approach currently operates with short delays and queue lengths of two vehicles or less during the AM and PM peak hours. Under both no-build and build conditions, the minor approaches are expected to continue operating with short delays and queue lengths of three vehicles or less during the AM and PM peak hours. No improvements are warranted or recommended at the build-out of the proposed site.

Summary and Conclusions

Based on the results of the analysis, all intersections are projected to operate with acceptable delay and queueing upon completion of the proposed townhome neighborhood. No improvements are warranted or recommended at build-out of this site. Figure 10 shows the recommended lane configuration.

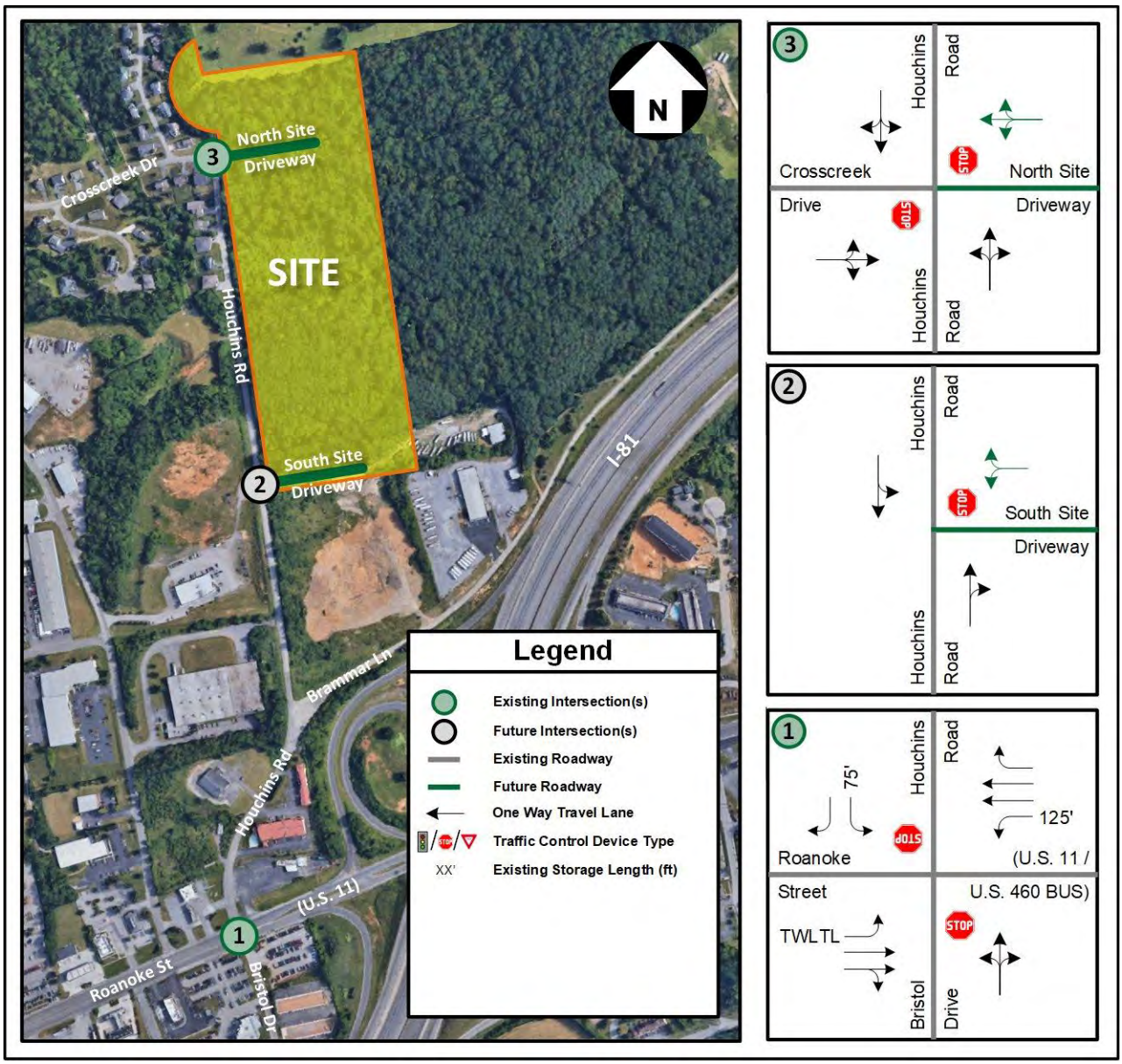

Figure 10: Recommended Lane Configuration

TECHNICAL APPENDIX

TECHNICAL APPENDIX

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Intersection Capacity Analysis Results – No-Build Conditions (2027)

APPENDIX E

Intersection Capacity Analysis Results – Build Conditions (2027)

APPENDIX F

Turn Lane Warrant Assessment

APPENDIX G

VDOT Pre-Scope Form

APPENDIX A

Turning Movement Count Sheets

TRAFFIC DATA COLLECTION

File Name : Christiansburg(Houchins Rd and US-11)
Site Code :
Start Date : 1/1/2023
Page No : 1

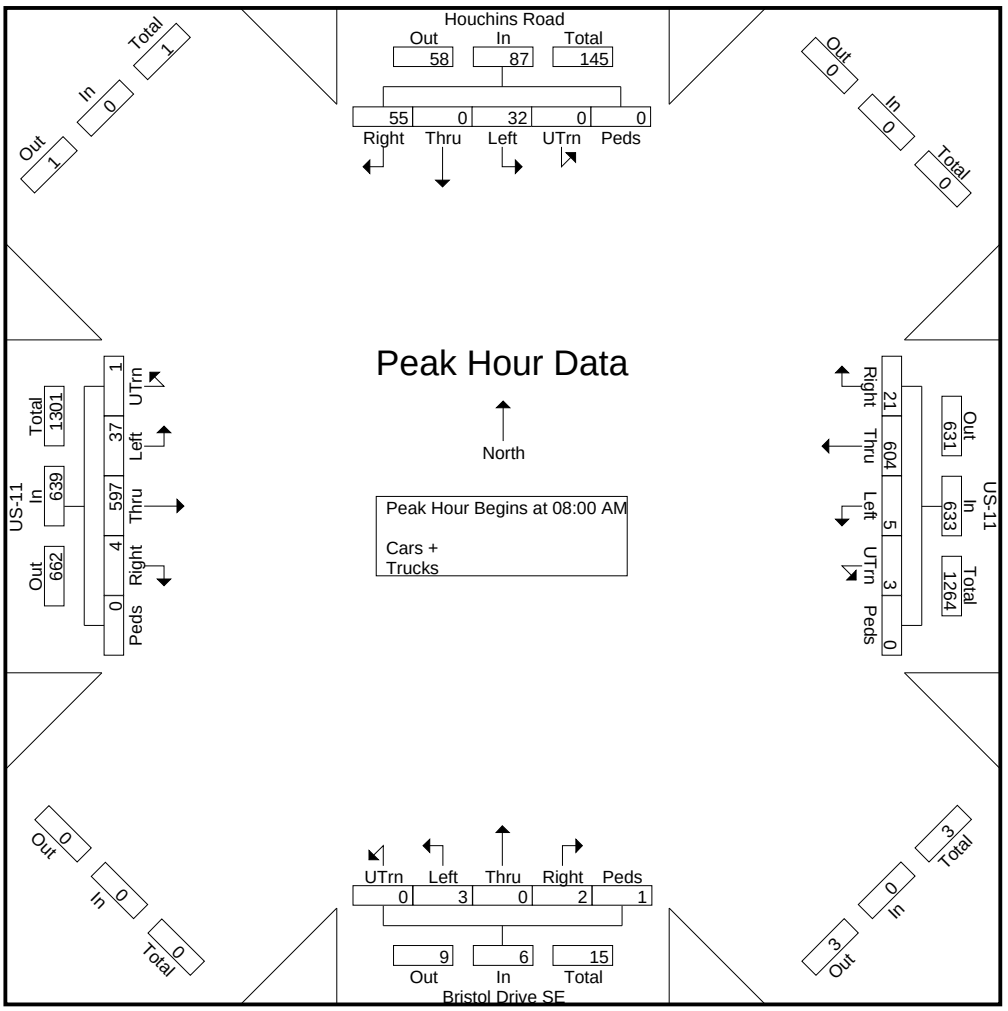
Groups Printed- Cars + - Trucks

	Houchins Road Southbound						US-11 Westbound						Bristol Drive SE Northbound						US-11 Eastbound						
Start Time	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Int. Total
07:00 AM	14	0	7	0	0	21	5	134	2	0	0	141	0	0	0	0	0	0	1	81	3	0	0	85	247
07:15 AM	16	0	14	0	0	30	7	172	0	0	0	179	1	0	0	0	0	1	1	86	8	0	0	95	305
07:30 AM	18	0	13	0	0	31	4	183	1	0	0	188	0	0	3	0	0	3	5	84	3	0	0	92	314
07:45 AM	17	0	6	0	0	23	5	185	5	0	0	195	1	1	2	0	0	4	4	98	9	0	0	111	333
Total	65	0	40	0	0	105	21	674	8	0	0	703	2	1	5	0	0	8	11	349	23	0	0	383	1199
08:00 AM	10	0	11	0	0	21	4	152	0	0	0	156	0	0	0	0	0	0	0	122	9	1	0	132	309
08:15 AM	15	0	11	0	0	26	7	148	1	1	0	157	0	0	0	0	1	1	0	149	12	0	0	161	345
08:30 AM	13	0	5	0	0	18	6	167	2	1	0	176	2	0	2	0	0	4	2	144	8	0	0	154	352
08:45 AM	17	0	5	0	0	22	4	137	2	1	0	144	0	0	1	0	0	1	2	182	8	0	0	192	359
Total	55	0	32	0	0	87	21	604	5	3	0	633	2	0	3	0	1	6	4	597	37	1	0	639	1365
Grand Total	120	0	72	0	0	192	42	1278	13	3	0	1336	4	1	8	0	1	14	15	946	60	1	0	1022	2564
Apprch %	62.5	0	37.5	0	0		3.1	95.7	1	0.2	0		28.6	7.1	57.1	0	7.1		1.5	92.6	5.9	0.1	0		
Total %	4.7	0	2.8	0	0	7.5	1.6	49.8	0.5	0.1	0	52.1	0.2	0	0.3	0	0	0.5	0.6	36.9	2.3	0	0	39.9	
Cars +	116	0	65	0	0	181	40	1224	13	3	0	1280	4	1	8	0	1	14	15	847	57	1	0	920	2395
% Cars +	96.7	0	90.3	0	0	94.3	95.2	95.8	100	100	0	95.8	100	100	100	0	100	100	100	89.5	95	100	0	90	93.4
Trucks	4	0	7	0	0	11	2	54	0	0	0	56	0	0	0	0	0	0	0	99	3	0	0	102	169
% Trucks	3.3	0	9.7	0	0	5.7	4.8	4.2	0	0	0	4.2	0	0	0	0	0	0	0	10.5	5	0	0	10	6.6

TRAFFIC DATA COLLECTION

File Name : Christiansburg(Houchins Rd and US-11)
Site Code :
Start Date : 1/1/2023
Page No : 2

	Houchins Road Southbound						US-11 Westbound						Bristol Drive SE Northbound						US-11 Eastbound						
Start Time	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 08:00 AM																									
08:00 AM	10	0	**11**	0	0	21	4	152	0	0	0	156	0	0	0	0	0	0	0	122	9	**1**	0	132	309
08:15 AM	15	0	11	0	0	**26**	**7**	148	1	**1**	0	157	0	0	0	0	**1**	1	0	149	**12**	0	0	161	345
08:30 AM	13	0	5	0	0	18	6	**167**	**2**	1	0	**176**	**2**	0	**2**	0	0	**4**	**2**	144	8	0	0	154	352
08:45 AM	**17**	0	5	0	0	22	4	137	2	1	0	144	0	0	1	0	0	1	2	**182**	8	0	0	**192**	**359**
Total Volume	55	0	32	0	0	87	21	604	5	3	0	633	2	0	3	0	1	6	4	597	37	1	0	639	1365
% App. Total	63.2	0	36.8	0	0		3.3	95.4	0.8	0.5	0		33.3	0	50	0	16.7		0.6	93.4	5.8	0.2	0		
PHF	.809	.000	.727	.000	.000	.837	.750	.904	.625	.750	.000	.899	.250	.000	.375	.000	.250	.375	.500	.820	.771	.250	.000	.832	.951



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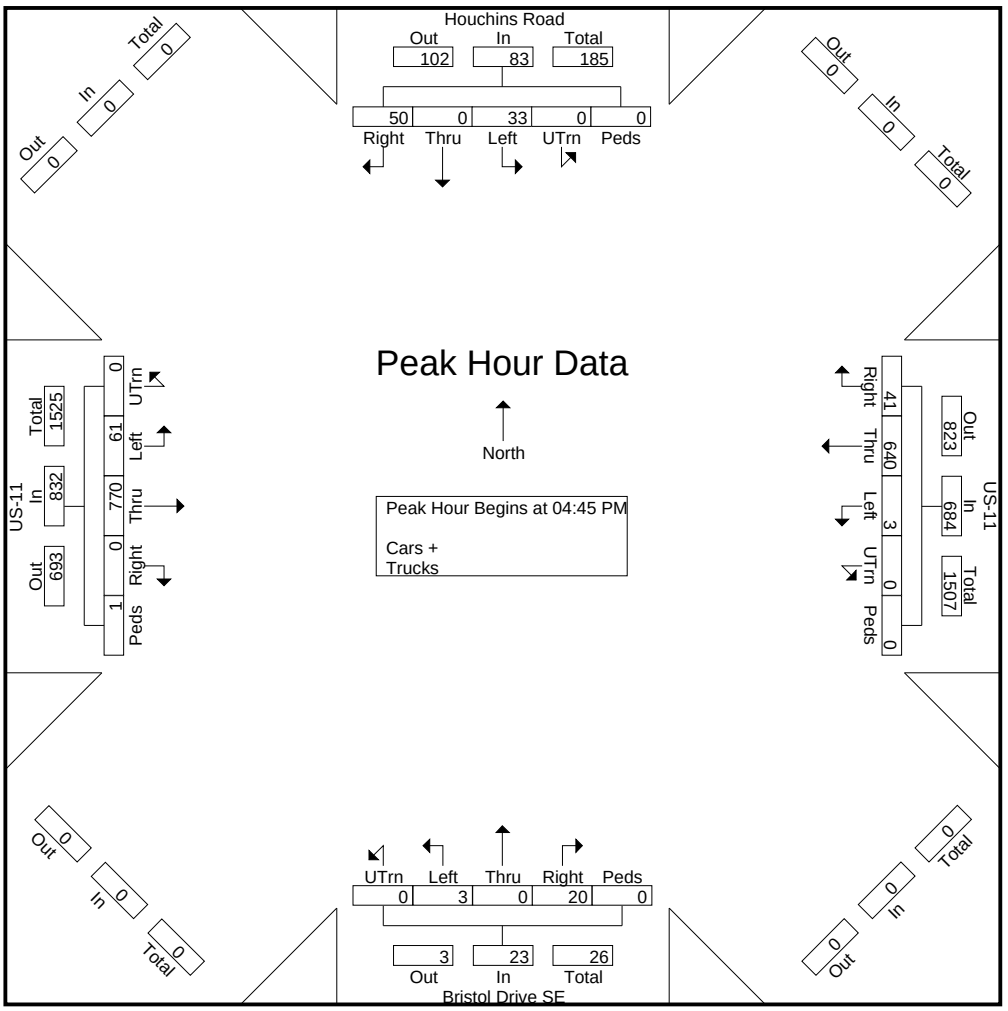
Groups Printed- Cars + - Trucks

	Houchins Road Southbound						US-11 Westbound						Bristol Drive SE Northbound						US-11 Eastbound						
Start Time	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Int. Total
04:00 PM	9	0	11	0	0	20	11	163	1	0	0	175	1	1	0	0	0	2	0	184	17	1	0	202	399
04:15 PM	9	0	13	0	0	22	5	154	0	0	0	159	1	0	0	0	0	1	0	188	10	0	0	198	380
04:30 PM	7	0	10	0	0	17	10	140	1	1	0	152	2	0	1	0	0	3	0	170	11	0	0	181	353
04:45 PM	9	0	4	0	0	13	10	159	0	0	0	169	5	0	0	0	0	5	0	166	15	0	0	181	368
Total	34	0	38	0	0	72	36	616	2	1	0	655	9	1	1	0	0	11	0	708	53	1	0	762	1500
05:00 PM	13	0	7	0	0	20	13	169	2	0	0	184	6	0	1	0	0	7	0	236	14	0	0	250	461
05:15 PM	21	0	6	0	0	27	8	154	1	0	0	163	6	0	1	0	0	7	0	195	19	0	1	215	412
05:30 PM	7	0	16	0	0	23	10	158	0	0	0	168	3	0	1	0	0	4	0	173	13	0	0	186	381
05:45 PM	14	0	4	0	0	18	8	139	1	1	0	149	0	0	1	0	0	1	0	147	18	0	0	165	333
Total	55	0	33	0	0	88	39	620	4	1	0	664	15	0	4	0	0	19	0	751	64	0	1	816	1587
Grand Total	89	0	71	0	0	160	75	1236	6	2	0	1319	24	1	5	0	0	30	0	1459	117	1	1	1578	3087
Apprch %	55.6	0	44.4	0	0		5.7	93.7	0.5	0.2	0		80	3.3	16.7	0	0		0	92.5	7.4	0.1	0.1		
Total %	2.9	0	2.3	0	0	5.2	2.4	40	0.2	0.1	0	42.7	0.8	0	0.2	0	0	1	0	47.3	3.8	0	0	51.1	
Cars +	87	0	70	0	0	157	72	1217	6	2	0	1297	24	1	5	0	0	30	0	1434	116	1	1	1552	3036
% Cars +	97.8	0	98.6	0	0	98.1	96	98.5	100	100	0	98.3	100	100	100	0	0	100	0	98.3	99.1	100	100	98.4	98.3
Trucks	2	0	1	0	0	3	3	19	0	0	0	22	0	0	0	0	0	0	0	25	1	0	0	26	51
% Trucks	2.2	0	1.4	0	0	1.9	4	1.5	0	0	0	1.7	0	0	0	0	0	0	0	1.7	0.9	0	0	1.6	1.7

TRAFFIC DATA COLLECTION

File Name : Christiansburg(Houchins Rd and US-11)
Site Code :
Start Date : 1/1/2023
Page No : 2

	Houchins Road Southbound						US-11 Westbound						Bristol Drive SE Northbound						US-11 Eastbound						
Start Time	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 04:45 PM																									
04:45 PM	9	0	4	0	0	13	10	159	0	0	0	169	5	0	0	0	0	5	0	166	15	0	0	181	368
05:00 PM	13	0	7	0	0	20	**13**	**169**	**2**	0	0	**184**	**6**	0	**1**	0	0	**7**	0	**236**	14	0	0	**250**	**461**
05:15 PM	**21**	0	6	0	0	**27**	8	154	1	0	0	163	6	0	1	0	0	7	0	195	**19**	0	**1**	215	412
05:30 PM	7	0	**16**	0	0	23	10	158	0	0	0	168	3	0	1	0	0	4	0	173	13	0	0	186	381
Total Volume	50	0	33	0	0	83	41	640	3	0	0	684	20	0	3	0	0	23	0	770	61	0	1	832	1622
% App. Total	60.2	0	39.8	0	0		6	93.6	0.4	0	0		87	0	13	0	0		0	92.5	7.3	0	0.1		
PHF	.595	.000	.516	.000	.000	.769	.788	.947	.375	.000	.000	.929	.833	.000	.750	.000	.000	.821	.000	.816	.803	.000	.250	.832	.880



File Name : Christiansburg(Houchins Rd atnd Crosscreek Dr)
Site Code :
Start Date : 2/22/2023
Page No : 1

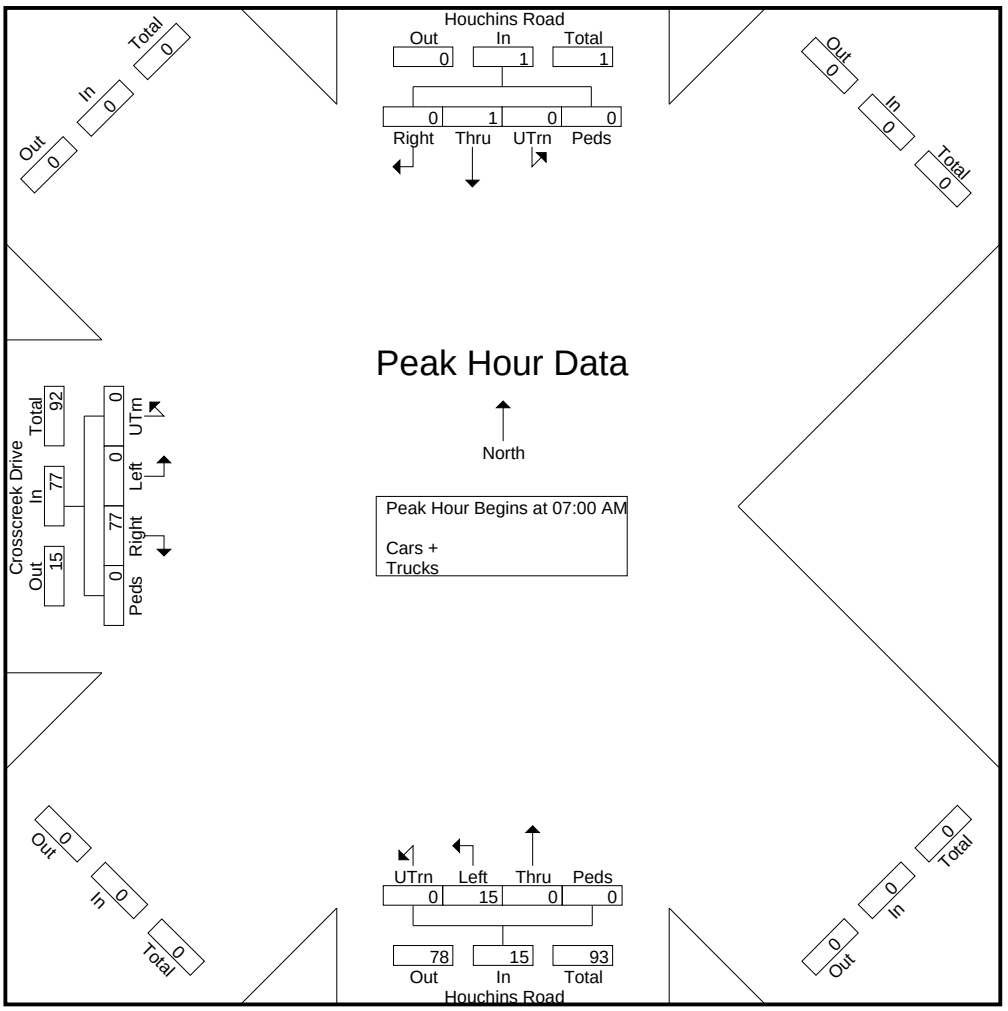
Groups Printed- Cars + - Trucks

	Houchins Road Southbound					Houchins Road Northbound					Crosscreek Drive Eastbound					
Start Time	Right	Thru	UTrn	Peds	App. Total	Thru	Left	UTrn	Peds	App. Total	Right	Left	UTrn	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	1	0	0	1	17	0	0	0	17	18
07:15 AM	0	0	0	0	0	0	7	0	0	7	23	0	0	0	23	30
07:30 AM	0	0	0	0	0	0	1	0	0	1	21	0	0	0	21	22
07:45 AM	0	1	0	0	1	0	6	0	0	6	16	0	0	0	16	23
Total	0	1	0	0	1	0	15	0	0	15	77	0	0	0	77	93
08:00 AM	0	0	0	0	0	0	3	0	0	3	12	0	0	0	12	15
08:15 AM	0	0	0	0	0	0	7	0	0	7	19	0	1	0	20	27
08:30 AM	0	0	0	0	0	0	4	0	0	4	8	0	0	0	8	12
08:45 AM	0	0	0	0	0	0	3	0	0	3	13	0	0	0	13	16
Total	0	0	0	0	0	0	17	0	0	17	52	0	1	0	53	70
Grand Total	0	1	0	0	1	0	32	0	0	32	129	0	1	0	130	163
Apprch %	0	100	0	0		0	100	0	0		99.2	0	0.8	0		
Total %	0	0.6	0	0	0.6	0	19.6	0	0	19.6	79.1	0	0.6	0	79.8	
Cars +	0	1	0	0	1	0	30	0	0	30	126	0	1	0	127	158
% Cars +	0	100	0	0	100	0	93.8	0	0	93.8	97.7	0	100	0	97.7	96.9
Trucks	0	0	0	0	0	0	2	0	0	2	3	0	0	0	3	5
% Trucks	0	0	0	0	0	0	6.2	0	0	6.2	2.3	0	0	0	2.3	3.1

TRAFFIC DATA COLLECTION

File Name : Christiansburg(Houchins Rd atnd Crosscreek Dr)
Site Code :
Start Date : 2/22/2023
Page No : 2

	Houchins Road Southbound					Houchins Road Northbound					Crosscreek Drive Eastbound					
Start Time	Right	Thru	UTrn	Peds	App. Total	Thru	Left	UTrn	Peds	App. Total	Right	Left	UTrn	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																
Peak Hour for Entire Intersection Begins at 07:00 AM																
07:00 AM	0	0	0	0	0	0	1	0	0	1	17	0	0	0	17	18
07:15 AM	0	0	0	0	0	0	**7**	0	0	**7**	**23**	0	0	0	**23**	**30**
07:30 AM	0	0	0	0	0	0	1	0	0	1	21	0	0	0	21	22
07:45 AM	0	**1**	0	0	**1**	0	6	0	0	6	16	0	0	0	16	23
Total Volume	0	1	0	0	1	0	15	0	0	15	77	0	0	0	77	93
% App. Total	0	100	0	0		0	100	0	0		100	0	0	0		
PHF	.000	.250	.000	.000	.250	.000	.536	.000	.000	.536	.837	.000	.000	.000	.837	.775



File Name : Christiansburg(Houchins Rd atnd Crosscreek Dr)
Site Code :
Start Date : 2/22/2023
Page No : 1

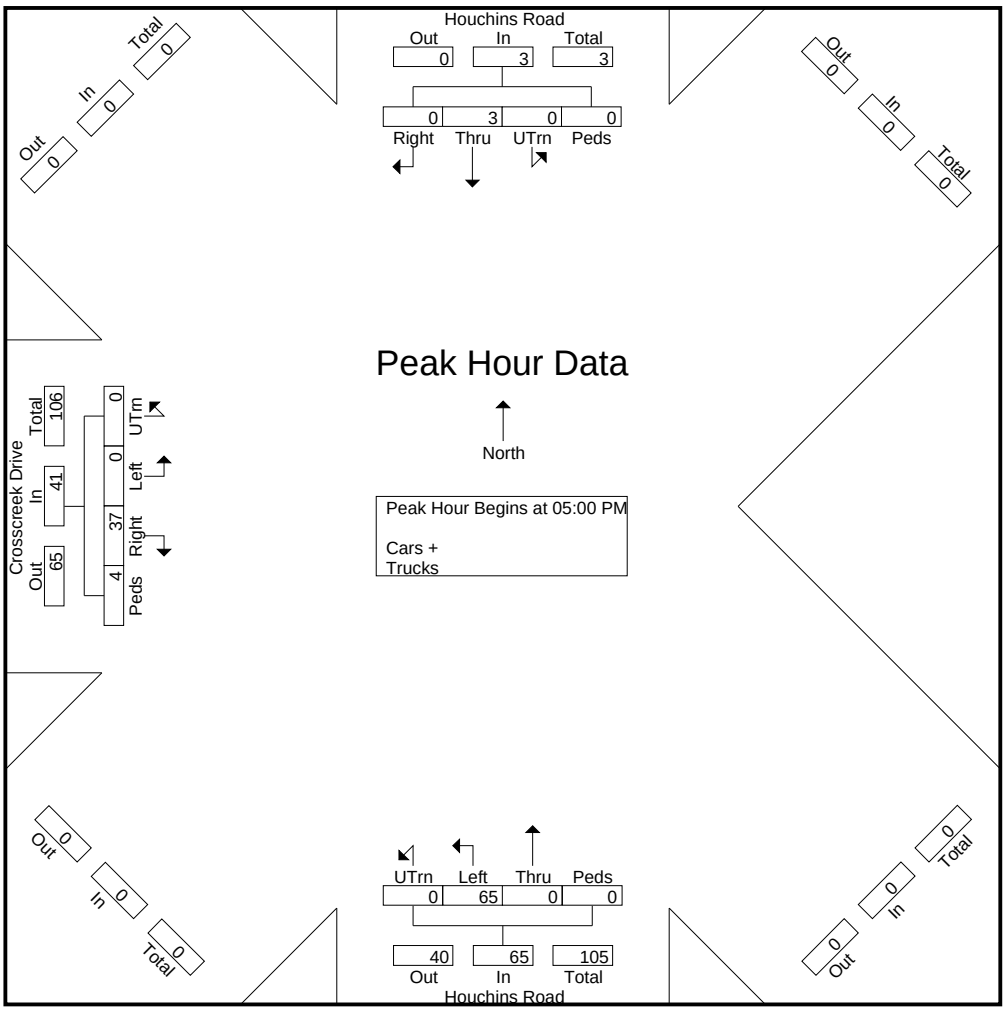
Groups Printed- Cars + - Trucks

	Houchins Road Southbound					Houchins Road Northbound					Crosscreek Drive Eastbound					
Start Time	Right	Thru	UTrn	Peds	App. Total	Thru	Left	UTrn	Peds	App. Total	Right	Left	UTrn	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	15	0	0	15	8	0	0	0	8	23
04:15 PM	0	0	0	0	0	0	9	0	0	9	5	0	0	0	5	14
04:30 PM	0	0	0	0	0	1	12	0	0	13	5	0	0	0	5	18
04:45 PM	0	0	0	0	0	0	19	0	0	19	7	0	0	0	7	26
Total	0	0	0	0	0	1	55	0	0	56	25	0	0	0	25	81
05:00 PM	0	2	0	0	2	0	18	0	0	18	10	0	0	0	10	30
05:15 PM	0	1	0	0	1	0	15	0	0	15	10	0	0	1	11	27
05:30 PM	0	0	0	0	0	0	12	0	0	12	10	0	0	0	10	22
05:45 PM	0	0	0	0	0	0	20	0	0	20	7	0	0	3	10	30
Total	0	3	0	0	3	0	65	0	0	65	37	0	0	4	41	109
Grand Total	0	3	0	0	3	1	120	0	0	121	62	0	0	4	66	190
Apprch %	0	100	0	0		0.8	99.2	0	0		93.9	0	0	6.1		
Total %	0	1.6	0	0	1.6	0.5	63.2	0	0	63.7	32.6	0	0	2.1	34.7	
Cars +	0	3	0	0	3	1	118	0	0	119	60	0	0	4	64	186
% Cars +	0	100	0	0	100	100	98.3	0	0	98.3	96.8	0	0	100	97	97.9
Trucks	0	0	0	0	0	0	2	0	0	2	2	0	0	0	2	4
% Trucks	0	0	0	0	0	0	1.7	0	0	1.7	3.2	0	0	0	3	2.1

TRAFFIC DATA COLLECTION

File Name : Christiansburg(Houchins Rd atnd Crosscreek Dr)
Site Code :
Start Date : 2/22/2023
Page No : 2

	Houchins Road Southbound					Houchins Road Northbound					Crosscreek Drive Eastbound					
Start Time	Right	Thru	UTrn	Peds	App. Total	Thru	Left	UTrn	Peds	App. Total	Right	Left	UTrn	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																
Peak Hour for Entire Intersection Begins at 05:00 PM																
05:00 PM	0	**2**	0	0	**2**	0	18	0	0	18	**10**	0	0	0	10	**30**
05:15 PM	0	1	0	0	1	0	15	0	0	15	10	0	0	1	**11**	27
05:30 PM	0	0	0	0	0	0	12	0	0	12	10	0	0	0	10	22
05:45 PM	0	0	0	0	0	0	**20**	0	0	**20**	7	0	0	**3**	10	30
Total Volume	0	3	0	0	3	0	65	0	0	65	37	0	0	4	41	109
% App. Total	0	100	0	0		0	100	0	0		90.2	0	0	9.8		
PHF	.000	.375	.000	.000	.375	.000	.813	.000	.000	.813	.925	.000	.000	.333	.932	.908



APPENDIX B

Level of Service Definitions

TECHNICAL MEMORANDUM

Subject: Level of Service Definitions

Introduction

The purpose of this memorandum is to define the level of service (LOS) metric that commonly used as a measure of effectiveness (MOE) for traffic operations.

All capacity analyses are based on the procedures specified by the Transportation Research Board's (TRB) Highway Capacity Manual (HCM), which is currently on its sixth edition. Level of service ranges 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 indicate 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 C

Intersection Capacity Analysis Results – Existing Conditions (2023)

Intersection	
Int Delay, s/veh	1.8

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	1	37	597	4	3	5	604	21	3	0	2	32	0	55
Future Vol, veh/h	1	37	597	4	3	5	604	21	3	0	2	32	0	55
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	125	-	0	-	-	-	75	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	39	628	4	3	5	636	22	3	0	2	34	0	58

Major/Minor	Major1				Major2				Minor1			Minor2		
Conflicting Flow All	636	658	0	0	633	632	0	0	1044	1384	316	1046	-	318
Stage 1	-	-	-	-	-	-	-	-	710	710	-	652	-	-
Stage 2	-	-	-	-	-	-	-	-	334	674	-	394	-	-
Critical Hdwy	6.44	4.14	-	-	6.44	4.14	-	-	7.54	6.54	6.94	7.54	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Follow-up Hdwy	2.52	2.22	-	-	2.52	2.22	-	-	3.52	4.02	3.32	3.52	-	3.32
Pot Cap-1 Maneuver	567	926	-	-	570	947	-	-	183	142	680	183	0	678
Stage 1	-	-	-	-	-	-	-	-	391	435	-	423	0	-
Stage 2	-	-	-	-	-	-	-	-	653	452	-	602	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	907	907	-	-	757	757	-	-	157	131	680	172	-	678
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	157	131	-	172	-	-
Stage 1	-	-	-	-	-	-	-	-	364	405	-	394	-	-
Stage 2	-	-	-	-	-	-	-	-	591	447	-	559	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.1	0.1	21.2	18.2
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	227	907	-	-	757	-	-	172	678
HCM Lane V/C Ratio	0.023	0.043	-	-	0.011	-	-	0.196	0.085
HCM Control Delay (s)	21.2	9.2	0.6	-	9.8	-	-	31	10.8
HCM Lane LOS	C	A	A	-	A	-	-	D	B
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.7	0.3

Intersection	
Int Delay, s/veh	8.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	77	15	0	1	0
Future Vol, veh/h	0	77	15	0	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	99	19	0	1	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	39	1	1	0	-	0
Stage 1	1	-	-	-	-	-
Stage 2	38	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	973	1084	1622	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	984	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	961	1084	1622	-	-	-
Mov Cap-2 Maneuver	961	-	-	-	-	-
Stage 1	1010	-	-	-	-	-
Stage 2	984	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	7.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1622	-	1084	-	-
HCM Lane V/C Ratio	0.012	-	0.091	-	-
HCM Control Delay (s)	7.2	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.3	-	-

Intersection	
Int Delay, s/veh	3

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	1	61	770	1	1	3	640	41	3	0	20	33	0	50
Future Vol, veh/h	1	61	770	1	1	3	640	41	3	0	20	33	0	50
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	125	-	0	-	-	-	75	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	69	875	1	1	3	727	47	3	0	23	38	0	57

Major/Minor	Major1				Major2				Minor1			Minor2		
Conflicting Flow All	727	774	0	0	876	876	0	0	1388	1798	438	1313	-	364
Stage 1	-	-	-	-	-	-	-	-	1016	1016	-	735	-	-
Stage 2	-	-	-	-	-	-	-	-	372	782	-	578	-	-
Critical Hdwy	6.44	4.14	-	-	6.44	4.14	-	-	7.54	6.54	6.94	7.54	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Follow-up Hdwy	2.52	2.22	-	-	2.52	2.22	-	-	3.52	4.02	3.32	3.52	-	3.32
Pot Cap-1 Maneuver	497	837	-	-	399	766	-	-	102	79	567	116	0	633
Stage 1	-	-	-	-	-	-	-	-	255	314	-	377	0	-
Stage 2	-	-	-	-	-	-	-	-	621	403	-	468	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	826	826	-	-	614	614	-	-	81	65	567	97	-	633
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	81	65	-	97	-	-
Stage 1	-	-	-	-	-	-	-	-	213	262	-	315	-	-
Stage 2	-	-	-	-	-	-	-	-	561	400	-	375	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2	0.1	17.3	32.1
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	318	826	-	-	614	-	-	97	633
HCM Lane V/C Ratio	0.082	0.084	-	-	0.007	-	-	0.387	0.09
HCM Control Delay (s)	17.3	9.8	1.4	-	10.9	-	-	63.8	11.2
HCM Lane LOS	C	A	A	-	B	-	-	F	B
HCM 95th %tile Q(veh)	0.3	0.3	-	-	0	-	-	1.6	0.3

Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	37	65	0	3	0
Future Vol, veh/h	0	37	65	0	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	41	71	0	3	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	145	3	3	0	-	0
Stage 1	3	-	-	-	-	-
Stage 2	142	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	847	1081	1619	-	-	-
Stage 1	1020	-	-	-	-	-
Stage 2	885	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	810	1081	1619	-	-	-
Mov Cap-2 Maneuver	810	-	-	-	-	-
Stage 1	975	-	-	-	-	-
Stage 2	885	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.5	7.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1619	-	1081	-	-
HCM Lane V/C Ratio	0.044	-	0.038	-	-
HCM Control Delay (s)	7.3	0	8.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

APPENDIX D

Intersection Capacity Analysis Results – No-Build Conditions (2027)

Intersection	
Int Delay, s/veh	3.1

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	1	55	621	4	3	5	629	28	3	0	2	50	0	107
Future Vol, veh/h	1	55	621	4	3	5	629	28	3	0	2	50	0	107
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	125	-	0	-	-	-	75	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	58	654	4	3	5	662	29	3	0	2	53	0	113

Major/Minor	Major1				Major2				Minor1			Minor2		
Conflicting Flow All	662	691	0	0	658	658	0	0	1121	1481	329	1123	-	331
Stage 1	-	-	-	-	-	-	-	-	774	774	-	678	-	-
Stage 2	-	-	-	-	-	-	-	-	347	707	-	445	-	-
Critical Hdwy	6.44	4.14	-	-	6.44	4.14	-	-	7.54	6.54	6.94	7.54	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Follow-up Hdwy	2.52	2.22	-	-	2.52	2.22	-	-	3.52	4.02	3.32	3.52	-	3.32
Pot Cap-1 Maneuver	546	900	-	-	549	926	-	-	161	124	667	160	0	665
Stage 1	-	-	-	-	-	-	-	-	357	406	-	408	0	-
Stage 2	-	-	-	-	-	-	-	-	642	436	-	562	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	885	885	-	-	735	735	-	-	122	110	667	145	-	665
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	122	110	-	145	-	-
Stage 1	-	-	-	-	-	-	-	-	320	363	-	365	-	-
Stage 2	-	-	-	-	-	-	-	-	527	431	-	501	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.5	0.1	25.5	21.6
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	181	885	-	-	735	-	-	145	665
HCM Lane V/C Ratio	0.029	0.065	-	-	0.011	-	-	0.363	0.169
HCM Control Delay (s)	25.5	9.4	0.8	-	10	-	-	43.3	11.5
HCM Lane LOS	D	A	A	-	A	-	-	E	B
HCM 95th %tile Q(veh)	0.1	0.2	-	-	0	-	-	1.5	0.6

Intersection	
Int Delay, s/veh	8.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	147	38	0	1	0
Future Vol, veh/h	0	147	38	0	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	160	41	0	1	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	83	1	1	0	-	0
Stage 1	1	-	-	-	-	-
Stage 2	82	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	919	1084	1622	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	941	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	896	1084	1622	-	-	-
Mov Cap-2 Maneuver	896	-	-	-	-	-
Stage 1	996	-	-	-	-	-
Stage 2	941	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	7.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1622	-	1084	-	-
HCM Lane V/C Ratio	0.025	-	0.147	-	-
HCM Control Delay (s)	7.3	0	8.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.5	-	-

Intersection	
Int Delay, s/veh	5.6

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	1	111	801	1	1	3	666	59	3	0	21	45	0	84
Future Vol, veh/h	1	111	801	1	1	3	666	59	3	0	21	45	0	84
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	125	-	0	-	-	-	75	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	121	871	1	1	3	724	64	3	0	23	49	0	91

Major/Minor	Major1				Major2				Minor1			Minor2		
Conflicting Flow All	724	788	0	0	872	872	0	0	1486	1912	436	1412	-	362
Stage 1	-	-	-	-	-	-	-	-	1116	1116	-	732	-	-
Stage 2	-	-	-	-	-	-	-	-	370	796	-	680	-	-
Critical Hdwy	6.44	4.14	-	-	6.44	4.14	-	-	7.54	6.54	6.94	7.54	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Follow-up Hdwy	2.52	2.22	-	-	2.52	2.22	-	-	3.52	4.02	3.32	3.52	-	3.32
Pot Cap-1 Maneuver	499	827	-	-	401	769	-	-	86	67	568	98	0	635
Stage 1	-	-	-	-	-	-	-	-	221	281	-	379	0	-
Stage 2	-	-	-	-	-	-	-	-	622	397	-	407	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	820	820	-	-	616	616	-	-	57	47	568	73	-	635
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	57	47	-	73	-	-
Stage 1	-	-	-	-	-	-	-	-	157	200	-	270	-	-
Stage 2	-	-	-	-	-	-	-	-	529	395	-	278	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.3	0.1	19.9	50.4
HCM LOS			C	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	268	820	-	-	616	-	-	73	635
HCM Lane V/C Ratio	0.097	0.147	-	-	0.007	-	-	0.67	0.144
HCM Control Delay (s)	19.9	10.2	2.3	-	10.9	-	-	122.8	11.6
HCM Lane LOS	C	B	A	-	B	-	-	F	B
HCM 95th %tile Q(veh)	0.3	0.5	-	-	0	-	-	3	0.5

Intersection	
Int Delay, s/veh	7.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	82	132	0	3	0
Future Vol, veh/h	0	82	132	0	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	89	143	0	3	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	289	3	3	0	-	0
Stage 1	3	-	-	-	-	-
Stage 2	286	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	702	1081	1619	-	-	-
Stage 1	1020	-	-	-	-	-
Stage 2	763	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	640	1081	1619	-	-	-
Mov Cap-2 Maneuver	640	-	-	-	-	-
Stage 1	930	-	-	-	-	-
Stage 2	763	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	7.4	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1619	-	1081	-	-
HCM Lane V/C Ratio	0.089	-	0.082	-	-
HCM Control Delay (s)	7.4	0	8.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.3	-	0.3	-	-

APPENDIX E

Intersection Capacity Analysis Results – Build Conditions (2027)

Intersection	
Int Delay, s/veh	4.5

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	1	71	621	4	3	5	629	33	3	0	2	65	0	154
Future Vol, veh/h	1	71	621	4	3	5	629	33	3	0	2	65	0	154
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	125	-	0	-	-	-	75	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	75	654	4	3	5	662	35	3	0	2	68	0	162

Major/Minor	Major1				Major2				Minor1			Minor2		
Conflicting Flow All	662	697	0	0	658	658	0	0	1155	1521	329	1157	-	331
Stage 1	-	-	-	-	-	-	-	-	808	808	-	678	-	-
Stage 2	-	-	-	-	-	-	-	-	347	713	-	479	-	-
Critical Hdwy	6.44	4.14	-	-	6.44	4.14	-	-	7.54	6.54	6.94	7.54	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Follow-up Hdwy	2.52	2.22	-	-	2.52	2.22	-	-	3.52	4.02	3.32	3.52	-	3.32
Pot Cap-1 Maneuver	546	895	-	-	549	926	-	-	152	117	667	151	0	665
Stage 1	-	-	-	-	-	-	-	-	341	392	-	408	0	-
Stage 2	-	-	-	-	-	-	-	-	642	434	-	537	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	881	881	-	-	735	735	-	-	102	100	667	134	-	665
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	102	100	-	134	-	-
Stage 1	-	-	-	-	-	-	-	-	295	339	-	353	-	-
Stage 2	-	-	-	-	-	-	-	-	480	429	-	463	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.9	0.1	29.2	25.5
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	154	881	-	-	735	-	-	134	665
HCM Lane V/C Ratio	0.034	0.085	-	-	0.011	-	-	0.511	0.244
HCM Control Delay (s)	29.2	9.5	1	-	10	-	-	57	12.2
HCM Lane LOS	D	A	A	-	A	-	-	F	B
HCM 95th %tile Q(veh)	0.1	0.3	-	-	0	-	-	2.4	1

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	47	0	43	16	0	163
Future Vol, veh/h	47	0	43	16	0	163
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	51	0	47	17	0	177

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	233	56	0	0	64	0
Stage 1	56	-	-	-	-	-
Stage 2	177	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	755	1011	-	-	1538	-
Stage 1	967	-	-	-	-	-
Stage 2	854	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	755	1011	-	-	1538	-
Mov Cap-2 Maneuver	755	-	-	-	-	-
Stage 1	967	-	-	-	-	-
Stage 2	854	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	755	1538	-
HCM Lane V/C Ratio	-	-	0.068	-	-
HCM Control Delay (s)	-	-	10.1	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	8.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	147	15	0	0	38	0	5	0	1	0
Future Vol, veh/h	0	0	147	15	0	0	38	0	5	0	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	160	16	0	0	41	0	5	0	1	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	86	88	1	166	86	3	1	0	0	5	0	0
Stage 1	1	1	-	85	85	-	-	-	-	-	-	-
Stage 2	85	87	-	81	1	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	900	802	1084	798	804	1081	1622	-	-	1616	-	-
Stage 1	1022	895	-	923	824	-	-	-	-	-	-	-
Stage 2	923	823	-	927	895	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	883	782	1084	667	784	1081	1622	-	-	1616	-	-
Mov Cap-2 Maneuver	883	782	-	667	784	-	-	-	-	-	-	-
Stage 1	996	895	-	900	803	-	-	-	-	-	-	-
Stage 2	900	802	-	790	895	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.9	10.5	6.4	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1622	-	-	1084	667	1616	-	-
HCM Lane V/C Ratio	0.025	-	-	0.147	0.024	-	-	-
HCM Control Delay (s)	7.3	0	-	8.9	10.5	0	-	-
HCM Lane LOS	A	A	-	A	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.1	0	-	-

Intersection	
Int Delay, s/veh	11.4

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	1	155	801	1	1	3	666	73	3	0	21	55	0	115
Future Vol, veh/h	1	155	801	1	1	3	666	73	3	0	21	55	0	115
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	125	-	0	-	-	-	75	-	0
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	168	871	1	1	3	724	79	3	0	23	60	0	125

Major/Minor	Major1				Major2				Minor1			Minor2		
Conflicting Flow All	724	803	0	0	872	872	0	0	1580	2021	436	1506	-	362
Stage 1	-	-	-	-	-	-	-	-	1210	1210	-	732	-	-
Stage 2	-	-	-	-	-	-	-	-	370	811	-	774	-	-
Critical Hdwy	6.44	4.14	-	-	6.44	4.14	-	-	7.54	6.54	6.94	7.54	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Follow-up Hdwy	2.52	2.22	-	-	2.52	2.22	-	-	3.52	4.02	3.32	3.52	-	3.32
Pot Cap-1 Maneuver	499	817	-	-	401	769	-	-	73	57	568	83	0	635
Stage 1	-	-	-	-	-	-	-	-	194	254	-	379	0	-
Stage 2	-	-	-	-	-	-	-	-	622	391	-	357	0	-
Platoon blocked, %			-	-			-	-						
Mov Cap-1 Maneuver	812	812	-	-	616	616	-	-	40	34	568	~ 54	-	635
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	40	34	-	~ 54	-	-
Stage 1	-	-	-	-	-	-	-	-	115	151	-	225	-	-
Stage 2	-	-	-	-	-	-	-	-	496	389	-	204	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4.3	0.1	24.1	98.6
HCM LOS			C	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	214	812	-	-	616	-	-	54	635
HCM Lane V/C Ratio	0.122	0.207	-	-	0.007	-	-	1.107	0.197
HCM Control Delay (s)	24.1	10.6	3.1	-	10.9	-	-	279.6	12.1
HCM Lane LOS	C	B	A	-	B	-	-	F	B
HCM 95th %tile Q(veh)	0.4	0.8	-	-	0	-	-	5.1	0.7

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	31	0	146	44	0	95
Future Vol, veh/h	31	0	146	44	0	95
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	34	0	159	48	0	103

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	286	183	0	0	207	0
Stage 1	183	-	-	-	-	-
Stage 2	103	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	704	859	-	-	1364	-
Stage 1	848	-	-	-	-	-
Stage 2	921	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	704	859	-	-	1364	-
Mov Cap-2 Maneuver	704	-	-	-	-	-
Stage 1	848	-	-	-	-	-
Stage 2	921	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	704	1364	-
HCM Lane V/C Ratio	-	-	0.048	-	-
HCM Control Delay (s)	-	-	10.4	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	82	10	0	0	132	0	14	0	3	0
Future Vol, veh/h	0	0	82	10	0	0	132	0	14	0	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	89	11	0	0	143	0	15	0	3	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	297	304	3	342	297	8	3	0	0	15	0	0
Stage 1	3	3	-	294	294	-	-	-	-	-	-	-
Stage 2	294	301	-	48	3	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	655	609	1081	612	615	1074	1619	-	-	1603	-	-
Stage 1	1020	893	-	714	670	-	-	-	-	-	-	-
Stage 2	714	665	-	965	893	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	610	555	1081	523	560	1074	1619	-	-	1603	-	-
Mov Cap-2 Maneuver	610	555	-	523	560	-	-	-	-	-	-	-
Stage 1	929	893	-	650	610	-	-	-	-	-	-	-
Stage 2	650	606	-	885	893	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.6	12	6.7	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1619	-	-	1081	523	1603	-	-
HCM Lane V/C Ratio	0.089	-	-	0.082	0.021	-	-	-
HCM Control Delay (s)	7.4	0	-	8.6	12	0	-	-
HCM Lane LOS	A	A	-	A	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	0.3	0.1	0	-	-

APPENDIX F

Turn Lane Warrant Assessment

Right Turn Lane Warrant Assessment

Two-Lane Highways

Based on NCHRP Report 279 / VDOT RDM Appendix F
"Intersection Channelization Guide"

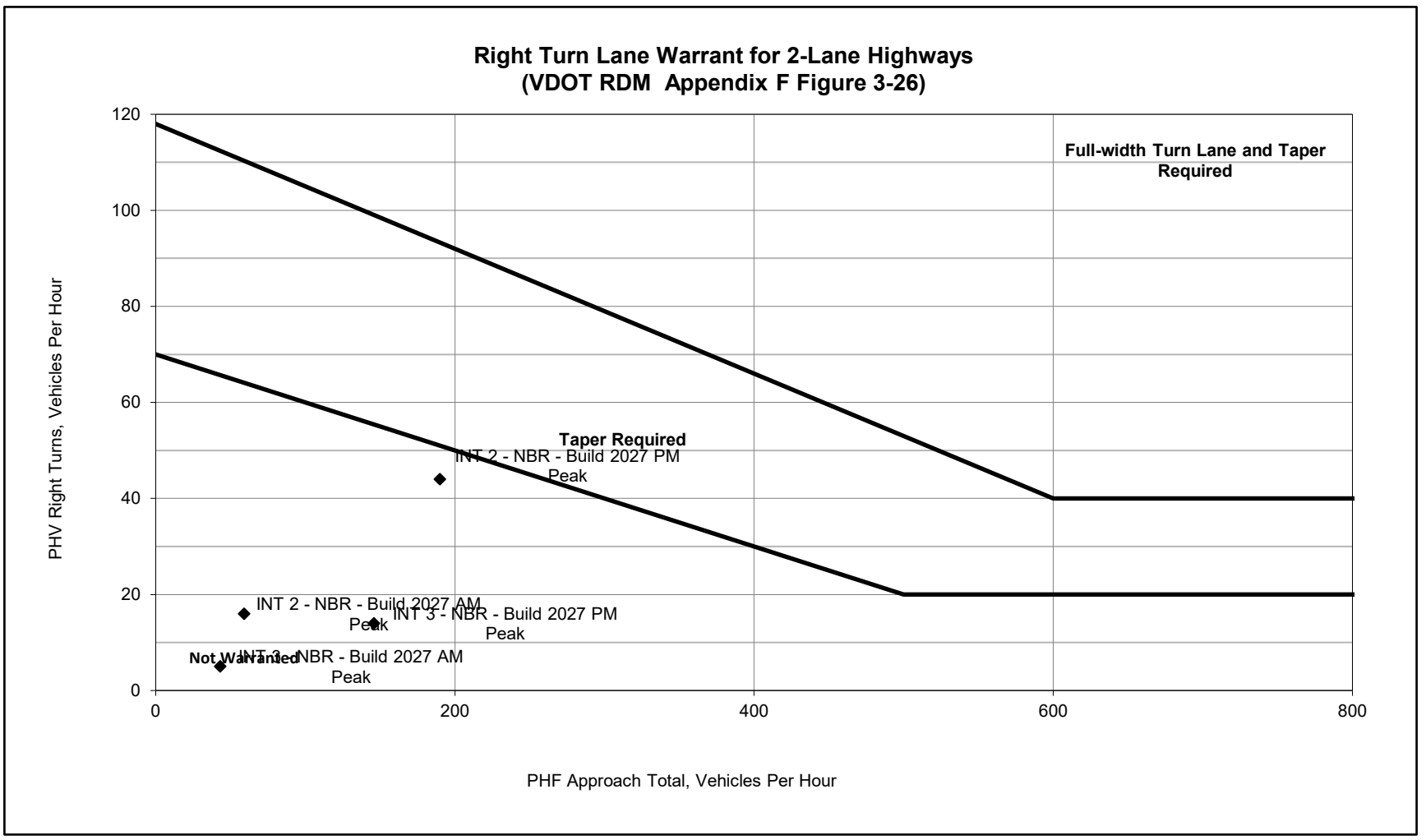
Background:

Warrants for right-turn storage lanes on two-lane highways at unsignalized intersections are based on Figure 3-26 in Appendix F of the Virginia Department of Transportation's (VDOT) ***Road Design Manual*** (RDM). This figure provides a graphical representation for determining the necessity of a right turn lane and / or taper by comparing the total volumes of a given approach with their respective right turn volumes.

Project Information:

Project:	
Project ID:	
Intersection(s) and Movement(s):	1 -
	2 - Houchins Road at South Site Driveway
	3 - Houchins Road at Crosscreek Drive / North Site Driveway
	4 -
	5 -
Scenario:	Build (2027) Conditions
Analyst:	Gorove Slade

Study Scenario	Approach Volume	Right Turn Volume	Minimum Right Turn Taper Threshold	Minimum Right Turn Full Lane Threshold	Treatment
INT 2 - NBR - Build 2027 AM Peak	59	16	64	110	Not Warranted
INT 2 - NBR - Build 2027 PM Peak	190	44	51	93	Not Warranted
INT 3 - NBR - Build 2027 AM Peak	43	5	66	112	Not Warranted
INT 3 - NBR - Build 2027 PM Peak	146	14	55	99	Not Warranted



APPENDIX G

VDOT Pre-Scope Form

THIS IS A NOT CHAPTER 870 STUDY

VDOT Virginia Department of Transportation	PRE-SCOPE OF WORK MEETING FORM Information on the Project Traffic Impact Analysis Base Assumptions

The applicant is responsible for entering the relevant information and submitting the form to VDOT and the locality no less than three (3) business days prior to the meeting. If a form is not received by this deadline, the scope of work meeting may be postponed.

Contact Information				
Consultant Name: Tele: E-mail:	Mike Bailey, P.E. – Gorove Slade Associates, Inc. 804-310-6040 mb@goroveslade.com			
Developer/Owner Name: Tele: E-mail:	John Neel – Foresight Design Services 1260 Radford Street Christiansburg, VA 24073			
Project Information				
Project Name:	Houchins Road Townhomes	Locality/County:	Montgomery County	
Project Location: (Attach regional and site specific location map)	See Figure 1			
Submission Type	Comp Plan ☐	REZ/SUP ☒	Site Plan ☐	Subd Plat ☐
Project Description: (Including details on the land use, acreage, phasing, access location, etc. Attach additional sheet if necessary)	The proposed development is planned to occupy two parcels of land, which can be identified on Montgomery County's Parcel Viewer with the Tax Map IDs 080-A46 and 080-A44 . The two parcels total approximately 26 acres and are both zoned as M-1 (Industrial Manufacturing) by Montgomery County. The proposed development plan includes the construction of 171 townhomes. The proposed site access includes two full-movement driveways on Houchins Road (Route 758).			
Proposed Use(s): (Check all that apply; attach additional pages as necessary)	Residential ☒	Commercial ☐	Mixed Use ☐	Other ☐
	Other Use(s) ITE LU Code(s): 215 (Single-Family Attached Housing) Square Ft or Other Variable: 171 d.u.		**Commercial Use(s)** ITE LU Code(s): n/a Square Ft or Other Variable: n/a	
Total Peak Hour Trip Projection:	Less than 100 ☒	100 – 499 ☐	500 – 999 ☐	1,000 or more ☐

Traffic Impact Analysis Assumptions

Study Period	Existing Year: 2023		Build-out Year: 2027		Design Year: 2027
Study Area Boundaries (Attach map)	North: See Figure 1			South:	
	West:			East:	
External Factors That Could Affect Project (Planned road improvements, other nearby developments)	TBD				
Consistency With Comprehensive Plan (Land use, transportation plan)	The Montgomery County Comprehensive Plan lists this area as an urban expansion area.				
Available Traffic Data (Historical, forecasts)	VDOT Historical AADT Data (2016-2021)				
Trip Distribution **(Please refer to attached Figure 2 in Supplement)**	Road Name: Roanoke Street (to/from the East) – 25%			Road Name:	
	Road Name: Roanoke Street (to/from the West) – 75%			Road Name:	
Annual Vehicle Trip Growth Rate:	1.0% / yr	Peak Period for Study (check all that apply)		☒ AM ☒ PM ☐ SAT	
		Peak Hour of the Adj. (to be used in study)			
Study Intersections and/or Road Segments (Attach additional sheets as necessary) **(Please refer to attached Figure 1.)**	1.	Roanoke Street (U.S. 11/U.S. 460 BUS) at Houchins Road / Bristol Drive		7.	
	2.	Houchins Road at Proposed Site Driveway		8.	
	3.	Houchins Road at Crosscreek Drive / Proposed Site Driveway		9.	
	4.			10.	
	5.			11.	
	6.			12.	
Trip Adjustment Factors	Internal allowance Reduction: ☐ Yes ☒ No			Pass-by allowance Reduction: ☐ Yes ☒ No	
Software Methodology	☒ Synchro ☐ HCS (v.2000/+) ☐ SIDRA ☐ CORSIM ☐ Other ____				

Traffic Signal Proposed or Affected (Analysis software to be used, progression speed, cycle length)	Existing traffic signals that could be affected: None Analysis Software: Synchro version 11 Results: HCM 6 Methodology (See Note 6) Queue Lengths to be Reported: 95th Percentile
Improvement(s) Assumed or to be Considered	TBD
Background Traffic Studies Considered	Walnut Creek Residential – 22 single-family detached, 145 townhomes
Plan Submission	☒ Master Development Plan (MDP) ☐ Generalized Development Plan (GDP) ☐ Preliminary/Sketch Plan ☐ Other Plan type (Final Site, Subd. Plan)
Additional Issues to be Addressed	☒ Queuing analysis ☐ Actuation/Coordination ☐ Weaving analysis ☐ Merge analysis ☐ Bike/Ped Accommodations ☒ Intersection(s) ☐ TDM Measures ☐ Other (_____)

NOTES on ASSUMPTIONS:

1. Traffic signal timings will be obtained from VDOT, if necessary.
2. The scenarios to be included in the study are Existing Conditions (2023), No-Build (2025), and Build (2025). The study will analyze the weekday AM and PM peak hours.
3. 2023 existing "baseline" condition counts will be collected at the study intersections.
4. Existing peak hour factors will be based on the traffic counts and utilized on a by-intersection basis. Peak hour factors by intersection in the range of 0.85 to 1.00 will be used for existing scenario. Peak hour factors of 0.92 will be used for all future scenarios if the existing peak hour factor by intersection is less than 0.92.
5. Heavy vehicle percentages (HV%) will be based on count data.
6. HCM 6 methodology will be utilized where applicable; HCM 2000 methodology will be utilized if HCM 6 methodology is not applicable.
7. Turn lane warrants will be assessed at the proposed site driveway(s).

Table 1: ITE Trip Generation (11th Edition)

Land Use	ITE Code	Size	Units	------ Weekday ------ AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total	Weekday Total
Single-Family Attached Housing	215	171	d.u.	21	62	83	58	41	99	1,254

Figure 1: Site Location and Study Intersections

Figure 2: Direction of Approach

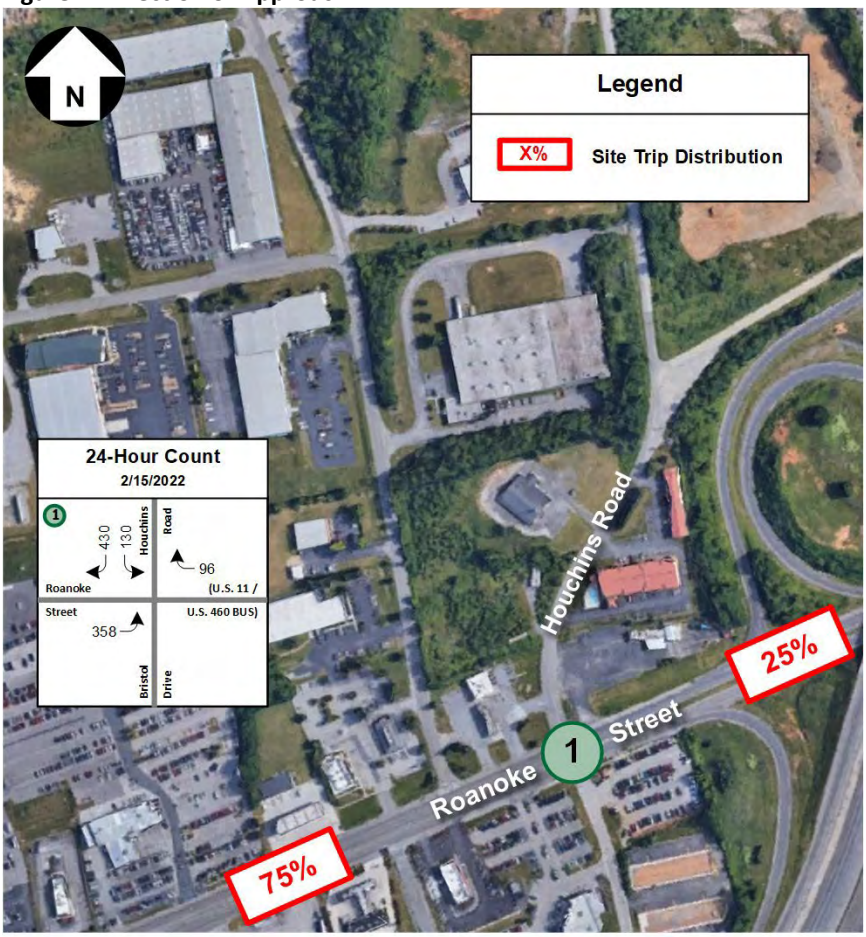


Figure 3: Proposed Site Plan

APPENDIX I: TRAFFIC IMPACT ANALYSIS SHEETZ COMPAIRSON

Table 1: Level-of-Service Summary for Roanoke Street at Houchins Road / Bristol Drive - Existing Conditions

Scenario	Intersection (Movement)	Effective Storage Length (ft.) [1]	AM Peak Hour			PM Peak Hour		
			LOS	Delay (sec/veh)	95th % Queue (ft.)	LOS	Delay (sec/veh)	95th % Queue (ft.)
			Synchro			Synchro		
Existing (2023) Conditions	**Roanoke Street (U.S. 11) [E/W] at Houchins Road / Bristol Drive [N/S] Overall Intersection (TWSC)**							
	Eastbound Approach							
	Eastbound U/Left	-	A	9.2	3	A	9.8	8
	Eastbound Thru/Right	-	-	-	-	-	-	-
	Westbound Approach							
	Westbound U/Left	125	A	9.8	0	B	10.9	0
	Westbound Thru	-	-	-	-	-	-	-
	Westbound Right	-	-	-	-	-	-	-
	Northbound Approach		***C***	***21.2***		***C***	***17.3***	
	Northbound Left/Thru/Right	-	C	21.2	3	C	17.3	8
	Southbound Approach		***C***	***18.2***		***D***	***32.1***	
	Southbound Left	75	D	31.0	18	F	63.8	40
	Southbound Right	-	B	10.8	8	B	11.2	8
Existing (2023) Conditions - *Without Sheetz*	**Roanoke Street (U.S. 11) [E/W] at Overall Intersection (TWSC)**							
	Eastbound Approach			***0.6***			***1.4***	
	Eastbound U/Left	-	A	9.1	3	A	9.6	5
	Eastbound Thru/Right	-	-	-	-	-	-	-
	Westbound Approach			***0.1***			***0.1***	
	Westbound U/Left	125	A	9.8	0	B	10.9	0
	Westbound Thru	-	-	-	-	-	-	-
	Westbound Right	-	-	-	-	-	-	-
	Northbound Approach		***C***	***19.5***		***C***	***16.2***	
	Northbound Left/Thru/Right	-	C	19.5	3	C	16.2	5
	Southbound Approach		***C***	***16.4***		***C***	***23.5***	
	Southbound Left	75	D	26.7	10	E	43.6	13
	Southbound Right	-	B	10.7	5	B	10.9	3

Table 2: Level-of-Service Summary for Roanoke Street at Houchins Road / Bristol Drive – No-Build Conditions

Scenario	Intersection (Movement)	Effective Storage Length (ft.) [1]	AM Peak Hour			PM Peak Hour		
			LOS	Delay (sec/veh)	95th % Queue (ft.)	LOS	Delay (sec/veh)	95th % Queue (ft.)
			Synchro			Synchro		
No-Build (2027) Conditions	**Roanoke Street (U.S. 11) [E/W] at Houchins Road / Bristol Drive [N/S] Overall Intersection (TWSC)**							
	Eastbound Approach							
	Eastbound U/Left	-	A	9.4	5	B	10.2	13
	Eastbound Thru/Right	-	-	-	-	-	-	-
	Westbound Approach							
	Westbound U/Left	125	A	10	0	B	10.9	0
	Westbound Thru	-	-	-	-	-	-	-
	Westbound Right	-	-	-	-	-	-	-
	Northbound Approach		***D***	***25.5***		***C***	***19.9***	
	Northbound Left/Thru/Right	-	D	25.5	3	C	19.9	8
	Southbound Approach		***C***	***21.6***		***F***	***50.4***	
	Southbound Left	75	E	43.3	38	F	122.8	75
	Southbound Right	-	B	11.5	15	B	11.6	13
No-Build (2027) Conditions - *Without Sheetz*	**Roanoke Street (U.S. 11) [E/W] at Houchins Road / Bristol Drive [N/S] Overall Intersection (TWSC)**							
	Eastbound Approach			***1***			***2.7***	
	Eastbound U/Left	-	A	9.2	3	A	9.9	10
	Eastbound Thru/Right	-	-	-	-	-	-	-
	Westbound Approach			***0.1***			***0.1***	
	Westbound U/Left	125	A	10	0	B	10.9	0
	Westbound Thru	-	-	-	-	-	-	-
	Westbound Right	-	-	-	-	-	-	-
	Northbound Approach		***C***	***23.2***		***C***	***18.2***	
	Northbound Left/Thru/Right	-	C	23.2	3	C	18.2	8
	Southbound Approach		***C***	***18.5***		***D***	***30.3***	
	Southbound Left	75	D	34.9	25	F	70.4	35
	Southbound Right	-	B	11.3	13	B	11.3	8

Table 3: Level-of-Service Summary for Roanoke Street at Houchins Road / Bristol Drive – No-Build Conditions

Scenario	Intersection (Movement)	Effective Storage Length (ft.) [1]	AM Peak Hour			PM Peak Hour		
			LOS	Delay (sec/veh)	95th % Queue (ft.)	LOS	Delay (sec/veh)	95th % Queue (ft.)
			Synchro			Synchro		
Build (2027) Conditions	**Roanoke Street (U.S. 11) [E/W] at Houchins Road / Bristol Drive [N/S] Overall Intersection (TWSC)**							
	Eastbound Approach							
	Eastbound U/Left	-	A	9.5	8	B	10.6	20
	Eastbound Thru/Right	-	-	-	-	-	-	-
	Westbound Approach							
	Westbound U/Left	125	A	10	0	B	10.9	0
	Westbound Thru	-	-	-	-	-	-	-
	Westbound Right	-	-	-	-	-	-	-
	Northbound Approach		***D***	***29.2***		***C***	***24.1***	
	Northbound Left/Thru/Right	-	D	29.2	3	C	24.1	10
	Southbound Approach		***D***	***25.5***		***F***	***98.6***	
	Southbound Left	75	F	57	60	F	279.6	128
	Southbound Right	-	B	12.2	25	B	12.1	18
Build (2027) Conditions - *Without Sheetz*	**Roanoke Street (U.S. 11) [E/W] at Houchins Road / Bristol Drive [N/S] Overall Intersection (TWSC)**							
	Eastbound Approach			***1.4***			***3.5***	
	Eastbound U/Left	-	A	9.3	5	B	10.2	15
	Eastbound Thru/Right	-	-	-	-	-	-	-
	Westbound Approach			***0.1***			***0.1***	
	Westbound U/Left	125	A	10	0	B	10.7	0
	Westbound Thru	-	-	-	-	-	-	-
	Westbound Right	-	-	-	-	-	-	-
	Northbound Approach		***D***	***26.1***		***C***	***20.1***	
	Northbound Left/Thru/Right	-	D	26.1	3	C	20.1	8
	Southbound Approach		***C***	***20.9***		***E***	***40***	
	Southbound Left	75	E	43.7	43	F	107.7	58
	Southbound Right	-	B	11.9	20	B	11.5	13