MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

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December 13, 2018

Christopher Conklin, P.E.
Deputy Director, Policy
Montgomery County Department of Transportation
Executive Office Building
101 Monroe Street, 10th Floor
Rockville MD 20850

Dear Mr. Conklin:

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is pleased to provide you with the final MD 586 Veirs Mill Road Bus Rapid Transit (BRT) Study Report. This report summarizes MDOT SHA's various efforts that culminated in the Montgomery County Council recommending Alternative 2.5: New BRT Service with Intersection Queue Jump.

Alternative 2.5 combines Alternative 2's lower-cost infrastructure improvements, such as queue jumps, with Alternative 3's enhanced BRT service patterns. This hybrid approach allows for near-term implementation of upgraded transit service while also allowing the County to continue to secure necessary rights-of-way for future dedicated-lane BRT service as described in the County's master plans.

Since the County Council's decision to recommend Alternative 2.5, MDOT SHA has committed itself to updating MDOT SHA's design guidance with an emphasized pedestrian focus, especially in urban areas such as central business districts. This updated urban design guidance, in line with the County's Vision Zero Action Plan, will approach pedestrian accommodations and safety in urban contexts differently than in suburban and rural areas. When the Montgomery County Department of Transportation (MCDOT) advances MD 586 BRT into design, MDOT SHA looks forward to partnering with the County and other stakeholders to refine Alternative 2.5 to reflect this updated approach.

Thank you again for MCDOT's partnership in developing the MD 586 Veirs Mill Road BRT Study. If you have additional questions or concerns, please contact Barry Kiedrowski, P.E., MDOT SHA Project Management Division Chief, at 410-545-8769, toll-free at 1-888-204-4828, or via email at bkiedrowski@mdot.state.md.us.

Sincerely,

C. Scott Pomento, P.E.
Director
Office of Planning and Preliminary Engineering

cc: Barry Kiedrowski, P.E., Chief, Project Management Division, MDOT SHA

MARYLAND DEPARTMENT OF TRANSPORTATION

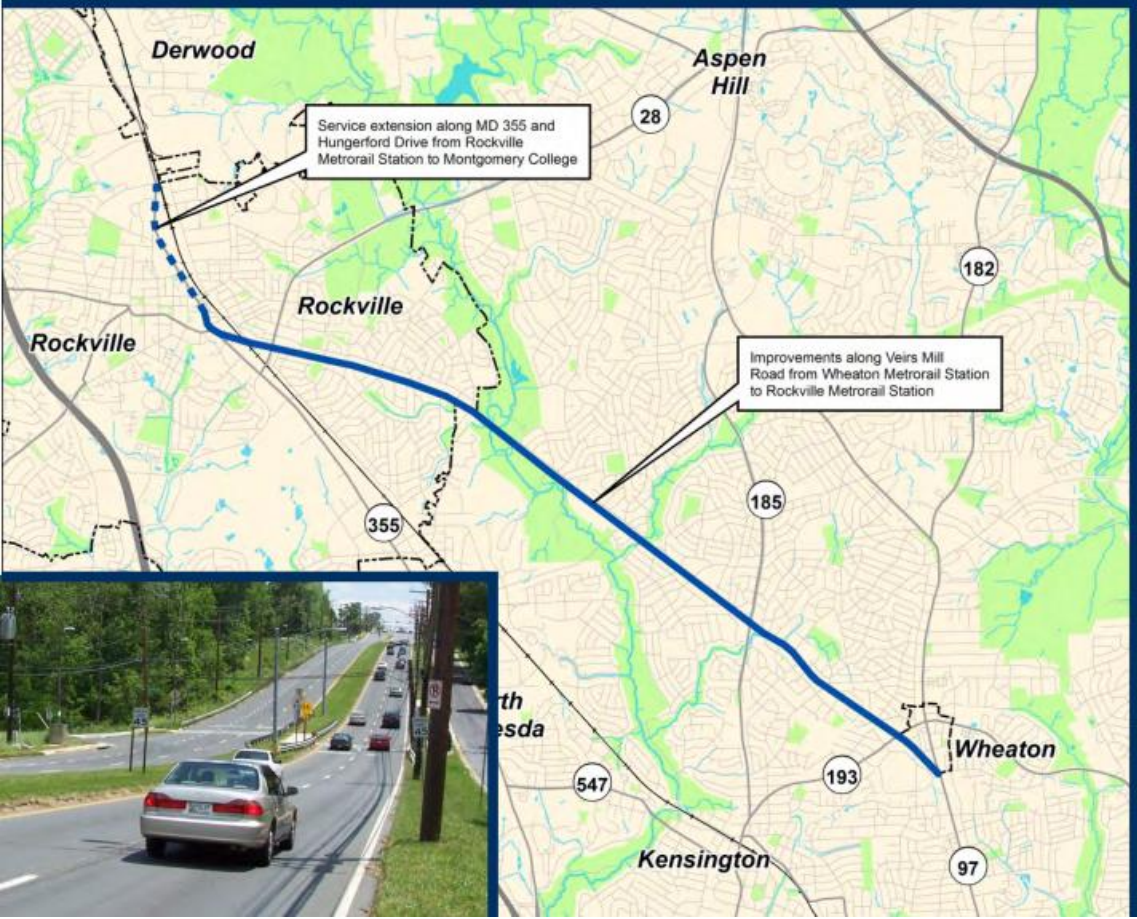
MCDOT
Montgomery County Department of Transportation

Montgomery County
RAPID TRANSIT
MD 586

FINAL Corridor Study Report

MD 586 / Veirs Mill Road Bus Rapid Transit Study

July 2018



EXECUTIVE SUMMARY

The proposed MD 586/Veirs Mill Road Bus Rapid Transit (BRT) Corridor Study extends approximately 6.4 miles from the Rockville Metrorail Station to the Wheaton Metrorail Station in Montgomery County, Maryland. This study also includes bus service improvements in mixed traffic along MD 355 from the Rockville Metrorail Station to Montgomery College, a distance of approximately 1.2 miles. The technical analyses for this study were completed by the Maryland Department of Transportation State Highway Administration (MDOT SHA) in close coordination with the Maryland Department of Transportation Maryland Transit Administration (MDOT MTA) and the Montgomery County Department of Transportation (MCDOT). The alternatives evaluation was originally presented in the Draft Corridor Study Report (CSR), which was published on September 6, 2016 and was open for public review and comment through October 14, 2016. This Final CSR documents the evaluation of alternatives and selection of a recommended alternative to provide new BRT service along MD 586/Veirs Mill Road.

BRT was identified as a potential solution for this transit-dependent area and congested corridor because it would increase transit reliability and opportunities for low-income and minority populations, as well as provide access to a larger supply of affordable housing. Additionally, enhanced transit access could play an integral role in revitalizing the adjacent neighborhoods, relieving congestion, supporting land conservation, and improving safety for bicyclists and pedestrians. It is expected that BRT improvements would increase the mobility, safety, and sustainability of the study corridor.

A federal lead agency has not been identified for this project as of the date of this CSR; however, federal funding may be required to implement the proposed improvements. Federal funding would require compliance with the National Environmental Policy Act (NEPA) and implementing regulations, as outlined in the Council of Environmental Quality (CEQ) 40 Code of Federal Regulations (CFR), Part 1500-1508. Anticipating that a federal funding source will be identified, the CSR that follows was written to inform future NEPA document(s) and implementing regulations.

PURPOSE AND NEED

The purpose of the MD 586/Veirs Mill Road BRT Corridor Study was to evaluate a new, higher-speed, higher-frequency, premium transit bus service along Veirs Mill Road between the Rockville Metrorail Station and the Wheaton Metrorail Station.

Transportation data, planned developments, and feedback from individual citizens and community groups was obtained during the project scoping to identify the following needs for the project:

1. **System Connectivity:** A high-quality, east-west transit connection is not currently available between the Rockville Metrorail Station and the Wheaton Metrorail Station.
2. **Mobility:** The Veirs Mill Road corridor is characterized by traffic congestion that hinders bus mobility (speed and reliability), resulting in unpredictable service and travel times.
3. **Transit Demand/Attractiveness:** The current transit service does not meet existing demand; this coupled with reliability issues (adherence to schedule, bus bunching, and

slow travel times), reduces serviceability for individuals who rely on public transit as their primary mode of transportation. In addition, issues associated with current bus service do not make buses attractive to individuals who have access to alternate modes of transportation.

4. **Livability:** Transit improvements are needed throughout the Veirs Mill Road corridor to create a more reliable, integrated and accessible transportation network that enhances choices for transportation users; provides easy access to affordable housing, employment, and other destinations; and promotes positive effects on the surrounding community.

ALTERNATIVES

Ten conceptual alternatives were developed for the study corridor by combining transit service options and runningway options. These conceptual alternatives were evaluated based on feasibility within the study corridor and expected right-of-way (ROW) and traffic impacts. Three build alternatives and the No-Build Alternative were retained for detailed study. MDOT SHA developed detailed alignments for each of the three retained build alternatives so that the costs and impacts of each alternative could be evaluated. Input from the public and key stakeholders, such as the City of Rockville, the Maryland-National Capital Park and Planning Commission (M-NCPPC), and the Washington Metropolitan Area Transit Authority (WMATA), was used to develop the alternatives. A detailed plan of each of the retained build alternatives, including the proposed limits of disturbance (LOD), is provided in **Appendix A**.

Alternative 1 – No-Build Alternative: Alternative 1 would not involve improvements to infrastructure or bus service along the Veirs Mill Road study corridor beyond those improvements already planned and programmed. The existing lane configurations and bus services would remain the same in the 2040 design year. The No-Build Alternative does not address the purpose and need for the project; however, it serves as a baseline for comparing the impacts and improvements associated with the build alternatives.

Alternative 2 – Transportation System Management (TSM) with Intersection Queue Jumps and Enhanced Bus Service: Alternative 2 would consist of minor infrastructure improvements at select intersections and the implementation of a limited-stop, enhanced bus service, similar to the proposed WMATA Q9 route. The minor infrastructure improvements would include enhanced bus stops with features such as shelters, real-time information, off-board fare collection, installation of transit signal priority (TSP), and widening for the installation of queue jumps. The proposed enhanced bus service would include 12-minute headways in the peak period and 15-minute headways in the off-peak period.

Alternative 3 – New Bus Rapid Transit Service in Dedicated Curb Lanes (where feasible): Alternative 3 would consist of widening or repurposing the existing travel lanes and shoulders along Veirs Mill Road to provide dedicated, curb-running bus lanes and a new BRT service. The dedicated lanes would be provided for the BRT service in areas where the improvements would result in minor ROW impacts and would improve bus service by increasing the travel speeds. The proposed BRT service would include six-minute headways in the peak period and ten-minute headways in the off-peak period.

Alternative 5B – New Bus Rapid Transit Service in the Median, via One Dedicated Bi-directional Lane or in Two Lanes (where feasible): Alternative 5B would implement new BRT service in a dedicated, bi-directional median lane or in two dedicated median lanes from MD 28 to Newport Mill Road. In the bi-directional median lane segments, BRT buses would operate in both directions in a single-lane operation. Eastbound and westbound vehicles would alternate when using the lane. Transit vehicles traveling in opposite directions would pass each other at stations where the bi-directional travel lanes would widen to two lanes. A two-lane, dedicated median section would be provided, where feasible. Generally, the dedicated lanes would be created by pavement widening to the outside and shifting the existing vehicular travel lanes out to allow the BRT to fit within the median. The number of existing travel lanes would be maintained. The proposed BRT service would include six-minute headways in the peak period and ten-minute headways in the off-peak period.

ALTERNATIVES COMPARISON

The 2040 transit and traffic modeling results showed that there are transit ridership and travel time benefits associated with all three build alternatives, as compared to the No-Build. For example, all three build alternatives would increase the transit ridership in the corridor and reduce transit travel time. However, the difference in transit travel times among the build alternatives was minor. The build alternatives would have a wide range of costs and property impacts. A comparative summary of transit and traffic operations, costs, and environmental impacts associated with the No-Build and three build alternatives is described below.

- The projected 2040 daily BRT boardings for the build alternatives would range from 2,600 to 7,300 passengers. The projected 2040 daily transit boardings in the corridor for the build alternatives would range from 33,400 to 35,300 passengers.
- In general, each of the build alternatives would improve travel times for cars and trucks traveling along MD 586, as compared to the No-Build while increasing delays for cars and trucks on side streets accessing MD 586.
- For the build alternatives, the number of miles of level of service (LOS) E or F along the corridor would range from 3.2 to 3.5 in the AM peak hour and from 3.8 to 4.2 in the PM peak hour, all of which are less than or equal to the No-Build distances of 3.5 miles in the AM peak hour and 5.8 miles in the PM peak hour.
- All three build alternatives would result in four or five intersections operating at LOS E or F in both the AM and PM peak hours.
- The cost to purchase the required ROW for the build alternatives would range from $6.2M to $35.4M and the amount of ROW required for the build alternatives would range from 0.7 acres to 6.7 acres.
- The cost of engineering and construction for the build alternatives would range from $23.2M to $236.9M and the total capital cost, including ROW and vehicles, would range from $34.8M to $288.8M.
- The annual operating costs of the build alternatives would range from $3.1M to $4.8M.

- The number of properties impacted by the build alternatives would range from 27 to 217. The number of residential relocations would range from four to 17 households and the number of business displacements would range from one to three. The residential relocations for Alternative 5B are presented as a range; the final locations of bus station locations would be determined following the identification of a recommended alternative.
- The number of public parks impacted by the build alternatives would range from one to five and the acreage would range from 0.2 acres to 1.6 acres.
- The number of public facilities impacted by the build alternatives would range from zero to three.
- The number of historic structures impacted by the build alternatives would range from zero to four. No archaeological sites would be impacted.
- The number of stream crossings impacted by the build alternatives would range from zero to ten. The 100-year floodplain impacts would range from zero to 0.3 acres. The wetland impacts would range from zero to less than 0.1 acres. The forest impacts would range from 0.8 acres to 3.1 acres. The Green Infrastructure impact would range from less than 0.1 acres to 1.7 acres.
- The transit provider would complete service equity and fare equity analyses no less than six months before the beginning of revenue operations that will indicate whether adverse impacts and/or benefits of BRT will be "equal" for EJ populations when compared to non-EJ populations.

ADDITIONAL ANALYSIS

On December 1, 2016, the results of the alternatives comparison were presented to the Transportation, Infrastructure, Energy, and Environment (T&E) Committee of the Montgomery County Council. The T&E Committee members were not in favor of Alternative 5B due to the high cost and lack of travel time benefit, as compared to the other build alternatives. The Committee was interested in understanding why the projected travel times for Alternatives 2 and 3 were similar to each other, despite the differences in dedicated lanes and infrastructure improvements included in each alternative. The Committee asked for additional analyses to determine how a new alternative would operate that combined the infrastructure improvements of Alternative 2 with the service improvements of Alternative 3. A description of this new alternative, Alternative 2.5 is provided below.

Alternative 2.5 – New BRT Service with Intersection Queue Jumps: In general, Alternative 2.5 would include the roadway improvements from Alternative 2 and the bus service improvements from Alternative 3. The minor roadway improvements would require widening for the installation of queue jumps at select intersections. Alternative 2.5 would use the same 12 station locations that were assumed for Alternatives 2 and 3 and new BRT stations would be constructed at each of the 12 station locations. **Appendix A4** provides detailed plans of the queue jump locations. The proposed BRT service would include six-minute headways in the peak period and ten-minute headways in the off-peak period.

Between December 2016 and May 2017, an additional traffic analysis was conducted for Alternative 2.5 and cost estimates were developed. Alternative 2.5 would incorporate the many of the same roadway improvements as Alternative 2; therefore, its footprint and environmental impacts would be similar to Alternative 2. Alternative 2.5 would incorporate the same transit service improvements as Alternative 3; therefore, the ridership forecast would be similar to Alternative 3. In summary, compared to Alternatives 2 and 3, the Alternative 2.5 metrics are as follows:

- **Daily BRT Boardings:** Provides 2.5 times more boardings than Alternative 2 and a similar number to Alternative 3.
- **Peak Hour Transit Person Travel Time Savings:** Provides a greater savings by serving more riders than Alternative 2. Provides slightly less savings in the eastbound direction and equal savings in the westbound direction than Alternative 3.
- **BRT Travel Times:** Provides slightly higher BRT travel times than Alternative 2 (except for along eastbound in the AM peak hour), due to higher ridership. Provides higher BRT travel times than Alternative 3 eastbound (up to two minutes) and equal BRT travel times in the westbound direction.
- **Cost:** Requires $44.3M more to design and construct than Alternative 2 and $68.8M less to design and construct than Alternative 3.

PUBLIC AND STAKEHOLDER INPUT

MCDOT has maintained and regularly updated the county BRT Project website to provide the public with information about the MD 586/ Veirs Mill Road BRT Corridor Study (https://www.montgomerycountymd.gov/brt/). Project newsletters and Public Open House/Workshops were also used to engage the public with the planning process in May 2012, November 2013, and September 2016.

Additionally, a Corridor Advisory Committee (CAC) was convened for the MD 586/Veirs Mill BRT Corridor Study. The CAC gives community residents and business owners/operators the opportunity to provide comments and make recommendations to the study team throughout the planning process. Nine CAC meetings were held between February 2015 and June 2017.

In addition to the ongoing stakeholder outreach that occurred during the development of the alternatives, stakeholder coordination meetings were held after the Draft CSR was published in September 2016 to understand the positions of key agency and municipal stakeholders. The project team met with staff from M-NCPPC, the City of Rockville, and WMATA to review the Draft CSR and discuss which alternative each stakeholder would like to see move forward as the recommended alternative. The Montgomery County Planning Board of M-NCPPC and the City of Rockville provided letters to the County Council expressing their preference for Alternative 3 and WMATA provided a letter to MDOT SHA also expressing their preference for Alternative 3 as the recommended alternative. Those letters are included in **Appendix F**.

RECOMMENDED ALTERNATIVE AND NEXT STEPS

On May 3, 2017, the T&E Committee voted to select Alternative 2.5 as their recommended alternative. On June 13, 2017, the County Council voted to adopt a resolution formally selecting Alternative 2.5 as their recommended alternative, with Alternative 3 retained as the master plan option. This recommendation was further documented by letter addressed to MDOT Secretary Pete Rahn, dated June 15, 2017, and signed by County Council President Roger Berliner (**Appendix G**). The County Executive concurrently selected Alternative 2.5 as the recommended alternative, with Alternative 3 retained as the master plan option, by letter dated July 10, 2017 (**Appendix G**).

Alternative 2.5 addresses the purpose and need for the project by providing high-quality BRT service with improved speed and reliability. Transit travel time will be reduced up to 13.2 minutes (33 percent) relative to the No-Build 2040 travel time. The $79.1M cost for Alternative 2.5 is less than the dedicated lane alternatives (3 and 5B), while the projected ridership is higher than Alternative 2. Retaining Alternative 3 as the master plan option acknowledges that dedicated curb lanes may be justified along MD 586 at some point in the future as traffic congestion and transit ridership continue to grow, and as Montgomery County builds the BRT network. It would also allow the County to require ROW dedication from developers to be consistent with the master plan recommendation, Alternative 3.

The next steps for the MD 586 BRT project include refining the recommended alternative by adjusting the station and queue jump locations to further maximize operations while reducing project costs and impacts. Station locations may be shifted from near-side to far-side and vice versa and queue jump locations may be refined based on how the BRT is expected to operate near each intersection. Further engineering refinements of Alternative 2.5 would include more detailed stormwater management design and minimizing utility and ROW impacts. Additional ridership modeling may also be performed to refine the projected ridership for Alternative 2.5.

There is not currently any funding available to advance the project. Once a funding source is identified, the appropriate environmental documentation should be completed for Alternative 2.5. Environmental documentation would include supplemental Section 106 coordination and impact analysis of natural features, and socio-economic factors such as potential impacts to communities, indirect and cumulative impacts, and additional related outreach. While this study did not complete detailed environmental impacts on Alternative 2.5, the analyses that were conducted on Alternatives 2 and 3 could be used as a starting point, depending on how soon the project moves into the environmental document phase. Additionally, the following detailed environmental analyses were not completed for Alternatives 2 and 3 and would need to be completed for Alternative 2.5 following the identification of a funding source: a detailed noise analysis, an air quality conformity determination, a Section 4(f) evaluation, and a wetland delineation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

TABLE OF ACRONYMS

ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
APE	Area of Potential Effect
ASTs	Aboveground Storage Tanks
BG&E	Baltimore Gas and Electric
BMPs	Best Management Practices
BRT	Bus Rapid Transit
CAA	Clean Air Act
CAC	Corridor Advisory Committee
CBD	Central Business District
CCT	Corridor Cities Transitway
CEA	Community Effects Assessment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CLRP	Constrained Long-Range Plan
COMAR	Code of Maryland Regulations
CSR	Corridor Study Report
dB(A)	A-weighted Decibel
DHHS	Department of Health and Human Services
DY	Design-Year
EA	Environmental Assessment
EJ	Environmental Justice
EO	Executive Order
EPA	Environmental Protection Agency
ESCP	Erosion and Sediment Control Plan
FCA	Forest Conservation Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration

FIDS	Forest Interior Dwelling Species
FTA	Federal Transit Administration
FY	Fiscal Year
GGRA	Greenhouse Gas Emission Reduction Act
GHG	Greenhouse Gas
GIS	Geographic Information System
HIAs	High Incidence Areas
ICE	Indirect and Cumulative Effects
ISA	Initial Site Assessment
JCA	Jewish Council for the Aging
LEP	Limited English Proficiency
LF	Linear Feet
LOD	Limits of Disturbance
LOS	Level of Service
MCCC	Maryland Climate Change Commission
MCDOT	Montgomery County Department of Transportation
MCFRS	Montgomery County Fire and Rescue Services
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MDOT	Maryland Department of Transportation
MDOT SHA	Maryland Department of Transportation State Highway Administration
MDOT MTA	Maryland Department of Transportation Maryland Transit Administration
MGS	Maryland Geological Survey
MHT	Maryland Historical Trust
M-NCPPC	Maryland-National Capital Park and Planning Commission
MOT	Maintenance of Traffic
MSATs	Mobile Source Air Toxics
MUTCD	Manual on Uniform Traffic Control Devices
MWCOG	Metropolitan Washington Council of Governments
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria

NEPA	National Environmental Policy Act
NETR	Natural Environmental Technical Report
NHPA	National Historic Preservation Act
NLEB	Northern long-eared bat
NRHP	National Register of Historic Places
NSAs	Noise Sensitive Areas
OTP	On-Time Performance
PCBs	Polychlorinated Biphenyls
PEPCO	Potomac Electric Power Company
PFA	Priority Funding Areas
PPM	Parts Per Million
PRD	Project Review Department
PRSA	Pedestrian Road Safety Audit
RECs	recognized environmental concerns
ROW	Right-of-way
RTE	Rare, threatened, or endangered
SF	Square Feet
SHPO	State Historical Preservation Officer
SIP	State Implementation Plan
T&E	Transportation, Infrastructure, Energy, and Environment
TIP	Transportation Improvement Program
TMP	Transportation Management Plan
TNM	Traffic Noise Model
TOD	Transit-Oriented Development
TPB	Transportation Planning Board
TSM	Transportation System Management
TSP	Transit Signal Priority
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service
USTs	Underground Storage Tanks

WHS	Wildlife & Heritage Service
WMATA	Washington Metropolitan Area Transit Authority
WRR	Watershed Resources Registry
WSSC	Washington Suburban Sanitary Commission

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I. INTRODUCTION AND BACKGROUND

The following Corridor Study Report (CSR) documents the evaluation of alternatives to provide new Bus Rapid Transit (BRT) service along MD 586 (Veirs Mill Road). This study has been completed by the Maryland Department of Transportation State Highway Administration (MDOT SHA) and the Maryland Department of Transportation Maryland Transit Administration (MDOT MTA), in cooperation with the Montgomery County Department of Transportation (MCDOT).

The MD 586/Veirs Mill Road BRT Corridor Study extends approximately 6.4 miles from the Rockville Metrorail Station to the Wheaton Metrorail Station in Montgomery County, Maryland (**Figure 1**). The area of potential impact extends approximately 100 feet from the edge of existing pavement and includes Veirs Mill Road, service roads, and adjacent properties, as represented by the blue line in **Figure 2**. This study also includes the extension of enhanced bus service from the Rockville Metrorail Station, north in mixed traffic along MD 355, an additional 1.2 miles to Montgomery College.

MDOT defines BRT as an integrated rapid transit system that combines the quality of rail with the flexibility of buses. It is a family of approaches that share common features or principles. BRT solutions range from BRT vehicles operating in general purpose travel lanes with preferential access and “queue jumping” at traffic signals, to full-fledged integrated systems operating in exclusive "runningways." Common BRT components or principles include the ability to:

- Move people as effectively as rail at a potentially lower initial capital cost;
- Utilize existing roadways, rights-of-way (ROW), and station sites;
- Take advantage of available technology (e.g., automatic vehicle location, passenger information, signal priority, and “Smart Card” type fare collection);
- Allow for incremental system development, based on demand and funding;
- Maximize operating flexibility; and
- Change the mindset for bus transit – from conventional bus fleet operations to state-of-the-art transit systems that are convenient, reliable, attractive, and comfortable.

BRT was identified as a solution for this transit-dependent and congested corridor because it would increase transit reliability and opportunities for low-income and minority populations, as well as provide access to a larger supply of affordable housing. Enhanced transit access could also play a role in revitalizing adjacent neighborhoods, relieving congestion, supporting land conservation, and improving safety for bicyclists and pedestrians.

A federal lead agency has not been identified for this project as of the date of this CSR; however, the project team acknowledges that federal funding may be required to implement the proposed improvements. The project may seek funding from the Federal Transit Administration (FTA) or Federal Highway Administration (FHWA). Federal funding would require compliance with the National Environmental Policy Act (NEPA) and implementing regulations, as outlined in the Council of Environmental Quality (CEQ) 40 Code of Federal Regulations (CFR), Part 1500-1508. Anticipating that a federal funding source will be identified, the CSR that follows was written to comply with NEPA and implementing regulations.

Figure 1: Project Location

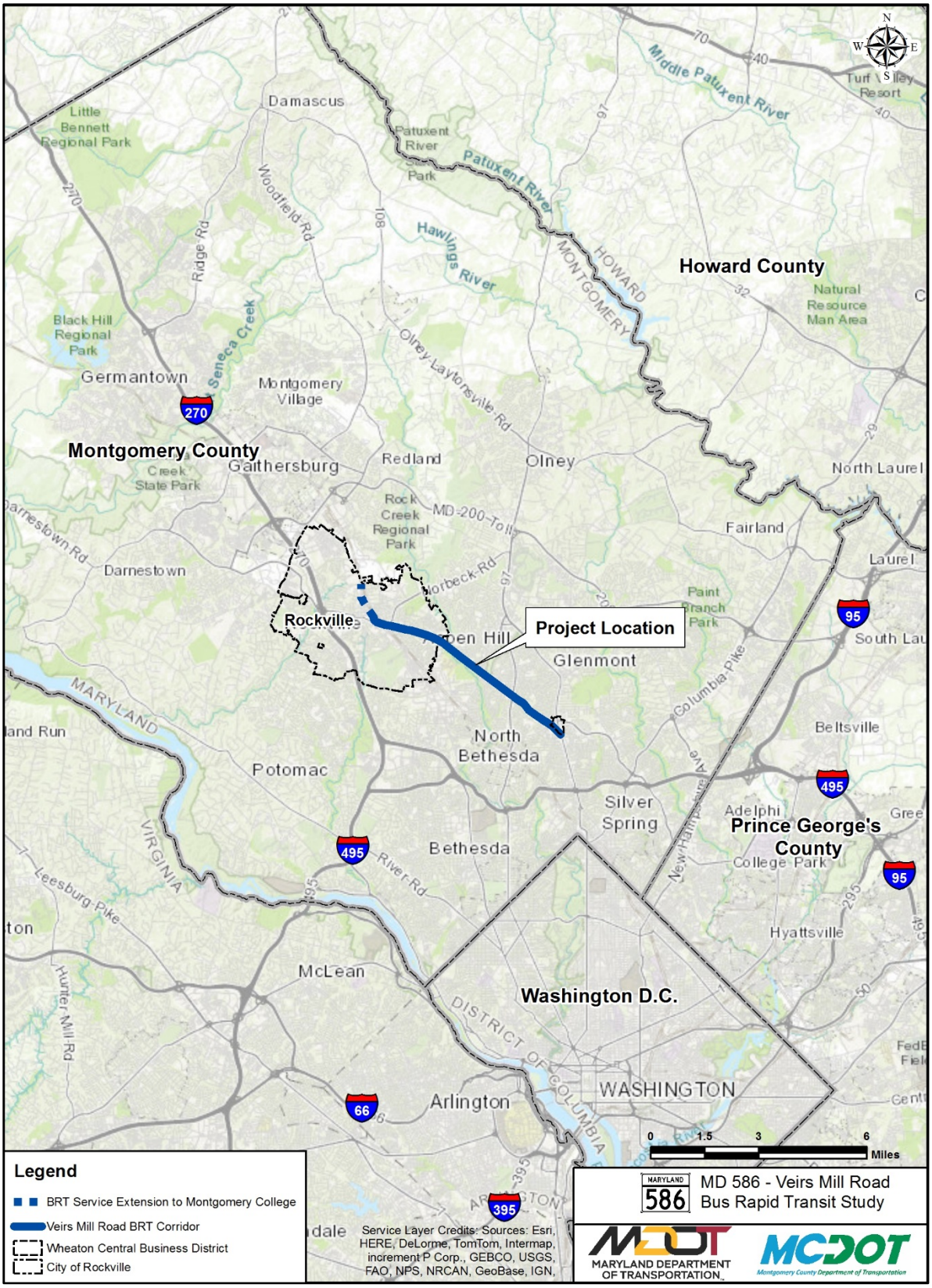
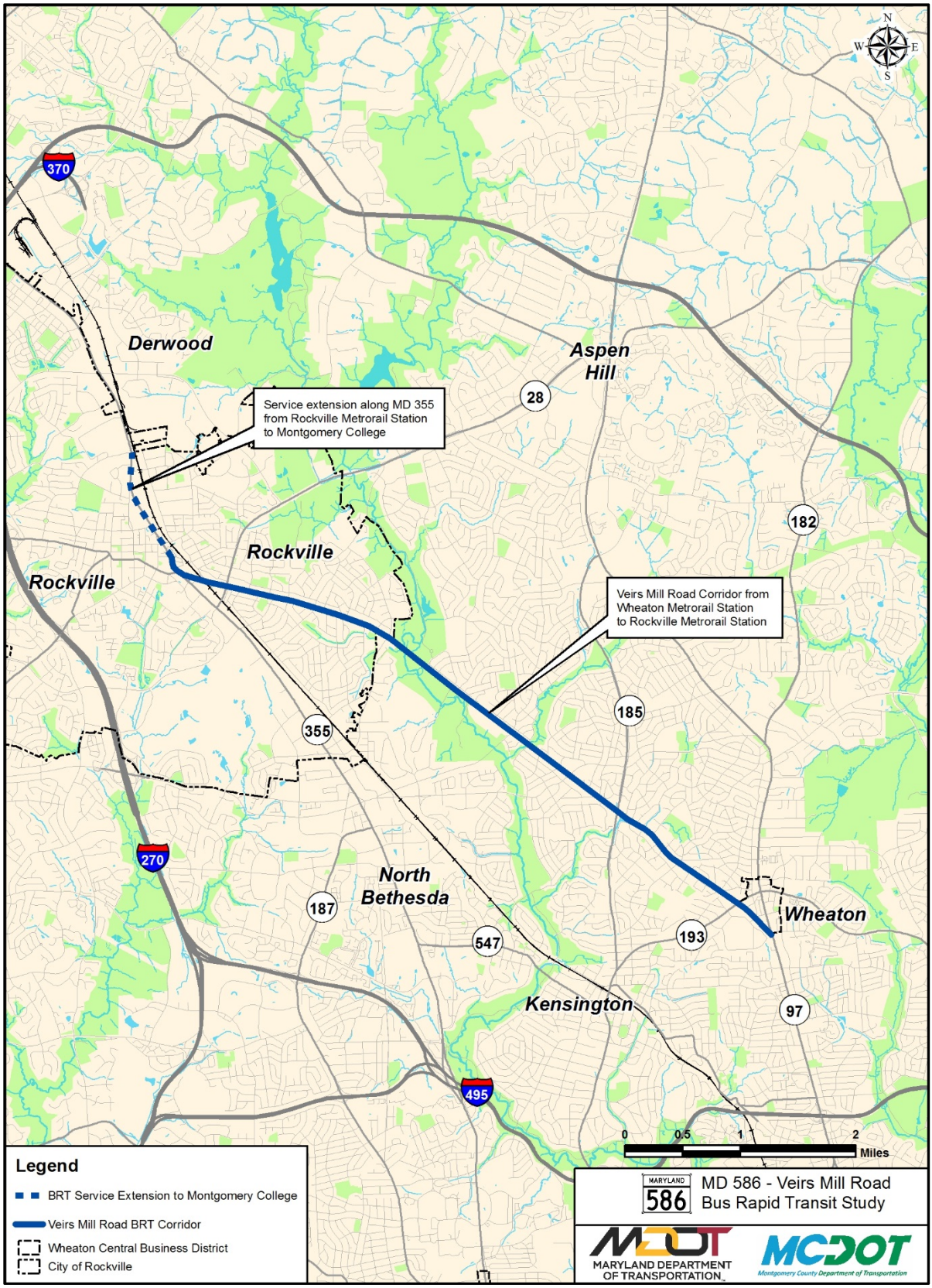


Figure 2: Study Corridor



A. Corridor Description

The existing Veirs Mill Road typical section varies with four-, five-, and six-lane lane segments. Some segments of Veirs Mill Road include shoulders and many segments include service roads that separate the main travel lanes from residential properties and parking. The service roads provide access control along Veirs Mill Road and allow on-street parking for the adjacent properties. The only parking on Veirs Mill Road is located within the Wheaton Central Business District (CBD). Although sidewalks are generally present throughout the study corridor (with a few exceptions), certain sections are less than five-feet wide and do not meet Americans with Disabilities Act (ADA) standards. A pedestrian bridge carries the Rock Creek Trail over Veirs Mill Road immediately west of Aspen Hill Road. A second pedestrian bridge crosses Veirs Mill Road at the Wheaton Metrorail Station. Marked crosswalks are located at 20 signalized intersections and at six of the 26 unsignalized intersections throughout the corridor. There are no striped bicycle lanes along Veirs Mill Road.

Land use proximal to the study corridor is characterized by medium and high-density housing with commercial areas concentrated in the City of Rockville and Twinbrook neighborhood area (the western end of the corridor) and in the Wheaton area (the eastern end of the corridor). These neighborhood areas have been the subject of on-going re-development activities aimed toward the creation of mixed-use and pedestrian-friendly environments. Current demographic data for households within a 0.5-mile radius of the study corridor indicate that 23.8 percent of residents currently use public transportation to get to work, and 48.2 percent of households have one or no vehicles; compared to 15.4 percent and 41.5 percent for the county (US Census Bureau, American Community Survey (ACS) 2013 five-year estimates). This CSR outlines detailed demographic and employment data within the defined Community Effect Analysis (CEA) area in Chapter V.A. As discussed in Chapter V., the percentage of the population defined as low-income is 9.8 percent, compared to the county percentage of 6.7 percent. These data indicate that many study corridor residents are transit users or transit dependent populations.

Montgomery County is home to many company headquarters and commerce centers because of its proximity to Washington, DC and the Baltimore Metropolitan Area, accessibility to transit, and the proliferation of federal, state, and health care services. One-hundred and eighteen (118) major companies (companies with more than 100 employees each) reside in Montgomery County.

B. Existing Transit Service and Traffic Overview

Veirs Mill Road is one of the most heavily used transit corridors in Montgomery County that does not have an existing parallel rail transit line. Local bus service along the Veirs Mill Road corridor is currently provided by the Washington Metropolitan Area Transit Authority (WMATA) Metrobus, with five bus routes serving approximately 12,900 boardings and alightings along Veirs Mill Road per day (2015 WMATA Metrobus weekday data). It is also served by Montgomery County's Ride On bus, with five bus routes serving approximately 5,200 passengers along Veirs Mill Road per day (per 2016 Montgomery County Ride On data). Veirs Mill Road carries 21,000 to 46,000 vehicles per day (2015 existing traffic volumes) within the 6.4-mile study corridor and is classified as an "Other Principal Arterial" by MDOT SHA. The

corridor experiences traffic congestion problems due to the high vehicular and transit volumes and limited roadway capacity. A detailed description of existing transit and traffic operations is provided in Chapter IV. A.

C. Prior Studies

BRT on MD 586/Veirs Mill Road has been the specific subject of numerous studies completed since 1999. BRT on MD 586/Veirs Mill Road was first studied and formally endorsed by Montgomery County and the City of Rockville in 1999, in conjunction with an application to become part of the FTA BRT Demonstration Program. In 2002, the County's *Go Montgomery!* program specifically adopted the MD 586/Veirs Mill Road BRT Corridor Study, which resulted in its incorporation into the County Council's 10-Year Transportation Plan.

The *WMATA Regional Bus Study – Final Report* (September 2003) recommended BRT on MD 586/ Veirs Mill Road as an organizational near-term priority, although the study intended to extend the limits farther on both ends of the corridor than currently proposed. Also in 2003, a cost/benefit study was completed to assess the degree to which BRT is likely to impact traffic flow on Veirs Mill Road. The study concluded that BRT service could provide time savings and increased reliability to transit users without increasing roadway congestion on existing transit routes.

In August 2005, MCDOT completed its *Veirs Mill Road Bus Rapid Transit Facility Planning – Phase 1 Report* that addressed project purpose and need, consideration of alternatives, costs and benefits, and public relations.

WMATA conducted the *Metrobus Q Line Study* in 2009, which identified key corridor issues requiring improvement: passenger crowding, bus bunching, poor schedule adherence, and long travel times. Subsequently, service improvements were implemented that included new routes along Veirs Mill Road, increased communication with bus drivers to help prevent bus bunching from roadway closures or other issues, greater parking enforcement, and enhanced bus driver training. The 2009 study also proposed implementation of the Q9 Service. WMATA proposed the Q9 Service at a public hearing in September 2015. Public opposition to truncating the Q lines at Wheaton and requiring riders to switch to Metrorail or another bus made WMATA re-evaluate the proposal. Ultimately, WMATA did not implement the service because of lack of funding.

In July 2011, MCDOT completed the *Countywide Bus Rapid Transit Study*. This study found that a BRT network could operate effectively and substantially increase transit use within the County. The study also promoted the Veirs Mill Road corridor as a suitable location for BRT services, provided an overview of the proposed route, described the route cross-section, and identified possible locations for BRT stations along the corridor. BRT along Veirs Mill Road could potentially serve the Rockville CBD, County and City offices, Westfield Wheaton Shopping Center, and the Wheaton CBD.

The *Report and Recommendations of the County Executive's Transit Task Force*, completed in May 2012, recommended that the Veirs Mill Road corridor from the Rockville Metrorail Station to the Wheaton Metrorail Station be included in the first of three phases for implementation of Countywide BRT service. The County Executive appointed a Transit Task Force, which included

community leaders, elected and appointed officials, and agency transportation and planning professionals.

The *Countywide Transit Corridors Functional Master Plan* was adopted by the Maryland-National Capital Park and Planning Commission (M-NCPPC) on December 18, 2013. The Master Plan contains recommendations for 11 BRT corridors in the County, including the Veirs Mill Road corridor. The Master Plan recommends "one or more dedicated lanes between the Rockville and Wheaton Metrorail Stations, where feasible" for the Veirs Mill Road corridor.

The plan provides more detail on the recommendation, as follows:

- A maximum of one additional transit lane from MD 355 to Twinbrook Parkway
- A maximum of two additional transit lanes from Twinbrook Parkway to Parkland Drive
- A maximum of one additional transit lane from Parkland Drive to the Wheaton Metrorail Station

The recommendation of one additional transit lane for the portion of the project in the City of Rockville would be consistent with the current *Twinbrook Neighborhood Plan* (2009), as long as improvements are made within the existing ROW and do not increase the roadway capacity for throughput (neighborhood cut-through) traffic.

II. PURPOSE AND NEED

Following the identification of a recommended alternative, this project may seek federal funding from the FTA or FHWA; therefore, this CSR follows the typical outline of a NEPA study.

A. PURPOSE OF THE PROJECT

The purpose of the MD 586/Veirs Mill Road BRT Corridor Study is to provide new higher-speed, higher-frequency, premium transit bus service along Veirs Mill Road between the Rockville Metrorail Station and the Wheaton Metrorail Station.

B. NEED FOR THE PROJECT

The study team reviewed transportation data, planned developments, and the feedback from individual citizens and community groups that was obtained during the project scoping to identify the following specific needs for the project: system connectivity, mobility, transit demand/attractiveness, and livability.

1. **System Connectivity:** A higher-quality, east-west transit connection is not currently available between the Rockville Metrorail Station and the Wheaton Metrorail Station. Although both stations are served by the Metrorail Red Line, they are near opposite ends of the rail corridor, and the average Red Line travel time between the two stations is 59 minutes. The study corridor, which carries 21,000 to 46,000 vehicles per day (2015 existing traffic volumes) is one of the most heavily traveled and congested roadway segments with parallel WMATA Q Metrobus Line service. During AM and PM peak periods, the average Q Line scheduled travel time between the two stations ranges from 26 to 35 minutes.

2. **Mobility:** The Veirs Mill Road corridor between the Rockville and Wheaton Metrorail stations is characterized by traffic congestion that hinders bus mobility and results in unpredictable service and travel times. This congestion frequently causes Metrobus and Montgomery County Ride On bus service along Veirs Mill Road to fall behind schedule.

   The high vehicular traffic volumes cause congestion that disrupts bus schedules. The number of intersections that are expected to fail in the AM and PM peak periods due to excessive delay is anticipated to increase from three intersections in 2015 to five intersections in 2040 without any improvements. The combination of traffic congestion along MD 586/Veirs Mill Road and delay at the signalized intersections causes delays in bus arrivals by as much as 15 minutes. Scheduled peak-hour average bus travel times between the Rockville Metrorail Station and Wheaton Metrorail Station range from 28 to 30 minutes; however, observed travel times for this trip are 35 to 40 minutes. Bus travel times are projected to increase to between 35 and 45 minutes by 2040. By comparison, observed average automobile travel times range from 16 to 19 minutes, and are projected to increase to between 21 and 35 minutes by 2040.

   Additionally, passenger on and off-loading can result in delays in on-time performance that eventually cause buses to bunch together and arrive in rapid succession followed by long periods without buses. Curb-height boarding and onboard fare collection may be sources of delay because each passenger must step up and pay as they board the

bus. This increases the dwell time for buses at each stop. A combination of offboard fare collection, that would enable passengers to purchase fares on the station platform while they wait for the bus, and level boarding would reduce overall dwell times at bus stops. Longer wait times cause a greater number of passengers to gather at bus stops, and on-time performance is adversely affected by the increased time required for passengers to board the buses once they arrive at those stops.

3. **Transit Demand/Attractiveness:** Transit demand and ridership in the Veirs Mill Road corridor continue to grow. Local bus service along the Veirs Mill Road corridor is currently provided by the WMATA Metrobus, with five bus routes serving approximately 12,900 boardings and alightings along Veirs Mill Road per day (2015 WMATA Metrobus weekday data), and Montgomery County's Ride On bus, with five bus routes serving approximately 5,200 passengers along Veirs Mill Road per day (per 2016 Montgomery County Ride On data). Currently, approximately 4,400 rail passengers use the Rockville Metrorail Station and 4,200 rail passengers use the Wheaton Metrorail Station to board the Red Line on a typical weekday (2015 WMATA Metrorail data). Proposed Transit-Oriented Development (TOD) at stations would increase the number of potential transit commuters who live within walking distance of the stations. High-density TOD constructed or planned in the vicinity of Rockville and Wheaton Metrorail Stations includes:

    - Rockville Town Center (Phase I) – Construction was completed in 2007. This mixed-use development included the addition of 7,000 square feet (SF) of retail restaurant space, 5,000 SF of bank with drive-through, and 12,000 SF of office space on the second floor.
    - Rockville Town Center (Phase II) – Construction ongoing. Upon completion, this 12.5-acre mixed-use development would include 275 condominiums/ apartments, 6,000 SF of street level commercial properties, and office space.
    - Metro Pointe at Wheaton Station – Construction was completed 2008. This mixed-use development included the addition of 173 residential units and 3,500 SF of retail space.
    - Georgia Crossing – Construction completed 2009. This development includes no residential units, but includes 32,000 SF of low-rise retail and office space.

    An ongoing partnership among Montgomery County, WMATA, and M-NCPPC is guiding the planned development of an additional 11.7 acres within a 1,200-foot radius of the Wheaton Metrorail Station.

    According to the most recent WMATA Capital Needs Inventory (2011 – 2020), transit ridership is expected to increase over the next 20 to 30 years, and the Metrorail System will experience demand approaching its design capacity. More transit users will shift to other modes of transportation, including buses. As bus ridership increases, bus crowding will also increase in the Veirs Mill Road corridor.

    The growing demand for transit in the region, coupled with the reliability issues (adherence to schedule, bus bunching, and slow travel times), reduces serviceability for individuals who rely on public transit as their primary mode of transportation. Within a

0.5-mile radius of the study corridor, 23.8 percent of residents currently use public transportation to get to work, and 48.2 percent of households have one or no vehicles; compared to 15.4 percent and 41.5 percent for the county (US Census Bureau, ACS 2013 five-year estimates). In addition, issues associated with current bus service do not make buses attractive to individuals who have access to alternate modes of transportation. Higher-quality transit service that offers improved comfort and convenience is needed to attract these potential new riders from other modes.

4. **Livability:** Transit improvements are needed throughout the Veirs Mill Road corridor in order to create a more reliable, integrated and accessible transportation network that enhance choices for transportation users; provide easy access to affordable housing, employment, and other destinations; and promote positive effects on the surrounding community.

C. Related Initiatives

1. Montgomery County BRT Initiatives

The *Countywide Transit Corridors Functional Master Plan* (M-NCPPC, December 18, 2013) recommended BRT facilities along 11 corridors, traversing 102 miles throughout the county. The proposed BRT service would move more people to and from jobs, homes, shopping, and entertainment areas in urbanizing parts of the county, while making more efficient use of our public ROW and existing pavement. Veirs Mill Road is one of the corridors recommended for improvements in the *Countywide Transit Corridors Functional Master Plan.*

Countywide BRT Goals and Objectives: In 2015, Montgomery County developed a list of goals and objectives (**Table 1**) to guide the development and implementation of the county-wide BRT system, including the MD 586, MD 355, and US 29 BRT corridors. These goals and measurable objectives provide a consistent framework for development of the entire system from the project planning phase for each corridor through the opening of service and ongoing operations. They also assist in the development of measures of effectiveness appropriate to each phase of the BRT system development and deployment. For the MD 586 corridor, the goals and objectives were used to develop the selection criteria outlined in the Alternatives Comparison Matrix (Chapter III, **Table 12**).

MD 355 Bus Rapid Transit Study: This study is evaluating roadway improvements to implement Montgomery County's BRT system between Bethesda and Clarksburg. The overall corridor is approximately 21-miles-long and alignments under study include MD 355 and Observation Drive north of Middlebrook Road. A total of 29 to 31 station locations are being evaluated depending on the alignment. This project is currently in the planning phase.

Table 1: Goals and Objectives

GOALS	OBJECTIVES
Improve Quality of Transit Service	Make bus trips faster
	Make door-to-door transit travel time competitive with door-to-door automobile travel time
	Increase transit ridership
Improve Mobility Opportunities and Choices	Serve as many travelers as possible
	Balance travel times for automobile and transit users
	Provide premium transit service convenient to households and jobs within the corridor
Develop Transit Services that Enhance Quality of Life and Safety	Minimize impacts to private property
	Engage public in process
Develop Transit Services that Support Master Planned Development	Increase trips by non-automobile modes to support development in the master plan
Support Sustainable and Cost-Effective Transportation Solutions	Maintain environmental quality
	Minimize cost of building and operating transportation services

Source: MCDOT LPA: Goals, Objectives, and Measures of Effectiveness.

US 29 Bus Rapid Transit Project: This project is for the implementation of BRT service and construction of BRT stations along US 29 from the Silver Spring Transit Center to the Burtonsville Park-and-Ride. The US 29 BRT project does not intersect with the MD 586 study corridor, but both projects are included in the *Countywide Transit Corridors Functional Master Plan*. The US 29 BRT project is currently in the design phase.

2. Other Transportation Studies and Projects

Corridor Cities Transitway (CCT): The CCT is a MDOT MTA-led, 15-mile-long BRT project in Montgomery County that would extend from the COMSAT facility near Clarksburg to the Shady Grove Metrorail Station. Phase I is the nine-mile portion of the project from the Metropolitan Grove MARC Station to the Shady Grove Metrorail Station. The 30 percent design was completed in Fall 2015 and the Environmental Assessment (EA) was released for public comment in Summer 2017. Phase I is being re-evaluated to lower the initial capital cost through a variety of cost reduction measures. These measures are intended to be short-term and will not preclude the full build out of the CCT at a later date. The remaining portion of the project, Phase II, would be developed as land use matures and additional transportation funding becomes available.

Purple Line Study: This MDOT MTA-led, 16-mile-long light rail transit line will run from Bethesda in Montgomery county, to New Carrolton in Prince George's county. In 2016, MDOT awarded a contract to a consortium of companies to design, build, and operate the line. Construction activities are underway, with an anticipated open to service date of 2022.

Montrose Parkway Extension: This MCDOT project would provide a new four-lane parkway that would intersect Veirs Mill Road at Gaynor Avenue. Construction is anticipated to begin in fiscal year (FY) 2021.

MD 586 Safety and Resurfacing Project: This MDOT SHA-led project involves safety and resurfacing improvements on MD 586 from the bridge over Rock Creek to Ferarra Avenue and from MD 193 to MD 97 for a total distance of 2.48 miles. The work will consist of the following: patching, grinding, and resurfacing the existing pavement; installing concrete bus pads; reconstructing pedestrian ramps and driveways to meet ADA standards; replacing damaged curbs, gutters, and sidewalks; removal of existing traffic barrier; installing new traffic barrier and traffic barrier end treatments; installing pavement markings, raised pavement markers, signs, and supports; and maintenance of traffic (MOT). Construction began Summer 2017 and is scheduled for completion this winter. The MD 586 Safety and Resurfacing Project improvements would be temporarily impacted by any of the proposed MD 586/Veirs Mill Road BRT build alternatives; however, impacted elements would be replaced in-kind as part of any construction activity.

Pedestrian Road Safety Audit (PRSA) Program: This MDOT SHA led program applies the FHWA's guidelines using a data-driven approach to identify safety issues along High Incidence Areas – areas identified as having the highest rates and severities of pedestrian-related crashes around the state. In 2010 Randolph Road between Selfridge Road and Colie Drive, including the segment of MD 586 between Gridley and the intersection with Randolph, was identified as an HIA. The PRSA Program identified two additional areas within the MD 586/Veirs Mill Road study corridor for further analysis: MD 586 Wheaton-Glenmont from Gridley Road to Claridge Road and MD 586 Wheaton Triangle between MD 193 and MD 97, and for which projects to mitigate high crash areas were developed. The PRSA Program Audit Teams, in conjunction with the MDOT SHA team members, developed recommendations for safety improvements for these corridors that address identified safety issues and implementation is ongoing. Coordination will continue as the MD 586/Veirs Mill Road BRT project is developed further to ensure that improvements recommended by the PRSA program are fully considered.

In January 2012, *Multimodal Coordination for Bus Priority Hot Spots – Task 2 Technical Memorandum: Development of Regional Hot Spots List* was prepared for the National Capital Region Transportation Planning Board. This study identified roadway segments with low-existing bus travel speeds and high volumes of buses, or "hot spots" around Washington, DC and the surrounding metropolitan area. The study identified the portion of MD 586 between Reedie Drive and the Wheaton Metrorail Station as a hot spot. A subsequent study recommended improvements that consisted of: 1) mid-block pedestrian signal on Reedie Drive at Triangle Lane, 2) protected left turn phase from Veirs Mill Road to Reedie Drive, 3) extension of the eastbound left turn lane on Veirs Mill to the Wheaton station bus loop, and 4) provision of new southbound bus stop on Georgia Avenue, south of Reedie Drive to better serve the adjacent Wheaton station.

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III. ALTERNATIVES

A. INITIAL ALTERNATIVES CONSIDERED

Including the No-Build, ten conceptual alternatives were developed for the study corridor. Transit service and runningway options were combined in order to develop the alternatives. The options considered were as follows:

Transit Service Options:

- No improvements to the existing bus services
- Providing enhanced bus service, similar to the Q9 limited-stop service proposed by WMATA
- Providing new BRT service

Runningway Options:

- Providing bus service in mixed traffic lanes
- Providing bus service in dedicated bus lanes
    - Providing the dedicated lane by repurposing the existing travel lanes
    - Providing the dedicated lane by widening to add new travel lanes
- Allowing the buses to operate in median-running lanes
- Allowing the buses to operate in curb-running lanes

The ten conceptual alternatives were defined as follows:

- **Alternative 1** – No-Build Alternative
- **Alternative 2** – Transportation System Management (TSM) with Intersection Queue Jumps and Enhanced Bus Service
- **Alternative 3** – Enhanced Bus Service in Dedicated, Curb Lanes (where feasible) (Note, that when Alternative 3 was selected to be retained for detailed study, the proposed service was changed from enhanced bus service to new BRT service.)
- **Alternative 4A** – New BRT Service in Dedicated Median Lanes (repurposing)
- **Alternative 4B** – New BRT Service in Dedicated Curb Lanes (repurposing)
- **Alternative 4C** – New BRT Service in Dedicated Median Lanes (widening)
- **Alternative 4D** – New BRT Service in Dedicated Curb Lanes (widening)
- **Alternative 5A** – New BRT Service in One Dedicated Reversible Lane, in Median
- **Alternative 5B** – New BRT Service in Dedicated Bi-directional Lane or in Two Lanes (where feasible), in Median
- **Alternative 6** – New BRT Service in Dedicated Curb Lanes (widening and repurposing)

The nine conceptual build alternatives were evaluated based on feasibility within the study corridor and expected ROW and traffic impacts. Engineering judgment and numerous discussions between MDOT and MCDOT were critical in the process of developing and evaluating the alternatives. Additionally, input from the appropriate local, environmental, and regulatory agencies and the public was used to select the alternatives retained for detailed study.

B. Alternatives Not Retained for Detailed Study

Alternatives that were not recommended for detailed study and the justification for not retaining them are described below.

Alternatives 4A and 4B – New BRT Service in Dedicated Lanes (repurposing): Alternatives 4A and 4B would consist of a new BRT service in dedicated lanes for the entire length of the study corridor. The dedicated lanes would be in the median in Alternative 4A and along the curb in Alternative 4B. In both alternatives, the dedicated BRT lanes would be created by repurposing existing travel lanes and shoulders. No outside or median widening would be required in either Alternative 4A or 4B. New BRT stations would be constructed along the route and both alternatives would provide two additional transit lanes for the entire length of the project.

The preliminary traffic analysis indicated that repurposing existing travel lanes would have numerous negative vehicular operational consequences, a few of which are outlined below:

- Of the 23 intersections, ten during the AM peak and 11 during the PM peak would experience delays ranging from three to five minutes per vehicle. One intersection, MD 586/Twinbrook Pkwy, would experience more than five minutes of delay per vehicle during the PM peak period.
- The total system-wide delay would increase by approximately 80 percent during both AM and PM peak periods.
- Average vehicular speed of motorists in the study corridor would decrease by about 30 percent during both AM and PM peak periods.

A preliminary lane repurposing analysis was conducted to determine if the negative traffic operations created by Alternatives 4A and 4B would be offset by increased person throughput due to increased transit ridership. The methodology for the analysis was based on the technical guidance in the *Montgomery County Transit Lane Repurposing Study* (2015). The analysis evaluated the number of people that could be moving through the study corridor with Alternatives 4A and 4B to determine if the forecasted transit or BRT ridership would exceed the general purpose lane-person throughput. The repurposing analysis was completed for seven roadway segments along MD 586 to see if lane repurposing would be feasible along any of the segments.

The forecasted transit and BRT ridership for Alternatives 4A and 4B were assumed to be the same as the projections that were calculated for Alternative 4C, which are described below. The projections were assumed to be equal to Alternative 4C because like Alternative 4C, Alternatives 4A and 4B would provide a dedicated lane for the entire length of the study corridor. This equivalent runningway component could result in similar vehicle speeds and therefore, similar ridership. The passenger loads along each of the seven segments were calculated by assuming that 15 percent of the daily riders would be traveling during the AM peak hour; this percentage was based on existing ridership data from WMATA.

The general purpose lane-person throughput was derived from the intersection capacity-based traffic volumes from the Synchro model. The number of people travelling in a general purpose

lane was calculated by multiplying the traffic volume by a factor of 1.25, which represents the average vehicle occupancy.

The results of the lane repurposing analysis are presented in **Table 2** and show that the forecasted transit and BRT ridership does not exceed the general purpose lane-person throughput for any of the seven segments analyzed. In addition, it was determined that there are no major parallel roadways along MD 586 that could be used as easy traffic diversion routes.

Table 2: Lane Repurposing Analysis for Alternatives 4A and 4B

Roadway Segment	2040 Transit Ridership			2040 General Purpose Lane Person Throughput[1,4]
	BRT Ridership[1,2]	Local Bus Ridership[1,3]	Total Transit Ridership	
MD 355 to Twinbrook Parkway	800	600	1,400	1,800
Twinbrook Parkway to Aspen Hill Road	700	500	1,200	2,300
Aspen Hill Road to Parkland Drive	700	200	900	2,100
Parkland Drive to Randolph Road	800	200	1,000	2,000
Randolph Road to Ferrara Drive	800	500	1,300	1,900
Ferrara Drive to MD 185	800	500	1,300	2,000
MD 185 to MD 193	800	800	1,500	2,000

NOTES:

1. Estimated ridership and person throughput has been rounded to nearest 100.
2. "2040 BRT Ridership" is for the AM peak hour for both the eastbound and westbound directions.
3. "2040 Local Bus Ridership" is for the AM peak hour for both the eastbound and westbound directions.
4. "2040 General Purpose Lane Person Throughput" is derived from the intersection capacity-based person throughput for the AM peak hour for existing lane configurations and includes both east and westbound throughput.

Due to the negative operational consequences that would occur with repurposing a lane for the entire length of the study corridor and the results of the lane repurposing analysis, Alternatives 4A and 4B were not retained for detailed study.

Alternative 4C – New BRT Service in Dedicated Median Lanes (widening): Alternative 4C would consist of implementing a new BRT service in dedicated median lanes for the entire length of the study corridor. The dedicated BRT lanes would be created by widening along the outside and shifting the existing travel lanes to allow the BRT to fit in the median; therefore, the number of travel lanes would be maintained. New BRT stations would be constructed along the BRT route, and passengers would access the median stations by using the crosswalks at the signalized intersections. Alternative 4C would provide two additional transit lanes for the entire length of the project.

Compared to the other conceptual alternatives, Alternative 4C would provide the highest level of transit service. At MDOT's request, the Metropolitan Washington Council of Governments (MWCOG) staff developed initial regional-level ridership forecasts for Alternative 4C. The initial forecast was undertaken to gauge the maximum potential BRT ridership in the study corridor, and MDOT conducted the additional post-processing. The model projected that there would be

approximately 9,100 daily BRT boardings in 2040 under Alternative 4C, of which approximately 4,600 would be new transit riders. It was assumed that the projected ridership for all other conceptual alternatives would be equal to or less than the projected Alternative 4C ridership.

However, the ROW impacts associated with the widening in Alternative 4C would result in nearly 100 displacements in the City of Rockville and more along the remainder of the study corridor. Therefore, even though the traffic impacts would be minimal, Alternative 4C was not retained for detailed study due to the anticipated high number of ROW impacts and displacements.

Alternative 4D – New BRT Service in Dedicated Curb Lanes (widening): Alternative 4D would consist of implementing a new BRT service in dedicated curb lanes for the entire length of the study corridor. The dedicated BRT lanes would be created by widening along the outside and into the existing median; therefore, the number of travel lanes would be maintained. New BRT stations would be constructed along the BRT route. Alternative 4D would provide two additional transit lanes for the entire length of the project.

The ROW impacts associated with the widening in Alternative 4D would result in nearly 100 displacements in the City of Rockville and more along the remainder of the study corridor. Therefore, even though the traffic impacts would be minimal, Alternative 4D was not retained for detailed study due to the anticipated high number of ROW impacts and displacements.

Alternative 5A – New BRT Service in One Dedicated Reversible Lane, in Median: Alternative 5A would consist of implementing a new BRT service in a dedicated, reversible median lane in the peak direction for the entire length of the study corridor. In the off-peak direction, BRT buses would travel in mixed traffic. The dedicated median lane would be created by widening to the outside and shifting existing lanes to allow the BRT to fit in the median; therefore, the number of travel lanes would be maintained. New BRT stations would be constructed along the route and passengers would access the median stations by using the crosswalks at the signalized intersections. Alternative 5A would provide an additional single transit lane for the entire length of the project.

The primary concern with Alternative 5A was that during half of the day new BRT buses would operate in mixed traffic just as the existing buses do today. This would result in no improvement to bus service in the off-peak direction. The second concern with Alternative 5A was the absence of a strongly defined peak direction along Veirs Mill Road. Traffic and ridership are nearly evenly split in both the eastbound and westbound directions in both the AM and PM peak periods. This unique characteristic about the service along Veirs Mill Road does not support a reversible system. Consequently, Alternative 5A was not retained for detailed study.

Alternative 6 – New BRT Service in Dedicated Curb Lanes (widening and repurposing): Alternative 6 would consist of implementing a new BRT service in a dedicated curb lane wherever feasible. The dedicated bus lane would be developed by repurposing the existing travel lanes and shoulders or by roadway widening. Wherever it is not feasible to provide a dedicated bus lane, buses would operate in mixed traffic. New BRT stations would be

constructed along the BRT route. Alternative 6, as defined, would extend two additional dedicated transit lanes through a portion of the study corridor.

Alternative 6 would be very similar to the modified Alternative 3, which was retained for detailed study. The primary difference between Alternatives 3 and 6 is that Alternative 6 would have more ROW impacts than Alternative 3. However, since the alignments for the alternatives were not developed when the alternatives to be retained for detailed study were selected, the actual differences in impacts between Alternatives 3 and 6 were not quantifiable. It was assumed that as Alternative 3 was developed in more detail, it would become a combination of conceptual Alternatives 3 and 6. Therefore, due to the similarities between Alternative 6 and the modified version of Alternative 3, and to prevent duplicate alternatives from being retained, Alternative 6 was not retained for detailed study.

C. Alternatives Retained for Detailed Study

Including the No-Build, four alternatives were retained for detailed study. The build alternatives were developed utilizing input from the appropriate environmental and regulatory agencies and the public. A detailed plan of each of the retained build alternatives, including the proposed limit of disturbance (LOD), is provided as **Appendix A**. The design criteria used in the development of the alternatives are presented in **Tables 3** and **4**.

Table 3: Minimum Roadway Design Criteria

Criteria	Alternative 2	Alternative 3	Alternative 5B
Design Speed	No Change - Match Existing (35-45 mph)	No Change – Match Existing (35-45 mph)	35 mph
Design Vehicle	Articulated Bus	Articulated Bus	Articulated Bus
Minimum BRT Lane Width (including gutter)	11’	11’	13’
General Purpose Lane Width (including gutter)	No Change – Match Existing (10-12 feet)	No Change – Match Existing (10-12 feet)	11’
Service Road with Parking Width (including gutter)	18’	18’	18’
Parking Lane Width	7’	7’	7’
Turning Lane Width	No Change – Match Existing (10-12 feet)	No Change – Match Existing (10-12 feet)	11’
Sidewalk Width	5’	5’	5’
Bicycle Lane Width	≤ 35 mph = 4’; >35 mph and ≤ 45 = 5’	≤ 35 mph = 4’; >35 mph and ≤ 45 = 5’	≤ 35 mph = 4’; >35 mph and ≤ 45 = 5’

Table 4: Station Design Criteria

Criteria	Side Station		Median Station	
	Absolute Minimum	Recommended Minimum	Absolute Minimum	Recommended Minimum
Platform Width	10’	10’	10’	12’
Platform Length	60’	120’	60’	120’
Platform Height	14”	14”	14”	14”

Alternative 5B would require complete reconstruction of the roadway to accommodate BRT in the median; therefore, a lower design speed and reduced general purpose lane widths were used to reduce the horizontal footprint of the alternative. The design speed and lane widths were not reduced for Alternatives 2 and 3 because the improvements associated with these alternatives would occur only along the outside of the existing roadway. The interior lanes and median would remain unchanged with Alternatives 2 and 3.

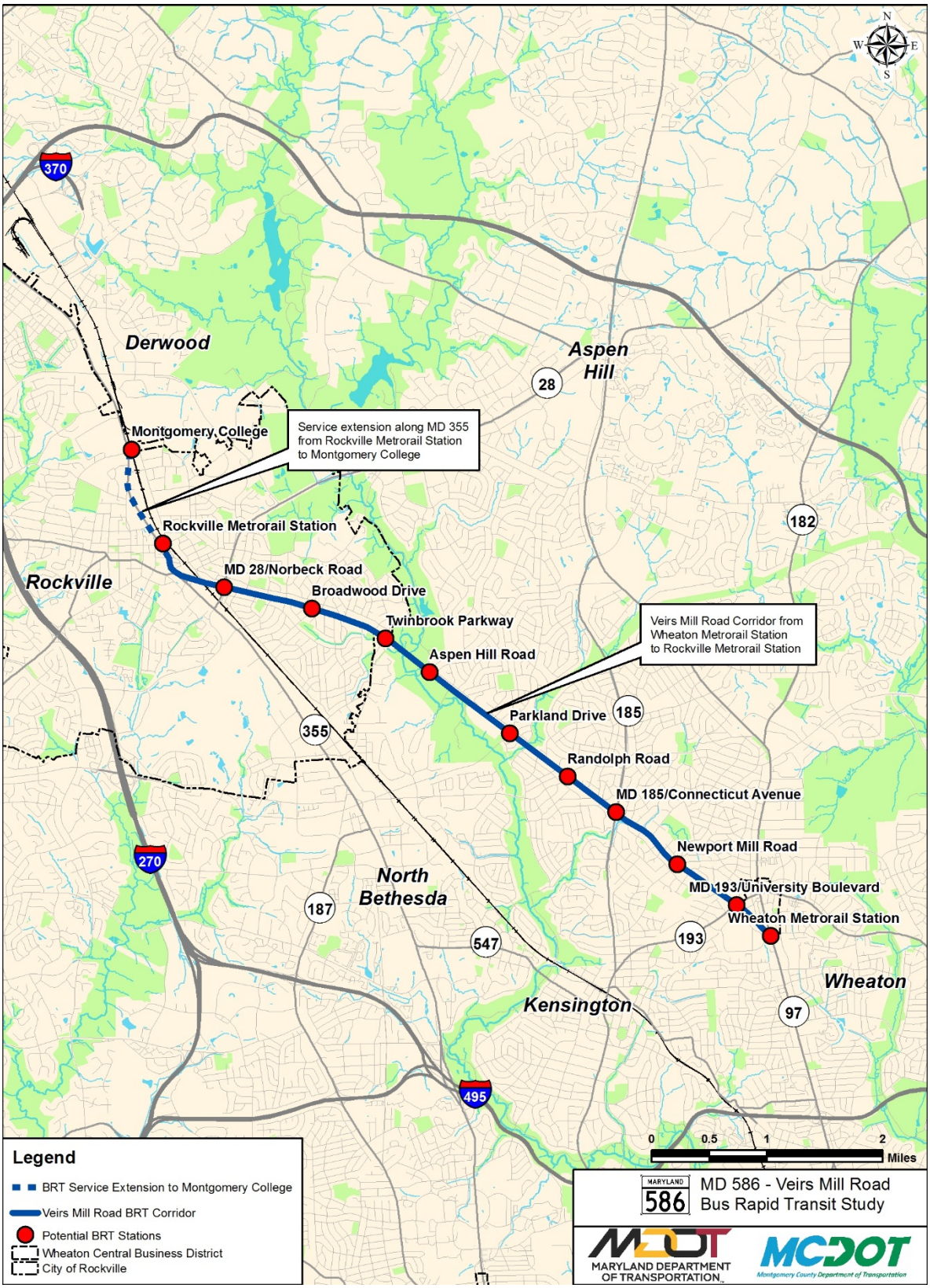
Each of the build alternatives would include marked bicycle lanes adjacent to sections of roadway widening to be consistent with the MDOT SHA *Bicycle Policy & Design Guidelines* (2015), so long as the bicycle lane did not directly result in a residential relocation or business displacement, except in the City of Rockville. Per the City of Rockville's request, no marked bicycle lanes were included within the City's limits in an effort to reduce the horizontal footprint of the alternatives. In the absence of marked bicycle lanes, the City would place signage along the service roads to designate that space for bicyclists. Sidewalks would be provided in each of the build alternatives wherever the roadway is being widened.

All three of the retained build alternatives assumed that bus stops or stations would be implemented at the eleven locations identified in the *Countywide Transit Corridors Functional Master Plan*, which was approved and adopted in December 2013. However, the final station locations could change as the project moves forward. Furthermore, after discussing the station locations with the City of Rockville, it was determined that if a build alternative is selected to move forward, a station would be added at Atlantic Avenue due to the existing high ridership at that intersection and the potential for future re-development at the Twinbrook Shopping Center. Further detailed study would be needed to determine how a station at Atlantic Avenue would impact the adjacent station locations, such as Twinbrook Parkway, Broadwood Drive, and MD 28. Therefore, for the purposes of this analysis, the station locations were assumed to match the *Countywide Transit Corridors Functional Master Plan*, with the assumption that future refinements to the recommended alternative should include a station at Atlantic Avenue. The Master Plan station locations, shown in **Figure 3**, include:

- Rockville Metrorail station (west entrance)
- MD 28/Norbeck Road
- Broadwood Drive
- Twinbrook Parkway
- Aspen Hill Road
- Parkland Drive
- Randolph Road
- MD 185/Connecticut Avenue
- Newport Mill Road
- MD 193/University Boulevard
- Wheaton Metrorail Station

For each of the retained build alternatives, the proposed bus service would extend 1.5 miles north of the Rockville Metrorail Station to Montgomery College. After stopping at the Rockville Station, every third bus would travel in mixed traffic along northbound MD 355 to South Campus Drive and stop at Montgomery College. The buses would then return to the Rockville Station by traveling in mixed traffic along southbound MD 355. The service to the college would be limited to 8 AM to 10 PM, compared to the Rockville to Wheaton Metrorail Station service which would operate from 6 AM on weekdays and 7 AM on weekends until 12 AM. In addition, service to the College would only be provided on days when classes are in session.

Figure 3: Potential Master Plan BRT Station Locations



The purpose of the service extension is to connect the proposed BRT service to Montgomery College for the commuter students that attend Montgomery College and is the result of feedback from the public during the planning process.

Technical memorandums for various disciplines, including transit and traffic operations, station layouts, stormwater management, and utilities were developed to document design considerations and impacts associated with each retained build alternative. These analyses were conducted as part of this study so a more accurate estimate of the associated costs and impacts of each alternative could be developed.

Alternative 1 – No-Build Alternative: Alternative 1 would not include improvements to infrastructure or bus service along the Veirs Mill Road study corridor beyond those improvements already planned and programmed, including those outlined in Chapter II.C. The existing lane configurations and bus services would remain the same in the 2040 design year. The No-Build Alternative would not address the purpose and need for the project; however, it serves as a baseline for comparing the impacts and improvements associated with the build alternatives.

Alternative 2 – Transportation System Management (TSM) with Intersection Queue Jumps and Enhanced Bus Service: Alternative 2 would consist of minor infrastructure improvements at select intersections and the implementation of an enhanced bus service, similar to the proposed WMATA Q9 limited-stop service. Minor infrastructure improvements could include enhanced bus stops with features such as shelters, real-time information, or off-board fare collection. Minor infrastructure improvements would also require widening for the installation of queue jumps at select intersections. **Appendix A1** provides detailed plans of the queue jumps.

The queue jump locations were selected using a traffic analysis to identify candidate intersections and an engineering feasibility analysis to refine the list of candidate intersections. The traffic analysis projected the delay and queue length at all signalized intersections along MD 586 to identify locations where queue jumps could be most effective. Those candidate intersections were then examined for general feasibility, such as the available ROW. The feasibility analysis identified additional intersections that were not identified in the traffic analysis, but could accommodate a queue jump without major impacts. The queue jump locations proposed with Alternative 2 include:

- Westbound at MD 28
- Eastbound at Edmonston Drive (west intersection)
- Eastbound at Atlantic Avenue
- Eastbound and westbound at Twinbrook Parkway
- Eastbound and westbound at Aspen Hill Road
- Eastbound and westbound at Parkland Drive
- Westbound at Gridley Road
- Westbound at Randolph Road
- Eastbound and westbound at MD 185
- Eastbound at MD 193

At each of the signalized intersections, transit signal priority (TSP) was considered for the buses providing the enhanced service. Various types of TSP such as “early green” and/or “extended

green" could be installed depending on the individual signal characteristics and the location of the bus stop relative to the intersection. Potential TSP treatments that could be included at each intersection are labeled on the Alternative 2 maps in **Appendix A1** and included in the *Traffic Operations Analysis Technical Report* (September 2016).

Buses would operate between the Wheaton Metrorail Station and the Rockville Metrorail Station with 12-minute headways in the peak period and 15-minute headways in the off-peak periods. Every third bus would continue from the Rockville Metrorail Station to Montgomery College, so the headways would be 36 minutes in the peak period and 45 minutes in the off-peak periods for the Montgomery College service extension. The span of service from the Wheaton Metrorail Station to the Rockville Metrorail Station would be from 6 AM to midnight, and the Rockville Metrorail Station to Montgomery College would be from 8 AM to 10 PM when classes are in session. **Table 5** summarizes the operating characteristics of Alternative 2.

Table 5: Alternative 2 Operating Characteristics

Bus Service	Frequency				Span of Service	
	Peak Period		Off-Peak Period			
	Wheaton to Rockville	Rockville to Montgomery College	Wheaton to Rockville	Rockville to Montgomery College	Wheaton to Rockville	Rockville to Montgomery College
Enhanced Bus Service – New Express Limited Stop Route (similar to proposed WMATA Q9 MetroExtra)	12 minutes	36 minutes	15 minutes	45 minutes	6 AM to midnight	8 AM to 10 PM

The enhanced bus service in Alternative 2 would stop at the following 12 locations:

- Montgomery College
- Rockville Metrorail station (west entrance)
- MD 28/Norbeck Road
- Broadwood Drive
- Twinbrook Parkway
- Aspen Hill Road
- Parkland Drive
- Randolph Road
- MD 185/Connecticut Avenue
- Newport Mill Road
- MD 193/University Boulevard
- Wheaton Metrorail Station

At each of the 12 stops, the existing bus stops would be upgraded to enhanced bus stops, which would be larger and have more amenities than a traditional bus stop. Potential amenities that could be included at each enhanced bus stop include: bus shelter, benches, real-time information, off-board fare collection, system maps, landscaping, and bicycle parking.

A stormwater management analysis and a utility impact analysis were conducted for the proposed improvements associated with Alternative 2 so those costs could be more accurately estimated.

Alternative 3 – New Bus Rapid Transit (BRT) Service in Dedicated (where feasible) Curb Lanes: Alternative 3 would consist of widening or repurposing the existing travel lanes and shoulders along Veirs Mill Road to provide dedicated, curb-running bus lanes, as well as the implementation of a new BRT service. The dedicated lanes would be provided for the BRT service in areas with minor impacts where doing so would improve bus service by increasing

the travel speeds. Only shoulders and short segments of travel lanes would be repurposed, which would leave nearly all of the existing lane configurations the same for general traffic. New BRT stations would be constructed at each of the 12 station locations in Alternative 3.

At each of the signalized intersections, TSP was considered for the buses providing the new BRT service. Various types of TSP such as "early green" and/or "extended green" could be installed depending on the individual signal characteristics and the location of the bus stop relative to the intersection. Potential TSP treatments that could be included at each intersection are labeled on the Alternative 3 maps in **Appendix A2** and included in the *Traffic Operations Analysis Technical Report* (September 2016).

The new BRT service would operate in the outside curb lane for the entire length of the project. For portions of the study corridor, the BRT would operate in dedicated "bus and right turn only" lanes. For the rest of the study corridor, the BRT would operate in mixed traffic. Dedicated "bus and right turn only" lanes are proposed along eastbound MD 586 from Midway Avenue to MD 193 and along westbound MD 586 from Kensington Boulevard to Clagett Drive. Dedicated lanes would be provided for 72 percent of the study corridor between the Wheaton and Rockville Metrorail Stations. **Table 6** provides a breakdown of where the BRT would operate in dedicated lanes and how those dedicated lanes would be developed.

Table 6: Alternative 3 Runningway

Direction	From	To	Lane Type	Method of Developing Dedicated Lane
Eastbound	Montgomery College	Midway Avenue	Mixed Traffic	N/A
	Midway Avenue	Bridge over Rock Creek	Dedicated curb	Repurpose existing curb lane
	Bridge over Rock Creek	Robindale Drive	Dedicated curb	Repurpose existing outside shoulder
	Robindale Drive	Gaynor Road	Dedicated curb	Repurpose existing curb lane
	Gaynor Road	MD 185	Dedicated curb	Widen to add a new lane
	MD 185	MD 193	Dedicated curb	Use existing bus and right turn only lane
	MD 193	Wheaton Metrorail Station	Mixed Traffic	N/A
Westbound	Wheaton Metrorail Station	Kensington Boulevard	Mixed Traffic	N/A
	Kensington Boulevard	Sherrie Lane	Dedicated curb	Use existing right turn lane
	Sherrie Lane	Pendleton Drive	Dedicated curb	Widen to add a new lane
	Pendleton Drive	Valleywood Drive	Dedicated curb	Repurpose existing curb lane
	Valleywood Drive	MD 185	Dedicated curb	Widen to add a new lane
	MD 185	Ferrara Avenue	Dedicated curb	Repurpose existing curb lane
	Ferrara Avenue	Havard Street	Dedicated curb	Widen to add a new lane
	Havard Street	Parkland Drive	Dedicated curb	Repurpose existing curb lane
	Parkland Drive	Bridge over Rock Creek	Dedicated curb	Repurpose existing outside shoulder

Direction	From	To	Lane Type	Method of Developing Dedicated Lane
	Bridge over Rock Creek	Meadow Hall Drive	Dedicated curb	Widen to add a new lane
	Meadow Hall Drive	Atlantic Avenue	Dedicated curb	Repurpose existing curb lane
	Atlantic Avenue	Clagett Drive	Dedicated curb	Widen to add a new lane
	Clagett Drive	Montgomery College	Mixed Traffic	N/A

Queue jumps would be provided in Alternative 3 along eastbound MD 586 at Edmonston Drive and along westbound MD 586 at MD 28. Alternative 3 would not otherwise include any physical infrastructure improvements at those locations.

All of the physical infrastructure improvements in Alternative 3 would occur along the outside of Veirs Mill Road. No changes or improvements would be made to the existing median or interior lanes.

All of the existing service roads along MD 586 that would be impacted by the proposed widening would be replaced in Alternative 3. In some cases, replacing the service roads would require ROW from the adjacent property owners. However, the service roads provide essential parking and access for those property owners, and many public comments were supportive of keeping the service roads.

In general, Alternative 3 would have minor traffic impacts because the improvements mostly consist of adding additional lanes as opposed to repurposing existing lanes. The dedicated bus curb lanes would also be used by vehicles turning right onto the numerous side streets and driveways. Although right-turning vehicles in this proposed dual-purpose transit and turn lane could impede the flow of buses, the lane could also improve traffic operations because the turning vehicles would be separated from the through traffic. Bicyclists who currently travel along the existing shoulder would have to travel in the repurposed travel lane. Refer to Chapter IV for the complete results of the traffic analysis for Alternative 3.

The proposed BRT service in Alternative 3 would operate between the Wheaton Metrorail Station and the Rockville Metrorail Station with six-minute headways in the AM and PM peak periods and ten-minute headways in the off-peak periods. Every third bus would continue from the Rockville Metrorail Station to Montgomery College, so the headways would be 18 minutes in the peak period and 30 minutes in the off-peak periods for the Montgomery College extension. The span of service from the Wheaton Metrorail Station to the Rockville Metrorail Station would extend from 6 AM to midnight. Between the Rockville Metrorail Station and Montgomery College, the service would operate from 8 AM to 10 PM when classes are in session. **Table 7** summarizes the operating characteristics of Alternative 3.

Table 7: Alternative 3 Operating Characteristics

Bus Service	Frequency				Span of Service	
	Peak		Off-Peak			
	Wheaton to Rockville	Rockville to Montgomery College	Wheaton to Rockville	Rockville to Montgomery College	Wheaton to Rockville	Rockville to Montgomery College
New BRT Service	6 minutes	18 minutes	10 minutes	30 minutes	6 AM to midnight	8 AM to 10 PM

The new BRT service in Alternative 3 would stop at 12 locations along the study corridor. New BRT stations would be constructed for use by the new BRT service at each of the 12 stops. Most of the BRT stations would be 120 feet long and able to accommodate two articulated buses or a mix of vehicle types. Smaller, 60-foot-long BRT stations that only accommodate one articulated bus are proposed at locations with limited ROW. The longer, 120-foot-long stations are preferred in Alternative 3 because the platforms would be used by both the BRT and local buses, so there is a high probability that more than one bus would be at the station at any given time. **Table 8** shows the station locations and the type of BRT station that is proposed at that location.

Table 8: Alternative 3 BRT Stations

Location	BRT Station Type
Montgomery College	Side Platform (120’)
Rockville Metrorail Station (west entrance)	Side Platform (120’)
MD 28/Norbeck Road	Side Platform (120’)
Broadwood Drive	Side Platform (120’)
Twinbrook Parkway	Side Platform (120’)
Aspen Hill Road	Side Platform (120’)
Parkland Drive	Side Platform (120’)
Randolph Road	Side Platform (120’)
MD 185/Connecticut Avenue	Side Platform (90’ EB/120’ WB)
Newport Mill Road	Reduced Side Platform (60’)
MD 193/University Boulevard	Reduced Side Platform (60’)
Wheaton Metrorail Station	Side Platform (120’)

A BRT station would be larger and have more amenities than both a traditional bus stop and the enhanced bus stops described in Alternative 2. Potential amenities that could be included at each BRT station include: level boarding, canopy, benches, real-time information, off-board fare collection, system maps, artwork, landscaping, and bicycle parking.

A stormwater management analysis and a utility impact analysis were conducted for the proposed improvements associated with Alternative 3 so those costs could be more accurately estimated.

Alternative 5B - New BRT Service in the Median, via One Dedicated Bi-directional Lane or in Two-Lanes (where feasible): Alternative 5B would implement a new BRT service in a dedicated, bi-directional median lane or in two dedicated median lanes from MD 28 to Newport Mill Road. In the bi-directional median lane segments, BRT buses would operate in both directions in a single-lane operation. Eastbound and westbound vehicles would alternate when

using the lane. Transit vehicles traveling in opposite directions would pass each other at stations where the bi-directional travel lanes would widen to two lanes. A two-lane, dedicated median section would be provided where feasible. Generally, the dedicated lanes would be created by pavement widening to the outside and shifting the existing vehicular travel lanes out to allow the BRT to fit within the median. New BRT stations would be constructed at each of the 12 station locations in Alternative 5B.

The existing number of travel lanes would be maintained in Alternative 5B. Sidewalks and bike lanes would be constructed along MD 586, where feasible. Alternative 5B would restrict left turns from MD 586 at unsignalized intersections because vehicles would not be allowed to make uncontrolled turns across the curb-separate BRT lanes. Although Alternative 5B would only include a one-lane median section in areas with limited ROW, the associated BRT stations would still impact adjacent properties in those areas due to the additional width needed at these locations (**Appendix A3**).

At each of the signalized intersections, TSP was considered for the buses providing the new BRT service. Various types of TSP such as "early green" and/or "extended green" could be installed depending on the individual signal characteristics and the location of the bus stop relative to the intersection. Potential TSP treatments that could be included at each intersection are labeled on the Alternative 5B maps in **Appendix A3** and included in the *Traffic Operations Analysis Technical Report* (September 2016).

The new BRT service would operate in mixed traffic on MD 355 and MD 28 from Montgomery College to the MD 28/MD 586 intersection. Heading eastbound, at the MD 28 intersection, the BRT buses would enter a single bi-directional median lane. The bi-directional lane would extend to Twinbrook Parkway. However, the bi-directional lane would widen to two lanes at the MD 28, Broadwood Drive, and Twinbook Parkway BRT stations to allow buses traveling in opposite directions to pass each other. A two-lane median busway would be provided between Twinbrook Parkway and Claridge Road. At Claridge Road, the eastbound buses would enter the existing "bus and right turn only" curb lane. The dedicated median lane for the westbound buses would continue to Newport Mill Road. All westbound buses would travel in mixed traffic between Newport Mill Road and the Wheaton Metrorail Station, and eastbound buses would travel in mixed traffic from MD 193 to the Wheaton Metrorail Station. Dedicated lanes would be provided in 81 percent of the study corridor between the Rockville and Wheaton Metrorail Stations. **Table 9** provides a breakdown of where the BRT would operate in dedicated lanes and what type of lane the BRT would be using.

Alternative 5B would require reconstruction of Veirs Mill Road within the limits of the dedicated median lane(s). For most of the study corridor, the existing median is not wide enough to accommodate the proposed transit lanes, so the roadway footprint would be widened by shifting the existing travel lanes north and south outside of their existing footprint, and BRT lanes would be added in the median.

Table 9: Alternative 5B Runningway

Direction	From	To	Lane Type	Method of Developing Dedicated Lane
Eastbound	Montgomery College	MD 28	Mixed Traffic	N/A
	MD 28	Twinbrook Parkway	Dedicated bi-directional median	Widen and reconstruct all lanes
	Twinbrook Parkway	Claridge Road	Dedicated two-lane median	Widen and reconstruct all lanes
	Claridge Road	MD 193	Dedicated curb	Use the existing bus and right turn only lane
	MD 193	Wheaton Metrorail Station	Mixed Traffic	N/A
Westbound	Wheaton Metrorail Station	Newport Mill Road	Mixed Traffic	N/A
	Newport Mill Road	Claridge Road	Dedicated one-lane median	Widen and reconstruct all lanes
	Claridge Road	Twinbrook Parkway	Dedicated two-lane median	Widen and reconstruct all lanes
	Twinbrook Parkway	MD 28	Dedicated bi-directional median	Widen and reconstruct all lanes
	MD 28	Montgomery College	Mixed Traffic	N/A

The proposed median separation between the BRT lanes and the general purpose lanes that is shown in the Alternative 5B alignment is a two-foot-wide monolithic median. If Alternative 5B moves forward into design, the method of median separation could be modified to allow the BRT vehicles and emergency vehicles the opportunity to enter or exit the BRT lanes at points other than the signalized intersections. In addition, depressed medians could be provided at unsignalized intersections to allow emergency vehicles the opportunity to make a left turn at a location that would otherwise be closed-off to left-turning vehicles. Identification of median entry and exit points and depressed medians would occur by coordinating with Montgomery County Fire and Rescue Services (MCFRS) during final design.

All of the existing service roads along MD 586 that would be impacted by the proposed widening would be replaced in Alternative 5B. In some cases, replacing the service roads would require ROW from the adjacent property owners. The service roads provide essential parking and access for those property owners, and many public comments were supportive of keeping the service roads.

The proposed BRT service in Alternative 5B would operate between the Wheaton Metrorail Station and the Rockville Metrorail Station with six-minute headways in the AM and PM peak periods and ten-minute headways in the off-peak periods. Every third bus would continue from the Rockville Metrorail Station to Montgomery College, so the headways would be 18 minutes in the peak period and 30 minutes in the off-peak periods for the Montgomery College extension. The span of service from the Wheaton Metrorail Station to the Rockville Metrorail Station would extend from 6 AM to midnight. Between Rockville Metrorail Station and

Montgomery College, service would operate from 8 AM to 10 PM when classes are in session. **Table 10** summarizes the operating characteristics of Alternative 5B.

Table 10: Alternative 5B Operating Characteristics

Bus Service	Frequency				Span of Service	
	Peak		Off-Peak			
	Wheaton to Rockville	Rockville to Montgomery College	Wheaton to Rockville	Rockville to Montgomery College	Wheaton to Rockville	Rockville to Montgomery College
New BRT Service	6 minutes	18 minutes	10 minutes	30 minutes	6 AM to midnight	8 AM to 10 PM

The new BRT service in Alternative 5B would stop at 12 locations along the study corridor. New BRT stations would be constructed for use by the new BRT service at each of the 12 stops. Most of the BRT stations would be 120 feet long and able to accommodate two articulated buses. Smaller, 60-foot-long BRT stations that only accommodate one articulated bus would be proposed at locations with limited ROW. **Table 11** shows the station locations and the type of BRT station that is proposed at that location. A BRT station would be larger and have more amenities than both a traditional bus stop and the enhanced bus stops, described in Alternative 2. Potential amenities that could be included at each BRT station include: level boarding, canopy, benches, real-time information, off-board fare collection, system maps, artwork, landscaping, and bicycle parking.

Table 11: Alternative 5B BRT Stations

Location	BRT Station Type
Montgomery College	Side Platform (120')
Rockville Metrorail Station (west entrance)	Side Platform (120')
MD 28/Norbeck Road	Center Platform (120')
Broadwood Drive	Split Side Platform (120')
Twinbrook Parkway	Split Side Platform (120')
Aspen Hill Road	Split Side Platform (120')
Parkland Drive	Split Side Platform (120')
Randolph Road	Split Side Platform (120')
MD 185/Connecticut Avenue	Split Side Platform (120')
Newport Mill Road	Split Side (120') (Westbound)/ Reduced Side (60') (Eastbound) Platform
MD 193/University Boulevard	Reduced Side Platform (60')
Wheaton Metrorail Station	Side Platform (120')

A stormwater management analysis and a utility impact analysis were conducted for the proposed improvements associated with Alternative 5B so that those costs could be more accurately estimated.

D. Alternatives Comparison

A comparison of the transit/traffic operations of the alternatives retained for detailed study is provided in **Table 12**. The 2040 transit and traffic operations projections were derived from the travel demand and ridership modeling and VISSIM analysis that were completed for each retained alternative, as explained in Chapter IV.

A comparison of the costs and environmental impacts of the alternatives retained for detailed study is provided in **Table 13**. The ROW cost estimates were developed by MDOT SHA and are based on the area of ROW and easement required on each property. For residential relocations or business displacements, the ROW cost includes the cost of purchasing the entire property and the cost for relocation assistance for affected residents and business owners. Engineering and construction costs were developed from a "major quantities estimate" for each alternative, using the methodology outlined in the MDOT SHA *Highway Construction Cost Estimating Manual*. Unit costs were derived from recent bid unit prices. Impacts to the socioeconomic, cultural, and natural environmental conditions are detailed in Chapter V.

Table 12: Alternatives Comparison Matrix – 2040 Ridership and Traffic

COMPARISON FACTORS		ALTERNATIVE 1 (No-Build)		ALTERNATIVE 2		ALTERNATIVE 3		ALTERNATIVE 5B	
		AM	PM	AM	PM	AM	PM	AM	PM
Ridership									
Total Daily Transit Boardings[1]		32,300		33,400[2]		35,000		35,300	
Total Daily BRT/Enhanced Bus Service Boardings[1]		N/A		2,600[2]		6,400		7,300	
Non-Auto Driver Mode Share		36%		36%		36%		36%	
Peak Period Person Throughput (Auto and Transit)[1]									
South of First Street		3,800	4,000	3,900	3,900	3,900	4,000	3,900	4,000
South of Twinbrook Parkway		5,200	5,700	5,400	5,800	5,400	5,800	5,400	5,900
North of Connecticut Avenue		5,100	5,400	5,200	5,600	5,200	5,800	5,100	5,700
South of Newport Mill Road		4,600	5,000	4,700	4,900	4,700	5,100	4,800	5,100
Travel Times in Minutes: End-to-End (Rockville Metrorail Station to Wheaton Metrorail Station)									
EB	Peak-Hour Enhanced Bus/BRT	N/A	N/A	27.9	24.9	26.2	25.3	22.8	23.7
	Peak-Hour Other Buses	35.5	40.4	36.7	32.7	34.0	30.4	37.1	33.8
	Peak-Hour Automobile	22.5	27.9	20.7	22.3	21.3	20.2	22.1	22.1
WB	Peak-Hour Enhanced Bus/BRT	N/A	N/A	21.6	22.3	22.7	25.7	25.5	24.6
	Peak-Hour Other Buses	29.5	32.9	28.8	29.1	29.2	29.0	32.0	34.6
	Peak-Hour Automobile	19.6	24.4	18.6	18.6	20.5	20.2	24.6	23.6
Vehicle Miles Traveled (VMT) in Study Corridor									
Percent Change in Automobile VMT, as compared to the No-Build		N/A		<1%		<1%		<1%	
Percent Change in Transit VMT, as compared to the No-Build		N/A		15%		26%		26%	
Accessibility									
Change in Number of Jobs within 45 Minutes of the Corridor, via Transit, as compared to the No-Build		N/A		<1%		<1%		<1%	
Change in Number of Jobs within 60 Minutes of the Corridor, via Transit, as compared to the No-Build		N/A		<1%		<1%		<1%	

COMPARISON FACTORS	ALTERNATIVE 1 (No-Build)		ALTERNATIVE 2		ALTERNATIVE 3		ALTERNATIVE 5B	
	AM	PM	AM	PM	AM	PM	AM	PM
Change in Number of People within 45 Minutes of the Activity Centers, via Transit, as compared to the No-Build	N/A		<1%		<1%		<1%	
Change in Number of People within 60 Minutes of the Activity Centers, via Transit, as compared to the No-Build	N/A		<1%		<1%		<1%	
Traffic Operations								
Miles of LOS E or F Operations Along the Corridor	3.5	5.8	3.2	4.2	3.5	3.8	3.3	4.1
Intersections Operating at LOS E or F	4	5	4	4	4	4	4	5

1. Values are rounded to the nearest 100.
2. If the service frequencies of the enhanced bus service in Alternative 2 were increased to match the proposed BRT service in Alternatives 3 and 5B, the projected total daily transit boardings would increase to 33,600 and the total daily enhanced bus service boardings would increase to 3,200.

Table 13: Alternatives Comparison Matrix - Costs and Environmental Impacts

	COMPARISON FACTORS	ALTERNATIVE 1 (No-Build)	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 5B
COSTS	Right-of-way (ROW)	$0	$6.2M	$12.8M	$35.4M
	Engineering and Construction[5]	$0	$23.2M	$118.6M[4]	$236.9M[4]
	Vehicles	$0	$5.4M	$16.5M	$16.5M
	Total Capital Cost	$0	$34.8M	$147.9M	$288.8M
	Annual Operating Cost	$0	$3.1M	$4.8M	$4.6M
ENVIRONMENTAL IMPACTS	**Socioeconomic**				
	Total Permanent ROW Required (acres)	0	0.7	2.3	6.7
	Properties Impacted (number)	0	27	116	217
	Residential Relocations (number)	0	4	7	9-17[1]
	Business Displacements (number)	0	1	2	3
	Public Parks Affected (number)	0	1	3	5
	Public Park Property Required (acres)	0	0.2	0.6	1.6
	Total Number of Public/Community Facilities Permanently Impacted	0	1	6	9
	Cultural Resources				
	Archaeological Sites (number)	0	0	0	0
	Historic Structures (number)	0	0	4[3]	2
	Determination of Effect	*No Effect*	*No Effect*	*No Adverse Effect*	*Adverse Effect*
	Natural Resources				
	Stream Crossings (number)	0	0	2	10
	Stream Impact (linear feet)	0	0	47	864
	100-Year Floodplain (acres)	0	0	<0.1	0.3
	Wetlands (acres)	0	0	<0.1	<0.1
	Forests (acres)	0	0.8	1.2	3.1

COMPARISON FACTORS		ALTERNATIVE 1 (No-Build)	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 5B
	Green Infrastructure (acres)	0	0.2	<0.1	1.7
	Federally or State Listed RTE Species (number)	0	0	0	0
	Air Quality National Ambient Air Quality Standards (NAAQS)	No Exceedances	No Exceedances	No Exceedances	No Exceedances
	Noise Receptors Impacted [2]	NA	NA	NA	NA
	Hazardous Waste Sites (number [square feet])	0 (0)	1 (2,940)	7 (17,800)	8 (36,870)

1. The residential relocations for Alternative 5B are presented as a range due to the uncertainty in the final station locations. The range was developed by identifying potential displacements for the most likely station locations based on discussions with the City of Rockville.
2. Due to the differences in FHWA and FTA noise impact methodologies, it was determined that the analysis for this study would focus on predicted noise levels. Noise impacts and mitigation would need to be assessed following the identification of a lead funding agency.
3. Subsequent to the June 22 MHT letter, the project team revised the detailed alternatives mapping. Based on this mapping, Alternative 3 would have reduced impact on historic properties. Further coordination with MHT will occur to make final effects determinations.
4. The unit costs for the BRT stations do not include the costs of certain system elements identified in November 2016 that could add approximately $62,000 per platform.
5. Costs to relocate impacted existing bus shelters are not included.

IV. TRANSIT AND TRAFFIC ANALYSIS

This section describes the existing transit and traffic operations in the study corridor and the future operations of the proposed BRT alternatives along MD 586/Veirs Mill Road.

A. EXISTING OPERATIONS

1. Transit Service

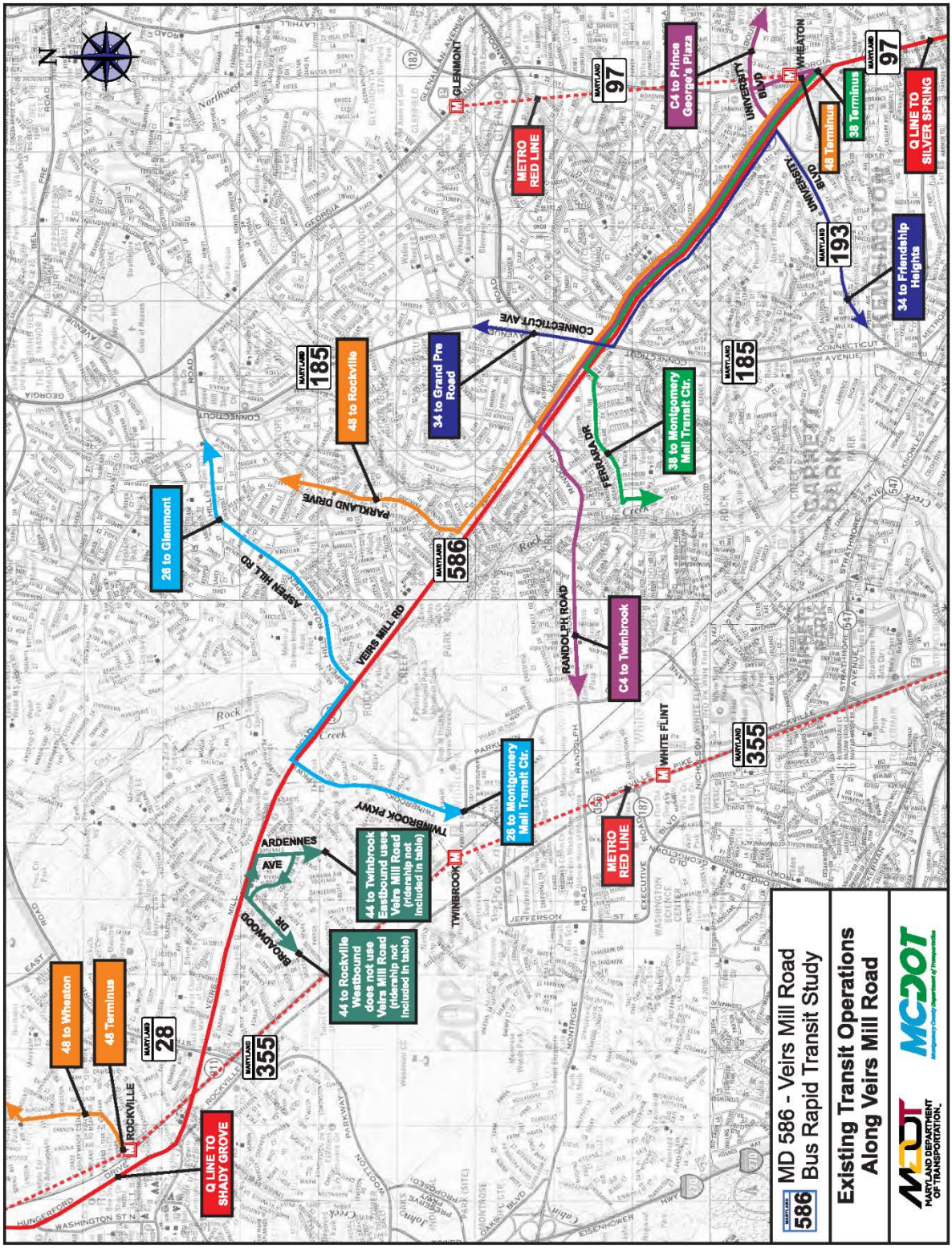
Local bus service along the study corridor is provided by WMATA Metrobus and Montgomery County's Ride On service. Eleven bus routes operate within the study corridor; six by WMATA and five by Montgomery County. WMATA's Q lines travel the entire corridor between the Rockville and Wheaton Metrorail stations. All other bus routes enter and exit the corridor at various points. **Figure 4** shows the bus routes along the study limits.

Metrobus routes Q1, Q2, Q4, Q5, and Q6 incorporate Veirs Mill Road from the Rockville Metrorail Station to the Wheaton Metrorail Station into their routes. Metrobus route C4 connects the Wheaton Metrorail Station to the Twinbrook Metrorail Station and incorporates the portion of Veirs Mill Road from the Wheaton Metrorail Station to Randolph Road. Approximately 17,200 passengers ride the WMATA Metrobus routes along the study corridor. According to the current Q Line schedule, the one-way travel time between the Rockville and Wheaton Metrorail stations is approximately 26 to 35 minutes during peak hours, depending upon the direction in which the bus is traveling. The bus schedule indicates that the trip between the Wheaton and Twinbrook Metrorail stations on the C4 route generally takes 20 to 25 minutes during peak hours. FTA recommends an On-Time Performance (OTP) goal of 85 percent for a bus system. On-time performance data reported for Metrobus routes along the Veirs Mill study corridor for Fiscal Year 2014 had an average OTP of 81 percent for weekdays, 82 percent for Saturdays, and 81 percent for Sundays.

Ride On bus routes 26, 34, 38, 44, and 48 each travel on a segment of Veirs Mill Road within the study area and serve approximately 5,400 passengers within the study corridor daily. Only Route 48 provides service to both ends of the study corridor. Route 26 connects the two branches of the Red Line (Twinbrook Metrorail Station to Glenmont Metrorail Station). Route 26 is circuitous and, according to the current schedule, the one-way travel time is approximately 34 minutes in the eastbound direction and 41 minutes in the westbound direction during the AM peak hour. Route 38 connects the two branches of the Red Line at the Wheaton Metrorail Station and the White Flint Metrorail Station. It operates with a scheduled travel time that varies from 21 to 24 minutes in the peak hours, depending upon the direction in which the bus is traveling.

The Ride On Route 48 bus connects the Wheaton Metrorail Station to the Rockville Metrorail Station and travels along Veirs Mill Road for a portion of the trip. The bus schedule indicates that the travel time between Metrorail stations ranges from 34 to 40 minutes and that headways range from 20 to 25 minutes during peak hours.

Figure 4: Existing Transit Operations



OTP varied among the five Ride On routes operating along the corridor. OTP for the period between Fiscal Year 2014 and Fiscal Year 2015 for Route 26 was 63.2 percent, for Route 34 was 71.3 percent, for Route 38 was 68.5 percent, for Route 44 was 73.4 percent and for Route 48 was 76.8 percent. The OTP of each Ride On route identified was eight to 21 percent below the FTA OTP goal of 85 percent. Ride On defines a vehicle as being on-time if it arrives no more than one minute early and four minutes late from the scheduled time. All Metrobuses and most Ride On buses can transport bicycles on racks mounted to the outside of the bus.

The study corridor experiences some of the highest existing transit volumes in Montgomery County. Although opportunities to increase ridership are limited because development outside of the central business district is constrained, current master plans propose redevelopment and density increases in the Wheaton and Rockville Town Centers, which are located at either end of the study area.

2. Traffic Operations

The MD 586/Veirs Mill Road BRT study corridor carries approximately 21,000 to 46,000 vehicles per day along its route. It is one of the most heavily used transportation and transit corridors in Montgomery County that does not have existing rail transit. The roadway cross section varies between four-lane, five-lane, and six-lane segments within the project limits. There is a "bus and right turn only" lane that extends approximately 1.4 miles from the MD 185 (Connecticut Avenue) intersection to just east of the MD 193 (University Boulevard) intersection. There are twenty (20) signalized intersections, twenty-six (26) unsignalized intersections, and numerous driveways provided along the corridor.

Veirs Mill Road is a commuter corridor, with the flow of traffic largely balanced in the eastbound and westbound directions between two large CBDs, Wheaton and Rockville. Smaller commercial districts exist at Randolph Road and just west of Twinbrook Parkway. Residential properties occupy much of the rest of the corridor. Service roads that provide access to residential properties exist along many sections of the roadway, consuming a significant part of the ROW.

A VISSIM model was used to analyze the 2015 peak hour operations from 7 to 8 AM and 4 to 5 PM. The models were calibrated to match balanced intersection turning movement counts and link volume data within the study area. The VISSIM models were also calibrated to match field-confirmed travel times. More detailed information on the VISSIM models is included in the *Traffic Operations Analysis Technical Report* (September 2016).

Overall, the total miles of poor or failing level of service (LOS E or F) for existing conditions (based on car and truck speeds along segments of MD 586 compared to the posted speed limit) during the AM peak was 1.6 miles in the westbound direction and 0.7 miles in the eastbound direction, for a total of 2.3 miles. During the PM peak, there were 1.2 miles of poor or failing LOS in the westbound direction and 0.8 miles in the eastbound direction, for a total of 2.0 miles. Additionally, the latent demand (vehicles that are denied entry into the modeled area due to traffic queuing) for existing conditions was 93 vehicles during the AM peak and 35 vehicles during the PM peak.

The MD 586 corridor travel time for cars and trucks in the eastbound direction for existing conditions ranged from 17.2 minutes during the AM peak to 19.2 minutes during the PM peak. In the westbound direction, the range was between 19.8 minutes during the AM peak and 16.4 minutes during the PM peak. The corridor travel time for local buses in the eastbound direction ranged between 33.5 minutes during the PM peak and 32.7 minutes during the AM peak. In the westbound direction, the travel time range for local buses was from 28.4 minutes during the PM peak to 29.3 minutes during the AM peak.

3. Crash Analysis

The crash data indicated that a total of 587 crashes were reported along Veirs Mill Road between 2011 and 2013. Seven crashes resulted in fatalities (all located between the structure over Rock Creek and MD 97) and 269 crashes resulted in injuries. The most prevalent types of collisions were rear-end (47 percent), sideswipe (15 percent), and angle (14 percent). The majority (71 percent) of the crashes occurred during the day, and 106 crashes occurred on a wet surface. The location with the highest frequency of crashes during the study period was the signalized intersection at Twinbrook Parkway, where a total of 25 crashes occurred.

B. Future Operations

1. 2040 Transit Service Plan and Ridership Projections

As described in Chapter III, two rounds of alternative analysis were performed. Initially, Alternatives 1 through 6 were identified, and preliminary ridership for conceptual Alternatives 1, 2, 4C, and 4D were modeled. Subsequently, the alternatives retained for detailed study were modeled, which included Alternatives 1, 2, 3, and 5B.

The location and length of dedicated lanes, number of station locations, and potential queue jump locations were used to estimate the average travel speeds of various alternatives for model testing purposes. The speeds were estimated based on bus speeds in the corridor (for the model year 2040) and adjusted to reflect BRT operating characteristics for each of the build alternatives, including the number of stops, anticipated dwell times, acceleration/deceleration, and operations in dedicated lanes versus mixed traffic. Additionally, the speed improvements achieved by other BRT services in operation across the country and the following reports or sources were used to estimate the BRT travel speeds:

- *TCRP-100 Transit Capacity and Quality of Service Manual, 2nd Edition*, Transportation Research Board, 2003
- *TCRP-118 Bus Rapid Transit Practitioner's Guide*, Transportation Research Board, 2007
- *Montgomery County Bus Rapid Transit Study*, 2011
- *Bus Rapid Transit Planning Guide*, Institute for Transportation & Development Policy, 2007
- *Characteristics of Bus Rapid Transit for Decision-Making*, Federal Transit Administration, 2009
- *National BRT Institute Database*, www.nbrti.org

In the 2040 model, several assumptions were made regarding the future operations of the proposed BRT. It was assumed that stations would be placed at the 11 locations recommended in Montgomery County's *Countywide Transit Corridors Functional Master Plan.* Following the identification of the alternatives retained for detailed study, the service was extended to Montgomery College. The transit service characteristics to that station were limited to every third bus. The full list of stations is as follows:

- Montgomery College
- Rockville Metro Station
- MD 28/ Norbeck Road
- Broadwood Drive
- Twinbrook Parkway
- Aspen Hill Road
- Parkland Drive
- Randolph Road
- MD 185/Connecticut Avenue
- Newport Mill Road
- MD 193/University Boulevard
- Wheaton Metro Station

It was also assumed that the service would run from 6 AM to midnight from the Wheaton Station to the Rockville Station, and from 8 AM to 10 PM between the Rockville Station and Montgomery College. The span of service was developed by analyzing existing boardings and alightings on the Q buses by time of day and locations along the corridor. It was assumed that there would be no changes to existing bus routes or service during the testing of the conceptual alternatives, and the speed on existing local bus services would not change.

Modeling and Ridership for Conceptual Alternatives 1, 2, and 4

In 2013, as directed by MDOT, the MWCOG National Capital Region Transportation Planning Board (TPB) staff estimated potential ridership by modeling Alternatives 2, 4C, and 4D utilizing MWCOG's adopted regional travel demand model. These alternatives were selected for the modeling effort to provide a range of potential ridership, with Alternative 2 providing the lower bound and Alternatives 4C and 4D providing the upper bound. **Table 14** shows the assumptions that were used in the modeling.

Table 14: Service Characteristics for Conceptual Alternatives 2, 4C, and 4D

		ALTERNATIVE 2	ALTERNATIVE 4C	ALTERNATIVE 4D
Description/ Characteristics		Enhanced Bus Service, TSM, Queue Jumps at Intersections	New BRT Service, Dedicated Median Lanes, Widening at Areas other than Stations	New BRT Service, Dedicated Curb Lanes, Widening at Areas other than Stations
Runningway		Runs in mixed use traffic	Runs in a dedicated lane in the median	Runs in a dedicated lane on the curb-side
Frequency	**Peak**	12 minutes	6 minutes	6 minutes
	Off Peak	15 minutes	10 minutes	10 minutes
Speed	**New Services**	16 mph	22 mph	20 mph
	Existing Metrobus/ Ride-On	12 mph (2012 CLRP)	12 mph (2012 CLRP)	12 mph (2012 CLRP)
Stations/Stops		11 Express bus stops	11 BRT stations	11 BRT stations

Table 15 provides the ridership results that indicated the new BRT service in fully dedicated lanes (Alternatives 4C and 4D) would generate 4,500 to 4,700 additional weekday total transit boardings as compared to the No-Build Alternative (2040) of approximately 29,400 daily boardings. Alternative 2 forecasts showed the least number of potential ridership with daily BRT boardings of 5,600, and Alternative 4C forecasts had the greatest number of BRT boardings at 9,100. For daily boardings of buses other than the BRT, Alternatives 2 and 4D had similar forecasts. Notably, the Alternative 1 forecasts for 2040 shows approximately 2,200 daily boardings for other buses that were not observed in the forecasts for Alternatives 2 or 4D.

Table 15: 2040 Forecasted Ridership for Alternatives 1, 2, 4C, and 4D

	Alternative 1 No-Build	Alternative 2 TSM/TDM	Alternative 4C Bus-Only Lanes for BRT in Median	Alternative 4D Bus-Only Lanes for BRT in Curb Lane[1]
Daily BRT Boardings[2]	0	5,600	9,100	6,900
Daily Other Bus Boardings[2,3]	29,400	27,200	24,800	27,200
Total Daily Boardings[2]	**29,400**	**32,800**	**33,900**	**34,100**

1. Dedicated bus-only lanes for use by BRT and WMATA buses
2. Estimated boardings have been rounded to nearest 100.
3. Boardings at bus stops within the boundary of the Veirs Mill Road Study Area

Modeling Assumptions for the Alternatives Retained for Detailed Study: 2, 3, and 5B

Table 16 presents a summary of service characteristics for the three build alternatives retained for detailed study. Information regarding the No-Build Alternative is not included because there would not be BRT or transit improvements beyond those already planned in the region's Constrained Long-Range Plan (CLRP). It is important to note that the information presented in **Table 16** only represents the modeling assumptions that were used to project future transit ridership in the corridor. The bus frequencies and span of service do not constitute a proposed service plan as a detailed operating plan has not been developed as part of this study. Future analysis on the recommended alternative would include development of an operating plan.

In Alternative 2, enhanced bus service would operate in mixed traffic in the existing curb lanes for the entire length of the project, but would stop only at the 12 express bus locations. Queue jumps would be installed at select intersections in the corridor to decrease the travel time of the enhanced bus service. Local bus services would continue to stop at all current bus stops. Riders would be able to transfer from the enhanced bus service to local Metrobus and Ride On routes at the enhanced bus stops.

In Alternative 3, BRT would operate in the outside curb lanes for the entire length of the project. For portions of the corridor, BRT would operate in dedicated "bus and right turn only" lanes (EB from Midway Avenue to MD 193 and WB from Kensington Boulevard to Clagett Drive). For the remaining portions of the corridors, the BRT would operate in mixed traffic in the curb lanes. The BRT would stop at all of the BRT stations. As with Alternative 2, the local bus services would continue to stop at all current bus stops and riders would be able to transfer from the curbside BRT service to local Metrobus and Ride On routes at the BRT stops.

In Alternative 5B, BRT would operate in mixed traffic within the following segments: between Montgomery College and the MD 586/MD 28 intersection; in the westbound direction between the Newport Mill Road station and the Wheaton Metrorail station; and in the eastbound direction between the University Boulevard station and the Wheaton Metrorail station. The BRT would use one bi-directional, dedicated, median lane between MD 28 and Twinbrook Parkway stations. The bi-directional lane would widen to two dedicated lanes at MD 28, Broadwood Drive and Twinbrook stations to allow for passing. The BRT would use two dedicated, median lanes between Twinbrook Parkway and Newport Mill Road stations. Local buses would continue to use the curb lanes and stop at all local bus stops. Riders would be able to transfer to/from local Metrobus and Ride On routes at the BRT stations, but for those stops in the dedicated median lane, pedestrian access from the BRT station to local curb-side bus stops would need to be addressed.

Table 16: Service Characteristics of Build Alternatives Retained for Detailed Study

		ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 5B
Description		TSM / Intersection Queue Jumps	BRT Service in Dedicated Curb Lanes (where feasible)	Bi-directional BRT in Dedicated Lane + 2-Lane in Median (where feasible)
Bus Service		Enhanced Bus Service – New Express Limited Stop route (similar to proposed Q9 MetroExtra)	New BRT Service	New BRT Service
Frequency	**Peak**	12 min (Wheaton – Rockville); 36 min (Rockville - College)	6 min (Wheaton -Rockville); 18 min (Rockville - College)	6 min (Wheaton - Rockville); 18 min (Rockville - College)
	Off Peak	15 min (Wheaton – Rockville); 45 min (Rockville - College)	10 min (Wheaton - Rockville); 30 min (Rockville - College)	10 min (Wheaton - Rockville); 30 min (Rockville - College)
Span of Service		6 am – midnight (Wheaton-Rockville); 8 am – 10 pm (Rockville - College)	6 am – midnight (Wheaton - Rockville); 8 am – 10 pm (Rockville - College)	6 am – midnight (Wheaton - Rockville); 8 am – 10 pm (Rockville - College)
Speed	**New Services**	16 mph	18 mph	20 mph
	Existing Metrobus/ Ride-On	No change (10-12 mph)	No change (10-12 mph)	No change (10-12 mph)
Stations/Stops		43 local stops 12 for Express	43 local stops 12 BRT stations	43 local stops 12 BRT stations

In Alternative 2, enhanced bus service would operate in mixed traffic in the existing curb lanes for the entire length of the project, but would stop only at the 12 express bus locations. Queue jumps would be installed at select intersections in the corridor to decrease the travel time of the enhanced bus service. Local bus services would continue to stop at all current bus stops. Riders would be able to transfer from the enhanced bus service to local Metrobus and Ride On routes at the enhanced bus stops.

In Alternative 3, BRT would operate in the outside curb lanes for the entire length of the project. For portions of the corridor, BRT would operate in dedicated "bus and right turn only" lanes (EB from Midway Avenue to MD 193 and WB from Kensington Boulevard to Clagett

Drive). For the remaining portions of the corridors, the BRT would operate in mixed traffic in the curb lanes. The BRT would stop at all of the BRT stations. As with Alternative 2, the local bus services would continue to stop at all current bus stops and riders would be able to transfer from the curbside BRT service to local Metrobus and Ride On routes at the BRT stops.

In Alternative 5B, BRT would operate in mixed traffic between Montgomery College and MD 586/MD 28 intersection and between the Newport Mill Road station and the Wheaton Metrorail station in the westbound direction, and between the University Boulevard station and the Wheaton Metrorail station in the eastbound direction. The BRT would use one bi-directional, dedicated, median lane between MD 28 and Twinbrook Parkway stations. The bi-directional lane would widen to two dedicated lanes at MD 28, Broadwood Drive and Twinbrook stations to allow for passing. The BRT would use two dedicated, median lanes between Twinbrook Parkway and Newport Mill Road stations. Local buses would continue to use the curb lanes and stop at all local bus stops. Riders would be able to transfer to/from local Metrobus and Ride On routes at the BRT stations, but for those stops in the dedicated median lane, pedestrian access from the BRT station to local curb-side bus stops would need to be addressed.

In the initial model iterations, the results showed additional transit riders would use the BRT; however, the new BRT services were competing with the high level of service already provided by the existing Q lines and other bus services in the corridor. The high frequency of the existing bus service means that the transit mode share in the corridor is already high – leaving fewer potential new riders for the new BRT services. Consequently, in later model iterations, the balance between the existing local service and the BRT was carefully evaluated.

MWCOG Model Background and Assumptions: The base travel demand model set for this study was the MWCOG/TPB regional travel model version 2.3.57 with validated 2014 base year model estimates for the MD 586 corridor, and the recently refined and updated 2040 No-Build model forecasts, prepared by MWCOG in April 2015 for this project. The model set had the following assumptions and refinements:

- Land Use: Round 8.3.
- Network: CLRP 2014 adopted on October 15, 2014, with refinements by MWCOG and MDOT for the study corridor to reflect the local transportation system at a finer level. MWCOG's modifications were focused on refining the model to ensure the roadway and transit networks were up to date, including matching headways and routing for existing transit services, verifying centroid connections, and reaching reasonable validation of outputs. Further model refinements were made to the 2014 and 2040 No-Build model sets as follows:
    - Reviewed assumptions about bus travel speeds, run time, and headways and refined these assumptions based on the 2014 CLRP and WMATA on-time performance data.
    - Reviewed existing land-use clustering in traffic analysis zones within ½-mile and 1-mile radius of proposed stations to improve walk accessibility to transit.
    - Reviewed walk accessibility within 0.5-mile and 1-mile of proposed stations.
    - Reviewed park-and-ride demand and capacities at Metrorail stations.

  - Validated the 2014 model using the observed ridership in the corridor.
- Background Transit
  - 2014: MWCOG coding of transit routes (routing, headways, and run time) by transit providers was based on the published schedule and route maps of the providers, with slight modifications of run time based on the on-time performance and auto travel time/speed from Synchro/VISSIM.
  - 2040 No-Build: CLRP 2040 coding of transit routes (routing, headways, and run time) by transit providers, with modification of run time based on the historical on-time performance.
- Parking Availability: The ridership model assumed unconstrained new parking at existing park-and-ride locations in the proposed BRT corridor with results checked against parking capacities.

Additionally, the ridership forecasting process was adjusted by MDOT to incorporate guideway effects into the study. The background materials for this are drawn from the report *Review of Transit Modeling with Respect to FTA Guidance*, *Task Order 15.3, Final Report* (Cambridge Systematics, 2015).

A major factor that appears to impact the demand for transit services is the preference for the trip maker to use a premium transit mode, such as BRT. In the mode choice model, this preference is addressed through expression of unmeasured attributes, which are usually calibrated using local transit survey data by metropolitan planning organizations, like MWCOG, and service providers for existing transit modes. For new transit modes, such as streetcar or BRT, the local surveys would not specifically distinguish them, as they do not currently exist in the region and the resulting calibration would not specially consider them.

FTA has issued guidance regarding appropriate levels to consider to represent potential unmeasured attributes of fixed-guideway modes. Three categories of attributes are recognized for credits, including guideway-like characteristics (e.g., reliability, branding and visibility), span of good service, and passenger amenities (e.g., dynamic schedule information at stops / stations).

In Version 2.3.57, BRT and streetcar (Mode 10) are treated like local Metrobus (Mode 1) in transit path building and skimming, mode choice, and transit assignment. Accordingly, there is no unmeasured guideway effect reflected for BRT and streetcar (coded travel times are used, so if a BRT offers a travel time advantage, it is still reflected). A typical arterial BRT operating on a mixed traffic facility would have a 5-minute equivalent of credits for the BRT attractiveness and a 5 percent discount on the weight applied to in-vehicle travel time. Consequently, for this project, a 5-minute discount on the in-vehicle travel time was used to represent the BRT guideway effects.

Ridership for Alternative 1: No-Build

This section presents ridership forecasting results for the No-Build scenario for the purposes of comparison with the build alternatives. The No-Build Alternative would consist of no improvements to existing infrastructure or bus service along the Veirs Mill Road study corridor beyond those improvements already planned and programmed to be in place by the year 2040

in the regional CLRP. These planned improvements include the expansion of the Gaynor Road/Parkland Drive intersection to accommodate the Montrose Parkway expansion project and more frequent service for the WMATA Q2 bus route. Beyond these improvements, the existing lane configurations and bus services remain the same in the 2040 design year. **Tables 17** and **18** highlight the modeling assumptions of the corridor bus routes, such as frequency of the corridor routes in the peak and off-peak periods, run time, distance, and speed. The same headway assumptions have been applied to the forecasted Alternatives 2, 3 and 5B and therefore are consistent with the No-Build assumptions.

Table 17: 2040 No-Build Headways on the Metrobus Corridor Routes

Route Name/Direction	Frequency (min)		Run Time (min)	Distance (miles)	Speed (mph)
	Peak[1]	Off Peak			
Q2 Inbound	10	30	60	13	13
Q2 Outbound	10	30	59	13	13
Q4 Inbound	60	30	47	10	12
Q4 Outbound	60	27	38	10	15
Q6 Inbound	20	27	52	9	11
Q6 Outbound	15	27	44	9	13
C2 Inbound	20	25	55	12	13
C2 Outbound	25	25	55	12	13
C4 Inbound	15	27	68	15	13
C4 Outbound	25	27	62	15	15

1. Peak Periods = 6 - 9 am and 3 -7 pm

Table 18: 2040 No-Build Headways on the Local Corridor Routes

Route Name/Direction	Frequency (min)		Run Time (min)	Distance (miles)	Speed (mph)
	Peak[1]	Off Peak			
Ride On 26 Inbound	15	30	72	14	11
Ride On 26 Outbound	30	30	72	14	11
Ride On 34 Inbound	30	30	80	14	10
Ride On 34 Outbound	30	27	80	14	10
Ride On 38 Inbound	20	30	25	5	13
Ride On 38 Outbound	20	30	25	5	13
Ride On 44 Inbound[2]	30	N/A	19	4	12
Ride On 44 Outbound[2]	30	N/A	19	4	12
Ride On 48 Inbound	25	25	38	9	15
Ride On 48 Outbound	25	25	38	9	15

1. Peak Periods = 6 - 9 am and 3 -7 pm
2. Ride On route 44 only operates in the peak period

Table 19 presents the summary of forecasted boardings of the bus routes in the No-Build alternative. The ridership on Q lines is approximately 13,800 boardings, while total study area ridership is approximately 32,300 boardings. As for Metrorail, the Rockville station is forecasted to have 8,800 daily boardings in 2040 and the Wheaton station is forecasted to have 8,000 daily boardings in 2040.

Table 19: 2040 No-Build Daily Summary of Transit Boardings

Bus Routes	Daily Boardings[1]
WMATA Q1/Q2/Q4/Q5/Q6	13,800
Other buses that only use individual segments	
WMATA C2/C4	9,800
Ride On 26	4,600
Ride On 34	3,200
Ride On 38	200
Ride On 44	<100
Ride On 48	700
Total	**32,300**

1. Boarding numbers have been rounded to the nearest 100

Ridership for Alternative 2

This section presents 2040 ridership forecasting results for Alternative 2, and **Table 20** presents the boardings by district. The Montgomery College/Rockville Center district includes the South Campus Drive and Rockville Metrorail stations. The MD 586 Twinbrook district includes stations at First Street (MD 28), Broadwood Drive, Twinbrook Parkway, Aspen Hill Road and Parkland Drive. The MD 586 North Wheaton district includes stations at Randolph Road, Connecticut Avenue (MD 185), and Newport Mill Road. The Wheaton District includes the University Boulevard (MD 193) and Wheaton Metrorail stations. The total ridership for Alternative 2 in the forecast year is approximately 2,600 boardings, with approximately 40 percent of the boardings in peak periods and 60 percent in off-peak periods.

Table 20: 2040 Alternative 2 Enhanced Service Boardings by Time of Day

District	Boardings[1]		
	Peak[2]	Off Peak	Daily
Montgomery College/Rockville Center	200	400	600
MD 586 Twinbrook	200	400	600
MD 586 North Wheaton	300	400	700
Wheaton	300	400	700
Total	**1,000**	**1,600**	**2,600**

1. Boarding numbers have been rounded to the nearest 100
2. Peak Periods (6 - 9 am and 3 -7 pm)

Table 21 presents the summary of boardings in 2040 on the new enhanced bus line and the other corridor bus routes, as a result of the implementation of Alternative 2. The ridership on the Q lines goes down to 12,400 boardings from 13,800 in the No-Build scenario (9 percent decrease), while the total study area ridership increases from 32,300 in the No-Build to 33,400 boardings in the Alternative 2 scenarip(3 percent increase).

Table 21: 2040 Alternative 2 Daily Transit Boardings

Bus Routes	Boardings[1]		
	Peak[2]	Off Peak	Daily
Alternative 2 Enhanced Bus	1,000	1,600	2,600
WMATA Q1/Q2/Q4/Q5/Q6	5,700	6,700	12,400
Other buses that only use individual segments			
WMATA C2/C4	3,800	6,000	9,800
Ride On 26	2,200	2,400	4,600
Ride On 34	1,300	1,900	3,200
Ride On 38	<100	100	100
Ride On 44	<100	-	<100
Ride On 48	300	400	700
Total	**14,300**	**19,100**	**33,400**

1. Estimated boardings have been rounded to the nearest 100.
2. Peak Periods = 6 - 9 am and 3 -7 pm

As for Metrorail, the Rockville station is forecasted to have 8,900 daily boardings in 2040 and the Wheaton station is forecasted to have 8,200 daily boardings in 2040. Metrorail ridership, as compared to the No-Build, is not expected to change significantly with the implementation Alternative 2.

Under Alternative 2, the total number of transit trips in the region increases by approximately 2,600 trips per day in comparison with 2040 No-Build scenario. Home-based work (HBW) transit trips constitute the highest share of transit trips of approximately 71 percent of total regional transit trips. Within the study area, MD 586 Twinbrook and Wheaton produce and attract slightly more transit riders in comparison to other districts.

Ridership for Alternative 3

This section presents ridership forecasting results for Alternative 3, and **Table 22** presents the boardings by district. The stations within each district are the same as Alternative 2. The total ridership in the forecast year is approximately 6,400 boardings, with approximately 49 percent of the boardings in the peak periods and 51 percent in off-peak period.

Table 22: 2040 Alternative 3 BRT Boardings by Time of Day

District	Boardings[1]		
	Peak[2]	Off Peak	Daily
Montgomery College/Rockville Center	700	800	1,500
MD 586 Twinbrook	800	1,100	1,900
MD 586 N Wheaton	700	500	1,200
Wheaton	1,000	800	1,800
Total	**3,200**	**3,200**	**6,400**

1. Estimated boardings have been rounded to the nearest 100.
2. Peak Periods = 6 - 9 am and 3 -7 pm

Table 23 presents the information by access mode to the BRT, including walking and driving. Walking access constitutes 91 percent of all trips, and the remaining trips are drive access. This is consistent with the MD 586 corridor as the proposed stations along MD 586 will not be accompanied by park and ride facilities.

Table 23: 2040 Alternative 3 BRT Boardings by Access Mode

District	Boardings[1]		
	Drive	Walk and Bike	Daily
Montgomery College/Rockville Center	<100	1,500	1,500
MD 586 Twinbrook	400	1,500	1,900
MD 586 N Wheaton	100	1,100	1,200
Wheaton	<100	1,800	1,800
Total	**500**	**5,900**	**6,400**

1. Estimated boardings have been rounded to the nearest 100.

Table 24 presents the summary of boardings on the BRT line and the other corridor bus routes as a result of the implementation of Alternative 3. The forecasted ridership on Q lines goes down to 10,300 boardings from 13,800 in the No-Build scenario (which is a 26 percent decrease), while the total study area ridership increases from 32,300 in the No-Build to 35,000 boardings in Alternative 3 (8 percent increase).

Table 24: 2040 Alternative 3 Daily Transit Boardings (BRT and Corridor Routes)

Bus Routes	Boardings[1]		
	Peak[2]	Off Peak	Daily
Alternative 3 BRT	3,200	3,200	6,400
WMATA Q1/Q2/Q4/Q5/Q6	4,500	5,800	10,300
Other buses that only use individual segments			
WMATA C2/C4	3,700	6,000	9,700
Ride On 26	2,100	2,400	4,500
Ride On 34	1,300	1,900	3,200
Ride On 38	<100	100	100
Ride On 44	<100	-	<100
Ride On 48	300	500	800
Total	**15,100**	**19,900**	**35,000**

1. Estimated boardings have been rounded to the nearest 100.
2. Peak Periods = 6 - 9 am and 3 -7 pm

As for Metrorail, the Rockville station is forecasted to have 8,900 daily boardings in 2040 and the Wheaton station is forecasted to have 8,600 daily boardings in 2040. Metrorail ridership, as compared to the No-Build, is expected to increase slightly with the implementation Alternative 3.

Under Alternative 3, the total number of transit trips in the region increases by approximately 2,800 trips per day in comparison with 2040 No-Build scenario. Home-based work transit trips constitute the highest share of total regional transit trips of approximately 71 percent on the BRT alternative. Within the study area, the MD 586 Twinbrook and Wheaton districts produce and attract the most transit riders in comparison to other districts.

Ridership for Alternative 5B

This section presents ridership forecasting results for Alternative 5B, and **Table 25** presents boardings by district. The stations within each district are the same as Alternatives 2 and 3. The total ridership in the forecast year is approximately 7,300 boardings per day, with

approximately 51 percent of the boardings in the peak period and 49 percent in the off-peak period.

Table 25: 2040 Alternative 5B BRT Boardings by Time of Day

District	Peak[1]	Off Peak	Daily Boardings[2]
Montgomery College/Rockville Center	800	900	1,700
MD 586 Twinbrook	900	1,200	2,200
MD 586 N Wheaton	700	600	1,300
Wheaton	1,200	900	2,100
Total	**3,700**	**3,600**	**7,300**

1. Peak Periods = 6 - 9 am and 3 -7 pm
2. Boarding numbers have been rounded to the nearest 100.

Table 26 presents the information by access mode. Walking access constitutes 90 percent of all trips, and the remaining trips are drive access.

Table 26: 2040 Alternative 5B BRT Boardings by Access Mode

District	Drive	Walk and Bike	Daily Boardings[1]
Montgomery College/Rockville Center	<100	1,700	1,700
MD 586 Twinbrook	400	1,800	2,200
MD 586 N Wheaton	100	1,200	1,300
Wheaton	<100	2,100	2,100
Total	**600**	**6,700**	**7,300**

1. Boarding numbers have been rounded to the nearest 100.

Table 27 presents the summary of boardings on the BRT line and the other corridor bus routes as a result of the implementation of Alternative 5B. The daily ridership on Q lines decreases from 13,800 in the No-Build to approximately 9,800 boardings in Alternative 5B (approximately 30 percent decrease), while total study area ridership increases from 32,300 in the No-Build to approximately 35,300 forecasted daily boardings in Alternative 5B (nine percent increase).

Table 27: 2040 Alternative 5B Daily Transit Boardings (BRT and Corridor Routes)

Bus Routes	Peak[1]	Off Peak	Daily Boardings[2]
Alternative 5B BRT	3,700	3,600	7,300
WMATA Q1/Q2/Q4/Q5/Q6	4,100	5,700	9,800
Other buses that only use individual segments			
WMATA C2/C4	3,700	6,000	9,700
Ride On 26	2,100	2,400	4,500
Ride On 34	1,300	1,900	3,200
Ride On 38	<100	100	100
Ride On 44	<100	-	<100
Ride On 48	300	400	700
Total	**15,200**	**20,100**	**35,300**

1. Peak Periods = 6 - 9 am and 3 -7 pm
2. Boarding numbers have been rounded to the nearest 10

As for Metrorail, the Rockville station is forecasted to have 8,900 daily boardings in 2040 and the Wheaton station is forecasted to have 8,600 daily boardings in 2040. Metrorail ridership, as compared to the No-Build, is expected to increase slightly with the implementation Alternative 5B.

Under Alternative 5B, the total number of transit trips in the region would increase by approximately 3,100 trips-per-day in comparison with the 2040 No-Build scenario. Home-based work transit trips constitute the highest share of total regional transit trips of approximately 71 percent. Within the study area, the MD 586 Twinbrook and Wheaton districts produce and attract the most number of transit riders in comparison to other districts.

Summary of Forecasts

Table 28 summarizes the ridership forecasts for the alternatives. Among the build alternatives, Alternative 5B would have the most riders using the proposed service. Alternative 5B also results in the highest overall corridor ridership increase relative to the No Build; however, Alternatives 2 and 3 are also expected to increase ridership along the corridor. Alternative 2 has the lowest ridership among the build alternatives because it only includes an express bus service and does not include new BRT service as in Alternatives 3 and 5B.

Table 28: Summary of 2040 Daily Transit Boardings by Alternative

	Daily Boardings[1]			
Bus Routes	**No Build**	**Express Bus 2**	**BRT 3**	**BRT 5B**
Express Bus/BRT	-	2,600	6,400	7,300
WMATA Q1/Q2/Q4/Q5/Q6	13,800	12,400	10,300	9,800
Other buses that only use individual segments				
WMATA C2/C4	9,800	9,800	9,700	9,700
Ride On 26	4,600	4,600	4,500	4,500
Ride On 34	3,200	3,200	3,200	3,200
Ride On 38	200	100	100	100
Ride On 44	<100	<100	<100	<100
Ride On 48	700	700	800	700
Total	**32,300**	**33,400**	**35,000**	**35,300**

1. Boarding numbers have been rounded to the nearest 10

2. 2040 Roadway Traffic Operations

The following section describes forecasted future traffic operations in the study corridor in 2040 on MD 586.

Alternative 1: No-Build

Discussion: The No-Build Alternative would not consider additional improvements to existing infrastructure or bus service along the Veirs Mill Road study corridor, other than those already planned and programmed for the year 2040. These improvements include the expansion of the Gaynor Road/Parkland Drive intersection to accommodate the Montrose Parkway expansion project and the increased frequency of the WMATA Q2 bus route. Traffic volumes, signal

timings, and local bus ridership/dwell times were updated in the model to reflect the 2040 No-Build conditions.

Level of Service: Overall, the total miles of poor or failing LOS for 2040 No-Build conditions (based on car and truck speeds along segments of MD 586) during the AM peak is 1.5 miles in the westbound direction and 2.0 miles in the eastbound direction, for a total of 3.5 miles. During the PM peak, there are 2.7 miles of poor or failing LOS in the westbound direction and 3.1 miles in the eastbound direction, for a total of 5.8 miles. Additionally, the latent demand (vehicles that cannot enter the model network due to congestion) for No-Build conditions is 917 vehicles during the AM peak and 226 vehicles during the PM peak.

Travel Time Savings: The travel time for cars and trucks in the eastbound direction along the MD 586 corridor, for No-Build conditions, ranges from 22.5 minutes during the AM peak to 27.9 minutes during the PM peak. In the westbound direction, the range is 19.6 minutes during the AM peak to 24.4 minutes during the PM peak. The corridor travel time for local buses in the eastbound direction ranges between 35.5 minutes during the AM peak and 40.4 minutes during the PM peak. In the westbound direction, the travel time range is from 29.5 minutes during the AM peak to 32.9 minutes during the PM peak.

Person Throughput: The total person throughput, including car, trucks, and local buses, for No-Build conditions at the two northern locations that were identified for throughput reporting along the corridor (i.e., south of First Street and South of Twinbrook Parkway), point to the AM westbound and PM eastbound as the peak travel directions, with up to approximately 3,300 people traveling westbound South of Twinbrook Parkway during the AM peak and 3,400 people traveling eastbound at the same location during the PM peak. At the two southern locations (i.e., North of Connecticut Avenue and South of Newport Mill Road) the traffic is more evenly distributed between directions, with a range from 2,200 to 2,600 people during the AM peak (per direction) and 2,500 to 2,800 people during the PM peak (per direction) between these two locations.

Alternative 2

Discussion: Alternative 2 generally provides a competitive express bus option as compared to the Alternative 2 local buses and cars and trucks traveling along MD 586, while also positively impacting traffic operations for these competing modes. The less-frequent headway associated with the enhanced bus service in Alternative 2, as compared to the other alternatives, contributes to lower ridership. While the enhanced bus service in Alternative 2 results in positive traffic operations, the low ridership means these benefits are limited to a lesser number of travelers.

Level of Service: Overall, the total miles of poor or failing LOS (based on car and truck speeds along segments of MD 586) is forecast to decrease from 3.5 and 5.8 miles during the AM and PM peak hours, respectively, with the No-Build, to 3.2 and 4.2 miles with Alternative 2 during the AM and PM peak hours, respectively. Similar to the travel time, this decrease can be attributed to TSP holding the green phase for mainline through traffic, which comes at least partially at the expense of additional delay for mainline left-turn and side street movements. Nonetheless, the mainline improvements still outweigh the additional side street and left-turn

delays, as the total network delay decreases by 7 percent during the AM peak and 18 percent in the PM peak. Additionally, latent demand decreases by 55 percent during the AM peak and 16 percent during the PM peak from the No-Build.

Travel Time Savings: The enhanced bus service with queue jump lanes and TSP as proposed in Alternative 2 provides a transit option between Rockville and Wheaton that offers a time savings, as compared to the local bus service for 2040 No-Build conditions, of approximately:

- 8 minutes per direction during the AM peak,
- 15 minutes in the eastbound direction during the PM peak, and
- 11 minutes in the westbound direction during the PM peak.

When compared to other travel modes in Alternative 2, the travel time of the enhanced bus service is:

- 4 minutes greater than cars and trucks in the westbound direction during the AM and PM peaks,
- 7 minutes greater than cars and trucks in the eastbound direction during the AM peak,
- 3 minutes greater than cars and trucks in the eastbound direction during the PM peak, and
- 7 to 9 minutes less than local buses for each peak.

On a segment basis, two segments (one in the AM eastbound direction and one in the PM westbound direction) experience an increase of more than 10 percent in BRT travel time as compared to the No-Build local buses, due to signal prioritization in the opposite direction and the enhanced bus stop location. As described in Chapter III, the enhanced bus stop locations have not been finalized so there could be an opportunity to reduce the bus travel time by adjusting the stop locations in the next stage of the study.

During both peaks, the travel times for cars and trucks along MD 586 decrease in each direction with Alternative 2 as compared to the No-Build. This decrease, due to TSP holding the green phase for through traffic, benefits the enhanced bus service and mainline through movements at the expense of additional delay for side streets and mainline left-turning movements. These side street and left-turn delays were minimized by providing TSP with green extension only at specific intersections where early green significantly delayed mainline left-turn or side street movements.

Person Throughput: The total person throughput is forecasted to increase by up to 5 percent with Alternative 2 at four locations identified along the corridor (i.e., south of First Street, South of Twinbrook Parkway, North of Connecticut Avenue, and South of Newport Mill Road). Of the locations identified, eastbound MD 586 south of First Street and eastbound MD 586 south of Newport Mill Road (both during the PM peak) are the only locations with a decreased person throughput as compared to the No-Build. At these locations, the throughput of passenger cars has decreased, which may be attributed to longer intersection delays. Since the enhanced bus service ridership would be relatively low, the increase in transit throughput would not be enough to offset the decrease in passenger car throughput.

Alternative 3

Discussion: Alternative 3 generally provides a competitive BRT option as compared to the Alternative 3 local buses and cars and trucks, with all modes along MD 586 benefiting from TSP. BRT operations in the curb lanes with local buses and right-turning traffic does introduce conflicts between modes, as compared to Alternative 5B. Despite these conflicts, the MD 586 corridor is able to serve more people with Alternative 3, due to the additional transit riders using the BRT beyond those that have switched from local buses.

Level of Service: Overall, the total miles of poor or failing segment-based LOS (based on car and truck speeds along MD 586) is forecast to decrease during the PM peak from 5.8 miles with the No-Build to 3.8 miles with Alternative 3, and remained the same for both during the AM peak at 3.5 miles. Similar to the travel time, the decrease can be attributed to the TSP holding the green phase for through traffic. Although the improvements for the mainline traffic on MD 586 come partially at the expense of mainline left-turn and side street movements, the total network delay decreases by 1 percent during the AM peak and 17 percent during the PM peak. The latent demand increases by 7 percent during the AM peak and 20 percent during the PM peak.

One disadvantage associated with Alternative 3 is related to the interaction between the BRT and local buses. Local buses are permitted to travel in the BRT lane and complete their stops in this lane. While BRT buses are permitted to exit the lane to bypass local buses or other delays, the local buses may still cause delays for BRT buses, especially in congested sections where passing the local bus may be challenging. The ability for BRT buses to leave the curbside lane is advantageous at intersections with high right-turn volumes.

Travel Time Savings: The dedicated curb lane BRT service as proposed in Alternative 3 provides a transit option between Rockville and Wheaton that offers a time savings of between 7 and 15 minutes per direction as compared to the local bus service for 2040 No-Build conditions.

When compared to other travel modes in Alternative 3, the travel time of the BRT service is:

- 3 minutes greater than cars and trucks in the westbound direction during the AM peak,
- 5 minutes greater than cars and trucks in the eastbound direction during the AM peak,
- 5.5 minutes greater than cars and trucks per direction during the PM peak, and
- 3 to 8 minutes less than local buses per direction for each peak.

On a segment basis, two segments (one in the AM eastbound direction and one in the PM westbound direction) experience an increase of more than 10 percent in BRT travel time as compared to the No-Build local buses, due to signal prioritization in the opposite direction and the BRT stop location. As described in Chapter III, the station locations have not been finalized so there could be an opportunity to reduce the BRT travel time by adjusting the station locations in the next stage of the study.

During the AM peak in the eastbound direction and in both directions during the PM peak, the travel times for general traffic along MD 586 decrease with Alternative 3, as compared to the No-Build. This decrease, due to TSP holding the green phase for through traffic, benefits the BRT and mainline through movements at the expense of additional delay for side streets and mainline left-turning movements. These side street and left-turn delays were minimized by

providing TSP with green extension only at high impact locations where early green significantly delayed mainline left-turn or side street movements.

The increase in pedestrian volumes associated with the new BRT ridership, in conjunction with the longer pedestrian clearance intervals required due to new or longer crossing distances, contributes to additional delays at certain intersections. The increase in pedestrian volumes also requires right-turning vehicles to yield more frequently, resulting in additional side street delay.

Person Throughput: The total person throughput with Alternative 3 increases by up to 8 percent at all locations except in the eastbound direction at the location north of Connecticut Avenue during the AM peak. At this point, the transit ridership increases but the personal vehicle throughput decreases, which is not offset by the additional transit riders. While the person throughput on local buses also decreases, many of those riders have switched to the BRT.

Alternative 5B

Discussion: Alternative 5B generally provides a BRT option with consistent travel times for each peak and travel direction, due to the BRT operating in a dedicated median lane. However, the dedicated BRT median lane does require left-turn restrictions at some locations along the corridor, which results in traffic diversions to other traffic signals. Additionally, protected-only left-turn phasing, which is required for left-turning vehicles to safety transverse the median BRT lane, increase delays. The high BRT ridership, comprised of both local bus riders who have switched to BRT riders, as well as new transit riders, allows the corridor to serve more people with this alternative.

Level of Service: Similar to Alternatives 2 and 3, the total forecasted miles of segment-level poor or failing LOS (based on car and truck speeds along MD 586) decreased for Alternative 5B as compared to the No-Build, from 3.5 and 5.8 miles during the AM and PM peak hours, respectively, with the No-Build to 2.8 and 4.1 miles during the AM and PM peak hours, respectively, with Alternative 5B. Similar to the travel time, this decrease can be attributed to the TSP holding the green phase for through traffic. The latent demand increases by 43 percent during the AM peak and 52 percent during the PM peak. The improvements for the mainline traffic on MD 586 balance some of the excess delay experienced by the turning movements and side streets, evident by the total network delay which increases by 20 percent during the AM peak and decreases by 5 percent during the PM peak.

With BRT operations in the median, the diverted movements from unsignalized intersections to signalized intersections significantly increases the traffic volumes at some signalized intersections. Another disadvantage associated with Alternative 5B is related to modifying the left-turn phasing for the mainline to protected-only phasing (the No-Build offers protected-permitted phasing). This signal phasing modification causes excess delay for some left-turning movements. Lagging the left-turn phase helps alleviate delay at specific locations. Additionally, extending the left-turn lane storage lengths is needed at some intersections with this alternative, to accommodate longer queues.

Travel Time Savings: The median lane BRT service as proposed in Alternative 5B provides a transit option between Rockville and Wheaton that offers a time savings, as compared to the local bus service for 2040 No-Build conditions, of approximately:

- 12 minutes in the eastbound direction during the AM peak,
- 3 minutes in the westbound direction during the AM peak,
- 15.5 minutes in the eastbound direction during the PM peak, and
- 8 minutes in the westbound direction during the PM peak.

In both directions and during both peaks, the mainline BRT travel time is only about 3 minutes greater than the travel time of cars and trucks in Alternative 5B.

On a segment basis, two segments (one in the AM eastbound direction and one in the PM westbound direction - the same segments as Alternatives 2 and 3) experience increases of greater than 10 percent in BRT travel time as compared to the local buses in the No-Build conditions due to signal prioritization in the opposite direction and BRT station location. As described in Chapter III, the station locations have not been finalized so there could be an opportunity to reduce the BRT travel time by adjusting the station locations in the next stage of the study. The overall travel time savings for the BRT occurs even where the BRT operates in a single median lane and may be required to wait to allow an opposing BRT vehicle to pass before continuing through the single lane section (the single median lane section occurs from First Street to Twinbrook Parkway). The BRT headways were set so that the dwell time due to opposing BRT buses is minimal to none and only occurs in the event of longer than anticipated delays elsewhere in the corridor.

The travel time for general traffic in the westbound direction during the AM peak is forecast to experience an increase since eastbound coordination is prioritized during the AM peak period. During the AM peak in the eastbound direction and in both directions during the PM peak, the general traffic travel time along MD 586 decreases in Alternative 5B, as compared to the No-Build, despite operating with the reduced speed limit of 35 MPH due to the road narrowing necessary to accommodate the BRT in the median. This decrease, due to TSP holding the green phase for through traffic, often occurs at the expense of the side streets and mainline left-turning movements. These side street and left-turn delays were minimized by providing green extension only TSP at the high-impact locations. Additionally, the side street delay was minimized due to the increased pedestrian clearance intervals required for pedestrians to cross the widened MD 586 roadway. The increase in pedestrian volumes also requires right-turning vehicles to yield more frequently, resulting in additional delay at some side streets.

Person Throughput: Similar to Alternative 3, the total person throughput with Alternative 5B increases by up to 7 percent at all locations except in the eastbound direction at the location north of Connecticut Avenue during the AM peak. At this point, the transit ridership increases but the personal vehicle throughput decreases, which is not offset by the additional transit riders. While the person throughput on local buses also decreases, many of those riders have switched to the BRT. The BRT ridership in Alternative 5B is expected to be the highest of all the alternatives which contributes to the increase in person throughput at nearly every location.

Summary

In general, each of the build alternatives improve travel times for cars and trucks traveling along MD 586, as compared to the No-Build; however, this occurs more as a secondary benefit of TSP. In some cases, increased travel times are reported due to longer side street green time. Due to the widening of the roadway for the BRT, longer pedestrian crosswalks are needed, lengthening the green time necessary to allow pedestrians to cross the mainline safely. Additionally, with Alternative 5B, the mainline left-turn signal phasing was modified to protected-only (i.e., where left turns are not permitted if the opposing through has a green phase) at many intersections, thus decreasing the available green time for mainline MD 586. Alternative 5B also operated with a reduced speed limit of 35 MPH for the general traffic lanes due to reduced lane widths needed to accommodate the median BRT lanes.

Similar to the travel time improvements for cars and trucks, local buses often benefit from TSP for the same reasons mentioned above. Across the alternatives, the local buses interact with general traffic and the proposed enhanced/BRT buses in different ways, which affects the local bus operations. For example, with Alternative 2 local buses generally do not utilize the queue jump locations provided for the proposed enhanced buses because of the exclusive enhanced bus phase that is required to allow the enhanced buses to merge into general traffic within the intersection without delays. With Alternative 3, the local buses and BRT both travel along and complete their stops within the outermost lane. Through the portion of MD 586 where a median lane BRT is proposed (Alternative 5B), the local buses travel in the outermost lane with no interaction with the median BRT vehicles. Additionally, the traffic signal timings, including TSP, and offsets were prioritized for cars and trucks and the BRT, with less of a focus on local buses.

While the enhanced service/BRT travel time results from VISSIM reflect an improvement as compared to local buses in the No-Build scenario for all alternatives, the degree of improvement varies among the alternatives.

In the eastbound direction, Alternative 5B results in the lowest, or best, travel time along the corridor. In this direction, the BRT dwell times at the stations do not hinder its progression through the signalized intersections and the median lane allows the BRT vehicles to travel the corridor with little interference. In the eastbound direction, the BRT travel time in Alternative 5B is faster than the BRT in Alternative 3 because the right turns and local buses slow down the BRT in the curbside lane as compared to the median lane.

In the westbound direction, progression for BRT vehicles is less efficient, which may be partially attributed to the BRT station locations, such as the far side station at Connecticut Avenue. The far side station at this location, coupled by the fact that the BRT phase in Alternative 5B can only be served when mainline left-turn phases are not being served (i.e., protected-only mainline left-turn phasing), causes BRT vehicles to miss the green indication at Randolph Road and results in longer corridor travel times than the enhanced bus line in Alternative 2 and the BRT in Alternative 3 during the AM peak. Similar situations occur with the far side stations at Randolph Road and Parkland Drive (i.e., other locations where the signal spacing is relatively short), causing delays for upstream segments. It is important to note that BRT buses with Alternative 5B receive a green signal indication only when both directions on the mainline are

green, which shortens the BRT phase at signals with lead-lag left-turn phasing and contributes to poorer progression for westbound BRT buses. Additionally, the BRT dwell times for Alternatives 3 and 5B are higher than the BRT dwell times for Alternative 2, due to increased ridership. During the AM peak in the westbound direction, and in both directions during the PM peak, the enhanced bus service travel time with Alternative 2 is faster than the BRT travel time with Alternative 3 (which may be attributed to longer dwell times for BRT vehicles with Alternative 3).

Despite no change in the forecasted No-Build vehicular traffic volume inputs and the reduction in local transit riders in each of the build alternatives, the total person throughput along the corridor increases for most of the alternatives, due to the BRT. According to the network statistics for the AM peak, Alternative 2 experiences a decrease in total network delay while Alternative 3 and Alternative 5B experience increases as compared to the No-Build. During the PM peak, each of the build alternatives experiences a reduction in the total network delay, indicating the improvements for mainline traffic offset the delays on the side streets with Alternatives 3 and 5B. However, during the PM peak, the latent demand increases for Alternative 3 and Alternative 5B as compared to the No-Build. Both of these increases occur as a result of excess delay on the side streets. These vehicles are unable to enter the network because of the effects of TSP and higher pedestrian volumes for these alternatives.

Table 29 and **30** provide a comparison summary of the 2040 traffic operational analyses for the alternatives retained for detailed study.

Table 29: MD 586 BRT Alternative Corridor Travel Time Comparison Table

	Segment	Length (miles)	Cars and Trucks (minutes)				Local Bus (minutes)				BRT (minutes)			
			No Build	Alt 2	Alt 3	Alt 5B	No Build	Alt 2	Alt 3	Alt 5B	No Build	Alt 2	Alt 3	Alt 5B
AM Eastbound	North of Middle Ln to First Street	0.8	4.0	3.2	3.3	3.4	3.6	5.3	5.3	4.9	N/A	5.2	5.4	5.1
	First Street to Twinbrook Pkwy	1.5	4.1	4.2	4.2	4.3	6.8	7.1	7.2	7.4	N/A	4.9	4.7	4.2
	Twinbrook Pkwy to Connecticut Ave	2.5	10.6	9.1	9.3	9.8	16.7	16.4	13.3	17.2	N/A	12.7	11.0	7.5
	Connecticut Ave to Wheaton Metro Station	1.6	3.8	4.2	4.5	4.6	8.4	7.8	8.2	7.7	N/A	5.0	5.1	6.0
	Total	**6.4**	**22.5**	**20.7**	**21.3**	**22.1**	**35.5**	**36.7**	**34.0**	**37.1**	**N/A**	**27.9**	**26.2**	**22.8**
AM Westbound	Wheaton Metro Station to Connecticut Ave	1.6	6.1	5.0	5.7	6.9	8.4	7.6	7.8	8.1	N/A	5.5	6.9	6.1
	Connecticut Ave to Twinbrook Pkwy	2.5	7.3	6.8	7.9	9.0	10.6	9.9	10.1	11.0	N/A	7.6	7.1	11.3
	Twinbrook Pkwy to First Street	1.5	3.9	4.1	4.2	6.0	7.1	7.8	7.5	9.4	N/A	5.7	5.3	4.7
	First Street to North of Middle Ln	0.8	2.4	2.7	2.8	2.7	3.3	3.5	3.7	3.5	N/A	2.7	3.5	3.4
	Total	**6.4**	**19.6**	**18.6**	**20.5**	**24.6**	**29.5**	**28.8**	**29.2**	**32.0**	**N/A**	**21.6**	**22.7**	**25.5**
PM Eastbound	North of Middle Ln to First Street	0.8	4.8	5.0	4.2	4.0	6.6	5.3	5.4	5.1	N/A	5.0	6.2	4.4
	First Street to Twinbrook Pkwy	1.5	3.8	3.8	4.1	4.6	6.5	6.0	6.4	7.7	N/A	3.9	4.3	4.1
	Twinbrook Pkwy to Connecticut Ave	2.5	14.4	9.2	7.3	8.0	18.8	13.1	10.4	12.0	N/A	10.8	8.6	8.0
	Connecticut Ave to Wheaton Metro Station	1.6	4.9	4.3	4.6	5.5	8.6	8.2	8.1	8.9	N/A	5.2	6.2	7.2
	Total	**6.4**	**27.9**	**22.3**	**20.2**	**22.1**	**40.4**	**32.7**	**30.4**	**33.8**	**N/A**	**24.9**	**25.3**	**23.7**
PM Westbound	Wheaton Metro Station to Connecticut Ave	1.6	7.1	5.1	5.5	6.9	9.8	8.7	9.0	10.6	N/A	5.1	7.5	7.2
	Connecticut Ave to Twinbrook Pkwy	2.5	11.0	7.2	7.4	9.1	14.2	10.2	9.6	12.9	N/A	7.8	7.8	7.7
	Twinbrook Pkwy to First Street	1.5	3.6	3.8	4.6	4.9	6.7	6.7	7.6	8.0	N/A	5.9	6.0	5.4
	First Street to North of Middle Ln	0.8	2.7	2.6	2.6	2.7	2.3	3.5	2.8	3.2	N/A	3.5	4.3	4.2
	Total	**6.4**	**24.4**	**18.6**	**20.2**	**23.6**	**32.9**	**29.1**	**29.0**	**34.6**	**N/A**	**22.3**	**25.7**	**24.6**

Travel Time decreases more than 10% from the No-Build

Travel Time increases more than 10% from the No-Build

NOTES: 10% Threshold corresponds to travel time calibration measure
BRT comparison is from No-Build Local Bus Travel Time
BRT and Local Bus Travel Times include Dwell Times

Table 30: MD 586 BRT Person Throughput and Traffic Operations

2040 Year		No-Build		Alternative 2		Alternative 3		Alternative 5B	
		AM	PM	AM	PM	AM	PM	AM	PM
Person Throughput at Select Locations (people)[1]									
Eastbound	South of First St	**1,500**	**2,300**	1,500	2,300	1,600	2,300	1,600	2,300
	South of Twinbrook Pky	**2,000**	**3,400**	2,000	3,400	2,000	3,500	2,000	3,500
	North of Connecticut Ave	**2,600**	**2,800**	2,700	3,000	2,600	3,000	2,500	3,000
	South of Newport Mill Rd	**2,400**	**2,500**	2,500	2,400	2,400	2,600	2,500	2,600
Westbound	South of Newport Mill Rd	**2,200**	**2,500**	2,200	2,500	2,300	2,500	2,300	2,500
	North of Connecticut Ave	**2,600**	**2,600**	2,600	2,600	2,600	2,800	2,600	2,700
	South of Twinbrook Pky	**3,300**	**2,300**	3,400	2,400	3,400	2,400	3,300	2,400
	South of First St	**2,300**	**1,600**	2,400	1,600	2,400	1,700	2,400	1,700
Miles of Poor or Failing Vehicle Speeds Along MD 586 (miles)									
LOS	E or F	**3.5**	**5.8**	3.2	4.2	3.5	3.8	3.3	4.1
Intersections Operating at LOS E or F									
LOS	E or F	**4**	**5**	4	4	4	4	4	5
Network Statistics									
Total Delay (minutes)[2]		**87,870**	**113,460**	81,640	92,730	86,770	93,670	99,410	104,590
Latent Demand (vehicles)[3]		**920**	**230**	410	190	980	270	1,310	340

1. Person throughput has been rounded to the nearest 100.
2. Total delay includes side street delay; does not include latent delay, rounded to nearest 10
3. Latent demand includes the vehicles that could not be served during the one-hour peak simulation period, rounded to nearest 10

V. ENVIRONMENTAL ANALYSIS

This section describes the existing socioeconomic, cultural and natural environmental conditions in the analysis area and the potential impacts of the proposed BRT service along MD 586/Veirs Mill Road Study corridor. The discussions include relevant environmental disciplines identified in the FHWA 23 CFR, Part 771, "Environmental Impact and Related Procedures" and all other appropriate federal, state, and local laws.

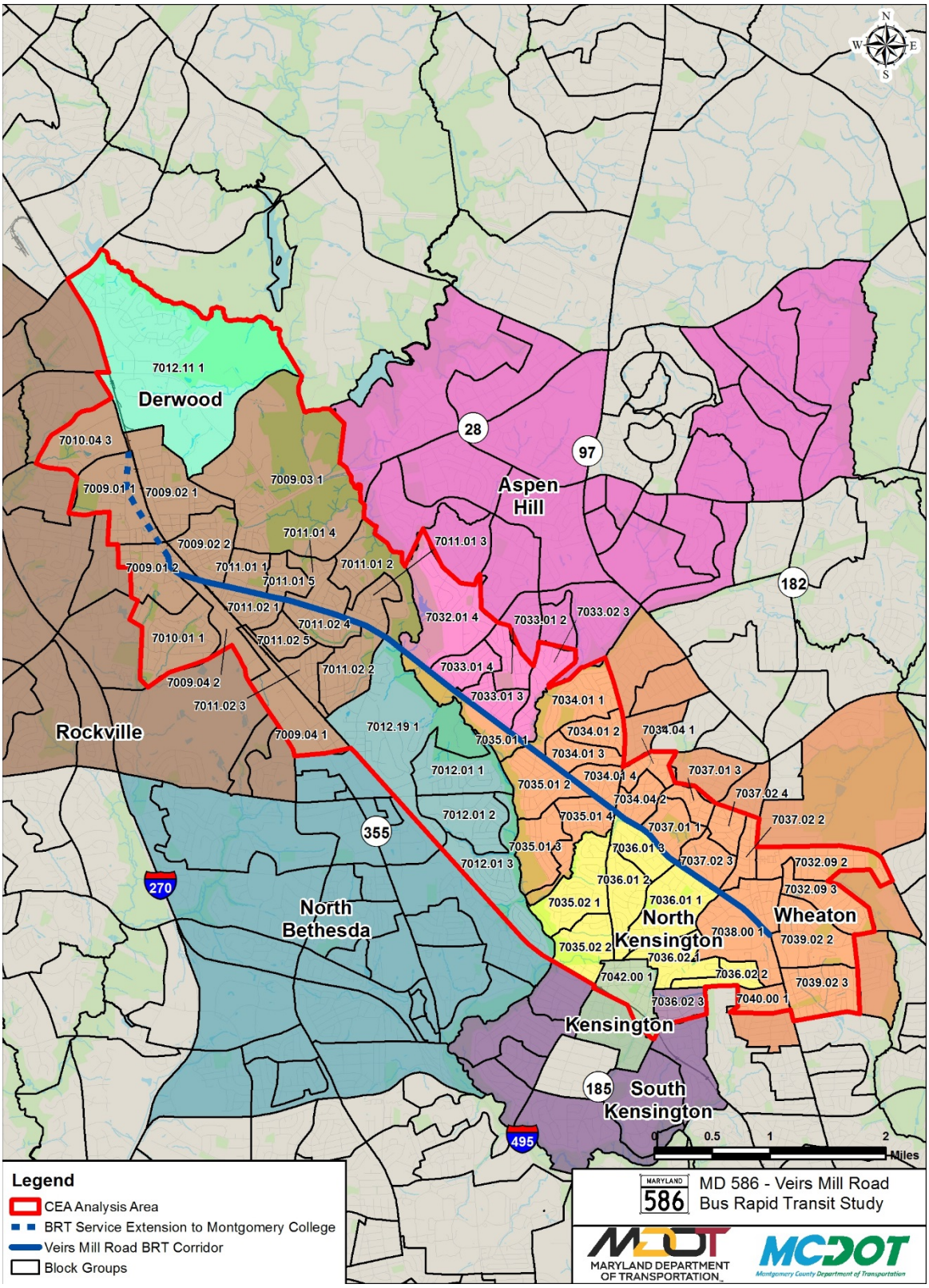
A. SOCIAL CHARACTERISTICS

The *Community Effects Assessment Technical Report* (CEA) (March 2016), documents the effects of the MD 586/Veirs Mill Road BRT Corridor Study on social, economic, and land use features that make up the affected community. This effort included public outreach and coordination with municipal and county officials and provided MDOT and MCDOT with information to help shape the outcome of the project and ensure that the improvements to be implemented address items of public importance, including: mobility, safety, employment, residential relocation, community isolation, and other potential community issues.

The assessment of effects on the community involves the collection and analysis of demographic and economic data from multiple sources (primarily the US Census Bureau, ACS 2013 five-year estimates; the Maryland Department of Planning; Montgomery County; Montgomery County Public Schools; and the City of Rockville), local and regional land use and transportation plans, water and sewer facility plans, and proposed private and public development plans. In addition, information was gathered through coordination with local officials and members of the public concerning the status of local plans and development and issues related to local minority and low-income; also referred to as Environmental Justice (EJ) and/or Title VI populations.

The CEA analysis area extends outside of the study corridor, recognizing that the socioeconomic and land use impacts would extend beyond the physical limits of the project; this area was loosely defined by the census tract block groups that would be impacted by the proposed activity. The CEA analysis area is mostly suburban, with central business districts located in Rockville and Wheaton and with additional small commercial hubs located at the intersections of Veirs Mill Road and Atlantic Avenue, Randolph Road, and University Boulevard West (MD 193). Veirs Mill Road passes through Rock Creek Regional Park. The CEA analysis area encompasses 10,499 acres and 59 census tract block groups, as identified on **Figure 5**.

Figure 5: 2010 Census Tract Block Groups



1. Demographics and Housing

According to the ACS 2013 five-year estimates, the CEA analysis area population was 89,553. The percentage of the population aged more than 65 years within the CEA analysis area was 11.3 percent, which is less than the county and state averages of 12.7 percent. The percentage of persons within the CEA analysis area who are aged 16 to 64 and have a disability is 5.1 percent, which is the same as the county and less than the state average of 8.3 percent. The percentage of persons within the CEA analysis area who live below the poverty level is 9.8 percent which is greater than the county average of 6.7 percent and the same as the state average. The CEA analysis area median household income of $84,778 is less than the county median household income of $98,221 and greater than the state median household income of $73,538. Within the CEA analysis area, 49.9 percent is racial minority, which is greater than the county minority percentage of 43.3 percent and the state minority percentage of 41.6 percent. The White CEA analysis area population is 50.1 percent, while Asian, Other, and Black/African American make up 15.5, 14.3, and 14.0 percent of the population, respectively. Those of Hispanic/Latino origin account for 29.9 percent of the CEA analysis area population which is greater than the county Hispanic/Latino percentage of 17.5 percent and the state Hispanic/Latino percentage of 8.5 percent. **Table 31** shows population statistics for the CEA analysis area, Montgomery County, and Maryland. Detailed demographic data for each block group with the CEA analysis area is provided in the CEA.

Table 31: Population Characteristics

POPULATION CHARACTERICS		CEA Analysis Area	Montgomery County	Maryland
Total Population		89,553	989,474	5,834,299
Projected Population (2040)		N/A	1,206,800	6,889,700
Percent Male / Percent Female		49.1% / 50.9%	48.1% / 51.9%	48.4% / 51.6%
Percent of Population 65 Years and Older		11.3%	12.7%	12.7%
Percent of Population Aged 16 – 64 with a Disability		5.1%	5.1%	8.3%
Percent of Population in Poverty/Low Income		9.8%	6.7%	9.8%
Median Household Income		$84,778	$98,221	$73,538
Race	White	50.1%	56.7%	58.4%
	Black/African American	14.4%	17.2%	29.4%
	American Indian	0.3%	0.3%	0.3%
	Asian	16.1%	14.1%	5.7%
	Native Hawaiian & Pacific Islander	0.1%	0.0%	0.0%
	Other	15.0%	7.7%	3.4%
	Two or More Races	4.1%	4.0%	2.8%
Percent of Population of Hispanic/Latino Origin (Ethnic Minority)		29.9%	17.5%	8.5%
Percent Racial Minority		49.9%	43.3%	41.6%

Source: ACS 2013 five-year estimates.

Within the CEA analysis area, the housing market supports the existing and planned population, and housing growth is generally expected to increase in proportion to population growth. In 2013, the CEA analysis area had 32,947 housing units, with an average owner-occupancy rate of 61 percent, which is comparable to the Montgomery County owner-occupancy rate of 67 percent and Maryland owner-occupancy rate of 68 percent (**Table 32**).

Table 32: Housing Characteristics

	Housing Units	Owner Occupied (%)	Renter Occupied (%)	Vacant (%)
CEA Analysis Area	32,947	61	39	4.5
Montgomery County	377,824	67	33	4.6
Maryland	2,387,285	68	32	10.1

Housing types within the CEA analysis area vary from single-family post-war residences to high-density apartments and condominiums. Most of the available housing near Veirs Mill Road consists of single-family homes. Large apartment complexes along Veirs Mill Road include the following block groups referenced here and shown in **Figure 5**: Westchester Rockville Station inside the City of Rockville (7011.02 BG 1); Rock Creek Woods Apartments abutting the City of Rockville (7012.19 BG 1); Village Square Apartments (7034.01 BG 4) and Rock Creek Terrace (7035.01 BG 1, with 457 Section 8 assisted living units), located about midway along the study corridor; and Archstone Wheaton Station (7038 BG 1) and Archstone (7038 BG 1), within the Wheaton neighborhood area. Smaller apartment buildings are also present along Veirs Mill Road.

The CEA provides additional detail comparing the average percentage of owner-occupied housing, renter-occupied housing, and vacant units within each block group to the CEA analysis area averages for this same information.

Impacts on Demographics and Housing

Temporary Easements and Property Acquisitions: Temporary easements and property acquisitions, including ROW acreage, residential relocations, and displacement impacts for each retained alternative are summarized in **Table 33** and shown in **Appendix A**.

Table 33: Right-of-Way Impacts by Alternative

	Alternative 2				Alternative 3				Alternative 5B			
	Temp Ease		ROW		Temp Ease		ROW		Temp Ease		ROW	
	Parcels	Acres	Parcels	Acres	Parcels	Acres	Parcels	Acres	Parcels	Acres	Parcels	Acres
Total Number of Parcels	45	1.2	27	0.7	265	5.0	116	2.3	310	7.9	217	6.7
Residential Relocations	4				7				9-17[1]			
Business Displacements	1				2				3			

1. The residential relocations for Alternative 5B are presented as a range due to the uncertainty in the final station locations. The range was developed by identifying potential displacements for the most likely station locations based on discussions with the City of Rockville.

Alternative 1 would require no temporary easement, ROW, or displacements. Each of the build alternatives would require temporary easements to facilitate construction activities and permanent property acquisition throughout the study corridor. Alternative 2 would require 1.2 acres of temporary easement from 45 parcels; Alternative 3 would require 5.0 acres from 265 parcels; and Alternative 5B would require 7.9 acres from 310 parcels.

In addition to temporary easement, each of the build alternatives would also require permanent ROW acquisition. Alternative 2 would require 0.7 acres of ROW from 27 parcels; Alternative 3 would require 2.3 acres from 116 parcels; and Alternative 5B would require 6.7 acres from 217 parcels. For each of the build alternatives, the majority of the property impacts would be narrow strip takes along the existing roadway. These impacts would require reconstruction of sidewalks along Veirs Mill Road. Alternative 5B would result in the highest

degree of impact because of the ROW required for the dedicated median lane(s) that would extend along the entire length of the study corridor. Under each of the build alternatives, land would be acquired to capture and treat stormwater runoff. Although preliminary stormwater analysis has been completed for the build alternatives, future detailed design efforts may result in further revisions to the ROW impacts identified here. The project would have no direct impact on senior centers or assisted living facilities. Any new sidewalk and pedestrian facilities would be designed in accordance with ADA requirements, as applicable.

Due to the permanent ROW acquisition required, residential relocations and business displacements would occur under each of the build alternatives, as depicted in **Appendix A**. Block groups referenced below are shown in **Figure 5**. Alternative 2 would result in four residential relocations, two in the City of Rockville (7011.01 BG 1) and two in 7034.04 BG 2. Alternative 2 would also require one business displacement (7034.01 BG 3). Alternative 3 would result in seven residential relocations, two in the City of Rockville (7011.01 BG 1), two in 7034.04 BG 2, two in 7037.01 BG 1, and one in 7036.01 BG 1. Alternative 3 would also require two business displacements, located in 7034.01 BG 3 and 7034.01 BG 4. Alternative 5B would result in up to 17 residential relocations, ten in the City of Rockville (7009.02 BG 2, 7011.01 BG 1, 7011.02 BG 1, and 7011.02 BG 4), one in 7033.01 BG 3, five in 7037.01 BG 1 and one in 7036.01 BG 1. Alternative 5B would also require three business displacements, in the City of Rockville (7011.01 BG 3), 7031.01 BG 3, and 7034.04 BG 4. 1. The residential relocations for Alternative 5B are presented in the impact summary tables as a range due to the uncertainty in the final station locations. The range was developed by identifying potential displacements for the most likely station locations based on discussions with the City of Rockville.

Title VI Statement and Uniform Relocation Assistance: Should a federal funding source be identified for the implementation of the proposed improvements, it is the policy of the MDOT to ensure compliance with the provisions of Title VI of the Civil Rights Act of 1964 and related civil rights laws and regulations which prohibit discrimination on the grounds of race, color, sex, national origin, age, religion, or physical or mental handicap in all state projects funded in whole or in part by the federal government. The state of Maryland will not discriminate in planning, design, construction, ROW acquisition, or provision of relocation advisory assistance. This policy has been incorporated in all levels of the planning process so that proper consideration may be given to the social, economic, and environmental effects of all projects.

Should a federal funding source be identified for the implementation of the proposed improvements, property owners affected by displacement would receive relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, revised June 10, 2005 as amended, and Sections 12-112 and Subtitle 2, Sections 12-201 to 12-212, of the Real Property Article of the Annotated Code of Maryland. The project shall not proceed into any phase that will cause the relocation of any persons or proceed with any construction project until it has furnished assurances that all displaced persons would be satisfactorily relocated to comparable decent, safe, and sanitary housing within their financial means, or that such housing is in place and has been made available to the displaced person. Payments for cost of moving are also provided.

2. Community Profiles/Neighborhoods

The CEA analysis area is made up of eight neighborhoods: Derwood, Rockville, Aspen Hill, North Bethesda, North Kensington, Kensington, South Kensington, and Wheaton (**Figure 5**). Wheaton and Rockville together make up 68 percent of the CEA analysis area population. **Table 34** summarizes the neighborhood profiles within the CEA analysis area.

The City of Rockville, designated as the Rockville CBD and a major employment center for the surrounding area, includes commercial, retail, mixed-use, high-density, and government uses. The Rockville Metrorail Station is located on the eastern side of the city. Outside the city-center, land use is almost exclusively medium-density residential. North of Rockville, commercial, industrial, and retail are the dominant land uses. The City of Rockville is home to 30.5 percent of the CEA analysis area population and the average Rockville median household income is $85,995. The Rockville low-income population average is 9.0 percent. Additionally, Rockville has an ethnic minority population of (24.4 percent) and a racial minority population of 43.2 percent.

Table 34: Neighborhood Profile Summary

Geographic Area/ Associated Neighborhood	Percent Study-Area Population	Median Income ($)	Low Income	Average Median Age (Years)	Owner Occupied Housing	Ethnic Minority Population	Racial Minority Population
Rockville	30.5%	$85,995	9.0%	38.5	54.4%	24.4%	43.2%
Derwood	2.5%	$104,500	10.6%	35.5	63.0%	12.3%	49.4%
N. Bethesda	10.0%	$84,815	9.1%	34.8	42.0%	25.9%	41.8%
Aspen Hill	6.5%	$84,858	6.2%	39.9	84.7%	33.0%	45.4%
Wheaton	37.4%	$80,716	11.7%	36.0	64.5%	38.0%	63.8%
N. Kensington	11.3%	$90,241	8.7%	41.1	74.8%	29.1%	36.5%
Kensington	0.9%	$88,438	2.9%	42.1	59.0%	7.6%	31.7%
S. Kensington	0.9%	$128,083	5.2%	42.2	94.0%	7.1%	26.2%
CEA Analysis Area		$84,778	9.8%	37.8	61.0%	29.9%	49.9%
Montgomery County		$98,221	6.7%	38.4	67.0%	17.5%	43.3%
Maryland		$73,538	9.8%	38.0	68.0%	8.5%	41.6%

The Wheaton Metrorail Station is surrounded by the Wheaton CBD planning area, which is dominated by retail use due to the presence of the Westfield Wheaton Mall. There is commercial development in the area as well. Additionally, mixed-use-, pedestrian-, and transit-oriented development underway should enhance the Wheaton area's presence as a retail destination. Outside the CBD, the area quickly transitions to medium-density residential land use. The unincorporated neighborhood of Wheaton is home to 37.4 percent of the CEA analysis area population. The average Wheaton median household income is $80,716. The Wheaton low-income population average is 11.7 percent. Additionally, Wheaton has an ethnic minority population of 38.0 percent and a racial minority population of 63.8 percent.

The other CEA analysis area neighborhoods, which include Derwood, North Bethesda, Aspen Hill, North Kensington, Kensington, and South Kensington, are primarily medium-density residential areas. Parks, schools, churches, and a few neighborhood shopping centers are prominent throughout these areas.

The unincorporated neighborhood of Derwood is home to 2.5 percent of the CEA analysis area population (7012.11 block group 1 is the only block group in this neighborhood that is part of the CEA analysis area). The average Derwood median household income is $104,500. The Derwood low-income population average is 10.6 percent. Derwood has an ethnic minority population of 12.3 percent and a racial minority population of 49.4 percent.

The unincorporated neighborhood of North Bethesda is home to 10.0 percent of the CEA analysis area population. The average North Bethesda median household income is $84,815. The North Bethesda low-income population average is 9.1 percent. North Bethesda has an ethnic minority population of 25.9 percent and a racial minority population of 41.8 percent.

The unincorporated neighborhood of Aspen Hill is home to 6.5 percent of the CEA analysis area population. The average Aspen Hill median household income is $84,858. The Aspen Hill low-income population average is 6.2 percent. Aspen Hill has an ethnic minority population of 33.0 percent and a racial minority population of 45.4 percent.

The unincorporated neighborhood of North Kensington is home to 11.3 percent of the CEA analysis area population. The average North Kensington median household income is $90,241. The North Kensington low-income population average is 8.7 percent. North Kensington has an ethnic minority population of 29.1 percent and a racial minority population of 36.5 percent.

The incorporated town of Kensington is home to approximately 1 percent of the CEA analysis area population (7042 block group 1 is the only block group in this neighborhood that is part of the CEA analysis area). The Kensington median income is $88,438. The Kensington low-income population average is 2.9 percent. Kensington has an ethnic minority population of 7.6 percent and a racial minority population of 31.7 percent.

The unincorporated neighborhood of South Kensington is home to approximately 1 percent of the CEA analysis area population (7036.02 block group 3 is the only block group in this neighborhood that is part of the CEA analysis area). The South Kensington median income is $128,083. The South Kensington low-income population average is 5.2 percent. South Kensington has an ethnic minority population of 7.1 percent and a racial minority population of 26.2 percent.

Impacts on Community Profiles and Neighborhoods

Roadway effects on neighborhoods and communities generally fall into the categories of community cohesion, mobility and access, and quality of life. In general, each of the build alternatives would increase mobility, reduce time spent in congestion for transit riders, improve safety for pedestrians and cyclists, and increase foot traffic for customers in business areas. The project would result in little to no change to the landscape or natural setting within the CEA analysis area and is consistent with the general planning vision of the region.

Alternative 1 (No-Build) would result in no displacements or ROW impacts and would have no direct effect on neighborhoods and communities. The BRT would not be implemented and the benefits of it would not be realized.

Veirs Mill Road is an existing point of separation between communities and neighborhoods along the study corridor. Since all of the build alternatives would widen within the current alignment of Veirs Mill Road, none of the build alternatives would bisect or fragment any neighborhoods or communities. The build alternatives would require strip and linear ROW takes along the existing road. Although displacements are a part of each of the three build alternatives, they would not bisect any neighborhoods or communities, disrupt community cohesion, or isolate residences from other residences within communities.

Access to residences and businesses would remain unchanged for Alternatives 1, 2, and 3. Access to businesses and residences could become more circuitous in Alternative 5B because the dedicated median lanes would not allow left-turns at the following un-signalized intersection locations:

- Westbound onto Gail Avenue
- Eastbound onto Woodburn Road
- Westbound onto Clagett Drive
- Eastbound onto Clagett Drive
- Westbound onto Ardennes Avenue
- Westbound onto Midway Avenue
- Eastbound onto service road across from Midway Avenue
- Westbound into Twinbrook Marketplace parking lot
- Eastbound into Twinbrook Center parking lot
- Westbound into business across from Meadow Hall Drive
- Eastbound onto Meadow Hall Drive
- Westbound into Parklawn Memorial Park
- Westbound U-turn at Arbutus Avenue
- Westbound U-turn at Parklawn Park Entrance

Transit mobility would be improved for Alternatives 2, 3, and 5B because of the additional mode of transportation that would be offered. The BRT would increase mobility within the study corridor as well as the surrounding area because of greater access to the regional transportation network. The proposed BRT would better connect the City of Rockville and Wheaton CBD and provide enhanced access to locations between those districts. Residents would have convenient and reliable transportation to the Rockville and Wheaton employment centers and access points for the Metrorail. The improved, faster access to the Metrorail would make it a more practical primary mode of travel for persons traveling to and from work and would open the entire region for work and recreation.

Quality of life is a combination of community cohesion; access and mobility; landscape/natural settings; and health, safety, and social values. The BRT would enhance the overall quality of life for residents by enhancing the choices for transportation users. Providing greater transit mobility and reliability would expand the transit options for drivers, which could result in a reduction in the number of automobiles on the road.

In general, the landscape of the study corridor would change very little except at station locations where, during final design, aesthetics and landscaping elements would be developed with consideration of community input. Particular attention would be given to design bus

stations that are not visually invasive and are consistent with other aesthetic elements of the study corridor. Much of the study corridor is already a developed area, with natural environments and settings concentrated in designated parks and open space areas. The project would not bisect or fragment any natural settings or create visually inconsistent landscapes along the study corridor.

3. Environmental Justice

On February 11, 1994, Executive Order 12898*, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* was signed by President William J. Clinton; which directs federal agencies to develop environmental justice strategies to help federal agencies address the disproportionately high and/or adverse human health and/or environmental effects of their programs on minority and low-income populations. The order is also intended to promote nondiscrimination in federal programs that affect human health and the environment. It aims to provide minority and low-income communities, access to public information, and public participation in matters relating to human health and the environment. This EJ analysis was prepared in accordance with the definitions, methodologies, and guidance provided in Executive Order 12898; the Council on Environmental Quality *Environmental Justice Guidance Under the National Environmental Policy Act* (1997); Unites States Department of Transportation (USDOT) Order 5610.2(a), *Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (2012 update); FHWA memorandum *Guidance on Environmental Justice and NEPA* (2011); and FTA Circular 4703.1 *Environmental Justice Policy Guidance for Federal Transit Administration Recipients* (2012).

Executive Order 12898 defines ***Environmental Justice*** as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. ***Fair treatment*** means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies. ***Meaningful involvement*** means that (1) people have an opportunity to participate in decisions about activities that may affect their environment and/or health; (2) the public's contribution can influence the regulatory agency's decision; (3) the public's concerns will be considered in the decision-making process; and (4) the decision makers seek out and facilitate the involvement of those potentially affected.

Executive Order 12898 defines ***minority*** as a person who is:

- Black (a person having origins in any of the black racial groups of Africa);
- Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race);
- Asian-American (a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands); or
- American Indian and Alaska Native (a person having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition).

Per Executive Order 12898, ***low income*** is defined as a person whose median household income is at or below the Department of Health and Human Services (DHHS) poverty guidelines. In 2013, the DHHS poverty threshold for a family/household of four was an annual median household income of $23,550. The poverty guidelines, referenced in the environmental justice definition of low income, are issued by the DHHS each year. The DHHSs' poverty guidelines include adjustments for inflation for the previous calendar year. Based on the ACS 2013 five-year estimates, Montgomery County had a low-income population of 6.7 percent.

The identification of low-income and minority populations was based primarily on existing ACS 2013 five-year estimates and 2010 US Census tract block group data. The total minority percentage and low-income percentage was determined for each census tract block group. The CEQ guidance does not define what constitutes "meaningfully greater." This was determined based on the nature of the CEA analysis area and best practices followed by agencies and socioeconomic analysts. Consistent with MDOT guidance, census tract block groups with potential minority and/or low-income populations have been identified based on a comparison of each census tract block group minority and/or low-income population being "meaningfully greater" than the CEA analysis area average (meaningfully greater = CEA analysis area average + CEA analysis area average * 5%). If the individual block-group percentage is at least 5 percent greater than the CEA analysis area average, it is considered "meaningfully greater."

As identified through analysis of the ACS 2013 five-year estimates, and summarized in **Table 35**, in the total percentage of the CEA analysis area, racial minority population (49.9 percent) is greater than the county (43.3 percent) and the state (41.6 percent). Therefore, the CEA analysis area has a "meaningfully greater" racial minority population compared to both the county and the state. Based on the ACS 2013 five-year estimates, 25 block groups within the CEA analysis area have racial minority populations "meaningfully greater" (49.9% + 49.9%*5% = 52.4%) than the CEA analysis area average. These census tract block groups are therefore identified as containing racial minority populations. The total percentage of the CEA analysis area ethnic minority population (29.9 percent) is greater than the county (17.5 percent) and the state (8.5 percent). Based on the ACS 2013 five-year estimates, 26 block groups have ethnic minority populations "meaningfully greater" than the CEA analysis area average. These census tract block groups are therefore identified as containing ethnic minority populations. **Table 35** details racial and ethnic minority populations within the CEA analysis area by block group. These are also shown graphically on **Figure 6**.

Table 35: Potential Environmental Justice Populations

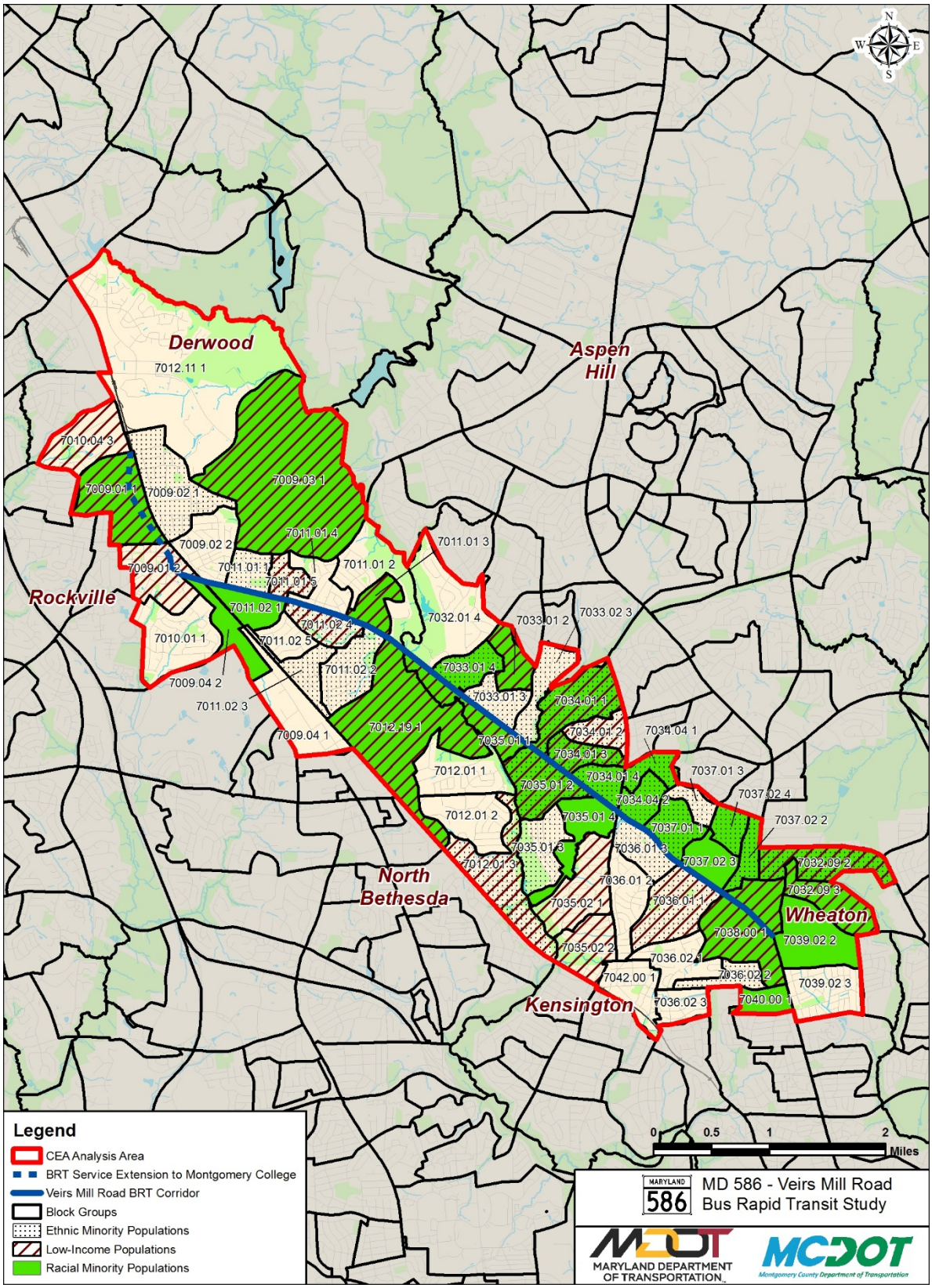
Geographic Area/ Associated Neighborhood	Census Tract Block Group	Population	Ethnic Minority (Hispanic/Latino)	Racial Minority	Low Income	Potential Environmental Justice Population
Rockville	7009.01 BG 1	2,459	10.2%	54.7%	13.0%	**Yes**
	7009.01 BG 2	1,557	8.4%	36.6%	14.0%	**Yes**
	7009.02 BG 1	2,085	32.1%	49.2%	9.0%	**Yes**
	7009.02 BG 2	1,770	27.1%	39.8%	3.1%	No
	7009.03 BG 1	1,923	22.2%	57.5%	14.7%	**Yes**
	7009.04 BG 1	1,321	19.1%	44.3%	8.0%	No
	7009.04 BG 2	1,431	24.4%	81.1%	4.0%	**Yes**
	7010.01 BG 1	2,754	17.8%	43.3%	6.8%	No
	7010.04 BG 3	1,365	14.6%	45.4%	14.3%	**Yes**
	7011.01 BG 1	469	49.7%	27.3%	2.3%	**Yes**
	7011.01 BG 2	877	7.5%	28.6%	3.8%	No
	7011.01 BG 3	681	19.1%	55.7%	17.6%	**Yes**
	7011.01 BG 4	1,253	21.6%	35.3%	4.0%	No
	7011.01 BG 5	1,216	42.5%	22.6%	14.2%	**Yes**
	7011.02 BG 1	1,295	11.3%	53.6%	0.7%	**Yes**
	7011.02 BG 2	1,802	32.0%	21.6%	9.2%	**Yes**
	7011.02 BG 3	1,455	51.1%	37.8%	7.7%	**Yes**
	7011.02 BG 4	772	38.2%	17.0%	18.5%	**Yes**
	7011.02 BG 5	811	14.2%	31.3%	3.6%	No
Derwood	7012.11 BG 1	2,245	12.3%	49.4%	2.6%	No
North Bethesda	7012.01 BG 1	1,886	12.8%	36.9%	9.2%	No
	7012.01 BG 2	1,742	16.1%	30.1%	4.4%	No
	7012.01 BG 3	1,880	44.3%	18.8%	10.6%	**Yes**
	7012.19 BG 1	3,418	30.3%	63.0%	15.2%	**Yes**
Aspen Hill	7032.01 BG 4	1,020	14.0%	14.8%	1.8%	No
	7033.01 BG 2	707	15.8%	53.7%	10.6%	**Yes**
	7033.01 BG 3	1,202	46.4%	51.7%	5.5%	**Yes**
	7033.01 BG 4	1,571	45.3%	59.8%	9.3%	**Yes**
	7033.02 BG 3	1,362	43.2%	41.8%	4.2%	**Yes**
Wheaton	7032.09 BG 2	2,086	36.1%	68.0%	23.8%	**Yes**
	7032.09 BG 3	2,148	29.0%	59.5%	16.6%	**Yes**
	7034.01 BG 1	2,185	41.4%	73.0%	12.9%	**Yes**
	7034.01 BG 2	1,307	51.3%	51.0%	11.9%	**Yes**
	7034.01 BG 3	968	34.5%	59.9%	13.4%	**Yes**
	7034.01 BG 4	845	50.9%	55.6%	1.7%	**Yes**
	7034.04 BG 1	747	51.3%	78.2%	7.5%	**Yes**
	7034.04 BG 2	2,169	66.4%	70.4%	10.1%	**Yes**
	7035.01 BG 1	1,773	8.6%	84.8%	29.0%	**Yes**
	7035.01 BG 2	2,882	66.8%	77.4%	21.5%	**Yes**
	7035.01 BG 3	796	32.5%	28.5%	3.0%	**Yes**
	7035.01 BG 4	1,456	21.4%	63.9%	8.2%	**Yes**
	7037.01 BG 1	1,195	58.3%	78.7%	7.3%	**Yes**

Geographic Area/ Associated Neighborhood	Census Tract Block Group	Population	Ethnic Minority (Hispanic/Latino)	Racial Minority	Low Income	Potential Environmental Justice Population
	7037.01 BG 3	773	60.0%	37.1%	7.4%	**Yes**
	7037.02 BG 2	1,130	34.3%	65.0%	2.0%	**Yes**
	7037.02 BG 3	999	29.9%	61.0%	1.0%	**Yes**
	7037.02 BG 4	1,433	51.9%	59.9%	2.0%	**Yes**
	7038 BG 1	3,098	29.8%	66.1%	14.6%	**Yes**
	7039.02 BG 2	3,171	22.5%	61.6%	7.6%	**Yes**
	7039.02 BG 3	1,595	9.3%	18.2%	1.9%	No
	7040 BG 1	691	11.4%	72.1%	0.0%	**Yes**
North Kensington	7035.02 BG 1	1,988	28.9%	31.0%	14.7%	**Yes**
	7035.02 BG 2	1,176	27.7%	45.2%	24.2%	**Yes**
	7036.01 BG 1	2,385	32.2%	50.6%	10.3%	**Yes**
	7036.01 BG 2	1,189	11.9%	40.0%	1.4%	No
	7036.01 BG 3	1,036	42.7%	39.2%	6.3%	**Yes**
	7036.02 BG 1	1,495	16.9%	20.9%	0.0%	No
	7036.02 BG 2	889	43.3%	17.3%	0.0%	No
Kensington	7042 BG 1	766	7.6%	31.7%	2.9%	No
S. Kensington	7036.02 BG 3	833	7.1%	26.2%	5.2%	No
CEA Analysis Area		89,533	29.9%	49.9%	9.8%	
Montgomery County		989,474	17.5%	43.3%	6.7%	
Maryland		5,834,299	8.5%	41.6%	9.8%	

NOTE: Gray shaded cells indicate those with "meaningfully greater" percentages than the study area average for a given factor.

The percentage of individuals living in poverty within the CEA analysis area (9.8 percent) is greater than the county (6.7 percent) and the same as the state (9.8 percent). Based on the ACS 2013 five-year estimates, 21 block groups have a "meaningfully greater" (9.8% + 9.8%*5% = 10.3%) percentage of persons living in poverty than the CEA analysis area average; these are therefore identified as containing low-income populations, as detailed in **Table 35** and shown in **Figure 6**.

Figure 6: Minority/Low-Income Block-Group Map



The MDOT SHA Equal Opportunity program also addresses Executive Order (EO) 13166 (originally issued on August 11, 2000) to ensure that people with limited English proficiency (LEP) have meaningful access to programs, services, and benefits. The LEP criterion is defined as one who does not speak English as a primary language and has limited ability to read, speak, write, or understand English. The goal of this EO is to improve or provide meaningful access to federally-conducted and federally-assisted programs and activities for persons with LEP, as well as to ensure that LEP individuals receive appropriate language support services. Different treatment based upon a person's inability to speak, read, write, or understand English may be considered a type of national-origin discrimination. ACS 2013 five-year estimates for languages spoken at home by the CEA analysis area population was reviewed and languages that have at least 1,000 speakers are summarized in **Table 36**. Note that this data is estimated at the census tract level where other ACS 2013 five-year data sets are estimated at the block group level; therefore, total populations in this table do not match those shown elsewhere is this document.

Table 36: ACS 2013 Five-Year Projected Languages Spoken in the Home

Language Spoken	CEA Analysis Area		Montgomery County		Maryland	
	Population (#)	Percent of Population	Population (#)	Percent of Population	Population (#)	Percent of Population
English Only	57,473	50.1	563,339	60.9	4,553,640	83.3
Spanish	30,370	26.5	144,016	15.6	378,010	6.9
French	2,034	1.8	22,054	2.4	52,960	1.0
Portuguese	1,104	1.0	5,769	0.6	10,971	0.2
Russian	1,227	1.1	7,834	0.8	21,388	0.4
Other Indic Language	1,394	1.2	10,346	1.1	21,406	0.4
Chinese	4,773	4.2	34,986	3.8	61,951	1.1
Korean	1,583	1.4	13,317	1.4	38,029	0.7
Vietnamese	1,419	1.2	10,204	1.1	21,268	0.4
Tagalog	2,660	2.3	9,265	1.0	32,818	0.6
African Languages	2,842	2.5	289,063	3.0	71,519	1.3
All Other Languages	7,740	6.8	75,429	8.2	203,985	3.7
TOTAL SPEAKERS (TOTAL POPULATION)	114,619	100	924,622	100	5,497,945	100

Source: ACS 2013 five-year estimates.

Of the ten languages with greater than 1,000 speakers in the CEA analysis area (except for English), eight languages have a percentage of people who speak them that is greater than or equal to the county and state percentages. These include: Spanish, Portuguese, Russian, Other Indic Languages, Chinese, Korean, Vietnamese, and Tagalog.

For each of the languages summarized in **Table 36**, ACS 2013 five-year estimates were reviewed to determine the number of speakers of that language who understand English "less than very well" within the CEA analysis area. **Table 37** summarizes these data and provides the percentage of speakers of the given language who understand English "less than very well" within the total number of speakers of that language.

Table 37: Speakers in CEA Analysis Area Who Understand English "Less Than Very Well"

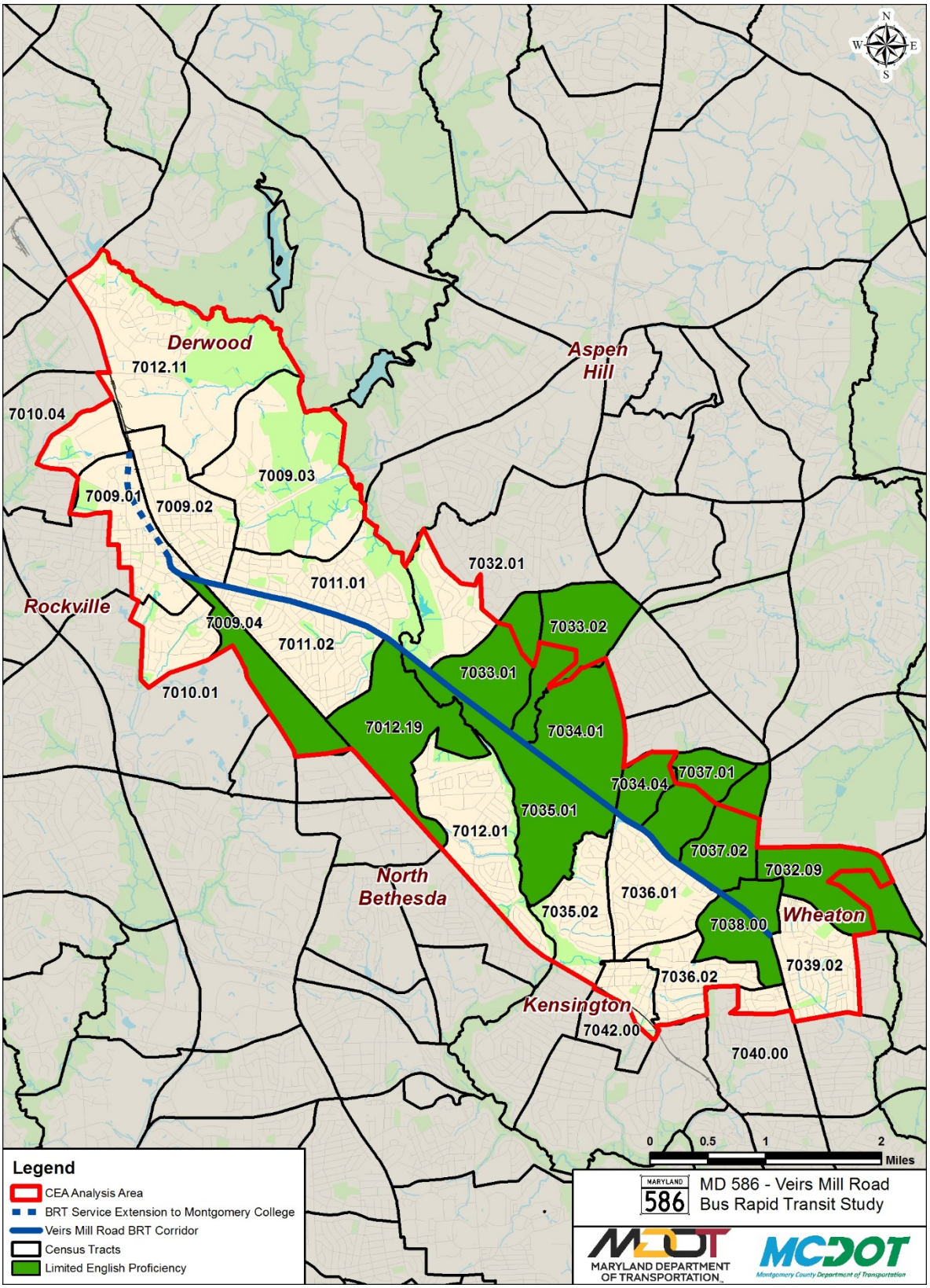
Language Spoken	Total Number of Speakers	Number of Speakers Who Understand English Less Than Very Well	Percent of Speakers Who Understand English Less Than Very Well
Spanish	30,370	15,278	50.3
French	2,034	235	11.6
Portuguese	1,104	435	39.4
Russian	1,227	512	41.7
Other Indic Languages	1,394	464	33.3
Chinese	4,773	2616	54.8
Korean	1,583	840	53.1
Vietnamese	1,419	914	64.4
Tagalog	2,660	918	34.5
African Languages	2,842	1,091	38.4
All Other Languages	7,740	2,325	30.0
TOTAL SPEAKERS (TOTAL POPULATION)	114,619	25,628	22.4

Source: ACS 2013 five-year estimates.

The CEA provided a comparison of the number of speakers whose primary language is not English and those who speak English "less than very well" by census tract since data for languages spoken in the home data was not available at the block group level as of October 1, 2015. A total of 27 census tracts are included in this comparison to represent the CEA analysis area. For the percentage of persons who do not speak English as the primary language in their home, the comparison revealed 10 census tracts were "meaningfully greater" (49.9% + 49.0%*5% = 52.4%) than the CEA analysis area average; eight of these are located in the Aspen Hill and Wheaton neighborhoods (**Figure 7**). For the percentage of persons who do not speak English as the primary language in their home and speak English "less than very" well, the comparison revealed 11 census tracts were "meaningfully greater" (22.4% + 22.4%*5% = 23.5%) than the CEA analysis area average.

Within the City of Rockville, census tract 7009.04 contains "meaningfully greater" LEP populations; the predominant minority population within block groups 1 and 2 of this census tract are Asian. In the North Bethesda neighborhood, census tract 7012.19 contains "meaningfully greater" LEP populations. Block group 1 is the only block group within this census tract that is located in the CEA analysis area, and the dominant minority groups within block group 1 are Asian and Hispanic/Latino populations. In the Aspen Hill neighborhood, two census tracts (7033.01 and 7033.02) contain "meaningfully greater" LEP populations. Asian, some other race, and Hispanic/Latino populations comprise the majority of the minority populations in these census tract block groups. Six of the census tracts identified as having "meaningfully greater" LEP populations are located in the Wheaton neighborhood. The dominant minority populations in these black groups include "meaningfully greater" African American/Black, Asian, some other race, and Hispanic/Latino populations.

Figure 7: Limited English Proficiency Populations



Effects on Environmental Justice Populations

Of the 59 census tract block groups located within the CEA analysis area, 43 census tract block groups (72.8 percent) have been defined as having significant ethnic or racial minority, low income, or a combination of populations (**Table 35**). The build alternatives would require property acquisition within 29 census tract block groups immediately adjacent to, or transected by, the study corridor; twenty-five (25) (86.2 percent) of which have been defined as containing potential EJ populations. Business displacements and residential relocations are outlined per their respective block group in **Table 38**. Under each of the build alternatives, all of the residential relocations and business displacements are located in block groups identified as containing potential EJ populations. For each of these alternatives, specific outreach would be required to determine if impacted individuals are minority, low income, or a combination of both populations. The majority of relocations and displacements are located at the western end of the study corridor. The average vacancy rate in the CEA analysis area is 4.5 percent; additionally, some of the CEA analysis area is currently undergoing re-development to provide enhanced accessibility to mixed-use, pedestrian friendly environments; therefore, options exist for relocations within the CEA analysis area. Based on the distribution of minority and low-income populations throughout the study corridor, targeted public outreach will occur as the project moves forward. This will include specialized outreach to churches, schools, and community associations located in block groups with meaningfully greater populations of minority, low-income, limited English proficiency, senior, and disabled individuals.

Table 38: Relocation/Displacement Impacts in Areas with Minority/Low Income Populations

Geographic Area/ Associated Neighborhood	Block Group	Potential EJ Population (Y/N)	Residential (Resi.) Relocations and Business (Busi.) Displacements					
			Alternative 2		Alternative 3		Alternative 5B	
			Resi.	Busi.	Resi.	Busi.	Resi.	Busi.
Rockville	7009.02 BG 2	Y	0	0	0	0	1	0
	7011.01 BG 1	Y	2	0	2	0	6	0
	7011.01 BG 3	Y	0	0	0	0	0	1
	7011.02 BG 1	Y	0	0	0	0	2	0
	7011.02 BG 4	Y	0	0	0	0	1	0
Aspen Hill	7033.01 BG 3	Y	0	0	0	0	1	0
Wheaton	7034.01 BG 3	Y	0	1	0	1	0	1
	7034.01 BG 4	Y	0	0	0	1	0	1
	7034.04 BG 2	Y	2	0	2	0	0	0
	7037.01 BG 1	Y	0	0	0	0	5	0
	7037.02 BG 2	Y	0	0	2	0	0	0
N. Kensington	7036.01 BG 1	Y	0	0	1	0	1	0
TOTAL			**4**	**1**	**7**	**2**	**17**[1]	**3**

1. The residential relocations for Alternative 5B presented here represent the greatest number of potential relocations. There is still uncertainty regarding the final station locations. This number may be reduced as design advances and station locations are finalized.

No disproportionately high or adverse impacts to environmental justice and/or limited English proficiency populations are expected. Although the majority of ROW impacts, including all relocations and displacements would occur in potential EJ population block groups; the alternatives follow an existing roadway alignment and more than 86 percent of the block

groups adjacent to Veirs Mill Road are considered potential EJ populations. Transportation benefits and enhanced service would be available for all individuals within the study corridor. Further, the transit provider would complete service equity and fare equity analyses no less than six months before the beginning of revenue operations. These analyses will indicate whether adverse impacts and/or benefits of BRT will be "equal" for EJ populations when compared to non-EJ populations. Mitigation for all property impacts would adhere to all relevant federal laws, policies, and standards, and the lead funding agency would comply with the *Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970* if the project is federally funded. All impacted persons, regardless of their ethnicity or income, would be fairly compensated for property impacts that occur as a result of the selected Build Alternative, and would be assisted in relocating, as necessary. A Transportation Management Plan (TMP) would be developed to document the impacts expected to occur during construction. MOT plans would be developed during design to ensure that temporary impacts are minimized.

4. Aesthetics and Visual Quality

Aesthetics and visual resources are those natural and cultural features of the environment that elicit one or more sensory reactions and evaluations by the observer, particularly in regard to pleasurable effects (Canter, 1996). The area of visual influence that a project may have on its surrounding environs is determined by estimating the visibility of the proposed action to viewers from public places. Factors that help determine the viewshed include the scale and mass of the project on the landscape, its proposed location, and the surrounding topography. The location of the visual resources can be described in terms of foreground, middleground, and background. Resources that may have particular sensitivity include historic structures and districts, recreational and park facilities, and public open spaces.

Views to and from the study corridor are primarily defined by the transportation infrastructure, which includes the four- to six-lane paved segments, shoulders, service roads, and sidewalks. The transportation infrastructure also includes WMATA Metrobus and Montgomery County's Ride On bus stop locations, which are typically demarcated by signage and standalone shelters. Medium- to high-density residential housing flanks the study corridor, with commercial areas concentrated within the City of Rockville CBD and Wheaton CBD. Views from the study corridor of the naturalistic environment are confined to the boundaries of Rock Creek Regional Park, Parklawn Local Park, and Matthew Henson State Park and Trail.

Impacts on Aesthetics and Visual Quality

In general, the temporary easement and ROW impacts for the build alternatives would be sliver or linear strip impacts along the existing Veirs Mill Road. Temporary visual impacts associated with construction would occur, including the presence of construction equipment, fencing and signage would be experienced throughout the corridor. These activities are short-term and construction materials would be removed from the study area after construction is complete. The users of the study corridor would experience little long-term visual impact, as the modifications would remain consistent with the current aesthetics of the study corridor. Persons living and/or owning businesses along Veirs Mill Road could experience greater impact due to the decrease of vegetated buffer separating their property from the roadway and

thereby changing their existing viewshed. In addition, as the project moves toward final design, bus station locations, design, and aesthetics would be determined with consideration of community input. Particular attention would be given to design bus stations that are not visually invasive and are consistent with other aesthetic elements of the study corridor.

5. Community Facilities and Services

Community facilities and services along the study corridor described here and listed in **Table 39**, are identified in **Figure 8**, and labeled on the detailed build alternatives mapping (**Appendix A**). No healthcare facilities were identified along the study corridor. As noted, private schools and properties eligible for listing on the National Register of Historic Places (NRHP) are italicized, while public schools and NRHP-listed properties are in plain text.

Outreach letters were mailed to emergency and community service providers along the study corridor on December 15, 2015. The letters provided a brief outline of the MD 586/Veirs Mill Road BRT Corridor Study and described the alternatives under consideration. The letter requested input regarding the potential effects of the study alternatives on services. Copies of these emergency and community service letters and the responses described in the text that follows are provided as **Appendix B**.

By letters dated January 13 and 14, 2016, respectively, Montgomery County Public Schools and Montgomery College indicated that they were interested in the project and requested continuing coordination with the project team.

By a letter dated January 7, 2016, Montgomery County Fire and Rescue Service (MCFRS) indicated that anticipated volume increases along MD 586 would result in increased emergency response times; however, this outcome would be consistent under Alternatives 1, 2, and 3. Under Alternative 5B in the lanes east of Broadwood Drive, there would be a single, 14-foot-wide, bi-directional bus lane bordered by concrete medians. Responding Fire and Rescue Service vehicles would not be able to pass a stopped or disabled BRT bus if they used that lane, thus delaying, or possibly halting, response from that point forward. At a follow-up meeting on March 11, 2016, MCFRS' concerns regarding impacts on emergency access and response times were discussed. Design modifications were discussed that could be implemented in the design of Alternative 5B to reduce these impacts, including installing lane-use control signals at the entrances of the single-lane BRT lane sections and mountable curbs, where needed. A revised comment letter from the MCFRS was issued on March 23, 2016, stating that the Fire Chief would retract his opposition to Alternative 5B if these design modifications were implemented. A follow-up letter dated April 7, 2016, from MCFRS requested that the existing left-turn lane from westbound Veirs Mill Road to the Park Terrace condominiums (12700-12714 Veirs Mill Road) be maintained. The letter indicated that the MCFRS would be amenable to the installation of a mountable median in conjunction with this left turn.

Publicly Owned Parks, Recreational Areas, and Memorials

Additional information regarding the entities with jurisdiction, acreage, and facilities provided at public parks and recreation areas along the study corridor is provided in **Table 40**. No planned or proposed parks have been identified along the study corridor. Parks and recreational areas identified in **Table 39** and **Table 40** are shown in **Figure 8**.

Table 39: Community Facilities

Facility	Location
Educational Facilities	
Montgomery College	900 Hungerford Drive #110, Rockville, MD 20850
Saint Mary's School	600 Veirs Mill Road, Rockville, MD 20852
Shrine of Saint Jude Regional School	4820 Walbridge Street, Rockville, MD 20853
Religious Institutions	
Living Faith Lutheran Church	1605 Veirs Mill Road, Rockville, MD 20851
Saint Mary's Church	520 Veirs Mill Road, Rockville, MD 20852
Shrine of St. Jude Catholic Church	12701 Veirs Mill Road, Rockville, MD 20853
Trinity Baptist Church	915 Veirs Mill Road, Rockville, MD 20851
Veirs Mill Baptist Church (Montgomery Chinese Baptist Church)	12221 Veirs Mill Road, Silver Spring, MD 20906
Saint Catherine Labouré Church	11801 Claridge Road, Wheaton, MD 20902
Emergency Services and Law Enforcement	
Kensington Volunteer Fire Station #21	12500 Veirs Mill Road, Rockville, MD 20853
Other Facilities and Services	
United States Post Office	2001 Veirs Mill Road, Rockville, MD 20851
Twinbrook Library	202 Meadow Hall Drive, Rockville, MD 20851
Historic Places	
Hammond Wood Historic District (NR-1387)	Veirs Mill Road and Highview Avenue, Silver Spring, MD 20902
Metropolitan Branch, B&O Railroad (M: 37-16)	Montgomery and Southern Frederick Counties; DC
Third Addition to Rockville and Old St. Mary's Church & Cemetery (NR-506)	520 Veirs Mill Road, Rockville, MD 20852
Rockville Park Historic District (NR-1526)	Northwest of Veirs Mill Road and MD 28, Rockville, MD
Rockville Railroad Station (NR-229)	98 Church Street, Rockville, MD
Hammond Hill Survey District (M: 31-58)	Veirs Mill Road and Pendleton Drive, Silver Spring, MD 20902
Saint Mary's Church (M:26-62)	520 Veirs Mill Road, Rockville, MD 20852
Saint Catherine Labouré Church (M:31-61)	11801 Claridge Road, Wheaton, MD 20902
Twinbrook Survey District (M:26-25)	Bounded by Veirs Mill Road, Atlantic Avenue and Vandegrift Ave, Rockville, MD 20851
Parks and Recreation Areas	
Hillcrest Park	1150 Crawford Drive Rockville, MD 20851
Lone Oak Park	Grandin Avenue & Woodburn Road, Rockville, MD 20851
Twinbrook Community Recreation Center/ Park	12920 Twinbrook Parkway, Rockville, MD 20850
Veterans Park	Route 28 & Route 355, Rockville, MD 20850
Aspen Hill Local Park	5013 Baltic Avenue, Aspen Hill, MD 20853
Matthew Henson State Park and Trail	Veirs Mill Road & Connecticut Avenue, Silver Spring, MD 20906 (crosses Veirs Mill Road at Turkey Branch Parkway)
Parklawn Local Park	13000 Veirs Mill Road Wheaton, MD 20853
Rock Creek Regional Park	6700 Needwood Road Derwood, MD 20855 (crosses Veirs Mill Road south of Twinbrook Parkway)

Note: *Private schools and National Register of Historic Places-eligible properties are italicized.*

Figure 8: Community Facilities and Services

Table 40: Study Corridor Public Parks and Recreation Facilities

Facility	Location	Jurisdiction	Acreage	Facilities
Hillcrest Park	1150 Crawford Drive Rockville, MD 20851	Rockville	4.4	Playground, baseball, basketball, tennis
Lone Oak Park	Grandin Avenue & Woodburn Road Rockville, MD 20851	Rockville	4.5	Baseball, basketball, playground, fitness cluster
Twinbrook Community Recreation Center/ Park	12920 Twinbrook Parkway Rockville, MD 20850	Rockville	9.2	Community center, basketball, tennis, volleyball, hike/bike trail
Veterans Park	Route 28 & Route 355 Rockville, MD 20850	Rockville	0.3	Art, memorial
Aspen Hill Local Park	5013 Baltic Avenue Aspen Hill, MD 20853	M-NCPPC	41.4	Softball, baseball, soccer
Matthew Henson State Park and Trail	Veirs Mill Road & Connecticut Avenue Silver Spring, MD 20906 (crosses Veirs Mill Road at Turkey Branch Parkway)	M-NCPPC	4.2-mile trail	Paved Trails
Parklawn Local Park	13000 Veirs Mill Road Wheaton, MD 20853	M-NCPPC	13	Soccer field
Rock Creek Regional Park	6700 Needwood Road Derwood, MD 20855 (crosses Veirs Mill Road south of Twinbrook Parkway)	M-NCPPC	1,800	Fishing, boating, canoeing, golf, trails, picnic shelters

Public Utilities

The Washington Suburban Sanitary Commission (WSSC) provides water and sewer services along the study corridor outside of the City of Rockville. The City of Rockville provides these utilities within the city limits.

On both sides of Veirs Mill Road, the study corridor is lined with overhead utilities including: electric, telephone, cable, and fiber optics. The study corridor also has underground utilities which include, but are not limited to, fiber-optic cable, storm sewer, water lines, and additional utility ducts. The electric utilities along the study corridor include Baltimore Gas and Electric (BG&E), First Energy/Potomac Edison, and Potomac Electric Power Company (PEPCO). The gas utility, Washington Gas, is located just outside the study corridor, along the northwest limits. Several telephone and internet providers also serve the study corridor.

Transportation Facilities

In addition to the traffic and transit facilities detailed in Chapter IV, the following transportation facilities serve the study corridor.

Connect-A-Ride is a free referral service that covers all private and public transportation options for adults age 50 and older. Connect-A-Ride is a program of the Jewish Council for the Aging (JCA) and is funded by MCDOT and the JCA of Greater Washington.

According to Montgomery County Transit Services' list of park-and-ride facilities, only the Rockville Metrorail Station parking facility is located along the study corridor.

Bicycle facilities within the study corridor include bike lanes/shoulders and shared-use paths. Bike lanes/shoulders are present from just south of the Veirs Mill Road/Twinbrook Parkway intersection south to the Veirs Mill Road/Parkland Drive intersection. Shared-use paths are located within Rock Creek Regional Park and Matthew Henson State Park (both cross Veirs Mill Road). Additional shared-use paths include Rockcrest Park Trail and Twinbrook Park Trail.

Impacts on Community Facilities

The build alternatives would result in varying quantities of ROW and temporary easement impacts to community facilities and services in the form of strip or linear takes of land along the existing study corridor; however, no community facilities would be displaced. The ROW and temporary easement requirements for each build alternative is detailed in **Table 41**.

Table 41: ROW and Temporary Easement Impacts to Public/Community Facilities

	ALT 2		ALT 3		ALT 5B	
	TE (acres)	ROW (acres)	TE (acres)	ROW (acres)	TE (acres)	ROW (acres)
Educational Facilities (private schools are *italicized*)						
Montgomery College	0.02	0	0.1	0	0.1	0
Shrine of Saint Jude Regional School	0	0	0.02	0	0.02	0
Religious Institutions						
Living Faith Lutheran Church	0	0	<0.01	<0.01	0.05	0.06
Shrine of Saint Jude Church	0	0	0.1	0.04	0.08	0
Trinity Baptist Church	0	0	0	0	0.02	0.01
Veirs Mill Baptist Church	0	0	0.02	0	<0.01	0
Saint Catherine Labouré Church*	0	0	0	0	0.1	0.2
Historic Places (NRHP eligible, but not listed properties are *italicized*)						
Hammond Wood Historic District	0	0	0.03	0.05	0.09	0.13
Hammond Hill Survey District	0	0	0	0	0.08	<0.01
*Saint Catherine Labouré Church**	*0*	*0*	*0*	*0*	*0.1*	*0.2*
Parks						
Twinbrook Park	0	0	0	0	0.01	0.02
Matthew Henson State Park	0	0	0.2	0.02	0.3	0.07
Parklawn Local Park	0	0	0	0.03	0.07	0.2
Rock Creek Regional Park	0.7	0.2	0.6	0.5	1.6	1.3
Total Number of Public/Community Facilities Permanently Impacted	1		6		9*	
Parking Spaces Removed	11		82		76	

* *Note, that Saint Catherine Labouré Church is included as both a Religious Institution and a Historic Place; this property has only been included once in the Total Number of Public/Community Facilities Permanently Impacted*

Educational facilities impacted by the build alternatives include Montgomery College and the Shrive of Saint Jude Regional School. Alternative 2 would require less than 0.1 acre of temporary easement; Alternatives 3 and 5B would require 0.1 acre of temporary easement from Montgomery College. Shrine of Saint Jude Regional School would be impacted by two of

three build alternatives; Alternatives 3 and 5B would both require less than 0.1 acre of temporary easement from Shrine of Saint Jude Regional School.

Religious Institutions impacted by the build alternatives include: the Living Faith Lutheran Church, Shrine of Saint Jude Church, Trinity Baptist Church, Veirs Mill Baptist Church, and Saint Catherine Labouré Church. Both Alternatives 3 and 5B would require less than 0.1 acre of both temporary easement and ROW from Living Faith Lutheran Church. Alternative 3 would require 0.1 acre of temporary easement and less than 0.1 acre of ROW, and Alternative 5 would require less than 0.1 acre of temporary easement and no ROW from Shrine of Saint Jude Church. Alternative 5B would require less than 0.1 acre of both temporary easement and ROW from Trinity Baptist Church. Alternatives 3 and 5B would require less than 0.1 acre of temporary easement and no ROW from Veirs Mill Baptist Church. Alternative 5B would require 0.1 acre of temporary easement and 0.2 acre of ROW from Saint Catherine Labouré Church.

Known historic places impacted by the build alternatives include Hammond Wood Historic District, Hammond Hill Survey District, and Saint Catherine Labouré Church. Details regarding the Section 106 effects determination of the build alternatives on historic properties is included in Chapter V.D. Alternative 3 would require less than 0.1 acre of both temporary easement and ROW and Alternative 5B would require less than 0.1 acre of temporary easement and 0.1 acre of ROW from Hammond Wood Historic District, an NRHP-listed historic place. Impacts would occur in the form of strip impacts to accommodate the dedicated median lane proposed for the BRT and subsequent roadway widening. Hammond Hill Survey District, an NRHP-eligible historic place, would be impacted by Alternative 5B, which would require less than 0.1 acre of temporary easement and less than 0.1 acre of ROW. Impacts would occur in order to accommodate the dedicated median lane proposed for the BRT and subsequent roadway widening. Saint Catherine Labouré Church, which was recommended NRHP-eligible by letter dated June 22, 2016, would be impacted by Alternative 5B, which would require 0.1 acre of temporary easement and 0.2 acre of ROW. Impacts would occur in order to accommodate the dedicated median lane proposed for the BRT and subsequent roadway widening. Additionally, Alternative 5B would require the construction of a 10-foot retaining wall between the roadway and historic property.

Regional and local parks that would be impacted by the build alternatives include Twinbrook Community Recreation Center/Park, Matthew Henson State Park and Trail, Parklawn Local Park, and Rock Creek Regional Park. Twinbrook Park would be impacted by only Alternative 5B, which would require less than 0.1 acre of both temporary easement and ROW. Matthew Henson State Park would be impacted by two of three build alternatives. Alternative 3 would require 0.2 acre of temporary easement and less than 0.1 acre of ROW, and Alternative 5B would require 0.3 acre of temporary easement and less than 0.1 acre of ROW from Matthew Henson State Park. Impacts would include a temporary construction detour for the Matthew Henson Trail crossing of MD 586 and the extension of a culvert under MD 586 to accommodate the widened roadway. Parklawn Local Park would be impacted by two of three build alternatives. Alternative 3 would require less than 0.1 acre of ROW, and Alternative 5B would require less than 0.1 acre of both temporary easement and ROW from Parklawn Local Park. Rock Creek Regional Park would be impacted by each of the three build alternatives. Alternative 2 would require 0.7 acre of temporary easement and 0.2 acre of ROW; Alternative 3 would require 0.6

acre of temporary easement and 0.5 acre of ROW; and Alternative 5B would require 1.6 acres of temporary easement and 1.3 acres of ROW from Rock Creek Regional Park.

Parking space impacts would occur under each of the build alternatives. Alternative 2 would require the removal of 11 on-road, weekend-only parking spaces adjacent to Parklawn Local Park. Alternative 3 would require the removal of 82 parking spaces, of which 52 are weekend-only spaces. Alternative 5B would require the removal of 76 parking spaces, of which 52 are weekend-only spaces.

Other than the direct impact of linear and strip ROW and temporary easement takes, the build alternatives would not directly impact the function or service of any community facilities. No hospitals, cemeteries, libraries, emergency services, senior centers, or government buildings would be directly impacted. There are no hospitals along the study corridor though BRT would improve residents access to the hospitals in the region. Additional facilities for bicyclists and pedestrians would increase the study corridor trail networks. WMATA and Montgomery County Ride On bus services would work in collaboration with BRT routes to further enhance service in the study corridor. Each of the build alternatives would have temporary construction impacts to traffic operations that would affect access along the corridor to all communities and services; however, the traffic operation impacts would be offset by the implementation of an MOT plan developed prior to construction.

Section 4(f) of the US Department of Transportation Act of 1966 as amended (49 USC Section 303) stipulates that USDOT agencies cannot approve the use of land from a significant publicly-owned public park, recreation area, wildlife or waterfowl refuge, or any significant historic site unless the following conditions apply:

- There is no feasible and prudent avoidance alternative to the use of land from the property, and the action includes all possible planning to minimize harm to the property resulting from such use; or
- The use of the Section 4(f) properties, including any measures to minimize harm (such as avoidance, minimization, mitigation, or enhancement measures) committed to by the applicant, will have a *de minimis* impact on the property.

Based on the impacts described above, should a federal funding source be identified for the further design or construction of the proposed BRT service, completion of a Section 4(f) Evaluation may be required.

B. Economic Environment

The economic environment was evaluated as part of the CEA technical report; therefore, the employment characteristics below are for the same geographic CEA analysis area referenced in Chapter V.A.1.

1. Regional Commerce Activities and Major Employment Centers

Because of its geographic proximity to the Washington, DC, and Baltimore Metropolitan Areas, Montgomery County is home to many company headquarters and commerce centers. Major employment centers in the region include Silver Spring, Germantown, Bethesda, Rockville, and

Gaithersburg. The major industries in Montgomery County include federal government, health care, professional services, and retail trade. One-hundred and eighteen (118) major companies, with more than 100 employees each, reside in Montgomery County.

2. Local Employment Centers and Characteristics

Management, business, science, and art industries employ the greatest number of workers in the CEA analysis area (43 percent), county (56 percent), and state (44 percent). Production, transportation, and material moving industries employ the least number of workers in the study area (6 percent), county (4 percent), and state (8 percent). The CEA analysis area employs more workers in the service industry (23 percent) than the county (15 percent) and state (17 percent). Employment by industry among the civilian population over 16 years of age in the CEA analysis area, county, and state is summarized in **Table 42**.

Table 42: Employment Characteristics

Industry	CEA Analysis Area		Montgomery County		Maryland	
	Number	Percent	Number	Percent	Number	Percent
Management, business, science, and arts	21,574	43%	295,587	56%	1,292,634	44%
Service	11,309	23%	80,682	15%	494,955	17%
Sales and Office	9,784	20%	99,383	19%	679,897	23%
Natural resources, construction, and maintenance	4,464	9%	30,276	6%	232,132	8%
Production, transportation, and material moving	2,856	6%	22,161	4%	226,580	8%
Total	**49,987**		**528,089**		**2,926,198**	

The study corridor extends between the City of Rockville and continues southeast to the Wheaton CBD. These two districts make up the primary employment centers located within the CEA analysis area.

The center of the Wheaton CBD is the Wheaton Metrorail Station, which is served by the Metrorail Red Line. Wheaton is a diverse district made up of ethnic restaurants, shops, small businesses, and the Westfield Wheaton Mall. Wheaton is surrounded by medium-density residential housing.

The City of Rockville is the largest incorporated city in Montgomery County and the third largest incorporated city in Maryland. It is served by the Metrorail Red Line. The City of Rockville has a large CBD, with several high-profile employers, business neighborhoods, and commercial corridors located within its corporate limits. Three of these are within the CEA analysis area: Rockville Town Square, Downtown Rockville, and Rockville Pike. Rockville Town Square is bounded by Beall Avenue, North Washington Street, Middle Lane, and MD 355 in Rockville. Rockville Town Square includes: (1) two buildings that provide 620,000 SF of office space, (2) approximately 40 businesses with 180,000 SF of retail space, and (3) 644 residential units. Downtown Rockville is bounded by MD 355, MD 28, and North Washington Street in Rockville. Downtown Rockville includes: (1) 12 buildings that provide 1,251,791 SF of office space, (2) more than five government buildings, (3) retail space, and (4) several residential apartments and condominium buildings. The Rockville Pike neighborhood of Rockville is bisected by the

MD 355 corridor from Twinbrook Parkway north to Edmonston Drive, south of Veirs Mill Road. Rockville Pike includes: (1) 2,120,297 SF of office space in 25 buildings, (2) more than 200,000 SF of retail space, (3) two hotels, and (4) residential neighborhoods that contain single-family homes, townhomes, condominiums, and apartments in four neighborhoods. Along the southwestern portion of the CEA analysis area, Kensington and North Bethesda are local commercial and retail employment centers.

Available travel time data presented in **Table 43** indicates that 59 percent of CEA analysis area residents have a 30-minute or more commute in comparison to 58 percent for the county and 50 percent for the state. Workers in the CEA analysis area have a similar commute time compared to the county average and a longer commute time compared to the state.

Table 43: Average Travel Time to Work

Travel Time to Work	CEA Analysis Area		Montgomery County		Maryland	
	Number	Percent	Number	Percent	Number	Percent
Less than 10 minutes	2,096	4%	25,881	5%	223,504	8%
10 to 14 minutes	3,542	7%	37,663	8%	272,382	10%
15 to 19 minutes	5,437	11%	52,738	11%	345,192	12%
20 to 24 minutes	5,725	12%	61,012	12%	366,793	13%
25 to 29 minutes	2,845	6%	30,058	6%	166,492	6%
30 to 34 minutes	8,752	18%	77,965	16%	418,894	15%
35 to 44 minutes	4,145	9%	54,460	11%	245,374	9%
45 to 59 minutes	7,804	16%	72,318	15%	327,792	12%
60 or more minutes	7,094	15%	78,982	16%	404,704	15%
Total	**47,440**		**491,077**		**2,771,127**	

The ACS 2013 five-year estimates provide data for means of transportation to work (**Table 44**). The data is categorized by car, truck, or van; public transportation; walk; and taxicab, motorcycle, bicycle, or other means. Seventy-four (74) percent of the CEA analysis area residents use a car, truck, or van as a means of transportation to work in comparison to 80 percent for the county and 87 percent for the state. Twenty-three (23) percent of the CEA analysis area residents use public transportation as a means of transportation to work in comparison to 16 percent for the county and 9 percent for the state. These data indicate that public transportation is more heavily relied upon in the CEA analysis area and could be a factor in the higher percentage of 30-minute or greater commute times for the CEA analysis area.

Table 44: Means of Transportation to Work

Means of Transportation to Work	CEA Analysis Area		Montgomery County		Maryland	
	Number	Percent	Number	Percent	Number	Percent
Car, truck, or van	34,937	74%	393,911	80%	2,413,682	87%
Public Transportation	10,807	23%	80,308	16%	256,052	9%
Walk	1,066	2%	11,008	2%	68,435	2%
Taxicab, motorcycle, bicycle, or other	630	1%	5,850	1%	32,958	1%
Total	**47,440**		**491,077**		**2,771,127**	

3. Impacts on the Economic Environment

Alternative 1 (No-Build) would have no direct impact on local employment characteristics. Alternatives 2 would require one business displacement (Chakakian Rugs), Alternative 3 would require two business displacements (Chakakian Rugs and McDonalds), and Alternative 5B would require three business displacements (Chakakian Rugs, McDonalds, and Shell Gas Station). Alternatives 2 and 3 would maintain all existing access to the businesses along the study corridor. Alternative 5B may reduce ease of access because left-hand turns could only be made at signalized intersections because of the dedicated bus lanes within the median. However, the build alternatives would facilitate more efficient travel through the study area by reducing transit travel times and encouraging more people to use public transportation. Decreased congestion, resulting from the decrease in travel time, could benefit the economy by enabling workers to travel through the study corridor more quickly. Also, the addition of BRT would enhance public transportation services for which the CEA analysis area is much more dependent than the county and the state (**Table 44**).

Any business displacements would result in loss of property and tax revenue and reduce the tax base by converting commercial land to transportation uses. However, improved access and mobility throughout the study corridor could encourage commercial growth, consistent with neighborhood area master plans. Additionally, planned re-development activities would provide new sites to allow displaced businesses to relocate along the study corridor.

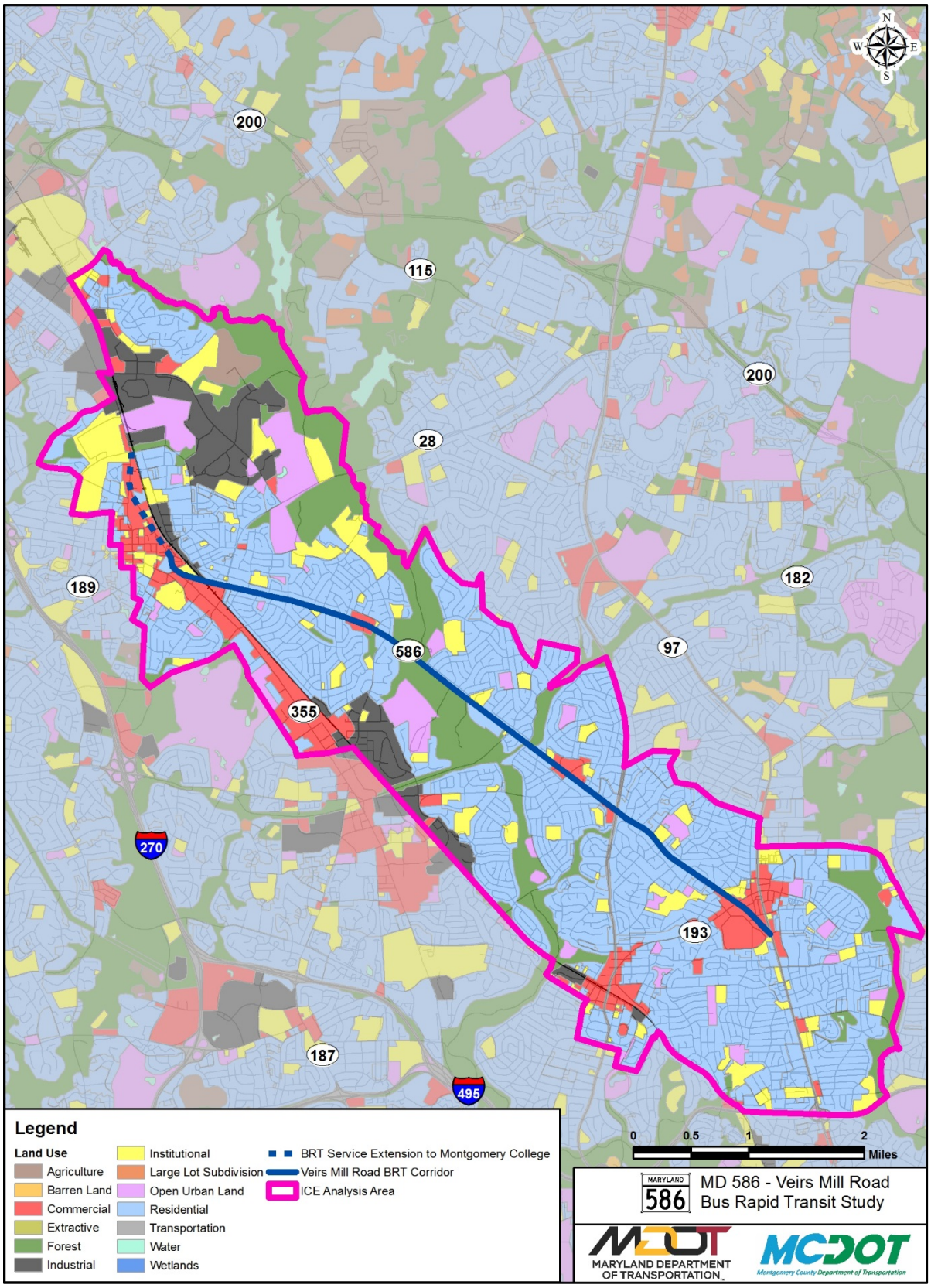
C. Land Use

Each community within Montgomery County has a master plan that creates a comprehensive view of land use trends and future development. Master plans recommend land uses, zoning, transportation, schools, parks, libraries, and fire and police stations, as well as address housing, historic preservation, pedestrian and trail systems, and environmental issues. The MD 586/Veirs Mill Road BRT Corridor Study is located in Montgomery County Planning Area 2, as defined by M-NCPPC. Land use and development along Veirs Mill Road are guided by the *Rockville Comprehensive Master Plan* (2002), the *Town Center Master Plan* (2001), and the *Twinbrook Neighborhood Plan* (2009). Additional guidance is found in the *Shady Grove Sector Plan* (2006), *Aspen Hill Master Plan* (1994), the *Kensington-Wheaton Master Plan* (1989), the *Upper Rock Creek Master Plan* (2004), the *Twinbrook Sector Plan* (2009), the *North Bethesda – Garrett Park Master Plan* (1992), the *Kensington Sector Plan* (2012), the *Wheaton Central Business District and Vicinity Plan* (2012), and the *Kemp Mill Master Plan* (2001).

1. Existing Land Use

Existing land use along the study corridor is predominantly medium- to high-density housing, with commercial areas concentrated at the intersections of Veirs Mill Road and Atlantic Avenue, Connecticut Avenue, Randolph Road, Wootton Parkway, and University Boulevard West (**Figure 9**). The commercial areas serve the needs of the surrounding communities. Schools and churches are interspersed along the study corridor. The Rockville Town Square consists of: (1) 644 residential units (condominiums and apartments, 15 percent of which are affordable, moderately-priced dwelling units), (2) 175,000 SF of street-level shops and restaurants, (3) a plaza fronted by the Rockville Library, (4) VisArts, and (5) three public parking

Figure 9: Existing Land Use (2010)



garages. Town Square is bisected by an extension of Maryland Avenue as well as Town Center's "Main Street" which includes Gibbs Street. As directed by the *Town Center Master Plan* (2001), sidewalks are wide and allow for outdoor dining, entertainment, and pedestrian-oriented activities. The proximity of the Rockville Metrorail Station enhances connectivity to destinations and activities within the Washington, DC metropolitan area. Also in the City of Rockville, the *Twinbrook Neighborhood Plan* (2009) directs development within the Twinbrook neighborhood area. Twinbrook is a neighborhood subdivision of Rockville that abuts the study corridor. Most of the Twinbrook neighborhood area is comprised of detached high-density (more than four units per acre) housing. Most of those homes were built in the post-WWII era for single-family use. Zoning throughout the neighborhood permits churches and schools within this residential area. Commercial properties are predominantly located along both sides of Veirs Mill Road at the intersection with Atlantic Avenue to accommodate the residents of the Twinbrook neighborhood.

The unincorporated neighborhood area of Derwood is part of the *Shady Grove Sector* and *Upper Rock Creek Sector Plans*. Derwood is a community of single-family residences and small commercial areas along Crabbs Branch Way. The majority of the residences were constructed in the 1970s and 1980s and the community is quite stable in terms of home sales. The southern portion of Derwood, including the major activity center of Shady Grove Metrorail Station, is located north of the study corridor. There is little vacant land available for new development in this area.

The unincorporated neighborhood of Aspen Hill area has few remaining areas that have not been developed or planned for development. Consistent with the *Aspen Hill Master Plan* (1994), Aspen Hill areas adjacent to Veirs Mill Road are zoned for residential use and include residential single-family houses, multi-family medium-density residential dwellings, and multiple-family high-rise apartments. Parks, schools, and shopping centers are conveniently located throughout the area to accommodate residents. Very little of Aspen Hill's commercial land use is located near the study corridor.

The unincorporated neighborhood of North Bethesda, in the *North Bethesda – Garrett Park Master Plan* area, is primarily composed of residential and industrial land use. The majority of the industry is west of Parklawn Drive and includes: warehouse and storage facilities, light manufacturers, research and development facilities, contracting businesses, automotive repair shops, and service businesses. Apartment complexes, single-family homes, and Rock Creek Regional Park are located east of Parklawn Drive.

Land use within the Kensington-Wheaton planning area is dominated by low- to medium-density housing. The few commercial areas accommodate the business and shopping needs of the community. Veirs Mill Village Shopping Center is located at the intersection of Veirs Mill Road and Randolph Road. According to the 1989 *Kensington-Wheaton Master Plan*, plans were in place to improve the shopping center by increasing green space, re-aligning parking spaces, and adding other improvements to make the shopping center more appealing to nearby residents and shoppers. Those improvements are now in place.

Land use within the Kensington Sector Plan area is commercial retail at the center. It is surrounded by single-family residential homes as well as institutional land use. In addition, there is some light industrial land use

Land use within the Wheaton Sector planning area is diverse: a CBD is centrally located, and single-family post-WWII housing is located at the perimeter. The Westfield Wheaton Mall is located west of Veirs Mill Road. The area adjacent to Veirs Mill Road, currently zoned for commercial use, includes high-density apartments and townhouses in the southeast and northern sections of the planning area.

Land use within the Kemp Mill planning area is defined by open space and greenery that is a backdrop to development. There is abundant greenery along Kemp Mill Road. Northwest Branch Park lies to the east and Wheaton Regional Park to the west. There is no vacant land within the planning area. All housing options, along with a commercial core and many parks exist within Kemp Mill.

2. Future Land Use – Planned Development

Future land use and development along the study corridor is guided by the same collection of community master plans outlined in the previous discussion regarding existing land use. These master plans focus on the re-development of existing commercial and residential cores and enhancements through increased pedestrian, bicycle, and transit accessibility. Existing public parks and open spaces would be maintained. Except for large public parks and open spaces, the study corridor is largely developed as described in the preceding discussion. None of the master plans call for major land use changes through the future timeframe.

The City of Rockville land use and zoning pattern is well established and appropriate for the future. The *Town Center Master Plan* envisions re-development activity within the Rockville Town Center area. Those areas include, but are not limited to: north of Beall Avenue between North Washington Street and Rockville Pike (MD 355); the open parking lot between West Montgomery and East Middle Lane; on the Rockville Metrorail Station parking lot; and the Foulger-Pratt office site next to Rockville Town Square. The goal is to achieve the vision of an easily identifiable, pedestrian-oriented daytime, evening, and weekend activity center that incorporates a mix of uses and amenities.

The *Twinbrook Neighborhood Plan* contains recommendations to help retain the character of residential neighborhoods, while directing future development toward existing commercial and industrial areas. The plan also makes recommendations to help maintain and upgrade public areas to ensure that recreational opportunities, public accessibility, and the natural environment enhance the quality of life for all residents. The *Twinbrook Sector Plan* calls for reduced levels of commercial development and increasing the amount of residential housing to create a mixed-use community.

The Derwood communities have changed little over the past ten years. The most significant changes have included an increase in traffic and roadway widenings. The *Shady Grove Sector Plan* supports the protection of the Derwood residential communities from encroachment by traffic and it does not call for expansion of the commercial uses into the residential areas. The Plan recommends new, compatible residential reuses in Old Derwood and no land use changes

in other existing residential neighborhoods. A significant transportation improvement called for in the Plan includes an increased network of pedestrian and bike paths to the Shady Grove Metrorail Station from the surrounding communities.

The *Aspen Hill Master Plan* (1994) did not outline zoning changes near the study corridor.

All major changes found in the 1992 *North Bethesda – Garrett Park Master Plan* have been completed.

All major changes found in the 1989 *Kensington-Wheaton Master Plan* have been completed.

The *Kensington Sector Plan* proposes a mixed-use town center with pedestrian-friendly connections to the vibrant Kensington neighborhoods. The scale and historic character of Kensington are to be preserved. Future zoning maintains and enhances public use spaces along with commercial re-development and maintains residential use surrounding the town center.

The *Wheaton Central Business District Plan* proposes that areas adjacent to Veirs Mill Road maintain mixed-commercial and residential zoning and attract new businesses and residents to the area. The plan calls for the organization of five districts, each with its own distinct character. These districts include the Core District, Westfield District, Price District, Blueridge District, and Kensington View/Wheaton Hills District. The Core District encompasses the approximately 40-acre triangle bounded by Georgia Avenue, Veirs Mill Road, and University Boulevard West. The area is a hub in the regional transit system and includes the Metro station. This district has some of the largest and most important re-development parcels in Wheaton, located on and near the Metro station. The County's Parking Lot 13 is currently the focus of a public/private partnership to create a major mixed-use project with more than 240,000 square feet of office space. The Wheaton Central Business District Plan also recommends a major landmark building be located at the confluence of Veirs Mill Road and Georgia Avenue because of its visibility and prominent location. The Westfield District would be developed into a mixed-use area and retail destination. The other three districts would increase residential and nonresidential uses as necessary. The area surrounding the "Districts" contain older single-family neighborhoods with post-WWII houses and some infill townhouses; no changes are proposed here.

The *Kemp Mill Master Plan* proposes some minor re-zoning of residential property to make subdivision lots more consistent with one another. The plan also proposes that once re-development of the Kemp Mill Shopping Center takes place, it should be more pedestrian-friendly to meet the goal of offering ample opportunity for socialization and promoting a strong sense of community.

3. Maryland Smart Growth Initiatives

Maryland's *Smart Growth Priority Funding Areas Act of 1997* (Smart Growth Act) directs state infrastructure funds to areas within or connecting county-designated and state-certified Priority Funding Areas (PFAs). The entire study corridor and surrounding areas are within a Maryland Department of Planning-designated PFA.

Smart Growth is a concept used to avoid development sprawling out away from population centers. It can be characterized by compact, transit-oriented, pedestrian-friendly land use, with neighborhood schools, walkable streets, mixed-use development, and a variety of housing choices. Smart Growth makes efficient use of land, water, and air; creates a sense of community and place; expands transportation, employment, and housing choices; distributes the costs and benefits of development in an equitable manner; and promotes the public health (MD Department of Planning).

Four major goals are associated with the Smart Growth concepts:

1. Support development in existing communities where infrastructure already exists.
2. Save and conserve natural resources.
3. Save taxpayers from paying for infrastructure that has developed far from the population centers.
4. Provide the residents of Maryland a high quality of life regardless of whether they live in a rural community, suburb, small town, or city.

4. Impacts on Land Use

The No-Build Alternative would have no impact on land use beyond what is already programmed and planned along the study corridor. No parcels would be impacted and no ROW would be required as a result of the No-Build Alternative.

The temporary easement and ROW encompasses 1.9 acres for Alternative 2. Most of the impacted land would be residential. The 1.2 acres of temporary easement would impact 45 parcels and the 0.7 acre of ROW would impact 27 parcels. Of those, 29 and 23 parcels respectively, are classified as residential use. Of the 0.7 acre required ROW, 0.3 acre is residential land use (**Table 45**). In addition, 11 of 827 on-street parking spaces would be impacted by this alternative.

Table 45: Alternative 2 – Right-of-Way Impacts by Land Use

	Alternative 2			
	Temp Ease		ROW	
	Parcels	Acres	Parcels	Acres
Unknown	2	<0.1	0	0
Commercial	5	0.1	1	0.1
Institutional	1	<0.1	0	0
Religious Institutions	0	0	0	0
Residential	29	0.3	23	0.3
Trans/Utilities	1	0.1	1	0.1
Parks	6	0.7	1	0.2
Recreation Areas	0	0	0	0
Vacant/Undeveloped	1	<0.1	1	<0.1
Total	**45**	**1.2**	**27**	**0.7**

The temporary easement and ROW encompasses 7.3 acres for Alternative 3. Most of the impacted land would be residential. The 5.0 acres of temporary easement would impact 265 parcels and the 2.3 acres of ROW would impact 116 parcels. Of those, 228 and 92 parcels respectively, are classified as residential use. Of the 2.3 acres required for ROW, 1.1 acres are residential land use (**Table 46**). In addition, 82 of 827 on-street parking spaces would be impacted by this alternative.

Table 46: Alternative 3 - Right-of-Way Impacts by Land Use

	Alternative 3			
	Temp Ease		ROW	
	Parcels	Acres	Parcels	Acres
Unknown	7	0.2	4	0.1
Commercial	11	0.5	9	0.3
Institutional	2	0.2	0	0
Religious Institutions	3	0.1	2	<0.1
Residential	228	2.9	92	1.1
Trans/Utilities	4	0.1	2	0.1
Parks	3	0.8	3	0.5
Recreation Areas	4	<0.1	1	<0.1
Vacant/Undeveloped	3	0.2	3	0.2
Total	**265**	**5.0**	**116**	**2.3**

The temporary easement and ROW encompasses 14.6 acres for Alternative 5B. Most of the impacted land would be residential. The 7.9 acres of temporary easement would impact 310 parcels and the 6.7 acres of ROW would impact 217 parcels. Of those, 254 and 178 parcels respectively, are classified as residential land use. Of the 6.7 acres required for ROW, 3.5 acres are residential land use (**Table 47**). In addition, 76 of 827 on-street parking spaces would be impacted by this alternative.

Table 47: Alternative 5B - Right-of-Way Impacts by Land Use

	Alternative 5B			
	Temp Ease		ROW	
	Parcels	Acres	Parcels	Acres
Unknown	9	0.3	5	0.1
Commercial	15	0.6	12	0.7
Institutional	2	0.2	0	0
Religious Institutions	5	0.3	3	0.3
Residential	254	4	178	3.5
Trans/Utilities	4	0.1	2	0.1
Parks	10	2.1	10	1.6
Recreation Areas	5	0.2	2	0.1
Vacant/Undeveloped	6	0.1	5	0.2
Total	**310**	**7.9**	**217**	**6.7**

The MD 586/Veirs Mill BRT Corridor Study is consistent with the local area master plans throughout the study corridor and with Montgomery County's 10-Year Transportation Plan. Local area master plans include the *Rockville Town Center Master Plan*, *Rockville Comprehensive Master Plan*, *Twinbrook Sector Plan*, *Upper Rock Creek Master Plan, Shady Grove Sector Plan, Aspen Hill Master Plan*, *North Bethesda – Garrett Park Master Plan,*

Kensington Sector Plan, Kensington-Wheaton Master Plan, and *Wheaton CBD and Vicinity Sector Plan*.

TOD is being planned and implemented near the Rockville and Wheaton Metrorail stations to create mixed-used, pedestrian-friendly environments. The Rockville Town Square, which opened in 2007, features a town plaza, library, art center, business center, pedestrian-friendly shop and restaurant area, and more than 600 apartments and condominiums. Per the *Rockville Town Center Master Plan,* Town Center will eventually include more than 600,000 SF of retail space. The same style of development will occur near the Wheaton Metrorail Station, where residential and retail space will create a mixed-use development that will supplement the existing retail and office space.

The other neighborhood master plans support the MD 586/Veirs Mill BRT Corridor Study's goals of reducing automobile dependency and encouraging the development of mixed-use centers. Those plans call for the improved access to housing, jobs, and services, and the conservation of environmental resources that will be provided by BRT. Efficient and convenient access to basic services and employment centers is essential to the primarily residential corridor between Rockville and Wheaton.

Land use changes are expected to be minimal through the future timeframe. TOD would occur in the areas closest to the Wheaton and Rockville Metrorail stations, where such changes are fully supported and planned. Changes in land use in the heavily developed, residential areas between the stations would be minimal. BRT would provide access to a larger supply of affordable housing and revitalize the adjacent neighborhoods, which could relieve congestion, support land conservation, and improve safety for bicyclists and pedestrians. Together, those improvements would increase the mobility, safety, and sustainability of the study corridor.

D. Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by ACHP. Revised regulations, "Protection of Historic Properties" (36 CFR Part 800), became effective August 5, 2004.

In accordance with Section 106, by letter dated December 29, 2015 (**Appendix C**), MDOT SHA provided the Maryland Historical Trust (MHT) and the State Historical Preservation Officer (SHPO) with information regarding the proposed MD 586/Veirs Mill Road BRT Corridor Study Alternatives, the proposed area of potential effect (APE), and information about NRHP eligibility of historic standing structures within the APE, as well as an assessment of archeological potential, in compliance with the requirements of 36 CFR Part 800. This information was also provided to Section 106 consulting parties via email, dated December 29, 2015. On February 10, 2016, Peerless Rockville requested reconsideration of Twinbrook Section 1 (also Twinbrook Survey District, M:26-25), as well as an evaluation of St. Mary's Catholic Church and School, M:26-62. Subsequent eligibility determinations and a preliminary effect finding were submitted to MHT on June 22, 2016. Coordination with MHT will continue to determine effects of the

study alternatives on standing structures and archeological resources within the APE, as plans are further developed, as required under 36 CFR 800.4.

1. Historic Places/ Architectural Resources

The following properties and districts within the APE are listed in or are eligible for listing in the NRHP:

- Third Addition to Rockville and Old St. Mary's Church and Cemetery (M:26-12): NR
- Jarvis House/Rockville Railroad Station (M:26-12-2): NR
- Rockville Park Historic District (M:26-13): NR
- Hammond Wood Historic District (M:31-38): NR
- Metropolitan Branch of the B&O Railroad (M:37-16): NRE
- Hammond Hill Survey District (M:31-58): NRE
- Twinbrook Survey District (M:26-25): NRE
- St. Catherine's Labouré Catholic Church (M:31-61): NRE
- St. Mary's Catholic Church and School (M:26-62): NRE

Third Addition to Rockville and Old St. Mary's Church and Cemetery (M:26-12): This historic district is located at the intersections of Veirs Mill Road and Old Baltimore Road and was listed on the NRHP in November 20, 1978. According to the NRHP nomination form, this area combines nineteenth-century residential-scale buildings with a tree-lined narrow street, country church, weathered headstones, Victorian Gothic railroad station, and a brick cast-iron front commercial structure. This district is representative of the growth of Rockville after the 1872 construction of the Metropolitan Branch of the B&O Railroad.

Jarvis House/Rockville Railroad Station (M:26-12-2): This historic site is located at 100 Park Avenue, Rockville, MD and was listed on the NRHP in July 18, 1974. According to the NRHP nomination form, the station is one of the surviving picturesque stations on the B&O's Metropolitan Branch. This site is also representative of the growth of Rockville after the 1872 construction of the Metropolitan Branch of the B&O Railroad.

Rockville Park Historic District (M:26-13): This historic district is located along Baltimore Road, Joseph Street and the B&O Railroad Tracks. This historic district was determined NRHP-eligible on November 25, 1996 and listed on the NRHP on July 18, 1974. This district is also representative of the growth of Rockville after the 1872 construction of the Metropolitan Branch of the B&O Railroad.

Hammond Wood Historic District (M:31-38): This historic district is located at Pendleton Drive, south of Veirs Mill Road and was listed on the NRHP on December 15, 2004. This district is one of two developments in the project APE that were designed by Washington architect Charles Goodman in the 1950s in the contemporary design style.

Metropolitan Branch of the B&O Railroad (M:37-16): This historic site was constructed in 1872 and extends from Washington, DC through Frederick, MD. MHT determined that this site was eligible for listing on the NRHP in October 12, 2000.

Hammond Hill Survey District (M:31-58): This historic district is located at Pendleton Drive, north of Veirs Mill Road. This district is one of two developments in the project APE that were designed by Washington architect Charles Goodman in the 1950s in the contemporary design style. MDOT SHA determined that this property was eligible for listing on the NRHP. MHT concurred with MDOT SHA's eligibility determination February 8, 2016.

Twinbrook Survey District (M:26-25): This district is bounded by Veirs Mill Road, Atlantic Avenue, and Vandegrift Avenue. Twinbrook contains approximately 610 late 1940s and 1950s residential houses. MHT concurred upon MDOT SHA's recommendation that this property is eligible for listing on the NRHP under Criterion A, due to its significance as an example of the post-World War II suburban housing, on August 23, 2016.

St. Catherine's Labouré Catholic Church (M:31-61): This historic property is located at 11801 Claridge Road. MHT concurred upon MDOT SHA's recommended that this property is eligible for listing on the NRHP under Criterion A and C on August 23, 2016.

St. Mary's Catholic Church and School (M:26-62): This historic property is located at 520 Veirs Mill Road. MHT concurred upon MDOT SHA's recommended that this property eligible for listing on the NRHP under Criterion A and C on August 23, 2016.

2. Archaeological Resources

MDOT SHA assessed the archeological potential of the survey area through consultation with the Geographic Information System (GIS) Cultural Resources Database, historic and environmental maps, soil survey data, archeological reports, aerial photographs, and site visits. The northern end of the study corridor has been included in prior archaeological surveys (Currey 1977; Gardner 1976; Olson 2004), and eight sites were identified; however, investigation (Olson 2007) revealed that the lots were extensively disturbed and none of these sites were recommended as eligible for listing in the NRHP. Prior surveys included portions of MD 586 where it crosses Matthew Henson State Park (Curry 1983; Thomas 1979) and the MD 586 intersection with Randolph Road (Epperson 1980). These surveys did not identify any archaeological sites. Based on the findings of the previously described surveys with negative results, and site visits conducted in 2012 and 2015 where MDOT SHA confirmed that the majority of the study corridor has been disturbed; MDOT SHA concluded that the archaeological potential for the remainder of the survey area is low and no further archaeological work was recommended. MHT provided concurrence with MDOT SHA's finding in their February 8, 2016 concurrence.

3. Impacts on Cultural Resources

By letter dated June 22, 2016, MDOT SHA requested MHT's concurrence that no historic properties would be affected by either Alternative 1 or 2, Alternative 3 would have *no adverse effect* on historic properties, and Alternative 5B would have *an adverse effect* on historic

properties. MHT provided their concurrence August 23, 2016. Details of the structures and archaeological impact assessment are presented below.

The MD 586 BRT No Build Alternative would have no impact on historic properties, but does not meet the project's purpose and need. Alternative 2 would be constructed at ten (10) intersections on the MD 586 Corridor and would have no impact on historic properties since ROW or easements would not be required from any of the standing historic properties in the APE and BRT service is similar to the currently available bus service.

Alternative 3 would require ROW and construction easements from historic properties, including Rockville Park Historic District, Hammond Wood Historic District, Hammond Hill Historic District, and St. Catherine Labouré Catholic Church. Because the ROW and easement amounts required would be strip takes from the edge of each property along MD 586, this alternative would have no adverse impacts on these historic properties. For the remaining eligible historic properties, no additional ROW or construction easements are required, and BRT bus service on MD 586 would continue similar to the current service with no impact on historic properties, including the Third Addition to Rockville & Old St. Mary's Church & Cemetery, Jarvis House/Rockville Railroad Station, Wilkins Estate, Metropolitan Branch of the B&O Railroad, Twinbrook Survey District and St. Mary's Catholic Church and School. Subsequent to the June 22, 2016 letter to MHT, the project team revised the detailed alternatives mapping. Based on this mapping, Alternative 3 would have a reduced impact on historic properties. Further coordination with MHT would occur to make final effects determination.

Alternative 5B would require ROW and the demolition of a single-family dwelling in the Hammond Hill Historic District which would cause an adverse impact to the historic district. Additional ROW, easements, and the construction of a 10-foot-tall retaining wall would be required within the St. Catherine Labouré Catholic Church's historic boundary. These changes would cause an adverse impact to this historic property since the wall and property takes would introduce new visual and physical elements that would change the character of the historic property. This alternative would have no impact on the following historic properties: Third Addition to Rockville & Old St. Mary's Church & Cemetery, Jarvis House/Rockville Railroad Station, Wilkins Estate, Metropolitan Branch of the B&O Railroad, and St. Mary's Catholic Church and School since no ROW or easements would be required from any of these historic properties. There is currently bus service along MD 586, and the bus's location on the highway would not alter the historic character of any of these properties.

The project corridor contains eight archaeological sites, all of which have been determined not eligible for listing in the NRHP. The archaeological potential of the remainder of the survey area is low, and portions have been included in prior surveys with negative results. No further archaeological work is recommended.

E. Natural Environment

The following information is summarized from the project *Natural Environmental Technical Report* (NETR) (MDOT SHA, 2015). The NETR analysis area was defined by a 100-foot buffer from the edge of pavement along Veirs Mill Road between the Wheaton and Rockville Metrorail Stations. The No-Build Alterative is not expected to result in any impacts to natural

environmental resources; therefore, impacts resulting from the No-Build Alternative are not detailed in the summary that follows.

1. Topography, Geology, and Soils

The study corridor is located within the Piedmont physiographic region, which can generally be defined by gently rolling terrain of low relief to very hilly topography. The elevation ranges from 250 feet to 450 feet above mean sea level. The higher elevations are at the eastern and western extent and the lower elevations are near the central portion of the study corridor (along Rock Creek and Turkey Branch). Steep slopes (greater than 25 percent) have been identified within the NETR analysis area, primarily near the western extent. A review of the Geologic Map of Montgomery County, Maryland, compiled by the Maryland Geological Survey (MGS), and dated 1968, indicates the NETR analysis area is underlain by Wissahickon, Lower Pelitic Schist, Boulder Gneiss, and Kensington Quartz Diorite geologic formations.

The NETR analysis area contains hydric soils, prime farmland soils, and soils of statewide importance. Fifteen (15) soil types were identified in the NETR analysis area; nine of the soil types have been known to contain hydric inclusions. Prime farmland soil and statewide important soil types included: Glenelg silt loam 3-8% slope (2B), Glenelg silt loam 8-15% slope (2C), Elioak silt loam 3-8% slope (4B), Elioak silt loam 8-15% slope (4C), and Elsinboro silt loam 3-8% slope (41B).

Impacts to Topography, Geology and Soils

Steep slope impacts are anticipated within the NETR analysis area. Alternatives 2 and 3 each impact 0.2 acre, Alternative 5B would impact with 0.3 acre of steep slopes. Regardless of build alternatives, the proposed improvements are limited to widening of the existing roadway. Limited cut/fill requirements are anticipated as a result of the proposed roadway improvements. Impacts to geology are not anticipated. Grading activities associated with the proposed intersection and widening improvements could affect micro-topography at local levels. Impacts to geology are not anticipated as a result of the improvement activities.

Alternative 2 would impact 1.2 acres; Alternative 3 would impact 14.3 acres; Alternative 5B would impact 15.8 acres of prime farmland soil and soils of statewide importance. None of the impacts would occur on actively-farmed lands. Generally, the impacts would occur as a result of the grading required at the selected intersections to accommodate queue jumps and where lane widening would occur. Grading would also be required for the addition of stormwater management facilities, as required. Most of the proposed improvements would occur within areas that have been previously disturbed.

The proposed improvements to the existing study corridor are limited to the widening of the existing roadway. Limited cut/fill requirements are anticipated as a result of the proposed roadway improvements. An Erosion and Sediment Control Plan (ESCP) would be prepared during the final design phase in accordance with the Maryland Department of the Environment (MDE) guidelines to minimize and mitigate the impact of the construction activities. Best management practices (BMPs) would be utilized to minimize soil erosion associated with the unstable and erodible soils during construction. These BMPs could include the use of sediment traps/basins, silt fences, interception channels, seeding, and mulching. In addition,

construction activities where surface waters are designated as Use Class I are restricted between March 1 and June 15. Therefore, the stream channel cannot be disturbed during this restricted time.

2. Water Quality and Groundwater

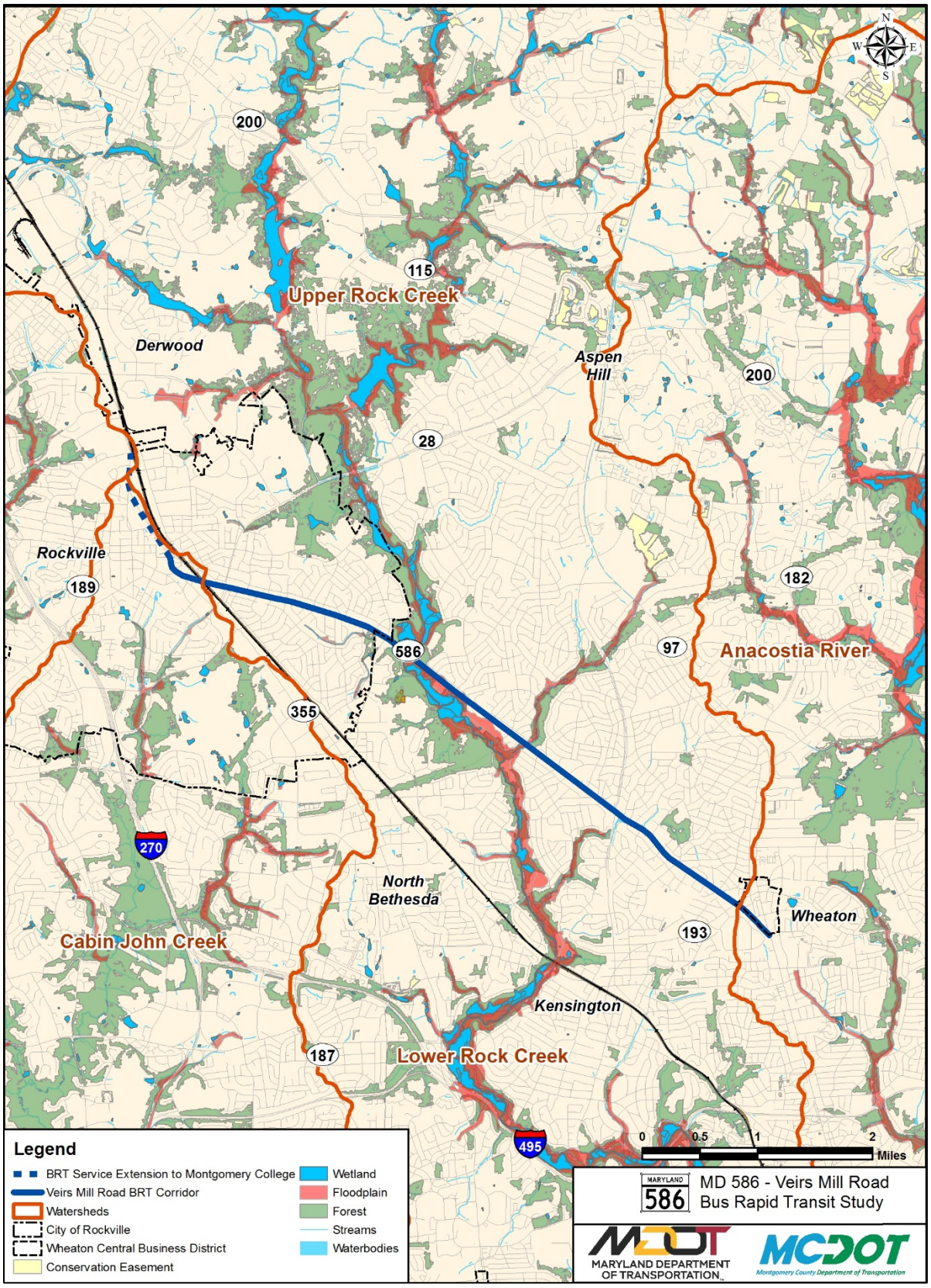
The Rock Creek watershed, located within the Potomac River watershed, is divided into two major subwatersheds: Lower Rock Creek and Upper Rock Creek. The majority of the proposed project is located within the Lower Rock Creek subwatershed. The northernmost extent of the study corridor is located partially in the Cabin John Creek subwatershed, while the study corridor southeast of MD 193 (University Boulevard) is located in the Anacostia River subwatershed (**Figure 10**). The total drainage area of the Rock Creek watershed is 39,300 acres with 21 percent impervious cover. The total drainage area of the Cabin John Creek watershed is 16,022 acres with 21 percent impervious cover. The total drainage area of the Anacostia watershed is 38,867 acres with 18 percent impervious cover. Many indicators of stream quality or relative health decline when impervious cover exceeds 10 percent and severe degradation is expected when impervious cover exceeds 25 percent (Center for Watershed Protection 2003).

The Lower Rock Creek subwatershed is characterized by heavy development that is piped to many headwater areas. Much of this area was developed prior to MDE and Montgomery County Department of Permitting Services stormwater management regulations. According to the Montgomery County Department of Environmental Protection, the overall resource condition for Lower Rock Creek is fair to poor, however, conditions immediately upstream (in the Upper Rock Creek watershed) are rated as good. Resource conditions improve to fair in the vicinity of Turkey Branch downstream to the Kensington Heights area.

The Lower Rock Creek subwatershed can be characterized by heavy development which introduced storm sewer pipes into previously natural drainageways. Heavily urbanized and densely populated areas surround Lower Rock Creek and many of these areas were developed prior to stormwater-runoff management regulations. Montgomery County Department of Environmental Protection classifies the Lower Rock Creek subwatershed in fair to poor condition, and the Upper Rock Creek watershed condition (immediately upstream of the Lower Rock Creek subwatershed) is rated as good. Turkey Branch drains into Rock Creek south of the Parkland Drive and Veirs Mill Road intersection. At this confluence, watershed conditions begin to improve to fair in the vicinity of Turkey Branch downstream to the vicinity of Kensington Heights.

Rock Creek and Turkey Branch generally flow south towards the Potomac River. Waters associated with the Potomac River watershed are assigned a Use Class I designation (water contact recreation, and protection of non-tidal warmwater aquatic life) as established by the Code of Maryland Regulations (COMAR). Surface waters of the State are assigned a designated use classification, used as a goal for the protection and potential future improvement of water quality.

Figure 10: Watershed Boundaries



The average depth to groundwater across the NETR analysis area is anticipated to range from 15 to 25 feet below ground surface. Based on topography and local hydrologic features, groundwater is anticipated to flow south-southeast towards Rock Creek. However, it should be noted that large areas of re-development including urbanization and road construction near the NETR analysis area (Rockville and Wheaton) may affect surface water features as well as the anticipated groundwater flow direction.

Impacts to Water Quality and Groundwater

Construction activities could impact water quality and hydrologic features, specifically within the Rock Creek watershed. Alternative 2 would result in 2.0 acres of new impervious surface; Alternative 3 in 14.8 acres; and Alternative 5B in 46.5 acres. Changes in hydrology could destabilize channel and stream banks, increase erosion and sediment loads in the stream, and affect water quality. Increases in impervious surface could also impact water quality and groundwater.

An ESCP would be prepared during the final design phase in accordance with the MDE guidelines to minimize and mitigate the impact of the construction activities. BMPs would be utilized, in accordance with Maryland's Stormwater Management Act of 2007 and subsequent MDE regulations and guidance, to minimize soil erosion associated with the unstable and erodible soils. These could include the use of sediment traps/basins, silt fences, interception channels, seeding, and mulching. In addition, construction activities within surface waters designated as Use Class I are restricted between March 1 and June 15. Therefore, stream channel disturbance is restricted during this time period.

3. Waters of the US, including Wetlands

A detailed field delineation of jurisdictional wetlands and streams was performed within the NETR analysis area on April 20, 2015 and from August 3 to 5, 2015, following the "Routine Method" described in the *US Army Corps of Engineers (USACE) Wetlands Delineation Manual (1987) and the 2012 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region*. Wetland vegetation, soils, and hydrology must be present for an area to qualify as a wetland in accordance with the aforementioned guidance. MDE and USACE would make the final determination of the jurisdictional status of delineated waters, including wetlands.

Fifteen features were identified within the NETR analysis area. This includes five palustrine emergent wetlands comprising 3,117 SF; eight perennial streams comprising 1,887 linear feet (LF); three ephemeral streams comprising 188 LF; and two intermittent streams comprising 209 LF (**Table 48**). The locations of these features are shown in **Appendix A**.

Impacts to Waters of the US, including Wetlands

No impacts to delineated wetlands or streams are anticipated for Alternative 2. Alternative 3 would impact wetland features WP002 and WP004, totaling less than 0.1 acre. WP002 is located within Rock Creek Regional Park near the intersection of Veirs Mill Road and Aspen Hill Road, and WP004 is located near the Rock Creek crossing of Veirs Mill Road. Alternative 3 would impact two stream features: WL001A, B (Turkey Branch) and WL003A, B (Rock Creek),

totaling less than 0.1 acre. WL001A, B is located at the Turkey Branch crossing of Veirs Mill Road and WL003A, B is located at the Rock Creek crossing of Veirs Mill Road.

Table 48: Summary of Delineated Waters, including Wetlands and Impacts

SUMMARY OF DELINEATED WATERS OF THE US, INCLUDING WETLANDS				SUMMARY OF IMPACTS (square feet (SF)/linear feet (LF)[1])		
Wetland/ Stream Name	USFWS Wetland and Stream Classification	Size Within NETR Analysis Area	Stream Use Designation	Alternative 2	Alternative 3	Alternative 5B
WP001	Palustrine, Emergent, Temporarily Flooded (PEM1A)	162 SF (<0.1 ac)	N/A	0 SF	0 SF	0 SF
WP002	Palustrine, Emergent, Seasonally Flooded (PEM1C)	702 SF (<0.1 ac)	N/A	0 SF	220 SF	260 SF
WP003	Palustrine, Emergent, Temporarily Flooded (PEM1A)	1,187 SF (<0.1 ac)	N/A	0 SF	0 SF	350 SF
WP004	Palustrine, Emergent, Temporarily Flooded (PEM1A)	344 SF (<0.1 ac)	N/A	0 SF	220 SF	350 SF
WP005	Palustrine, Emergent, Temporarily Flooded (PEM1A)	722 SF (<0.1 ac)	N/A	0 SF	0 SF	0 SF
WL001A, B	Perennial; Riverine, Lower Perennial, Unconsolidated Bottom, Cobble-Gravel (R2UB1)	159 LF	I	0 SF/ 0 LF	1,660 SF/ 44 LF	2,610 SF/ 68 LF
WL002	Ephemeral; Riverine, Intermittent, Streambed, Sand (R4SB4)	26 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	0 SF/ 0 LF
WL003A, B	Perennial; Riverine, Lower Perennial, Unconsolidated Bottom, Cobble-Gravel (R2UB1)	310 LF	I	0 SF/ 0 LF	130 SF/ 3 LF	1,050 SF/ 14 LF
WL004	Ephemeral; Riverine, Intermittent, Streambed, Cobble-Gravel (R4SB1)	36 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	0 SF/ 0 LF
WL005	Perennial; Riverine, Lower Perennial, Unconsolidated Bottom, Cobble-Gravel (R2UB1)	356 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	220 SF/ 6 LF

SUMMARY OF DELINEATED WATERS OF THE US, INCLUDING WETLANDS				SUMMARY OF IMPACTS (square feet (SF)/linear feet (LF)[1])		
Wetland/ Stream Name	**USFWS Wetland and Stream Classification**	**Size Within NETR Analysis Area**	**Stream Use Designation**	**Alternative 2**	**Alternative 3**	**Alternative 5B**
WL006	Perennial; Riverine, Lower Perennial, Unconsolidated Bottom, Cobble-Gravel (R2UB1)	208 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	610 SF/ 21 LF
WL007	Intermittent; Riverine, Intermittent, Streambed, Cobble-Gravel (R4SB1)	105 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	90 SF/ 16 LF
WL008	Intermittent; Riverine, Intermittent, Streambed, Sand (R4SB4)	104 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	130 SF/ 0 LF
WL009	Ephemeral; Riverine, Intermittent, Streambed, Sand (R4SB4)	126 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	130 SF/ 15 LF
WL010A, B	Perennial; Riverine, Lower Perennial, Unconsolidated Bottom, Sand (R2UB4)	511 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	3,830 SF/ 502 LF
WL011	Perennial, Riverine, Lower Perennial, Unconsolidated Bottom, Sand, Artificial Substrate (R2UB4r)	282 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	2,700 SF/ 186 LF
WL012	Perennial, Riverine, Lower Perennial, Unconsolidated Bottom, Sand, Artificial Substrate (R2UB4r)	7 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	40 SF/ 7 LF
WL013	Perennial, Riverine, Lower Perennial, Unconsolidated Bottom, Sand, Artificial Substrate (R2UB4r)	55 LF	I	0 SF/ 0 LF	0 SF/ 0 LF	480 SF/ 29 LF
TOTAL WETLAND IMPACTS in square feet (acres)				**0 SF**	**440 SF (<0.1 ac)**	**960 (<0.1 ac)**
TOTAL STREAM IMPACTS in square feet (acres)				**0 SF**	**1,790 SF (<0.1 ac)**	**11,760 SF (0.3 ac)**
TOTAL STREAM IMPACTS in linear feet				**0 LF**	**47 LF**	**864 LF**

Alternative 5B would impact wetland features WP002, WP003, and WP004 totaling less than 0.1 acre. WP004 is located within Rock Creek Regional Park near the Rock Creek Crossing of Veirs Mill Road. Alternative 5B would impact ten stream features: WL001A, B, WL003A, B, WL005, WL006, WL007, WL009, WL010A, B, WL011, WL012, and WL013, totaling 0.3 acre. WL001A, B is located at the Turkey Branch crossing of Veirs Mill Road and WL003A, B, WL005, and WL006 are associated with Rock Creek at the crossing of Veirs Mill Road. WL009 is a tributary of Rock Creek located south of Veirs Mill Road. WL010A, B is a perennial channel parallel to the eastbound lanes of Veirs Mill Road within the boundary of Rock Creek Park. WL011, WL012, and WL013 are perennial channels located within the southeast quadrant of the intersection of Connecticut Avenue and Veirs Mill Road.

4. Floodplains

Floodplains provide important functions that are vital to the natural environment and human safety, including flood storage, pollutant attenuation, wildlife habitat, recreational opportunities, open space, and groundwater recharge. Floodplains in the NETR analysis area were identified using Federal Emergency Management Agency (FEMA) mapping. The FEMA 100-year floodplains were overlaid with study corridor mapping. The study corridor crosses the floodplains of Rock Creek and Turkey Branch (**Figure 10**). MDE requires that increases to the existing 100-year floodplain caused by new construction are limited to a maximum of 0.1 foot of flood elevation in developed areas and 1.0 foot for undeveloped properties. In undeveloped floodplains, increases greater than 0.5 foot require notification of the affected property owner and acceptance of the increase by the affected property owner. Additional property acquisition may be required if the constraints of these requirements cannot be met.

Impacts to Floodplains

Alternative 2 would have a total impact of 1.6 acres; Alternative 3 would impact 8.6 acres; and Alternative 5B would impact 10.7 acres of 100-year floodplain. More specifically, the Rock Creek 100-year floodplain would be impacted by Alternative 2 (1.6 acres), Alternative 3 (7.8 acres), and Alternative 5B (9.9 acres). The Turkey Branch 100-year floodplain would be impacted by Alternative 3 (0.8 acre) and Alternative 5B (0.8 acre).

5. Terrestrial Resources

The NETR analysis area includes forest corridors associated with Rock Creek and Turkey Branch, as well as terrestrial habitats associated with highly developed urban/suburban areas. A field investigation was conducted on July 1 and 2, 2015, to identify forest stands within the NETR analysis area. Eleven forest stands were identified that total 10.6 acres; of which, ten forest stands are dominated by mixed-deciduous forest and one is dominated by tulip poplar. Seven of the forest stands (5.0 acres) were determined to be in fair condition, three (5.2 acres) in good condition, and one (0.4 acre) in poor condition.

According to the Maryland Department of Natural Resources (MDNR), Maryland provides habitat for an estimated 90 species of mammals, 93 species and subspecies of reptiles and amphibians, and over 400 species of birds. The majority of viable wildlife habitat associated with the proposed project alignment is located along the riparian corridors adjacent to Rock Creek and Turkey Branch. The highly developed areas of the proposed project alignment can

be expected to provide limited habitat for wildlife species adapted to conditions associated with anthropogenic disturbance.

Impacts to Terrestrial Resources

Alternative 2 would impact 0.9 acre of forest; of which, 0.6 acre would be in forests in fair condition and 0.3 acre would be in forests in good condition. Alternative 3 would impact 1.2 acres of forest; of which, 0.9 acre would be in forests in fair condition and 0.3 acre would be in forests in good condition. Alternative 5B would impact 3.1 acres of forest; of which, 1.9 acres would be in forests in fair condition, 1.0 acres would be in forests in good condition, and 0.2 acres would be in forests in poor condition. The impacts would be a result of strip and linear ROW and temporary construction easement takes along the existing Veirs Mill Road alignment and would not bisect or fragment and existing forest. **Table 49** summarizes the forest stand impacts.

Table 49: Forest Stand Impacts

Forest Stand	Condition	Size within NETR Analysis Area (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 5B (acres)
FS-1	Fair	0.2	0.0	<0.1	0.1
FS-2	Fair	0.7	<0.1	<0.1	0.2
FS-3	Good	3.1	0. 2	0.2	1.0
FS-4	Fair	0.4	<0.1	<0.1	0.2
FS-5	Fair	1.9	0.0	0.0	0.5
FS-6	Fair	0.2	0.0	<0.1	<0.1
FS-7	Poor	0.4	0.0	0.0	0.2
FS-8	Fair	0.9	0.0	0.2	0.4
FS-9	Good	1.2	0.0	0.0	0.0
FS-10	Good	0.9	0.1	0.1	<0.1
FS-11	Fair	0.7	0.6	0.6	0.5
TOTAL		**10.6**	**0.9**	**1.2**	**3.1**

6. Rare, Threatened, and Endangered Species

Correspondence was submitted to the MDNR Wildlife and Heritage Service (WHS) and the MDNR Project Review Department (PRD) to determine whether there are any records for state or federally-listed rare, threatened, or endangered (RTE) species within the NETR analysis area. Correspondence from the United States Fish and Wildlife Service (USFWS), obtained via online review (June 20, 2016), indicates that no federally proposed or listed endangered species are known to exist within the project area (**Appendix D**).

Correspondence from PRD, dated June 22, 2016, indicates no instream work is proposed, nor are there any State or Federal office records for plant or animal species listed within the project area (**Appendix D**).

7. Unique and Sensitive Areas

Unique and sensitive areas are resources that have unique ecological characteristics, are sensitive to anthropogenic impacts, or provide unique aesthetic value to the public. The proposed project alternatives were evaluated to determine whether they would have impacts

associated with the Chesapeake Bay Critical Area, Forest Interior Dwelling Species (FIDS) habitat, green infrastructure, Use III or IV watersheds, Wetlands of Special State Concern, or park property. The study corridor is not located within a Use III or IV watershed and therefore contains no Wetlands of Special State Concern, nor is the study corridor located within the limits of the Chesapeake Bay Critical Area. MDNR Green Infrastructure includes forest along the Rock Creek corridor and M-NCPPC mapped park boundaries (**Appendix A**).

Impacts to Unique and Sensitive Areas

The impacts to Unique and Sensitive Areas are associated with activities within the Rock Creek and Turkey Branch corridors. Green Infrastructure impacts total 0.2 acre for Alternative 2, less than 0.1 acre for Alternative 3, and 1.7 acres for Alternative 5B. The impacts would be a result of strip and linear ROW and temporary construction easement takes along the existing Veirs Mill Road alignment.

Rock Creek Regional Park bisects the study corridor along the Rock Creek and Turkey Branch corridors. The Twinbrook Community Recreation Center property intersects the south side of the proposed study area, just east of the portion of Rock Creek Regional Park associated with the Rock Creek Corridor. Park impacts total 0.2 acres for Alternative 2, 0.6 acres for Alternative 3, and 1.6 acres for Alternative 5B.

Watershed Resources Registry (WRR) models were examined to determine whether high-quality ecological areas exist within the NETR analysis area and to identify the potential for on-site mitigation opportunities. Several riparian preservation opportunities exist along MD 586 within or adjacent to the Rock Creek and Turkey Branch floodplain areas. These areas would be the focus of forest impact avoidance and minimization strategies during design. The WRR model also indicates that that the majority of the NETR analysis area is in need of stormwater improvements. There are little to no opportunities present in the NETR analysis area for upland and wetland preservation and restoration.

F. Air Quality

The air quality analysis was conducted in accordance with the Environmental Protection Agency (EPA), FHWA, and MDOT SHA guidelines. FTA follows FHWA guidelines for air quality analysis. Refer to the *Air Quality Analysis Technical Report* for details on the technical analysis and its components.

The EPA established the National Ambient Air Quality Standards (NAAQS) for seven criteria pollutants under the Clean Air Act (CAA). These pollutants include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), fine particulate matter ($PM_{2.5}$), coarse particulate matter (PM_{10}), and sulfur dioxide (SO_2). In addition, the EPA identified six priority mobile source air toxics (MSATs) which include benzene, acrolein, formaldehyde, 1,3-butadiene, acetaldehyde, and diesel exhaust.

Montgomery County is listed by the EPA as a nonattainment area for ozone and maintenance areas for both $PM_{2.5}$ and CO.

At a regional level, a project is considered to be conforming if it is part of a conforming Transportation Improvement Program (TIP) and CLRP. The *2014 Constrained Long-Range Transportation Plan* and the *FY 2015-2020 Transportation Improvement Program* were approved on October 15, 2014 and were found to conform to the State Implementation Plan (SIP). The BRT along the study corridor is included in the Washington Metropolitan Region CLRP as project ID 3112 and the FY 2015 – 2020 TIP under TIP ID 6000.

1. Particulate Matter

In January 2015 Montgomery County was designated a *maintenance* area for the 1997 $PM_{2.5}$ standard, therefore, transportation conformity standards are still applicable. If a project is considered a *Project of Air Quality Concern*, a quantitative hot-spot analysis is necessary to determine conformity.

Projects of Air Quality Concern include [40 CFR 93.123(b)(1)]:

i. *New highway projects that have a significant number of diesel vehicles, and expanded projects that have a significant increase in the number of diesel vehicles;*
ii. *Projects affecting intersections that are at Level-of-Service D, E, or F with a significant number of diesel vehicles, or those that will change to Level-of-Service D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project;*
iii. *New bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location;*
iv. *Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and*
v. *Projects in or affecting locations, areas, or categories of sites which are identified in the PM_{10} or $PM_{2.5}$ applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violations.*

Table 50 provides a summary of the available traffic data used in this analysis. The average daily traffic (ADT) reported is an average of vehicular traffic in the study corridor. For this study, it is assumed that ADT and diesel truck percentages will be the same for the build and No-Build alternative(s) because the project is the addition of a BRT system and would not increase roadway capacity, vehicle volume, or the percentage of diesel truck traffic. Changes to traffic volumes over time reflect growth and development in the surrounding area. The projected traffic data indicates no increase in truck percentages between the existing, interim, and design year. The data also indicates that there is no variation of ADT and diesel truck traffic between alternatives. The ADT is projected to increase 10.1 percent by 2040 with the percent of diesel truck traffic remaining the same.

Based on this review, the build alternatives should meet the CAA and 40 CFR 93.109 requirements. These requirements are met for $PM_{2.5}$ without a project-level hot-spot analysis since the project does not meet the criteria set forth in 40 CFR 93.123(b)(1) to be considered a project of air quality concern. Therefore, this is not a project of air quality concern and would not cause or contribute to a new violation of the $PM_{2.5}$ NAAQS, or increase the frequency or severity of a violation.

Table 50: ADT and Truck Percentages (MDOT SHA, 2015)

	Existing (2015)			Interim (2027)			Design (2040)		
	2015 ADT	2015 Diesel Truck %	Diesel Trucks	2027 ADT	2027 Diesel Truck %	Diesel Trucks	2040 ADT	2040 Diesel Truck %	Diesel Trucks
No-Build Alternative	35,719	3.20%	1,144	37,394	3.21%	1,198	39,338	3.20%	1,260
Build Alternatives	35,719	3.20%	1,144	37,394	3.21%	1,198	39,338	3.20%	1,260

2. Carbon Monoxide

Montgomery County is classified as a maintenance area for carbon monoxide in Election Districts 4, 7, and 13. The study corridor is located within Election Districts 4 and 13 and is therefore subject to transportation conformity requirements.

Based on the data gathered from five regional CO monitoring stations (Maryland Department of the Environment-Air Quality Division), there has not been a violation of either the 1-hour or 8-hour standard between 2012 and 2014. The highest 1-hour concentration recorded during this timeframe was 5.8 parts per million (ppm) which is 16.6 percent of the 35-ppm standard. The highest 8-hour concentration recorded during this timeframe was 2.8 ppm which is 31.1 percent of the 9-ppm standard. The air quality data is further discussed in the *Air Quality Analysis Technical Report*.

Based on the monitored air quality data, projected ADT, and projected diesel truck percentage, the build alternatives would not cause or contribute to creating a new violation of the NAAQS and it is suggested that it not be considered a project of air quality concern. Once a recommended alternative is selected, a conformity determination will be required.

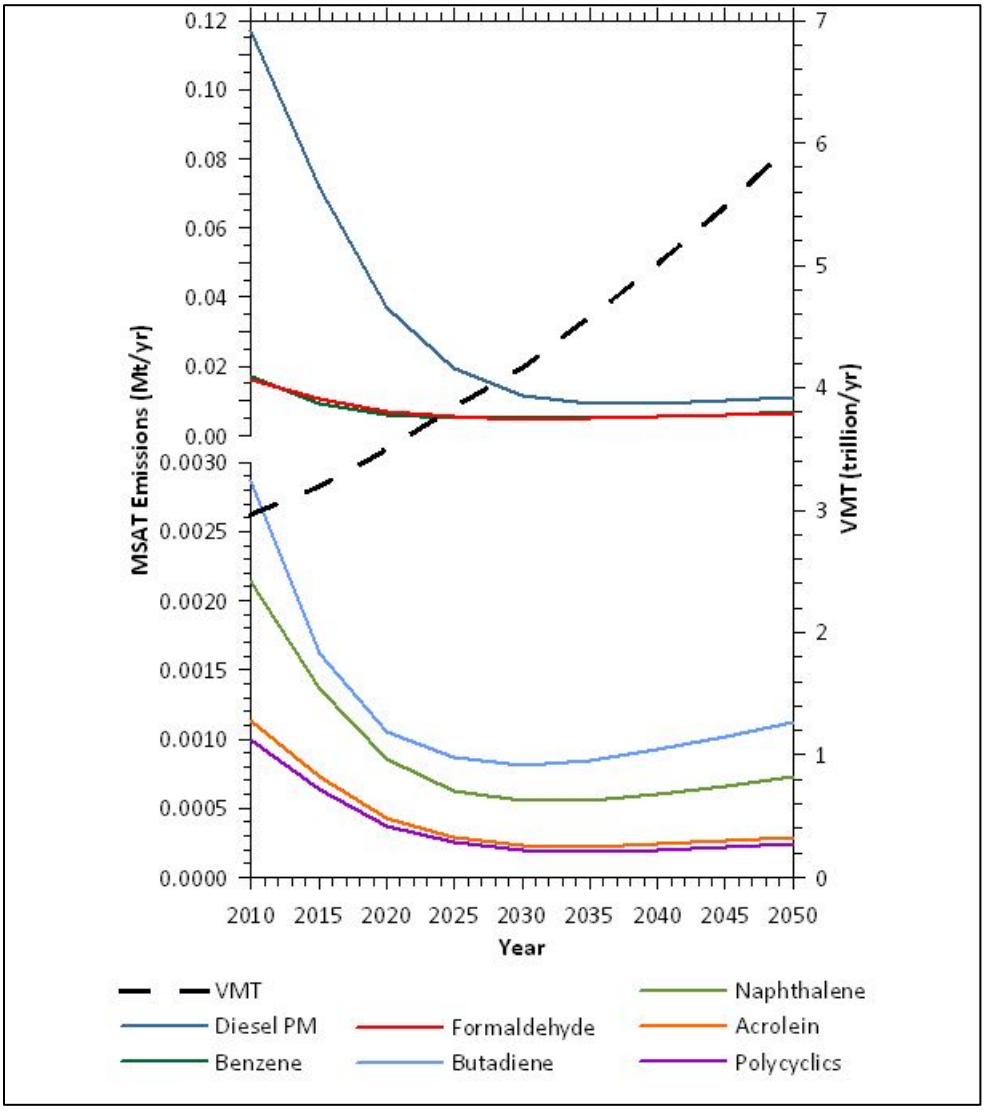
3. Mobile Source Air Toxics

Though not a criteria pollutant, MSATs are emitted by motor vehicles as well. FHWA provides guidance for analyzing MSATS; *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA*. The guidance categorizes projects into three levels: 1) no meaningful MSAT effects, 2) low potential MSAT effects, and 3) high potential MSAT effects. Qualitative analyses are required for projects with low potential for MSAT effects and quantitative analyses are required for projects with high potential for MSAT effects.

Implementation of BRT improvements along MD 586 would not result in changes in traffic volumes, vehicle mix, basic project location, or any other factor that would cause an increase in MSAT impacts of the project from that of the No-Build alternative. Neither the No-Build nor the three build alternatives have an impact on design year ADT including diesel truck traffic. Therefore, this project is one with no meaningful potential for MSAT effects (no meaningful impact on traffic volumes or vehicle mix) and does not require a qualitative or quantitative analysis.

Moreover, EPA regulations for vehicle engines and fuels will cause overall MSAT emissions to decline significantly over the next several decades. Based on regulations now in effect, an analysis of national trends with EPA's MOVES model forecasts a combined reduction of over 80 percent in the total annual emission rate for the priority MSAT from 2010 to 2050 while vehicle-miles of travel are projected to increase by over 100 percent (**Figure 11**). This will both reduce the background level of MSAT as well as the possibility of even minor MSAT emissions from this project.

Figure 11: National MSAT Emission Trends 1999 – 2050 for Vehicles Operating on Roadways (FHWA, 2012)



Note: Trends for specific locations may be different, depending on locally-derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors. Source: EPA MOVES2010b model runs conducted during May – June 2012 by FHWA.

4. Greenhouse Gases

Maryland's Greenhouse Gas Emission Reduction Act of 2009 (GGRA) seeks a reduction in greenhouse gas (GHG) emissions of 25 percent from the 2006 baseline by 2020. The *Greenhouse Gas Reduction Plan* was published in October 2013, and puts the State on track to achieve the 25 percent GHG reduction required by the law. The Maryland Climate Change Commission (MCCC) was signed into law by Governor Hogan in 2015. The MCCC is charged with assessing future year goals for GHG emissions in Maryland.

Currently there are no federal requirements for consideration of GHG impacts in transportation planning; however, MDOT recognizes that highway transportation accounts for approximately 28 percent of the GHGs in Maryland.

Much like environmental habitats, Maryland's transportation system is a network of interdependent elements and the interactions and synergy between each part impact the transportation system as a whole. GHG emissions from major transportation projects need to be considered as part of the planning process and recognition needs to be made that all projects may not reduce GHG emissions, but as a whole, the network needs to focus on reductions. Consequently, project-level emissions analyses are less informative than analysis conducted at the regional, state, and national scale. EPA has not identified NAAQS for GHGs, but has finalized standards and adopted regulations to enable the production of a new generation of clean vehicles along with implementing cleaner fuel standard regulations to achieve significant reductions of GHG emissions.

MDOT SHA continues to strive for improved operations and system efficiency through improved operations which typically goes hand-in-hand with GHG reductions. System operations improvements such as improved signal timing, roundabouts, reduced vehicle idling, congestion pricing and reduction, smoothing traffic flow, eliminating bottlenecks, and encouraging eco-driving are incorporated into many MDOT SHA projects. Environmental benefits and consequences are considered on all projects prior to implementation.

G. Noise

Federal regulations require the evaluation of noise when certain transportation improvements are being proposed. However, the federal regulations defer to the lead agency's policy and guidance for the assessment of noise. FTA, FHWA, and Montgomery County, the three potential lead agencies, each have their own noise assessment policy and procedures. The analysis presented here is focused on predicted noise levels for the alternatives using both FTA and FHWA methodologies. Noise impacts and mitigation were not assessed since the methodology for assessing impacts differs between the agencies. Upon the identification of a lead agency, a noise analysis methodology will be identified that is standard with the lead funding agency practices and a full impact and mitigation analysis will be completed.

FTA's governing statute is defined in 23 CFR 771. This regulation refers to the FTA's manual *Transit Noise and Vibration Impact Assessment* (FTA-VA-90-1003-06, May 2006), which provides guidance for completion of a transit noise assessment. FHWA's governing statute is defined in 23 CFR 772, requiring all states to develop a Traffic Noise Analysis Policy, in accordance with and as approved by FHWA. Additionally, the regulation requires the use of FHWA's Traffic

Noise Model (TNM) for the prediction of highway traffic noise. The MDOT SHA Highway Noise Policy is based upon the latest provisions contained in 23 CFR 772 and was approved by FHWA in 2011. The Montgomery County Highway Noise Abatement Policy, dated October 2001 – Amended April 2010, essentially follows the requirements of 23 CFR 772, and mandates TNM as the computer program that is to be used as the computation method for noise assessments.

In general, the FTA considers the incremental increase in noise levels a result of the new transit service only. Whereas, the FHWA method considers the current traffic noise levels and the absolute future noise levels of all traffic sources, including not only the transit improvement, but vehicle traffic within the study corridor. Because the lead agency has not been determined, the analysis for this study identifies predicted noise levels for the alternatives presented utilizing both methodologies, and does not assess noise impact or noise mitigation.

The FTA and FHWA define different land uses in assessing potential noise impact to the land use. The majority of noise sensitive receptors in the study corridor fall within Activity Categories associated with residential properties. This typically includes ground-level outdoor living spaces where frequent human use typically occurs, but may also include the evaluation of upper floors in certain instances. **Table 51** shows the FTA Land Use categories and metrics which establishes noise levels based on the type of activity or land use. **Table 52** shows the FHWA Noise Abatement Criteria (NAC) which establishes noise levels based on the type of activity or land use. In general, FTA land use Category 1 equates to FHWA land use Category A, Category 2 to Category B, and Category 3 to Category C.

Table 51: FTA Land Use Categories and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor Leq(h)	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor Ldn	Residences and buildings where people normally sleep. This category includes homes, hospitals and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor Leq(h)	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

1. Leq for the noisiest hour of transit-related activity during hours of noise sensitivity.

Table 52: FHWA Noise Abatement Criteria (NAC) [Hourly A-Weighted Sound Level in Decibels]

Activity Category	Evaluation Location	Description of Activity Category
A	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the

Activity Category	Evaluation Location	Description of Activity Category
		area is to continue to serve its intended purpose.
B	Exterior	Residential
C	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[1]	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F.
F	--	Agriculture, airports, bus yards, emergency services, industrial, logging maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted.

1. Includes undeveloped lands permitted for this activity category.

For reporting predicted noise levels using FTA methodology, the noise analysis area concentrated on residential, Category 2 land use only, and noise levels were only predicted for residential properties that abut Veirs Mill Road.

Using the FTA methodology, noise levels were assessed for ambient measurement receptor locations M-01 (700 Gail Street, in NSA 37-B), M-02 (4902 Adrian Street, in NSA 23-B), M-03 (12104 Veirs Mill Road, in NSA 63-B) and M-04 (11413 Veirs Mill Road, in NSA 05-B), as calculated by the FTA Noise Impact Assessment Spreadsheet to allow comparison using the residential metric, Ldn (**Table 53**). The Ldn is based upon the number of bus operational events per hour during the day (7:00 AM to 10:00 PM) combined with and during the night (10:00 PM to 7:00 AM). The Ldn values shown for the existing condition reflect all noise sources measured over the 24-hour period, whereas the Ldn values calculated for each alternative are the maximum contributions of transit bus operations only. For this reason, Ldn values for the alternatives are lower than those reported for existing conditions.

Table 53: FTA Noise Prediction Summary

Receptor	Existing Ldn[1]	Alternative 3		Alternative 5B	
		Dist. Transit to Receptor (Feet)[2]	Ldn[3]	Dist. Transit to Receptor (Feet)[1]	Ldn[3]
M-01	68	55	53	85	51
M-02	71	50	54	85	51
M-03	67	35	56	75	52
M-04	63	85	50	85	51

1. *The existing Ldn is reflective of accumulation of all measured noise sources.*
2. *The distance is from the centerline of the proposed transit bus lane to the receptor.*
3. *The Ldn calculation is associated with transit bus operations only.*

For use of reporting predicted noise levels using FHWA TNM methodology, the noise analysis area was divided into 94 distinct areas of similar land use in accordance with MDOT SHA and

FHWA policies and guidance. Of these, 77 were identified as noise sensitive areas (NSAs) falling within land use Category A to E and 17 were identified as non-noise sensitive, Category E or F. A total of 42 NSAs were determined to be Category B (residential), 11 were Category C (areas such as parks or active sports areas with exterior use), eight were Category C/D (involving potential interior activities), and 16 were Category E (offices, restaurants, etc.).

The future noise levels were predicted for the proposed 2040 Design-Year (DY); Alternatives 3 and 5B for each Category B NSA (**Table 54**). The future traffic volumes used within the model reflect 7:00 AM projections, which was concluded to represent the loudest hour of the day. While the 7:00 AM hour generally possesses slightly lower overall traffic volumes, it has significantly greater truck percentages compared to 5:00 PM, thus producing the highest predicted noise levels for each NSA.

Noise levels were assessed at TNM-modeled receptors which were added to the model, to be representative of first-row locations in areas with common noise environments where topography and traffic characteristics do not change drastically. Receptors were also added to represent upper stories of multi-family dwellings, where applicable.

Table 54: FHWA Noise Prediction Summary

NSA	Land Use	Predicted Noise Levels dB(A)	
		Alternative 3	Alternative 5B
05-B	Single-family homes	65	65
06-B	Single-family homes	68	68
09-B	Single-family homes	67	68
10-B	Town homes	67	68
11-B	Single-family homes	67	68
12-B	Multi-family, multi-story	63-68	63-68
13-B	Single-family homes	67	67
19-B	Single-family homes	66	66
20-B	Single-family homes	66	66
21-B	Single-family homes	66	66
23-B	Single-family homes	67	67
24-B	Single-family homes	67	67
25-B	Single-family homes	68	68
28-B	Single-family homes	67	67
29-B	Single-family homes	66	67
30-B	Single-family homes	66	67
31-B	Single-family homes	71	71
32-B	Single-family homes	71	71
34-B	Single-family homes	69	69
37-B	Single-family homes	67	68
39-B	Single-family homes	67	68
40-B	Single-family homes	67	68
42-B	Single-family homes	67	68
43-B	Single-family homes	67	68
45-B	Single-family homes	68	69

NSA	Land Use	Predicted Noise Levels dB(A)	
51-B	Multi-family, multi-story	60-68	61-68
52-B	Multi-family, multi-story	58-68	59-68
56-B	Multi-family, multi-story	60-67	60-67
57-B	Multi-family, multi-story	58	58
59-B	Single-family homes	68	68
61-B	Single-family homes	68	68
63-B	Single-family homes	68-71	68-71
66-B	Single-family homes	65	65
67-B	Single-family homes	68	68
68-B	Single-family homes	68	68
69-B	Single-family homes	68	68
70-B	Town homes	65	65
71-B	Single-family homes	65	65
73-B	Single-family homes	63	63

H. Hazardous Materials

An Initial Site Assessment (ISA) was conducted to identify and account for municipal, industrial, and residual waste materials adjacent to the study corridor. Below is a summary of the assessment; for the full report, refer to the *Initial Site Assessment* (October 2015).

A total of 740 sites with potential hazardous materials were identified. There is potential for the presence of hazardous materials within the study corridor and/or adjacent properties associated with aboveground storage tanks (ASTs), asbestos-containing materials, automotive repair facilities, discharge permits, drum storage, dry cleaning facilities, lead-based paint, mercury-containing devices, polychlorinated biphenyls (PCBs), railroad properties, solid waste, underground storage tanks (USTs), and other. The 740 sites were ranked 1 through 5 with 1 being assigned to sites for the highest potential of impact and 5 being assigned to those sites with low potential, as summarized in **Table 55**.

Table 55: Summary of Impact Ranking Criteria

Rank 1 - High Potential for Impact (23 Sites)	
• Industrial facilities • Gasoline stations • Automobile repair facilities • Paint manufacturing facilities • ASTs with a large amount of staining • USTs containing gasoline, jet fuel, kerosene fuel, waste oil, or solvents	• Landfills • Remediation systems in place • Pits and lagoons • Dry cleaners • PCB transformers with major stains • Surface dumps with drums or other hazardous materials
Rank 2 - Listed Sites (1 Site)	
• Regulatory database listed sites that could not be otherwise classified, due to insufficient location data or MDE regulatory information. • Sites that were unable to be properly inspected.	

Rank 3 - Medium/High Potential for Impact (5 Sites)	
• USTs containing materials other than listed above • Surface dump with empty drums or other materials of concern • Mounds	• ASTs with several medium stains • Suspected PCB containing transformers with minor stains • Significant evidence of surficial staining
Rank 4 - Medium Potential for Impact (104 Sites)	
• Minimal evidence of surficial staining • Slightly discolored surface water • Suspected PCB containing transformers with no staining • Distressed vegetation • Unmarked transformers	• Large surface dumps containing household wastes • ASTs with a few small stains or no staining, but questionable integrity • Hazardous material storage sites
Rank 5 - Low Potential for Impact (607 Sites)	
• Small surface dumps containing household wastes • ASTs (relatively new) with no staining or evidence of poor structural integrity	• Septic systems • Non-adjacent sites used for automobile repair/vehicle maintenance facilities

There is potential for residual soil and/or groundwater contamination within the study corridor associated with the current/historic land usage, petroleum storage, chemical handling, current/historic gas stations, current/historic dry-cleaning facilities, and active railroad tracks. However, based on the type of recognized environmental concerns (RECs) that were identified, the majority of the potential contamination would occur at greater depths than would be encountered during surficial construction activities for the proposed MD 586/Veirs Mill Road BRT improvements. Therefore, there would be minimal contact with contaminants and hazardous materials. If the proposed construction will require deeper excavations (for the purposes of utility relocations, stormwater management structures, and/or the construction of new building structures), impacted soils and/or groundwater may be encountered in the vicinity of the sites assigned a ranking of 1, 2, or 3. The eight REC sites with a risk ranking between 1 and 3 that are adjacent to the project area and impacted by the proposed action alternatives are summarized in **Table 56**. Site numbers (#'s) included in this table correspond with their identification in the ISA (October 2015). Each of these sites will need to be re-assessed during the design phase of the recommended alternative when utility relocations and stormwater management structures are identified.

Table 56: Summary of Impacted Sites with Recognized Environmental Concerns (RECs)

Site #	Location/Description	Hazardous Material Group/Type	Risk Ranking	Alternative 2	Alternative 3	Alternative 5B
VM-57	Active WMATA Metrorail ROW Rockville Pike	Petroleum (diesel and lubricating oils), PCBs, and Creosote	3	0 SF	1,500 SF	1,500 SF

Site #	Location/Description	Hazardous Material Group/Type	Risk Ranking	Alternative 2	Alternative 3	Alternative 5B
VM-85	Public ROW/Sidewalk associated with the Westchester at Rockville Station Apartments 100 1st Street	Petroleum (gasoline)	1	0 SF	3,100 SF	2,600 SF
VM-89	Public ROW/Sidewalk associated with the Westchester at Rockville Station Apartments 801 Veirs Mill Road	Petroleum (gasoline)	1	0 SF	910 SF	710 SF
VM-283	Twinbrook Shopping Center and Gas Station 2000 Veirs Mill Road	Petroleum (gasoline, diesel, fuel oil) and Solvents (dry-cleaning chemicals)	1	0 SF	0 SF	7,800 SF
VM-353	Rock Creek Terrace Apartment Complex 12630 Veirs Mill Road	Petroleum (heating oil)	1	0 SF	7,600 SF	15,800 SF
VM-437	Exxon Gas Station 12245 Veirs Mill Road	Petroleum (gasoline)	1	0 SF	540 SF	2,050 SF
VM-439	Stoney Mill Square Shopping Center and Gas Station 12201 Veirs Mill Road	Petroleum (gasoline) and Solvents (dry-cleaning chemicals)	1	0 SF	470 SF	3,080 SF
VM-491	Verizon Maryland Maintenance Garage 12001 Connecticut Avenue	Petroleum (gasoline, diesel, kerosene)	1	2,940 SF	3,680 SF	3,330 SF

NOTE: Site #'s provided here correspond with the identification assigned in the *Initial Site Assessment* (October 2015).

Should ROW acquisition be required at sites where RECs have been identified, the ISA recommends additional investigations be performed, including the following:

- Subsurface soil sampling to confirm or deny the presence of residual petroleum contamination associated with the previously removed or decommissioned USTs (Sites VM-85, VM-89, VM-353, and VM-491).
- Subsurface soil and groundwater sampling to confirm or deny the presence of residual petroleum contamination associated with the active UST tank fields. (Sites VM-283, VM-353, and VM-437).
- Subsurface soil and groundwater sampling to confirm or deny the presence of residual solvent contamination associated with the current and historic dry-cleaning facilities (Sites VM-283 and VM-439).
- Surficial soil sampling to confirm or deny the presence of residual contamination associated with the railroad activities that occur along the railroad tracks (Site VM-57).

Additionally, if the proposed construction will impact any pad-mounted or pole-mounted transformers, additional information requests should be made to regulatory agencies and local utility companies to confirm or deny the presence of PCBs in the unlabeled electrical transformers.

I. Indirect and Cumulative Effects Analysis

An Indirect and Cumulative Effects (ICE) Analysis was conducted in compliance with current guidelines established by MDOT SHA, the NEPA, and CEQ regulations. For further information, refer to the *Indirect and Cumulative Effects Analysis* (MDOT SHA, 2016).

1. Scoping

The CEQ regulations set forth in 40 Code of Federal Regulations [CFR] § 1500 et. seq. identifies three types of environmental effects that must be addressed and considered to meet NEPA requirements. The terms "effects" and "impacts" are synonymous, as used in the CEQ regulations. Definitions of direct, indirect, and cumulative effects are as follows:

- *Direct effects* are caused by the action and occur at the same time and place (40 CFR § 1508.8[a]).
- *Indirect effects* are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR § 1508.8[b]).
- *Cumulative impact* is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively-significant actions taking place over a period of time (40 CFR § 1508.7).

Resources

In order to determine which environmental resources should be considered in the ICE analysis, the resources that would be directly impacted by the proposed improvement alternatives were identified. The resources directly impacted by the project form the basis for resources that are examined in the ICE analysis. In addition, the availability of the data (and the quality of the available data) to quantify and characterize the resources was evaluated. **Table 57** summarizes the types of resources and their respective sub-boundaries that were considered for analyses in the MD 586/Veirs Mill Road BRT Corridor Study ICE Analysis.

Geographic Boundary

The ICE analysis defined a geographic boundary (analysis area) that encompasses resources where indirect and cumulative effects could occur. The ICE analysis area was formed considering a series of map overlays of relevant sub-boundaries for resources which could be indirectly or cumulatively affected by the MD 586/Veirs Mill Road BRT Corridor Study, as listed

in **Table 57**. These sub-boundaries include watershed/subwatershed boundaries, 2010 US Census tracts and block groups, and M-NCPPC Planning Areas.

Table 57: ICE Analysis Resources and Effects

POTENTIAL RESOURCES	INCLUDED IN ICE	RATIONALE FOR INCLUSION	REPRESENTATIVE SUB-BOUNDARY USED
Socioeconomic			
Community Facilities/ Businesses	Yes	Direct and/or Indirect Effects, Including Displacements, New Development, and Community Cohesion Impacts	Montgomery County Planning Areas, Census Tract Block Group Boundaries
Park and Recreation Facilities	Yes	Direct and/or Indirect Effects	Montgomery County Planning Areas, Census Tract Block Group Boundaries
Cultural			
Historic Standing Resources	Yes	Direct and/or Indirect Effects	Montgomery County Planning Areas
Natural Resources			
Water Quality/ Groundwater	Yes	Indirect Effects	Rock Creek Subwatersheds
Waters/Wetlands	Yes	Direct and/or Indirect Effects	Rock Creek Subwatersheds
Floodplains	Yes	Direct and/or Indirect Effects	Rock Creek Subwatersheds
Terrestrial Resources	Yes	Direct and/or Indirect Effects	Rock Creek Subwatersheds

Sub-boundary Considerations

Subwatershed Boundaries: Subwatershed boundaries were considered to assess impacts to natural resources such as water quality/groundwater; wetlands/streams; floodplains; and terrestrial resources. The subwatershed boundaries were established by identifying the MDNR eight-digit subwatersheds completely or partially within the project limits. The study corridor is primarily within the Rock Creek watershed (MD #02140206) of the Potomac River watershed. The Rock Creek watershed is composed of the Upper and Lower Rock Creek subwatersheds and these drain south toward the Potomac River. The watershed boundary extends far beyond the study corridor; therefore, it was not used to define the ICE analysis area.

Census Tracts: Census tract boundaries are recommended under MDOT SHA guidelines to define boundaries representing socioeconomic resources and communities affected by the project. The study area is primarily residential with commercial and business centers, also known as CBDs, located in Rockville and Wheaton. The study corridor bisects or is adjacent to 30 census tracts. The sub-boundary includes census tracts adjacent to Veirs Mill Road, as well as those within close proximity where socioeconomic impacts could occur. Block group boundaries were used to define the ICE analysis area when a census tract extended significantly beyond the study corridor.

Planning Areas: Planning areas can be used to define boundaries representing socioeconomic resources and communities affected by the project. Montgomery County is broken into three major planning areas: Area 1, Area 2, and Area 3. These are further divided into community master plans. There are over 50 community master plans comprising the *Montgomery County*

Comprehensive Master Plan. The study corridor is located within Area 2, passing through or adjacent to four of the community master planning areas, as well as the City of Rockville. These include Wheaton, Kensington-Wheaton, Aspen Hill, and North Bethesda-Garrett Park. Many of the community planning areas extend far beyond the study corridor. Therefore, the community planning area boundaries were used to define the ICE analysis area only when the entire community planning area would likely incur indirect and cumulative effects from the project.

Overall ICE Geographic Boundary

The ICE geographic boundary (analysis area) was established by evaluating and synthesizing appropriate sub-boundaries as shown in **Figure 12**. The ICE analysis involves consideration of natural environment and socioeconomic resources. Based on the suburban/urban nature of the study corridor, the census tracts and planning areas form the majority of the ICE analysis area. The ICE analysis area is nearly identical to the CEA analysis area with the exception of the southeastern portion; here, the boundary was extended to completely include the Kensington, Capitol View and Vicinity, and Forest Glen community planning areas, and Census Tracts 7032.09, 7032.02, 7039.01, and 7040. The subwatershed boundaries were taken into consideration as well. However, other than Rock Creek and its associated floodplain, wetlands, and forests that traverse through the middle of the study corridor, the study corridor is urban in nature and already disturbed by existing development. Therefore, though impacts to natural resources were taken into consideration during the development of the ICE analysis area, the subwatershed boundaries were not considered critical in identifying indirect and cumulative effects within the study corridor.

Temporal Boundary

The temporal boundary established for the MD 586/Veirs Mill BRT ICE analysis begins in 2000 and extends to 2040. The past time frame was selected based on available historic events, development trends, and population changes. Montgomery County has experienced steady growth since the 1940s, when opportunities for federal government work expanded in the area. Population growth slowed moderately in the 1970s until the construction of the Silver Spring Metrorail Station late in the decade. The construction of the Red Line to Shady Grove, the Metropolitan Grove MARC station in 1984 (Montgomery County Historical Society, 1999), and economic growth for the period between 1970 and 2000, resulted in a 67 percent increase in population and a 152 percent increase in jobs within Montgomery County (**Table 58**). Between 2000 and 2010, population and job growth slowed to single-digit percentages. Based on the available census data, historic events, development trends, and population changes, the year 2000 has been defined as the past time frame for the temporal boundary.

The future time frame was selected since it encompasses the 2040 design year for the MD 586/ Veirs Mill BRT Corridor Study and regional plans and projections have been forecasted through 2040. Potential future development beyond 2040 is not considered reasonably foreseeable. Between 2000 and 2040, a period of 40 years, Montgomery County is expected to experience a 38 percent increase in population and a 34 percent increase in jobs (**Table 58**).

Figure 12: ICE Analysis Boundary

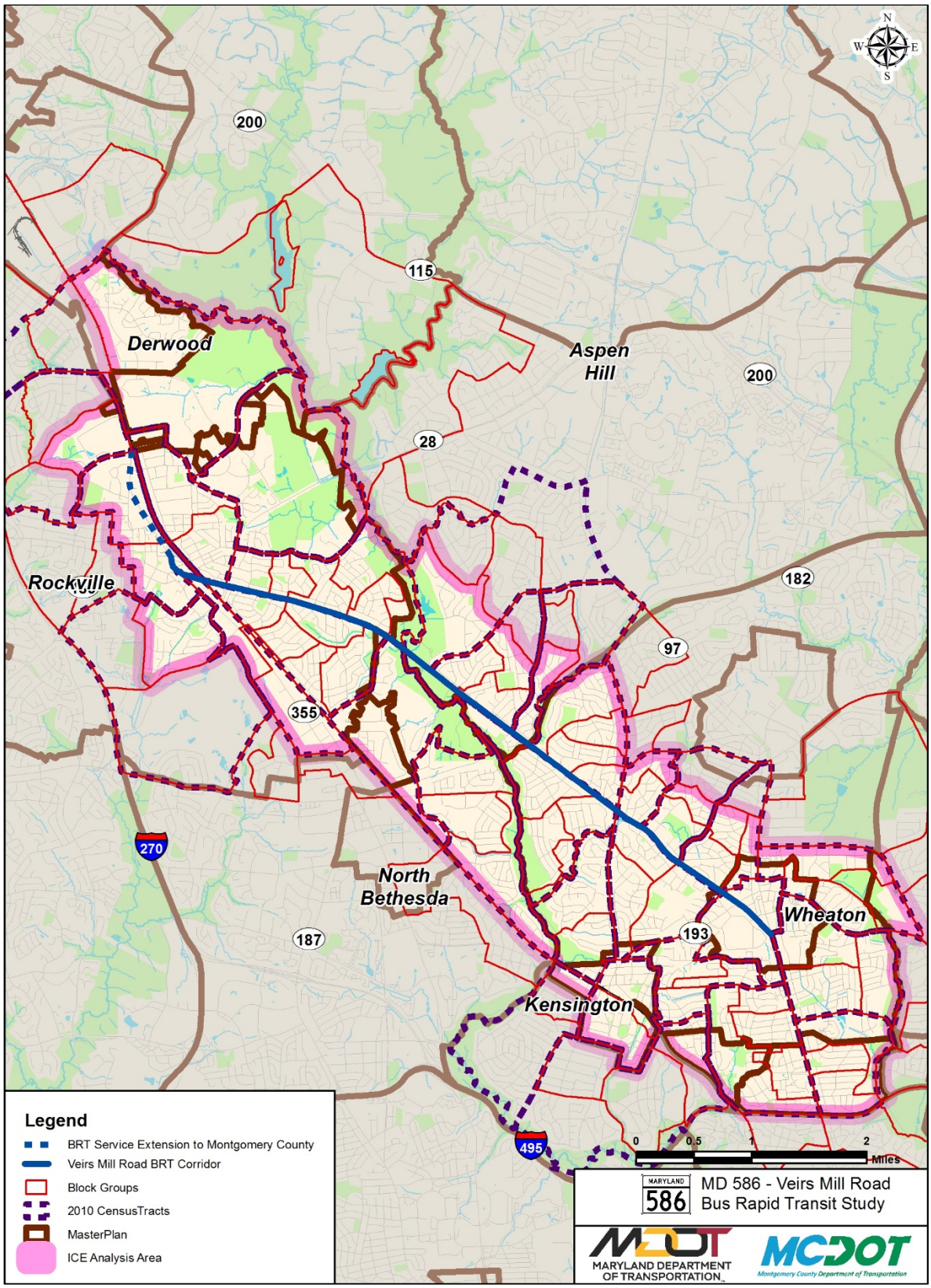


Table 58: Population and Jobs Comparison (1970 – 2040)

	Maryland		Montgomery County			
Year	**Population**	**Increase**	**Population**	**Increase**	**Jobs**	**Increase**
1970	3,922,399		522,809		235,394	
1980	4,216,975	8%	579,053	11%	349,504	48%
1990	4,780,753	13%	757,027	31%	512,644	47%
2000	5,296,486	11%	873,341	15%	592,976	16%
Increase, 1970-2000	1,374,087	35%	350,532	67%	357,582	152%
2010	5,773,552	9%	971,777	11%	644,992	9%
2015	6,010,140	4%	1,036,000	7%	676,500	5%
2020	6,224,510	8%	1,067,000	3%	715,200	6%
2025	6,426,750	6%	1,110,000	4%	742,700	4%
2030	6,612,190	3%	1,153,900	4%	759,000	2%
2035	6,765,300	2%	1,186,600	3%	774,800	2%
2040	6,889,690	2%	1,206,800	2%	792,500	2%
Increase, 2000-2040	1,593,204	30%	333,459	38%	202,524	34%

SOURCE: US Census and MD Department of Planning.

Analysis Methodology

The ICE analysis was conducted using scoping and analysis. Scoping was initiated during the development of the preliminary alternatives and included the identification of potentially-affected resources and associated data to characterize the resources for impact assessment. The initial steps of an ICE analysis include establishment of the geographic and temporal boundary in which the full analysis is conducted. The analysis includes determination of other past, present, near-future and reasonably-foreseeable future development projects and, ultimately, an analysis of indirect and cumulative effects to resources within the defined temporal and geographic boundaries. The following analysis methodologies were employed to fully assess indirect and cumulative effects:

- **Trend Analysis:** Past and future trends in demographics, employment, and land use were analyzed to identify effects over time, including future indirect and cumulative effects.
- **Data Review:** The project team reviewed the TIP, CLRP, and MDOT projects databases to identify information on present and future development projects.
- **Overlays:** Overlays of land use maps and aerial photography from 1973 to 2010 were used to identify past trends and to identify resources potentially affected by future developments. While future land use mapping for the ICE analysis area was not available for inclusion in this technical report, data from approved Master Plans within the study area was used to provide textual future land use information.

Table 59 identifies the resource data that was used to evaluate potential ICE, and the proposed methodology for assessing the impacts. The analysis used readily available GIS data to create resource overlays and assess potential ICE related to transportation projects and other planned development.

Table 59: Proposed ICE Analysis Methodology

Resources	Available Data	Data Sources	Analysis Methodology
Socioeconomic			
Community Facilities/ Businesses Parks and Recreation Facilities (**Figure 13**)	Aerial photos, census records, parcel data, land use maps, historic maps, planning maps	Wheaton Sector Plan (2012); Town of Kensington Sector Plan (2012); Master Plan for Kensington Wheaton (1990); Aspen Hill (1994); Kemp Hill Master Plan (2001); Capitol View & Vicinity (1982); Forest Glen Sector Plan (1996); Twinbrook (2009); City of Rockville Comprehensive Plan (2002)	Overlay map layers of existing and future land uses/zoning, priority funding area, census tracts/blocks, tax parcels, future land use development plans; compare to historic aerials and maps and analyze trends in development and available services; compile and evaluate census population data and proposed development plans; identify factors that constrain and promote community growth (past, present, and future)
Cultural			
Historic/ Cultural Resources (**Figure 14**)	Eligible and listed historic property records, historic maps and photos, land use maps	MD Historic Trust inventory files; National Register of Historic Places	Overlay map layers of historic resources and land use/land development projects surrounding historic sites; trend analysis
Natural Resources			
Water Quality/ Ground-water	Stream quality records; topo/contour mapping; Historic Records; well data; land use data	Montgomery County DEP; COMAR; EPA; MDE; MD Geological Survey	Land use and water quality comparison; trend analysis
Waters/ Wetlands (**Figure 15**)	Aerial phots; topo/contour mapping; stream quality records; surveyed mapping	MDNR geospatial data; US Fish and Wildlife – NWI Inventory; USGS Survey Topographic Maps; Wetland Delineation for MD 586/Veirs Mill BRT Study; DNR	Overlay stream and wetland layers, land uses, impervious surface; land use comparison and trend analysis
Floodplains (**Figure 15**)	Aerial photos, topo/contour mapping, floodplain maps; stream mapping	FEMA mapping: Firm Nos. 24031CO334D, 24031CO353D, 24031CO355D, 24031CO361D, 24031CO365D, 24031CO370D; DNR; EPA	Overlay floodplain layers, impervious surface, and land use; trend analysis
Terrestrial Resources	Aerial photos; land use mapping; habitat mapping and data	Field Investigation (CEM, July 2015); MDNR; NPS; National Audubon Society's Field Guide to the Mid-Atlantic States	Overlay map layers of terrestrial and FIDS habitat and land uses; land use comparison and trend analysis

Figure 13: Parks and Recreation Facilities in ICE Analysis Area

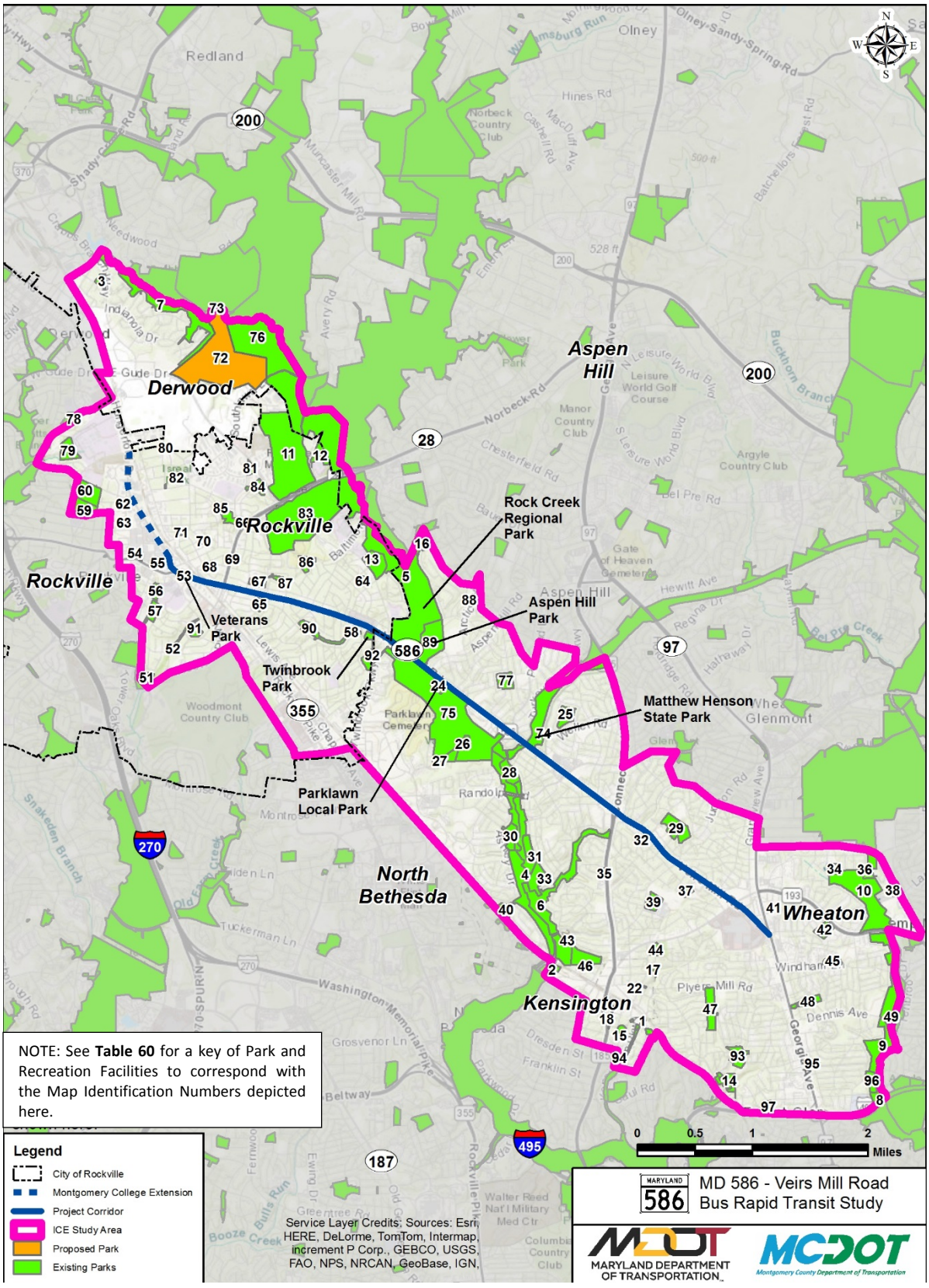


Table 60: Parks and Recreation Facilities within the CEA Analysis Area

Map ID	Park Name	Map ID	Park Name
0	Clum-Kennedy Gardens Park	*49*	Sligo-Dennis Avenue Local Park
1	Kensington Parkway Stream Valley Park	*50*	Kensington-Frederick Avenue Neighborhood Park
2	Rock Creek Stream Valley Unit 3	*51*	Dogwood Park
3	Derwood Station Neighborhood Park	*52*	Dawson Farm Park
4	Rock Creek Stream Valley Unit 5	*53*	Veterans Park
5	Rock Creek Stream Valley Unit 7	*54*	Courthouse Square Park
6	Rock Creek Stream Valley Unit 4	*55*	James Monroe Park
7	Crabbs Branch Stream Valley Park	*56*	Elwood Smith Park
8	Sligo Creek Stream Valley Unit 3	*57*	Elwood Smith Park
9	Sligo Creek Stream Valley Unit 4	*58*	Rockcrest Park
10	Sligo Creek Stream Valley Unit 5	*59*	Welsh Park
11	RedGate Municipal Golf Course	*60*	Rockville Municipal Swim Center
12	Mark Twain Athletic Park	*61*	Memory Park Walk
13	Broome Athletic Park	*62*	North Street Park
14	Capitol View Park Open Space	*63*	Kinship Park
15	Circle Manor Urban Park	*64*	Tweed Park
16	Drake Drive Neighborhood Conservation Park	*65*	Hillcrest Park
17	Saint Paul Neighborhood Conservation Area	*66*	Maryvale Park
18	Ernest Memorial Park	*67*	Lone Oak Park
19	Reinhardt Park	*68*	Grandin Avenue Park
20	Howard Avenue Park	*69*	First Street Park
21	Flinn Park	*70*	Horners Lane (Pump House), Croydon Park
22	St. Paul Park	*71*	Mary Trumbo Park
23	Joseph Park	***72***	**Gude Drive Recreational Park**
24	**Parklawn Local Park**	*73*	Needwood Golf Course
25	Stoneybrook Local Park	***74***	**Matthew Henson State Park Unit #1**
26	Parklawn Group Picnicking Area	*75*	Rock Creek Stream Valley Unit 6
27	Parklawn Group Camping Area	***76***	**Rock Creek Regional Park**
28	Winding Creek Local Park	*77*	Wheaton Woods Local Park
29	Wheaton-Claridge Local Park	*78*	College Gardens Park
30	Randolph Hills Local Park	*79*	Anderson Park
31	Dewey Local Park	*80*	Lincoln Terrace Park
32	College View Neighborhood Park	*81*	David Scull Park
33	Veirs Mill Local Park	*82*	Israel Park Recreation Area
34	Arcola Local Park	*83*	Civic Center Park
35	Connecticut Avenue Neighborhood Park	*84*	Northeast Park
36	Colt Terrace Neighborhood Park	*85*	Maryvale Park
37	Pleasant View Local Park	*86*	Calvin Park
38	Kemp Mill Urban Park	*87*	Silver Rock Park
39	Newport Mill Local Park	*88*	Arctic Neighborhood Conservation Area

Map ID	Park Name	Map ID	Park Name
40	Waverly-Schuylkill Neighborhood Park	***89***	**Aspen Hill Local Park**
41	Wheaton Veteran's Urban Park	*90*	Rockcrest Park
42	Wheaton Forest Local Park	*91*	Dawson Farm Park
43	Ken-Gar Palisades Local Park	***92***	**Twinbrook Park**
44	Kensington Heights Neighborhood Park	*93*	McKenney Hills Neighborhood Park
45	Glen Haven Neighborhood Park	*94*	Kensington Cabin Local Park
46	Edith Throckmorton Neighborhood Park	*95*	General Getty Neighborhood Park
47	Capitol View-Homewood Local Park	*96*	Forest Grove Neighborhood Park
48	Evans Parkway Neighborhood Park	*97*	Forest Glen Neighborhood Park

NOTE: Names and identification numbers in bold black text denote impacted parks. Names and identification numbers in bold red text denote planned parks that have not yet been constructed.

Figure 14: NRHP-Listed Properties within the ICE Analysis Area

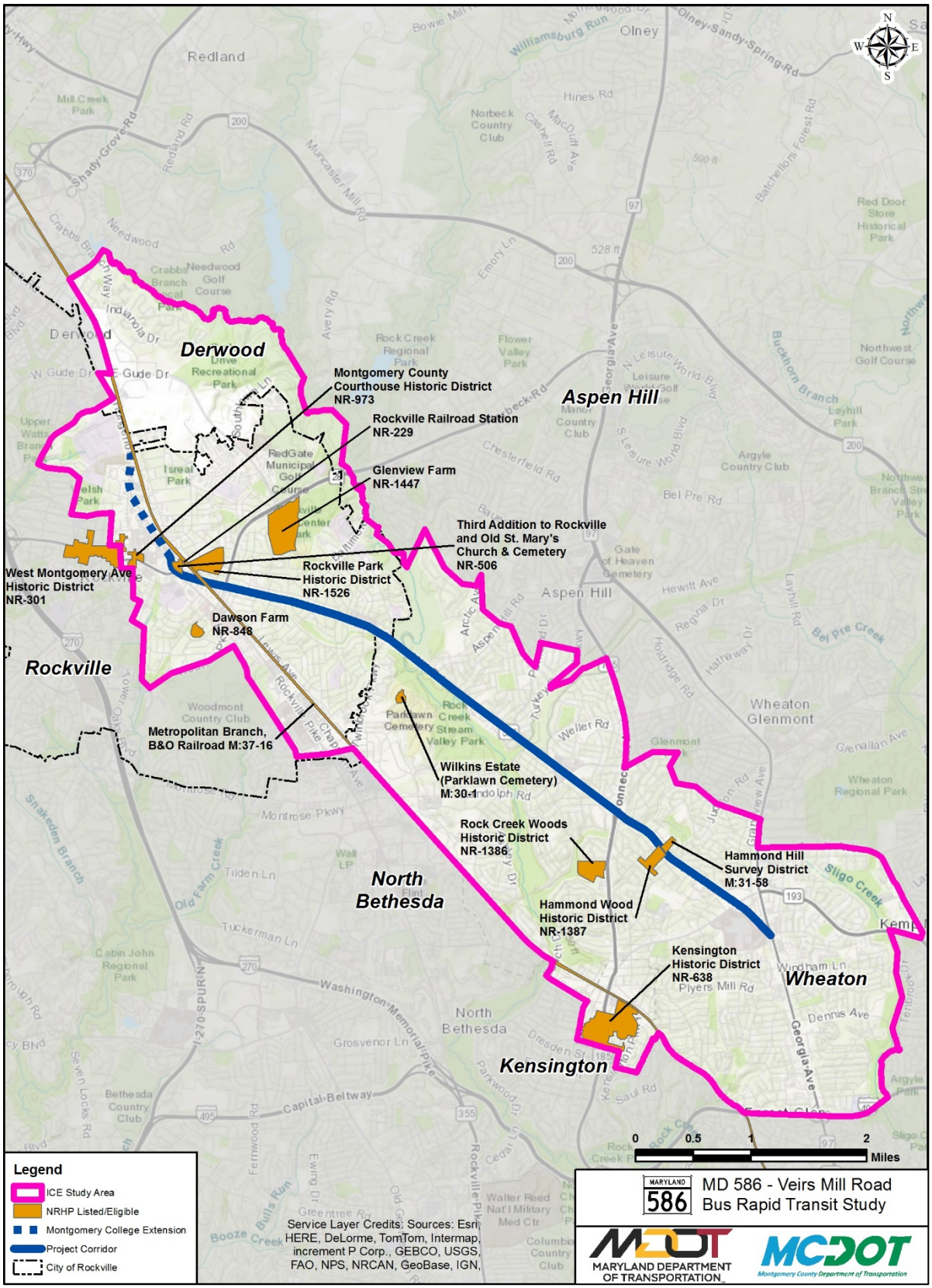
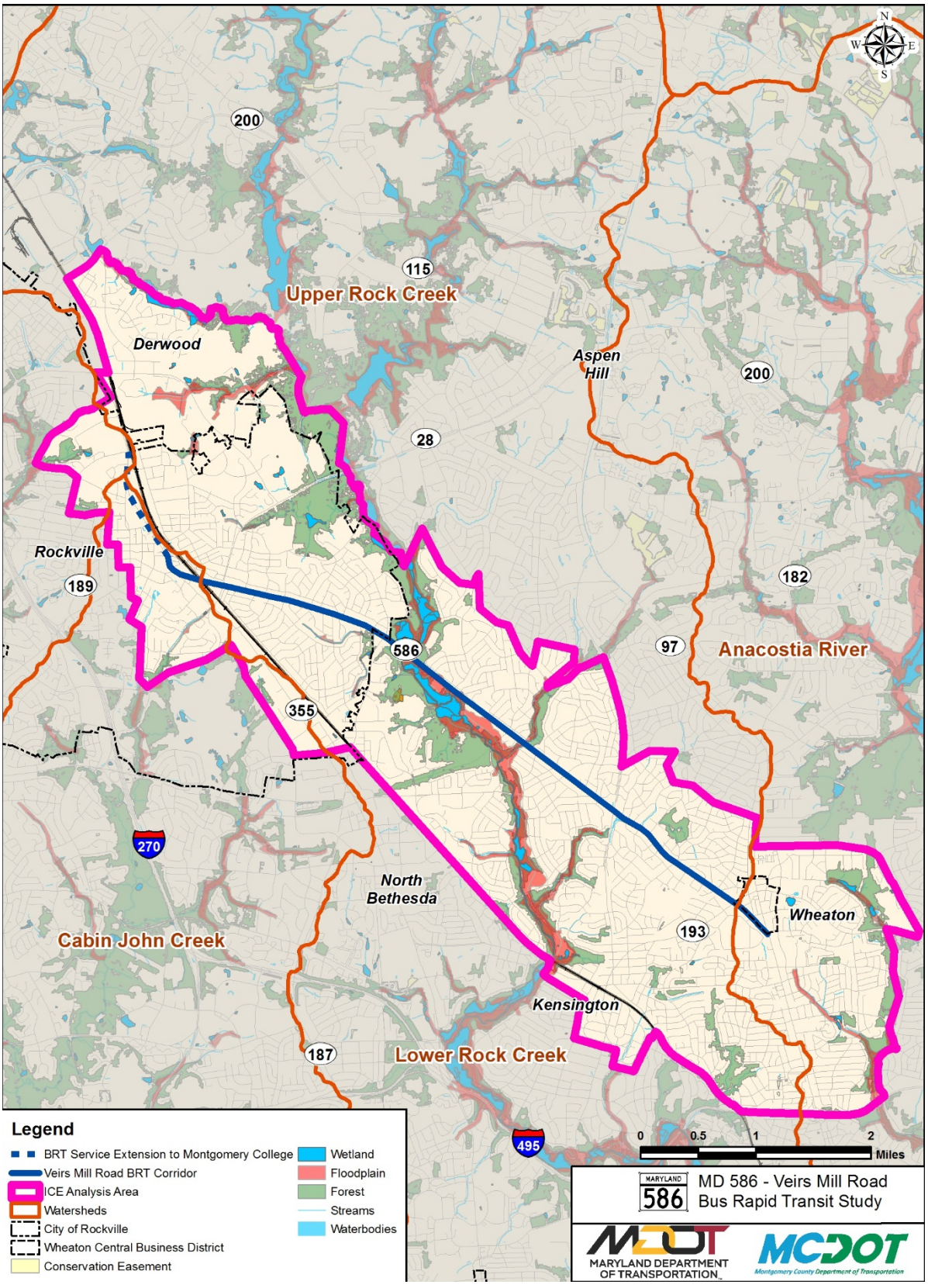


Figure 15: Watersheds and Floodplains within the ICE Analysis Area



2. Land Use and Development Projects

Past and Present Land Use

The historic and existing land use in the ICE analysis area was evaluated using aerial mapping and land use data from 1973, 2002, and 2010. Land use for each of these years is summarized in **Table 61**. Throughout the period between 1973 and 2010, the land area dedicated to residential (+1.1 percent), industrial (+7.3 percent), institutional (+2.5 percent), open urban land (+1 percent), and transportation (+0.7 percent) land uses have increased. However, transportation uses were not quantified in 1973 or 2002 land use maps. Overall, the percentage of developed lands increased by 6.1 percent to 86.3 percent. From 1973 to 2010, the percentage of commercial (-6.5 percent) and agricultural (-1.9 percent) land uses decreased. Overall, the percentage of resource lands decreased by 6.1 percent to 13.7 percent. The increase in development was focused north of Rockville and Bethesda, the Twinbrook Sector Plan area.

Table 61: ICE Analysis Area Land Use 1973 – 2010

	1973		2002		2010	
	Acres	Percent of Total Land	Acres	Percent of Total Land	Acres	Percent of Total Land
Residential	6,617	55.3%	6,736	56.3%	6,742	56.4%
Commercial	1,680	14.0%	930	7.8%	902	7.5%
Industrial	15	0.1%	868	7.3%	881	7.4%
Institutional	755	6.3%	978	8.2%	1,057	8.8%
Open Urban Land	526	4.4%	807	6.7%	651	5.4%
Agriculture	310	2.6%	148	1.2%	83	0.7%
Forest	1,955	16.3%	1,490	12.5%	1,553	13.0%
Barren Land	103	0.9%	0	0.0%	0	0.0%
Water	0	0.0%	5	0.0%	5	0.0%
Transportation	0	0.0%	0	0.0%	86	0.7%
Developed Land	9,592	80.2%	10,318	86.3%	10,320	86.3%
Resource Lands	2,368	19.8%	1,642	13.7%	1,640	13.7%

SOURCE: Montgomery County GIS.

The ICE analysis area has maintained a primarily residential character (56 percent) over the past 40+ years. The land use throughout the time frame is depicted in **Figures 16, 17**, and **18**. In comparison to Montgomery County, the ICE analysis area has not changed as drastically. The increase in developed land from 1973 to 2002 within the ICE analysis area was 6.1 percent compared to 18.3 percent for the county; and the percentage of developed land in the ICE analysis area from 2002 to 2010 did not change, compared to an increase of 4.5 percent for the county.

Figure 16: ICE Analysis Area Land Use (1973)

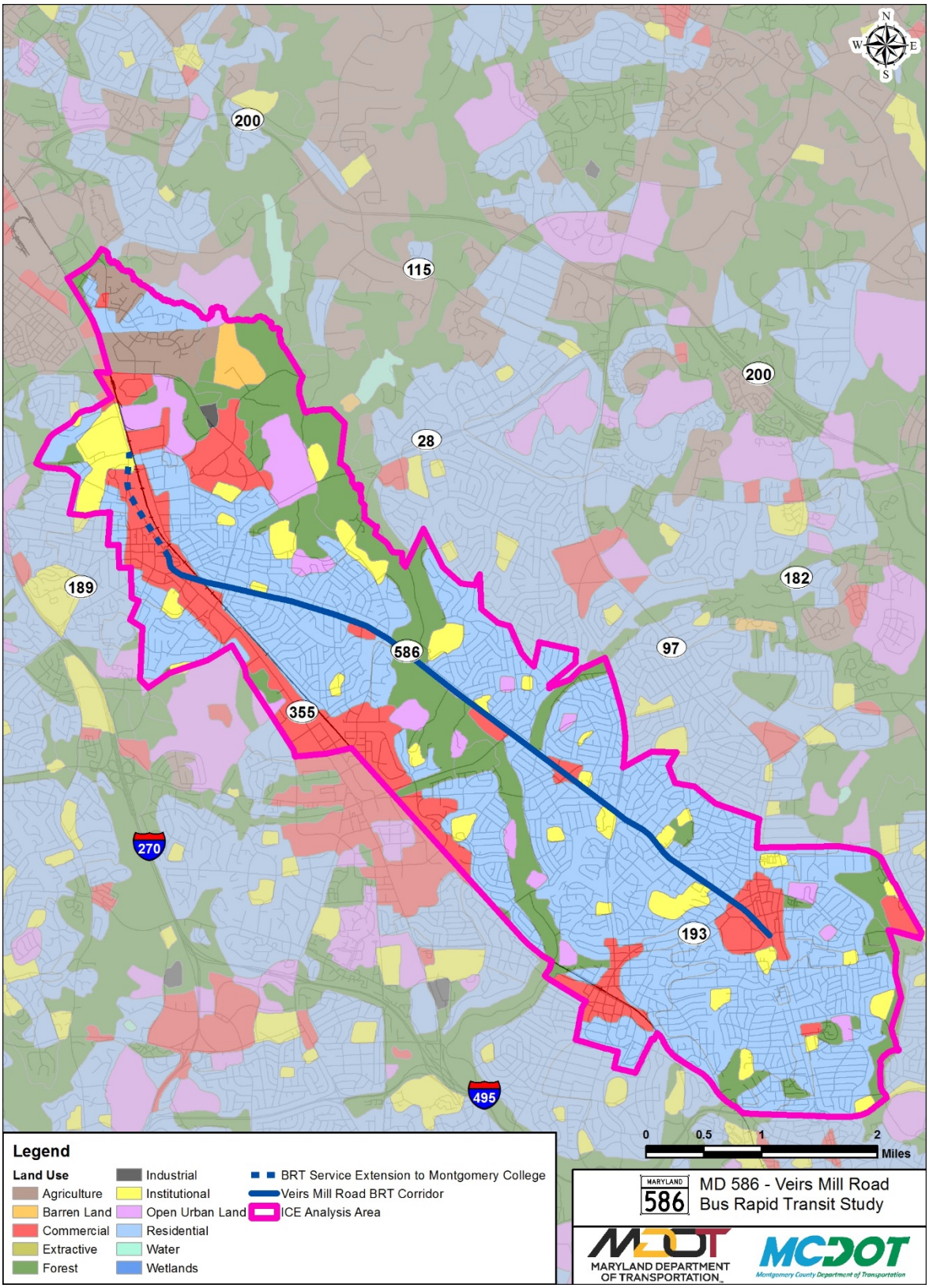


Figure 17: ICE Analysis Area Land Use (2002)

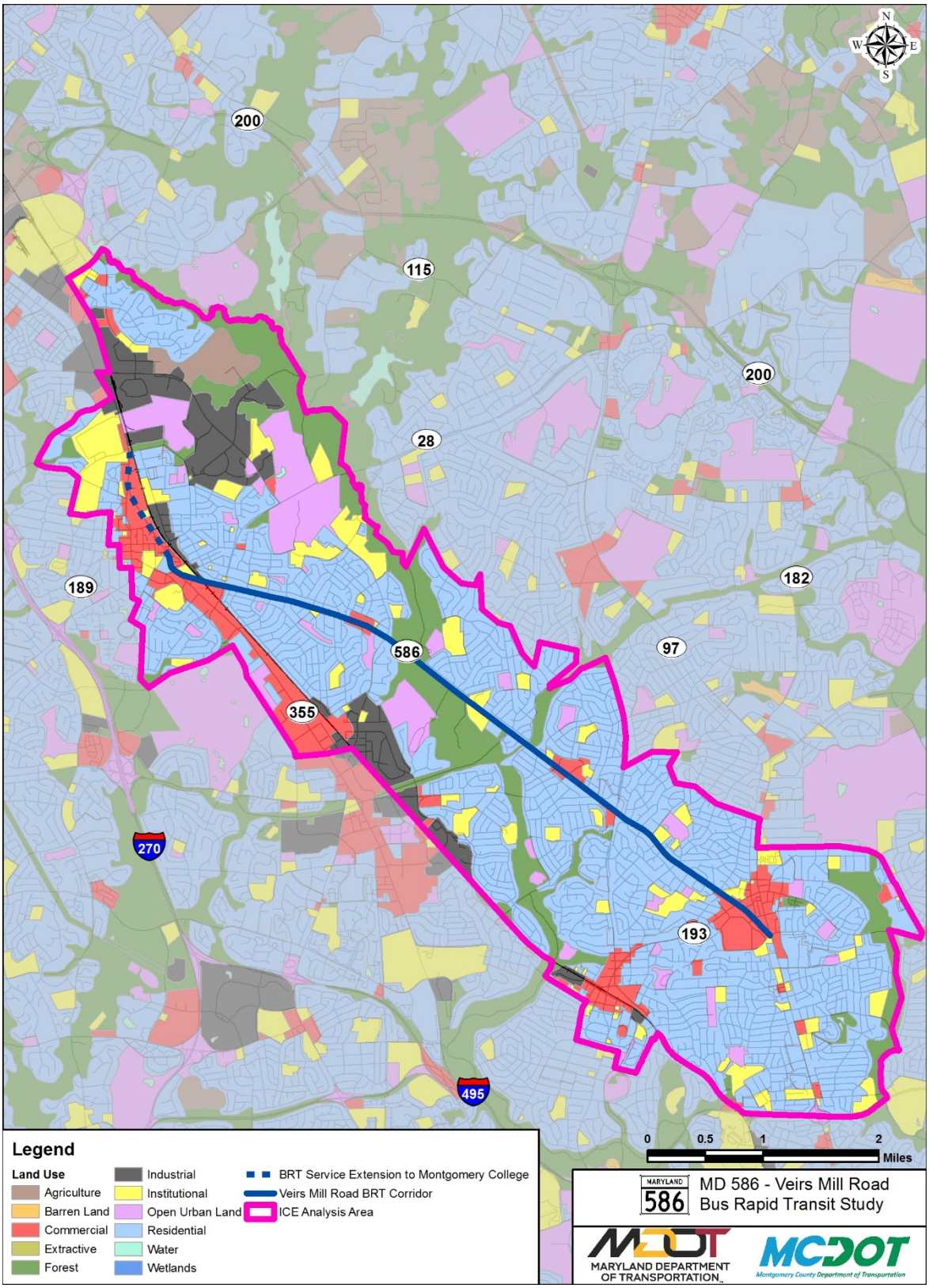
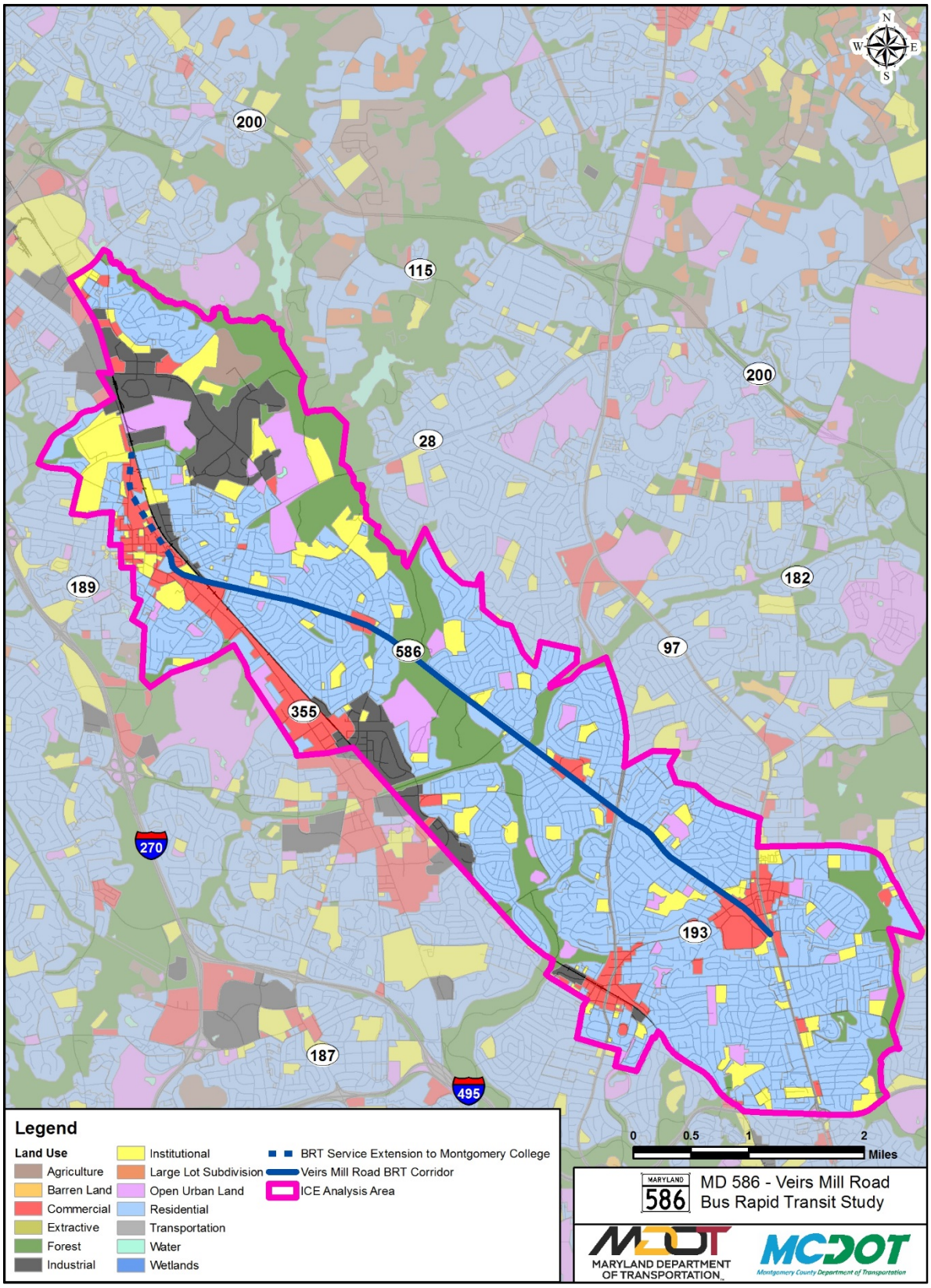


Figure 18: ICE Analysis Area Land Use (2010)



Land Use Plans and Initiatives

There are 14 community master plans that guide land use and development within the ICE analysis area:

- Town Center Master Plan — Approved 2001
- Twinbrook Neighborhood Plan — Approved 2009
- Shady Grove Sector Plan — Approved 2006
- Upper Rock Creek Master Plan — Approved 2004
- City of Rockville Comprehensive Master Plan — Approved 2002
- Aspen Hill Master Plan — Approved 1994
- Twinbrook Sector Plan — Approved 2009
- North Bethesda Garrett Park Master Plan — Approved 1992
- Kensington-Wheaton Master Plan — Approved 1989
- Kensington Sector Plan — Approved 2012
- Wheaton CBD and Vicinity Sector Plan — Approved 2012
- Kemp Mill Master Plan — Approved 2001
- Capitol View and Vicinity Sector Plan — Approved 1982
- Forest Glen Sector Plan — Approved 1996

The ICE analysis area has been largely developed including the planning areas of: Kensington-Wheaton, Aspen Hill, North Bethesda-Garrett Park, Capitol View & Vicinity, and the Forest Glen Sector. The Wheaton CBD, Kensington, and Twinbrook Sector planning documents cite plans for re-development of already developed land areas. Although undeveloped land exists within the Upper Rock Creek planning area, the *Upper Rock Creek Master Plan* directs development away from sensitive areas, maintains low densities, and preserves open space to enhance overall water quality protection. Recommended low-density development would encourage the preservation of natural resources. All land that is available for potential development within the Upper Rock Creek and Shady Grove Master Plan Areas is located outside of the ICE analysis area and is therefore not included in this analysis.

Additionally, the review of past land use trends within the ICE analysis area did not show any drastic changes in land use between 2002 and 2010. This suggests that the majority of land available to be developed is limited and new construction would be focused on the re-development of already developed land. Therefore, it is assumed that the future land use would look very similar to the 2010 land use in the ICE analysis area.

Recent and Proposed Development

The continued population and job growth of the county is anticipated to affect transportation and development within the ICE analysis area and county for the foreseeable future. The ICE analysis area is considered a desirable location to live and work due to its proximity to Washington, DC and Baltimore, as well as its wealth of local high-profile employers. The number of recently completed and proposed projects are a testament to the area's continued growth and development. Recent and Proposed Transportation Projects and Local Developments (**Table 62**) were derived from the Metropolitan-Washington Council of Governments CLRP/TIP, Montgomery County Capital Improvement Program, MCDOT

Consolidated Transportation Program, M-NCPPC development project, and the Montgomery County neighborhood project databases. The Map ID#'s in **Table 62** correspond to the projects mapped on **Figure 19**. **Table 62** also provides impact quantities for recent and proposed development, where available. Based on a review of available data, none of the recent or proposed developments would have impacts to wetlands, streams, floodplains, historic standing structures, or parks.

Induced Growth

The purpose of the Veirs Mill BRT Corridor Study is to provide new high-efficiency bus service along Veirs Mill Road between Wheaton Metrorail and Rockville Metrorail stations. The proposed improvements do not include additional lanes for passenger car use and therefore, would not result in an increase in capacity and would not provide new or improved access to previously-isolated parcels of undeveloped land. Consequently, significant changes to population, development, and community setting are not expected to result from this project. Transit-oriented re-development is already planned and approved in the ICE analysis area. This development is planned in areas already zoned for residential and commercial development. Increased transit options would contribute to the viability of these developments; however, development plans along the study corridor have continued and been approved without any major road, intersection, or other transportation improvements in-place. Because the entire ICE analysis area is designated as a state PFA, various institutional and economic incentives are in place to focus on residential and commercial development in the area. The construction of any of the proposed transportation improvement alternatives will accommodate the on-going and planned land development; however, none of the on-going or planned development projects by others are dependent on the completion of the proposed MD 586/Veirs Mill BRT improvements. All planned projects have existing access to MD 586 or other connecting roads in the network.

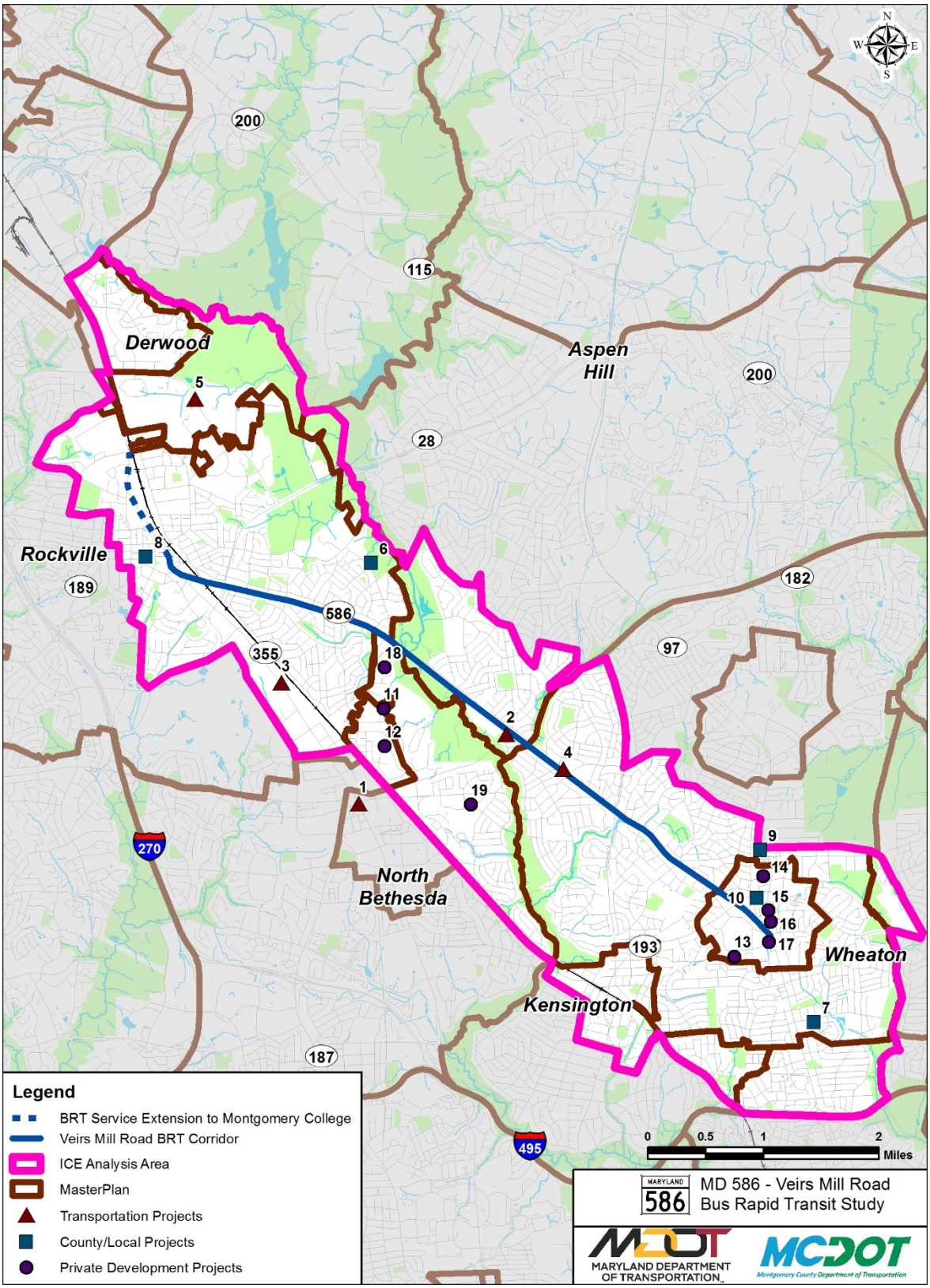
Since the MD 586/Veirs Mill BRT improvements would maintain existing property access and would not increase vehicular capacity, none of the project alternatives will cause growth-inducing effects nor other effects related to induced changes in the current and planned pattern of land use, population density, or growth rate and/or related effects on the environment in the study corridor or region. The pattern of land development and growth in the region and in the study corridor is guided by the planning and growth management initiatives undertaken by the town, county, and state and not by the proposed improvements to the existing study corridor.

Table 62: Recent and Proposed Transportation Projects and Local Development

Map ID#	Project Name	Planning Area	Project Description	Size	Project Type	Potential Impacts	Project Location
1	Montrose Parkway (Phase I) - MD 355 at Randolph Road Interchange	North Bethesda - Garrett Park	•MDOT SHA led •Grade separated interchange •Construction completed 2010	Interchange	Transportation Project	•9.6 acres of ROW •0 Residential Relocations •0 Business Displacements •3.6 acres of forest	MD 355/Montrose Parkway Interchange
2	Montrose Parkway East (Phase II), *aka, Montrose Parkway Extension*	North Bethesda - Garrett Park	•County funded •New four-lane divided parkway, bikepath, and sidewalk •Includes: bridge over CSX rail tracks, a single-point urban interchange over Parklawn Drive, Rock Creek Trail pedestrian bridge over the Parkway, bridge over Rock Creek, and at-grade tie-in to Veirs Mill Road •Construction begins FY2021, 3.5 years' duration	1.6 miles	Transportation Project	•2.26 acres of ROW •0 Residential Relocations •2 Business Displacements •11.2 acres of forest	MD 355/Montrose Parkway Interchange east to Veirs Mill/Parkland Drive Intersection
3	MD 355 BRT Study	Countywide Transit Corridors Functional Master Plan	•State and County funded •BRT study from the Bethesda Metrorail Station to the Shops at Seneca Meadows in Clarksburg •Project planning only	North Corridor: 15 miles South Corridor: 8 miles	Transportation Project	•Minimal anticipated ROW •Estimated impacts unavailable •Improvements proposed within current alignment	North Corridor: from Rockville Metrorail Station, north to the Shops at Seneca Meadows in Clarksburg South Corridor: from Rockville Metrorail Station, south to the Bethesda Metrorail Station
4	MD 586 Safety and Resurfacing Project	Kensington – Wheaton and Aspen Hill	•MDOT SHA funded •Safety and resurfacing improvements •Advertised in Winter 2017, construction anticipated to begin in Summer 2017	2.48 miles	Transportation Project	•No additional ROW •Other impacts not been identified	MD 586 from the bridge over Rock Creek to Ferarra Avenue and from MD 193 to MD 97
5	East Gude Drive Roadway Improvements	Shady Grove	•County funded •Roadway capacity, safety improvements •Design/ land acquisition FY 2019 •Construction 2020-2021	1.1 miles	Transportation Project	•ROW impacts currently unknown •0 Residential Relocations •0 Business Displacements •Potential floodplain impacts •Other impacts not been identified	East Gude Drive from Crabbs Branch Way to Southlawn Lane
6	Children's Resource Center: Building Addition	City of Rockville	•Montgomery County Public Schools project •Includes Early Childhood Services, Infants and Toddlers Program, and Parent Resources Center •Construction 2015-2016	41,000 gross SF at 19.47 acre Broome Middle School Site	Institutional	•No additional ROW •No other impacts available	751 Twinbrook Parkway Rockville, MD

Map ID#	Project Name	Planning Area	Project Description	Size	Project Type	Potential Impacts	Project Location
7	Dennis Avenue Health Center: Building Addition	Kensington-Wheaton	•County and State project •New building on the existing site adjacent to existing building •Construction Spring 2016	53,432 gross SF	Institutional	•No additional ROW •0.3 acre of forest impact •No other impacts available	2000 Dennis Avenue Silver Spring, MD
8	Judicial Center Annex	City of Rockville	•County project •Addition/ renovation of Judicial Center •Includes 10 new courtrooms and administrative spaces •Construction ongoing	Existing site	Institutional	•No additional ROW •No impacts available	50 Maryland Avenue Rockville, MD
9	Wheaton Volunteer Rescue Squad – November 2013	Kensington-Wheaton	•Montgomery County Fire and Rescue Service project •Relocate existing facility to a new two--story Class I Rescue Station •Completed Fall 2013	29,000 gross SF	Institutional	•No additional ROW •No impacts available	2400 Arcola Ave Wheaton, MD
10	Wheaton Re-development Project	Wheaton	•Private development •Government office building, public parking, and mixed-use town square development	142,000 gross SF	Government Offices and Mixed-use TOD	•No additional ROW • No forest impacts •No other impacts available	Between Grandview and Triangle Avenues, Wheaton, MD
11	Parklawn North	Twinbrook	•Private development •Approved January 2014	520,000 gross SF office space + 1,000 SF of retail use on 13 acres	Office building	•No additional ROW •0.5-acre forest impact •No other impacts available	Fishers lane 1,000 feet east of Twinbrook Parkway
12	Greencourt at Parklawn	Twinbrook	•Private development •Three-story industrial •Approved December 2013	110,000 gross SF on 2 acres	Industrial/ warehouse	•No additional ROW •No impacts available	Parklawn Drive, 225 feet south of Wilkins Avenue
13	Kensington Heights	Wheaton	•Private development •Single-family attached and detached housing •Approved July 2015	1.8 acres	14 Residential units	•No additional ROW •1.2-acre forest impact •No other impacts available	McComas Avenue, 130 feet west of Littleford Lane
14	AVA Wheaton	Wheaton	•Private development •5-story apartment/ condominiums •Approved December 2014	4.5 acres	Multi-family residences, 324 units	•No additional ROW •No impacts available	Northeast quadrant of Georgia Avenue and Blueridge Avenue
15	Wheaton Safeway	Wheaton	•Private development •18-story mixed-use •Approved January 2014	59,500 gross SF on 1.9 acres	Commercial, 500 apartment units	•No additional ROW •No impacts available	Northeast quadrant of Georgia Avenue and Reedie Drive
16	11141 Georgia Avenue	Wheaton	•Private development •Mixed-use •Approved May 2014	0.61 acres	Multi-family residences (194 units), Retail	•No additional ROW •No impacts available	Georgia Avenue, 200 feet south of Reedie Drive
17	10914 Georgia Avenue	Wheaton	•Private development •Apartment/ condominiums •Approved October 2014	1.65 acres	Multi-family residences (245 units)	•No additional ROW •No impacts available	Georgia Avenue, 20 feet south of Veirs Mill Road
18	Halpine View	North Bethesda - Garrett Park	•Private development •Apartment/ condominiums •Approved December 2013	37.3 acres	Multi-family residences (564 units)	•No additional ROW •0.5-acre forest impact •No other impacts available	Northeast quadrant of Twinbrook Parkway and Halpine Road
19	Randolph Farms	North Bethesda - Garrett Park	•Private development •Single-family homes •Approved June 2015	1.2 acres	Single-family residences (3 units)	•No additional ROW •1.0-acre forest impact •No other impacts available	5909 Macon Road Rockville, MD

Figure 19: ICE Analysis Area Recent and Proposed Development



3. Analysis of Resources

Communities

The proposed improvements would not bisect any neighborhoods or communities, disrupt community cohesion, or isolate residences from other residences within the communities. In addition, the majority of the relocations/displacements that would occur are within the Rockville and Wheaton communities which are the two largest communities within the study area. Planned re-development activities within the Wheaton community would ensure that relocation opportunities exist for residents. Further, businesses and services displaced by the proposed improvements would have an opportunity to relocate to the re-developing areas. Efforts will be made to avoid and minimize displacements during the development of final design plans. If federal funding is used, the acquisition of ROW and the displacement of residents would be done in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Thus, minimal impact to the study area communities are expected and the project would not be expected to disrupt community cohesion.

The proposed improvements are for an existing facility on an existing alignment through a developed area, and all the impacted properties are immediately adjacent to the existing road. No remaining residences would be isolated from the community. No community facilities would be displaced nor would their function be impacted; therefore, there will be no indirect impact to community cohesion. Additional outreach is proposed throughout the duration of the project to ensure that adverse impacts and/or benefits of BRT would be "equal" for potential environmental justice populations when compared to non-environmental justice populations. The project would increase transit, mobility, and connectivity for residents in the communities within ICE study area and those passing through the corridor. Businesses in the study area would benefit from increased ease of access to the corridor and their facilities. The project would improve pedestrian safety and transit mobility within the corridor by reducing congestion and providing additional connection opportunities to the regional transit network. Pedestrians and bicyclists would also benefit from the addition of sidewalks and bike lanes along MD 586, where feasible. Twenty-one (21) un-signalized intersections would be eliminated with the construction of Alternative 5B in locations were a median BRT lanes(s) is proposed. This would result in a change in circulation patterns within the corridor as well as access to and from neighborhoods. For example, if motorists typically turn left at an unsignalized intersection to access a neighborhood, they may have to proceed to the next signalized intersection or access the neighborhood or make a U-turn.

Based on the above, no indirect changes to communities, community facilities, and businesses beyond what is already planned or projected, would be expected in the ICE study area due to MD 586/ Veirs Mill BRT improvements.

The entire ICE study area is within a Maryland Department of Planning-designated PFA. Growth and development are occurring and will occur in the ICE study area in accordance with local development plans and zoning independent of the MD 586/Veirs Mill BRT project. Planned residential and commercial developments, including: Parklawn North; Greencourt at Parklawn; Kensington Heights; AVA Wheaton; Wheaton Safeway; 11141 Georgia Avenue; 10914 Georgia

Avenue; Halpine View; and Randolph Farms, would provide 1,644 additional residential units and 813,932 gross SF of new business/commercial space in the study area (**Table 62**). These developments would enable population growth within the ICE study area, resulting in increased demand on community facilities and services including: schools, health and emergency services, utilities, and roadways. Local planning would ensure adequate new facilities would also be built. The MD 586/Veirs Mill BRT project would support planned commercial and residential developments by offsetting increased traffic congestion. Additional transportation and local improvements in the study area are outlined in existing community and county master plans and summarized in **Table 62**.

Planned transportation improvement projects, including Phases I and II of the MD 355/ Montrose Parkway improvements, and East Gude Drive would improve access and traffic conditions throughout the study area. These projects would require some temporary easement and ROW within the ICE study area, resulting in some business and residential relocations. However, these transportation projects have been included in long-range plans and would occur along existing transportation corridors. Further, the potential residential and commercial displacements associated with these projects and the proposed MD 586/Veirs Mill Road BRT improvements would be offset by the proposed residential and commercial re-development throughout the ICE study area. The improved transportation infrastructure would reduce congestion and enhance safety throughout the ICE study area. Improved transportation infrastructure would benefit local communities with better connectivity to local and regional services and facilities. With modest population growth expected by 2040, the improved transportation infrastructure would create greater access to community facilities and services within the study area. The other projects would also allow more people to pass through the area and visit the local businesses; providing a benefit to study area communities.

Local development projects, including the: Children's Resource Center, Dennis Avenue Health Center, Judicial Center Annex, Wheaton Re-Development Project, and Wheaton Volunteer Rescue Squad would improve access to community facilities and services within the ICE study area, including: schools, health, and emergency services.

In sum, the proposed action alternatives (Alternatives 2, 3, and 5B) would contribute both adverse (property/parking loss, relocations and displacements) and positive effects (increased access to transportation options and improved mobility and safety) to communities, community facilities, and businesses. Other planned development activities would also provide both adverse effects as well as increased residence options and use of community facilities and businesses, improved transportation safety and reduced congestion, and enhanced access to community facilities and services. In sum, the project actions in a relatively built-up area as a result of, and in addition to, past, present, and reasonably foreseeable actions, does result in cumulative impacts.

Parks and Recreation Facilities

No indirect effects on parklands are anticipated with the No-Build Alternative. Overall, ROW impacts and construction within parks are minor under any of the action alternatives; however, there could be minor indirect impacts to water quality downstream within Rock Creek Regional Park facilities as a result of increased impervious surface. Water quality impacts would be

minimized by the use of best management practices during construction and the installation of stormwater management facilities in accordance with the Maryland Sediment and Erosion Control and Stormwater management requirements. The loss of weekend parking along the Veirs Mill Road shoulder, adjacent to Parklawn Local Park, would inconvenience park users and could cause congestion issues near the park; however, the existing parking lot within Parklawn Local Park would not be impacted and coordination with the study-area communities would occur to identify appropriate replacement parking as the project progresses. As the project progresses through NEPA, Section 4(f) and permitting, additional coordination would occur with individual park jurisdictional officers and local, state, and federal regulatory agencies.

Based on a review of known recent and proposed transportation and local development projects, none of the near-term and future transportation projects or developments identified within the ICE boundary are expected to impact parks and recreation facilities. The majority of near-term and future transportation projects are included in long-range planning by local and state government with measures that would minimize harm to these resources. Additionally, Section 4(f) of the Department of Transportation Act of 1966 requires federally-funded or approved transportation projects to demonstrate there is no prudent or feasible alternative to the taking of lands from parks and recreation areas open to the public and requires all measures to minimize harm be taken. Parks affected by non-federal transportation actions would be protected by state and local ordinances that preserve existing open space.

Population growth and private developments in the ICE study area are accounted for in local planning to preserve parks, recreational areas, and open spaces and develop new park and recreational opportunities. Montgomery County completed their original Park, Recreation and Open Space Plan Master Plan in 1998 (Montgomery County Planning Department, 1998), with their commitment to parklands most recently reinforced in their Vision 2030 Strategic Plan for Parks and Recreation (2011) and final 2012 Park, Recreation and Open Space Plan (Montgomery County Planning Department, 2012b). These planning documents emphasize that park and recreation goals should support Smart Growth by locating facilities that are accessible by walking and transit, as much as possible. The plans also recognize providing sufficient parks and open space, which will depend heavily on renovation and repurposing of existing lands and facilities, while strategically acquiring new land. Rockville developed its City of Rockville Parks, Recreation, and Open Space Plan (City of Rockville, 2009), which recognized a significant challenge: the need to retrofit the "City to meet demands for increased pedestrian connectivity and for more "natural" greenways and open space." In addition, several of the community master plan areas outline plans for additional recreation areas such as sport fields, trail connections, and smaller neighborhood and local parks. The Upper Rock Creek Master Plan proposes the largest new park within the ICE boundary, Gude Drive Recreational Park (167 acres), identified on **Figure 13** by map identification number 72. However, no local or private development projects have been identified within the ICE boundary that would include the addition of recreation areas.

Past, present, and reasonably foreseeable future projects, in conjunction with the MD 586/ Veirs Mill BRT project, would cumulatively result in increased use of park facilities, as well as potentially increased noise and visual encroachment on recreation areas. Given current land use plans and regulations, proposed developments would not require the conversion of

parkland, and are not anticipated to significantly impact the function and use of the areas. In sum, while past impacts are irreversible, and future impacts would be minimized through the application of protective laws including planning for parks, adverse cumulative impacts to these resources are anticipated as a result of this project and in conjunction with other past, present, and future actions.

Historic Standing Structures

Pending the identification of a funding source, the lead agency will continue to consult with MHT and consulting parties to identify and resolve any potential adverse effects to significant historic properties resulting from the MD 586/Veirs Mill BRT project. Indirect effects to historic properties could occur further removed in time or distance outside the limits of direct disturbance of an action. For example, indirect effects may occur due to impacts to the setting, feeling, and association of features contributory to the NRHP eligibility of historic properties.

As the population in the study area increases and commercial and residential development pressures rise, independent of the MD 586/Veirs Mill BRT project, there could be additional cumulative impacts to potentially significant cultural resources; however, based on a review of projects identified within the ICE boundary, no impacts to historic standing resources have been identified. The Judicial Center Annex development project is located within the boundary of the Montgomery County Courthouse Historic District. Due to the relatively developed state of the ICE study area, present, and future development would not change the overall land use within the ICE study area because much of the area is already built out. There could be cumulative effects to cultural resources when combined with the incremental impacts of the MD 586/Veirs Mill BRT project. Cumulative contributions from this project as well as contributions from other actions to cultural resources would be minimized based on regulations requiring undertakings to take into account effects to these resources.

The M-NCPPC, Montgomery County, and the city of Rockville administer the provisions of local historic preservation ordinances to help preserve all significant cultural resources. State law protecting burial grounds apply to private property. Section 106 of the National Historic Preservation Act and Section 4(f) of the 1966 Department of Transportation Act are also in place to protect significant historic properties, minimize permitted impacts, and/or mitigate for any unavoidable impacts associated with projects that require a federal transportation action.

Water Quality/Groundwater

The MD 586/Veirs Mill BRT improvements may have indirect impacts to downstream surface water from increased impervious surfaces and temporary construction impacts that would potentially increase sediment and pollutant-loaded runoff. However, these potential water quality effects would be minimized by using best management practices during construction as previously described, and by constructing stormwater management facilities for the MD 586/Veirs Mill BRT project.

Water quality cumulative effects could occur from stream loss and incremental increase of impervious surfaces that may increase stormwater runoff from past, present, and future development projects. Transportation improvement projects outlined in **Table 62** would, overall, increase the amount of impervious in the study area. Many of the planned local,

commercial, and residential developments would occur on already disturbed and/or impervious surface. Increased stormwater runoff within the ICE study area could also increase erosion and sedimentation of surface water and introduce pollutants picked up in runoff. Within the region, the relative health of surface waters has continued to decline due to past and current land use practices and development, despite existing regulations, plans, and policies. Cumulative adverse effects on streams and water quality are likely to continue to the extent that existing forest and agricultural resources are converted to residential and other urban uses; however, there are no agricultural or forest areas within the ICE boundary that would be converted to residential or other urban uses. Much of the ICE study area has been built out, including the planning areas of Kensington - Wheaton, Aspen Hill, North Bethesda – Garrett Park, Capitol View & Vicinity, and Forest Glen Sector. The Wheaton Sector, Town of Kensington, and Twinbrook Sector planning areas outline plans for the re-development of already disturbed areas. Although undeveloped land exists within the Upper Rock Creek planning area, the master plan aims to direct development away from sensitive areas, maintain low densities, and build on the heritage of open space to enhance overall water quality protection to encourage the preservation of natural resources.

Water quality effects would be minimized by using BMPs during construction and the installation of stormwater management facilities, in accordance with MDE and Montgomery County Stormwater Management regulations. Existing laws and regulations requiring permits ensuring avoidance, minimization, and/or mitigation would help offset stream loss and degradation of water quality and aquatic habitat due to ICE. Additionally, new stormwater management regulations would provide for additional water quality treatment in areas that were previously developed and where water quality treatment does not currently exist. Therefore, future impacts to water quality in combination with minor adverse impacts of the action alternatives from the MD 586/ Veirs Mill BRT project would result in future adverse cumulative impacts to water quality.

Wetlands and Streams

Many of the wetlands within the study area have experienced changes from non-urban to urban land uses within the last three decades. However, it is likely that most of these wetlands were preserved or their potential loss was compensated given their regulation under Section 404 of the Clean Water Act. Any changes would have been reviewed by MDE and incorporated into total wetland acreage changes for their respective watershed.

Since the proposed improvements are for an existing facility on an existing alignment and the proposed improvements are not expected to enable further development beyond what is currently planned for within the study area, it is anticipated that there would be no indirect impacts associated with the MD 586/Veirs Mill BRT project.

As of 1995, the National Wetlands Inventory estimated Maryland has lost between 45-65 percent of its wetlands since the early 1700s, leaving approximately 600,000 acres statewide (Tiner and Burke, 1995). More recent trends for certain wetland classification types have been examined by Tiner and Finn (1986) and Tiner et al. (1994) for the periods of 1955-1978 and 1982-1989. **Table 63** compares the trends of the two studies. The forested wetland statistic presented is misleading because the net change figure includes loss in addition to changes in

wetland type; e.g., changes from forested wetland to emergent or scrub-shrub wetlands induced by timber harvest.

MDNR also provides historical wetland trends for watersheds on their *Surf Your Watershed* website (www.dnr.state.md.us/watersheds/surf/). Since 1991, MDNR estimates a net gain of 11.35 acres in the Potomac River watershed for the watersheds in the ICE study area. This includes a net gain of 0.56 wetland acres in the Rock Creek watershed. According to mapped land use trends within Montgomery County, between 1973 and 2010, the area of wetlands has increased from 171 acres to 1,438 acres.

Table 63: Comparison of Wetland Trend Estimates in Maryland, 1955-1978 and 1982-1989

Wetland Type	1955-1978		1982-1989	
	Net Change Trends (Acres)	Average Annual Net Change (Acres)	Net Change Trends (Acres)	Average Annual Net Change (Acres)
Estuarine Emergent	-9,845	-428	-72	-10
Estuarine Scrub-Shrub	-183	-8	+279	+40
Estuarine Forested	No Data	NA[1]	-766	-109
Estuarine Non-vegetated	+1,049	+46	+1,074	+153
Palustrine Emergent	-11,496	-500	-1,638	-234
Palustrine Scrub-Shrub	-5,557	-242	+5,178	+740
Palustrine Forested	-2,004	-87	-7,863	-1,123
Palustrine Non-vegetated (Ponds)	+14,435	+628	+3,236	+462

Source: Tiner and Finn (1986) and Tiner et al. (1994).
Note: Gains are indicated by a "+" and losses by a "-". The data are based on the *net changes* which tend to understate the conversion of existing wetlands to dryland and deepwater habitats.
[1] not applicable

Federal and state wetland regulations are the most widely-used means of controlling wetland impacts in Maryland. Based on the current implementation of the federal government's 1989 "no net loss' policy and Maryland's National Wetlands Protection Act of 1989, it is anticipated that future wetland loss in the ICE study area would be reduced from earlier loss levels. A detailed discussion of streams and wetlands can be found in the *MD 586/Veirs Mill BRT Project Natural Environmental Technical Report* (September 2015).

It is reasonable to assume that potential impacts to wetlands and waters resulting from development projects would be subject to the same permits as the MD 586/Veirs Mill Road BRT improvements. Similar avoidance, minimization, and/or mitigation would be required. This would help offset wetland losses caused by cumulative development. Additionally, because of the level of regulation protecting wetlands (i.e., The Maryland Non-Tidal Wetlands Act, the Section 404 program, and other regulatory programs) and trends illustrating overall gains in wetland acreage since 1991, it is anticipated that impacts from past, present, and reasonably foreseeable future projects would be minor. The minor adverse impacts of past, present, and future development in combination with the incremental impact of the action alternatives for BRT improvements would result in minor adverse cumulative effects to streams and wetlands.

Floodplains

Since the proposed improvements are for an existing facility on an existing alignment and the proposed improvements are not expected to enable further development beyond what is currently planned for within the study area; it is anticipated that indirect impacts to floodplains associated with the MD 586/Veirs Mill BRT project would be minor.

Past, present, and future development independent of the MD 586/Veirs Mill BRT project, construction of the project, and indirectly linked actions may potentially impact floodplains by placement of structures, fill, and excavation, or increased stormwater runoff from impervious surfaces. The East Gude Drive Roadway Improvements may impact floodplains in the vicinity of the widening and it is reasonably foreseeable the floodplain would be within the project impact area. The other local, commercial, and residential development projects are not expected to impact floodplains. However, as applicable to the MD 586/Veirs Mill BRT project, governmental regulations at the federal, state, and local level would require developers to acquire permits prior to constructing in a floodplain that would ensure proposed actions would not increase flood hazard and would minimize potential erosion or sedimentation impacts. Similarly, regulations and ordinances would require development to include best management practices to minimize potential stormwater impacts by requiring more use of permeable surfaces, and construction of facilities to reduce flood risk. Therefore, anticipated present and future projects minor adverse impacts to floodplains in combination with the minor adverse impacts of the action alternatives of the MD 586/Veirs Mill BRT project would result in minor adverse cumulative effects to floodplains.

Terrestrial Resources

Since the proposed improvements are for an existing facility on an existing alignment through a developed corridor, and the proposed improvements are not expected to enable further development beyond what is currently planned for within the study area; there would be minimal fragmentation or destruction of forested areas and FIDS habitat. The proposed roadway widening would only impact the outer edges of the exiting forest stands and FIDS habitat which are currently impacted by the existing roadway. Given that the affected wildlife habitat exists adjacent to the existing MD 586 roadway, the proposed improvements are not anticipated to induce fragmentation of wildlife habitat or increase animal collision encounters with vehicles, and, therefore, indirect impacts to wildlife and FIDS habitat are not expected.

Based on the above, no substantial indirect adverse impacts to terrestrial resources would occur due to the MD 586/Veirs Mill BRT project.

Terrestrial habitats are defined as areas of land that provide food and shelter required for the survival of various terrestrial plants and animals where organisms live on land. Terrestrial habitats in the ICE study area include forests and vegetated areas (e.g., lawns, meadows, and parkland). Terrestrial habitats are not broadly protected by federal or state law; however, forested areas are regulated by the State of Maryland through the Forest Conservation Act of 1991 (FCA) that is implemented by local jurisdictions (Montgomery County Planning Department, 2014d).

The purpose of the FCA is to minimize the loss of Maryland's forest resources during land development by making the identification and protection of forests and other sensitive areas an integral part of the site planning process. With certain exceptions, any activity requiring an application for a subdivision, grading permit or sediment control permit on areas 40,000 SF (approximately 0.91 acre) or greater is subject to the FCA and a Forest Conservation Plan is required. Depending on the amount of forest proposed to be removed, the property owner could qualify for an exemption from submitting a Forest Conservation Plan. In addition, the Maryland Reforestation Law requires state-funded highway projects to replace cut forests acre for acre by planting new ones, and the Maryland Roadside Tree law requires replacing individual trees.

According to mapped land use trends within Montgomery County, between 1973 and 2010, forested area decreased from 99,635 acres to 85,998 acres. Since implementation of the FCA, Maryland Department of Forestry (2010) cites that more than 7,800.7 acres were retained under the FCA, 3,255.5 acres were cleared, and 2,083.4 acres were planted on development sites. An additional 159.9 acres of forest was planted or retained in forest mitigation banks.

In 1973, forest made up 1,955 acres (16.3 percent) of the total ICE study area land cover. Between 1973 and 2002, the ICE study area lost 505 acres of forest, reducing forest area to 1,490 acres (12.5 percent). Between 2002 and 2010, the ICE study area gained 63 acres of forest, increasing the forest area to 1,553 acres (13.0 percent).

Past and present development actions have cumulatively reduced the acreage of high-quality terrestrial resources in the ICE study area. There is approximately 1,500 acres of forest within the ICE study area. Specifically, Montrose Parkway Interchange impacted 3.6 acres of forest and Montrose Parkway Phase II is estimated to impact 11.2 acres of forest. The private development projects including Parklawn North, Kensington Heights, Halpine View, and Randolph Farms are estimated to impact a total of 3.2 acres. The total forest impacts of past, present, and reasonably foreseeable projects are estimated to be 18 acres which is approximately one percent of the total forest in the study area. There are no estimated impacts to FIDS habitat; however, it would be expected that some of the forest impacts could also be associated with FIDS habitat. The study area is presently highly developed and existing development surrounds MD 586. Federal, state, and local laws controlling future development and requiring forest conservation and mitigation/reforestation would minimize the potential for severe direct and indirect impacts to terrestrial resources. Therefore, for present and future projects, minor adverse impacts to terrestrial resources in combination with the minor adverse impacts of the action alternatives of the MD 586/ Veirs Mill BRT project would result in minor adverse cumulative effects to terrestrial resources.

4. Conclusions

Indirect

The MD 586/Veirs Mill BRT project is expected to result in only minimal indirect effects. The built-up nature of the ICE analysis area suggests at least in part, an irreversible loss of resources; however, it is anticipated that protective laws will ameliorate future potential resource losses. There are no planned development projects in the area that are dependent on

the completion of the proposed MD 586/Veirs Mill BRT project. The MD 586/Veirs Mill BRT project would not increase the overall capacity of the roadway, nor would it provide new access to previously isolated parcels of undeveloped land; however, it would improve access to currently developed and re-developing parcels by providing increased reliability and service frequency. The improvements would not immediately cause or induce new unplanned development that would affect changes in the current and planned pattern of land use, population density, or growth rate. There could be minor indirect impacts within park facilities to downstream water quality as a result of increased impervious surface. Indirect effects could occur to historic properties due to impacts to the setting, feeling, and association of features contributory to the NRHP eligibility of the properties. Water quality, downstream of the project, could be indirectly impacted from the increased impervious surface and temporary construction impacts that could potentially increase sediment and pollutant-loaded runoff. Floodplains could be indirectly impacted downstream from the increase in impervious surface which could cause excess erosion or sedimentation. Indirect effects are not expected to occur to communities, wetlands/waters, or terrestrial resources.

Cumulative

Past, present, and reasonably foreseeable projects would contribute impacts within the ICE boundary as outlined in **Table 62**. The largest of these projects are the Montrose Parkway Phase I and Phase II improvements, as well as the East Gude Drive Roadway improvements. These three projects could have the most direct impact on the resources of the ICE analysis area, including: ROW, business displacements, water quality, and forests. The local, commercial, and residential development projects would also contribute to the impact of the forested areas within the ICE boundary. Planned and proposed projects, in combination with the MD 586/Veirs Mill Road BRT improvements, could result in residential relocations and commercial displacements; however, these would be offset by ongoing residential and commercial re-development throughout the ICE analysis area. Additionally, improved transportation infrastructure would reduce congestion and improve safety. Planned and proposed projects, in conjunction with the MD 586/ Veirs Mill BRT project, would cumulatively result in increased use of park facilities, as well as potentially increased noise and visual encroachment on recreation areas. However, considering current land use plans, regulations, and proposed developments would not require the conversion of parkland and are not anticipated to significantly impact the function and use of the areas. Water quality cumulative effects could occur from stream loss and incremental increase of impervious surfaces that may increase stormwater runoff from past, present, and future development projects. However, these would be minimized by using BMPs during construction and the installation of stormwater management facilities, in accordance with MDE and Montgomery County Stormwater Management regulations. Past and present development actions have cumulatively reduced the acreage of high-quality terrestrial resources in the ICE boundary by an estimated 18 acres. Federal, state, and local laws controlling future development and requiring forest conservation and mitigation/reforestation would minimize the potential for severe cumulative impacts to forest and terrestrial resources.

No MD 586/ Veirs Mill BRT project-specific mitigation is proposed to minimize or compensate for unavoidable cumulative impacts associated with the project and the incremental impacts of the other planned and proposed land development actions. It is expected that the current statutes and regulations protecting various sensitive resources will ensure that the site plans for proposed development projects is designed to avoid and minimize significant adverse impacts.

In summary, the minor direct and indirect impacts of the MD 586/Veirs Mill BRT, in combination with the minor impacts of present and reasonably foreseeable future projects, would result in the project contribution of minor adverse cumulative impacts when considering: (1) the existing conditions of the resources evaluated and (2) the planning and resource protection laws and efforts undertaken by government agencies and private developers.

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VI. PUBLIC INVOLVEMENT

Public and Corridor Advisory Committee (CAC) outreach materials or summaries discussed in the text that follows are included as **Appendix E**. Outreach letters were sent to emergency and public service providers along the study corridor on December 15, 2015. A summary of these letters and responses is provided in the community facilities and services discussion (Chapter V.A.5.); letters are provided in **Appendix B**. Public, agency, and municipal stakeholder comments on the Draft CSR are summarized in Chapter VI, Sections A and C. These comments are also presented in a matrix with responses in **Appendix F**.

A. PUBLIC OUTREACH AND WORKSHOPS

MCDOT has maintained and regularly updated the county BRT project website to provide the public with information about the MD 586/Veirs Mill Road BRT Corridor Study (https://www.montgomerycountymd.gov/brt/).

At the beginning of the study, MDOT SHA mailed project newsletters and a BRT survey to more than 40,000 property owners in the CEA analysis area in May 2012 (**Appendix E**). Approximately 1,000 property owners returned the completed survey. Subsequently, an informational Open House was held May 23, 2012, from 4:30 PM to 8:00 PM, at the Holiday Park Senior Center (3950 Ferrara Drive, Silver Spring, MD 20906) to introduce the purpose and need of the MD 586/Veirs Mill BRT Corridor Study. Maps and displays provided project-related information to the public and members of the study team were available to answer questions and respond to attendees' concerns. Approximately 80 people attended the Open House and expressed general support for the project. Attendees were asked to vote on the BRT features they found most important. Features cited as most important included: 1) buses operating in an exclusive lane rather than in mixed traffic; 2) improved safety for pedestrians and bicyclists; and 3) easy, efficient transfers between buses, metro, and future BRT. Attendees offered the following comments and concerns:

- Cost: Make a careful study of the 'No-Build' option as the cost may outweigh the benefits.
- Congestion: The transit option is favored for reducing time of commute, traffic, and pollution.
- Service: Improved access for commuters, bicyclists, and pedestrians.
- Safety: More lighting on the study corridor would increase the sense of safety for night travel.
- Connectivity: BRT would benefit riders to west Gaithersburg, the Metrorail, and other connections.
- Operations: Who would operate and maintain the service and stations?
- Right-of-Way: The importance of providing the transit connection should supersede right-of-way impacts.
- Opposition: Not convenient for daily commute, prefer personal vehicle.
- Development: Economic revitalization could positively impact the neighborhoods.
- Bus Stop Recommendation: Relocate the northbound bus stop at Ferrara Drive that obstructs a lane and increases congestion.

On November 21, 2013, MDOT SHA held an Alternatives Public Workshop from 7:00 PM to 9:00 PM at Richard Montgomery High School in Rockville. The purpose of this meeting was to familiarize interested persons with the project planning process and to present the preliminary alternatives of the MD 586/Veirs Mill BRT Corridor Study. Approximately 100 people attended the meeting, and 55 written comments were submitted. Major concerns cited at the Alternatives Public Workshop included cost, impacts (ROW and environmental), property access/impacts to the service road, and pedestrian crossing and refuge. Suggestions for improving the study included requests to evaluate the addition of bike lanes, increasing the frequency of existing bus service, and making sidewalk improvements throughout the study corridor.

The Draft CSR was made available for public and agency review and comment from September 6 through October 14, 2016. The Draft CSR and appendices, along with supporting technical reports and memos, were also made available on the project website: www.montgomerycountymd.gov/BRT. Hard copies of the Draft CSR were also made available at the following public libraries and community facilities:

Rockville Memorial Library
21 Maryland Avenue
Rockville, MD 20850
Phone: 240-777-0140

Twinbrook Library
202 Meadow Hall Drive
Rockville, MD 20851
Phone: 240-777-0240

Wheaton Interim Library
2400 Arcola Avenue
Wheaton, MD 20902
Phone: 240-777-0678

Mid County Regional Services Center
2424 Reedie Drive
Wheaton, MD 20902
Phone: 240-777-8103

Holiday Park Senior Center
3950 Ferrara Drive
Holiday Park, MD
240-777-4999

A range of outreach methods and activities were used to notify the public of the Draft CSR public review period:

- E-mail notifications were sent the week of September 8, 2016 to municipalities, elected officials, CAC members, and the Montgomery County list serve;
- Facebook and Twitter posts were made the week of September 8, 2016 by MDOT SHA, MDOT MTA, WMATA, and MCDOT;
- Postcards were mailed to 13,997 addresses located within 0.5 miles of corridor the week of September 12, 2016;

- MDOT SHA, MDOT MTA, and MCDOT made press releases which were accompanied by print ads and/or online banner ads posted in the Washington Post, El Tiempo Latino, Gazette, Sentinel, Afro American, Asian Fortune the week of September 13, 2016;
- Public Service Announcements were made on various radio stations the week of September 20, 2016; and
- 3,000 printed fliers in both English and Spanish languages were distributed at bus stops, Montgomery College, Metro Stations, county libraries and facilities, and made available at the Montgomery County Executive Office Building.

Additionally, the project team held a public meeting on September 28, 2016, between 6:30 and 8:30 PM, at the Montgomery County Executive Office Building Cafeteria, 101 Monroe Street, Rockville, MD 20850 to present the results of the alternatives analysis and Draft CSR. The public meeting was organized in an open-house format with informational boards providing an overview of the project, large-scale maps of the build alternatives, a comparison of the alternatives, an overview of next steps, and a video describing BRT. Meeting attendees were provided comment cards, Title VI survey forms, meeting effectiveness survey forms, a project brochure, and right-of-way brochure. Copies of the display board, flyer, and brochure were posted on the project website following the public meeting. Thirty-five attendees signed in at the meeting.

Meeting attendees were encouraged to provide written and privately-recorded comments at the public meeting. The public was also encouraged to submit comments during the public comment period by email to: MD586BRT@sha.state.md.us or mail to:

Laura Barcena, Consultant Project Manager
State Highway Administration
707 N. Calvert Street, Mail Stop C-301
Baltimore, MD 21202.

A total of 36 public comments were received during the comment period, and while most people were in favor of BRT service, there did not appear to be a clear alternative that was preferred by the public. Eight comments were received that were in favor of the No-Build Alternative or generally against providing BRT service along the corridor. Those eight comments cited factors such as high costs, impacts to adjacent properties, and impacts to car and truck traffic as reasons for supporting the No-Build. **Table 64** summarizes the number of comments that were for or against BRT service along MD 586.

Table 64: Summary of Public Comments on Draft CSR

	For Alt. 2	For Alt. 3	For Alt. 5B	For Alts. 1/2	For Alts. 2/3	For Alts. 3/5B	For BRT[1]	Against BRT	Unclear/ Unrelated	TOTAL
NUMBER OF COMMENTS	1	2	2	2	1	1	12	8	4	**33[2]**

NOTES: 1. Comments in favor of BRT, no alternative specified.
2. Total number of comments does not include the agency representative comments.

B. Corridor Advisory Committee (CAC)

Upon the Montgomery County Council's approval of the *Countywide Transit Corridors Functional Master Plan* (2013), the Council called for the formation of a CAC for the MD 586/Veirs Mill BRT Corridor Study. The CAC was intended to give community residents and business owners/operators the opportunity to provide comments and make recommendations throughout the planning process. MCDOT identified 19 residents and business owners/operators to serve as CAC representatives. Twelve (12) of those members represent the following organizations: Mid-County Citizens Advisory Board, Westfield Wheaton Mall, Connecticut Avenue-Greenwood Knolls Civic Association, Wheaton Urban District Advisory Committee, Kemp Mill Civic Association, American Home Lending, East Rockville Civic Association, Wheaton Hills Civic Association, Twinbrook Citizens Association, Housing Opportunities Commission, Staiano Engineering, and Kensington Heights Civic Association. Seven local residents not affiliated with a civic group represented the community at-large.

To date, nine CAC meetings have been held:

1. February 28, 2015, Montgomery County Executive Office Building, 11:00 AM to 12:15 PM
2. March 25, 2015, Montgomery County Executive Office Building, 6:30 PM to 8:30 PM
3. May 27, 2015, Montgomery County Executive Office Building, 6:30 PM to 8:30 PM
4. September 21, 2015, Rockville Memorial Library, 6:30 PM to 8:30 PM
5. January 20, 2016, Montgomery County Executive Office Building, 6:30 PM to 8:30 PM
6. February 17, 2016, Montgomery County Executive Office Building, 6:30 PM to 8:30 PM
7. April 13, 2016, Montgomery County Executive Office Building, 6:30 PM to 8:30 PM
8. September 14, 2016, Montgomery County Executive Office Building, 6:30 PM to 8:30 PM
9. June 14, 2017, Montgomery County Executive Office Building, 6:30 PM to 8:30 PM

CAC meetings have included presentations and open discussions to spur questions and comments that contribute to project planning and the community's understanding of the project. Community concerns cited at CAC meetings included the following:

- BRT service in existing travel lanes would reduce vehicle capacity;
- General roadway operational issues remain unresolved;
- BRT would adversely impact existing bus services;

- Montgomery College would continue to be underserved;
- BRT would only provide a short-term solution to increased transit demand;
- Additional discussion and detailed analysis is needed to appropriately identify station locations; and
- The character/appearance of the study corridor would still need improvements.

CAC meeting materials and summaries are available at: http://www.montgomerycountymd.gov/BRT/md586.html and summaries are attached in **Appendix E**.

C. Stakeholder Outreach

In addition to the ongoing stakeholder outreach that occurred during the development of the alternatives, stakeholder coordination meetings were held after the Draft CSR was published in September 2016 to understand the positions of key agency and municipal stakeholders. The meetings were held with staff from M-NCPPC and the City of Rockville on October 7, 2016 and with staff from WMATA on October 13, 2016 to review the Draft CSR and discuss which alternative each stakeholder would like to see move forward as the recommended alternative.

By letter dated November 9, 2016, WMATA documented Alternative 3 as their recommended alternative. This letter along with a matrix of additional comments and responses is included in **Appendix F**.

On November 3, 2016, the study findings from the Draft CSR were presented to the Montgomery County Planning Board of M-NCPPC. The Planning Board expressed support for Alternative 3, if more detailed analysis showed that buses in the dedicated curb lane would not be degraded by non-transit vehicles. By letter dated November 14, 2016 the Planning Board documented their recommendation for Alternative 3 to the County Council. This letter along with a matrix of additional comments and responses is included in **Appendix F**.

The alternatives were presented to the Rockville Mayor and City Council on October 10, 2016 and November 21, 2016. The Mayor and Council voted to recommend Alternative 3, as documented in a letter dated November 29, 2016. This letter along with a matrix of additional comments and responses is included in **Appendix F**.

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VII. ADDITIONAL ANALYSIS

On December 1, 2016, MCDOT and MDOT SHA, presented the information contained in the September 2016 Draft CSR to the Transportation, Infrastructure, Energy and Environment (T&E) Committee of the Montgomery County Council. The presentation primarily focused on the details of the alternatives retained for detailed study (ARDS) and the benefits and impacts of each alternative.

The T&E Committee members were not in favor of Alternative 5B due to the high cost and lack of travel time benefit, as compared to the other build alternatives. Additionally, Committee members were interested in understanding why the projected travel times for Alternatives 2 and 3 were similar to each other, despite the differences in dedicated lanes and infrastructure improvements included in each alternative. The Committee asked for additional analyses to determine how a new alternative would operate that combined the roadway improvements of Alternative 2 with the service improvements of Alternative 3.

Between December 2016 and May 2017, additional traffic analysis was conducted for a new alternative, referred to as Alternative 2.5, and cost estimates were developed. Alternative 2.5 would incorporate the many of the same roadway improvements as Alternative 2; therefore, its footprint would be similar. As a result, stormwater management, utility, ROW, CEA, air quality, NETR, cultural resources, hazardous materials, and ICE analyses would expect to yield similar impacts to Alternative 2. Alternative 2.5 would incorporate the same service improvements as Alternative 3; therefore, the ridership forecast would be similar to Alternative 3. The purpose of this chapter is to document and compare the results of the traffic analysis and cost estimates that were developed for Alternative 2.5 with Alternatives 1, 2, and 3.

A. Alternative 2.5 New BRT Service with Intersection Queue Jumps

In general, Alternative 2.5 would include the roadway improvements from Alternative 2 and the bus service improvements from Alternative 3. The minor roadway improvements would require widening for the installation of queue jumps at select intersections. Alternative 2.5 would use the same 12 station locations that were assumed for Alternatives 2 and 3 and new BRT stations would be constructed at each of the 12 station locations. **Appendix A4** provides detailed plans of the queue jump locations.

The queue jump locations for Alternative 2.5 would be the same as the queue jump locations for Alternative 2. As explained in the description of Alternative 2, the queue jump locations were selected using a traffic analysis to identify candidate intersections and an engineering feasibility analysis to refine the list of candidate intersections. The traffic analysis projected the delay and queue length at all signalized intersections along MD 586 to identify locations where queue jumps could be most effective. Those candidate intersections were then examined for general feasibility, such as available ROW. The feasibility analysis identified additional intersections that were not proposed in the traffic analysis for Alternative 2, but could accommodate a queue jump without major impacts. The queue jump locations proposed with Alternative 2.5 include the following:

- Westbound at MD 28
- Eastbound and westbound at

- Eastbound at Edmonston Drive (west intersection)
- Eastbound at Atlantic Avenue
- Eastbound and westbound at Twinbrook Parkway
- Eastbound and westbound at Aspen Hill Road
- Parkland Drive
- Westbound at Gridley Road
- Westbound at Randolph Road
- Eastbound and westbound at MD 185
- Eastbound at MD 193

Similar to Alternatives 2 and 3, Alternative 2.5 would include the installation of TSP at several signalized intersections along the corridor. Various types of TSP such as "early green" and/or "extended green" could be installed depending on the individual signal characteristics and the location of the bus stops relative to the intersection. The intersections where TSP is proposed in Alternative 2.5 are the same as those proposed for Alternative 2, as presented in the *Traffic Operations Analysis Technical Report* (September 2016).

Alternative 2.5 would include striped bicycle lanes at several of the proposed queue jump locations. The proposed bicycle lane locations would match what was proposed in Alternative 2.

The proposed BRT service in Alternative 2.5 would match the BRT service for Alternatives 3 and 5B. It would operate between the Wheaton Metrorail Station and the Rockville Metrorail Station with six-minute headways in the AM and PM peak periods and ten-minute headways in the off-peak periods. Every third bus would continue from the Rockville Metrorail Station to Montgomery College, so the headways would be 18 minutes in the peak period and 30 minutes in the off-peak periods for the Montgomery College extension. The span of service from the Wheaton Metrorail Station to the Rockville Metrorail Station would extend from 6 AM to midnight. Between the Rockville Metrorail Station and Montgomery College, the service would operate from 8 AM to 10 PM when classes are in session. **Table 65** summarizes the operating characteristics of Alternative 2.5.

Table 65: Alternative 2.5 Operating Characteristics

Bus Service	Frequency				Span of Service	
	Peak		Off-Peak			
	Wheaton to Rockville	Rockville to Montgomery College	Wheaton to Rockville	Rockville to Montgomery College	Wheaton to Rockville	Rockville to Montgomery College
New BRT Service	6 minutes	18 minutes	10 minutes	30 minutes	6 AM to midnight	8 AM to 10 PM

The new BRT service in Alternative 2.5 would stop at 12 locations along the study corridor. New BRT stations would be constructed for the new BRT service at each of the 12 stops. Most of the BRT stations would be 120 feet long and able to accommodate two articulated buses or a mix of vehicle types. Smaller, 60-foot-long or 90-foot-long BRT stations that only accommodate one articulated bus would be proposed at locations with limited ROW. The longer, 120-foot-long stations were preferred in Alternative 2.5 because the platforms would be used by both the BRT and local buses, given the high probability that more than one bus would be at the

station at any given time. **Table 66** shows the station locations and the type of BRT station that is proposed at each location.

Table 66: Alternative 2.5 BRT Stations

Location	BRT Station Type
Montgomery College	Side Platform (120')
Rockville Metrorail Station (west entrance)	Side Platform (120')
MD 28/Norbeck Road	Side Platform (120')
Broadwood Drive	Side Platform (120')
Twinbrook Parkway	Side Platform (120')
Aspen Hill Road	Side Platform (120')
Parkland Drive	Side Platform (120')
Randolph Road	Side Platform (120')
MD 185/Connecticut Avenue	Side Platform (90' EB/120' WB)
Newport Mill Road	Reduced Side Platform (60')
MD 193/University Boulevard	Reduced Side Platform (60')
Wheaton Metrorail Station	Side Platform (120')

A BRT station would be larger and have more amenities than both a traditional bus stop and the enhanced bus stops described in Alternative 2. Potential amenities that could be included at each BRT station are: level boarding, canopy, bench, real-time information, off-board fare collection, system maps, artwork, landscaping, and bicycle parking.

B. Alternative 2.5 Transit and Traffic Analysis Results

The ridership forecasting model was not run for Alternative 2.5. An assumption was made for the expected daily ridership for the proposed BRT service in Alternative 2.5 to complete the traffic analysis. Since the travel speeds for Alternatives 2 and 3 were similar and Alternative 2.5 would include the same attractive BRT elements as Alternative 3, the ridership for Alternative 2.5 was assumed to be 6,400 daily boardings, or the same as what was projected for Alternative 3.

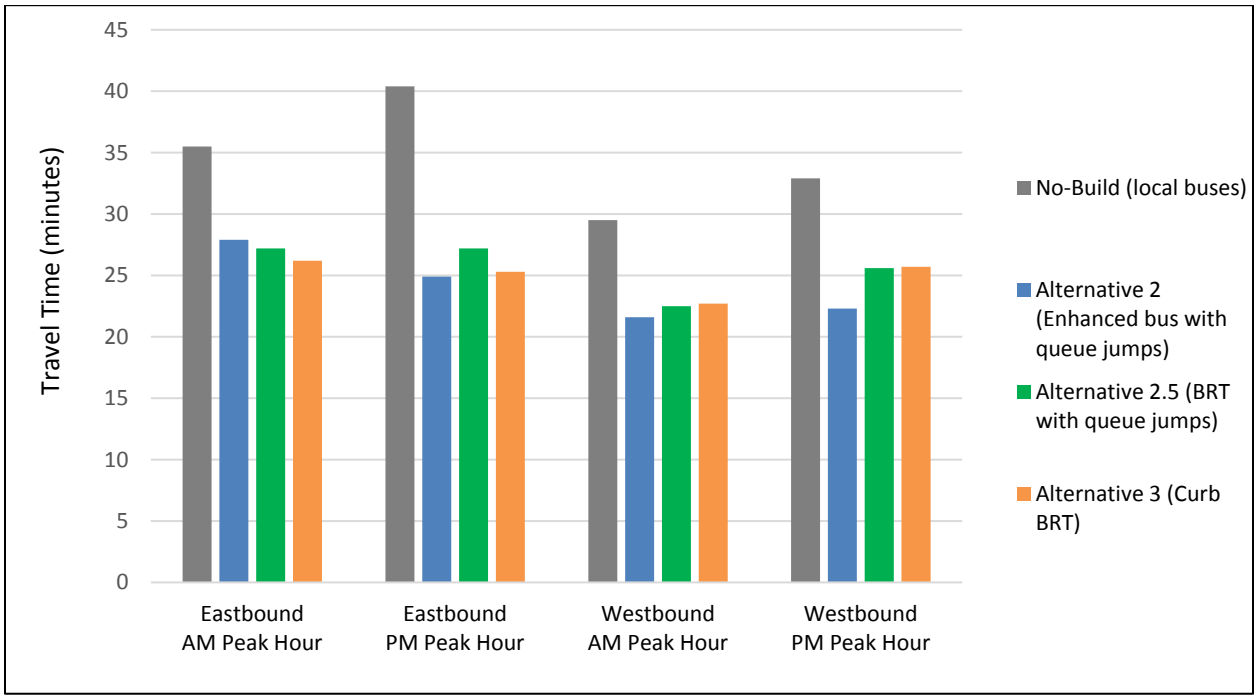
The traffic analysis showed that Alternative 2.5 would provide travel time benefits including BRT travel time savings of 13 minutes along eastbound MD 586 in the PM peak hour, as compared to the No-Build. The analysis also showed that Alternative 2.5 would result in the same BRT westbound travel times as Alternative 3 and would operate one to two minutes slower than Alternative 3 in the eastbound direction. The projected transit travel times are summarized in **Figure 20** and the key findings are summarized below:

- Alternatives 2, 2.5, and 3 would reduce eastbound transit travel times by at least 7.5 minutes in the AM peak hour and 13 minutes in the PM peak hour compared to the No-Build. Additionally, all three alternatives would reduce westbound transit travel times by at least 6.5 minutes in the AM peak hour and seven minutes in the PM peak hour compared to the No-Build.
- Alternative 2.5 provides a faster BRT travel time as compared to Alternative 2 during the AM peak hour in the eastbound direction. Alternative 2 provides a faster BRT travel time during the PM peak hour in both the eastbound and westbound directions and during the AM peak hour in the westbound direction. However, this can likely be attributed to

the lower ridership that is anticipated with Alternative 2, which results in shorter dwell times and fewer pedestrians.

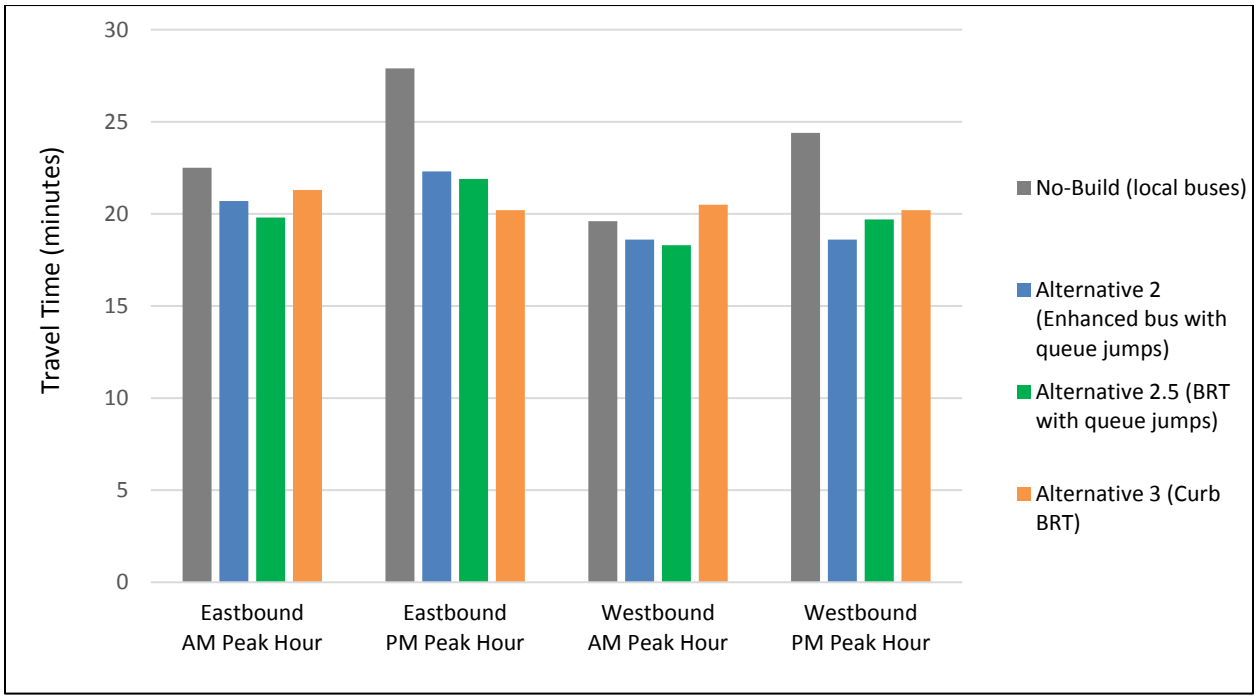
- Alternative 2.5 provides comparable BRT travel times to Alternative 3 in the westbound direction during both the AM and PM peak hours. However, Alternative 3 provides a travel time savings in the eastbound direction during both peaks (one minute during the AM peak hour and two minutes during the PM peak hour) when compared to Alternative 2.5.

Figure 20: Projected 2040 Peak Hour Transit Travel Times



The projected automobile travel times are presented in **Figure 21**. In general, the automobile travel times for each alternative along MD 586 are lower than in the No-Build condition, except for in the westbound direction in the AM peak hour, where the automobile travel times would be longer with Alternative 3.

Figure 21: Projected 2040 Peak Hour Auto Travel Times



The projected total peak hour person travel time savings by mode were calculated by summing the travel time savings for each roadway segment and multiplying that savings by the number of people in that mode of travel. For buses, this equated to the average bus load in the desired segment, while for automobiles, this equated to 1.2 average persons per vehicle. Total peak hour person transit travel time savings (including BRT and local bus travelers) are outlined in **Figure 22**, total peak hour person travel time savings (including BRT, local bus, and automobile travelers) are outlined in **Figure 23**, and the key findings are summarized below:

- Alternative 2.5 provides a greater peak hour transit (BRT and local bus) person travel time savings for both directions and peaks when compared to Alternative 2.
- Alternative 3 provides a greater peak hour transit (BRT and local bus) person travel time savings than Alternatives 2 and 2.5 in the eastbound direction in both peaks. In the westbound direction during both peak hours, Alternative 2.5 is nearly equal to Alternative 3.
- The greatest total person peak hour travel time savings for the PM peak occurs under Alternative 3.
- The greatest peak hour total person travel time savings for the AM peak occurs under Alternative 2.5.
- Overall, transit users would save the most time under Alternative 3 (143 person-hours total during the combined AM and PM peak hours each day). Time savings are 11 percent lower (127 person-hours) for Alternative 2.5 and 34 percent lower (95 person-hours) for Alternative 2. (Note that time savings during off-peak times are not included in these figures.)

Figure 22: 2040 Total Peak Hour Person Transit Travel Time Savings (Includes Local Bus and BRT)

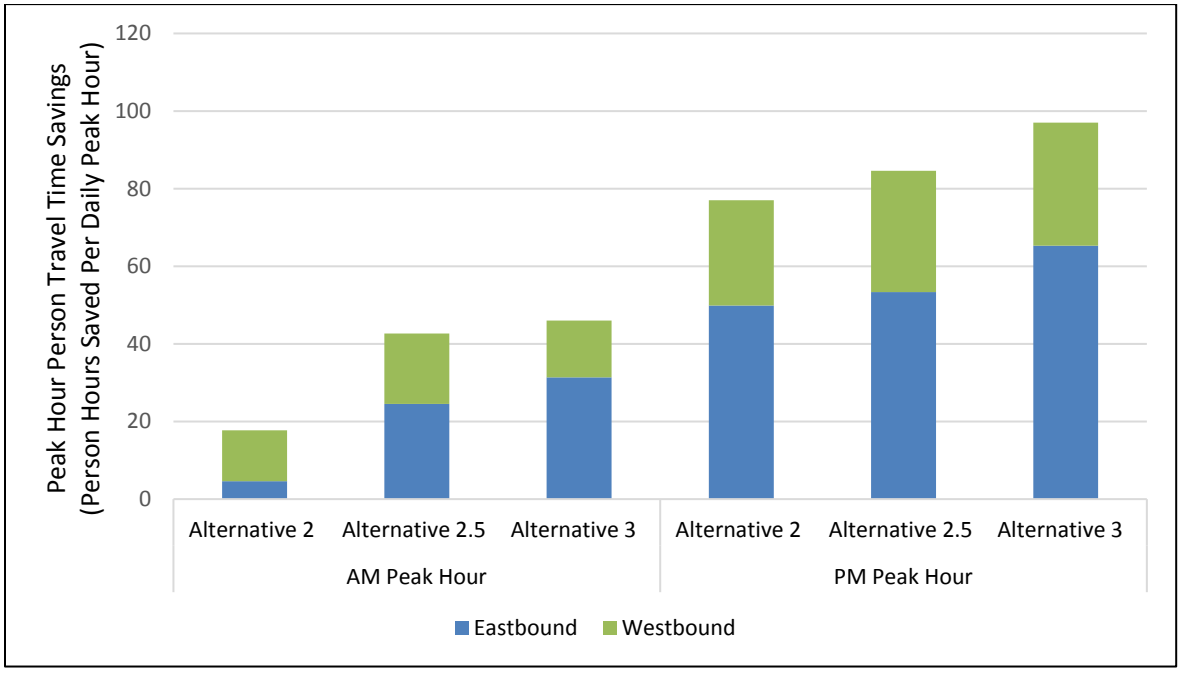
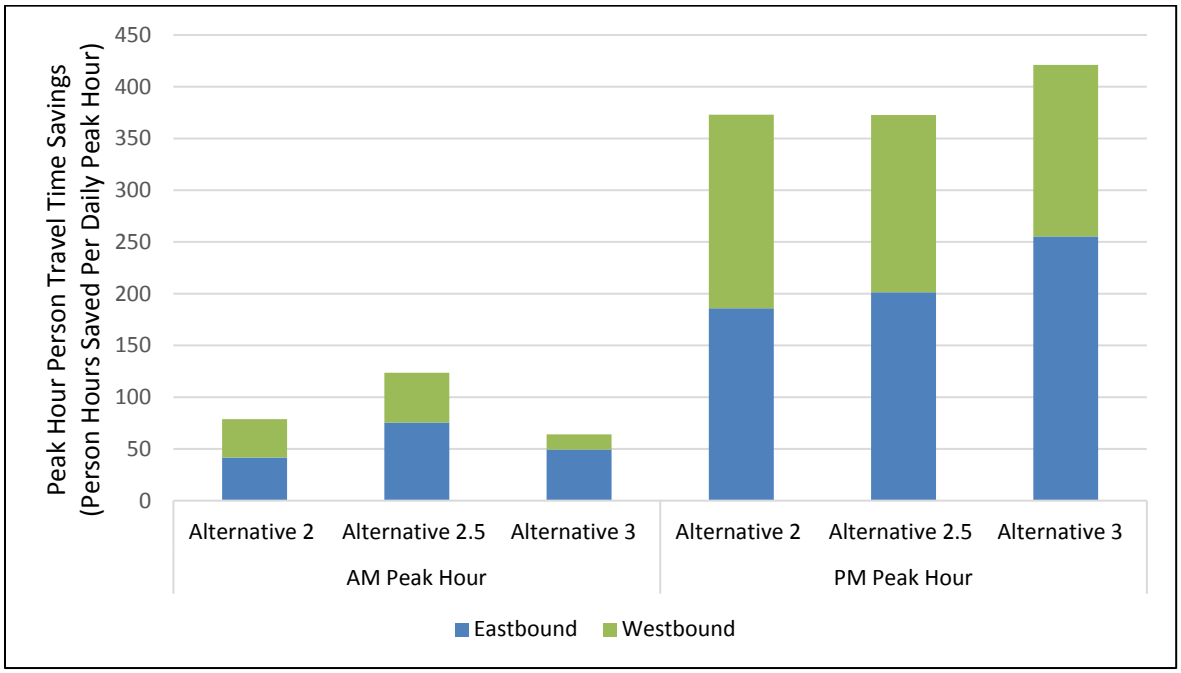


Figure 23: 2040 Total Peak Hour Person Travel Time Savings (Includes Auto, Local Bus, and BRT)



As part of the additional analysis, several test scenarios were conducted to understand why the alternatives would have similar transit travel times despite large differences in the length of dedicated lanes. The test scenarios showed that other factors, such as daily boardings, pedestrian activity, and station locations all affect the travel times. For example, Alternative 3

has more projected boardings than Alternative 2, which results in longer dwell times at the stations in Alternative 3. In addition, the higher ridership in Alternative 3 results in more pedestrian activity around the stations, which affects the signal timing and the minimum green time for the pedestrian crossing phase, which causes more delay for the BRT vehicles. Finally, the stations were located to minimize ROW impacts for each alternative, which sometimes led to different (near-side versus far-side) station locations between Alternatives 2 and 3. However, the test scenarios showed that station placement also influenced travel time and in some cases, the station placements in Alternative 3 were not ideal from an operations perspective, even though they were preferred from a ROW perspective. When the recommended alternative moves forward, the location of BRT stations will be further refined to optimize travel time benefits while continuing to minimize right-of-way impacts.

C. Alternative 2.5 Costs and Property Impacts

For each of the ARDS, Alternatives 1, 2, 3, and 5B, a "major quantities estimate" was prepared based on the guidance in the MDOT SHA Cost Estimating Manual. The engineering completed on the build alternatives allowed the team to quantify several of the major cost items, such as grading, paving, structures, and roadside features.

To aid in the cost estimating process, stormwater management, utility, and ROW impact analyses were completed for each of the ARDS. The stormwater management analysis identified the treatment quantity and quality requirements for the alternatives and the associated costs for meeting those requirements. The utility impact analysis documented the existing utilities in the corridor, quantified impacts to the existing utilities, and estimated costs for relocating the impacted utilities. The ROW analysis, completed by the MDOT SHA, determined which properties would be displacements and estimated the ROW costs based on the amount of ROW and/or easement required for each parcel.

Alternative 2.5 was engineered to a similar level of detail as Alternatives 2 and 3 so a "major quantities estimate" was developed to further compare Alternative 2.5 to Alternatives 2 and 3. As previously described, Alternative 2.5 would incorporate the roadway improvements of Alternative 2; therefore, the cost estimates for stormwater management, utilities, and ROW costs were estimated based on the footprint of Alternative 2.5 relative to the footprint of Alternative 2. More detailed analysis would be required to refine those categories.

As shown in **Table 67**, the estimated cost to design and construct Alternative 2.5 is $79.1M, including ROW and vehicle costs. This is approximately $44.3M more than Alternative 2, with the majority of the cost difference due to the construction of the larger BRT stations and purchase of larger vehicles. Alternative 2.5 would be approximately $68.8M cheaper than Alternative 3 due to the reduction in dedicated lanes.

Table 67 also includes the property impacts for Alternative 2.5, which would be greater than Alternative 2 but less than Alternative 3.

Table 67: Alternatives Comparison Matrix - Costs and Property Impacts

COMPARISON FACTORS	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 2.5	ALTERNATIVE 3
Costs				
Right-of-way (ROW)	$0	$6.2M	$11.1M	$12.8M
Roadway Engineering and Construction	*$0*	*$21.9M*	*$28.6M*	*$95.7M*
Enhanced Bus Stop/BRT Station Engineering and Construction[2]	*$0*	*$1.3M*	*$22.9M*[1]	*$22.9M*[1]
Total Engineering and Construction	$0	$23.2M	$51.5M	$118.6M
Vehicles	$0	$5.4M	$16.5M	$16.5M
Total Capital Cost	**$0**	**$34.8M**	**$79.1M**	**$147.9M**
Annual Operating Cost	$0	$3.1M	$4.8M	$4.8M
Property Impacts				
Total Permanent ROW Required (acres)	0	0.7	1.1	2.3
Properties Impacted (number)	0	27	45	116
Residential Relocations (number)	0	4	5	7
Business Displacements (number)	0	1	2	2

1. The unit costs for the BRT stations do not include the costs of certain system elements identified in November 2016 that could add approximately $62,000 per platform.
2. Costs to relocate impacted existing bus shelters are not included.

D. SUMMARY

In summary, compared to Alternatives 2 and 3, Alternative 2.5 metrics are as follows:

- **Daily BRT Boardings:** Provides 2.5 times more boardings than Alternative 2 and a similar number to Alternative 3.
- **Peak Hour Transit Person Travel Time Savings:** Provides a greater savings by serving more riders than Alternative 2. Provides slightly less savings in the eastbound direction and equal savings in the westbound direction than Alternative 3.
- **BRT Travel Times:** Provides slightly higher BRT travel times than Alternative 2 (except for along eastbound in the AM peak hour), due to higher ridership. Provides higher BRT travel times than Alternative 3 eastbound (up to 2 minutes) and equal BRT travel times in the westbound direction.
- **Cost:** Requires $44.3M more to design and construct than Alternative 2 and $68.8M less to design and construct than Alternative 3.

As previously described, detailed environmental impact analyses, such as socioeconomic, cultural, and natural resources, air quality, noise, hazardous materials, and indirect and cumulative effects were not completed for Alternative 2.5 as they were for the original ARDS. For planning purposes, it is reasonable to assume that the environmental impacts for Alternative 2.5 would be greater than or equal to those for Alternative 2 and less than those for Alternative 3. The environmental impacts of Alternatives 2 and 3 are presented in Chapter V.

VIII. RECOMMENDED ALTERNATIVE AND NEXT STEPS

On June 13, 2017, the Montgomery County Council voted to select Alternative 2.5 as their recommended alternative, with Alternative 3 retained as the master plan option. This recommendation was further documented by letter addressed to MDOT Secretary Pete Rahn, dated June 15, 2017, and signed by County Council President Roger Berliner (**Appendix G**). The County Executive concurrently selected Alternative 2.5 as the recommended alternative, with Alternative 3 retained as the master plan option, by letter dated July 10, 2017 (**Appendix G**).

Alternative 2.5 addresses the purpose and need for the project by providing high-quality BRT service with improved speed and reliability. Transit travel time will be reduced up to 13.2 minutes (33 percent) relative to the No-Build 2040 travel time. The $79.1M cost for Alternative 2.5 is less than the dedicated lane alternatives (3 and 5B), while the projected ridership is higher than Alternative 2.

Retaining Alternative 3 as the master plan option acknowledges that dedicated curb lanes may be justified along MD 586 at some point in the future as traffic congestion and transit ridership continue to grow, and as Montgomery County builds a BRT network. It would also allow the County to require ROW dedication from developers to be consistent with the master plan recommendation, Alternative 3. Most of the infrastructure included in Alternative 2.5 would remain in the same location under Alternative 3, and Alternative 2.5 would not preclude the proposed dedicated lanes in Alternative 3. Over time, the dedicated lanes in Alternative 3 can be reevaluated to determine if they should be constructed. As the County's BRT network is established on surrounding corridors, such as MD 355, Randolph Road, MD 193, and MD 97, the ridership along the MD 586 BRT corridor may increase, which could warrant the ultimate construction of Alternative 3.

The next steps for the recommended alternative include refining the alignment by adjusting the station and queue jump locations to further maximize operations while reducing project costs and impacts. Station locations may be shifted from near-side to far-side and vice versa and queue jump locations may be refined based on how the BRT is expected to operate near each intersection. Further engineering refinements of Alternative 2.5 would include more detailed stormwater management design and minimizing utility and ROW impacts. Additional ridership modeling may also be performed to refine the projected ridership for Alternative 2.5.

There is not currently any funding available to advance the project. Once a funding source is identified, the appropriate environmental documentation should be completed for Alternative 2.5. Environmental documentation would include supplemental Section 106 coordination and impact analysis of natural features, and socio-economic factors such as potential impacts to communities, indirect and cumulative impacts, and additional related outreach. While this study did not complete detailed environmental impacts on Alternative 2.5, the analyses that were conducted on Alternatives 2 and 3 could be used as a starting point, depending on how soon the project moves into the environmental document phase. Additionally, the following detailed environmental analyses were not completed for Alternatives 2 and 3 and would need to be completed for Alternative 2.5 following the identification of a funding source: a detailed noise analysis, an air quality conformity determination, a Section 4(f) evaluation, and a wetland delineation.

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