FEBRUARY 2013

TIER 1
DRAFT ENVIRONMENTAL IMPACT STATEMENT

INTERSTATE 66

From US Route 15 in Prince William County
To Interstate 495 in Fairfax County

VDOT Virginia Department of Transportation

DRPT
Virginia Department of Rail and Public Transportation

U.S. Department of Transportation
Federal Highway Administration

FHWA-VA-EIS-13-01-T1D

INTERSTATE 66 CORRIDOR– From U.S. Route 15 to Interstate 495 (Capital Beltway)
Fairfax and Prince William Counties, Virginia

TIER 1 DRAFT ENVIRONMENTAL IMPACT STATEMENT

Submitted Pursuant To:
42 U.S.C. 4332(2)(c)

By:
U.S. Department of Transportation, Federal Highway Administration
and
Virginia Department of Transportation
Virginia Department of Rail and Public Transportation

Cooperating Agencies:
Federal Transit Administration
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency

2-12-13
Date of Approval

Environmental Administrator
Virginia Department of Transportation

2-12-13
Date of Approval

Thelma Drake
Director
Virginia Department of Rail & Public Transportation

2-12-13
Date of Approval

Division Administrator
Federal Highway Administration

This Tier 1 Draft Environmental Impact Statement defines existing and future transportation conditions and needs within the 25-mile I-66 corridor from U.S. Route 15 to I-495 (Capital Beltway), identifies a range of conceptual-level improvements that would address those needs, and evaluates the potential effects of these concepts on the natural and human environments. The "Build" improvement concepts in this Tier 1 study are based on a systems level analysis that focuses on broad issues such as purpose and need, travel modes, technology choices, and general location of multi-modal improvements. At the conclusion of the Tier 1 study, decisions will be made on the concepts to be advanced; the general location for studying future highway and transit improvements in Tier 2 National Environmental Policy Act (NEPA) document(s); identification of projects with independent utility to be studied in Tier 2 NEPA document(s) and evaluated pursuant to other environmental laws; and advancing tolling for subsequent study in Tier 2 document(s).

FHWA will issue a single Final Environmental Impact Statement and Record of Decision document pursuant to Public Law 112-141, 126 Stat. 405, Section 1319(b) unless FHWA determines statutory criteria or practicability considerations preclude issuance of the combined document pursuant to Section 1319.

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Comments on this Tier 1 Draft Environmental Impact Statement are due by April 8, 2013 and should be sent to Ms. Deem at the above address or submitted using the online comment form at www.helpfix66.com.

ES EXECUTIVE SUMMARY

ES.1 NEPA TIERING PROCESS

The Virginia Department of Transportation (VDOT) and the Virginia Department of Rail and Public Transportation (VDRPT), in cooperation with the Federal Highway Administration (FHWA), are studying the potential environmental impacts of transportation improvement concepts along Interstate 66 (I-66). As a Tier 1 document, this Draft EIS represents the first step within a tiered approach to National Environmental Policy Act (NEPA) analyses as presented in the Council on Environmental Quality's (CEQ's*) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR 1500 – 1508), and in FHWA's and FTA's *Environmental Impact and Related Procedures* (23 CFR 771) and *Linking the Transportation Planning and NEPA Processes* (Appendix A to 23 CFR 450; Question and Answer #9). Tiering involves the evaluation of broad level programs and issues in an initial (Tier 1) analysis followed by more detailed evaluation of specific improvements in subsequent (Tier 2) analyses.

This Tier 1 study was designed to aid in the development of a long-term vision for the I-66 corridor from US 15 to I-495 (Capital Beltway) that includes corridor-wide multimodal concepts and assists in making informed decisions about the best program of near-term and long-term transportation improvements.

This Tier 1 Draft EIS defines existing and future transportation conditions and needs within the study corridor, identifies a range of transportation improvement concepts that would serve those needs, and evaluates the potential effects of the concepts on the natural and human environment. The "Build" improvement concepts in this Tier 1 study are based on a systems-level analysis that focuses on broad issues such as purpose and need, travel modes, technology choices, and general location of improvements. This Tier 1 analysis examines potential impacts at a conceptual level while subsequent Tier 2 NEPA documents will include site-specific quantitative analyses of effects and provide avoidance, minimization, and mitigation measures.

ES.2 STUDY AREA

I-66 is the main east-west interstate highway in Northern Virginia and serves the District of Columbia, Arlington County, Fairfax County, Loudoun County, Prince William County and points west, the cities of Fairfax, Falls Church, Manassas, and Manassas Park and the Towns of Vienna and Haymarket. The study corridor is a complex, comprehensive transportation facility that includes general-purpose and high-occupancy vehicle (HOV) highway facilities, heavy rail transit, local and regional bus service, and bicycle and pedestrian facilities.

The study corridor is comprised of the 25-mile section of the I-66 corridor that extends from US 15 in Prince William County east to I-495 (Capital Beltway) in Fairfax County, as shown in **Figure ES-1**. Within the study corridor, I-66 includes eleven general-purpose traffic interchanges and

two HOV-dedicated interchanges. The analysis area for this study extends beyond the study corridor and includes areas adjacent to the study corridor. The analysis area includes I-66, its parallel arterial routes US 50 and US 29, and several key routes serving north-south travel, including US 15, VA 234, VA 28, Fairfax County Parkway, VA 123, and I-495.

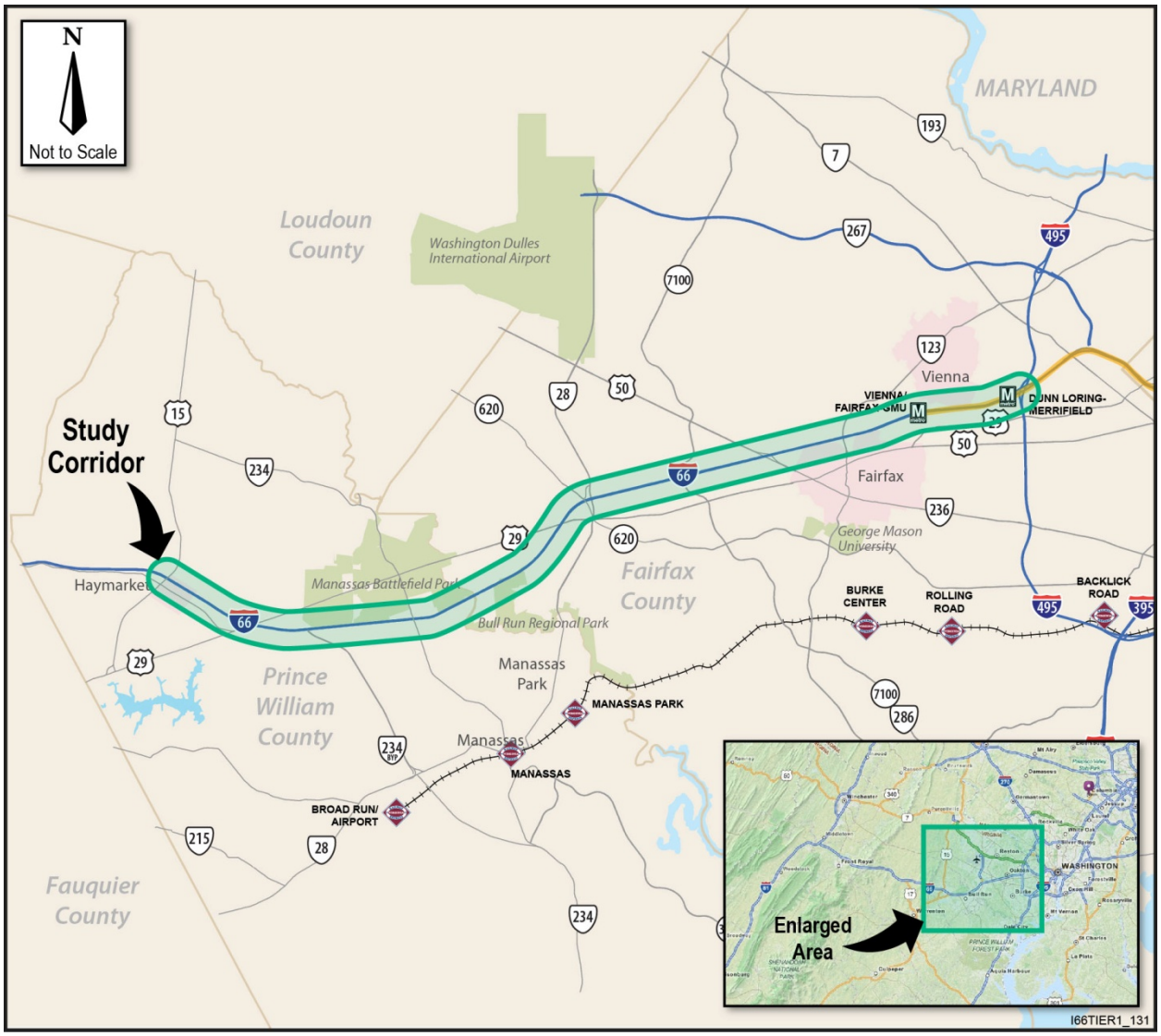

Figure ES-1. Study Corridor

ES.3 PURPOSE AND NEED

The purpose of this Tier 1 EIS is to address existing and future transportation problems on I-66. The study evaluates the effectiveness of both highway and transit improvements in meeting the identified needs. The identified needs to be addressed include: transportation capacity deficiencies, major points of congestion, limited travel mode choices, safety deficiencies, and lack of transportation predictability.

TRANSPORTATION CAPACITY DEFICIENCIES

Travel demands in the corridor, particularly during peak demand periods, exceed the carrying capacity of existing transportation facilities within the corridor. Growth in population and employment in the corridor is expected to further increase travel demand, resulting in a widening differential between demand and capacity.

MAJOR POINTS OF CONGESTION

In addition to the need for increased overall transportation capacity in the I-66 corridor, traffic operations are adversely affected by points of constraint based on either capacity or geometric issues. There are a number of localized constraints (chokepoints) where daily peak period congestion affects both car and bus transit operations.

LIMITED TRAVEL MODE CHOICES

Metrorail service is primarily focused on serving commuter trips to and throughout the region's inner core (Arlington and the District of Columbia) employment areas. Even with the corridor's current transit and commuter bus service, alternatives to single occupant vehicle travel are limited due to lack of connecting facilities/transfer points and largely lack of service and facilities. Transit services for the reverse of the peak direction, and during off-peak times, is much less robust. Existing bus routes in the study corridor are radial in nature and lack north/south routes. Travel choices for bicycling and walking, whether as the primary transportation mode for a trip or as a means to connect to other modes, are lacking within the corridor. Associated with the lack of modal choices are limitations with respect to coordination across the various travel models, limitations on traveler information across these modes, and the need to improve physical linkages between modes and supporting facilities.

SAFETY DEFICIENCIES

The I-66 study corridor in both directions has a lower crash rate, fatality rate, and injury rate than the overall statewide average for urban facilities; however, several key areas within the corridor have high crash rates compared to the I-66 corridor average. In both directions of I-66, the areas around the three eastern interchanges have crash rates of over 100 crashes per hundred million vehicle miles travelled (HMVMT). Also, westbound I-66 within the interchange areas at VA 28 and US 29 has a higher crash rate than the corridor; this is likely due to the high weaving volumes in the short segment between the two interchanges.

LACK OF TRANSPORTATION PREDICTABILITY

While it is difficult to quantify, travelers experience highly unreliable travel times on I-66, particularly during peak periods. With volumes either at or over capacity, events such as a disabled vehicle in the travel lane or on the shoulder, adverse weather conditions and/or glare from sunrises or sunsets, can result in substantial variability in travel time. The lack of predictability for travel in the corridor adversely affects the quality of life for travelers in the corridor and also makes it difficult for travelers to make decisions about when to travel and which mode to take. In addition, it adversely affects both travel times and service predictability for the bus services that make use of the I-66 roadway.

EXISTING AND FUTURE CONDITIONS ALONG I-66

The follow existing conditions within the corridor illustrate the need for improvements:

- Over half of the corridor's peak direction roadway miles operate at a Level of Service (LOS) E or LOS F in the AM peak.
- Nearly two-thirds of the corridor's peak direction roadway miles operate at a LOS E or LOS F in the PM peak.
- Peak period congestion in the eastern portion of the corridor is 4-5 hours per day (in each direction).
- Seven of twenty (one-way) segments within the corridor experience crash rates above the statewide average for urban interstates.
- Nine specific areas of congestion exist along the corridor where geometrics or capacity constraints cause peak period delay.
- There is a lack of traveler information along the corridor that can be used to identify alternate routes and modes.

Future conditions will lead to further deteriorating traffic conditions by 2040 as follows:

- Traffic is expected to grow between 10-66% along the corridor, adversely affecting both vehicular and transit bus operations.
- Employment in the Gainesville-Haymarket area is expected to grow 141%.
- During the AM peak, all of the study corridor segments in the eastbound direction are expected to operate at LOS E or LOS F.
- During the PM peak, over 90% of the study corridor segments in the westbound direction are expected to operate at LOS E or LOS F.
- Peak period congestion in the eastern portion of the corridor is expected to increase to 8-10 hours per day (in each direction), affecting both vehicular operations as well as the reliability of bus transit services.
- Metro's Orange Line demand will exceed the capacity of 120 riders per car.
- Safety concerns are expected to increase as congestion increases and traffic volumes continue to grow, particularly in areas that currently have geometric deficiencies and high weaving volumes between interchanges.
- As volumes increase, the nine specific areas of congestion identified along the corridor where geometrics or capacity constraints cause peak period delay will remain and likely worsen.

ES.4 BUILD IMPROVEMENT CONCEPTS

The Build Improvement Concepts include corridor-length options that are intended to increase capacity within the corridor, as well as options to increase travel mode choices, improve individual interchanges, address spot safety needs, and enhance travel efficiency. The concepts were developed with public and participating agency input.

IMPROVEMENT CONCEPT DEVELOPMENT PROCESS

The term *improvement concept* is used in this document rather than the traditional term *alternative* because the improvements developed for this Tier 1 study are conceptual. Ten Build Improvement Concepts that directly address the needs were identified and considered. These concepts, along with the No-Build, are:

1. **General Purpose Lanes**: Construction of additional highway lanes open to all traffic.
2. **Managed Lanes**: Conversion of the existing HOV lane into either a one- or two-lane (in each direction) facility that would operate as a high-occupancy toll facility where only high-occupant vehicles would be exempt from paying a toll.
3. **Metrorail Extension**: Metrorail service extending west from Vienna to either Centreville or Haymarket.
4. **Light Rail Transit**: Light rail service extending west from Vienna to either Centreville or Haymarket.
5. **Bus Rapid Transit**: Separate guideway bus rapid transit extending west from Vienna to Haymarket; service could extend east of Vienna.
6. **VRE Extension**: Extension of existing VRE service from Manassas to Haymarket.
7. **Improve Spot Locations/Chokepoints**: Improvements that address operational constraints at discrete locations (chokepoints) such as individual interchanges or specific junction points within the interchanges (i.e., merge, diverge, or weaving areas).
8. **Intermodal Connectivity**: Availability of a full range of travel modes within the corridor, as well as availability and functionality of connections between travel modes.
9. **Safety Improvements**: Safety improvements that address both location-specific and corridor-wide safety concerns.
10. **Transportation Communication and Technology**: Continued enhancements to Intelligent Transportation Systems (ITS) technology for all modes in the corridor, including traveler information, corridor and incident management, and transit technology.
11. **No-Build**: The No-Build is a stand-alone concept that serves as the baseline against which the Build Improvement Concepts are measured.

The concept development process for **General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension** are described as capacity improvement concepts. The process of developing these capacity improvement concepts consisted of four steps:

1. Quantify total travel demand in person-trips for each segment of the corridor in the horizon year of 2040.

2. Identify the range of capacity improvement concepts for carrying person-trips in the corridor.
3. Quantify the generalized ability of each improvement concept to carry person-trips in the study corridor.
4. Identify the range of possible improvement concept combinations (i.e., the improvement concept scenarios).

After evaluation of the six capacity improvement concepts revealed that none could meet the needs of the corridor as stand-alone improvement concepts, they were combined into 47 improvement concept scenarios (ICS). The ICSs represent the logically consistent combinations of the capacity-related improvement concepts and were evaluated for their ability to meet the needs in the corridor. Although a Tier 1 decision will be made on advancing an improvement concept(s) and not an ICS, the ICSs aid decision-makers in understanding how the various improvement concepts can work together.

The process for the remaining improvement concepts (i.e., the non-capacity improvement concepts noted as Concepts 7 through 10 above) followed a similar, but less detailed, process of developing and testing concepts to determine the extent of which they address identified needs. This is due to the fact that these concepts focus more on a single mode and/or involve less potential interactions between modes and concepts; additionally, these concepts are generally more geographically focused and/or would involve lesser levels of potential impacts. These concepts can complement the capacity improvement concepts or serve in isolation to address components of the project's purpose and need to varying degrees.

OTHER IMPROVEMENT CONCEPTS ELIMINATED FROM DETAILED STUDY

In addition to those improvement concepts carried forward in this document, other transportation improvement concepts were considered but eliminated from further study. These included the improvement of parallel roadways and system-wide or out-of-corridor improvements to Metrorail (such as Metrorail core capacity improvements). While these concepts may be important to improving mobility across the region, they were not advanced as part of this study because it was determined that they would not directly address the needs within the study corridor across multiple measures, including those related to capacity deficiencies, major points of congestion, and travel time predictability.

In addition, Transportation Demand Management (TDM), which includes a wide range of strategies and policies that seek to reduce the demands on the transportation system by reducing travel by single-occupant vehicle (SOV); reducing peak period travel; promoting travel by transit, walking, or bicycling; and promoting more transportation-efficient land development patterns, has been eliminated as a stand-alone concept because of its inability to meet the purpose and need. TDM strategies were, however, incorporated into the improvement concepts that were carried forward.

ANALYSIS OF BUILD IMPROVEMENT CONCEPTS

The ten Build Improvement Concepts address the identified needs to varying degrees. **Table ES-1** summarizes the ability of each improvement concept to meet the purpose and need.

Based on the improvement concept analysis it was determined that:

- None of the Build Improvement Concepts, as stand-alone concepts, fully satisfy the purpose and need.
- The project peak travel demands in the corridor highlight the need for a transportation solution that provides space efficiency – the ability to carry a large number of persons within limited spaces.
- Fully meeting demand with single-mode improvements is unlikely given the constraints within the corridor; multi-modal solutions would be more practicable in addressing transportation needs in the corridor.
- The non-capacity improvement concepts partially address the purpose and need and could advance independently of the capacity improvement concepts.
- The No-Build Concept does not satisfy the purpose and need.

All ten improvement concepts, as well as the No-Build, are evaluated in the Tier 1 Draft EIS.

Table ES-1. Evaluation of Improvement Concepts Against Purpose and Need Elements

BUILD IMPROVEMENT CONCEPT	EXISTING AND FUTURE CAPACITY DEFICIENCIES	IMPROVE SPOT LOCATIONS/ CHOKEPOINTS	LIMITED MODE CHOICES	SAFETY DEFICIENCIES	UNPREDICTABLE TRAVEL TIMES
General Purpose Lanes	🟡[1]	🟡	🔴	🟡	🟡
Managed Lanes	🟡	🟡	🟡	🟡	🟡
Metrorail Extension	🟡	🔴	🟢	🔴	🟡
Light Rail Transit	🟡	🔴	🟢	🔴	🟡
Bus Rapid Transit	🟡	🔴	🟢	🔴	🟡
VRE Extension	🟡	🔴	🟢	🔴	🟡
Improve Spot Locations/Chokepoints	🟡	🟢	🔴	🟢	🟢
Intermodal Connectivity	🟡	🟡	🟢	🔴	🟢
Safety Improvements	🟡	🟡	🔴	🟢	🟢
Communication and Technology	🟡	🟡	🟡	🟢	🟢
No-Build	🔴	🔴	🔴	🔴	🔴

Meets Purpose and Need? 🟢 = *Yes* 🟡 = *Partially* 🔴 = *No*

Notes: [1]Fully meeting purpose and need would require a total of 18 lanes for higher volume portions of the I-66 study corridor. The "partial" rating shown here reflects the fact that such a roadway width is impractical and not reasonable.

ES.5 ENVIRONMENTAL CONSEQUENCES

The potential impacts of the ten Build Improvement Concepts and the No-Build Concept on the existing conditions and resources within the human and natural environments of the study area were analyzed at a level of detail appropriate for a Tier 1 EIS and the decisions to be made in Tier 1.

APPROACH

The impact analysis:

- **Uses information at a level of detail available at this stage of the process**: The overall transportation improvement development process recognizes that details such as specific footprints and operational details would be developed as part of Tier 2.
- **Focuses on the individual improvement concepts rather than combinations of improvements**: Unless the No-Build is selected, a Tier 1 decision would advance one or more of the improvement concepts. If multiple improvement concepts are advanced to Tier 2, additional studies would be performed to address in detail the specific interfaces between the specific projects.
- **Supports Tier 1 decision-making by focusing on the comparative impacts of various multi-modal capacity, operational, and safety improvements**: The intent of the impact analysis is to provide decision-makers with information to assist in understanding the potential impacts of each individual improvement concept on the natural and built environment.

PROCESS

For purposes of estimating potential impacts, the ten Build Improvement Concepts were grouped into four categories (referred to as "templates") based on the space requirements for implementation. The description and generalized footprint width for each template are shown in the **Table ES-2**. The **Safety Improvements**, **Intermodal Connectivity**, and **Transportation Communication and Technology Improvement** concepts are anticipated to have limited need for additional rights-of-way.

POTENTIAL IMPACTS

Based on the templates, the analysis of the potential impacts of the improvement concepts on the human and natural environments are summarized below. **Table ES-3** summarizes the potential quantitative impacts and **Table ES-4** summarizes the potential qualitative impacts. The No-Build would not require any additional right-of-way and would have no impact on the resources below with the exception of air quality and energy which would be affected by continued traffic congestion. The No-Build would not be consistent with local land use plans.

Table ES-2. Improvement Concept Widths and Description

TEMPLATE	FOOTPRINT WIDTH	DESCRIPTION
Median	235 feet	Space within the median would be used by **Metrorail Extension**, **Light Rail Transit**, or **Bus Rapid Transit**.
Outside		Space to the outside of existing highway would be used for either **General Purpose Lanes** or **Managed Lanes**. Widths for three possibilities of Outside widening are considered as part of the impact analysis.
Add one lane in each direction (either general purpose or managed lane)[1]	270 feet	
Add two lanes in each direction (either general purpose or managed lanes)[2]	295 feet	
Add 5 lanes in each direction (general purpose lanes)[3,4]	355 feet	
Interchange	Existing footprint plus 100 feet within the study area	**Improve Spot Locations/Chokepoints** would require space within or immediately adjacent to the existing interchange.
VRE	100 feet	Requirements for rights-of-way for the **VRE Extension** would generally be located approximately 5 miles from the I-66 corridor.

Notes: The estimated footprint widths shown are planning level and would be further refined during Tier 2 analyses. The Outside templates are indicated as: [1] *Outside Minimum;* [2] *Outside Medium;* [3] *Outside Maximum.* [4] Five lanes were chosen to represent a likely maximum upper limit. It was not intended to be a fixed number based on a desirable number of lanes.

Table ES-3. Quantitative Summary of Potential Impacts from Build Improvement Concepts

RESOURCE	SUMMARY OF POTENTIAL IMPACTS - QUANTITATIVE FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Approximate template width:	235 feet	270 feet	295 feet	355 feet	Existing plus 100 feet	100 feet
Social and Economic:						
Residential Relocations[1]	0	1	4	36	14	1
Community Facility Impacts	2	10	10	10	2	4
Business Relocations	0	0	0	4	5	6
Relocations within Minority Census Tracts	0	0	1	14	5	0
Relocations within Low-Income Census Tracts	0	0	0	0	0	0
Relocations within Limited English Proficiency Census Tracts	0	0	1	8	4	0
Farmlands *(acres)*	6.5	10.1	13.2	22.4	16.1	<0.1
Public Parks, Recreation Areas, and Open Space Easements[2] *(acres)*	0.9	6.6	12.2	21.2	0.7	0
Historic Properties[3]:						
Architectural Sites	3	3	3	3	1	1
Archaeological Sites	0	1	1	2	2	0
Potential Impacts to Section 4(f) Properties	21.2	32.6	43.5	62.9	41.5	19.5

RESOURCE	SUMMARY OF POTENTIAL IMPACTS - QUANTITATIVE FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Hazardous Material Sites[4]	1	2	2	5	1	4
Wetlands[5] *(acres)*	3.6	6.8	9.6	17.4	9.4	7.2
Streams *(linear feet)*	5,172	6,354	7,636	9,703	5,634	1,048
Floodplains *(100-yr floodplain, acres)*	22.0	28.3	33.2	45.4	15.4	13.5
Natural Heritage Sites[6] *(acres)*	152.8	175.0	190.9	228.7	164.8	14.5

Notes:

1: Includes single family and multi-family structures.

2: There are no open space easements located within the study area. Acreage includes potential impacts to two federal, state, and regional parks, and five local public parks and recreation areas. However, given the nature of Manassas National Battlefield Park as a federally owned national park, it is very likely that direct impacts to the Park will be avoided.

3: Includes direct potential impacts to resources that are either listed, eligible, or potentially eligible for listing in the NRHP.

4: Includes CERCLIS Sites (none); VRP Sites (none); Unidentified HAZMAT Sites (none); and Solid Waste Facilities (1). All other identified sites are Petroleum Release Sites.

5: Includes wetland types: Palustrine Forested; Palustrine Scrub Shrub; and Palustrine Emergent.

6: Acreage includes potential impacts to five natural heritage locations within the study area.

Table ES-4. Qualitative Summary of Potential Impacts from Build Improvement Concepts

RESOURCE	SUMMARY OF POTENTIAL IMPACTS - QUALITATIVE FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)
Land Use	The Build Improvement Concepts are generally consistent with local comprehensive plan objectives which identify the need to improve transportation facilities along the I-66 corridor to reduce congestion and air pollution. The transit improvement concepts (i.e., **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit,** and **VRE Extension**), and **Managed Lanes** improvement concepts within the I-66 corridor are compatible with transportation policies of local jurisdictions located along the corridor, because these policies cite the need to move large numbers of people within relatively confined spaces. The **VRE Extension** concept is consistent with the City of Manassas Comprehensive Plan, which seeks to expand the service and promote infill and transit-oriented development. The **Safety Improvements** and **Transportation Communication and Technology** improvement concepts would further contribute to local transportation objectives of reducing congestion by lowering crash rates and providing tools to inform drivers of traffic flow problems.
Air Quality	The additional highway lanes associated with the **General Purpose Lanes** and **Managed Lanes** improvement concepts would improve traffic flow and increase vehicle speeds, thereby reducing vehicle idling and stop-and-start driving conditions that are associated with higher levels of air emissions. However, an increase in vehicles speeds may have different effects for different pollutants, depending on the rate of speed. The **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension** improvement concepts all would reduce the number of vehicles on the roadway resulting in lower air emissions. **Spot Locations/Chokepoints** improvements would allow traffic to flow more efficiently and generally result in lower air emissions compared to the existing conditions. Demonstration of conformity with the State Implementation Plan in accordance with the Clean Air Act will occur during Tier 2 when individual projects are analyzed.
Noise	An initial inventory of noise-sensitive and vibration-sensitive buildings and activity areas adjacent to the study areas was completed. Detailed noise modeling, quantification of potential impacts from individual projects, and identification of appropriate abatement measures will be conducted during Tier 2. The noise analyses for the I-66 corridor would be performed in accordance with FHWA 23 CFR 772 and VDOT noise policy. For the VRE Extension corridor, rail sources are the dominant component to the noise and vibration environment and therefore the noise and vibration analyses for the VRE corridor would be conducted according to FTA criteria.

RESOURCE	SUMMARY OF POTENTIAL IMPACTS - QUALITATIVE FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)
Visual Quality	The transit improvement concepts (i.e., **Metrorail Extension**, **Light Rail Transit**, or **Bus Rapid Transit**) would introduce a new visual element that suggests a more urban environment. Widening of the roadway as part of the capacity improvement concepts (i.e., **General Purpose Lanes** and **Managed Lanes**) as well as the **Spot Locations/Chokepoints** improvement concept would potentially impact views of parkland and farmland through the conversion of open space to a more expansive transportation facility. The intensity of potential impacts would be greatest for the Outside Maximum template.
Water Quality	The I-66 corridor crosses four impaired water bodies as identified in the303(d) VDEQ 2010 list. The Build Improvement Concepts have the potential to increase stormwater runoff velocities and roadway contaminants received by these impaired water bodies, and other water resources in the study area. To minimize these potential impacts, appropriate erosion and sediment control practices would be implemented for the individual Tier 2 projects, if a build improvement concept is advanced, in accordance with the Virginia Erosion and Sediment Control Regulations, the Virginia Stormwater Management Law and regulations, and VDOT's Road and Bridge Specifications. More detailed analyses of water quality impacts and necessary stormwater management controls would be conducted for the individual Tier 2 projects when additional design details would be available.
Coastal Zone Management Areas	The entire study area is located within the Coastal Zone. The Build Improvement Concepts would be constructed to be consistent with the established Virginia Coastal Zone Enforceable Policies; and with implementation of mitigation measures, the Build Improvement Concepts would not impair resources protected by the Virginia Coastal Zone Enforceable Policies, including wetlands, dunes, and aquatic animals.
Wild and Scenic Rivers	There are no designated Wild and Scenic Rivers located within the study area. One stream is listed in the National Rivers Inventory and as a potential component of the state Scenic River Inventory; however, as the proposed crossing of the river would be at the existing crossing location, the scenic nature of the river would not be substantially altered.
Wildlife Habitat	While there are some natural lands adjacent to I-66, the Build Improvement Concepts would only potentially affect small amounts of these natural habitats. No substantial fragmentation or disruption of large habitat areas or potential movement corridors would occur because potential impacts would take place along existing facilities. Therefore, the effects of the Build Improvement Concepts should not be substantial.
Threatened and Endangered Species	Based on the habitat model used in the USFWS Information Planning and Conservation (IPAC) online review, potential habitat may exist within the templates for two federally listed plants and one-federally listed mollusk. Correspondence with the VDGIF indicates suitable habitat may occur for two state-listed species. According to the VDGIF Species Observation Database (SppObs), no known occurrences of federal or state listed wildlife species would be impacted by any Build Improvement Concepts based on the templates.
Invasive Species	While highway right-of-way is vulnerable to colonization by invasive plant species from adjacent properties, implementation of the provisions of VDOT's Road and Bridge Specifications would reduce the potential for the establishment and proliferation of invasive species within the study area.
Energy	The capacity improvement concepts range in their rate of energy consumption with average British Thermal Units (BTUs) per passenger mile ranging from 2520 to 4118 for the various modes. The rate of energy consumption for the **Spot Locations/Chokepoints**, **Safety Improvements**, **Intermodal Connectivity**, and **Transportation Communication and Technology** improvement concepts cannot be computed at the passenger mile level, however these concepts are likely to have minimal energy expenditures.

ES.6 TIER 1 DECISIONS

A Memorandum of Agreement (MOA) established in June 2011 between VDOT, FHWA, DPRT, and FTA outlines the roles of each agency during the Tier 1 NEPA process and the decisions to be made following completion of the Tier 1 study (See Appendix A). Per the agreement, VDOT, VDRPT, and FHWA are joint Lead Agencies for the Tier 1 EIS pursuant to 23 USC 139(c); while

FTA is a Cooperating Agency and may therefore adopt the Tier 1 EIS. Different Lead Agencies may be identified during subsequent Tier 2 NEPA studies.

Per the MOA, decisions on the following will be made upon completion of the Tier 1 study:

- The concepts to be advanced for the I-66 corridor, including transit improvements, transportation demand management strategies, and/or roadway improvements. Within these concepts, consideration will be given to managed lanes and tolling;
- The general location for studying future highway and transit improvements in Tier 2 NEPA document(s);
- Identification of projects with independent utility to be evaluated in Tier 2 NEPA document(s) and evaluated pursuant to other environmental laws; and
- Advancing tolling for subsequent study in Tier 2 NEPA document(s).

Per the MOA, the following decisions will not be made until after the completion of the Tier 2 NEPA document(s):

- Approval of final design;
- Authority to utilize federal funds to acquire right-of-way;
- Authority to utilize federal funds for construction;
- Approval to modify access to Interstate 66; and
- Approval for FTA New Starts.

ES.7 AGENCY COORDINATION AND PUBLIC PARTICIPATION PROCESS

PUBLIC OUTREACH

An extensive public involvement program is being implemented to ensure that concerned citizens, interest groups, civic organizations, and businesses were provided adequate opportunities to express their views throughout the NEPA process for the Tier 1 EIS.

Various communication media, including newsletters, brochures, questionnaires, informational videos, a project website, and public meetings are being used to provide information about the project and gather input from citizens and other interested parties. A mailing list of interested citizens and local, state, and federal agency representatives and elected officials was created at the beginning of the study; this was used to distribute periodic study updates, as well as announcements of upcoming public meetings and project newsletters.

Three project newsletters were prepared during the course of the Tier 1 Draft EIS study to keep interested parties informed about its status and progress. Information is available on the study website at www.helpfix66.com. Efforts were made throughout the study to engage the media and local transportation stakeholders in helping to build awareness of the study with residents. Individual citizens contacting VDOT about the project were referred to the project website for further information and encouraged to subscribe to project updates as well as participate in public meetings.

SCOPING

The study team has coordinated extensively with local, state, and federal agencies on the I-66 Tier 1 EIS study in accordance with 40 CFR 1501.7. FHWA published a Notice of Intent in the Federal Register on April 18, 2011 to announce its intent to prepare this Tier 1 EIS.

Representatives from federal, state, regional, and local agencies were invited to participate in the scoping process through attendance at a scoping meeting and/or by providing comments and suggestions in writing to the study team. Fourteen agencies participated in the June 7, 2011 scoping meeting that was held at the VDOT Northern District Office in Fairfax.

A total of four public scoping/citizen information meetings were held in Fairfax and Prince William counties in June 2011 and January/February 2012. The purpose of the meetings was to obtain public input on the transportation problems and needs in the corridor, identify options to address those needs, and gain input on any key environmental considerations in the corridor.

AGENCY COORDINATION

Coordination with various federal, state, and local agencies on the scope of this EIS began early and continued throughout the study. Three federal agencies are serving as Cooperating Agencies for this Tier 1 EIS study: Army Corps of Engineers, Environmental Protection Agency, and FTA.

Of the twenty-three federal, regional, state or local agencies that were invited to be Participating Agencies for this study, fourteen accepted the invitation. Meetings were held with the Cooperating and Participating Agencies on November 29, 2011; March 19, 2012; and May 31, 2012.

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ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
ADT	Average Daily Traffic
APE	Area of Potential Effects
ATMS	Advanced Transportation Management Systems
BMP	Best Management Practice
BRT	Bus Rapid Transit
BTU	British Thermal Unit
CAA	Clean Air Act of 1970
CAAA	1990 Clean Air Act Amendments
CBPA	Chesapeake Bay Protection Act
CD	Collector-Distributor
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CE	Categorical Exclusion
CLRP	Constrained Long Range Plan
CNE	Common Noise Environment
CO	Carbon Monoxide
CRMP	Virginia Coastal Resources Management Program
CTB	Commonwealth Transportation Board
CUE	City-University-Enegysaver (Fairfax City Bus)

CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
dBA	Decibels (on an A-weighted scale)
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
EDR	Environmental Data Resources
FAQ	Frequently Asked Question
FCPA	Fairfax County Park Authority
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FFPA	Farmland Protection Policy Act
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Maps
FONSI	Finding of No Significant Impact
FTA	Federal Transit Administration
GIS	Geographic Information System
GP	General Purpose Lane
HCM	Highway Capacity Manual
HMVMT	Hundred Million Vehicle Miles Travelled
HOT	High Occupancy Toll

HOV	High Occupancy Vehicle
HUC	Hydrologic Unit Code
I-66	Interstate 66
ICM	Integrated Corridor Management
ICS	Improvement Concept Scenario
ITS	Intelligent Transportation System
JPA	Joint Permit Application
Ldn	Day-Night Average Sound Levels
LEP	Limited English Proficiency
Leq	Equivalent Sound Level
LID	Low Impact Development
LOS	Level of Service
LOV	Low Occupancy Vehicle
LRT	Light Rail Transit
LWCF	Land and Water Conservation Fund
MIS	Major Investment Study
ML	Managed Lane
MOA	Memorandum of Agreement
mph	Miles per Hour
MPO	Metropolitan Planning Organization
MSAT	Mobile Source Air Toxics
msl	Mean Sea Level
MUTCD	Manual on Uniform Traffic Control
MWCOG	Metropolitan Washington Council of Governments
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act

NHPA	National Historic Preservation Act
NHR	Natural Heritage Resources
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOx	Nitrogen Oxides
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NVRC	Northern Virginia Regional Commission
NVRPA	Northern Virginia Regional Park Authority
NVTA	Northern Virginia Transportation Authority
NVTC	Northern Virginia Transportation Commission
NWI	National Wetlands Inventory
O_3	Ozone
O/D	Origin/Destination
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns
PM_{10}	Particulate matter less than or equal to 10 microns
ppm	Parts per Million
PPTA	Public-Private Transportation Act
PRTC	Potomac and Rappahanock Transportation Commission
PWCPA	Prince William County Park Authority
RCRA	Resource Conservation and Recovery Act
RMA	Resource Management Area
RPA	Resource Protection Area
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Act: A Legacy for Users

SDWA	Safe Drinking Water Act
sf	Square Feet
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SIU	Sections of Independent Utility
SHPO	State Historic Preservation Office
SOV	Single-Occupant Vehicle
SO_x	Sulfur Oxides
TAZ	Traffic Analysis Zone
TDM	Transportation Demand Management
TIP	Transportation Improvement Program
TMDL	Total Maximum Daily Load
TNM	FHWA Traffic Noise Model
TNMLOOK	FHWA-TNM lookup program
TOD	Transit Oriented Development
TPB	Transportation Planning Board
TSM	Transportation System Management
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
V/C	Volume to Capacity
VDACS	Virginia Department of Agriculture and Consumer Services
VdB	Vibration Decibel
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality

VDF	Virginia Department of Forestry
VDGIF	Virginia Department of Game and Inland Fisheries
VDHR	Virginia Department of Historic Resource
VDRPT	Virginia Department of Rail and Public Transportation
VDOT	Virginia Department of Transportation
VIMS	Virginia Institute of Marine Science
VLR	Virginia Landmarks Register
VMRC	Virginia Marine Resource Commission
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
VOF	Virginia Outdoors Foundation
vpd	Vehicles per Day
VRE	Virginia Railway Express
VRP	Voluntary Remediation Program
W&OD	Washington & Old Dominion
WMATA	Washington Metropolitan Area Transit Authority
WOUS	Waters of the United States

GLOSSARY OF COMMONLY USED TERMS

Alluvial Communities: Habitat of variable vegetation type that has developed in an area with a stream and a well-developed floodplain. The terms "alluvial" and "riparian" are synonymous, and imply overbank flooding events.

Attainment: A condition where a pollutant conforms to or shows levels at or below one or more of the National Ambient Air Quality Standards.

Benthic: Located on the bottom of a body of water or in the bottom sediments, or pertaining to bottom-dwelling organisms.

Best Management Practices (BMPs): Various methods of minimizing the impacts of change in land use on surface and groundwater systems.

Biochemical Oxygen Demand (BOD): The quantity of oxygen used by a mixed population of microorganisms in the oxidation of organic matter.

Biodiversity: The variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur.

Biotic Integrity: Condition of the living things in the natural community.

Bottleneck: A section of roadway where traffic flow is constricted, for example, at ramp merges/diverges, weaving areas, lane drops, and incidents.

Capacity: The maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform segment of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions. Expressed as vehicles per hour or persons per hour. The theoretical capacity of a single freeway lane is 2,200 vehicles per hour.

Carbon Monoxide (CO): A colorless, odorless, poisonous gas that is formed as a product of the incomplete combustion of carbon and is emitted directly by automobiles and trucks.

Code of Federal Regulations (CFR): A compilation of the general and permanent rules of the executive departments and agencies of the federal government as published in the Federal Register. The code is divided into 50 titles that represent broad areas subject to federal regulation.

Collector Distributor (CD) Road: Roadways that parallel the interstate and provide access/egress at multiple cross roads, while eliminating off-ramp and on-ramp movements along the mainline of the interstate, thereby improving traffic flow.

Community Cohesion: The connections between and within communities that are essential for serving the needs of the residents.

Concept: General term that refers to possible approaches to meeting the transportation deficiencies identified in the purpose and need statement.

Congestion: Traffic flow, which is influenced by the affects of a bottleneck. In this type of flow, speeds may range from 10 to 45 mph on the freeway, with periods of stop-and-go traffic and queuing.

Congestion (Moderate): Average speeds between 20 and 45 mph.

Congestion (Severe): Average speeds below 20 mph.

Corridor: A broad geographical band that follows a general directional flow connecting major sources of trips that may contain a number of streets, highways and transit route alignments.

Criteria Pollutants: Pollutants for which National Ambient Air Quality Standards (NAAQS) have been adopted. All other air pollutants are considered non-criteria pollutants.

Cumulative Effects: The incremental consequences of a proposed action in addition to other past and reasonably foreseeable future actions that affect the same resources. Other actions in the project area include other highway projects and residential, commercial, and institutional development.

Delay: Additional travel time experienced by a person or vehicle beyond what would be reasonable for a given trip.

Demand: The traffic volume expected to desire service past a point or segment of the highway system, or the traffic currently arriving or desiring service past such a point, usually expressed as vehicles per hour.

Diurnal: The typical 24-hour travel pattern on a particular roadway, usually expressed ion vehicles per hour.

Emissions Budget: The part of the State Implementation Plan (SIP) that identifies the allowable emissions levels, mandated by the National Ambient Air Quality Standards (NAAQS), for certain pollutants emitted from mobile, stationary, and area sources. The emissions levels are used for meeting emission reduction milestones, attainment, or maintenance demonstrations.

Environmental Justice: Presidential Executive Order 12898 requires federal agencies to ensure that their actions (or actions they oversee) do not disproportionately discriminate against (impact) minority populations and low-income populations

Eutrophication: The process by which lakes gradually age and become more productive. It normally takes thousands of years to progress. However, humans, through their various cultural activities, have greatly accelerated this process in many lakes. Cultural or anthropogenic "eutrophication" is water pollution caused by excessive plant nutrients.

Fauna: Animals characteristic of a region, period, or special environment.

Floodplain: The portion of a river or stream valley, adjacent to the channel, that is covered with water when the river or stream overflows its banks at flood stage.

Floodway: A large-capacity channel constructed to divert floodwaters safely through or around population areas.

Free-flow: Traffic flow which is unaffected by upstream or downstream conditions. This flow is generally defined within a speed range of 45 to 65 mph at high flow rates.

Groundwater: Naturally-occurring water that moves through the ground and underlying rock, at a depth of several feet to several hundred feet.

Hazardous Material: Any toxic substance or explosive, corrosive, combustible, poisonous, or radioactive material that poses a risk to the public's health, safety, or property, particularly when transported in commerce.

High Occupancy Vehicle Lanes (HOV): Designated travel lanes which require two or more occupants per vehicle. Future regional plans anticipate occupancy requirement to be three (HOV-3^{+}).

High Occupancy Toll Lanes (HOT): Designated travel lanes which are utilized by high occupancy vehicles, buses, and tolled vehicles carrying less than noted high occupancy levels.

Independent Utility: A project is said to have independent utility if it will provide functional improvements that can stand alone and serve a major purpose, even if no other improvements are made in the region.

Indirect Effects: Impacts on the environment resulting from the primary impact of the proposed action but occurring later in time or farther removed in distance, although still reasonably foreseeable.

Intelligent Transportation Systems (ITS): The application of advanced technologies to improve the efficiency and safety of transportation systems.

Intermodal Relationships: Relationships between transportation modes. An example of a mode is bus mass transit.

Invasive Species: A plant, animal, or other organism (1) that is non-native (or alien) to the ecosystem under consideration and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Isolated Wetlands: Non-jurisdictional wetlands. Wetlands that are not subject to Clean Water Act regulation.

Jurisdictional Determination: A written statement issued by the COE that identifies areas within a discrete project area that are subject to Clean Water Act regulation.

Jurisdictional Wetlands: Wetlands that are subject to Clean Water Act regulation.

L_{eq}: The equivalent sound level, containing the same amount of sound energy as the varying sound level measured over a specified time period.

Lane Balance: For smooth and efficient operation through an interchange, there should be a balance between the number of lanes on the highway and the ramps.

Lane Configuration: Layout of lanes, including the number of lanes and type of traffic allowed to use each lane.

Lane Continuity: Maintenance of a basic number of lanes on a roadway, which is essential for uniformity in service.

Level of Service (LOS): Operating conditions within a stream of traffic describing safety, traffic interruptions, speed, freedom to maneuver, comfort and convenience. Six levels of service are defined, designated A through F, with A representing the best conditions and F the worst.

Link: Traffic term referring to one portion of a longer trip in the transportation system.

Logical Termini: Rational endpoints for consideration of transportation improvements and for review of environmental impacts.

Long Range Transportation Plan (LRTP): A document resulting from regional or statewide collaboration and consensus on a region or state's transportation system, and serving as the defining vision for the region's or state's transportation systems and services. In metropolitan areas, the plan indicates all of the transportation improvements scheduled for funding over the next 20 years.

Low-Income Population: A low-income-household is one where the median household income is below the Department of Health and Human Services poverty guidelines.

Measure of Effectiveness (MOE): Parameters describing the quality of service provided by a traffic facility, for example speed and delay.

Minority Individuals: Members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black (not of Hispanic origin), and Hispanic.

Mobile Source: 1) The mobile source-related pollutants are carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), and particulate matter (PM10 and PM2.5). 2) Mobile sources include motor vehicles, aircraft, seagoing vessels, and other transportation modes. The mobile source related pollutants are carbon monoxide (CO), hydrocarbons (HC) or volatile organic compounds (VOCs), nitrogen oxides (NOx), and small particulate matter (PM10).

National Ambient Air Quality Standards (NAAQS): Federal standards that set allowable concentrations and exposure limits for various pollutants. The EPA developed the standards in response to a requirement of the CAA. Air quality standards have been established for the following six criteria pollutants: ozone (or smog), carbon monoxide, particulate matter, nitrogen dioxide, lead, and sulfur dioxide.

National Environmental Policy Act of 1969 (NEPA): Established a national environmental policy requiring that any project using federal funding or requiring federal approval, including

transportation projects, examine the effects of proposed and alternative choices on the environment before a federal decision is made.

National Priority List (NPL): Also known as the United States Environmental Protection Agency's (EPA's) Superfund program. The National Priorities List is a comprehensive list of the sites/facilities that have been evaluated using the Hazard Ranking System and have been found to pose a sufficient threat to human health and/or the environment to warrant cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). EPA is responsible for updating and maintaining the NPL.

Noise Abatement Criteria: In accordance with Section 772 of the Federal Aid Policy Guide, the Federal Highway Administration has established noise standards. These standards include Noise Abatement Criteria, which are noise levels that represent a balancing of desired levels of noise with achievable levels.

Non-attainment: A condition where one or more of the National Ambient Air Quality Standards for a pollutant have been violated.

Notice of Intent (NOI): The CEQ regulations and Title 23, Code of Federal Regulations, Part 771, Environmental Impact and Related Procedures, require the sponsoring agency to publish a notice of intent in the Federal Register as soon as practicable after the decision is made to prepare an environmental impact statement and before the scoping process for a proposed action.

Ozone: Unstable blue gas with a pungent odor, formed principally in secondary reactions involving volatile organic compounds, nitrogen oxides, and sunlight.

Palustrine, Emergent Wetlands (PEM): Wetlands characterized by erect, herbaceous vegetation present for most of the growing season (e.g., marshes, wet meadows, fens, sloughs, or potholes).

Palustrine, Forested Wetlands (PFO): Wetlands characterized by woody vegetation over 6 meters (20 feet) in height (e.g., swamps or bottomlands).

Palustrine, Scrub-Shrub Wetlands (PSS): Wetlands characterized by the dominance of small trees, saplings and shrubs. These wetlands generally have higher value than emergent systems, but not as much as forested systems.

Physiographic Province: A region that is generally consistent in geologic structure and climate and which has had a unified geomorphic history.

Resource Management Areas: As designated by Fairfax County and Prince William Counties, these areas include floodplains, highly erodible soils, steep slopes, highly permeable soils, and non-tidal wetlands not designated in RPA zones.

Resource Protection Areas (RPAs): Lands at or near the shoreline that have intrinsic water quality value for ecological and biological processes, or are sensitive to significant water quality degradation impacts. The RPA designation includes tidal wetlands, tidal shores, non-tidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams, and

a minimum 100-foot (30.5-meter) buffer landward along both sides of any tributary stream and all other components of RPAs.

Riparian: Pertaining to anything connected with or immediately adjacent to the banks of a stream.

Screenline: A line drawn to cross two or more parallel roadways to determine the total traffic that is traveling in a specific direction. For example, a horizontal line may be drawn to cross two or more north-south roadways to determine the volume of traffic traveling northbound or southbound in that corridor.

Slip ramp: A ramp between two parallel roadways traveling in the same direction (as in an express/local roadway system) which allow vehicles to move between the two facilities.

State Implementation Plan (SIP): Produced by the state environmental agency, not the MPO. A plan mandated by the CAA that contains procedures to monitor, control, maintain, and enforce compliance with the NAAQS. Must be taken into account in the transportation planning process.

Throughput: The number of vehicles or persons that traverse past a point or uniform segment of a lane or roadway during a specified time period, usually expressed as vehicles or persons per hour.

Through trip: A trip which has an origin and destination outside of a specified area.

Transportation Demand Management (TDM): Programs designed to reduce demand for transportation through various means, such as the use of transit and alternative work hours.

Transportation Improvement Program (TIP): A document prepared by a metropolitan planning organization that lists projects to be funded with FHWA/FTA funds for the next one- to three-year period.

Travel demand forecast: A forecast for travel demand on future or modified transportation system alternatives using existing or projected land use, socioeconomic, and transportation services data.

Upstream: Direction from which traffic is arriving at a location. When a vehicle is upstream of a bottleneck, it means that the vehicle is traveling toward the bottleneck and has yet to reach it.

Volume to capacity ratio (v/c): The ratio of demand flow rate to capacity for a freeway facility.

Watershed: A specific geographic area drained by a major stream or river.

Wetlands: Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

1 INTRODUCTION AND NATIONAL ENVIRONMENTAL POLICY ACT TIERING PROCESS

This Tier 1 Draft Environmental Impact Statement (EIS) for the Interstate-66 (I-66) corridor from US 15 in Prince William County to I-495 in Fairfax County has been prepared in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA) through a joint effort by the Federal Highway Administration (FHWA), the Virginia Department of Transportation (VDOT), and the Virginia Department of Rail and Public Transportation (VDRPT). This Tier 1 study was designed to aid in the development of a long-term vision for the I-66 corridor from US 15 to I-495 (Capital Beltway) that takes into account corridor-wide multimodal concepts and assists in making informed decisions about the best program of near-term and long-term transportation improvements. This corridor-level conceptual study provides the opportunity for transportation agencies to work together to address issues that are currently ripe for decision making and to preserve a long-term vision while allowing on-going improvements to continue.

As a Tier 1 level document, this Draft EIS represents the first step within a tiered approach to NEPA analyses as presented in the Council on Environmental Quality's (CEQ's*) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR 1500 – 1508), and in FHWA's and FTA's *Environmental Impact and Related Procedures* (23 CFR 771) and *Linking the Transportation Planning and NEPA Processes* (Appendix A to 23 CFR 450; Question and Answer #9). Tiering under NEPA involves the evaluation of broad level programs and issues in an initial (Tier 1) analysis followed by more detailed evaluation of specific improvements in subsequent (Tier 2) analyses.

A description of the scope of analysis and decisions to be made in association with this Tier 1 Draft EIS is provided below. Analyses and decisions anticipated during subsequent Tier 2 NEPA documentation are also discussed to outline the process by which preferred programs of improvements identified in this Tier 1 EIS would be implemented.

1.1 SCOPE OF THIS TIER 1 DRAFT EIS

This Tier 1 Draft EIS defines existing and future transportation conditions and needs within the study corridor, identifies a range of transportation improvement concepts that would serve those needs, and evaluates the potential effects of these concepts on the natural and human environment. The "Build" concepts in this Tier 1 study are based on a systems level analysis that focuses on broad issues such as purpose and need, travel modes, technology choices, and general location of improvements.

The evaluation of potential environmental effects of the "Build" concepts within this Tier 1 Draft EIS has been performed at a qualitative level of analysis commensurate with the conceptual nature of the improvements and the program-level decisions to be made. For

example, the inventory of sensitive resources within the human and natural environment is based on a broad-level identification of features using Geographic Information Systems (GIS) data and other readily available databases, agency scoping and coordination activities, and reconnaissance-level field review. Similarly, avoidance and minimization measures provided to address potentially adverse effects outline general standard practices rather than precise prescriptions for site-specific impacts. This level of analysis is commensurate with the decisions being made and is at an appropriate level of detail to allow a comparison of the relative differences in the improvement concepts.

1.2 RELATIONSHIP BETWEEN TIER 1 AND TIER 2 NEPA EVALUATIONS

This Tier 1 Draft EIS lays the groundwork for subsequent Tier 2 studies by identifying "Build" concepts to be advanced for further study and analysis. During Tier 2 studies, these "Build" concepts will be further developed into individual independent projects with more detailed locations and design features. The environmental effects of each individual project will be evaluated within a subsequent Tier 2 NEPA document prior to final design and construction. Tier 2 NEPA documents will include site-specific quantitative analyses of effects and provide avoidance, minimization, and mitigation measures tailored for each project. Similarly, adherence to other applicable environmental laws and regulations relative to the "Build" concepts will be conducted during or following Tier 2 NEPA analyses to provide the site-specific level of design, impacts, and avoidance, minimization and mitigation measures required for approvals.

1.3 TIER 1 AND TIER 2 DECISIONS

A Memorandum of Agreement (MOA) established in June 2011 between FHWA, VDOT, VDPRT, and FTA outlines the roles of each agency during the Tier 1 NEPA process and the decisions to be made following completion of the Tier 1 study (See **Appendix A**). Per the agreement, FHWA, VDOT, and VDRPT are joint Lead Agencies for the Tier 1 EIS pursuant to 23 USC 139(c); while FTA is a Cooperating Agency and may therefore adopt the Tier 1 EIS. Different Lead Agencies may be identified during subsequent Tier 2 NEPA studies.

Per the MOA, decisions on the following will be made upon completion of the Tier 1 study:

- The concepts to be advanced for the I-66 corridor, including transit improvements, transportation demand management strategies, and/or roadway improvements. Within these concepts, consideration will be given to managed lanes and tolling;
- The general location for studying future highway and transit improvements in Tier 2 NEPA document(s);
- Identification of projects with independent utility to be evaluated in Tier 2 NEPA document(s) and evaluated pursuant to other environmental laws; and
- Advancing tolling for subsequent study in Tier 2 NEPA document(s).

Per the MOA, the following decisions will not be made until after the completion of the Tier 2 NEPA document(s):

- Approval of final design;

- Authority to utilize federal funds to acquire right-of-way;
- Authority to utilize federal funds for construction;
- Approval to modify access to Interstate 66; and
- Approval for FTA New Starts.

2 PURPOSE AND NEED

The purpose of this Tier 1 EIS is to address existing and future transportation problems on I-66 and, therefore, the transportation needs presented in this chapter focus on I-66. Although it is recognized that there are broader transportation needs in the region as well as additional transit needs in the study area, they are beyond the scope of this Tier 1 EIS. The study evaluates the effectiveness of both highway and transit improvements in meeting the identified needs (see Chapter 3).

This chapter presents the purpose and needs used to guide the development of potential transportation improvements in the corridor. Section 2.1 describes the study corridor, including a description of the existing roadway and transit system. Section 2.2 describes the history of I-66, including recent and on-going studies, plans, and projects. Section 2.3 outlines travel patterns and trends in the corridor, including projected population and employment growth. Based on these conditions, Section 2.4 and Section 2.5, respectively, detail the need for transportation improvements as well as the purpose of the improvements. Section 2.6 summarizes Chapter 2.

2.1 STUDY CORRIDOR

I-66 is the main east-west interstate highway in Northern Virginia and serves the District of Columbia, Arlington County, Fairfax County, Loudoun County, Prince William County and points west, the cities of Fairfax, Falls Church, Manassas, and Manassas Park and the towns of Vienna and Haymarket. The study corridor is a complex, comprehensive transportation facility that includes general-purpose and high-occupancy vehicle (HOV) highway facilities, heavy rail, local and regional bus service, and bicycle and pedestrian facilities. Virginia Railway Express (VRE) commuter rail service, while located outside of the study corridor, also serves east-west traffic and there is some overlap in terms of the travelshed served by commuter rail and the other modes that are physically located within the study corridor. Note that, in this report, the "study corridor" refers to the section of I-66 between US 15 and I-495 (i.e., the extents of I-66 that are being studied as part of this Tier 1 EIS); the "analysis area" refers to a wider area surrounding the study corridor.

The study corridor is comprised of the 25-mile section of the I-66 corridor that extends from US 15 in Prince William County east to I-495 (Capital Beltway) in Fairfax County, as shown in **Figure 2-1**. Within the study corridor, I-66 includes eleven general-purpose traffic interchanges and two HOV-dedicated interchanges. Within the analysis area for this study (which includes areas adjacent to the study corridor), major highway facilities include I-66, its parallel arterial routes US 50 and US 29, and several key routes serving north-south travel, including US 15, VA 234, VA 28, Fairfax County Parkway, VA 123, and I-495.

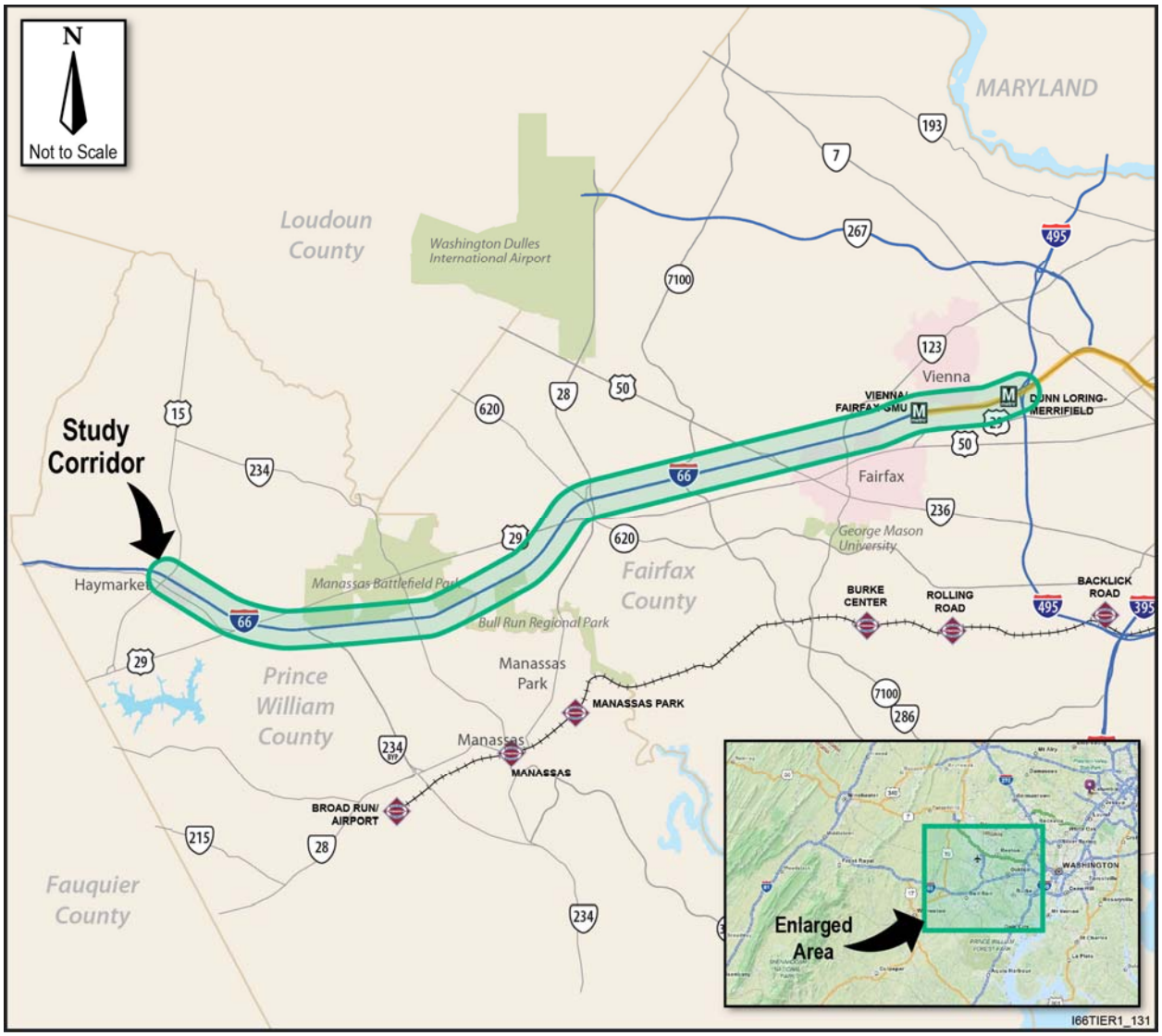


Figure 2-1. Study Corridor

Roadway System. The lane configuration and associated operating characteristics of I-66 varies within the study corridor, as shown in **Figure 2-2** and summarized below. Refer to the *Transportation Technical Report* for details of the roadway system within the study corridor.

- **Capital Beltway (I-495) to US 50.** This section is a six-lane facility. The inside lane (median side) is used as a concurrent HOV-2 (two occupants or more) lane in the peak travel direction between the hours of 5:30 to 9:30 AM and 3:00 to 7:00 PM on weekdays. Additionally, the median is used by heavy rail (Metrorail) to just west of the interchange with VA 243. The shoulder (outside) is used as a general-purpose travel lane in the peak travel direction from 5:30 to 11:00 AM and 2:00 to 8:00 PM on weekdays. The posted speed limit is 55 miles per hour (mph).
- **US 50 to US 29 (Gainesville).** This section is an eight-lane facility. The inside lane (median side) is used as a concurrent HOV lane during the peak hours in the peak directions, with the same operating characteristics as the previous section. The

width of the median preserves a potential future extension of Metrorail. The posted speed limit is 55 mph in Fairfax County, and transitions to 65 mph in Prince William County.

- **US 29 (Gainesville) to US 15.** This section is currently a four-lane facility, and has no HOV lanes. A planned project by VDOT is slated to widen I-66 to eight lanes in this section, including concurrent HOV lanes. The widening is planned to be completed by 2015. In addition, there are plans to upgrade the interchange at US 15 as part of a separate project. Figure 2-2 shows the lane configurations once the roadway improvements are completed.

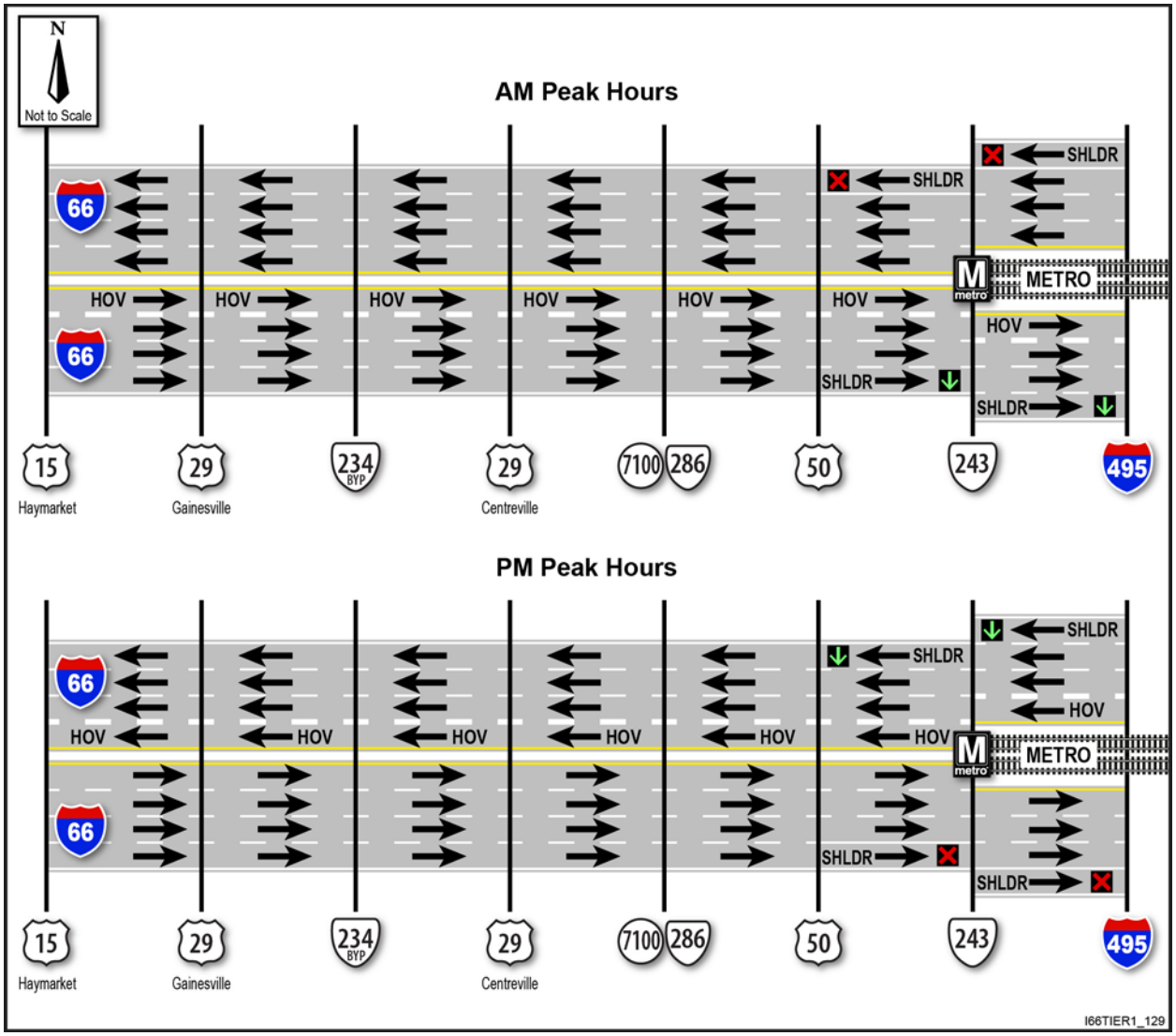


Figure 2-2. I-66 Lane Configuration

Transit System. Thousands of commuters use transit daily in the I-66 corridor, which is supported by a range of services and associated facilities as shown in **Figure 2-3**. The current transit system in the corridor includes service that uses the I-66 roadway itself (local and regional bus service), service on separate rail facilities (Metrorail), as well as associated facilities

such as park-and-ride lots. An overview of these resources within the study corridor is provided below:[1]

- **Metrorail Orange Line.** The Washington Metropolitan Area Transit Authority (WMATA) operates a heavy rail transit system, Metrorail, throughout the Washington, D.C. region that serves almost 800,000 trips per day. Metrorail's Orange Line operates aboveground on two tracks in the I-66 median at the eastern end of the study corridor, continuing east through Falls Church into Arlington County and the Washington, D.C. core. Two Metrorail stations are located within the study corridor: Vienna/Fairfax GMU Station (just west of VA 243), which is the Orange Line's western-most station, and the Dunn Loring-Merrifield Station (just west of I-495). In June 2012, WMATA initiated a new "Rush+" service, which included six additional trains in both directions (three per direction) along the Orange Line, for a total of 19 trains in each direction per hour. This results in a total increase of 18 percent in capacity or a total increase of approximately 2,600 seats per peak hour. The Orange Line is Metrorails's second busiest, carrying approximately 180,000 passenger trips on a typical weekday; peak hour trains on the Orange Line between Courthouse and Rosslyn Stations carry more passengers per car than anywhere else on the system.[2]
- **Local and Regional Bus.** Local and regional bus service operating along I-66 and on adjacent roadways is provided by six different transit agencies: City-University-Energysaver (CUE) (City of Fairfax), Fairfax Connector (Fairfax County), Loudoun County Transit, OmniRide (a commuter bus operated by the Potomac and Rappahannock Transit Commission), and WMATA. Combined, the corridor bus services result in approximately 5 buses per hour along I-66 during the peak period.
- **Park-and-Ride Lots.** A total of 13 Park-and-Ride lots are located within the study corridor: 10 in Fairfax County and 3 in Prince William County. The Park-and-Ride lots are served by a variety of bus services and can also be used by carpoolers. Of the 13 lots, the following locations are fully utilized: the Metrorail stations at Vienna/Fairfax-GMU and Dunn Loring/Merrifield; I-66/Stringfellow Road; and Stone Road/US 29. Overall lot utilization within the corridor is approximately 85 percent.
- **Bicycle and Pedestrian Facilities.** Although I-66 itself is a high-speed controlled access facility that does not allow bicycles, people may travel by bicycle for part of a trip that also includes the use of I-66. Specifically, this means bicycling to or from a bus or rail station or park and ride and carrying a bicycle on a bus or train. However, there are no bicycle and/or pedestrian trails located within the I-66 right-of-way outside of the Capital Beltway in the study corridor.

[1] A previous study (I-66 Transit/Transportation Demand Management Study, Virginia Department of Rail and Public Transportation, December 2009) presents additional details on the system.

[2] WMATA News Release on March 19, 2012. http://www.wmata.com/about_metro/news/PressReleaseDetail.cfm?ReleaseID=5186

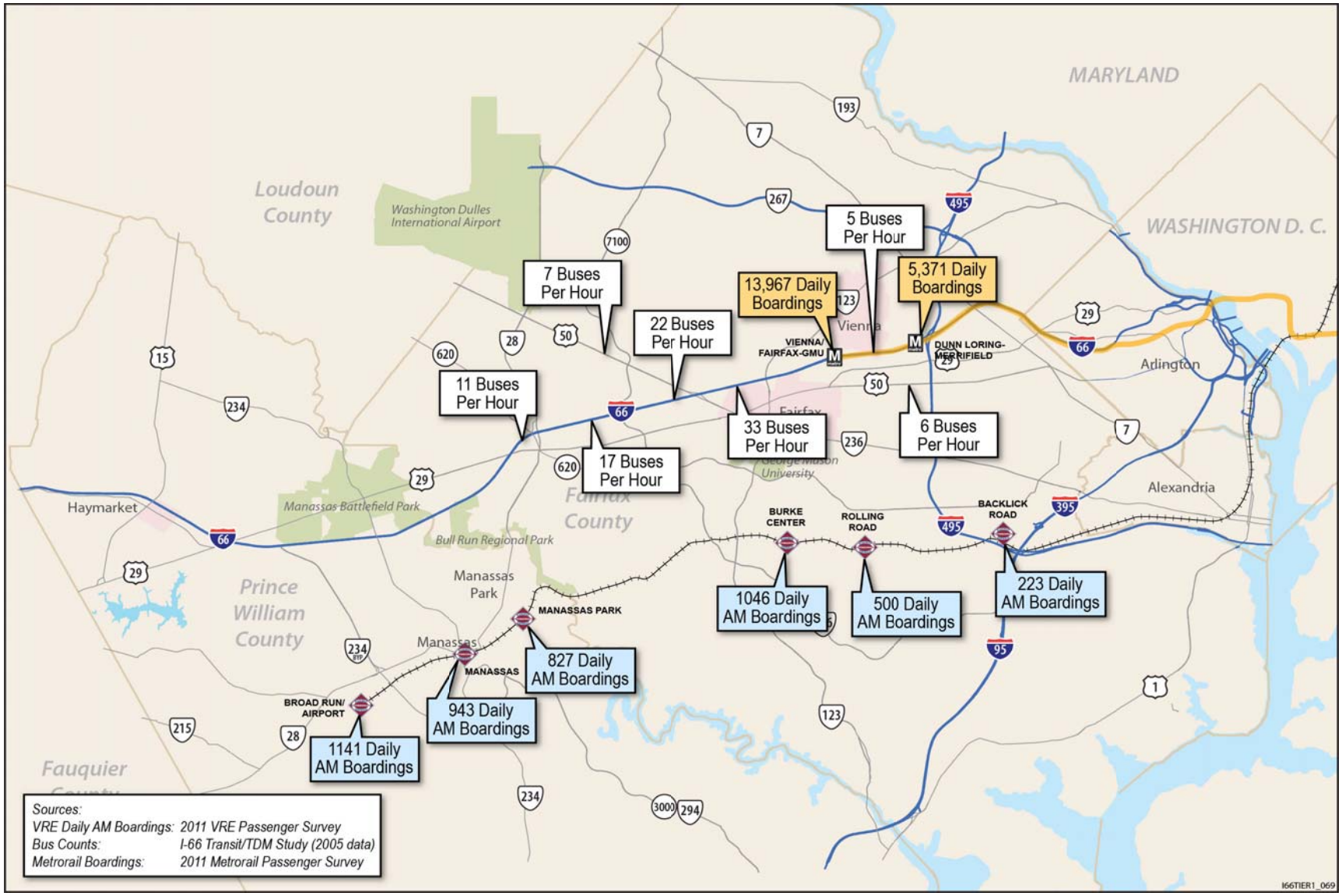


Figure 2-3. Transit Service along I-66 Corridor

- **Transportation Demand Management (TDM) Programs.** A variety of TDM programs and services are in place to support transit use and other ridesharing activities, and to reduce overall travel demand in the Washington, D.C. area. These services, operated by federal, state, county/city, and private agencies, include: park-and-ride lots (discussed on the previous page, but also an important component of an overall TDM program); carpool ridematching and incentives; Guaranteed Ride Home program; vanpool ridematching and subsidies; commuter stores; telework programs; carsharing services; traveler information services, and commercial site plan review. Corridor-specific strategies were identified in the *I-66 Transit/TDM Study* for implementation by 2015 and by 2030.
- The area is also supported by **VRE Commuter Rail** service located south of the study corridor. VRE commuter rail connects the Northern Virginia suburbs to Union Station in Washington, D.C. VRE's Manassas Line generally runs parallel to I-66, but is removed by over five miles. The Manassas Line's western-most station is Broad Run/Airport in Bristow, continuing east with stations at Manassas, Manassas Park, Burke Centre, and Rolling Road outside of the Capital Beltway. VRE operates two eastbound trains per hour and one morning westbound train along the Manassas Line during the morning peak period. The Manassas Line averages almost 10,000 daily trips, with ridership increasing.[3]

2.2 I-66 HISTORY

I-66 was originally developed to serve east-west travel between Washington, D.C. and I-81 near Strasburg, Virginia. Initial planning for the 76-mile corridor began in 1956, and the first segments west of I-495 were opened between 1958 and 1964. Since its original construction, access and capacity along the interstate west of the Capital Beltway have been expanded numerous times, including the following:

- A Metrorail Orange Line extension from Ballston to Vienna, operating in the median of I-66, opened in June 1986.
- An additional general purpose lane and HOV lane between I-495 and US 50 were opened in 1993.
- Construction of a new general purpose lane and HOV lane west of US 50 was completed in 1997.
- The widened section of I-66 between US 50 and Centreville opened in 1995.
- The widened section of I-66 between Centreville and Manassas was opened in 1996.
- Widening between Manassas and Gainesville (one general purpose lane and one HOV lane in each direction) (including a reconstructed interchange at I-66/US 29) was constructed as a series of projects and completed in 2010.
- Currently, VDOT is designing improvements for the 2.6-mile section of I-66 between US 29 in Gainesville and US 15 near Haymarket (scheduled completion 2015). Like

[3] VRE Chief Executive Officer's Report, July 2012. http://vre.org/about/Ops_board_items/2012/July/CEO_report.pdf

the previous projects, two lanes will be added in each direction: one general purpose lane and one HOV lane.

Despite these infrastructure improvements, growth in Fairfax and Prince William counties has steadily increased demand for travel along I-66 and its parallel routes, resulting in congested conditions, especially during commute periods. In response, VDOT and VDRPT have conducted several studies in recent years to identify and evaluate potential solutions to ease roadway congestion and improve overall mobility in the corridor, which have led to initiation of this Tier 1 EIS:

- In 1995, VDRPT initiated the *I-66 Major Investment Study* (MIS) to identify a Locally Preferred Transportation Investment Strategy for the corridor. The study was completed in 1999 and recommended a range of improvements, including the roadway widening improvements west of Manassas that are now being implemented. Other recommendations were advanced to the *I-66 Multimodal Transportation and Environmental Study*, which was initiated in 2002, but was subsequently terminated, pending additional study of highway, transit, and TDM options to address mobility needs within the corridor. FHWA ultimately rescinded the Notice of Intent for the EIS in a Federal Register notice dated May 22, 2008.
- Subsequently, in 2009, VDOT and VDRPT completed the *I-66 Transit/Transportation Demand Management (TDM) Study*, which focused on the longer I-66 corridor from US 15 to downtown Washington, DC. The study primarily focused on defining potential priority bus and bus rapid transit options; however, potential highway, Metrorail, commuter rail, and bicycle and pedestrian improvements were also evaluated. Upon completion of this study, the corridor was divided into two sections for more detailed analysis of the recommendations. The eastern section between I-495 and downtown Washington, DC is the subject of a separate, ongoing mobility study; the western segment between US 15 and I-495 is the subject of this Tier 1 EIS.

In addition to the initiatives leading up to this Tier 1 EIS, **Table 2-1** summarizes the numerous studies, plans, and projects that have been completed or are under development that influence transportation planning for the I-66 corridor. **Table 2-2** summarizes VDOT's projects to manage congestion along the I-66 corridor that are in the design phase or under construction. Refer to the *Transportation Technical Report* for full details of the projects that are included in the existing conditions (No-Build) analysis.

Additionally, the comprehensive and transportation plans for the jurisdictions along the I-66 corridor serve as a guide for future growth and decisions regarding investment in public infrastructure. These plans identify the development of a multi-modal transportation network as an essential element in promoting future mobility for their residents and employees, and the I-66 corridor is specifically identified as a target for multimodal, high-capacity transportation improvements. All call for more closely integrating land use and transportation planning to allow for growth.

Table 2-1. Related Studies and Plans

NAME	DESCRIPTION
I-66 Multimodal Study *(Inside the Beltway)*	This study focuses on the identification of multimodal and corridor management solutions (operational, transit, bike, pedestrian, and highway) that can be implemented to reduce highway and transit congestion and improve overall mobility on I-66 between I-495 and Washington, D.C. Potential concepts for this Tier 1 EIS will be closely coordinated to ensure an integrated assessment of the infrastructure needs that would be required to support potential Orange Line extensions or service enhancements. *On-going.*
VDRPT Super NOVA Vision Plan	This study to identify transit and TDM needs/strategies for the near, mid, and long term encompasses Northern Virginia and includes coordination with Maryland, the District of Columbia, and West Virginia. *On-going.*
WMATA Plans	Completed in 1999, a Transit Service Expansion Plan recommended a fixed-guideway expansion of the Metrorail Orange Line from Vienna to Centreville along the I-66 corridor. WMATA is also developing a Regional Transit System Plan to guide development of a sustainable, integrated, multimodal, regional transit network for 2040. *On-going.*
Metrorail Silver Line	WMATA is currently developing a 23-mile extension of the Metrorail system from East Falls Church to Washington Dulles International Airport and Loudoun County. The Silver Line (previously called the "Dulles Rail") will operate from the Stadium-Armory Station in downtown Washington, DC, and share 18 stations with the Orange Line. It is anticipated that Silver Line operations would affect demand at existing Metrorail Orange Line stations in the I-66 corridor. *On-going; Phase I planned completion in 2013.*
Tri-County Parkway	The Tri-County Parkway (previously known as the VA 28 Bypass) is a proposed new four- to six-lane road to extend from VA 234 in Prince William County to I-66 in Fairfax County. The road would include bicycle and pedestrian accommodations, and is expected to provide congestion relief for VA 28 and I-66. Right-of-way has already been acquired for the portion of the road south of I-66. *On-going.*
I-66 HOV Lane Operations Study	This 2009 study analyzed the operational characteristics of HOV lanes from VA 234 (outside the Capital Beltway) to VA 7 (inside the Capital Beltway). Although the focus of the study was on low-cost, near-term solutions, a broader set of mitigation measures, including both spot and general improvements, were also presented, including many that would require more resources to study and potentially implement.
VRE Plans and Projects	The 2009 VRE Gainesville-Haymarket Alternatives Analysis studied potential options for extending commuter rail service on the Manassas Line, as well as potential commuter bus service improvements to enhance connectivity. A commuter rail extension to either Gainesville or Haymarket was recommended for more detailed analysis. Commuter bus options were recommended for further study as part of the *I-66 Transit/TDM Study*.

Table 2-2. I-66 Projects Funded for Construction within Study Corridor

NAME	DESCRIPTION
Design Phase	
I-66 Widening *(US 29 Gainesville – US 15 Haymarket)*	Pavement widening to add one HOV and one general purpose lane in each direction on I-66, and related modifications to the westbound off-ramp at US 15. Construction scheduled to commence 2013.
I-66 / US 15 Interchange Reconstruction	Interchange modifications/replacement to address traffic volumes and safety. Construction scheduled to commence in 2014
I-66 Vienna Metrorail Access Ramp	Provision of a bus-only ramp from the HOV lanes of I-66 near the Vienna Metrorail Station. At this time, the preferred alternative has not been selected; however the ramps would connect to either Saintsbury Drive or Vaden Drive. This project is slated to be advertised for construction in 2014.
I-66 / VA 28 Southbound Turn Lanes	Extension of southbound VA 28 turn lanes into eastbound I-66. Construction will begin in summer 2013.

NAME	DESCRIPTION
I-66 ATM – Active Traffic Management *(DC Line – US15)*	Includes: gantry structures, lane/shoulder control display, queue/incident detectors, robust closed circuit television (CCTV) coverage, queue/speed warning dynamic message signs (DMS) for lane/shoulder control, responsive incident management, emergency areas with detection/surveillance to enhance mobility and safety. This project is slated to begin in fall 2012/winter 2013.
I-66 / Rt 234 Bypass Park & Ride Lot	A 437-space commuter lot accessible from the Balls Ford Road / Cushing Road intersection. Buses and HOV vehicles would have direct access to eastbound I-66 from the lot. Construction of this lot is anticipated to be complete in 2013.
Under Construction	
I-66 *(US 29/Linton Hall Rd Interchange)*	The previous phases which included the widening of I-66 from VA 234 Business to US 29, and the reconstruction of the I-66/US 29 interchange have been completed. The next phase – upgrading the existing at-grade intersection to an interchange at the nearby US 29 and Linton Hall Rd – is underway.
I-66 Pavement Rehabilitation *(I-495 – US 50)*	Includes concrete patching and asphalt overlay on mainline and ramps. The project also includes upgrades to corridor drainage, concrete barrier, and guardrail.
I-66/I-495 Express Lanes	VDOT MEGA-Project team reconstruction of existing bridges and ramps, and construction of new Express Lanes (high occupancy toll lanes), including access ramps at the I-66/I-495 interchange.

2.3 TRAVEL PATTERNS AND TRENDS

2.3.1 TRAVEL DEMAND PATTERNS

I-66 in the study corridor connects a variety of land uses and activity centers. These include relatively low density residential and agricultural areas, bedroom communities, major retail and employment centers both immediately within the study corridor and within a few miles of the study corridor, and the region's urban core consisting of Arlington and Washington, D.C. I-66 also connects to key roadways such as US 50 and I-495, and the segment of the Metrorail Orange line within the study corridor extends into Washington DC and connects to the region as a whole. Traffic volumes (year 2011) on I-66 range from 57,600 vehicles per day (vpd) just east of US 15 to a high of 191,400 vpd just west of Nutley Street (VA 243). Just as the volumes vary within the corridor, the origins and destinations of trips in the corridor also vary. **Table 2-3 through Table 2-5** summarize where traffic enters and exits the corridor. Two key observations from the data shown in the tables are:

- Only a small proportion of traffic travels entirely through the corridor. For example, of the traffic between Nutley Street and the Capital Beltway, only 7 percent of the eastbound traffic in the morning starts west of US 15 and 42 percent of the traffic enters I-66 at either VA 123 or Nutley Street.
- Traffic on I-66 just west of I-495 (Capital Beltway) is almost as likely to go to/from I-495 North (in the direction of Tysons Corner) as it is to remain on I-66 to/from Arlington and Washington DC – an average of 43 percent goes to/from I-66 while an average of 39 percent goes to/from I-495 North. Additionally, an average of 18 percent goes to/from I-495 South (in the direction of Springfield).

Table 2-3. Entry and Exit Points for Traffic at Eastern End of the Corridor

EASTBOUND TRAFFIC		
Percent Coming From:	West of US 15	7%
	US 15	3%
	US 29 Gainesville	6%
	VA 234 Bypass	5%
	VA 234 Business	4%
	US 29 Centreville	4%
	VA 28	9%
	Fairfax County Parkway	9%
	US 50	11%
	VA 123	19%
	Nutley Street	23%
Percent Going To:	I-66 East	45%
	I-495 North	39%
	I-495 South	16%

WESTBOUND TRAFFIC		
Percent Coming From:	I-495 North	39%
	I-495 South	21%
	I-66 East	40%
Percent Going To:	Nutley Street	22%
	VA 123	18%
	US 50	13%
	Fairfax County Parkway	8%
	VA 28	9%
	US 29 Centreville	4%
	VA 234 Business	4%
	VA 234 Bypass	5%
	US 29 Gainesville	7%
	US 15	2%
	West of US 15	8%

Table 2-4. Entry and Exit Points for Traffic in Middle of Corridor Between VA 28 and Fairfax County Parkway

EASTBOUND TRAFFIC		
Percent Coming From:	West of US 15	12%
	US 15	8%
	US 29 Gainesville	13%
	VA 234 Bypass	11%
	VA 234 Business	16%
	US 29 Centreville	14%
	VA 28	26%
Percent Going To:	Fairfax County Parkway	31%
	US 50	15%
	VA 123	12%
	Nutley Street	9%
	I-66 East	11%
	I-495 North	14%
	I-495 South	8%

WESTBOUND TRAFFIC		
Percent Coming From:	I-495 North	14%
	I-495 South	10%
	I-66 East	10%
	Nutley Street	9%
	VA 123	10%
	US 50	19%
	Fairfax County Parkway	28%
Percent Going To:	VA 28	27%
	US 29 Centreville	12%
	VA 234 Business	16%
	VA 234 Bypass	10%
	US 29 Gainesville	17%
	US 15	6%
	West of US 15	12%

Table 2-5. Entry and Exit Points for Traffic at Western End of Corridor

EASTBOUND TRAFFIC		
Percent Going To:	US 15	17%
	US 29 Gainesville	4%
	VA 234 Bypass	20%
	VA 234 Business	9%
	US 29 Centreville	7%
	VA 28	5%
	Fairfax County Parkway	8%
	US 50	3%
	VA 123	3%
	Nutley Street	3%
	I-66 East	6%
	I-495 North	9%
	I-495 South	6%

WESTBOUND TRAFFIC		
Percent Coming From:	I-495 North	10%
	I-495 South	7%
	I-66 East	5%
	Nutley Street	3%
	VA 123	2%
	US 50	3%
	Fairfax County Parkway	8%
	VA 28	5%
	US 29 Centreville	7%
	VA 234 Business	6%
	VA 234 Bypass	24%
	US 29 Gainesville	3%
	US 15	17%

2.3.2 TRAVEL DEMAND TRENDS

The existing transportation infrastructure in the corridor, both highway and transit, is heavily utilized and experiences frequent congestion. Projected growth in population and employment is expected to significantly increase in future years and additionally strain transit and highway capacity. Historical travel patterns reflect existing capacity constraints for all modes of travel.

Estimates of predicted traffic growth, developed from analysis of the regional travel demand model and shown in **Figure 2-4**, indicate substantial growth along the corridor, particularly in the western half. Between 2012 and 2040, traffic is expected to more than double west of Gainesville. Between the two interchanges with US 29, traffic is forecasted to grow between 35% and 66%; further east, the total growth is expected to be 10% to 23%. In addition to vehicular growth, demand for rail and bus trips in the study corridor is anticipated to grow. The growth in these travel modes is documented in WMATA's *Regional Transportation System Plan*, VRE's *Strategic Plan*, and the VDRPT *I-66 Transit/Transportation Demand Management (TDM) Study*.

Fairfax and Prince William counties have experienced significant growth in both population and employment in recent decades, and are projected to have additional substantial growth through 2040, as shown in **Figure 2-5**. For employment growth, the Gainesville-Haymarket area is projected to grow the most (141% increase). However, the greatest concentration of jobs within Fairfax County is expected in Tysons Corner (north of I-66 and west of I-495), which is forecasted to continue to have the highest overall number of jobs (152,500 by 2040). Tysons Corner is also projected to experience the greatest population growth (50% increase by 2040); however, the largest residential populations are forecasted to remain in the western end the I-66 corridor in the Manassas, Centreville, and Gainesville-Haymarket areas. These projections support historical travel demand patterns of commuters traveling eastbound during the AM peak period (to access high employment areas) and westbound during the PM peak period (to access high residential

areas). The growth in both employment and population in Tysons Corner will impact the entire transportation infrastructure, both highway and transit, in the area.

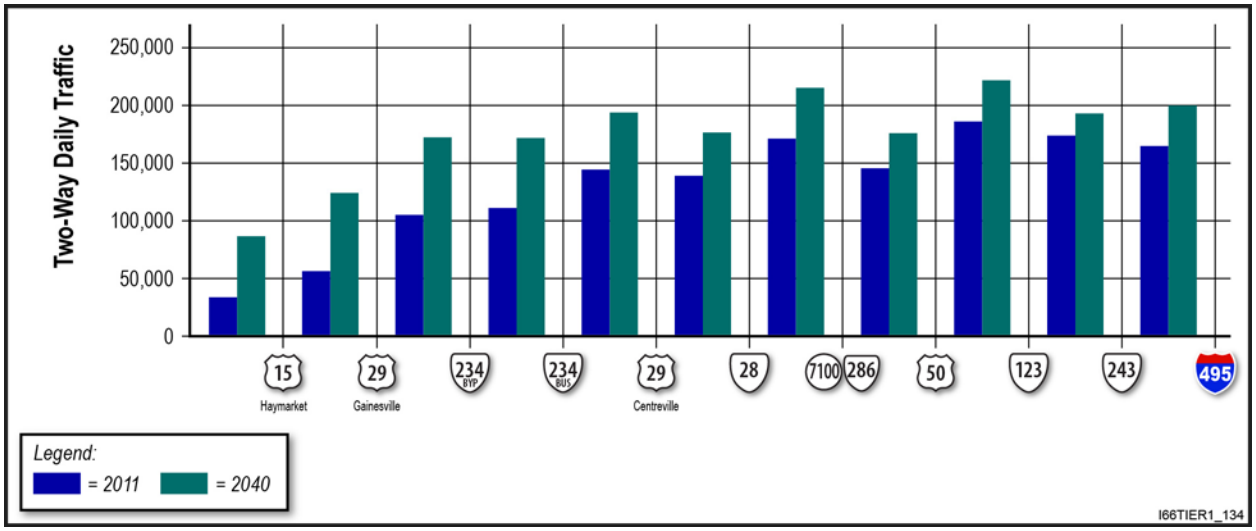


Figure 2-4. Projected Traffic Growth along I-66 Corridor

2.4 I-66 CORRIDOR NEEDS

Transportation needs in the I-66 study corridor were identified based on analysis of existing and future no-build conditions in the study corridor, and supplemented based on input from participating agencies and the general public. Five major aspects of need, many of them interlinked, were identified. These are described below.

2.4.1 TRANSPORTATION CAPACITY DEFICIENCIES

Travel demands in the corridor, particularly during peak demand periods, exceed the carrying capacity of both I-66 and the current Metrorail Orange Line service. As described in Section 2.3.2, the growth in population and employment in the corridor is expected to further increase travel demand, resulting in a widening differential between demand and capacity.

Table 2-6 summarizes the levels of service by segment for both existing year (2011) and forecast year (2040). Those segments shown in the table as currently operating at Level of Service (LOS)[4] E or F in the AM peak hour comprise over half (12.8 miles) of the study corridor's peak direction roadway miles while, for the PM peak hour, they comprise two-thirds (15.7 miles) of the peak direction roadway miles. By 2040, 100 percent of the study corridor's peak direction roadway miles are expected to operate at LOS E and F in the AM peak hour with over 90 percent operating at LOS E or F in the PM peak hour.

[4] Level of service (LOS) characterizes the operating conditions on roadway facilities in terms of traffic performance measures related to speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. The Highway Capacity Manual defines LOS for freeway segments as LOS A: 0-11 passenger cars per mile per lane (pc/mi/ln); LOS B 11-18 (pc/mi/ln); LOS C 18-26 (pc/mi/ln); LOS D 26-35 (pc/mi/ln); LOS E 35-45 (pc/mi/ln); and LOS F > 45 (pc/mi/ln).

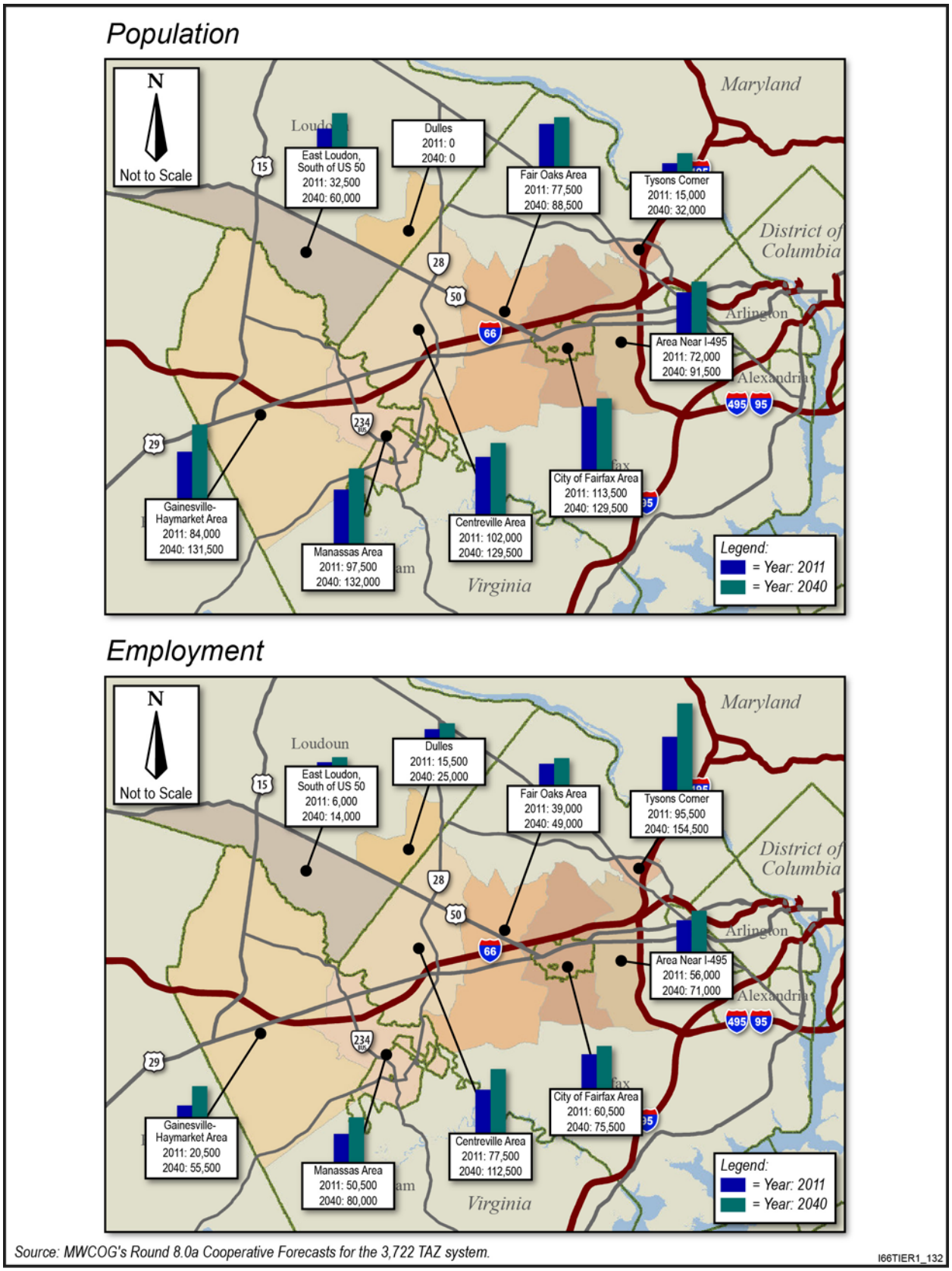


Figure 2-5. Projected Population and Employment Growth along I-66 Corridor

Table 2-6. Summary of Roadway Segment Levels of Service

FROM:	TO:	WESTBOUND				EASTBOUND			
		2011		2040		2011		2040	
		AM	PM	AM	PM	AM	PM	AM	PM
West of US 15		A	B	B	F	B	A	F	C
US 15 Gainesville	US 29	A	C	A	E	C	A	F	B
US 29	VA 234 Bypass	A	D	A	D	C	A	E	B
VA 234 Bypass	VA 234 Business	A	D	B	F	D	B	F	C
VA 234 Business	US 29 Centreville	B	E	C	F	F	B	F	C
US 29	VA 28	A	D	B	E	F	B	F	C
VA 28	Stringfellow HOV ramp	C	F	C	F	F	C	F	D
Stringfellow HOV ramp	Fairfax County Parkway	C	F	C	F	F	C	F	D
Fairfax County Parkway	Monument HOV ramp	B	E	C	F	D	B	F	D
Monument HOV ramp	US 50	B	E	C	F	D	B	F	D
US 50	VA 123	E	F	D	F	F	D	F	D
VA 123	VA 243 (Nutley Street)	E	E	D	F	E	D	F	D
VA 243 (Nutley Street)	Capital Beltway	D	E	E	F	D	C	F	D

Increased travel demand is expected to not only increase congestion during the highest peak hours of the day, but to also increase the number of hours of congestion as motorists make trips either earlier or later in order to avoid the times of highest congestion. As shown in **Table 2-7**, peak period congestion in the eastern portion of the corridor east of Nutley Street is expected to increase from the current 4-5 hours per day (in each direction) to 8-10 hours a day. Increases are also expected in other portions of the study corridor: from 2-4 hours of congestion to 5-6 hours in the middle section of the corridor and from current levels of an hour or less to 5-6 hours in these western portion. It is important to note that these are planning estimates of congestion; congestion in the corridor is affected by the number and type of chokepoints (interchanges, ramp merge points) and incidents related to crashes or weather, and the effects of these chokepoints can extend well beyond individual analysis segments.

Table 2-7. Projected Number of Hours of Congestion (LOS E or F) on I-66

SEGMENT	2011 (HOURS)		2040 (HOURS)	
	EASTBOUND	WESTBOUND	EASTBOUND	WESTBOUND
US 29 West – VA 234 Bypass	Less than one hour		5	6
VA 28 - Fairfax County Parkway	2	4	5	6
East of VA 243 (Nutley Street)	4	5	8	10

Note: These results are based on planning-level analysis that represents typical conditions. Incidents created by crashes, disabled vehicles, or other factors are accounted for only in an aggregate sense.

The existing HOV lanes in the corridor are intended to provide for smoother flow, and provide the incentives that come from reduced travel time for those who use bus service and for travelers who form carpools. While current data[5] shows that the HOV lanes experience a level of success in

[5] *Interstate 66 HOV Lane Operations Study*, VDOT, October 15, 2009.

terms of promoting higher levels of vehicle occupancy, the lack of barrier separation on the existing concurrent lane configuration allows motorists to easily move into and out of the HOV lanes, resulting in reduced speeds in the HOV lanes and increased difficulty in enforcing the HOV restrictions. During the peak period in peak directions between VA 234 and I-495 on I-66, eastbound HOV commuters save approximately 12.5 minutes and westbound HOV commuters save approximately 7 minutes, compared to drivers in the general purpose lanes. The HOV lanes operate approximately 6 mph faster in both directions. Speeds in both directions, however, are well below speeds of 50 mph (they average less than 40 mph[6]).

The Metrorail Orange Line, which covers only the easternmost 2.6 miles of the study corridor within the I-66 median, also experiences peak hour demand that exceeds capacity. As previously stated, the Orange Line is the Metrorail's second busiest line, and east of the study corridor, contains the segment that carries more passengers than any other in the system. Because of the merge at Rosslyn, the number of Blue and Orange trains that can operate in Virginia is limited. Congestion on the Orange Line east of East Falls Church will likely be further exacerbated once the Silver Line comes online (though the Silver Line service plan is still under development). The on-going development and growth of both population and employment will translate into increased demand for all WMATA transit services. Metrorail's expanding ridership will place substantial demands on the fleet, system, and station capacity. Many of the capacity issues and needs are inter-related; for example, achieving 100% 8-car trains will increase capacity requirements for station platforms, vertical circulation, and supporting facilities.

By 2030, Metrorail estimates that ridership will be close to 1 million trips a day (including the addition of the Silver Line, which, based on transfers, is expected to add to the total ridership on the Orange Line).[7] By comparison, with the record-high 1.1 million trips that the Metrorail system experienced on Inauguration Day in 2009, Metrorail operated an unprecedented amount of service (22 consecutive hours, including 17 straight hours of rush hour service) and customers experienced long lines, crowded platforms, and over-capacity trains. **Figure 2-6** presents the Metrorail system capacity with expansion to 100% 8-car trains during peak periods. Some rail lines will have adequate capacity through 2030, some will be congested, but the Orange/Silver Line will exceed capacity as forecasts indicate that demand will exceed 120 passengers per car as 2030 approaches.

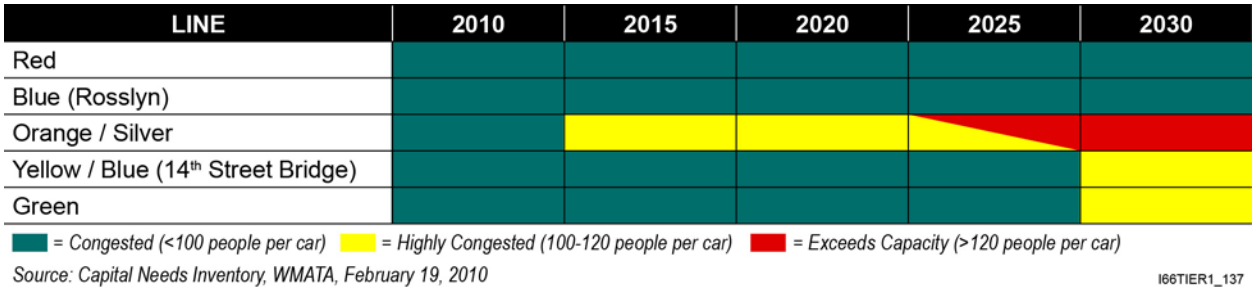


Figure 2-6. Metrorail System Capacity (with 100% 8-Car Trains by 2020)

[6] *Interstate 66 HOV Lane Operations Study*, VDOT, October 15, 2009.

[7] Capital Needs Inventory, WMATA, February 19 2010.

2.4.2 MAJOR POINTS OF CONGESTION

In addition to the need for overall transportation capacity in the I-66 corridor as presented in Section 2.4.1, traffic operations are adversely affected by points of constraint based on either capacity or geometric issues. There are a number of localized constraints (chokepoints), where daily peak period congestion that affects both cars and bus transit operations occurs:

- **VA 234 Bypass interchange**. The merge area on I-66 for the northbound VA 234 movement to the eastbound I-66 movement is projected to deteriorate from LOS D to LOS F in the AM peak hour.
- **VA 234 Business.** Operational analysis indicates that the on-ramp to eastbound I-66 would perform at LOS F in the 2040 AM peak hour conditions due to short acceleration lanes. In the PM peak hour, the off-ramps would perform at LOS F in the 2040 conditions due to heavy exiting volumes. Four signals within a half mile causes operational deficiencies on VA 234 Business, as queue spill back from one signal affects the adjacent signals, including the I-66 off-ramps.
- **US 29 "east" interchange.** The merge and diverge areas on I-66 would operate at LOS F during the peak hours in the peak direction of flow. Close proximity of signals on US 29 periodically causes operational problems when one signal is above capacity and queues extend back to adjacent signals.
- **I-66 mainline between US 29 "east" and VA 28**. The eastbound direction of I-66 slows down due to the heavy entering traffic from US 29 and the heavy exiting traffic at VA 28 due to the lack of a weaving lane to accommodate the heavy weaving movements.
- **VA 28 Interchange.** The off-ramps from I-66 are projected to operate at LOS F during the peak periods in the peak direction of travel. Short acceleration lanes on VA 28 causes poor merging operations, which lead to traffic queues to spillback onto I-66 in each peak hour. The southbound to eastbound movement is accommodated by a left turn phase at a signal; the demand, however, exceeds the storage provided, and queues extend back into the southbound mainline impacting through movement. Queues often extend back beyond the signal at Braddock Road. The signal at Braddock Road/Walney Road is within the interchange influence area; to accommodate the left turns originating from westbound I-66, an intermediate signal is provided for cross-over movement from the ramp to the left turn bay, which impacts northbound VA 28 flows. All signals within the interchange influence area would operate at LOS F in 2040 conditions.
- **Fairfax County Parkway Interchange.** The merge/diverge areas on I-66 to/from the collector distributor (CD) roads would operate at LOS F by 2040.
- **US 50 Interchange.** At this interchange, I-66 transitions from an eight lane facility to a six lane facility (with the shoulder lane being used as a fourth lane in the peak direction). In the eastbound direction, congestion reoccurs daily at the merge from US 50 due to the heavy volumes merging; in essence, a four lane I-66 merges with a

two-lane on-ramp from US 50 to feed a four lane section downstream. Part of the merging issue is caused by short acceleration lanes. The close proximity of the access points of Fair Oaks Mall also impacts this interchange.

- **VA 123 Interchange.** Acceleration lane lengths that do not meet current standards, causing poor merging operation which then impacts travel speeds on I-66.
- **Nutley Street/Vienna Metrorail Station Access Interchange.** Operational analyses of the I-66 merge and diverge areas into/from the CD roads indicate that the projected demand at these locations would exceed capacity resulting in congestion for both cars and buses. Over-capacity operations would also exist on the CD roads themselves.

2.4.3 Limited Travel Mode Choices

While the Metrorail Orange Line carries approximately 180,000 persons per day, the service is primarily focused on serving commuter trips to and throughout the region's inner core (Arlington and the District of Columbia) employment areas. Even with the inclusion of the corridor's limited amount of transit and commuter bus service, alternatives to single occupant vehicle travel are limited. Travel choices for bicycling and walking, whether as the primary transportation mode for a trip or as a means to connect to other modes, are lacking within the corridor. Associated with the lack of modal choices are limited coordination and limited comprehensive and coordinated traveler information across travel modes as well as the need to improve physical linkages between travel modes through the construction of park-and-ride facilities, intermodal transfer centers, and connections that are supportive of access to intermodal facilities by walking and bicycling.

Existing bus routes in the study corridor are radial in nature and lack north/south routes. The I-66 TDM Study identified the need for improved regional bus service from:

- Gainesville/Haymarket to Tysons Corner;
- Manassas to the Dulles Corridor;
- Western Prince William County to Reston/Herndon; and
- Chantilly/Fairfax area to DC via US 29 and US 50, operating as an express service.

Within the study corridor there is also a lack of TDM strategies. The I-66 TDM Study identified the need for:

- Enhanced corridor marketing;
- Vanpool driver incentives;
- Corridor-specific startup carpool incentives;
- Rideshare program operational support;
- Carsharing at priority bus activity nodes;
- Bike hubs/storage at priority bus activity nodes;

- TDM program evaluation;
- Enhanced Virginia Vanpool insurance pool;
- Enhanced Telework!VA; and
- Northern Virginia ongoing financial incentive.

There is also a need for improvements to Park-and-Ride lots within the study area as well as direct connections to the HOV lanes for priority buses.

2.4.4 Safety Deficiencies

As shown in **Table 2-8**, the I-66 study corridor in both directions has a lower crash rate, fatality rate, and injury rate than the overall statewide average for urban facilities.

Table 2-8. 2008-2010 I-66 Crash Rate

DIRECTION	LENGTH (MILES)	CRASH RATE [1]	FATALITY RATE [2]	INJURY RATE [1]
I-66 Study Corridor				
Eastbound	27	79.30	0.11	37.91
Westbound	27	78.03	0.11	39.87
Statewide				
Urban Interstates	454.76	84	0.3	41

[1] Rates are measured in per hundred million vehicle miles travelled.

[2] Crash rates are based on most recently available analysis of urban interstate crash rates (2008).

Source: VDOT 2012

Within the study corridor, **Table 2-9** presents the crash rate for each segment as compared to the corridor average. Several key areas have high crash rates compared to the I-66 corridor average, as highlighted in the table. In both directions of I-66, the areas around the three eastern interchanges have crash rates of over 100 crashes per hundred million vehicle miles travelled (HMVMT). Also, the westbound segment consisting of the interchanges of VA 28 and US 29 has a higher crash rate than the corridor; this is likely due to the high weaving volumes in a short segment between the two interchanges.

Table 2-9. Crash Rate by Segment (2008-2010)

SEGMENT/ROUTE/INTERCHANGE	EASTBOUND	WESTBOUND
US 15	44.2	41.7
US 29 (Gainesville) and VA 234 Bypass	38.9	70.3
VA 234 Business	70.3	67.6
Rest Area between VA 234 Business & US 29 (Centreville)	28.4	47.2
US 29 (Centreville) and VA 28	61.8	90.4
Fairfax County Parkway – VA 286	44.2	53.4
US 50	62.2	31.0
VA 123	104.5	109.3
VA 243 – Nutley Street	132.2	111.3
I-495 – Capital Beltway	255.4	131.0

I-66 Corridor Crash Rate (as shown in Table 2-8): Eastbound: 79.30; Westbound 78.03; Crash rate is per hundred million vehicle miles travelled (HMVMT).

Safety needs in the corridor include geometric deficiencies along both the I-66 mainline and at specific interchanges, and high weaving volumes in a short segment between the two interchanges. Examples of these deficiencies include:

WEAVING AND INTERCHANGE SPACING

AASHTO's *Geometric Design of Highways and Streets* (Sixth Edition, 2011) provides a general rule of thumb for minimum interchange spacing of one mile in urban areas and two miles in rural (Chapter 8, page 807); closely spaced interchanges can cause weaving and other operational and safety deficiencies. As VDOT classifies I-66 within the study corridor as urban, the spacing between interchanges is at or near this limit at two locations. These two locations are listed below.

- **US 29 Centreville ("east")/VA 28** spacing is one mile,
- **US 29 Gainesville ("west")/VA 234 Bypass** spacing is 1.4 miles, but the distance for vehicles to weave onto and off the I-66 mainline lanes is less than 2,800 feet in both directions.

GEOMETRICS

- **I-66 mainline (east of US 50).** The shoulder lane is used as a travel lane in the peak period of the peak direction of travel to help accommodate traffic demands. Because the shoulder is used for peak period, peak direction travel, much of it is not available to serve disabled vehicles needing to pull out of the travel lanes; this need is partially addressed through the provision of defined pull-off areas that are spaced along the roadway. A travel lane can be blocked, however, by disabled vehicles that cannot reach these defined pull-off areas. In addition, there are a number of locations where the roadway has substandard inside and/or outside shoulder widths; this resulted from the need to fit the overall roadway cross-section underneath existing road bridges (HOV lane operational deficiencies are identified in VDOT's *Interstate 66 HOV Lane Operations Study*, September 2009).
- **VA 234 Business.** A geometric deficiency exists on VA 234 within the interchange as no shoulder exists under the I-66 bridges.
- **I-66 mainline between VA 234 Business and VA 29 "east".** Substandard shoulders exist on I-66 where I-66 passes under Bull Run Drive, due to the locations of the existing bridge piers of the Bull Run Drive overpass.
- **US 29 "east" interchange.** US 29 mainline is geometrically deficient as it passes under I-66 as no shoulders exist due to the I-66 bridge piers. The southbound deceleration lane for the loop ramp to westbound I-66 is substandard in length due to the bridge pier.
- **US 50 Interchange.** The I-66 shoulders are substandard as it passes under the US 50 bridges, due to the locations of the existing bridge piers. The bridge piers also cause the acceleration and deceleration lanes for the back-to-back loop ramps to be substandard in length.

- **VA 123 Interchange.** Shoulder widths that do not meet current standards exist in the interchange due to the location of the existing bridge piers of VA 123 and the westbound to southbound flyover, and insufficient acceleration lane lengths exist due to the shoulder being used as a travel lane.
- **Nutley Street/Vienna Metrorail Station Access Interchange**. Inside shoulder widths do not meet current standards.

2.4.5 TRANSPORTATION PREDICTABILITY

While it is difficult to quantify, travelers experience highly unreliable travel times on I-66, particularly during peak periods. With volumes either at or over capacity, events such as a disabled vehicle in the travel lane or on the shoulder, or adverse weather conditions and glare from sunrises or sunsets, can result in substantial differences in travel time. The lack of predictability for travel in the corridor adversely affects the quality of life for travelers in the corridor and also makes it difficult for travelers to make decisions about when to travel and which mode to take. It also adversely affects both travel times and service predictability for the bus services that make use of the I-66 roadway. In addressing both capacity constraints and travel reliability, there is a need to support smoother travel within the corridor through the use of technology to identify and clear traffic incidents (crashes, disabled vehicles) safely and quickly and to provide travelers with information that can be used to identify alternative routes, modes, or travel times. Specific problems related to travel predictability include:

- Specifics on alternative routes are not known to all drivers (including travel time on these routes);
- Alternative mode choices and travel times for these modes are not known to all drivers;
- Locations of alternative modes, such as bus stops, are not known to all drivers;
- Lack of advance notice and real time notice of congestion results in drivers entering the I-66 lanes instead of making other choices;
- Need for further improvements to incident management practices and systems to reduce delays associated with non-recurring congestion.

When crashes occur, there is a lack of information available to assist drivers which can contribute to:

- Increased travel time;
- Failure to select alternate routes or modes of travel;
- Secondary crashes; and
- Increased response times.

2.5 SUMMARY OF NEEDS

Improvements to I-66 are needed to address:

- Existing and future capacity deficiencies
- Points of congestion

- Limited mode choice
- Safety
- Unpredictable travel

A summary of these conditions, both now and in the future, is provided below.

EXISTING TRANSPORTATION CONDITIONS ALONG I-66

- Over half of the corridor's peak direction roadway miles operate at a LOS E or LOS F in the AM peak.
- Nearly two-thirds of the corridor's peak direction roadway miles operate at a LOS E or LOS F in the PM peak.
- Peak period congestion in the eastern portion of the corridor is 4-5 hours per day (in each direction).
- Seven of twenty (one-way) segments within the corridor experience crash rates above the statewide average for urban interstates.
- Nine specific areas of congestion exist along the corridor where geometrics or capacity constraints cause peak period delay.
- There is a lack of traveler information along the corridor that can be used to identify alternate routes and modes.

PROJECTED 2040 CONDITIONS

- Traffic is expected to grow between 10-66% along the corridor, which would adversely affect both vehicular and transit bus operations.
- Employment in the Gainesville-Haymarket area is expected to grow 141%.
- All of the AM peak roadway miles are expected to operate at LOS E or LOS F.
- Over 90% of the PM peak roadway miles are expected to operate at LOS E or LOS F.
- Peak period congestion in the eastern portion of the corridor is expected to increase to 8-10 hours per day (in each direction), affecting both vehicular operations as well as the reliability of bus transit services.
- Metrorail's Orange/Silver Line demand will exceed the capacity of 120 riders per car.
- Safety concerns will increase by 2040 as traffic volumes continue to grow.
- As volumes increase the nine specific areas of congestion identified along the corridor where geometrics or capacity constraints cause peak period delay will remain and likely worsen.

2.6 I-66 TIER 1 EIS PURPOSE

The purpose of improvements is to improve multimodal mobility along the I-66 corridor by providing diverse travel choices in a cost-effective manner, and to enhance transportation safety and travel reliability for the public along the I-66 corridor.

3 IMPROVEMENT CONCEPTS

This chapter describes the development and evaluation of a range of improvement concepts within the I-66 study area. These improvement concepts include corridor-length options to provide increased multi-modal capacity as well as options to improve individual interchanges, address spot safety needs, and enhance travel efficiency. The concepts were developed with public and participating agency input. As illustrated in **Figure 3-1**, the improvement concept development and evaluation process identifies improvement concepts which satisfy the study's purpose and need and those that were carried forward for more detailed evaluation. The discussion in this chapter is intended to provide decision-makers with an understanding of the range of viable concepts as well as the supporting information on these concepts in order to support an informed Tier 1 decision on how to address the transportation needs in this section of I-66. It also provides examples of combinations of improvement concepts (termed "improvement concept scenarios" in this document) that can be evaluated in Tier 2.

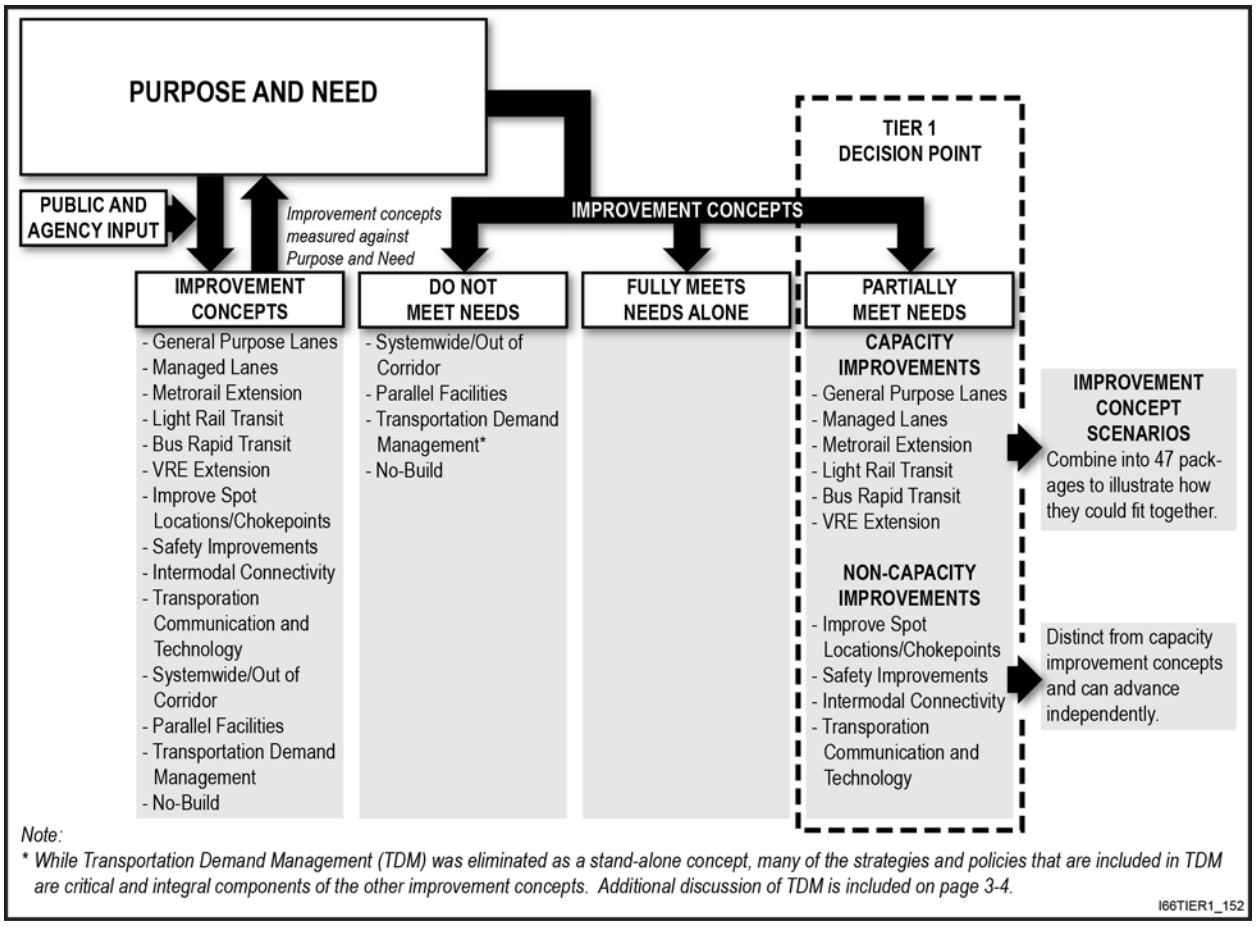


Figure 3-1. Concept Development and Evaluation Process

3.1 IMPROVEMENT CONCEPT DEVELOPMENT AND EVALUATION PROCESS

3.1.1 GOALS AND OBJECTIVES

While the goal of this evaluation is to address the purpose and need (as presented in Chapter 2), specific goals and objectives were developed in cooperation with participating agencies and the general public. These goals and objectives were used as a guide in the development of the improvement concepts. Improvement concepts presented in this EIS were developed with the following considerations:

- Addressing the safe movement of people and goods;
- Capitalizing on the use of existing facilities to the extent practicable;
- Improving accessibility to existing and future developments;
- Creating connections between centers of employment, education, residence, shopping, culture, and entertainment;
- Funding and cost effectiveness;
- Providing high-capacity, multi-modal transportation facilities with attractive travel choices;
- Minimizing project operating and maintenance costs;
- Minimizing impacts to the human and natural environments; and
- Supporting state, regional and local plans and policies.

In order to meet the **Transportation Capacity Deficiencies** and **Major Points of Congestion** needs identified in Chapter 2, consideration was given to reducing travel times, increasing person through-put in the corridor, and creating opportunities to manage travel demand.

When developing improvement concepts to meet the **Limited Travel Mode Choices** need, consideration was given to increasing mobility options; providing enhanced rail and bus services to support mode choices; providing focused transit infrastructure including transit stations with park-and-ride connectivity to transit services; providing infrastructure that supports connectivity to general purpose lanes, managed lanes and transit infrastructure; improving connectivity to bike/pedestrian networks from transit infrastructure; providing improved mobility and mode choice to transit oriented development (TOD); and integrating transit service with local bus, bicycle, pedestrian, and private automobile travel modes and facilities.

The need to address **Safety Deficiencies** and **Transportation Predictability** are also described in detail in Chapter 2. To address these needs, consideration was given to spot roadway improvements as well as supporting the use of Intelligent Transportation Systems (ITS) and operations techniques such as incident management and active traffic management during the concept development process.

3.1.2 IMPROVEMENT CONCEPTS: OVERVIEW

The term *improvement concept* is used in this document rather than the traditional term *alternative* because the improvements developed for this Tier 1 study are conceptual. These concepts

provide a level of detail commensurate with a Tier 1 NEPA document and the decisions to be made. Ten Build Improvement Concepts that directly address the needs described in the previous chapter were identified and considered. These concepts, along with the No-Build, which were developed in cooperation with participating agencies and the general public, are:

1. **General Purpose Lanes**: Construction of additional highway lanes open to all traffic.
2. **Managed Lanes**: Conversion of the existing HOV lane into either a one or two lane (in each direction) facility that would operate as a high-occupancy toll facility where only high-occupant vehicles[1] would be exempt from paying a toll.
3. **Metrorail Extension**: Metrorail service extending west from Vienna to either Centreville or Haymarket.
4. **Light Rail Transit**: Light rail service extending west from Vienna to either Centreville or Haymarket.
5. **Bus Rapid Transit**: Separate guideway bus rapid transit extending west from Vienna to Haymarket; service could extend east of Vienna.
6. **VRE Extension**: Extension of existing VRE service from Manassas to Haymarket.
7. **Improve Spot Locations/Chokepoints**: Improvements that address operations constraints at discrete locations (chokepoints) such as individual interchanges or specific junction points within the interchanges (i.e., merge, diverge, or weaving areas).
8. **Intermodal Connectivity**: Availability of a full range of travel modes within the corridor, as well as availability and functionality of connections between travel modes.
9. **Safety Improvements**: Safety improvements that address both location-specific and corridor-wide safety concerns.
10. **Transportation Communication and Technology**: Continued enhancements to ITS technology for all modes in the corridor, including traveler information, corridor and incident management, and transit technology.
11. **No-Build**: The No-Build is a stand-alone concept that serves as the baseline against which the Build Improvement Concepts are measured.

The following sections describe the concept development process, which varied across the ten Build Improvement Concepts.

- The development process for **General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**, which are described as *capacity improvement concepts*, was the most extensive as the improvements in these six categories would have the greatest potential to affect existing and future capacity deficiencies within the corridor. After evaluation of the six capacity improvement concepts revealed that none could meet the needs of the corridor as stand-alone improvement concepts, they were combined into 47 improvement concept scenarios (ICS). The ICS were evaluated for their ability to meet the needs in the corridor. The primary purpose of the ICS analysis is to aid decision-makers in understanding how the various improvement concepts can work

[1] Specific operational characteristics, including the number of persons per vehicle required to qualify as a high-occupant vehicle, would be determined in Tier 2 analyses. Per current VDOT policy, the analysis performed for this study assumed that vehicles with 3 or more persons qualify.

together. However, in accordance with the MOA, the Tier 1 decision will be to advance an improvement concept(s) to Tier 2, and not a specific ICS[2]. This process, described in Section 3.2, resulted in the definition and analysis of capacity-related improvement concepts and ICSs.

- The process for the non-capacity improvement concepts (**Improve Spot Locations/Chokepoints**, **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology**) followed a similar, but less detailed, process of developing and testing concepts with respect to the extent to which they address identified needs. This is due to the fact that these concepts focus more on a single mode and/or involve less potential interactions between modes and concepts; additionally, these concepts are generally more geographically focused and/or would involve lesser levels of potential impacts. These concepts can complement the capacity improvement concepts or serve in isolation to address components of the project's purpose and need to varying degrees. Section 3.3 through Section 3.6 describes the concept development process for these remaining improvement concepts.

The No-Build Concept is described in Section 3.7. Section 3.8 provides the analysis results of the Build Improvement Concepts and ICSs and Section 3.9 presents overall key findings of the analysis.

3.1.3 Other Improvement Concepts Eliminated from Detailed Study

In addition to the improvement concepts carried forward in this document, a wide range of other transportation improvement concepts were considered but eliminated from further study. These included the improvement of parallel roadways and system-wide or out-of-corridor improvements to Metrorail (such as Metrorail core capacity improvements). While these concepts may be important to improving mobility across the region, they were not advanced as part of this study because it was determined that they would not directly address the needs within the study corridor across multiple measures, including those related to capacity deficiencies, major points of congestion, and travel time predictability.

In addition, Transportation Demand Management (TDM), which includes a range of strategies and policies that seek to reduce the demands on the transportation system by reducing travel by single-occupant vehicle (SOV); reducing peak period travel; promoting travel by transit, walking, or bicycling; and promoting more transportation-efficient land development patterns, has been eliminated as a stand-alone concept because of its inability to meet the purpose and need. TDM strategies, however, have been incorporated into the Build Improvement Concepts that were carried forward. For example, the **Intermodal Connectivity** improvement concept includes intermodal transportation centers that include connections to I-66 managed lanes and local bus service, are easily accessible by walking and bicycling, and provide information and amenities that support carpool and vanpool formation. The **Managed Lanes** improvement concepts also provide critical support for carpools and vanpools by ensuring travel time savings for these modes of travel. The **Transportation Communication and Technology** improvement concept seeks to provide real-time information to support traveler shifts to other routes, times, or modes.

[2] Memorandum of Agreement among VDOT, VDRPT, FHWA and FTA Regarding the National Environmental Policy Act Process for Improvements in the Interstate 66 Corridor (June 7, 2011). Additional discussion of the MOA is included in Chapter 1.

While these particular improvements are not being advanced as stand-alone improvement concepts because they don't meet the needs, they are, as noted above, important parts of improvement concepts being carried forward. In addition, the selection of a Build Improvement Concept(s) will not preclude their development in the future as separate projects.

3.2 CAPACITY IMPROVEMENT CONCEPTS (GENERAL PURPOSE LANES, MANAGED LANES, METRORAIL EXTENSION, LIGHT RAIL TRANSIT, BUS RAPID TRANSIT, AND VRE EXTENSION)

The process of defining and then evaluating improvement options to address transportation capacity needs in the I-66 corridor utilized a strategic planning approach that assessed the ability of the full range of improvement combinations to carry predicted levels of travel in the corridor. This approach is detailed in the *Transportation Technical Report* and summarized in this section.

For all of the analysis, travel is represented in terms of person-trips, rather than vehicle-trips[3]. This reflects the fact that trips are currently, and will increasingly be, made across multiple travel modes. The process of developing the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**) consisted of four steps:

1. Quantify total travel demand in person-trips for each segment of the corridor in the horizon year of 2040.
2. Identify the range of improvement concepts for carrying person-trips in the corridor.
3. Quantify the generalized ability of each improvement concept to carry person-trips in the study corridor.
4. Identify the range of possible improvement concept combinations (i.e., the ICSs).

Each step of this process is described in greater detail below. The product of this four-step process is a high-level analysis framework that assists in identifying issues at a broad level and supports informed discussion and decision-making with respect to travel mode at a level of detail appropriate for a Tier 1 EIS. The analysis of the various improvement concepts is presented in Section 3.8.

Step 1: Quantify Total Travel Demand. Total travel demand for the study corridor was determined for the horizon year of 2040 using the Metropolitan Washington Council of Governments (MWCOG) Version 2.3 travel demand forecasting model[4]. The demand was calculated as the peak period (three-hour) person-trip demand for each segment of I-66 and reflects

[3] In simplified terms, the basis for travel demand modeling is trips made by individuals (person-trips) which are then converted to trips made by various modes (walking-trips, transit-trips, vehicle-trips, etc.) within the modeling environment using a set of validated mode-split assumptions. As described in this chapter, and in more detail in the *Transportation Technical Report*, the analysis process for the strategic planning approach employed in this study makes use of person-trips across all modes rather than trips by particular modes.

[4] The region's travel demand forecasting model was developed and is maintained by MWCOG. This study utilized the *TPB Travel Forecasting Model, Version 2.3 Build 38* (obtained from MWCOG on February 9, 2012). The 3,722 zone system Round 8.0a Cooperative Forecasts was used for the population and employment estimates.

the highest direction across both the morning and evening peak periods. Demand is also based on unconstrained capacity on I-66 itself (although connecting roads were constrained) in order to ascertain total demand. As shown in **Figure 3-2**, the three-hour maximum demand in 2040 ranges from a low of 33,000 person-trips between US 15 and US 29 West, to a high of approximately 76,000 person-trips (both between VA 28 and the Fairfax County Parkway and between VA 243 and the Capital Beltway). As these are person-trip estimates, it is important to note that these maximum-direction demand volumes will not match vehicle traffic forecasts on I-66.

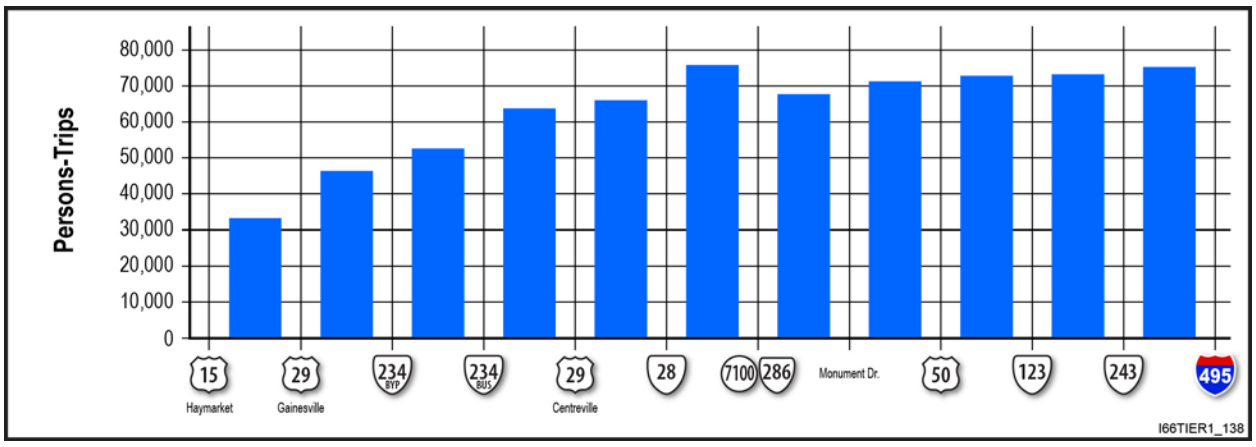


Figure 3-2. Three-Hour Demand in Person-Trips in 2040 (Maximum of Both Directions)

Steps 2 and 3: Identify Capacity Improvement Concepts and Quantify Their Ability to Carry Person-Trips. Based on previous studies as well as input from the general public and participating agencies, a list of means for carrying person-trips in the corridor was developed. These were identified as potential improvement concepts that represent the full range of travel modes that are likely within the I-66 corridor. Based on the inclusion of bicycle facilities in locality transportation plans, all capacity improvement concepts are assumed to include them. As previously discussed, a total of six capacity improvement concepts (with abbreviations shown in parentheses) were considered:

1. **General Purpose Lanes** (GP): Representing up to nine additional lanes (in each direction) depending on demand.
2. **Managed Lanes 1 & 2** (ML1/ML2): Representing one or two additional lanes in each direction that would operate as a high-occupancy toll facility with non-toll vehicles carrying 3+ persons.
3. **Metrorail Extension** (Metrorail): Metrorail-type service extending west from Vienna to either Centreville or Haymarket.
4. **Light Rail Transit** (LRT): Light rail service extending west from Vienna to either Centreville or Haymarket.
5. **Bus Rapid Transit** (BRT): Separate guideway bus rapid transit extending west from Vienna to Haymarket; service could extend east of Vienna.
6. **VRE Extension** (VRE): Extension of existing VRE service from Manassas to Haymarket.

These capacity improvement concepts represent discrete units with unique carrying abilities that can be put together in various combinations to accommodate the travel demands within the corridor. Two options for the **Managed Lanes** improvement concept (i.e., constructing one or two additional lanes in each direction) were carried forward. The sizing of the concepts varies, particularly for transit modes, based on many measures, including overall demand, development patterns, feeder bus service, and support facilities such as park-and-ride lots. Sizing considerations took into account all of these variables at a high-level; reflecting a combination of typical values and experiences in similar facilities across the country. The values were then reviewed with staff from regional transportation agencies.

Table 3-1 summarizes the assumed carrying ability for the six capacity improvement concepts for the peak three hours[5]; full details on the sizing considerations and their development are included in the *Transportation Technical Report*. Note that the "sizes" shown in Table 3-1, with the exception of **General Purpose Lanes**, are for the concept as a whole. The **General Purpose Lanes** size is shown per lane.

Table 3-1. Capacity Improvement Concept Size Summary

CAPACITY IMPROVEMENT CONCEPT	ESTIMATED PERSON-TRIPS CARRIED IN THREE-HOUR PEAK PERIOD
General Purpose Lanes	7,900
Managed Lanes 1	17,900
Managed Lanes 2	29,300
Metrorail Extension	18,300
Light Rail Transit	5,400
Bus Rapid Transit	4,200
VRE Extension	8,300

Step 4: Identify Improvement Concept Scenarios. Forty-seven capacity ICSs are shown in **Table 3-2**; these represent all logically consistent combinations of the capacity-related improvement concepts[6]. The total number of capacity ICSs was affected by the fact that combinations including both **Managed Lanes 1** and **Managed Lanes 2** are not possible, and only one of the following three improvement concepts are part of any combination due to significant overlap in service: **Metrorail Extension**, **Light Rail Transit**, and **Bus Rapid Transit**.

Order of Combining Improvement Concepts: If one visualizes each improvement concept as a "building block", the improvement concept sizes shown in Table 3-1 represent the sizes of these blocks. An ICS that fully meets the estimated person-trip demands shown in Figure 3-2 would consist of putting together the building blocks into an ICS so that the sizes add up to the total estimated person-trip demand. With the exception of **General Purpose Lanes**, only one of each improvement concept block is included in an ICS (note that in Table 3-1, Managed Lanes are included as a one-lane block concept as well as a two-lane block concept). This is because, for example, one would not add more than one Metrorail line in the study corridor; this same logic applies to all of the other improvement concepts shown in Table 3-1.

[5] The MWCOG travel demand model provides forecasts for both peak and off-peak (mid-day and night-time) travel. The forecasts for the peak period (which covers three hours for the AM peak) were used. Further details are included in the *Transportation Technical Report*.

[6] Some combinations within the same corridor, such as both **Managed Lanes 1** and **Managed Lanes 2** or **Metrorail Extension** and **Bus Rapid Transit**, would provide overlapping and/or competing services; the 47 total ICSs excludes these types of combinations.

Table 3-2. Listing of Improvement Concept Scenarios (ICS)

SCENARIO	NAME	SCENARIO	NAME	SCENARIO	NAME
0	No-Build	16	ML1 + BRT	32	GP + ML2 + VRE
1	GP Only	17	ML1 + VRE	33	GP + Metrorail + VRE
2	ML1 Only	18	ML2 + Metrorail	34	ML1 + Metrorail + VRE
3	ML2 Only	19	ML2 + LRT	35	ML2 + Metrorail + VRE
4	Metrorail Only	20	ML2 + BRT	36	GP + LRT + VRE
5	LRT Only	21	ML2 + VRE	37	ML1 + LRT + VRE
6	BRT Only	22	Metrorail + VRE	38	ML2 + LRT + VRE
7	VRE Only	23	LRT + VRE	39	GP + BRT + VRE
8	GP + ML1	24	BRT + VRE	40	ML1 + BRT + VRE
9	GP + ML2	25	GP + ML1 + Metrorail	41	ML2 + BRT + VRE
10	GP + Metrorail	26	GP + ML1 + LRT	42	GP + ML1 + Metrorail + VRE
11	GP + LRT	27	GP + ML1 + BRT	43	GP + ML1 + LRT + VRE
12	GP + BRT	28	GP + ML1 + VRE	44	GP + ML1 + BRT + VRE
13	GP + VRE	29	GP + ML2 + Metrorail	45	GP + ML2 + Metrorail + VRE
14	ML1 + Metrorail	30	GP + ML2 + LRT	46	GP + ML2 + LRT + VRE
15	ML1 + LRT	31	GP + ML2 + BRT	47	GP + ML2 + BRT + VRE

Key to Abbreviations: GP = general purpose lane(s), ML1 and ML2 = managed lane(s) with either one or two lanes in each direction, Metrorail = WMATA Orange Line extension, LRT = light rail transit, BRT = bus rapid transit, VRE = Virginia Railway Express commuter rail

Unlike for the other improvement concepts, there is a range in the number of **General Purpose Lanes** that could be added to meet demand. A key assumption for the study's approach was that the General Purpose Lanes were the last to be added to every ICS. As an example, ICS Number 45 in Table 3-2 includes **General Purpose Lanes**, two **Managed Lanes** (in each direction), **Metrorail Extension**, and **VRE Extension**. Once the building blocks for the set of two **Managed Lanes**, **Metrorail Extension**, and **VRE Extension** were added, there remained an unmet person-trip demand. It was only at this point that **General Purpose Lanes** were added to meet the remaining unmet demand. Section 3.8, which describes the results of the analysis of the various combinations, also identifies the number of **General Purpose Lanes** that were added to each ICS that included them.

3.3 IMPROVE SPOT LOCATIONS/CHOKEPOINTS

While overall capacity presents one major need within the I-66 study corridor, operations at individual locations, particularly at interchange locations, present impediments to the flow of traffic, particularly during peak periods. An analysis of travel speeds in the study corridor[7] identified four primary locations that can be described as chokepoints where daily congestion occurs. These are interchanges at the following locations:

- US 50 (Lee Jackson Highway);
- VA 123 (Chain Bridge Road);
- VA 243 (Nutley Street); and

[7] *Interstate 66 HOV Lane Operations Study*, prepared for Virginia Department of Transportation (Northern Virginia Region Operations), October 2009.

- I-495 (Capital Beltway) – note that the travel speed analysis was performed prior to the completion of improvements at this interchange which were part of the I-495 Express Lanes project.

Confirmation of these chokepoints, as well as the identification of additional chokepoints, was based on LOS analysis performed for the No-Build Concept in the study horizon year of 2040. The LOS analysis (described in detail in the *Traffic and Transportation Technical Report*) confirms congestion at the locations listed above and also highlights operations deficiencies (LOS E or F) at several additional locations. These, which are shown in **Figure 3-3**, include:

- The merge area where VA 234 Bypass (Prince William Parkway) northbound to eastbound traffic merges with eastbound I-66 traffic;
- VA 234 Business (Sudley Road) within the interchange area which affects the ability of traffic to enter and exit I-66;
- VA 28 (Sully Road) at the off-ramps in peak direction of travel, on VA 28 both within the interchange and also extending to the north;
- VA 286 (Fairfax County Parkway), within the merge/diverge areas on the collector/ distributor roads; and
- Between US 50 and VA 123 and in the vicinity of the VA 243 (Nutley Street and Vienna Metrorail station), due to heavy merging volumes. This congestion can result in queue spillback to adjacent upstream interchanges.

Improvements to address these deficiencies, in conjunction with overall multi-modal capacity enhancements, would improve the flow of traffic by removing major chokepoints within the study corridor.

3.4 INTERMODAL CONNECTIVITY

Increasing the number of travel mode options and improving coordination and connections between these modes was identified as a transportation need in the study corridor. The majority of the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**) partially address this need by providing for additional capacity across multiple modes. Additional improvements that could further improve travel choices and interconnectivity include the provision of a bicycle trail adjacent to or near I-66 and intermodal facilities that include park-and-ride and priority bus facilities that include direct connections to the I-66 travel lanes (particularly the HOV or managed lanes).

The following features are important components of the intermodal centers:

- **Ramps from/to station areas to/from I-66 travel lanes:** Ramp connections from parking and station areas to I-66 general purpose or managed lanes.
- **Information and support amenities:** Station designs and features that include a full range of features such as traveler information kiosks, bus shelters, and bicycle lockers.

- **Station area bicycle and pedestrian improvements:** Safe and efficient connectivity to the bicycle and pedestrian system would be provided, with particular emphasis on the half-mile radius around the stations.
- **Adjustments and/or enhancements to local bus service:** Modifications to local bus service would provide enhanced connectivity to these intermodal stations.

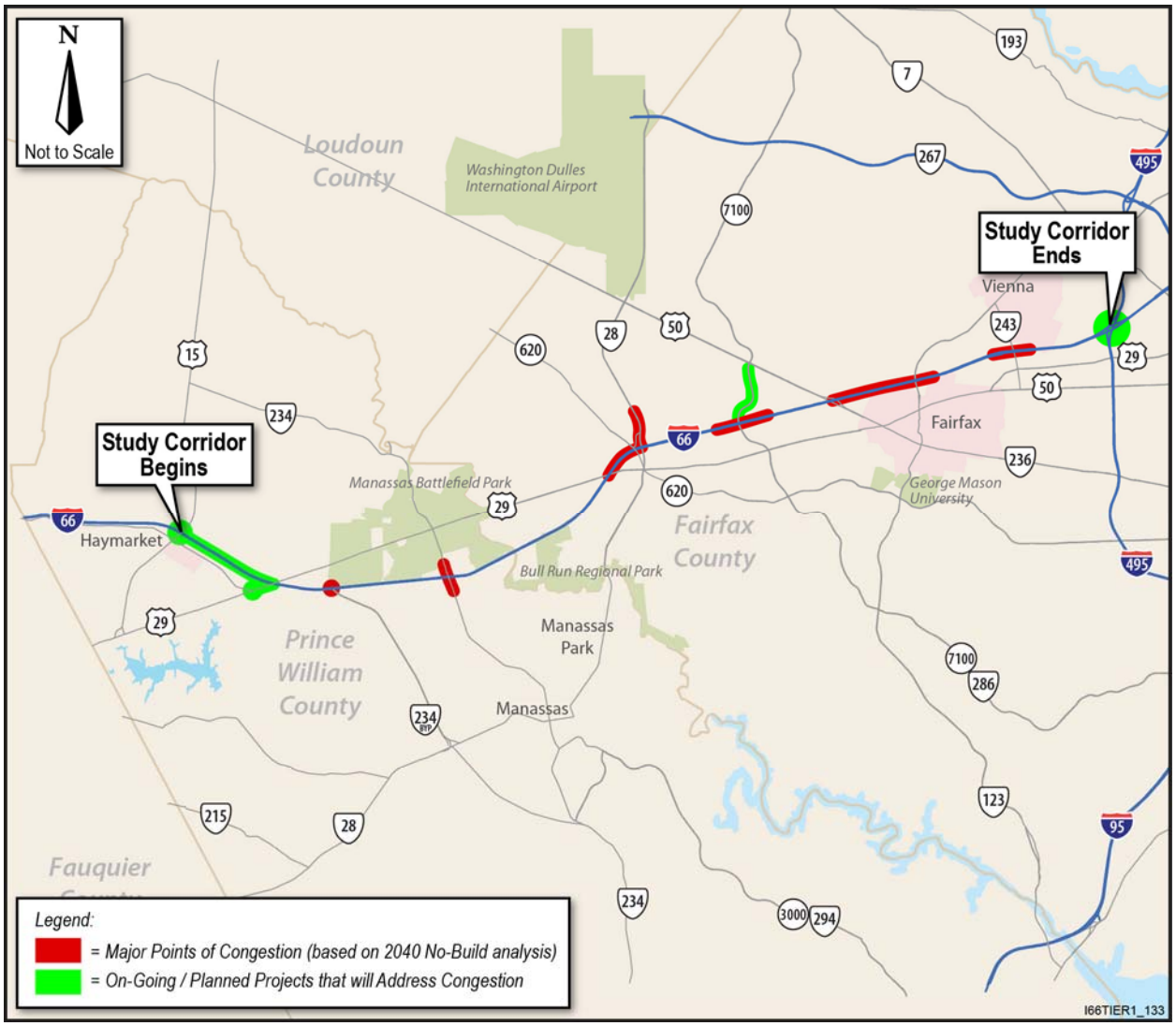


Figure 3-3. Major Points of Congestion

Bicycle travel is becoming an increasingly important travel mode for both commuter and recreational travel. The Washington and Old Dominion Trail (owned and operated by the Northern Virginia Regional Park Authority) serves much of the I-66 corridor inside the Capital Beltway and runs immediately adjacent to the highway in several locations. The trail diverts from I-66 at the Capital Beltway and runs northwest to the Towns of Vienna and Herndon. The provision of a bicycle trail that serves the I-66 corridor outside of the Beltway would provide bicycle accessibility to large portions of Fairfax County and beyond, and is included in the County's transportation plan. In addition, a bicycle trail in the I-66 study corridor would connect to other bicycle facilities planned in both Fairfax and Prince William Counties.

Key contributors to the success of bus service and HOV or managed lanes within a suburban environment are intermodal centers that include priority bus stations that are served by feeder bus service and park-and-ride facilities and also have direct connections to the managed lanes. Key locations for intermodal centers that have been identified in regional planning documents (both expansion of existing locations as well as new locations) include[8]:

- Haymarket;
- Gainesville;
- VA 234 Bypass (enhancements to existing park-and-ride lot);
- Bull Run;
- Centreville;
- Stringfellow Road;
- Monument Drive/Fairfax Corner; and
- Vienna/GMU (enhancements to existing Metrorail station).

3.5 SAFETY IMPROVEMENTS

As noted in Chapter 2, the crash rate in the study corridor is just under the statewide average for urban interstates in Virginia, but is higher when compared to the overall I-66 corridor from I-81 to the Potomac River. There are segments and spot locations where the history of crashes indicates specific safety improvement needs. Within the study corridor, the segment of I-66 between US 50 and the Capital Beltway has higher crash rates, both overall and those with injuries, than the statewide average. Contributing features include high levels of congestion as well as geometric features of the roadway that do not meet current design standards. Some of the contributing elements include short acceleration and deceleration lanes, use of the shoulder lane as a travel lane during the peak periods, and the lack of a shoulder during the peak periods with limited emergency pullout areas. Examples of specific safety improvements include:

- **Interchange at US 50:** Improve eastbound entrance, including extension of merge lanes.
- **Interchange at Vienna Metrorail Station:** Improve westbound merge/diverge areas; provide tow-truck at the interchange for contingent use during PM peaks.
- **Interchanges at VA 28/US 29:** Improve the eastbound on-ramp from US 29 and eastbound off-ramp to VA 28 to meet current auxiliary lane standards to improve merge and diverge operations.
- **Interchange at VA 234 Business:** Extend the westbound on-ramp from VA 234 Business and widen ramp widths for westbound dual-lane exit.

[8] These locations were identified in the *I-66 Transit/TDM Study* (Virginia Department of Rail and Public Transportation, December 2009); the locations were confirmed as part of this study.

3.6 TRANSPORTATION COMMUNICATION AND TECHNOLOGY

These improvements make use of new technologies, often collectively referred to as intelligent transportation systems, or ITS. They provide the tools to increase the efficiency of the corridor in moving people and in enhancing safety. The improvements enhance the ability to provide additional real-time information to travelers for all modes of travel, allow for rapid response to incidents, provide for smoother flow of traffic through ramp metering, and allow for dynamic use of shoulders when needed. A key focus of ITS is collecting, processing and disseminating information to the system's users. Improvements within this group include:

- **Advanced Transportation Management Systems (ATMS):** This includes improvements aimed at safety and incident management through the use of sign gantries, shoulder and lane control signs, speed displays, incident and queue detection, and increased traffic camera coverage. An ATMS continuously monitors traffic and roadway conditions and supports rapid response to incidents and other on-the-road changes. The system collects information on conditions using monitoring equipment, such as vehicle detection sensors, closed-circuit television cameras, etc. Some ATMS enhancement efforts are currently ongoing in the corridor.[9]
- **Integrated Corridor Management (ICM):** The focus of ICM is on providing information to travelers with respect to travel conditions, so that decisions can be made with respect to shifting routes or travel modes. A complete system would provide the traveler with information such as the location of a transit facility, the availability of parking, and route schedules.

3.7 NO-BUILD

The no action or No-Build Concept provides a baseline against which to compare the Build Improvement Concepts. Under the No-Build, only those projects included in the *2011 Constrained Long Range Plan (CLRP) for the Washington Metropolitan Region* are included. They include:

1. Upgrade of US 15 interchange.
2. I-66 Widening (from four to eight lanes) between US 15 and US 29 (Gainesville) with inside (median) HOV lane.
3. Widening of US 15 to four lanes from US 29 to I-66.
4. Construct interchange at US 29 Linton Hall Road, including bridging railroad tracks.
5. Extend VA 234 Bypass to US 50 (Tri-County Parkway); environmental studies ongoing.
6. Widen VA 28 from six to eight lanes from I-66 to VA 7.
7. Fairfax County Parkway improvements, including a new interchange at Fair Lakes Parkway and Monument Drive, construction of HOV lanes from I-66 to the Dulles Toll Road, and widening from four to six lanes between VA 123 and I-66.

[9] ATMS improvements within the I-66 corridor, as well as other key corridors across the Commonwealth, are continually being identified to enhance efficiency and safety and reflect ongoing advances in technology. Improvements that are currently being implemented in the corridor are described here: http://www.virginiadot.org/projects/northernvirginia/i-66_atms.asp

8. Construct bus-only ramps at the Vienna Metrorail station.
9. Pavement rehabilitation of I-66 between US 50 and I-495.

The 2012 CLRP (approved by the National Capital Region Transportation Planning Board on July 18, 2012) also includes the construction of the Manassas National Battlefield Park Bypass along with the closure of US 29 through the central portion of the park[10].

3.8 ANALYSIS OF IMPROVEMENT CONCEPTS

The ten Build Improvement Concepts address the needs that were identified in Chapter 2 to varying degrees. The capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**) address the needs with particular emphasis on accommodating demand and supporting travel mode choices, but would also improve congestion at chokepoints and improve safety by providing roadways that meet current standards. The **Improve Spot Locations/Chokepoints** improvement concept specifically addresses congestion at existing major points of congestion as well as those projected to occur based on increased travel demands, and it would improve safety. The **Intermodal Connectivity** improvement concept would enhance travel mode choices and provide increased interconnectivity between travel modes. The **Safety Improvements** concept would enhance safety, primarily at spot locations, and the **Transportation Communication and Technology** improvement concept would enhance the efficiency and safety of the corridor through the application of information technologies and traveler information.

The **Improve Spot Locations/Chokepoints**, **Intermodal Connectivity**, **Safety Improvements**, **Transportation Communication and Technology** improvement concepts are, to a large extent, enhancements that have been studied and proposed in previous studies within the corridor; and have also been suggested as part of the public and agency outreach process of the previous studies as well as this EIS. If any of these improvement concepts are advanced to Tier 2, refinements would take place through a combination of detailed studies and Tier 2 environmental analyses. The capacity improvement concepts, on the other hand, reflect high-level analyses performed as part of this study to identify and evaluate transportation improvements, and combinations thereof, that address, to various degrees, the projected travel demands in the study corridor to the year 2040. The remainder of this section describes the relative ability of the various capacity improvement concepts, and combinations of capacity improvement concepts, to meet these travel demands.

Table 3-3 summarizes the ability of each improvement concept to meet the purpose and need. The No-Build Concept does not meet any of the needs identified in Chapter 2, and none of the other ten concepts can meet the needs alone. As illustrated by the table, it is necessary to combine the improvement concepts to identify a solution capable of meeting all of the needs in the corridor. In addition, no single capacity improvement concept (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension)** can meet the capacity needs of the corridor. For this reason, combinations of the six

[10] Because of the recent adoption of the 2012 CLRP, this project was not included in the No-Build modeling for the I-66 Tier 1 EIS. Sensitivity runs of the travel demand model indicate limited effects on I-66 of the combined actions of constructing the MNBPB and closing US 29 in the park.

capacity improvement concepts have been assembled into 47 capacity ICSs. Each of the ICSs was evaluated based on metrics that represent the measurable aspects of the goals and objectives described in Section 3.1. These metrics are described below, with the results shown in **Table 3-4**.

- **Ability to accommodate demand:** the percent of total demand accommodated (represented by the three-hour carrying ability of the improvement concept divided by the total three-hour (peak period) person-trip demand);
- **Ability to enhance modal choices:** the percent of total demand accommodated by transit (represented by the transit portion of the three-hour carrying ability of the improvement concept divided by the total three-hour person-trip demand);
- **Generalized physical width:** estimated width based on planning-level footprint widths for the improvement concepts;
- **Space efficiency:** persons that can be moved within the generalized width of the improvement concept (represented by the ratio of total demand accommodated divided by the generalized width of the improvement concept);
- **Generalized planning-level cost:** sum of capital cost plus 30-year operations and maintenance; and
- **Cost per incremental person-trip accommodated:** 30-year operations and maintenance cost divided by the person-trips served by the ICS as compared to person-trips served by the No-Build.

Table 3-3. Evaluation of Improvement Concepts Against Purpose and Need Elements

IMPROVEMENT CONCEPT	EXISTING AND FUTURE CAPACITY DEFICIENCIES	IMPROVE SPOT LOCATIONS/ CHOKEPOINTS	LIMITED MODE CHOICES	SAFETY DEFICIENCIES	UNPREDICTABLE TRAVEL TIMES
General Purpose Lanes	🟡[1]	🟡	🔴	🟡	🟡
Managed Lanes	🟡	🟡	🟡	🟡	🟡
Metrorail Extension	🟡	🔴	🟢	🔴	🟡
Light Rail Transit	🟡	🔴	🟢	🔴	🟡
Bus Rapid Transit	🟡	🔴	🟢	🔴	🟡
VRE Extension	🟡	🔴	🟢	🔴	🟡
Improve Spot Locations/Chokepoints	🟡	🟢	🔴	🟢	🟢
Intermodal Connectivity	🟡	🟡	🟢	🔴	🟢
Safety Improvements	🟡	🟡	🔴	🟢	🟢
Communication and Technology	🟡	🟡	🟡	🟢	🟢
No-Build	🔴	🔴	🔴	🔴	🔴

Meets Purpose and Need? 🟢 *= Yes* 🟡 *= Partially* 🔴 *= No*

Notes:
[1]Fully meeting purpose and need would require a total of 18 lanes for higher volume portions of the I-66 study corridor. The "partial" rating shown here reflects the fact that such a roadway width is impractical and not reasonable.

Table 3-4. Evaluation of Capacity Improvement Scenarios (ICSs)

CAPACITY IMPROVEMENT CONCEPT SCENARIO[1]	ABILITY TO ACCOMMODATE TOTAL DEMAND[2]	ABILITY TO ENHANCE MODAL CHOICES[3]	ABILITY TO REDUCE SOV SHARE AND SUPPORT TDM[4]	GENERALIZED PHYSICAL WIDTH (FEET)[5]	SPACE EFFICIENCY[6]	GENERALIZED PLANNING-LEVEL COST ($MILLIONS)[7]	COST PER INCREMENTAL PERSON-TRIP ACCOMMODATED[8]
No-Build	0.54	0.08	0.25	91	0.60	$0	$0
1: GP (12) Only	1.06	0.08	0.40	175	0.61	$3,854	$4,900
2: ML1 Only	0.71	0.11	0.39	91	0.78	$1,107	$4,300
3: ML2 Only	0.94	0.53	0.65	111	0.85	$1,901	$3,100
4: Metrorail Only	0.69	0.23	0.40	103	0.67	$2,123	$9,100
5: LRT Only	0.59	0.12	0.29	106	0.56	$1,216	$16,400
6: BRT Only	0.60	0.13	0.30	117	0.51	$412	$4,700
7: VRE Only	0.55	0.08	0.25	91	0.60	$53	$8,900
8: GP (8) + ML1	1.02	0.11	0.48	143	0.71	$3,502	$4,800
9: GP (4) + ML2	1.06	0.53	0.69	130	0.82	$2,754	$3,500
10: GP (8) + Metrorail	1.01	0.23	0.49	158	0.64	$4,626	$6,400
11: GP (10) + LRT	1.00	0.12	0.42	173	0.58	$4,276	$6,100
12: GP (10) + BRT	1.02	0.13	0.43	186	0.55	$3,556	$4,800
13: GP (10) + VRE	1.02	0.08	0.39	167	0.61	$3,544	$4,800
14: ML1 + Metrorail	0.86	0.27	0.54	103	0.83	$3,229	$6,600
15: ML1 + LRT	0.76	0.16	0.44	106	0.71	$2,323	$7,000
16: ML1 + BRT	0.77	0.17	0.45	118	0.65	$1,518	$4,400
17: ML1 + VRE	0.71	0.12	0.39	91	0.78	$1,160	$4,400
18: ML2 + Metrorail	1.09	0.69	0.81	123	0.89	$4,024	$4,800
19: ML2 + LRT	0.99	0.58	0.70	126	0.78	$3,118	$4,600
20: ML2 + BRT	1.00	0.59	0.71	138	0.72	$2,313	$3,300
21: ML2 + VRE	0.94	0.54	0.66	111	0.85	$1,955	$3,200
22: Metrorail + VRE	0.70	0.23	0.40	103	0.68	$2,176	$9,100
23: LRT + VRE	0.59	0.13	0.30	106	0.56	$1,269	$15,800
24: BRT + VRE	0.60	0.14	0.31	117	0.51	$465	$5,000
25: GP (6) + ML1 + Metrorail	1.03	0.27	0.59	135	0.76	$4,689	$6,300
26: GP (8) + ML1 + LRT	1.04	0.16	0.52	153	0.68	$4,457	$5,900
27: GP (8) + ML1 + BRT	1.03	0.17	0.53	162	0.64	$3,546	$4,700
28: GP (8) + ML1 + VRE	1.03	0.12	0.49	143	0.72	$3,555	$4,800
29: GP (2) + ML2 + Metrorail	1.11	0.69	0.81	127	0.87	$4,204	$4,900
30: GP (4) + ML2 + LRT	1.07	0.58	0.73	141	0.76	$3,769	$4,600
31: GP (4) + ML2 + BRT	1.08	0.59	0.74	152	0.71	$2,983	$3,600
32: GP (4) + ML2 + VRE	1.05	0.54	0.69	129	0.82	$2,764	$3,500
33: GP (8) + Metrorail + VRE	1.01	0.23	0.50	157	0.64	$4,625	$6,500

CAPACITY IMPROVEMENT CONCEPT SCENARIO[1]	ABILITY TO ACCOMMODATE TOTAL DEMAND[2]	ABILITY TO ENHANCE MODAL CHOICES[3]	ABILITY TO REDUCE SOV SHARE AND SUPPORT TDM[4]	GENERALIZED PHYSICAL WIDTH (FEET)[5]	SPACE EFFICIENCY[6]	GENERALIZED PLANNING-LEVEL COST ($MILLIONS)[7]	COST PER INCREMENTAL PERSON-TRIP ACCOMMODATED[8]
34: ML1 + Metrorail + VRE	0.87	0.27	0.55	103	0.84	$3,282	$6,600
35: ML2 + Metrorail + VRE	1.10	0.69	0.81	123	0.89	$4,077	$4,800
36: GP (10) + LRT + VRE	1.01	0.13	0.42	173	0.58	$4,320	$6,100
37: ML1 + LRT + VRE	0.76	0.17	0.44	106	0.71	$2,376	$7,100
38: ML2 + LRT + VRE	0.99	0.58	0.71	126	0.78	$3,171	$4,600
39: GP (10) + BRT + VRE	1.01	0.14	0.43	184	0.55	$3,497	$4,900
40: ML1 + BRT + VRE	0.77	0.17	0.45	118	0.65	$1,571	$4,500
41: ML2 + BRT + VRE	1.00	0.59	0.72	138	0.73	$2,366	$3,400
42: GP (6) + ML1 + Metrorail + VRE	1.02	0.27	0.59	133	0.77	$4,654	$6,300
43: GP (6) + ML1 + LRT + VRE	1.02	0.17	0.52	150	0.68	$4,381	$6,000
44: GP (8) + ML1 + BRT + VRE	1.04	0.17	0.53	162	0.64	$3,599	$4,800
45: GP (0) + ML2 + Metrorail + VRE	1.06	0.69	0.80	121	0.88	$3,984	$5,000
46: GP (4) + ML2 + LRT + VRE	1.06	0.58	0.73	139	0.76	$3,727	$4,700
47: GP (4) + ML2 + BRT + VRE	1.08	0.59	0.74	152	0.71	$3,036	$3,700

Notes:

To assist in interpreting the results, the top ten ranking values for each metric are highlighted in yellow, while the bottom ten ranking values are highlighted in blue.

[1]As described in the body of this chapter, the analytic approach summarized in this table sought to serve person-trip demand through transit modes first, with general purpose lanes added (for those scenarios that included general purpose lanes) to serve remaining demand. The number in parenthesis following "GP" in the scenario title is the total number of general purpose lanes (in both directions) that were added to accommodate this demand; the value is the maximum number of lanes across all segments of I-66 in the study area. Note that, while scenario 45 does not include general purpose lanes to widen I-66 at its peak width, it does differ from scenario 35 on several segments.

[2]Ratio of total demand accommodated by the improvement concept (1.00 indicates 100 percent of projected demand would be accommodated).

[3]Ratio of total demand accommodated by transit (1.00 indicates 100 percent of projected demand would be accommodated on transit).

[4]Ratio of total demand accommodated by transit and multi-occupant vehicles with 3 or more persons per vehicle (1.00 indicates 100 percent of projected demand would be accommodated on transit and multi-occupant vehicles).

[5]Estimated physical width (in feet) based on planning-level footprint (averaged for entire corridor).

[6]Relationship between the number of persons moved and the width of the improvement concept footprint (this is a relative scale where higher numbers reflect either more trips accommodated, less space required, or both).

[7]Estimated planning-level costs in millions: sum of capital cost and 30-year operations and maintenance costs.

[8]Measures the 30-year cost per person-mile of the increment of additional trips served by each scenario as compared to the No-Build.

Key to Abbreviations: GP = general purpose lane(s), ML1 and ML2 = managed lane(s) with the addition of either one or two lanes in each direction, Metrorail = WMATA Orange Line extension, LRT = light rail transit, BRT = bus rapid transit, VRE = Virginia Railway Express extension

It is important to note that the purpose of the evaluation was not to definitively identify one or more improvement concepts as being the "best," but rather to illustrate the effects of combining the improvement concepts into various ICSs and to objectively incorporate the experience and

knowledge of the study team as well as members of the participating agencies and the general public. Note that this analysis is provided as an illustration of how the various modes interact and, in accordance with the MOA, a specific ICS will not be selected as part of this Tier 1 study.

3.9 KEY FINDINGS

The following are key findings from the analysis of the improvement concepts:

- The No-Build Concept does not satisfy the purpose and need.
- None of the improvement concepts, as stand-alone concepts, fully satisfy the purpose and need.
- While TDM does not meet the purpose and need as a stand-alone improvement concept, TDM features are incorporated in all improvement concepts and enhance their effectiveness.
- Other than the two-lane **Managed Lanes** concept (ML2) which accommodates autos and buses alike, single mode improvement concepts result in large corridor width, high cost, poor efficiency, and/or inability to serve total demand. Fully meeting demand with these single-mode improvements is unlikely given the constraints within the corridor; multi-modal solutions would be more practicable in addressing transportation needs in the corridor.
- The projected peak period travel demands in the corridor highlight the need for a transportation solution that provides space efficiency – the ability to carry large numbers of persons within limited spaces. **Managed Lanes** and fixed-guideway transit (in descending order of carrying capacity: **Metrorail Extension**, **Bus Rapid Transit**, and **Light Rail Transit**) provide space efficiency.
- A two-lane (in each direction) **Managed Lanes** system would address projected demands in a more space-efficient manner than would **General Purpose Lanes**. A **General Purpose Lanes** only solution would require up to nine travel lanes in each direction to meet projected demand.
- The share of trips made either by transit or in multi-occupant vehicles for those ICSs that perform best against the Table 3-4 metrics reach over 80 percent. While accommodating such high percentages of trips by transit and multi-occupant vehicles would be very difficult[11], the fact that these percentages are so high is indicative of the benefit of including transit and managed lanes that can carry large numbers of person-trips as part of the solution.
- Tables 3-3 and 3-4 highlight that fully meeting demand with individual improvement concepts may not be possible given the constraints of the corridor. Not serving demand has implications such as diverting traffic to parallel routes that

[11] As noted earlier, the methodology used for the analysis first seeks to accommodate person-trips on transit or in multi-occupant vehicles. The high percentages of trips accommodated on these modes for many of the ICSs reflect this approach.

have even less ability to accommodate demand with its attending effects on the quality of life of surrounding communities[12].

- The non-capacity improvement concepts (**Intermodal Connectivity**, **Safety Improvements**, **Transportation Communication and Technology**, and **Improving Spot Locations/Chokepoints**) partially address the purpose and need and could advance independently of the capacity improvement concepts.

3.10 IMPROVEMENT CONCEPTS UNDER CONSIDERATION

All ten Build Improvement Concepts, as well as the No-Build Concept, are under consideration.

[12] This statement also reinforces the need to accommodate person-trips through both physical improvements and policies.

4 AFFECTED ENVIRONMENT

This Tier 1 EIS evaluates multiple improvement concepts within the I-66 corridor and one improvement concept, the VRE Extension, along the Norfolk Southern "B" Line Branch. As these are two distinct alignments, existing environmental conditions within the areas potentially affected by the proposed improvement concepts will be discussed in separate sections. The I-66 Study Area is 24.4 miles in length and encompasses a 1,000 foot wide corridor along Interstate 66 from US 15 in Prince William County to Interstate 495 in Fairfax. The VRE Extension Corridor includes a 1,000 foot wide corridor along the Norfolk Southern "B" Line Branch from Manassas to Haymarket. These areas were established by placing a 500-foot buffer to each side of the centerline of I-66 and the Norfolk Southern rail line within the project limits. These areas were used because it was believed to represent the maximum areas within which potential improvement concepts would be developed. The areas have been extended beyond the 500-foot buffer for the analysis of selected resources as indicated in the following sections.

This chapter contains descriptions of the existing conditions and resources within the human and natural environments of the I-66 Study Area and VRE Extension Corridor. This chapter is organized in such a way that readers can either review a brief summary table of existing conditions or they may read individual sections that have more specific information for each resource. A summary of the existing conditions is provided in **Table 4-1**. The sections following the table provide additional information on the affected environment to be assessed in Chapter 5, Environmental Consequences. Figures referenced in the following sections are provided at the end of this chapter.

4.1 HUMAN ENVIRONMENT

This section presents the existing conditions for the human environment within the I-66 Study Area and the VRE Extension Corridor. For the purposes of this Tier 1 EIS, the human environment includes land use; social and economic resources; farmlands and agricultural/forestal districts; air quality; noise; visual quality; parks, recreation areas and open space easements; historic properties, and hazardous materials.

4.1.1 LAND USE

The existing and future land use characteristics within the I-66 Study Area and VRE Extension Corridor are based on available planning documents, GIS mapping layers provided by the local jurisdictions, aerial photography (Google Earth), and coordination with planning staff within the local jurisdictions. Existing land uses, future development patterns and transportation objectives were characterized by reviewing current comprehensive plans and coordination with staff from the two counties and four municipalities included in the I-66 Study Area and the VRE Extension Corridor.

4.1.1.1 I-66 Study Area

LAND USE AND DEVELOPMENT PATTERNS

Land use in the I-66 Study Area is largely residential or preserved open space in the counties and a mixture of commercial, office and residential within and adjacent to the municipalities. Commercial, industrial and office uses tend to be clustered at the highway interchanges. **Figure 4-1** depicts existing land use categories within 500 feet of either side of I-66.

The study area is partially bordered by the Manassas National Battlefield Park which extends from the point where I-66 intersects with Battleview Parkway and Vandoor Lane easterly to Bull Run Drive just west of the City of Fairfax. Other notable clusters of land uses within the study area include:

- East of Manassas National Battlefield Park is a large area of vacant forested or agricultural land with Bull Run Regional Park located to the south.
- Three large regional shopping centers: Fair Lakes Promenade located at the interchange of I-66 and VA 608 (West Ox Road); Fairfax Corner located just south of I-66 on Monument Drive; Fair Oaks Mall located at the interchange of I-66 and US 50.
- A cluster of mixed commercial uses at the interchanges of I-66 with US 29 and Fairfax County Parkway.
- The American Military University and Northern Virginia Community College campuses at the interchange of I-66 with VA 234 as well as the Oakton High School campus at the intersection of VA 655 with I-66.
- The Vienna Metrorail station and associated surface parking lots and garages located at I-66 and VA 243 just west of Fairfax.
- A cluster of office complexes occurs at the interchange of I-66 with VA 608 (Monument Drive) in Fairfax.
- The Dunn Loring-Merrifield Metrorail Station, surface parking lots, and mixed residential and high-density office uses located at the interchange of I-66 and VA 650 (Gallows Road).

LAND USE OBJECTIVES / PLANNED GROWTH AREAS

The future land use vision and planned growth areas for each of the jurisdictions in the I-66 Study Area are summarized below. This information was derived from adopted comprehensive plans and future land use maps. Planned and programmed large-scale projects presented below are anticipated to be built within the coming five years. A large-scale project has been defined as one which requires 100 or more parking spaces or includes 50 or more housing units.

Town of Haymarket: Land use objectives of the Town of Haymarket include building and revitalizing the Town with emphasis on conserving the historic setting and resources, and protecting established residential areas as the primary land use. One of the Town's transportation objectives is to work with VDOT and Prince William County to improve transportation facilities within the I-66 corridor.

Table 4-1. Summary of Environmental Resources in I-66 Study Area and VRE Extension Corridor

	RESOURCE	I-66 STUDY AREA	VRE EXTENSION CORRIDOR
HUMAN ENVIRONMENT	Land Use	Land use is largely residential or preserved open space in the county areas and a mixture of commercial, office and residential uses within and adjacent to the municipalities. Commercial, industrial and office uses tend to be clustered at the highway interchanges. The corridor is partially bordered by the Manassas National Battlefield Park (see parklands).	Land use is largely industrial, interspersed with areas of undeveloped or vacant land. In Haymarket, the corridor is bordered on the north by residential development. Commercial and residential developments are also concentrated near the downtown area of the City of Manassas.
	Communities and Neighborhoods	The corridor is located in the Towns of Haymarket and Vienna, City of Fairfax, Fairfax County and Prince William County. Communities adjacent to the corridor include: Gainesville, Wellington, Sudley, Bull Run, Uniontown, Centreville, Oakton, Merrifield, and Dunn Loring. Large residential neighborhoods adjacent to the corridor include: Centreville Farms, Willow Springs, Crystal Springs, Penderlan, Dixie Hill, Fairfax Farms, Fairchester, Fairfax Woods, Cobbdale, Vienna Woods. Thirteen community facilities are located within the study corridor, including schools, places of worship, cemeteries and metro stops.	The corridor is located within the Town of Haymarket, the City of Manassas, and Prince William County. Communities adjacent to the corridor include: Gainesville, Wellington, Bull Run, and Ashton Glen. Large residential neighborhoods adjacent to the corridor include Georgetown South. Nine community facilities are located within the study corridor, including schools, places of worship, and cemeteries.
	Population and Employment	The City of Fairfax, Fairfax County and Prince William County have been experiencing steady growth from 1990 through 2010. Prince William County has experienced the highest level of growth, nearly doubling in population during that 20 year time frame. Population projections by the Virginia Employment Commission predict continued growth in all three localities. Limited growth is predicted in the Fairfax County at only 8% between 2010 and 2030. Major population growth is expected to continue in Prince William County with a 52% increase in population predicted by 2030. Employment is projected to increase significantly in the next 20 years with Prince William County having the greatest projected increase in employment, 92%, between 2009 and 2030.	The City of Manassas and Prince William County have been experiencing steady growth from 1990 through 2010. Prince William County has nearly doubled in population during that 20 year time frame while the City of Manassas has experienced more moderate growth. Population projections by the Virginia Employment Commission predict continued growth in both localities with an average growth of 50% by 2030. Employment is projected to increase significantly in the next 20 years with Prince William County having the greatest projected increase in employment, 92%, between 2009 and 2030.
	Environmental Justice	Seven census tracts have minority populations greater than 50%. The average minority population within the study area (i.e. Prince William and Fairfax counties and the City of Fairfax combined) is 38.5%. An additional three census tracts have minority populations greater than 10% above the study area average (i.e., greater than 48.5%). The average low-income population percentage within the study area is 5.2%, and two census tracts have low-income populations greater than 10% above the study area average (i.e. greater than 15.2%). There are no census tracts with low-income populations greater than 50%. The regional average for populations with limited English proficiency is 14.4%. There are seven census tracts with an LEP population greater than 10% above the regional average (i.e. greater than 24.4%). There are no census tracts within the corridor with LEP populations greater than 50%.	Three census tracts within the corridor have minority populations of greater than 50%. Within the VRE Extension Corridor area (Prince William County and the City of Manassas), the average minority population is 41.9%. Since 10% above the area average (51.9%) is also greater than 50%, no additional census tracts are identified with this criterion. The average low-income population percentage within the corridor is 6.0%, and two census tracts have low-income populations greater than 10% above the corridor average (i.e. greater than 16.0%). There are no census tracts with low-income populations greater than 50%. The regional average for populations with limited English proficiency is 13.8%. There are three census tracts with an LEP population greater than 10% above regional average (i.e. greater than 23.8%). There are no census tracts within the corridor with LEP populations greater than 50%.
	Farmlands and Agricultural/ Forestal Districts	The study area includes 143 acres of prime farmland or farmland of statewide importance. There are no agricultural or forestal districts within the study area.	The corridor includes 16 acres of prime farmland or farmland of statewide importance. There are no agricultural or forestal districts within the corridor.
	Air Quality	The I-66 Study Area is located in the National Capital Interstate Air Quality Control Region. The area is classified by the U.S. Environmental Protection Agency (EPA) as being in attainment for sulfur dioxide (SO_2), nitrogen dioxides (NO_2), particulate matter (PM_{10}), carbon monoxide (CO) and lead. It is classified as non-attainment for particulate matter ($PM_{2.5}$), and the 8-hour ozone (O_3) standard.	The VRE Extension Corridor is located in the National Capital Interstate Air Quality Control Region. The area is classified by the EPA as being in attainment for sulfur dioxide (SO_2), nitrogen dioxides (NO_2), particulate matter (PM_{10}), carbon monoxide (CO) and lead. It is classified as non-attainment for particulate matter ($PM_{2.5}$), and the 8-hour ozone (O_3) standard.
	Noise	Land uses within the study area that are subject to FHWA Noise Abatement Criteria include residential areas, parks, active sport areas, schools, cemeteries, places of worship, hotels, and offices.	Sensitive land uses within the corridor according to FTA noise screening procedures include single and multi-family residences, a mobile home park, schools, churches and libraries. The corridor also includes facilities that may have vibration-sensitive equipment such as BAE Systems, Lockheed Martin and IBM Systems.
	Visual Quality	Views from I-66 are dominated by the highway and adjacent trees, with occasional views of adjacent residential, commercial, and office buildings. Unique views from I-66 are limited to short duration views of open spaces within the Manassas National Battlefield Park and Bull Run Regional Park, and longer duration views of the distant Bull Run Mountains. Sensitive visual resources with views of I-66 include one Virginia Byway, seven public parks, and one National Rivers Inventory stream.	There are no existing public views from the rail corridor. Sensitive visual resources within the vicinity of the VRE Extension Corridor include one Virginia Byway and one scenic road..
	Public Parks, Recreation Areas, and Open Space Easements	The study area contains Manassas National Battlefield Park, Bull Run Regional Park, ten county and local parks and two schools with recreational facilities/play areas.	The corridor contains one school with recreational facilities. No publicly-owned parks have been identified within this corridor.
	Historic Properties	Within 1000 feet of the I-66 corridor, one property, Manassas National Battlefield Park, is listed on the National Register of Historic Places (NRHP) and five other architectural resources have been determined eligible for the NRHP by the Virginia Department of Historic Resources (DHR). Within 500 feet of the I-66 corridor, four archaeological properties have been formally evaluated by the DHR and determined to be potentially eligible for the NRHP.	Four architectural resources located within 1,000 feet of the Norfolk Southern “B” Line Branch are listed, or determined eligible or potentially eligible for the NRHP by DHR. No archaeological properties within the corridor have been formally evaluated by the DHR and determined to be eligible for, or are listed on the NRHP.
	Hazardous Materials	A total of 64 petroleum release sites and 20 other hazardous materials release sites were located within 0.25 mile and 0.5 mile of I-66, respectively. Seven solid waste facilities are located within 0.5 mile of I-66.	A total of 48 petroleum release sites and 55 other hazardous materials release sites were located within 0.25 mile and 0.5 mile of the Norfolk Southern “B” Line Branch, respectively. Two solid waste facilities are located within 0.5 mile of the rail line.

	RESOURCE	I-66 STUDY AREA	VRE EXTENSION CORRIDOR
NATURAL ENVIRONMENT	Water Quality	The study area includes four impaired water bodies, Bull Run, Cub Run, Big Rocky Run and Holmes Run. Within the study area, there are no EPA-designated sole source aquifers or public drinking water surface resource watersheds. There are seven public groundwater wells.	There are no impaired streams located within the corridor. Within the corridor, there are no EPA-designated sole source aquifers. The corridor is located within the Lake Manassas Dam watershed. No public groundwater wells have been identified within the corridor.
	Wetlands	A total of approximately 20 acres of wetlands are within the study area per National Wetlands Inventory (NWI) mapping. The types of wetlands found include palustrine emergent, palustrine scrub shrub, and palustrine forested. The predominant wetland type is palustrine forested.	A total of approximately 171 acres of wetlands are within the corridor per NWI mapping. The types of wetlands found include palustrine emergent, palustrine scrub shrub, and palustrine forested. The predominant wetland type is palustrine forested.
	Streams	The entire study area is located within the Potomac-Shenandoah River major watershed and is within two eight digit hydrologic unit code (HUC) boundaries (02070010 and 02070008).The study corridor crosses ten named streams and several unnamed smaller tributaries.	The entire VRE Extension Corridor is located within the Potomac-Shenandoah River major watershed and the Middle Potomac-Anacostia-Occoquan HUC code 02070010. The VRE Extension Corridor includes three named streams and several unnamed smaller tributaries.
	Coastal Zone Management Areas	Both Fairfax County and Prince William County are located within Virginia's coastal zone.	Prince William County is located within Virginia's coastal zone.
	Floodplains	The three major floodplains within the I-66 Study Area include Bull Run, Cub Run, and Big Rocky Run.. A total area of 202 acres of 100-year floodplain is located in the study area.	The corridor crosses two floodplains associated with North Fork Broad Run and Dawkins Branch. The total acreage of floodplains within the corridor is 108 acres.
	Wild and Scenic Rivers	There are no federally-listed Wild and Scenic Rivers in the study area. The segment of Bull Run north of I-66 is identified in the National River Inventory and as a potential component of the Virginia Scenic Rivers Inventory.	There are no federally designated Wild and Scenic Rivers or National Rivers Inventory rivers, or state-designated Scenic Rivers within the corridor.
	Wildlife Habitat	The study corridor is primarily urban and suburban in nature with wildlife communities typical of urban environments. Large parks and preservation areas within the western portion of the corridor provide natural forest habitats. Aquatic habitats are present within the streams and ponds that lie within the study area. There are no designated trout streams or anadramous fish use areas in the study area.	The corridor is primarily developed with forested areas scattered throughout the corridor. Aquatic habitats are present within the streams and ponds that lie within the corridor. There are no designated trout streams or anadramous fish use areas in the corridor.
	Natural Heritage Sites	The Cub Run Slopes Conservation Site and three natural heritage General Location Areas are located within the study area.	One natural heritage General Location Area is located within the corridor. No Conservation Sites are present.
	Threatened and Endangered Species	Based on the USFWS Information Planning and Conservation (IPAC) online review database, three federally listed species could potentially occur in the study area: harperella, small whorled pogonia, and dwarf wedgemussel. Additionally, two state-listed species have the potential to occur in the study area: wood turtle and brook floater.	Based on the USFWS Information Planning and Conservation (IPAC) online review database, three federally listed species could potentially occur in the VRE Extension Corridor: harperella, small whorled pogonia, and dwarf wedgemussel. Additionally, two state-listed species have the potential to occur in the corridor: wood turtle and brook floater.
	Invasive Species	The study area consists of both developed/disturbed areas and natural areas. While invasive species are common within disturbed areas, they are often observed within the natural areas of Fairfax and Prince William counties as well.	The corridor consists of both developed/disturbed areas and natural areas. While invasive species are common within disturbed areas, they are often observed within the natural areas of Prince William County as well.

No large-scale planned and programmed developments are anticipated in the Town of Haymarket in or adjacent to the study corridor. New development is expected to be mostly residential for townhomes or single-family homes.

City of Fairfax: One of the land use objectives of the City of Fairfax is to establish the intersection of VA 123 and US 50 as the City's gateway entrance from I-66 and Chain Bridge Road. Within the I-66 corridor, City transportation objectives include supporting the westward extension of Metrorail, consideration of mass transit or HOV lanes, and improved accessibility and capacity.

No large-scale projects are approved or under construction in close proximity to I-66 in the City of Fairfax. Two master redevelopment plans are currently being programmed for implementation by the City:

- Fairfax Boulevard Redevelopment Plan; and
- Old Town Fairfax Redevelopment.

Town of Vienna: The Town of Vienna's Comprehensive Plan identifies the need to mitigate the effects of regional development and traffic changes on the Town's transportation system while maintaining the single-family residential character of the Town. Specifically, the Comprehensive Plan calls for expediting the movement of traffic along Maple Avenue and Nutley Street, SW, and exploring opportunities for public transportation system improvements to reduce congestion, noise and air pollution.

There are no large-scale planned or programmed development projects anticipated in Vienna in or adjacent to the study corridor.

Prince William County: One of the major land use objectives of the Prince William County Comprehensive Plan is to achieve centers of commerce at appropriate locations that promote high-density, mixed-use development near existing and planned multi-modal transit centers that will facilitate greater use of mass transit by County residents and bring in new high-quality employment opportunities. One such location for higher density development identified in the Plan is the intersection of I-66 and US 29. Transportation objectives of the County relevant to I-66 include working with VDOT to speed the process of extending the I-66 HOV lanes, preparing design guidelines for the east end of the county's I-66 gateway (entering Prince William County from Fairfax County), and studying an alternative for US 29 that maintains and improves existing local access via the existing VA234/VA 234 Business from areas north of I-66.

Several large-scale projects are approved or under construction in close proximity to I-66 in Prince William County including:

- Commercial project just west of US 15 along I-66;
- A mixed-use commercial development with large-scale grocer near US 29;
- A number of industrial sites under development along Ballsford Road;
- Two hotels in the vicinity of VA234 and to the north of I-66;
- Several parcels in the business park on the north side of VA 234; and

- A new hospital at the location of the existing Heathcote Health center near the US 15 and I-66 interchange.

Fairfax County: The Fairfax County Comprehensive Plan identifies the need for a land use pattern which increases transportation efficiency, encourages transit use, and decreases automobile dependency. The Plan further suggests that regional and local efforts to achieve a balanced transportation system should include a focus on development of rapid rail, commuter rail, expanded bus, and pedestrian and bicycle facilities that connect with mass transit. For the I-66 corridor, the Plan calls for enhancing the public transportation corridor with rail/BRT and HOV lanes as far east as the VA 243 interchange, including extension of Metrorail service to Centreville. The Plan calls for widening of major arterial roads that cross I-66 including US 29, VA 608, VA 123, VA 698, and VA 650, and a partial grade separated interchange at I-66 and VA 243.

Some planned projects noted in the Fairfax County Comprehensive Plan have been approved but are not yet under construction according to County planning staff.

Projects under construction include:

- Dun Loring-Merrifield Metro Station Mixed Use Development on Gallows Road near Vienna;
- Metro West – Vienna Metro Station expansion on the south side of I-66 at US 29 and I-66 near the City of Fairfax; and
- Fair Oaks Mall Mixed Use Development at I-66 and US 50 near the City of Fairfax.

4.1.1.2 VRE Extension Corridor

LAND USE AND DEVELOPMENT PATTERNS

Land use in the VRE Extension Corridor through Prince William County is largely industrial, interspersed with areas of undeveloped or vacant land. Through Haymarket, the corridor character changes and is bordered on the north by residential development. In the City of Manassas, the rail corridor transitions from industrial land uses to more commercial uses and more mixed neighborhood-scale development as it approaches the downtown. **Figure 4-2** depicts existing land use categories within 500 feet of either side of the Norfolk Southern "B" Line Branch. Notable clusters of land uses within the VRE Extension Corridor include:

- West of Haymarket and US 15, the rail line is bordered by mostly undeveloped land;
- There is a cluster of commercial land uses where the rail line intersects with the junction of VA 55 and US 29 (Lee Highway);
- Other small commercial clusters occur near the intersection of the rail line with the Prince William Parkway and Sudley Manor Drive;
- The Lockheed Martin office and industrial complex abuts the rail line as part of the Manassas Office Research Park in Manassas;
- There is one cemetery at the southern tip of the rail corridor in Manassas; and
- There are three schools which sit adjacent to the rail line.

LAND USE OBJECTIVES / PLANNED GROWTH AREAS

The future land use vision and planned growth areas for each of the jurisdictions in the VRE Extension Corridor are summarized below. This information was derived from adopted comprehensive plans, future land use maps, and interviews with county and municipal planners.

Town of Haymarket: The same land use and transportation objectives of the Town of Haymarket described above for the I-66 Study Area are relevant to the VRE Extension Corridor.

Two large-scale planned and programmed developments are anticipated in the Town of Haymarket in or adjacent to the VRE Extension Corridor:

- Villages at Piedmont; proposed residential/master planned community on the south side of the rail line and just west of James Madison Highway; and
- Haymarket Industrial park; an approved site plan for an industrial park north of the rail line and abutting James Madison Parkway to the east.

City of Manassas: Land use objectives of the City of Manassas include maintaining its existing pattern of residential, commercial and open space land uses, promoting mixed uses compatible with existing neighborhoods, accommodating high quality infill and redevelopment where appropriate, and reinforcing the unique and positive qualities of diverse neighborhoods. The VRE Extension Corridor occurs in a "character area" classified as "Industrial/Suburban Business" in the Manassas Comprehensive Plan. Land use goals for this character area include supporting business and economic development, providing access to regional transportation networks to efficiently move goods, encouraging high quality development/redevelopment, and providing appropriate buffering to adjacent uses. City transportation objectives call for maximizing the efficiency and effectiveness of the City's connections to the regional road, rail, air, and bikeway transportation systems and specifically, improving access to regional and local transit services for all residents by supporting the expansion of VRE and OmniRide.

There are two large-scale projects programmed for development along the VRE Extension Corridor in Manassas:

- Van Metre at Old Town Manassas; located on Center Street and Quarry Road, approved in March, 2006 as mixed use with 182 residential units (condominiums) and 30,000 square feet of commercial space; currently under construction for a scaled down plan for 59 Townhomes; and
- Village of Wellington; located at the intersection of Hendley Road and Charleston Drive. It is under construction with 175 residential units and has potential for up to 25,000 square feet of commercial space.

Prince William County: The same land use and transportation objectives of Prince William County described above for the I-66 Study Area are relevant to the VRE Extension Corridor.

Two large-scale projects have been approved or are under construction in close proximity to the VRE Extension Corridor in Prince William County including:

- At the intersection of I-66 and US 29; commercial development under construction; and

- Wellington Rd. near Sudley Road; approved townhome development.

4.1.2 Social and Economic Resources

I-66 is a major transportation corridor for communities throughout the Northern Virginia and Washington, DC region. As a limited-access roadway, I-66 connects to the communities and neighborhoods with access only at designated interchanges. It is the major east-west route between Washington, DC and the cities and towns to the west in Virginia.

4.1.2.1 I-66 Study Area

Communities and Neighborhoods

The study area is located within the towns of Haymarket and Vienna, the City of Fairfax, and Fairfax and Prince William counties. Communities adjacent to the corridor include: Gainesville, Wellington, Sudley, Bull Run, Uniontown, Centreville, Oakton, Merrifield, and Dunn Loring. Large residential neighborhoods adjacent to the corridor include: Centreville Farms, Willow Springs, Crystal Springs, Penderlan, Dixie Hill, Fairfax Farms, Fairchester, Fairfax Woods, Cobbdale, and Vienna Woods.

Thirteen community facilities are located within the study corridor, including schools, places of worship, cemeteries and metro stops. Park and recreation facilities available to the community are presented in Section 4.1.7. Community facilities within or adjacent to the study area are listed in **Table 4-2**. Figure 4-1 depicts the locations of these facilities.

Table 4-2. Community Facilities in I-66 Study Area

FACILITY NAME	TYPE OF FACILITY
Marstellar	Cemetery
George G. Tyler Elementary	School
Monroe Cemetery	Cemetery
Manassas Mosque	Place of Worship
DeVry University	School
ECPI College of Technology – Northern Virginia Campus	School
University of Northern Virginia - Manassas	School
Sully Senior Center (formerly Centreville Methodist Church)	Other
Providence Elementary School	School
Oakton High School	School
Vienna/Fairfax-GMU Metro Station	Metro Station
Stenwood Elementary School	School
Dunn-Loring Merrifield Metro Station	Metro Station

Sources: VDOT GIS, ADC Mapping, Field Reviews (June 2012)

Population and Employment

Economic and employment data were examined for the City of Fairfax, Fairfax County and Prince William County for the I-66 corridor. **Table 4-3** and **Table 4-4** show historic population trends from 1990 through 2010 and population projections through 2030, respectively. All

localities have been experiencing steady growth from 1990 through 2010. Prince William County has experienced the highest level of growth nearly doubling in population during that 20 year time frame. Population projections by the Virginia Employment Commission predict continued growth in all three localities. Limited growth is predicted in Fairfax County at only 8% between 2010 and 2030. Major population growth is expected to continue in Prince William County with a 52% increase in population predicted by 2030.

Table 4-3. Total Population over Time for I-66 Study Area

LOCATION	1990	2000	2010	PERCENT CHANGE 1990-2010
City of Fairfax	19,622	21,498	22,565	15%
Fairfax County	818,584	969,749	1,081,726	32%
Prince William County	215,686	280,813	402,022	86%
Study Area Total	1,053,892	1,272,060	1,506,313	43%

Sources: Virginia Employment Commission, U.S. Census Bureau

Table 4-4. Population Projections for I-66 Study Area

LOCATION	2010	2020	2030	PERCENT CHANGE 2010-2030
City of Fairfax	22,565	24,193	25,561	13%
Fairfax County	1,081,726	1,101,144	1,165,525	8%
Prince William County	402,022	515,235	609,953	52%
Study Area Total	1,506,313	1,640,572	1,801,039	20%

Source: Virginia Employment Commission

Table 4-5 provides employment data for 2005, 2009, and projected data for 2030 for the I-66 Study Area. Due to the current state of the economy, employment levels in the area have decreased or remained steady between 2005 and 2009. Employment is projected to increase significantly in the next 20 years with Prince William County having the greatest projected increase with a 92% increase in employment between 2009 and 2030. The highest numbers of jobs in the Washington DC metropolitan region are in Business Services, Trades/Transportation and Utilities, and Federal government.

Table 4-5. Employment Data for I-66 Study Area

LOCATION	EMPLOYMENT 2005	EMPLOYMENT 2009	PERCENT CHANGE 2005-2009	EMPLOYMENT FORECAST 2030	PERCENT CHANGE FORECAST 2009-2030
City of Fairfax	23,692	20,070	-15%	34,000	69%
Fairfax County	565,179	570,932	1%	812,200	42%
Prince William County	100,751	102,008	1%	195,900	92%
Study Area Totals	689,622	693,010	0.5%	1,042,100	50%

Source: Metropolitan Washington Council of Governments, Economic Trends 2005-2009

ENVIRONMENTAL JUSTICE

Demographic data for the City of Fairfax, Fairfax County, and Prince William County were analyzed to determine whether the improvement concepts would have disproportionately high

and adverse human health or environmental effects on minority populations and low-income populations within the I-66 Study Area, as required by Title VI of the Civil Rights Act of 1964 and Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Population." Minority persons include citizens or lawful permanent residents of the U.S. who are African-American, Hispanic or Latino, Asian-American, American Indian, Native Alaskan, or Native Hawaiian/Pacific Islander. Low-income persons are defined as those whose median household income is below the U.S. Department of Health and Human Services poverty guidelines.

Data collection to determine the presence of persons with limited English proficiency (LEP) and considering the needs of the LEP population has also occurred as a part of this project, as per Executive Order 13166 "Improving Access to Services for Persons with Limited English Proficiency."

The reporting of detailed data by the decennial US Census changed between 2000 and 2010. In 2000, a long form was used for respondents to provide detailed demographic, housing, employment, and income data. In 2010, respondents to the decennial census were given a short form that did not include questions regarding employment or income. The Census Bureau has noted in its guidance for use that if a particular data product is available in the 2010 decennial census, this data product should be used. Therefore, total population and race, data from the 2010 data set appear in this EIS document. The American Community Survey (ACS) of 2006-2010 was used to provide detailed demographic data on persons with low-income and LEP. For the purposes of this EIS document, minorities are determined by subtracting the white only population from the total population, which means that persons that have identified themselves as white in combination with another race are reported as minorities.

Consistent with the CEQ's *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ, 1997), the criteria for identification of minority populations within the study area included census tracts in which 1) the minority population percentage exceeds 50%, or 2) the minority population is "meaningfully greater" than the minority population percentage in the "general population or other appropriate unit of geographic analysis." For the purpose of this EIS, the census data for the City of Fairfax, Fairfax County, and Prince William County were combined to establish a regional average for comparison to the census tracts within the I-66 Study Area. Minority population percentages exceeding ten percent above the regional average are considered to have met the second criteria[1].

Table 4-6 provides the census data on race, minority status, and LEP for the three localities and the combined regional average. Census tracks within the I-66 Study Area exceeding the 50% criteria are identified with orange shading in **Table 4-7**. Additionally, those census tracts exceeding the ten percent criteria are identified with yellow shading in Table 4-7. **Figure 4-3** and **Figure 4-4** depict the identified census tracts that have higher than 50% or 10% higher than average populations of concern along the I-66 corridor.

[1] The use of a "meaningfully greater" percentage is appropriate pursuant to Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

Seven census tracts within the I-66 Study Area have minority populations of greater than 50%. Within the region, the average minority population is 38.5%. An additional three census tracts have minority populations greater than 10% above the regional average (i.e., greater than 48.5%). Eight of these census tracts are located in Fairfax County. The other two census tracts are located in Prince William County. There are no census tracts within the study area in the City of Fairfax with higher minority populations than the regional average. The predominant minority group in the Fairfax County census tracts is Asian, while the predominant minority in the two census tracts of concern in Prince William County is Black or African-American.

Table 4-6. 2010 Demographic Data within City of Fairfax, and Fairfax and Prince William Counties

LOCATION	TOTAL POPULATION 2010	TOTAL MINORITIES (PERCENT MINORITIES)	TOTAL LOW-INCOME (PERCENT LOW-INCOME)	TOTAL LEP (PERCENT LEP)[1]
City of Fairfax	22,565	6,859 (30.4%)	1,128 (5.0%)	2,493 (11.9%)
Fairfax County	1,081,726	403,736 (37.3%)	55,168 (5.1%)	145,723 (14.9%)
Prince William County	402,022	169,601 (42.2%)	21,307 (5.3%)	45,652 (13.2%)
Regional Average	N.A.	580,196 (38.5%)	77,603 (5.2%)	193,868 (14.4%)

[1] Percent of population 5 years and older

Sources: US Census Bureau, 2010, SF1; US Census Bureau, ACS 2006-2010

Table 4-7. 2010 Demographic Data By Census Tract for I-66 Study Area

LOCATION	TOTAL POPULATION 2010	TOTAL MINORITIES (PERCENT MINORITIES)	TOTAL LOW-INCOME (PERCENT LOW-INCOME)	TOTAL LEP (PERCENT LEP)[1]
City of Fairfax				
Tract 3001	5,129	1,749 (34.1%)	385 (7.5%)	517 (11.7%)
Tract 3002	4,775	1,271 (26.6%)	201 (4.2%)	453 (10.3%)
Fairfax County				
Tract 4913.01	6,677	3,119 (46.7%)	127 (1.9%)	1,348 (20.7%)
Tract 4913.02	3,359	1,596 (47.5%)	215 (6.4%)	411 (13.0%)
Tract 4913.03	3,838	2,073 (54.0%)	288 (7.5%)	1,456 (40.8%)
Tract 4912.01	6,213	2,810 (45.2%)	149 (2.4%)	821 (14.9%)
Tract 4912.02	1,549	656 (42.3%)	307 (19.8%)	182 (13.7%)
Tract 4901.01	5,250	1,683 (32.1%)	278 (5.3%)	381 (7.7%)
Tract 4915.01	7,015	4,763 (67.9%)	386 (5.5)	1,722 (29.5%)
Tract 4915.02	7,079	2,367 (33.4%)	42 (0.6%)	931 (13.9%)
Tract 4917.05	3,327	1,903 (57.2%)	399 (12.0%)	746 (22.0%)
Tract 4918.01	2,349	988 (42.1%)	162 (6.9%)	596 (26.2%)
Tract 4917.01	3,588	1,481 (41.3%)	97 (2.7%)	369 (12.1%)
Tract 4917.04	4,969	2,457 (49.4%)	402 (8.1%)	520 (14.0%)
Tract 4917.02	6,967	3,118 (44.8%)	523 (7.5%)	665 (10.9%)
Tract 4917.03	4,548	1,789 (39.3%)	309 (6.8%)	534 (12.9%)
Tract 4612.02	4,660	2,288 (49.1%)	592 (12.7%)	442 (10.6%)
Tract 4619.02	1,775	1,148 (64.7%)	186 (10.5%)	649 (38.2%)

LOCATION	TOTAL POPULATION 2010	TOTAL MINORITIES (PERCENT MINORITIES)	TOTAL LOW-INCOME (PERCENT LOW-INCOME)	TOTAL LEP (PERCENT LEP)[1]
Tract 4618.02	5,167	1,712 (33.1%)	320 (6.2%)	506 (12.1%)
Tract 4619.01	3,708	2,121 (57.2%)	426 (11.5%)	997 (29.7%)
Tract 4616.01	6,237	2,554 (40.9%)	150 (2.4%)	1,180 (21.7%)
Tract 4618.01	1,370	524 (38.2%)	115 (8.4%)	80 (7.7%)
Tract 4615	6,380	1,965 (30.8%)	217 (3.4%)	548 (3.8%)
Tract 4616.02	3,916	2,237 (57.1%)	251 (6.4%)	665 (18.5%)
Tract 4607.01	3,528	1,332 (37.8%)	402 (11.4%)	664 (21.2%)
Tract 4606	3,849	846 (22.0%)	23 (0.6%)	392 (10.2%)
Tract 4713.03	3,887	1,329 (34.2%)	148 (3.8%)	518 (14.8%)
Tract 4713.04	1,803	283 (15.7%)	0 (0.0%)	28 (1.8%)
Prince William County				
Tract 9015.10	4,908	1,385 (28.2%)	255 (5.2%)	288 (8.1%)
Tract 9015.09	4,888	585 (12.0%)	186 (3.8%)	46 (1.1%)
Tract 9015.06	5,261	2,050 (39.0%)	121 (2.3%)	526 (12.6%)
Tract 9015.07	2,564	719 (28.0%)	72 (2.8%)	145 (7.5%)
Tract 9015. 04	3,460	321 (9.3%)	69 (2.0%)	35 (1.2%)
Tract 9014.10	7,472	2,591 (34.7%)	142 (1.9%)	652 (9.0%)
Tract 9015.03	5,781	778 (13.5%)	121 (2.1%)	437 (7.9%)
Tract 9014.08	7,291	4,095 (56.2%)	1,356 (18.6%)	1,422 (24.7%)
Tract 9014.07	3,727	1,819 (48.8%)	157 (4.2%)	680 (25.1%)
Tract 9016.02	7,539	3,354 (44.5%)	407 (5.4%)	1,149 (8.8%)
Study Area Totals	**1,506,313**	**580,196 (38.5%)**	**77,603 (5.2%)**	193,868 (14.4%)

[1] Percent of population 5 years and older

Sources: US Census Bureau, 2010, SF1; US Census Bureau, ACS 2006-2010

The regional average low-income population percentage is 5.2%. Only two census tracts have low-income populations greater than 10% above the regional average (i.e., greater than 15.2%). One is located in Fairfax County and one is located in Prince William County. There are no census tracts within the I-66 Study Area with low-income populations greater than 50%.

The regional average for populations with limited English proficiency is 14.4%. There are seven census tracts with an LEP population greater than 10% above the regional average (i.e. greater than 24.4%). Two are located in Prince William County and five are located in Fairfax County. There are no census tracts within the corridor with LEP populations greater than 50%.

4.1.2.2 VRE Extension Corridor

COMMUNITIES AND NEIGHBORHOODS

The VRE Extension Corridor is located within the Town of Haymarket, the City of Manassas, and Prince William County. Communities adjacent to the corridor include: Gainesville, Wellington, Bull Run, and Ashton Glen. Large residential neighborhoods adjacent to the corridor include Georgetown South.

Nine community facilities are located within the corridor, including schools, places of worship, and cemeteries. Park and recreation facilities available to the community are presented in Section 4.1.7. Community facilities within or adjacent to the VRE Extension Corridor are listed in **Table 4-8**. Figure 4-2 depicts the locations of these facilities.

Table 4-8. Community Facilities in VRE Extension Corridor

FACILITY NAME	TYPE OF FACILITY
St. Pauls Episcopal Church	Place of Worship
St. Pauls Episcopal Church Cemetery	Cemetery
Manassas Pentacostal Church	Place of Worship
New Directions Alternative Education Center	School
Church of God	Place of Worship
Stonewall Jackson High	School
ACT College	School
Old School Negro Baptist Church Cemetery	Cemetery
Manassas City Confederate Cemetery	Cemetery

Sources: VDOT GIS, Googlemaps (December 2012)

POPULATION AND EMPLOYMENT

Economic and employment data were examined for Prince William County and the City of Manassas for the VRE Extension Corridor. **Table 4-9** and **Table 4-10** show historic population trends from 1990 through 2010 and population projections through 2030, respectively. Both localities have been experiencing steady growth from 1990 through 2010. Prince William County has experienced the highest level of growth nearly doubling in population during that 20 year time frame while the City of Manassas has experienced more moderate growth. Population projections by the Virginia Employment Commission predict continued growth in both localities with an average growth of 50% by 2030.

Table 4-9. Total Population over Time for VRE Extension Corridor

LOCATION	1990	2000	2010	PERCENT CHANGE 1990-2010
City of Manassas	27,957	35,135	37,821	35%
Prince William County	215,686	280,813	402,022	86%
Study Area Total	243,643	315,948	439,843	81%

Sources: Virginia Employment Commission, U.S. Census Bureau

Table 4-10. Population Projections for VRE Extension Corridor

LOCATION	2010	2020	2030	PERCENT CHANGE 2010-2030
City of Manassas	37,821	43,654	48,181	27%
Prince William County	402,022	515,235	609,953	52%
Study Area Total	439,843	558,889	658,134	50%

Source: Virginia Employment Commission, U.S. Census Bureau

Table 4-11 provides employment data for 2005, 2009 and projected data for 2030. Due to the current state of the economy, employment levels in the area have decreased or remained steady between 2005 and 2009. Employment is projected to increase significantly in the next 20 years with Prince William County having the greatest projected increase in employment, 92%, between 2009 and 2030. Employment in the City of Manassas is expected to increase by 38% in that same time frame. The highest numbers of jobs in the Washington DC metropolitan region are in Business Services, Trades/Transportation and Utilities, and Federal government.

Table 4-11. Employment Data for VRE Extension Corridor

LOCATION	EMPLOYMENT 2005	EMPLOYMENT 2009	PERCENT CHANGE 2005-2009	EMPLOYMENT FORECAST 2030	PERCENT CHANGE FORECAST 2009-2030
City of Manassas	24,399	23,060	-5%	31,800	38%
Prince William County	100,751	102,008	1%	195,900	92%
Study Area Totals	125,150	125,068	0%	227,700	82%

Source: Metropolitan Washington Council of Governments, Economic Trends 2005-2009

ENVIRONMENTAL JUSTICE

Demographic data for Prince William County and the City of Manassas were analyzed to determine whether the proposed project would have disproportionately high and adverse human health or environmental effects on minority populations, low-income or LEP populations within the VRE Extension Corridor. Census data for Prince William County and the City of Manassas were combined to establish a regional average for comparison to the census tracts within the VRE Extension Corridor.

Table 4-12 provides the census data on race, minority status and LEP for the two localities and the combined regional average. Groups exceeding the 50% criteria are identified with orange shading in **Table 4-13**. Additionally, those census tracts exceeding the ten percent criteria are identified with yellow shading in Table 4-12. **Figure 4-5** and **Figure 4-6** depict the identified census tracts that have higher than 50% or 10% higher than average populations of concern along the VRE Extension Corridor.

Table 4-12. 2010 Demographic Data for Prince William County and City of Manassas

LOCATION	TOTAL POPULATION 2010	TOTAL MINORITIES (PERCENT MINORITIES)	TOTAL LOW-INCOME (PERCENT LOW-INCOME)	TOTAL LEP (PERCENT LEP)[1]
Prince William County	402,022	169,601 (42.2%)	21,307 (5.3%)	45,652 (13.2%)
City of Manassas	37,821	14,485 (38.3%)	5,068 (13.4%)	6719 (20.4%)
Regional Average		184,086 (41.9%)	26,375 (6.0%)	52,371 (13.8%)

[1] Percent of population 5 years and older

Sources: US Census Bureau, 2010, SF1; US Census Bureau, ACS 2006-2010

Three census tracts within the VRE Extension Corridor have minority populations of greater than 50%. Two are located within Prince William County and one is located within the City of Manassas. Within the region, the average minority population is 41.9%. Since 10% above the

regional average (51.9%) is also greater than 50%, no additional census tracts are identified with this criterion. The predominant minority in the identified City of Manassas and Prince William County census tracts is Black or African-American.

Table 4-13. 2010 Demographic Data by Census Tract for VRE Extension Corridor

LOCATION	TOTAL POPULATION 2010	TOTAL MINORITIES (PERCENT MINORITIES)	TOTAL LOW-INCOME (PERCENT LOW-INCOME)	TOTAL LEP (PERCENT LEP)[1]
Prince William County				
Tract 9015.09	4,888	585 (12.0%)	186 (3.8%)	46 (1.1%)
Tract 9015.08	4,218	1,831 (43.4%)	131 (3.1%)	517 (15.6%)
Tract 9015.07	2,564	719 (28.0%)	72 (2.8%)	145 (7.5%)
Tract 9015. 04	3,460	321 (9.3%)	69 (2.0%)	35 (1.2%)
Tract 9014.11	5,491	1,639 (29.8%)	126 (2.3%)	629 (12.2%)
Tract 9014.10	7,472	2,591 (34.7%)	142 (1.9%)	652 (9.0%)
Tract 9014.09	6,135	2,578 (42.0%)	80 (1.3%)	1,017 (27.8%)
Tract 9014.08	7,291	4,095 (56.2%)	1,356 (18.6%)	1,422 (24.7%)
Tract 9014.03	6,438	3,230 (50.2%)	438 (6.8%)	873 (18.1%)
City of Manassas				
Tract 9101	4,213	1272 (30.2%)	299 (7.1%)	404 (10.0%)
Tract 9104.01	6,324	3,354 (53.0%)	1,436 (22.7%)	1,697 (34.2%)
Tract 9104.02	5,013	1,346 (26.9%)	135 (2.7%)	318 (7.0%)
Study Area Totals	**439,843**	**184,086 (41.9%)**	**26,375 (6.0%)**	52,371 (13.8%)

[1] Percent of population 5 years and older

Sources: US Census Bureau, 2010, SF1; US Census Bureau, ACS 2006-2010

The regional average low-income population percentage for the VRE corridor is 6.0%. Only two census tracts have low-income populations greater than 10% above the regional average (i.e., greater than 16.0%). One is located in the City of Manassas and one is located in Prince William County. There are no census tracts within the VRE corridor with low-income populations greater than 50%.

The regional average for populations with limited English proficiency is 13.8%. There are three census tracts with an LEP population greater than 10% above regional average (i.e. greater than 23.8%). Two are located in Prince William County and one is located in City of Manassas. There are no census tracts within the corridor with LEP populations greater than 50%.

4.1.3 Farmlands and Agricultural/Forestal Districts

The Farmland Protection Policy Act (FPPA) is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to non-agricultural uses. For the purpose of the FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forest land, pastureland, cropland, or other land, but not water or urban developed land.

Information regarding farmland and agricultural and forestal districts within the study areas is based on GIS databases maintained by the Natural Resources Conservation Service (NRCS) and local planning agencies.

4.1.3.1 I-66 Study Area

FARMLANDS

The City of Fairfax, Fairfax County, and portions of Prince William County are located in an Urbanized Area (UA) on U.S. Census Bureau mapping; therefore, the affected land in those areas does not meet the Act's definition of prime farmland. Outside of the UA boundary, the I-66 Study Area includes 124.2 acres of prime farmland and 18.8 acres of farmland of statewide importance. Figure 4-1 shows the prime farmlands and farmlands of statewide importance and **Table 4-14** provides the acreages of each within the study area.

Table 4-14. Farmlands within I-66 Study Area

FARMLAND TYPE	ACREAGE IN STUDY AREA
Prime Farmlands	124.2
Farmlands of Statewide Importance	18.8
Total	**143.0**

Sources: Natural Resource Conservation Service, US Census Bureau

AGRICULTURAL AND FORESTAL DISTRICTS

There are no agricultural or forestal districts within the I-66 Study Area.

4.1.3.2 VRE Extension Corridor

FARMLANDS

Outside of the UA boundary, the VRE Extension Corridor includes 13.3 acres of prime farmland and 2.6 acres of farmland of statewide importance. Figure 4-2 shows the prime farmlands and farmlands of statewide importance and **Table 4-15** provides the acreages of each within the corridor.

AGRICULTURAL AND FORESTAL DISTRICTS

There are no agricultural or forestal districts within the VRE Extension Corridor.

Table 4-15. Farmlands within VRE Extension Corridor

FARMLAND TYPE	ACREAGE IN CORRIDOR
Prime Farmlands	13.3
Farmlands of Statewide Importance	2.6
Total	**15.9**

Sources: Natural Resource Conservation Service, US Census Bureau

4.1.4 AIR QUALITY

Pursuant to the Federal Clean Air Act of 1970 (CAA), the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for major pollutants known

as "criteria pollutants." Currently, the EPA regulates six criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter, and lead (Pb). Particulate matter (PM) is organized in two particle size categories: particles with a diameter less than 10 micrometers (PM_{10}) and those with a diameter of less than 2.5 micrometers ($PM_{2.5}$).

Table 4-16 shows the primary and secondary NAAQS for the criteria pollutants. The NAAQS are two-tiered. The first tier (primary) is intended to protect public health; the second tier (secondary) is intended to prevent further degradation of the environment.

Table 4-16. National Ambient Air Quality Standards

POLLUTANT	AVERAGING TIME	PRIMARY STANDARDS[1]	SECONDARY STANDARDS[1]	
CO	8- hour	9 ppm (10 mg/m^3)	None	
	1- hour	35 ppm (40 mg/m^3)	None	
Pb [2]	Rolling 3-Month Average[3]	0.15 µg/m^3	Same as Primary	
NO_2	Annual Arithmetic Mean	0.053 ppm (100 µg/m^3)	Same as Primary	
	1-hour	0.100 ppm[4]	None	
PM_{10}	24-hour	150 µg/m^3	Same as Primary	
$PM_{2.5}$	Annual Arithmetic Mean	15 µg/m^3	Same as Primary	
	24-hour	35 µg/m^3	Same as Primary	
O_3	8-hour (2008 Standard)	0.075 ppm	Same as Primary	
	8-hour (1997 Standard)	0.08 ppm	None	
	1-hour	0.12 ppm[5]	Same as Primary	
SO_2	1-hour	75 ppb[6]	None	
			3-hour	0.5 ppm

Notes:

1. National standards (other than O_3, particulate matter, and those based on annual averages) are not to be exceeded more than once per year. The O_3 standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or is less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 ug/m^3 is equal to or is less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or are less than the standard.

2. Pb is categorized as a "toxic air contaminant" with no threshold exposure level for adverse health effects determined.

3. National Pb standard, rolling three-month average: final rule signed October 15, 2008.

4. To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).

5. EPA revoked the 1-hour O_3 standard in all areas; however, some areas have continuing obligations under that standard.

6. Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

Section 176(c) of the CAA requires Federal agencies to assure that all of their actions conform to applicable implementation plans for achieving and maintaining the NAAQS. Federal actions must not cause or contribute to any new violation of any standard, increase the frequency or severity of any existing violation, or delay timely attainment of any standard.

The standards in Table 4-16 apply to the concentration of a pollutant in outdoor ambient air. If the air quality in a geographic area is equal to or is better than the national standard, it is called an attainment area. Areas where air quality does not meet the national standard are called non-attainment areas. Once the air quality in a non-attainment area improves to the point where it

meets the standards and the additional redesignation requirements in the CAA [Section 107(d)(3)(E)], EPA redesignates the area as a "maintenance area."

The Clean Air Act Amendments (CAAA) of 1990 requires states to designate the status of all areas within their borders as being in or out of compliance with the NAAQS. The CAAA further defines non-attainment areas for O_3, CO, and PM based on the severity of the violation as marginal, moderate, severe, and extreme.

4.1.4.1 I-66 Study Area

ATTAINMENT CLASSIFICATIONS

The study area is in Fairfax and Prince William counties, which are included in Virginia Department of Environmental Quality's (VDEQ) National Capital Interstate Air Quality Control Region. Fairfax and Prince William counties are classified by the EPA as being in attainment for the criteria pollutants SO_2, NO_2, PM_{10}, CO and Pb. The two counties are currently classified as non-attainment for $PM_{2.5}$, and both the 1997 and 2008 O_3 standard. Air monitoring conducted by the VDEQ shows that air quality has improved significantly in the National Capital Interstate Air Quality Control Region over the past 20 years.

SUMMARY OF REPRESENTATIVE MONITORING DATA

The existing air quality of the study area was estimated using monitoring data reported by the VDEQ Office of Air Quality Monitoring and the EPA for the most recent three year period available (2009 to 2011). The analysis focused on regulated air pollutants contained in the NAAQS; including SO_2, CO, NO_2, O_3, PM_{10} and $PM_{2.5}$.

For the short-term average period (i.e.,. 1-hour, 3-hour, 8-hour, and 24-hour averages), the highest of the second highest observations were selected for the background concentration for each year, except 24-hour $PM_{2.5}$ which represents the 98th percentile and O_3 which represents the fourth highest daily 8-hour maximum within each year. For long-term averages (i.e.,. annual averages), the highest observation was used as the background concentration for each pollutant in each year. The highest background concentration among the three years of monitoring data was then selected to represent the 3-year background level of each pollutant. These averaging periods are consistent with the short-term and long-term ambient air quality standards.

The closest and most representative monitoring stations to the project area are the nearby Alexandria, Culpeper, Fairfax, and Prince William County monitoring locations. A summary of the background air quality concentrations are presented in **Table 4-17** along with the NAAQS.

The measured levels from the VDEQ monitoring stations are all below the NAAQS except for O_3 which exceeded the 2008 eight-hour standard for eleven days in 2011 at the Fairfax County monitor. A review of the VDEQ ten year monitoring data shows that most criteria pollutants concentrations have been decreasing since 2001. The decrease in NO2, VOCs, and CO emissions is predominantly due to motor vehicle controls and reductions in evaporative emissions from gasoline stations and consumer products.

Table 4-17. Observed Ambient Air Quality Concentrations and Selected Background Levels

POLLUTANT	AVERAGING PERIOD	2009	2010	2011	BACKGROUND LEVEL	NAAQS
NO_2 (ppm)[1]	1-Hour Annual	26 ppb 5 ppb	30 ppb 5 ppb	29 ppb 6 ppb	30 ppb 6 ppb	100 ppb 53 ppb
SO_2 (ppm)[2]	1-Hour 3-Hour	36 ppb 55 ppb	17 ppb 17 ppb	14 ppb 36 ppb	36 ppb 55 ppb	75 ppb 500 ppb
CO (ppm)[2]	1-Hour 8-Hour	1.7 ppm 1.4 ppm	2.0 ppm 1.6 ppm	1.7 ppm 1.4 ppm	2.0 ppm 1.6 ppm	35 ppm 9 ppm
O_3 (ppm)[5]	8-Hour	0.070 ppm	0.089 ppm	0.087 ppm	0.089 ppm	0.075 ppm (2008) 0.080 ppm (1997)
PM_{10} ($\mu g/m^3$)[3]	24-Hour	26	30	26	30 $\mu g/m^3$	150 $\mu g/m^3$
$PM_{2.5}$ ($\mu g/m^3$)[4]	24-Hour Annual	24.2 9.8	23.7 9.9	24.1 9.2	24.2 9.9	35 $\mu g/m^3$ 15 $\mu g/m^3$

Notes:

1. Represents the VDEQ Prince William Monitoring Station (45-L).
2. Represents the VDEQ Alexandria Monitoring Station (L-126-C).
3. Represents the VDEQ Culpepper County Monitoring Station (42-B).
4. Represents the VDEQ Fairfax County Monitoring Station (46-B9).
5. Represents the higher of VDEQ Prince William Monitoring Station (45-L) and Fairfax County (46-B9).

4.1.4.2 VRE Extension Corridor

ATTAINMENT CLASSIFICATIONS

Prince William County and the City of Manassas are also included in the National Capital Interstate Air Quality Control Region. The area is classified by the EPA as an attainment region for the criteria pollutants SO_2, NO_2, PM_{10}, CO and Pb. This area is currently classified as non-attainment for $PM_{2.5}$, and the 1997 and 2008 O_3 standard.

SUMMARY OF REPRESENTATIVE MONITORING DATA

The VRE Extension Corridor is located in the same air quality region as the I-66 Study Area, therefore, the ambient air quality monitoring data and monitoring locations presented in Table 4-17 are representative of the VRE Extension Corridor as well. The results show that all measured pollutants are below the NAAQS except O_3 which exceeded the 2008 eight-hour ozone standard for eleven days in 2011.

4.1.5 NOISE

The effects of highway traffic noise in connection with a highway improvement project are evaluated with respect to criteria established by the FHWA in Title 23 of the Code of Federal Regulations, Part 772 (23 CFR 772) revised July 2011,[2] and in VDOT's Highway Traffic Noise Impact

[2] 23 CFR Part 772, as amended 75 FR 39820, July 13, 2010; Effective date July 13, 2011 – "Procedures for Abatement of Highway Traffic Noise and Construction Noise," Federal Highway Administration, U.S. Department of Transportation. http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/

Analysis Guidance Manual, 2011.[3] The Federal regulations establish Noise Abatement Criteria (NAC) thresholds for noise impact above which noise abatement measures are considered.

A Washington Metropolitan Area Transit Authority rail line is located in the median of the I-66 corridor between I-495 and VA 655. Per FHWA guidance, noise from passenger rail operations are computed in accordance with the approved FTA "Transit Noise and Vibration Impact Assessment" guidance manual[4], and are included in the analysis of noise from the corridor. The composite noise impact from the highway and rail traffic is then evaluated in accordance with the FHWA and VDOT NAC. For the VRE Extension Corridor, rail sources are the dominant component to the noise and vibration environment and therefore potential impact is assessed according to FTA impact criteria.

The FHWA NAC are based upon the A-weighted sound level, which is a single number measure of sound intensity with weighted frequency characteristics that corresponds to human subjective response to noise. Most environmental noise and the A-weighted sound level fluctuates from moment to moment, and it is common practice to characterize the fluctuating level by a single number called the equivalent sound level (L_{eq}). For traffic noise assessment, L_{eq} is typically evaluated over a one-hour period, and may be denoted as $L_{eq}(h)$. The NAC for different human activity categories are given in **Table 4-18**.

Table 4-18. FHWA Noise Abatement Criteria

ACTIVITY CATEGORY	Leq(h)[1]	DESCRIPTION OF ACTIVITY CATEGORY
A	57 (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 area is to continue to serve its intended purpose
B[2]	67 (Exterior)	Residential
C[2]	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care 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	52 (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	72 (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
E2	–	Undeveloped lands that are not permitted (without building permits)

[1] Hourly Equivalent A-weighted Sound Level (dBA)

[2] Includes undeveloped lands permitted for this activity category

Source: 23 CFR Part 772.

[3] "Highway Traffic Noise Impact Analysis Guidance Manual (Version 2)," Virginia Department of Transportation , September 16, 2011.

[4] "Highway Traffic Noise Impact Analysis Guidance Manual (Version 2)," Virginia Department of Transportation , September 16, 2011.

The FTA classifies noise-sensitive land use according to categories described in **Table 4-19**. The FTA noise impact criteria are based upon the loudest one-hour L_{eq} from transit-related activity for institutional land uses (Category 3) with primarily daytime and evening use, and tracts of land where quiet is an essential part of their use (Category 1). FTA noise impact criteria for residential land uses (Category 2) are based upon the 24-hour day-night sound level (L_{dn}). Special-use buildings such as concert halls, recording studios and theaters can be very sensitive to noise and have different impact criteria than the three FTA noise categories. Due to the sensitivity of these buildings, they usually warrant special attention during the environmental assessment of a transit project.

Table 4-19. FTA Noise-Sensitive Land Use Categories

FTA NOISE-SENSITIVE LAND USE CATEGORY	NOISE METRIC (dBA)	DESCRIPTION OF FTA NOISE CATEGORY
1	L_{eq}[1]	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	L_{dn}[2]	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity is assumed to be of utmost importance.
3	L_{eq}[1]	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. Areas 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] Hourly Equivalent A-weighted Sound Level (dBA)

[2] A-weighted Day-night Sound Level (dBA)

Source: Federal Transit Administration, 2006.

Another consideration for the noise environment is the potential impacts of ground-borne vibration. Ground-borne vibration is the oscillatory motion of the ground about an equilibrium position that can be described in terms of displacement, velocity or acceleration. Humans are typically sensitive to vibration velocity in the low frequency region (4 to 80 Hz). Vibration levels are described in terms of the smoothed root-mean-square vibration velocity and are quantified in decibels (VdB) referenced to one micro-inch per second. VdB is used for vibration decibels to avoid confusion with the decibels used to describe noise (dB or dBA).

Vibration generated by rubber-tired vehicles is typically not a concern and is not evaluated for roadway projects under FHWA guidance. Potential vibration impact is assessed for steel-wheeled trains according to FTA guidance. Vibration impact criteria are based on the potential for human annoyance for institutional and residential land uses. There also are vibration impact criteria for the potential disruption to vibration-sensitive equipment such as electron microscopes and magnetic resonance imaging scanners in medical or research facilities. Similar to noise, special-use buildings such as concert halls, recording studios and theaters can be very

sensitive to vibration and have their own impact criteria. As shown in **Table 4-20**, the FTA categorizes vibration-sensitive land use similar to that for noise.

Table 4-20. FTA Vibration-Sensitive Land Use Categories

FTA VIBRATION-SENSITIVE LAND USE CATEGORY	DESCRIPTION OF FTA VIBRATION CATEGORY
1	This category includes buildings where vibration would interfere with operations within the building such as precision manufacturing, hospitals, and research institutes.
2	Residences and buildings where people normally sleep such as homes, hospitals, and hotels.
3	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.

Source: Federal Transit Administration, 2006.

4.1.5.1 I-66 Study Area

Land uses within the study area fall into all of the activity categories listed in Table 4-18 except for Category A. Category B residential areas are most prevalent in the corridor, followed by Category E commercial land uses. Category C uses include outdoor recreation areas associated primarily with parks and schools. Two large parks adjacent to I-66 are Bull Run Regional Park and Izaak Walton Park have outdoor use areas that may be affected by project noise.

Undeveloped lands are not identified by common noise environments, as they do not have applicable NAC. Category B and C uses are most commonly identified as the most sensitive to noise and the most likely to warrant noise abatement measures if future impacts are identified. Some Category E uses, such as restaurant outdoor dining and motel swimming pools may be identified as potentially impacted by noise, but the abatement criteria is higher and abatement less likely to be feasible and reasonable.

4.1.5.2 VRE Extension Corridor

The VRE Extension Corridor has been defined according to FTA noise screening procedures and extends up to 750 feet from the mainline sections and up to 1,600 feet from highway-rail grade crossings where trains would be sounding their horns. The VRE Extension Corridor includes noise and vibration-sensitive receptors within primarily suburban and rural settings in the City of Manassas, Gainesville and Haymarket. Sensitive land use includes FTA Noise and Vibration Category 2 land use such as single and multi-family residences and a mobile home park. There are FTA Noise and Vibration Category 3 land uses including schools (e.g., Stonewall Jackson High School), churches and libraries. The corridor also includes facilities that may have vibration-sensitive equipment such as BAE Systems, Lockheed Martin and IBM Systems (FTA Vibration Category 1).

4.1.6 VISUAL QUALITY

The visual environment for the I-66 Study Area and VRE Extension Corridor was reviewed through a windshield survey and supplemented with GIS data, aerial photography, and topographic mapping. Documents used for this study for relevant identification included: 1)

VDOT's Scenic Roads in Virginia, 2) *Ellanor C. Lawrence Park Trail Map*, 3) *Manassas National Battlefield Park Map*, 4) *Bull Run Regional Park Map*.

4.1.6.1 I-66 Study Area

VIEWS FROM I-66

The visual experience of driving or riding the Metrorail along I-66 within the project limits is overall characterized by common views of everyday suburban elements. The highway and adjacent trees are the most dominant features within views from I-66 throughout the project limits. Noise barriers are another dominant visual feature within the eastern portion of the study corridor from Centreville to the I-495 interchange. Views of adjacent commercial, residential and office buildings occur only intermittently within the study corridor because of the visual screening provided by trees.

Unique views from I-66 are limited to select points where a glimpse of rural elements like open hills (including those within Manassas National Battlefield Park and Bull Run Regional Park) and farm buildings can be seen in the western portion of the corridor. At the posted speed of 55mph, views of these scenic elements from the highway are brief. Views of the distant Bull Run Mountains heading westbound from the US 29 interchange in Prince William County are of a longer duration. The presence of rural elements and the decreased roadway width west of the US 29 interchange (reduced from 8 to 4 lanes) contribute to a more rural character of views within the western portion of the study corridor.

VIEWS OF I-66

Sensitive visual resources within the vicinity of the study corridor include one Virginia Byway, seven public parks with natural and/or historic views, and one National Rivers Inventory stream.

- US 15;
- Manassas National Battlefield Park;
- Bull Run Regional Park;
- Bull Run;
- Cub Run Stream Valley Park and Trail;
- Lanes Mill Park;
- Ellanor C. Lawrence Park;
- Rocky Run Stream Valley Park; and
- East Blake Lane Park.

US 15 has been designated by the Commonwealth Transportation Board (CTB) as a Virginia Byway, a road corridor containing aesthetic or cultural value near areas of historical, natural or recreational significance. Views along US 15 within approximately 2 miles north and 0.5 mile south of I-66, are dominated by commercial, residential and industrial uses, with some forest land between residential developments. These are not the views of natural areas and farmland

that comprise the scenic experience along other portions of US 15 further to the north and south of the I-66 interchange.

With the exception of Manassas National Battlefield Park and Bull Run Regional Park, views of I-66 from the above parks are blocked by trees and noise barriers. Most of Manassas National Battlefield Park adjacent to I-66 is forested and without views of I-66 from trails and historic sites. I-66 is visible from trails and a historic home site known as Portici within the more open areas of the Battlefield Park, between VA 234 and Bull Run. I-66 is also visible from a walking and equestrian trail located between Portici and I-66 that follows the southern edge of Battlefield Park. As with Manassas National Battlefield Park, views toward I-66 within most of Bull Run Regional Park are concealed by forest. I-66 is visible from the Bull Run Special Events Center and the park road leading to it.

One stream, Bull Run, crosses I-66 at the east end of Manassas National Battlefield Park and the west end of Bull Run Regional Park. The stream is rather narrow (approximately 50 feet) and bounded by thick forests. Only recreational boaters traveling along Bull Run would have views of the I-66 bridge at this location.

4.1.6.2 VRE Extension Corridor

As there is no existing passenger service along the Norfolk Southern "B" Line Branch, views from the rail line are not evaluated within this Tier 1 EIS. Sensitive visual resources that may have views of the rail line are described.

Sensitive visual resources within the vicinity of the VRE Extension corridor include one Virginia Byway and one scenic road.

- US 15; and
- VA 55.

The Norfolk Southern "B" Line Branch is visible from US 15 where it crosses US 15 at grade. Views along US 15 from the north of the crossing are dominated by commercial, residential and industrial uses. Views from the south of the crossing are of dense forests immediately adjacent to US 15.

VDOT has identified VA 55 between I-66 and US 29 as a scenic road, which means that it qualifies for Virginia Scenic Byway status; however, it has not yet been designated as such. Within the corridor, the Norfolk Southern "B" Line Branch is visible from VA 55 where it crosses the road just north of the intersection of VA 55 and US 29 in Gainesville. Views within this area are characterized by commercial buildings and warehouses, lacking scenic attributes found elsewhere along VA 55.

4.1.7 Parks, Recreation Areas, and Open Space Easements

Existing parks, recreation areas, wildlife and waterfowl refuges and open-space easements within the I-66 Study Area and VRE Extension Corridor are described based on available mapping and GIS data, review of the *Virginia Outdoors Plan* (2007) and coordination with local parks and recreation directors. Information was obtained on the location and ownership of

parks, recreation areas, and wildlife/waterfowl refuges. Use of publicly-owned parks, recreation areas and wildlife/waterfowl refuges are subject to the requirements set forth in Section 4(f) of the Department of Transportation Act of 1966 as described in Chapter 5, Section 5.1.7. Properties that were acquired or improved with the use of Land and Water Conservation Funds are subject to the requirements of Section 6(f) of the Land and Water Conservation Funds Act of 1965. These properties are noted in the list of parks and recreation areas in **Table 4-21** .

Table 4-21. Parks and Recreation Areas in I-66 Study Area

PARK/FACILITY NAME	CITY/TOWN/COUNTY	OWNERSHIP
Federal Ownership		
Manassas National Battlefield Park	Manassas/Prince William	National Park Service
Regional Ownership		
Bull Run Regional Park	Centreville/Fairfax	Northern Virginia Regional Park Authority
Local/County Ownership		
Mayhew Sports Complex Park	Manassas/Prince William	Prince William County Park Authority
Cub Run Stream Valley Park	Chantilly/Fairfax	Fairfax County Park Authority
Lane's Mill Park	Centreville/Fairfax	Fairfax County Park Authority
Rocky Run Stream Valley Park[1]	Centreville/Fairfax	Fairfax County Park Authority
Centre Ridge North Park	Centreville/Fairfax	Fairfax County Park Authority
Ellanor C. Lawrence Park[1]	Chantilly/Fairfax	Fairfax County Park Authority
Arrowhead Park	Centreville/Fairfax	Fairfax County Park Authority
Providence Elementary School	Fairfax/Fairfax	Fairfax County Public Schools
East Blake Lane Park	Fairfax County	Fairfax County Park Authority
Briarwood Park	Fairfax County	Fairfax County Park Authority
Southside Park	Vienna/Fairfax	Town of Vienna
Stenwood Elementary School	Vienna/Fairfax	Fairfax County Public Schools

Sources: Department of Conservation and Recreation, Fairfax County Park Authority, Northern Virginia Regional Park Authority, Prince William County Park Authority, National Park Service

[1] Parks acquired or improved using Land and Water Conservation Funds.

4.1.7.1 I-66 Study Area

PARKS AND RECREATION AREAS

The I-66 Study Area contains one national park, one regional park, ten local parks and two schools with recreational facilities/play areas. Table 4-21 below summarizes the information obtained for each of these properties/facilities. Publicly-owned parks and recreation areas are shown in Figure 4-1.

MANASSAS NATIONAL BATTLEFIELD PARK

Manassas National Battlefield Park within the U.S. National Park system was the site of two battles in the American Civil War in 1861 and 1862. This park is on the National Register of Historic Places and is managed by the National Park Service (NPS). The park encompasses 4,522 acres in Prince William and Fairfax counties. The park enters the study area north of I-66

near the intersection of I-66 and VA 234 in Manassas. This park has open spaces, picnic areas, trails, natural areas, historical exhibits and a museum.

BULL RUN REGIONAL PARK

Bull Run Regional Park is located in Centreville within Fairfax County and is run by the Northern Virginia Regional Park Authority (NVRPA). This 1,653-acre park is on the south side of I-66 immediately east of VA 621. The park travels along I-66 in the study area until just before the intersection of I-66 and VA 658. Amenities include open space, playgrounds, play areas, athletic and multi-use fields, natural areas, trails, picnic areas, a shooting range, water park and an amphitheater. Some of the activities supported by the park include equestrian activities, hiking, biking and camping. Bull Run Regional Park also offers historical activities and a museum.

MAYHEW SPORTS COMPLEX PARK

Mayhew Sports Complex Park is comprised of nearly 49-acres owned by Prince William County Park Authority (PWCPA). The park crosses the study area approximately 650 feet southwest of the intersection of I-66 and VA 621. The Mayhew Sports Complex Park is located in Manassas, within Prince William County, and offers open space, multi-use fields and athletic fields.

CUB RUN STREAM VALLEY PARK

Cub Run Stream Valley Park is comprised of approximately 817 acres located in Chantilly. This Fairfax County Park Authority (FCPA)-owned park crosses into the study area northwest of I-66, just north of the intersection of I-66 and VA 658. The park has natural areas and trails that provide biking and hiking opportunities.

LANE'S MILL PARK

Lane's Mill Park is an eight-acre park located in Centreville, owned by FCPA. The southeastern tip of Lane's Mill Park crosses into the study area northwest of I-66, more than one-half mile northeast of the intersection of I-66 and VA 658. This park is an archeological/historic site that is designated as a Cultural Resource Park. The historical amenities include grist mill ruins from the 1760's and various associated stone structures. Visitors also have access to hiking, biking and nature trails.

ROCKY RUN STREAM VALLEY PARK

Rocky Run Stream Valley Park encompasses approximately 269 acres in Centreville. The park is owned by FCPA and enters the study area just north of the intersection of I-66 and US 29. Only two small portions of the park are located within the study area, northwest of I-66. The park offers visitors natural areas, trails, hiking and biking opportunities.

CENTRE RIDGE NORTH PARK

Centre Ridge North Park, located in Centreville, is almost nine acres, and is owned by FCPA. This neighborhood park enters the study area south of I-66, just south of Exit 52 on I-66 Eastbound. The park offers a basketball court, playground equipment and athletic fields.

ELLANOR C. LAWRENCE PARK

Located in Chantilly, the 667-acre Ellanor C. Lawrence Park is another FCPA-owned property located within the study area. The majority of this park is located north of the study area, with only the southern end of the park entering the study area in the vicinity of the intersection of I-66 and VA 28. This park provides numerous athletic fields, including baseball, basketball and soccer. There are also open spaces, play areas, playgrounds, picnic areas, a community center, nature center and an amphitheater. This park provides opportunities for hiking and biking as well. The historic Cabell's Mill is located on the park property, which is now utilized for meeting and event space. The mill was formerly a guesthouse for notable Washington visitors, including Franklin and Eleanor Roosevelt.

ARROWHEAD PARK

Arrowhead Park, which comprises approximately 13 acres in Centreville, is also owned by the FCPA. A small portion of the northern extent of Arrowhead Park enters the study area just south of the intersection of I-66 and VA 645. There are open areas, picnic areas, playgrounds and athletic fields (soccer, football and basketball). Hiking and biking are supported by the park's trails and open spaces. There are also historical amenities on-site.

PROVIDENCE ELEMENTARY SCHOOL

Providence Elementary School in the City of Fairfax is part of the Fairfax County Public School system. The school is located within the study area to the south of I-66, between US 50 and VA 123. This property provides athletic fields for baseball and soccer. The four ball fields and one rectangular field comprise approximately four acres.

EAST BLAKE LANE PARK

Located in Fairfax County, East Blake Lane Park is approximately 17 acres. The northern tip of the park is located within the study area, south of I-66, approximately 1,500 feet southeast of where VA 655 travels under I-66. This FCPA-owned park provides open spaces and trails for hikers and bikers.

BRIARWOOD PARK

Briarwood Park in Fairfax County is owned by FCPA. The entire two-acre park is located within the study area, just north of the cloverleaf at the intersection of I-66 and VA 243. This small park is comprised of a basketball court and playground.

SOUTHSIDE PARK

Southside Park is comprised of 17 acres owned by the Town of Vienna. Only the southern portion of the park is located within the study area, north of I-66. The park is located approximately 1,300 feet northwest of the intersection of I-66 and VA 698 and includes two baseball fields, two football fields, a basketball court, playground, volleyball court and small trail.

STENWOOD ELEMENTARY SCHOOL

Stenwood Elementary School is located in the Town of Vienna and is part of the Fairfax County Public School system. This school is located within the study area, north of I-66, approximately

1,900 feet northwest of the intersection of I-66 and I-495. The school grounds include two baseball fields, a playground and tot lot, as well as other open play areas on 1.5 acres.

WILDLIFE AND WATERFOWL REFUGES

No wildlife or waterfowl refuges are present within the I-66 study area.

OPEN SPACE EASEMENTS

No open space easements are located within the I-66 study area, based on information reviewed from the Virginia Outdoors Foundation.

4.1.7.2 VRE Extension Corridor

PARKS AND RECREATION AREAS

The VRE Extension Corridor contains one school with recreational facilities. No publicly-owned parks have been identified within this corridor.

STONEWALL JACKSON HIGH SCHOOL

Stonewall Jackson High School in Manassas is part of the Prince William County Public School System. The school is located within the VRE Extension Corridor to the north of the railroad right-of-way, just west of Rixlew Lane. This property includes ten lighted tennis courts, four lighted basketball courts, a football field, and track and field facilities, as well as several soccer, baseball, and recreational fields.

WILDLIFE AND WATERFOWL REFUGES

No wildlife or waterfowl refuges are present within the VRE Extension Corridor.

OPEN SPACE EASEMENTS

No open space easements are located within the VRE Extension Corridor, based on information reviewed from the Virginia Outdoors Foundation.

4.1.8 HISTORIC PROPERTIES

The historic properties identified in this study are defined as those known architectural and archaeological resources that are either:

- Listed on the National Register of Historic Places (NRHP), or
- Have been determined eligible for the NRHP by the Virginia Department of Historic Resources (VDHR).

A listed or NRHP-eligible historic property is any district, site, building, structure, or object that has been determined to meet at least one of the National Register's Criteria for Evaluation. In the State of Virginia, VDHR serves as the State Historic Preservation Office (SHPO) for the purposes of National Historic Preservation Act of 1966 and related regulations, including Section 106.

Known historic properties were identified within defined architectural and archaeological study areas for I-66 and the VRE Extension Corridor. The area of study for architectural resources included the entire project impact area plus any areas within the viewshed of I-66 and the

Norfolk Southern "B" Line Branch where potential impacts to a resource's setting and feeling could occur. Therefore, the architectural study area was measured at 1,000 feet from either side of the roadway and railway, creating a 2,000-foot wide corridor around I-66 and the rail line where historic architectural resources were assumed to be within the viewshed of the transportation facilities. Archaeological properties were inventoried within 500 feet of either side of I-66 and the rail line.

Identification of previously recorded historic properties within the architectural study areas involved background research at the VDHR, including review of relevant literature, archival records, maps, and other primary sources available at this repository. This investigation reviewed existing records, and additional documentation received from the VDHR Data Sharing System (DSS) online database, to gather the locations, descriptions, and eligibility status of all previously surveyed historic properties.

4.1.8.1 I-66 Study Area

PREVIOUSLY RECORDED HISTORIC PROPERTIES

A total of 58 properties (22 architectural resources and 36 archaeological resources) were identified within the I-66 architectural and archeological study areas. Properties that are either listed in the NRHP or determined eligible for the NRHP by VDHR[5] are presented in the following discussions. Additional information on properties that have yet to be evaluated is provided in the *Historic Properties Technical Report.*

The western portion of the I-66 study areas passes through the Hallowed Ground National Heritage Area. This heritage area highlights Civil War sites in four states extending from Gettysburg in Pennsylvania, through Maryland and West Virginia, and ending at Monticello in Virginia. Numerous battlefields, including the Manassas National Battlefield Park, are located within the Hallowed Ground National Heritage Area. The title of "national heritage area" is an honorary distinction bestowed by Congress and, as a whole this territory has not been listed or formally evaluated for the NRHP.

NRHP-LISTED OR DETERMINED ELIGIBLE ARCHITECTURAL RESOURCES

One architectural resource, Manassas National Battlefield Park, is listed on the NRHP and five other architectural resources have been determined eligible for the NRHP by VDHR.

Of these six resources, three are historic buildings or structures and three are historic districts. The three known historic buildings and structures within 1,000 feet of either side of I-66 are listed, eligible, or potentially eligible for listing in the NRHP. Identified in **Table 4-22**, these historic architectural properties include two single dwellings and a school.

[5] The regulations for Section 106 (36CFR800) give the lead federal agency for an undertaking the authority to make determinations of eligibility for the NRHP for resources. While some of these resources may have been identified during federal projects through the Section 106 process, others would have eligibility determinations made by DHR.

Table 4-22. NRHP-Listed or Determined Eligible Historic Buildings and Structures in I-66 Architectural Study Area

TOWN, CITY, OR COUNTY	DHR NO.	RESOURCE NAME	QUAD NAME	NRHP-ELIGIBILITY STATUS	CURRENT CONDITION
Prince William	076-5381	Gainesville District School/PACE West School, 14550 John Marshall Highway	Thoroughfare Gap	DHR Staff: Eligible 8/23/2011	School Still Standing
Fairfax (County)	029-5268	Woodaman House, 12816 Westbrook Road	Manassas	DHR Staff: Potentially Eligible 4/17/2003	House Still Standing
Fairfax (County)	029-5269	House, 12820 Westbrook Drive	Manassas	DHR Staff: Potentially Eligible 4/17/2003	Property Not Accessible

Source: Virginia Department of Historic Resources Data Sharing System

Three historic districts located within 1,000 feet of I-66 are either listed, or determined eligible or potentially eligible for listing in the NRHP by DHR. Identified in

Table 4-23, the districts include two Civil War battlefields and one historic rail corridor.

Table 4-23. NRHP-Listed or Determined Eligible Historic Districts in I-66 Architectural Study Area

TOWN, CITY, OR COUNTY	DHR NO.	RESOURCE NAME	QUAD NAME	NRHP-ELIGIBILITY STATUS
Prince William	076-0271	Manassas National Battlefield Park/Manassas Battlefield Historic District	Gainesville; Manassas	VLR Listing 1973, 2004; NRHP Listing 1966, 2004, and 2006
Prince William	076-5036; 076-5168	Manassas Station Operations Battlefield/Bristoe Station Battlefield/Kettle Run Battlefield	Manassas; Nokesville	DHR Staff: Potentially Eligible 1/24/2007
Loudon (County)	053-0276	Washington and Old Dominion Railroad Historic District/Alexandria, Loudoun and Hampshire Railroad	Alexandria; Annandale; Falls Church; Herndon; Leesburg; Purcellville; Sterling; Vienna; Waterford	DHR Staff: Eligible 2/4/1999

Source: Virginia Department of Historic Resources Data Sharing System

NRHP-LISTED OR DETERMINED ELIGIBLE ARCHAEOLOGICAL RESOURCES

As noted in **Table 4-24**, four archaeological properties within the project archeological study area have been formally evaluated by the VDHR and determined eligible or potentially eligible for the NRHP.

4.1.8.2 VRE Extension Corridor

PREVIOUSLY RECORDED HISTORIC PROPERTIES

A total of 116 properties—93 architectural resources and 23 archaeological resources—were identified within the VRE Extension architectural and archeological study areas for the project.

Table 4-24. NRHP-Listed or Determined Eligible Archaeological Resources in I-66 Archaeological Study Area

TOWN, CITY, OR COUNTY	SITE NUMBER	RESOURCE NAME/TYPE	QUAD NAME	ELIGIBILITY STATUS
Prince William	44PW0080; 076-0147	Monroe Site, Poplar Spring/Single Dwelling	Gainesville	DHR Staff: Eligible 11/12/1991
Fairfax (County)	44FX1116	Earthworks	Manassas	DHR Staff: Potentially Eligible 11/24/1992
Fairfax (County)	44FX1965	Brown (Thomas) Farmstead/Temporary Camp	Manassas	DHR Staff: Eligible 2/1/1994
Fairfax (County)	44FX1966	Other	Manassas	DHR Staff: Potentially Eligible 11/24/1992

Source: Virginia Department of Historic Resources Data Sharing System

Properties that are either listed in the NRHP or determined eligible for the NRHP by VDHR are presented in the following discussions. Additional information on properties that have yet to be evaluated is provided in the *Historic Properties Technical Report.*

The VRE Extension architectural and archeological study areas pass through the First and Second Battles of Bull Run/Manassas. The First Battle of Bull Run/Manassas Battlefield is associated with the 1861 Manassas Campaign in Fairfax and Prince William counties. The Second Battle of Bull Run/Manassas Battlefield was the location of the decisive battle of the Northern Virginia Campaign in late-August 1862. VDHR staff has not formally evaluated the NRHP eligibility of either resource. Both of these battlefields are associated with the Manassas National Battlefield Park (076-0271), which was listed on the NRHP in 1966. The Manassas National Battlefield Park is located outside of the VRE Extension architectural and archeological study areas.

NRHP-Listed or Determined Eligible Architectural Resources

Four architectural resources located within 1,000 feet of the Norfolk Southern "B" Line Branch are listed, or determined eligible or potentially eligible for the NRHP by DHR. Two known historic resources, a former school site and a historic church, are listed on the NRHP. One architectural resource, the Kettle Run Battlefield (also known as the Manassas Station Operations Battlefield/Bristoe Station Battlefield), was determined potentially eligible for the NRHP by DHR Staff in 2007. Another resource, the Monroe House/Poplar Spring, was determined eligible for the NRHP in 1979; however, it was destroyed the following year. No revision to the formal evaluation has occurred for this resource, therefore, it continues to have an eligible determination. These architectural properties are identified in **Table 4-25**.

NRHP-Listed or Determined Eligible Archaeological Resources

No archaeological properties within the VRE archeological study area have been formally evaluated by the VDHR and determined to be eligible for or are listed on the NRHP.

4.1.9 Hazardous Materials

The federal government and Commonwealth of Virginia, primarily through the EPA and the VDEQ, respectively, regulate hazardous materials under multiple statutes. Two statutes that regulate materials of primary concern include the Resource Conservation and Recovery Act of

1976 (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and their respective amendments.

Table 4-25. NRHP-Listed or Determined Eligible Historic Buildings, Structures, and Districts in VRE Extension Architectural Study Area

TOWN, CITY, OR COUNTY	DHR NO.	RESOURCE NAME	QUAD NAME	NRHP-ELIGIBILITY STATUS	CURRENT CONDITION
Prince William	076-0147 (also 44PW0080)	Monroe House (Poplar Spring)	Gainesville	DHR Staff: Eligible 3/01/1979	Destroyed in 1980
Prince William	076-5036; 076-5168	Manassas Station Operations Battlefield/Bristoe Station Battlefield/Kettle Run Battlefield	Manassas; Nokesville	DHR Staff: Potentially Eligible 1/24/2007	Some development; significant landscapes and views intact
Manassas	155-0010	Manassas Industrial School for Colored Youth (Jennie Dean Memorial Site) (also 44PW0505)	Independent Hill	DHR Staff: Eligible 4/05/1994	Archaeological site with building foundation preserved; now park land
Prince William (Haymarket)	233-0002	St. Paul's Episcopal Church	Thoroughfare Gap	NRHP Listed: 1/20/1975	Fair

Source: Virginia Department of Historic Resources Data Sharing System

Known petroleum release sites within 0.25 mile of I-66 and the Norfolk Southern "B" Line Branch, and other hazardous materials release sites within 0.5 mile of these transportation facilities were inventoried based on the results of a database search provided by a reputable commercial database search firm. The report includes all data collected from federal, state, local, tribal, and proprietary records for the project corridor.

Hazardous materials release sites include: CERCLIS sites – sites listed under the Comprehensive Environmental Response, Compensation, and Liability Information System (i.e.,. Superfund sites); VRP Sites – facilities enrolled in the Voluntary Remediation Program; petroleum release sites – leaking underground or above ground storage tanks; and unidentified HAZMAT – sites listed in the databases that lack specific information. These sites may pose potential risks to human health and the environment as a result of possible contamination to soil and/or groundwater.

4.1.9.1 I-66 Study Area

HAZARDOUS MATERIALS RELEASE SITES

A total of 64 petroleum release sites and 20 other hazardous materials release sites were located within 0.25 mile and 0.5 mile of I-66, respectively, as shown in **Table 4-26** and Figure 4-1. Some sites may be listed twice if they have been listed within more than one category.

SOLID WASTE FACILITIES

Seven solid waste facilities are located within 0.5 mile of I-66. These facilities are shown on Figure 4-1.

Table 4-26. Hazardous Materials Sites in I-66 Study Area

HAZARDOUS MATERIALS RELEASE SITE	STUDY AREA
CERCLIS Sites	2[1]
VRP Site	1[1]
Unidentified HAZMAT Sites	17[1]
Petroleum Release Sites	64[2]
Total	**84**

Source: Virginia Department of Environmental Quality (VDEQ), 2012

[1] The study area includes sites within 0.50 mile of I-66.

[2] Petroleum release sites are provided within 0.25 mile of I-66.

4.1.9.2 VRE Extension Corridor

HAZARDOUS MATERIALS RELEASE SITES

A total of 48 petroleum release sites and 55 other hazardous materials release sites were located within 0.25 mile and 0.5 mile of the Norfolk Southern "B" Line Branch, respectively, as shown in **Table 4-27** and Figure 4-2. As with the I-66 Study Area listing, some sites may be listed twice if they have listings in more than one category.

Table 4-27. Hazardous Materials Release Sites in VRE Extension Corridor

HAZARDSOU MATERIALS RELEASE SITE	CORRIDOR
CERCLIS Sites	1[1]
VRP Site	2[1]
Unidentified HAZMAT Sites	52[2]
Petroleum Release Sites	48[2]
Total	**103**

Source: Virginia Department of Environmental Quality (VDEQ), 2012

[1] The corridor includes sites within 0.50 mile of the Norfolk Southern "B" Line Branch.

[2] Petroleum release sites are provided within 0.25 mile of the Norfolk Southern "B" Line Branch.

SOLID WASTE FACILITIES

Two solid waste facilities are located within 0.5 mile of the Norfolk southern "B" Line Branch. These facilities are shown on Figure 4-2.

4.2 NATURAL ENVIRONMENT

This section presents the existing conditions for the natural environment within the I-66 Study Area and VRE Extension Corridor. For the purposes of this Tier 1 EIS, water resources and wildlife habitat comprise the natural environment. Water resources addressed in this section include water quality, wetlands, streams, coastal zone management areas, floodplains, and wild and scenic rivers. Information provided on wildlife habitat includes natural heritage resources, threatened and endangered species, and invasive species.

4.2.1 WATER RESOURCES

Water resources are regulated by the EPA and the U.S. Army Corps of Engineers (USACE) according to the Water Pollution Control Act of 1972 (Clean Water Act) and the Water Quality Act of 1987. Section 404 of the Clean Water Act regulates activities affecting Waters of the United States (WOUS). WOUS can be generally defined as all navigable waters and waters that have been or can be used for interstate or foreign commerce, their tributaries, and any waters that, if impacted, could affect the former. WOUS include surface waters (streams, lakes, bays, etc.) and their associated wetlands (inundated or saturated areas that support vegetation adapted for life in wet soils). The EPA, USACE, the VDEQ, and the Virginia Marine Resources Commission (VMRC) all issue permits for various activities in, under, and over WOUS.

Water resources within I-66 Study Area and VRE Extension Corridor were identified based on a combination of GIS databases, aerial photography, and published lists maintained by federal and state agencies. Additional information regarding applicable regulations pertaining to specific types of water resources are addressed in this section.

4.2.1.1 I-66 Study Area

WATER QUALITY

In compliance with Sections 303(d), 305(b), and 314 of the federal Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA), states develop a prioritized list of water bodies that currently do not meet water quality standards. In Virginia, the VDEQ monitors streams for a variety of water quality parameters, including temperature, dissolved oxygen, pH, fecal coliform, e. coli, enterococci, total phosphorus, chlorophyll a, benthic invertebrates, as well as metals and toxics in the water column, sediments, and fish tissues.

The 303(d) VDEQ 2010 list includes those water bodies and watersheds that exhibit levels of impairment requiring investigation and restoration. The I-66 Study Area includes four impaired water bodies, Bull Run, Cub Run, Big Rocky Run and Holmes Run. The locations of these streams are shown in **Figure 4-7**. Impairment can be in any of five use areas: recreation, fish consumption, wildlife, aquatic life or public water consumption. **Table 4-28** lists the impaired water bodies, impaired use, reason for impairment, and location relative to the study corridor.

Table 4-28. Impaired Waterbodies in I-66 Study Area

WATERBODY	IMPAIRED USE	COUNTY	REASON FOR IMPAIRMENT	ORIENTATION TO I-66
Bull Run	Fish consumption	Prince William/Fairfax	PCB in fish tissue	Crossed
Cub Run	Recreation	Fairfax	E. coli, fecal coliform	Crossed
Big Rocky Run	Aquatic life	Fairfax	Benthic-Macroinvertebrate bioassessments	Crossed
Holmes Run	Recreation	Fairfax	E. coli	Crossed

Source: Virginia Department of Environmental Quality, 2010 303(d) List

In 1974, the Safe Drinking Water Act (SDWA) was passed by Congress to regulate the public drinking water supply. The 1986 and 1996 Amendments further protect the water supply by requiring actions that protect both drinking water and its sources. EPA defines sole source aquifers as those that supply at least 50% of the drinking water supply for the area. The sole source aquifer program provides for federal overview of federally-funded projects within the designated area. There are no sole source aquifers as designated by the EPA within the study area.

Through coordination with the Virginia Department of Health (VDH), it was determined that the study area is not located within any public drinking water surface resource watersheds; however, there are seven public groundwater wells within the study area.

WETLANDS

Executive Order 11990, Protection of Wetlands, mandates that each federal agency take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance their natural values.

Wetlands are currently defined by the USACE (33 CFR 328.3[b]) and the EPA (40 CFR 230.3[t]) as:

> *Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

Wetlands in the I-66 Study Area, based on the National Wetland Inventory, are depicted in **Figure 4-7**. A total of approximately 20 acres of wetlands are found, as shown in **Table 4-29** describing the wetland acreages by type. The types of wetlands found include palustrine emergent, palustrine scrub shrub, and palustrine forested.

Table 4-29. Wetlands in I-66 Study Area

WATERBODY	ACREAGE WITHIN STUDY AREA
Palustrine Emergent	3.5
Palustrine Forested	16.3
Palustrine Scrub Shrub	0.3
Total	**20.1**

Source: National Wetlands Inventory

The predominant wetland type is palustrine forested. Palustrine forested wetlands typically include the forested floodplain areas bordering the moderately-sized streams and creeks.

STREAMS

The entire I-66 Study Area is located within the Potomac-Shenandoah River major watershed. This watershed encompasses a total of 5,702 square miles in Virginia and extends into adjacent states. Within this watershed, the study area is within two eight-digit hydrologic unit code (HUC) boundaries. The majority of the study area is within Middle Potomac-Anacostia-Occoquan HUC code 02070010. A small portion of the study area near the City of Fairfax is within the Middle Potomac-Catoctin HUC code 02070008.

The I-66 Study Area includes ten named streams and several unnamed smaller tributaries. The named streams are Youngs Branch, Chinns Branch, Holkums Branch, Bull Run, Cub Run, Big Rocky Run, Difficult Run, Bear Branch, Long Branch, and Holmes Run. Figure 4-7 depicts the streams and watershed boundaries. The total length of streams in the I-66 Study Area is 44,920 feet.

COASTAL ZONE MANAGEMENT AREAS

Federal actions occurring within or with the likelihood of affecting any land or water use, or natural resource of a state's coastal zone, including cumulative and secondary effects, must be consistent with a state's federally approved Coastal Zone Management Plan (CZMP) according to Section 307 of the Federal Coastal Zone Management Act of 1972, as amended (CZMA), and National Oceanic and Atmospheric Administration (NOAA) regulations (15 CFR part 930).

According to VDEQ, Virginia's coastal zone "encompasses the 29 counties, 17 cities, and 42 incorporated towns in the coastal region of Virginia, as defined in the Code of Virginia 28.2-100" (VDEQ, 2011). Both Fairfax County and Prince William County are located within Virginia's coastal zone.

FLOODPLAINS

In accordance with Executive Order 11988, Floodplain Management, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities."

One hundred-year floodplains within the study area were identified based on Flood Insurance Rate Maps (FIRM) produced by the Federal Emergency Management Agency (FEMA). One hundred-year floodplains have a one percent chance of flooding in any given year. Figure 4-7 depicts the 100-year floodplains within the study area.

Floodplains are generally associated with the perennial streams in the area. The three major floodplains within the I-66 Study Area include Bull Run, Cub Run, and Big Rocky Run. **Table 4-30** provides a listing and general information on the 100-year floodplains. The table notes if the floodplain is crossed or located parallel to I-66. If the floodplain is located within the study area but is not crossed or parallel, it was identified as adjacent to the north or south. In many cases, streams that cross under I-66 have associated floodplains to the north and south of I-66 but the stream has been artificially channeled near the roadway so the area is not designated as floodplain. A total of 202 acres of 100-year floodplain is located in the study area.

WILD AND SCENIC RIVERS

There are no federally listed Wild and Scenic Rivers in the I-66 Study Area. The segment of Bull Run north of I-66 is identified in the National Rivers Inventory. There are no state-listed Scenic Rivers as designated by the Virginia Department of Conservation and Recreation (VDCR) within the study area. Bull Run is identified by VDCR as a potential component of the Scenic Rivers inventory for further study.

Table 4-30. 100-Year Floodplains in I-66 Study Area

ASSOCIATED RIVER/STREAM	COUNTY	ORIENTATION TO I-66
Youngs Branch	Prince William	Adjacent to North
Holkums Branch	Prince William	Adjacent to North and South
Bull Run	Prince William/Fairfax	Perpendicular Crossing
Cub Run	Fairfax	Perpendicular Crossing and Parallel to North
Big Rocky Run	Fairfax	Parallel to North
Unnamed Tributary to Big Rocky Run	Fairfax	Adjacent to South
Unnamed Tributary to Big Rocky Run	Fairfax	Adjacent to South
Unnamed Tributary to Big Rocky Run	Fairfax	Adjacent to North and South
Unnamed Tributary to Big Rocky Run	Fairfax	Adjacent to North
Big Rocky Run	Fairfax	Adjacent to North
Difficult Run	Fairfax	Adjacent to North and South
Unnamed Tributary to Difficult Run	Fairfax	Adjacent to North
Unnamed Tributary to Accotink Creek	Fairfax	Adjacent to South
Unnamed Tributary to Accotink Creek	Fairfax	Adjacent to South
Unnamed Tributary to Accotink Creek	Fairfax	Adjacent to North and South
Bear Branch	Fairfax	Adjacent to South
Long Branch	Fairfax	Adjacent to South
Holmes Branch	Fairfax	Adjacent to South

Source: Federal Emergency Management Agency Flood Insurance Rate Maps

4.2.1.2 VRE Extension Corridor

WATER QUALITY

Based on the 303(d) VDEQ 2010 list, there are no impaired streams located within the VRE Extension Corridor. There are no sole source aquifers as designated by EPA within the corridor. The corridor is located within the Lake Manassas Dam watershed. No public groundwater wells have been identified within the corridor.

WETLANDS

Wetlands in the VRE Extension Corridor, based on the National Wetland Inventory, are depicted in **Figure 4-8**. Wetlands are more numerous in the VRE Extension Corridor than in the I-66 Study Area with a total of approximately 171 acres of wetlands within the VRE Extension Corridor. **Table 4-31** lists the wetland acreages by type. The types of wetlands found include palustrine emergent, palustrine scrub shrub, and palustrine forested. As in the I-66 Study Area, the predominant wetland type is palustrine forested.

STREAMS

The entire VRE Extension Corridor is located within the Potomac-Shenandoah River major watershed and the Middle Potomac-Anacostia-Occoquan HUC code 02070010. The VRE Extension Corridor includes three named streams and several unnamed smaller tributaries. The named streams are North Fork Broad Run, Dawkins Branch, and Cannon Branch. Figure

4-8 depicts the streams and watershed boundaries. The total length of streams in the VRE Extension Corridor is 23,462 feet.

Table 4-31. Wetlands in VRE Extension Corridor

WATERBODY	ACREAGE WITHIN CORRIDOR
Palustrine Emergent	14.8
Palustrine Forested	133.6
Palustrine Scrub Shrub	22.7
Total	**171.1**

Source: National Wetlands Inventory

COASTAL ZONE MANAGEMENT AREAS

Prince William County is located within Virginia's coastal zone.

FLOODPLAINS

The VRE Extension Corridor crosses two floodplains. The 100-year floodplain for the North Fork Broad Run runs parallel on the south side of the Norfolk Southern "B" Line Branch at the western end of the VRE Extension Corridor. The Dawkins Branch floodplain is crossed perpendicularly. The total acreage of floodplains within the VRE Extension Corridor is 108 acres. Figure 4-8 depicts the 100-year floodplains within the VRE Extension Corridor.

WILD AND SCENIC RIVERS

There are no federally designated Wild and Scenic Rivers or National Rivers Inventory rivers, or state-designated Scenic Rivers within the VRE Extension Corridor.

4.2.2 WILDLIFE HABITAT, INCLUDING THREATENED AND ENDANGERED SPECIES

Wildlife habitat within the I-66 Study Area and VRE Extension Corridor is described based on review of aerial photography and a windshield survey that focused on the distribution of developed land uses and natural areas within the I-66 Study Area and VRE Extension Corridor. Federal and state agency databases were also reviewed to identify the potential for threatened and endangered species and other natural heritage resources to be present. Lastly, the degree to which invasive species may influence habitats within the I-66 Study Area and VRE Extension Corridor is addressed based on advisory lists maintained by VDCR.

4.2.2.1 I-66 Study Area

WILDLIFE HABITAT

The I-66 Study Area is primarily urban and suburban in nature with the densest levels of development in the eastern half of the corridor. Some small areas of agriculture are located within Prince William County. Large parks and preservation areas within the western portion of the corridor provide natural forest and grassland habitats. Aquatic habitats are present within the streams and ponds that lie within the study area. Wildlife in developed areas includes species adapted to urban/suburban conditions, such as rabbits, whitetail deer, eastern grey squirrels, red fox, and a number of common bird species. These species and many other wildlife species are present within the natural habitats areas. For example, NPS has identified

168 bird species, 26 mammal species, 23 reptile species, and 19 amphibian species within the meadows, forests, and streams of Manassas National Battlefield Park (NPS, 2012).

The Virginia Department of Game and Inland Fisheries (VDGIF) designates trout streams for special management considerations and protection. No trout streams are located within the study area. Anadramous Fish Use Areas are migration pathways, spawning grounds, or nursery areas identified by the VDGIF as having been used or have the potential to be used by anadromous fish. There are no identified anadromous fish use areas within the study area.

NATURAL HERITAGE RESOURCES

The VDCR Natural Heritage GIS database indicated five natural heritage resources within the I-66 Study Area. These natural heritage resource sites are shown in Figure 4-7. Cub Run Slopes is a Conservation Site located between I-66 and US 29 near Lanes Mill Park. Conservation Sites represent key areas of the landscape of protection and stewardship action because of the natural heritage resources and habitat they support.

Long Branch Stream Conservation Unit (SCU) is located along the Long Branch stream west of the I-495 interchange. SCU's identify stream reaches that contain aquatic natural heritage resources including an upstream and downstream buffer.

Three natural heritage General Location Areas were also identified within the study area. General Location Areas for natural heritage resources represent the approximate locations of documented natural heritage resource occurrences that were not incorporated into Conservation Sites, either because they are poor quality, their location was not precisely identified, or they have not been reverified in over 20 years. None of these natural heritage sites within the study area has known occurrences of federal or state listed species recorded.

THREATENED AND ENDANGERED SPECIES

The U.S. Fish and Wildlife Service (USFWS) is responsible for listing, protecting, and managing federally-listed threatened and endangered Species under the Endangered Species Act of 1973, as amended. The USFWS defines an endangered species as one that is in danger of extinction throughout all or in a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future. The Commonwealth of Virginia also has a listing of state endangered or threatened species.

The USFWS Information Planning and Conservation (IPAC) online review database was consulted for the project area. Based on the habitat model used in IPAC, three federally listed species were identified with the potential to occur in the project study area: harperella, small whorled pogonia, and dwarf wedgemussel, as listed in **Table 4-32**.

The VDGIF's Species Observation Database (SppObs) contains no known occurrences of federal or state listed wildlife species in Virginia. Correspondence with the VDGIF identified two state-listed species known to or with the potential to occur in the study area: wood turtle and brook floater, as listed in Table 4-32.

Table 4-32. Listed Species Potentially Occurring in I-66 Study Area

COMMON NAME	SCIENTIFIC NAME	STATUS	HABITAT
PLANTS			
Harperella	*Ptilimnium nodosum*	Federally Endangered	Rocky or gravel shoals and margins of clear, swift-flowing streams; and edges of intermittent pineland ponds in the coastal plain
Small whorled pogonia	*Isotria medeoloides*	Federally Threatened	Third-growth upland forests with an open understory and a closed canopy where the topography is typically moderately sloping or almost level, usually associated with decaying vegetative matter and acidic sandy loam soils
REPTILES			
Wood turtle	*Glyptemys insculpta*	State Threatened	Forested floodplains, fields, wet meadows, and farmland, with nearby streams
MOLLUSKS			
Dwarf wedgemussel	*Alasmidonta heterodon*	Federally Endangered	Muddy sand, sand or gravel bottomed creeks with little siltation and slow to moderate current
Brook floater	*Alasmidonta varicosa*	State Endangered	Small streams to large rivers with high to moderate flows excluding scour-prone areas of high gradient streams and high velocity flow channels.

Source: USFWS Information Planning and Conservation (IPAC) and Virginia Department of Game and Inland Fisheries' (VDGIF) Species Observation Database (SppObs)

INVASIVE SPECIES

Invasive species are non-native plant, animal, or microbial species that cause, or have the potential to cause, economic or ecological harm or harm to human health. Invasive species are regulated by Presidential Order 13112 as given authority by NEPA, as amended (42 U.S.C. 4321 et seq.), Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), and the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

The study area consists of both developed/disturbed areas and natural areas. While invasive species are common within disturbed areas, they are often observed within the natural areas of Fairfax and Prince William counties as well. According to the University of Georgia Center for Invasive Species and Ecosystem Health, both Fairfax and Prince William counties have relatively high occurrences of invasive species compared to other counties in Virginia.

VDCR maintains an advisory list of invasive plants to inform land managers of potential risks associated with certain plant species known to exhibit invasive behavior in some situations (VDCR, 2009). The list is divided into three regions: Coastal Plain, Piedmont, and Mountains. The study area is located within the Piedmont region. Some of the highly invasive plant species listed for this region that are anticipated within the study area include tree-of-heaven (*Ailanthus*

altissima), winged burning bush (*Euonymus alata*), multiflora rose (*Rosa multifolora*), Japanese honeysuckle (*Lonicera japonica*), mile-a-minute (*Polygonum perfoliatum*), garlic mustard (*Alliaria petiolata*), and Japanese stilt grass (*Microstegium vimineum*).

4.2.2.2 VRE Extension Corridor

WILDLIFE HABITAT

The VRE Extension Corridor is primarily developed with forested areas scattered throughout the corridor. Similar species could be expected to be found in this corridor as those identified above for the I-66 Study Area. There are no designated trout streams or anadramous fish use areas in the corridor.

NATURAL HERITAGE RESOURCES

No Conservation Sites for natural heritage resources are located within the VRE Extension Corridor. As shown in Figure 4-8, one General Location Area is located within the corridor east of Dawkins Branch. The Division of Natural Heritage does not identify any known occurrences of threatened or endangered species within this General Location Area.

THREATENED AND ENDANGERED SPECIES

The USFWS IPAC online review database was consulted for the project area. Based on the habitat model used in IPAC, three federally listed species were identified with the potential to occur in the VRE Extension Corridor: harperella, small whorled pogonia, and dwarf wedgemussel. In addition to the IPAC, the VDGIF SppObs and Fish and Wildlife Information System (FWIS) were consulted for information on threatened and endangered species known or potentially occurring in the VRE Extension Corridor. The SppObs database indicated no known occurrences of federal or state endangered and threatened species within the corridor. Federal and state endangered and threatened species identified as potentially occurring within the VRE Extension Corridor based on agency database results and species habitat requirements are the same species as listed for the I-66 Study Area in Table 4-32.

INVASIVE SPECIES

The VRE Extension Corridor consists of developed/disturbed areas and natural areas. Invasive species can be expected to be found in both types of areas. The highly invasive plant species that could be expected to be encountered would be the same as those listed above for the I-66 Study Area as both areas fall within the Piedmont region.

Figure 4-1. Land Use and the Man-Made Environment – I-66 Study Area
(Sheet 1)

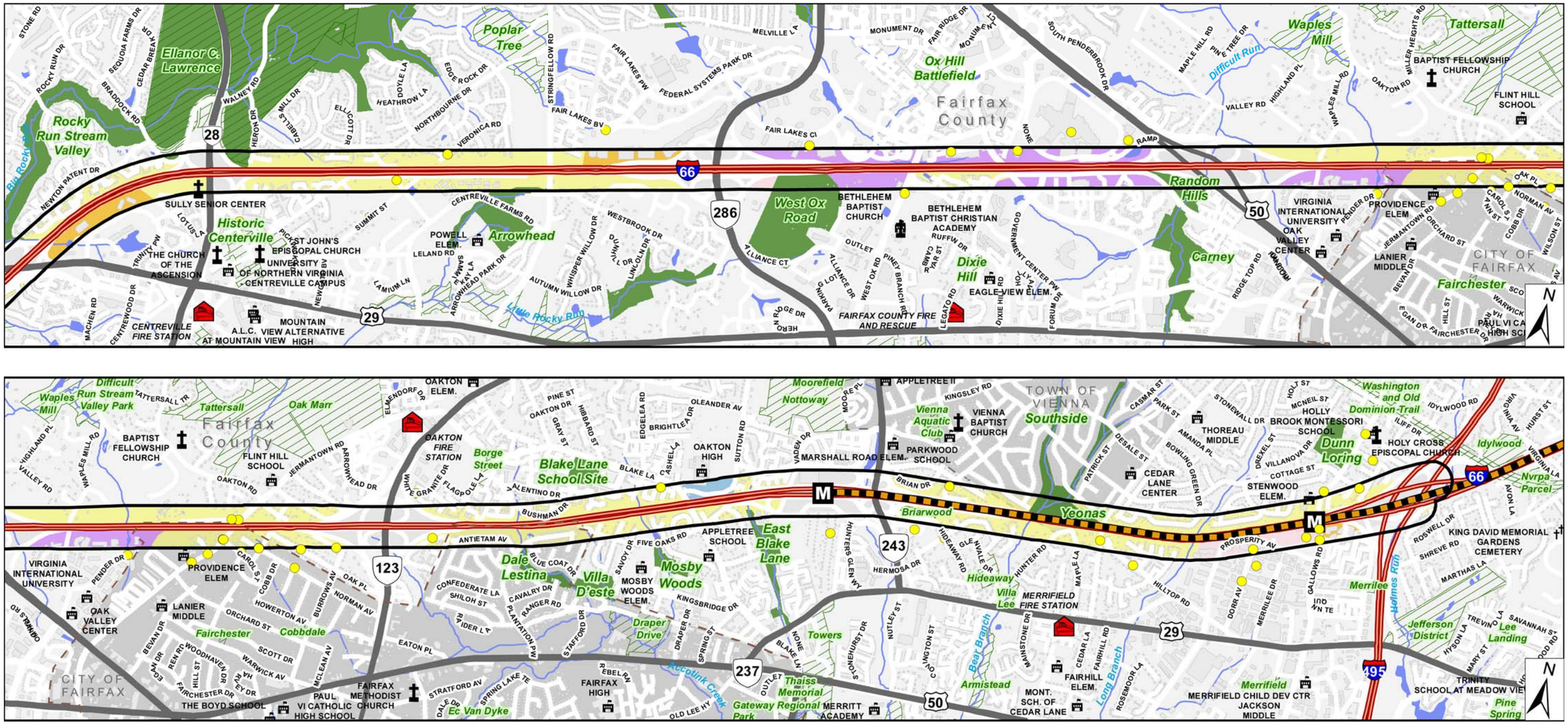


Figure 4-1. Land Use and the Man-Made Environment – I-66 Study Area
(Sheet 2)

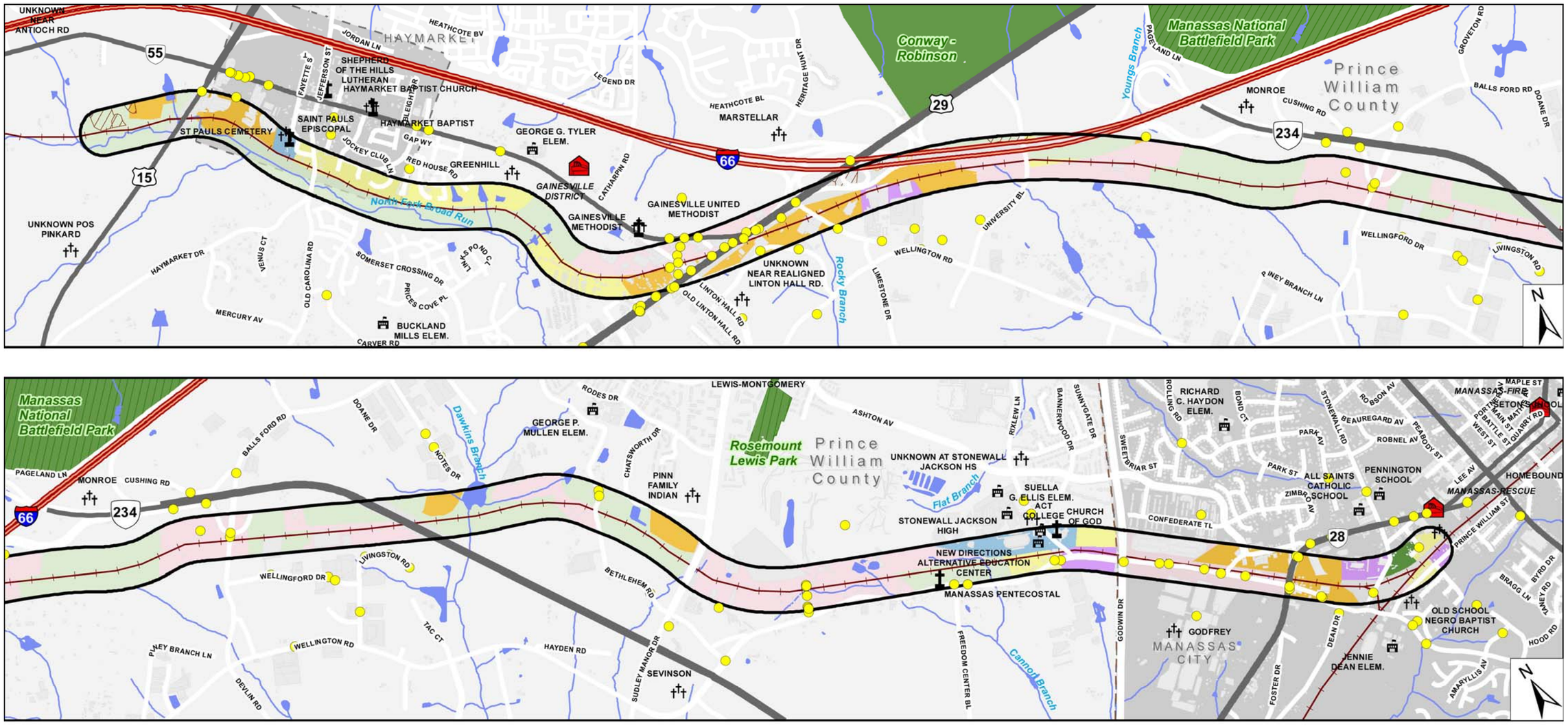


Figure 4-2. Land Use and the Man-Made Environment – VRE Extension Corridor

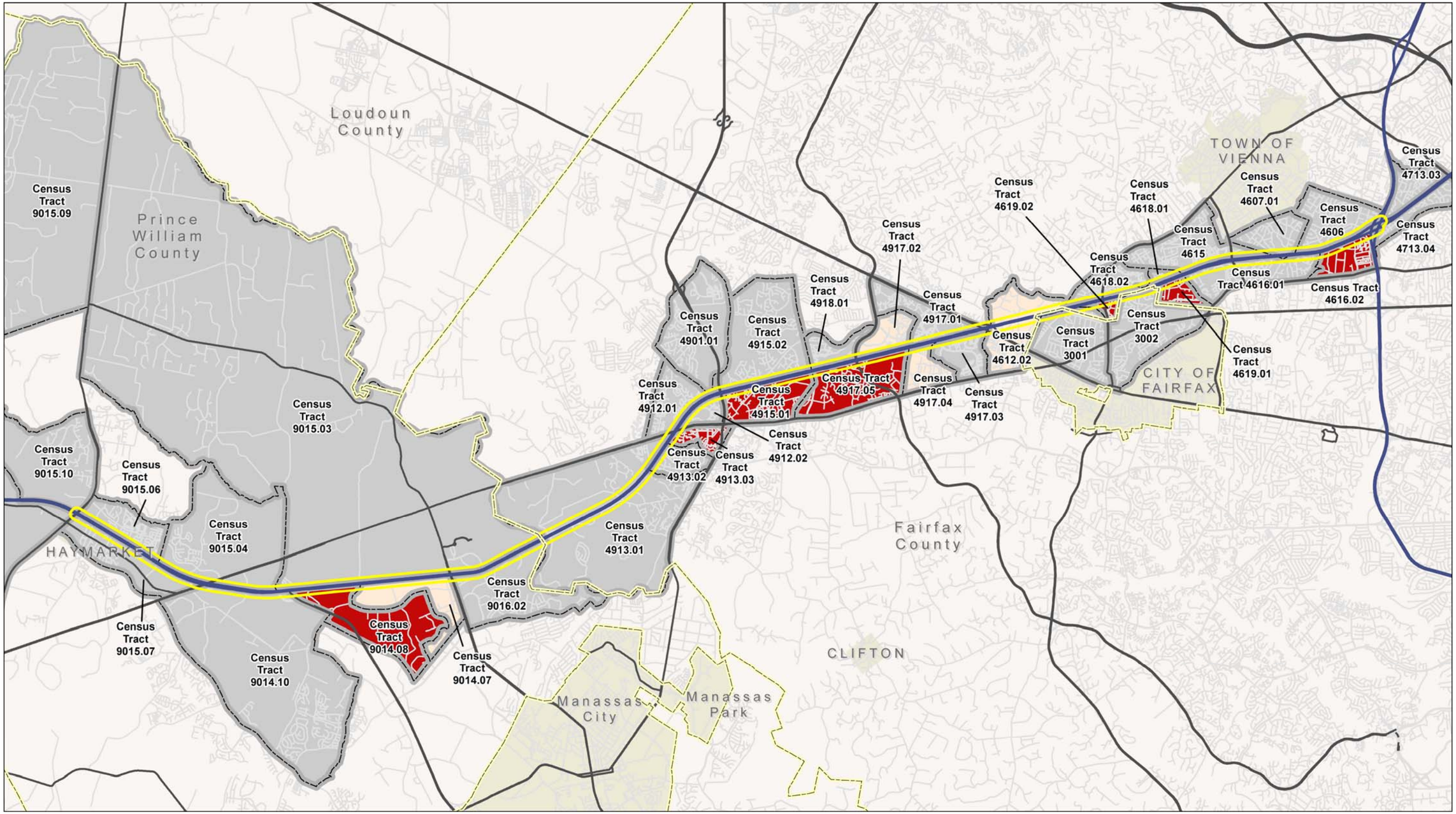


Figure 4-3. Minority Populations – I-66 Study Area

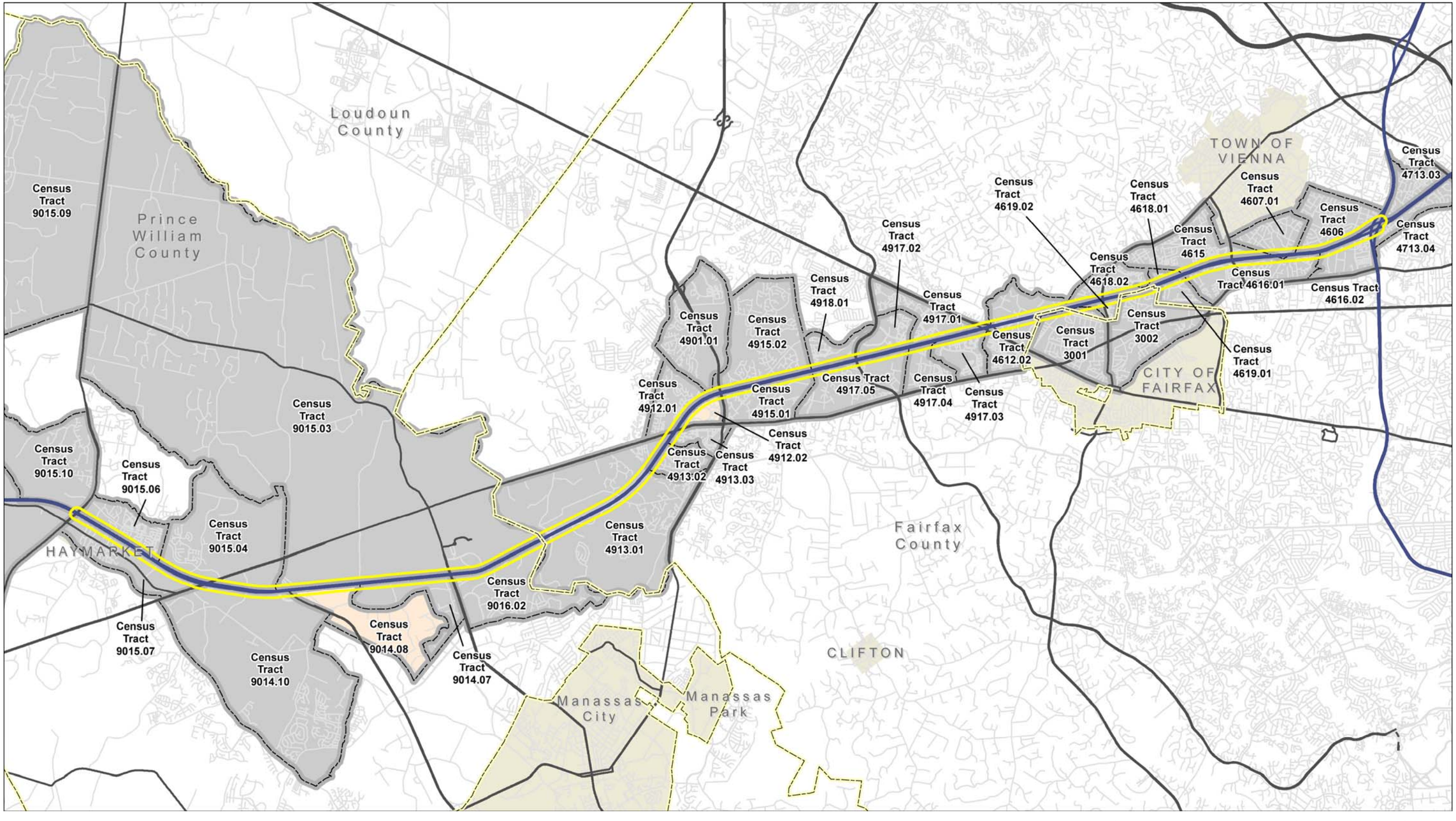


Figure 4-4. Low Income Populations – I-66 Study Area

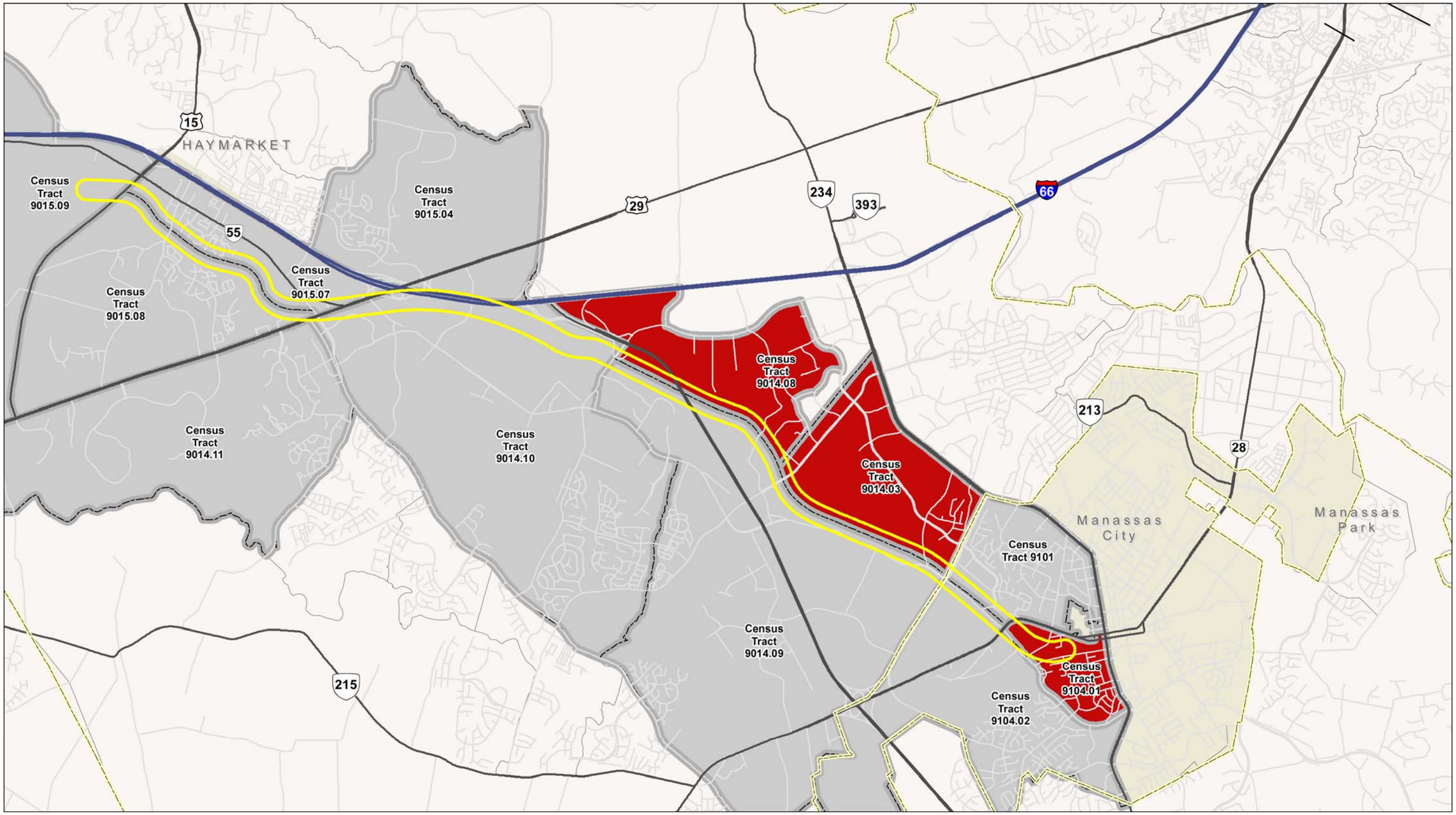


Figure 4-5. Minority Populations – VRE Extension Corridor

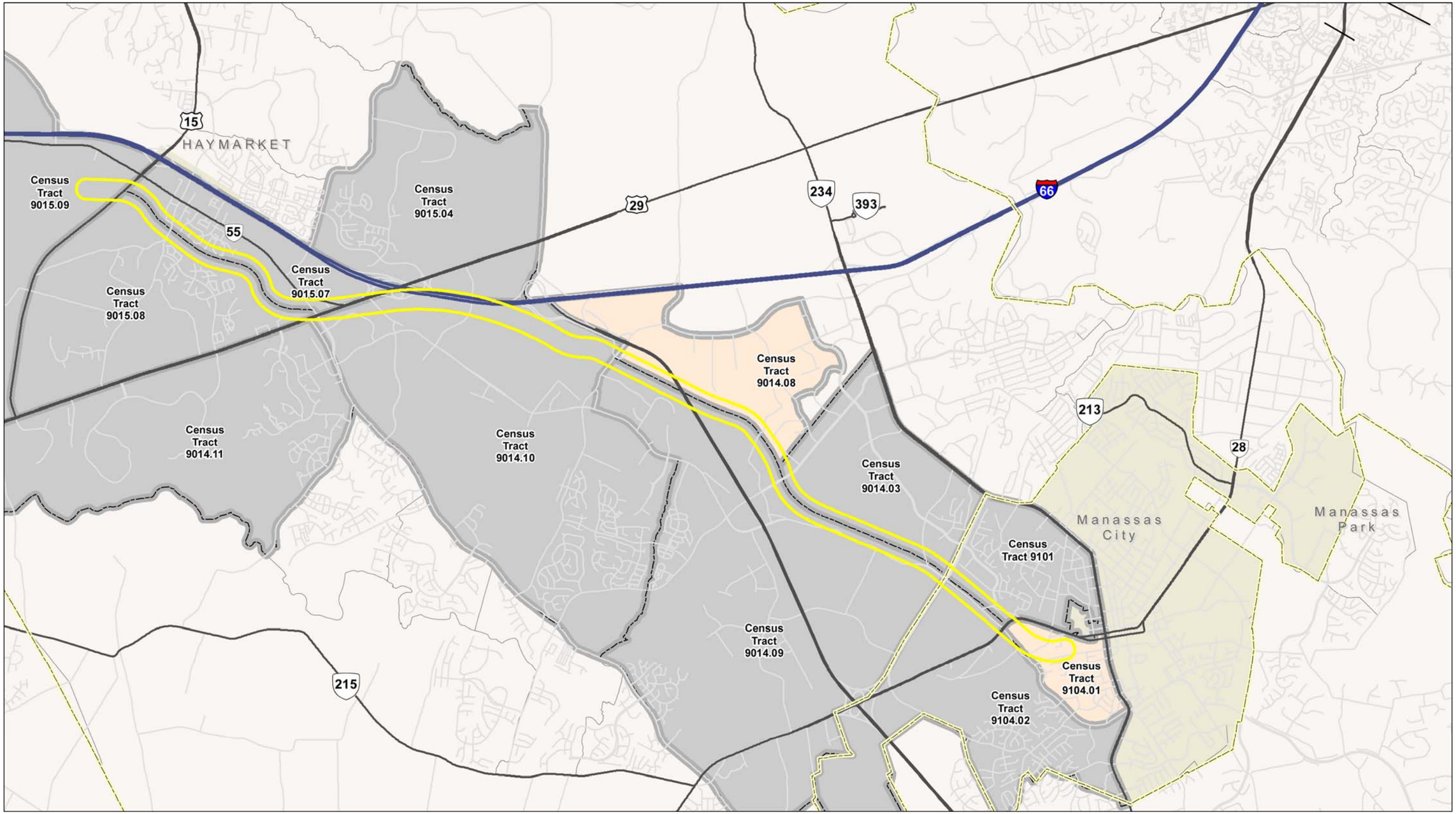
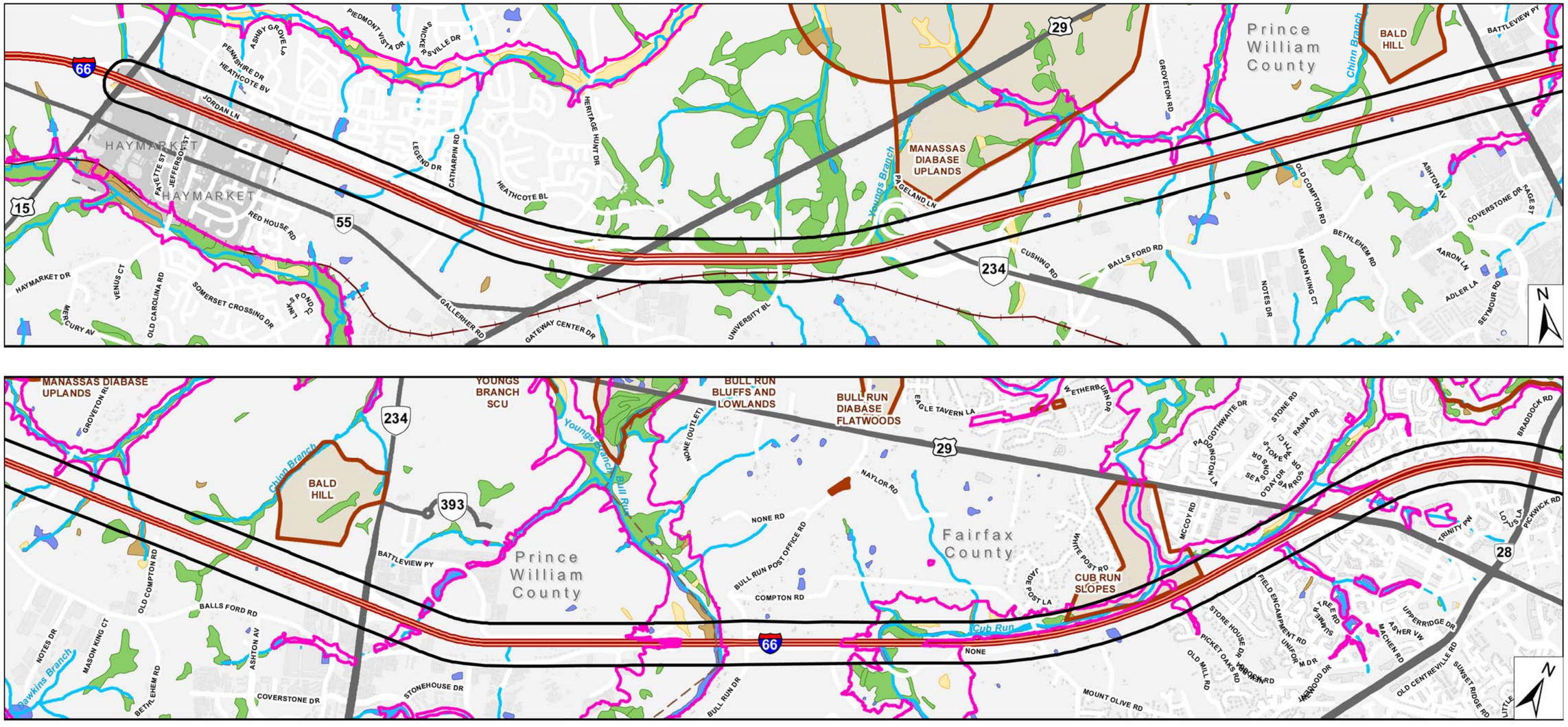


Figure 4-6. Low Income Populations – VRE Extension Corridor



Legend

- 500 ft Buffer
- Streams
- 100-year Floodplain
- Natural Heritage Resource Site

NWI Wetlands

- Palustrine Emergent
- Palustrine Forested
- Palustrine Scrub-Shrub
- Open Water

Miles
0 1

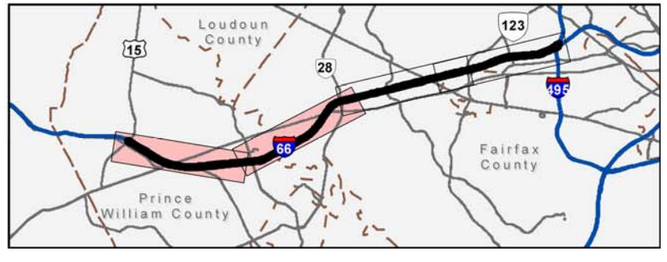
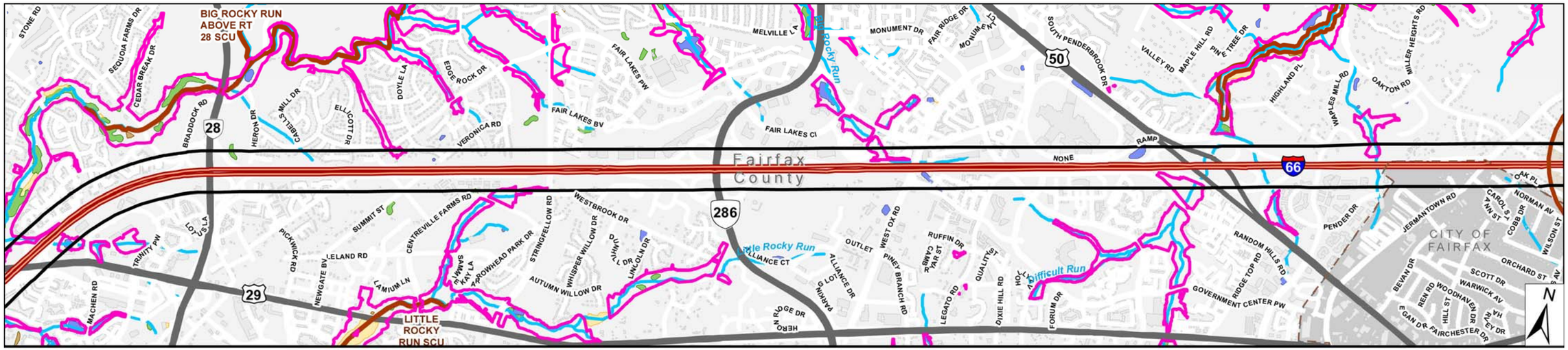
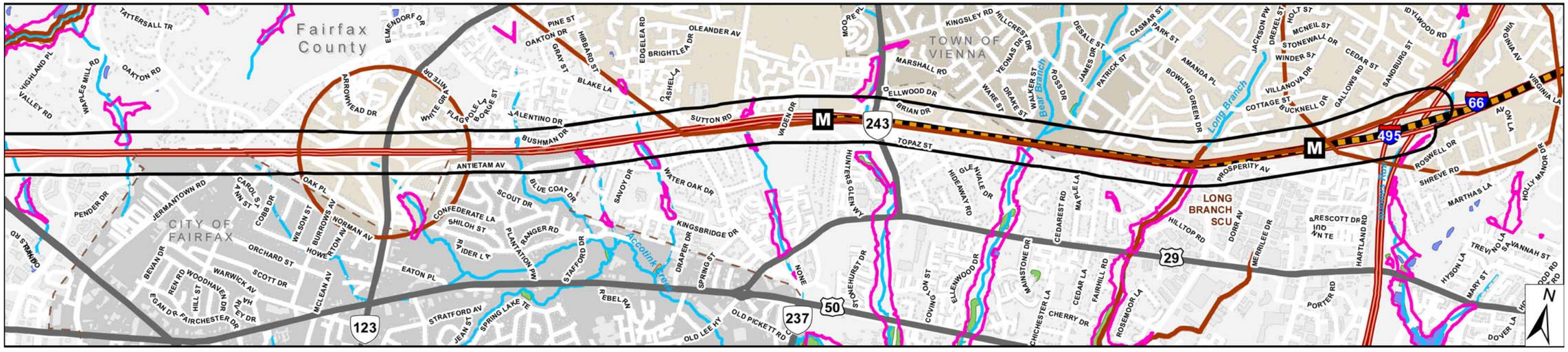


Figure 4-7. Natural Resources – I-66 Study Area
(Sheet 1)





Legend

- 500 ft Buffer
- Streams
- 100-year Floodplain
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NWI Wetlands

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- Palustrine Forested
- Palustrine Scrub-Shrub
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Miles
0 1

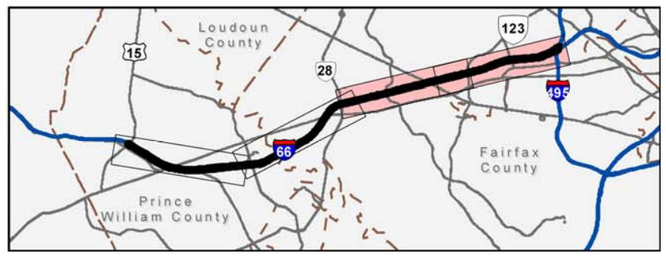
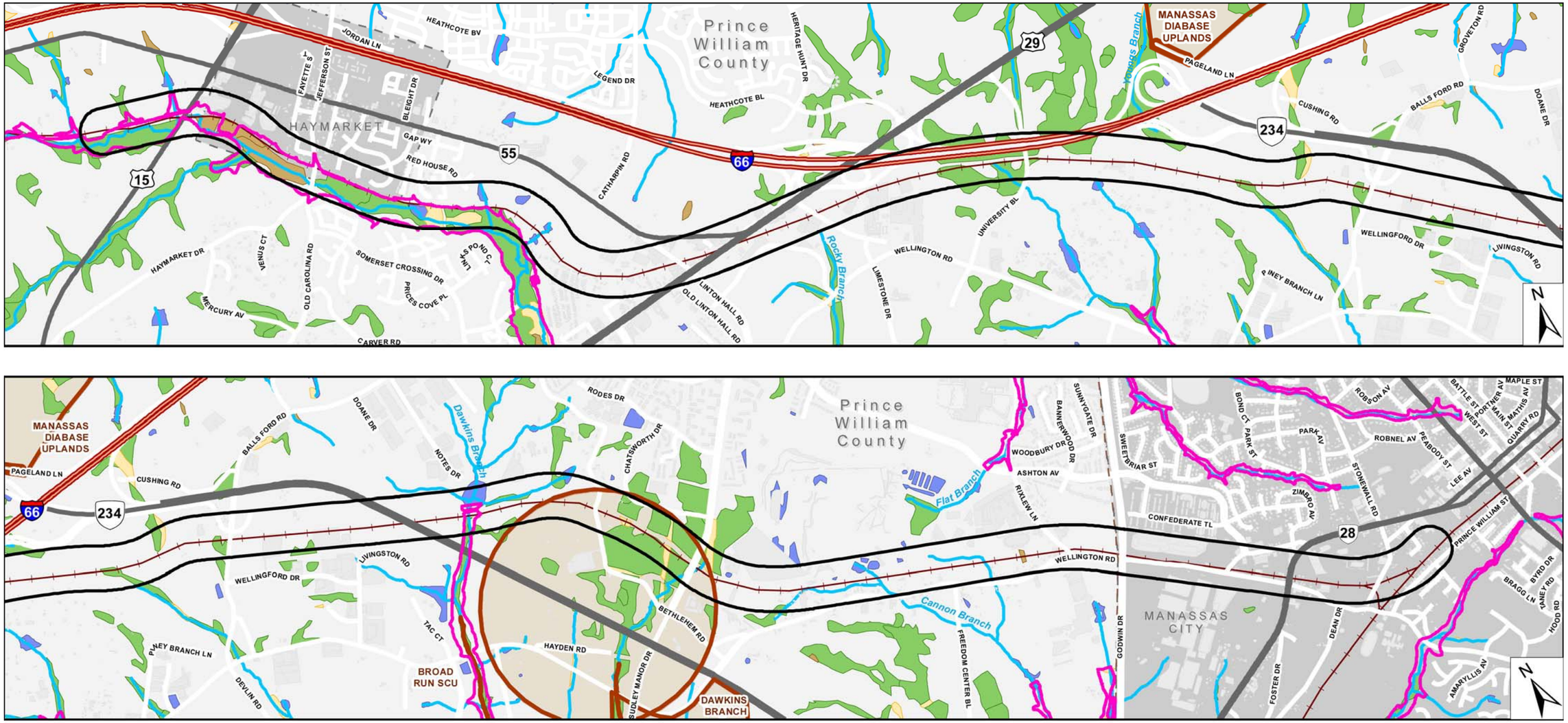


Figure 4-7. Natural Resources – I-66 Study Area
(Sheet 2)



Legend

- 500 ft Buffer
- Streams
- 100-year Floodplain
- Natural Heritage Resource Site

NWI Wetlands

- Palustrine Emergent
- Palustrine Forested
- Palustrine Scrub-Shrub
- Open Water

Miles

0 1

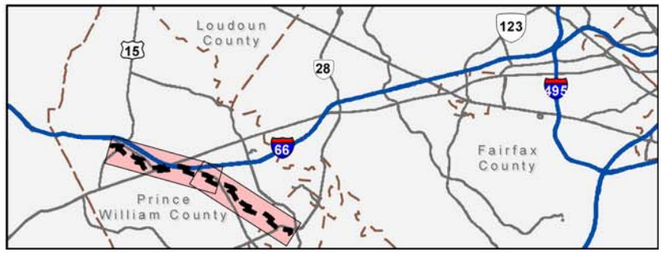


Figure 4-8. Natural Resources – VRE Extension Corridor

5 ENVIRONMENTAL CONSEQUENCES

This chapter presents the potential environmental impacts of the improvement concepts on the resources described in Chapter 4. This EIS uses an approach to impact analysis that is at a level of detail appropriate for a Tier 1 EIS and the decisions to be made in Tier 1. The impact analysis has the following characteristics:

1. **Uses information at a level of detail available at this stage of the process.** The overall transportation improvement development process recognizes that details such as specific footprints and operational details would be developed as part of Tier 2.

2. **Focuses on the individual improvement concepts rather than the combinations of improvements that are described in Chapter 3 as improvement concept scenarios.** Unless the No-Build Concept is selected, Tier 1 decisions would advance one or more of the improvement concepts identified in Chapter 3. As such, this EIS focuses on the potential impacts of the individual Build Improvement Concepts. If multiple improvement concepts are advanced to Tier 2, additional studies would be performed in Tier 2 to address in detail the specific interfaces between the projects associated with the improvement concepts.

3. **Supports Tier 1 decision-making by focusing on the comparative impacts of various multi-modal capacity, operational, and safety improvements.** The intent of this chapter is to provide decision-makers with information on the potential impacts of the improvement concepts on the natural and built environment. In addition, it is important to note that full compliance with the applicable environmental laws and regulations will not occur until Tier 2, when individual projects have been identified and are being evaluated.

In order to organize the analysis as well as maintain the ability to compare the potential impacts of various concepts, the following three-step approach was used:

1. Identify general width necessary to implement each improvement concept.

2. Group improvement concepts into templates with similar widths.

3. Apply templates for the purpose of identifying potential impacts.

These three steps are shown in the diagram in **Figure 5-1** while specifics on the three steps are described on the pages following.

STEP 1 – IDENTIFY GENERAL WIDTHS FOR BUILD IMPROVEMENT CONCEPTS

Implementing any of the ten Build Improvement Concepts described in Chapter 3 would require the incorporation of additional space into the transportation facility. Planning-level estimates of these widths are shown in **Table 5-1**. For purposes of assessing the potential impacts at a Tier 1

level, the width of existing I-66, based on the widest section within the corridor, was assumed at 200 feet. It is important to note that shoulder widening and additional space for drainage upgrades, noise walls, lighting, and other ancillary features would also be required for improvement concepts in the I-66 corridor that involve the addition of new impervious surface (i.e., any type of pavement widening). In addition, much of the existing I-66 median west of the Vienna Metrorail station is insufficient to accommodate future transit service so any improvements to I-66 would require widening of the median space. The extension of Metrorail or Bus Rapid Transit west of the Vienna Metrorail station is included in the current Fairfax County Transportation Plan[1]. While such transit service may not be part of the improvement concept(s) that are selected to advance as part of this Tier 1 analysis, space to preserve this option in conformity with current local planning documents was included as a "worse-case" footprint width scenario for purposes of the analysis[2]. Based on these considerations, it was assumed that an additional 35 feet to accommodate the median and shoulder widening would be needed, and that the need for this additional space would require that existing travel lanes be shifted to the outside for all of the capacity improvement concepts.

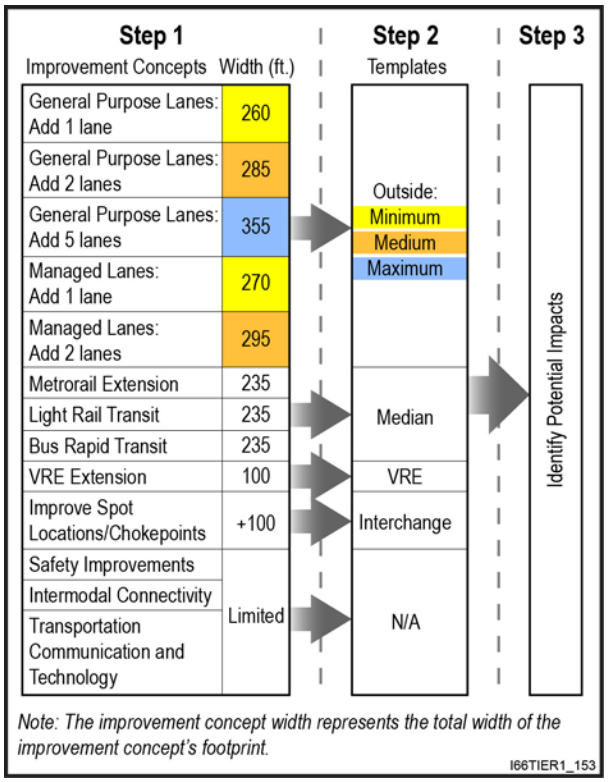


Figure 5-1. Analysis Approach for Identifying Potential Impacts

As shown in Table 5-1, it is anticipated that improvements associated with the **Safety Improvements**, **Intermodal Connectivity**, and **Transportation Communication/Technology** improvement concepts would take place within existing rights-of-way or have limited need for increased rights-of-way. Generalized locations for some proposed intermodal facilities are identified in current planning documents, and additional studies would be conducted to further pinpoint locations and footprints. Connections to those facilities by sidewalk and bicycle facilities could require rights-of-way, portions of which would be on arterial or local roads. Because space requirements for these three improvement concepts would be substantially less than required for the other seven Build Improvement Concepts, and because additional studies are needed to define many improvements to a level that allows an appropriate analysis of space requirements, physical corridor widths were not developed for these three improvement concepts. It is also anticipated that the minimal space requirements necessary to implement projects associated with these improvement concepts would not result in any significant impacts.

[1] Fairfax County Transportation Plan, Adopted by the Board of Supervisors on July 31, 2006 and amended through September 13, 2011.

[2] It is recognized that, should median-running transit not be selected to advance to Tier 2 and decisions are made to minimize rights-of-way, reductions in right-of-way width from this "worse-case" assumption may be possible.

STEP 2 – GROUP IMPROVEMENT CONCEPTS INTO TEMPLATES

For purposes of estimating potential impacts, and as shown in Table 5-1, the Build Improvement Concepts were grouped into four categories based on where the space requirements are located. The templates are described below:

- **Outside:** As noted previously, the worse-case assumption (in terms of space requirements) for this analysis is that the median would be preserved, and expanded where necessary, to support future median-running transit. For this template, therefore, space to the outside of the highway would be used for either **General Purpose Lanes** or **Managed Lanes** improvement concepts;
- **Median:** Space within the median would be used by the **Metrorail Extension** improvement concept, as well as either **Light Rail Transit** or **Bus Rapid Transit** improvement concepts;
- **Interchange**: The **Improve Spot Locations/Chokepoints** improvement concept would require space within or immediately adjacent to the interchanges;
- **VRE**: Because the VRE corridor is several miles from I-66 itself, requirements for rights-of-way for the **VRE Extension** improvement concept would be located off of I-66.

As noted for Step 1, the template widths incorporate the worse-case assumption of widening the median to accommodate future transit service (including the need to shift existing travel lanes to the outside as a result of the median widening) as well as shoulder widening and additional space for ancillary features that would be necessary for any improvement that adds impervious surface within the corridor. Because there is substantial variability in the number of lanes that could be added for the **General Purpose Lanes** and **Managed Lanes** improvement concepts, widths are shown for three possibilities for the Outside template. Potential impacts associated with these concepts would fall within the ranges shown and will depend on the number of lanes constructed (which would be determined in Tier 2 if one of these improvements concepts were to be advanced).

The **Improve Spot Locations/Chokepoints** improvement concept addresses operations constraints at discrete locations such as interchanges or specific junctions within the interchanges (i.e., merge, diverge, or weave areas). It is important to note that identifying specific footprints for these types of improvements requires detailed operations analysis of multiple potential solutions including converting free-flow ramps to high-capacity configurations that could incorporate traffic signals for some movements. Such detailed operations analysis allows for assessing trade-offs between the effectiveness of the improvement relative to costs and impacts. Since such detail is beyond the Tier 1 level, analysis footprints for the **Improve Spot Locations/Chokepoints** improvement concept were developed at a high level intended to include an area to which most improvements are likely to be limited. For the analysis of potential impacts, this footprint extends up to 100 feet within the study area beyond the existing edge-of-pavement for each interchange. It is important to recognize that there may be cases where operational improvements could result in reductions rather than increases in the roadway footprint or in totally new shapes for the ultimate improvement footprints.

Table 5-1. Build Improvement Concepts and Template Widths

IMPROVEMENT CONCEPT	ESTIMATED FOOTPRINT WIDTH[1]	TEMPLATE	TEMPLATE WIDTH[1]
General Purpose Lanes: Add 1 general purpose lane in each direction	260	Outside Minimum	270
Managed Lanes: Add 1 managed lane in each direction	270		
General Purpose Lanes: Add 2 general purpose lanes in each direction	285	Outside Medium	295
Managed Lanes: Add 2 managed lanes in each direction	295		
General Purpose Lanes: Add 5 general purpose lanes in each direction[4]	355	Outside Maximum	355
Metrorail Extension	235	Median	235
Light Rail Transit	235		
Bus Rapid Transit	235		
VRE Extension	100[2]	VRE	100[2]
Improve Spot Locations/Chokepoints	Existing footprint plus 100 feet within the study area[3]	Interchange	Existing footprint plus 100 feet[3]
Safety Improvements	Limited need for additional rights-of-way		
Intermodal Connectivity			
Transportation Communication and Technology			

Notes:

[1]The estimated footprint widths shown for both the improvement concepts and the templates include the entire footprint inclusive of existing I-66. Widths shown are planning-level; Tier 2 analyses would refine these widths based on more detailed analyses.

[2]This represents the total width of the footprint/template for the VRE improvement concept which would be centered on the existing rail tracks. Note that this template is not located in the existing I-66 corridor, but is generally located 5 miles from the corridor.

[3]The template for this improvement concept represents the existing interchange footprint plus 100 feet in all directions within the study area.

[4] Five lanes were chosen to represent a likely maximum upper limit. It was not intended to be a fixed number based on a desirable number of lanes.

STEP 3 – APPLY TEMPLATES IN ORDER TO IDENTIFY POTENTIAL IMPACTS

The analysis of relative impacts to the various features of the human (built) and natural environments described in the remainder of this chapter is based on the application of these templates as shown in Table 5-1. Each of the templates fits within the study areas described in Chapter 4 and potentially impacts the resources in the study areas to varying degrees. It is important to note that this analysis represents a high-level planning approach that describes "worse-case" but not "worst-case" conditions. The intent is to support informed decision-making by listing the potential impacts of the improvement concepts based on the high-level Tier 1 definitions of these concepts to facilitate comparison. The reader is reminded that the quantification of potential impacts should be interpreted as comparisons across the various concepts. Further studies that would be part of any Tier 2 analysis would define footprints and impacts to a much higher degree of certainty.

SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

The No-Build Concept would not require any additional right-of-way and would have no impact on the resources below with the exception of air quality and energy which would be affected by continued traffic congestion. The No-Build would not be consistent with local land use plans.

Based on the templates, the analysis of relative potential impacts to the features of the human (built) and natural environments are summarized in **Table 5-2** and **Table 5-3** for the Build Improvement Concepts. Table 5-2 summarizes the potential quantitative impacts and Table 5-3 summarizes the potential qualitative impacts. Additional detail on impacts can be found in subsequent sections.

Table 5-2. Quantitative Summary of Potential Impacts for Build Improvement Concepts

RESOURCE	SUMMARY OF POTENTIAL IMPACTS - QUANTITATIVE FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Approximate template width:	235 feet	270 feet	295 feet	355 feet	Existing plus 100 feet	100 feet
Social and Economic:						
Residential Relocations[1]	0	1	4	36	14	1
Community Facility Impacts	2	10	10	10	2	4
Business Relocations	0	0	0	4	5	6
Relocations within Minority Census Tracts	0	0	1	14	5	0
Relocations within Low-Income Census Tracts	0	0	0	0	0	0
Relocations within Limited English Proficiency Census Tracts	0	0	1	8	4	0
Farmlands *(acres)*	6.5	10.1	13.2	22.4	16.1	0.1
Public Parks, Recreation Areas, and Open Space Easements[2] *(acres)*	0.9	6.6	12.2	21.2	0.7	0
Historic Properties[3]:						
Architectural Sites	3	3	3	3	1	1
Archaeological Sites	0	1	1	2	2	0
Potential Impacts to Section 4(f) Properties	21.2	32.6	43.5	62.9	41.5	19.5
Hazardous Material Sites[4]	1	2	2	5	1	4
Wetlands[5] *(acres)*	3.6	6.8	9.6	17.4	9.4	7.2
Streams *(linear feet)*	5,172	6,354	7,636	9,703	5,635	1,048
Floodplains *(100-yr floodplain, acres)*	22.0	28.3	33.2	45.4	15.4	13.5
Natural Heritage Sites[6] *(acres)*	152.8	175.0	190.9	228.7	164.8	14.5

Notes:

1: Includes single family and multi-family structures.

2: There are no open space easements located within the study area. Acreage includes potential impacts to two federal, state, and regional parks, and five local public parks and recreation areas. However, given the nature of Manassas National Battlefield Park as a federally owned national park, it is very likely that direct impacts to the Park will be avoided.

3: Includes direct potential impacts to resources that are either listed, eligible, or potentially eligible for listing in the NRHP.

4: Includes CERCLIS Sites (none); VRP Sites (none); Unidentified HAZMAT Sites (none); and Solid Waste Facilities (1). All other identified sites are Petroleum Release Sites.

5: Includes wetland types: Palustrine Forested; Palustrine Scrub Shrub; and Palustrine Emergent.

6: Acreage includes potential impacts to five natural heritage locations within the study area.

Table 5-3. Qualitative Summary of Potential Impacts from Build Improvement Concepts

RESOURCE	SUMMARY OF POTENTIAL IMPACTS - QUALITATIVE FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)
Land Use	The Build Improvement Concepts are generally consistent with local comprehensive plan objectives which identify the need to improve transportation facilities along the I-66 corridor to reduce congestion and air pollution. The transit improvement concepts (**Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit,** and **VRE Extension**), and **Managed Lanes** improvement concepts within the I-66 corridor are compatible with transportation policies of local jurisdictions located along the corridor, because these policies cite the need to move large numbers of people within relatively confined spaces. The **VRE Extension** concept is consistent with the City of Manassas Comprehensive Plan, which seeks to expand the service and promote infill and transit-oriented development. The **Safety Improvements** and **Transportation Communication and Technology** improvement concepts would further contribute to local transportation objectives of reducing congestion by lowering crash rates and providing tools to inform drivers of traffic flow problems. Refer to Section 5.1.1 for additional information.
Air Quality	The additional highway lanes associated with the **General Purpose Lanes** and **Managed Lanes** improvement concepts would improve traffic flow and increase vehicle speeds, thereby reducing vehicle idling and stop-and-start driving conditions that are associated with higher levels of air emissions. However, an increase in vehicles speeds may have different effects for different pollutants, depending on the rate of speed. The **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension** improvement concepts all would reduce the number of vehicles on the roadway resulting in lower air emissions. Improvements to chokepoints to allow traffic to flow more efficiently would also generally result in lower air emissions compared to the existing conditions. Demonstration of conformity with the State Implementation Plan in accordance with the Clean Air Act will occur during Tier 2 when individual projects are analyzed. Refer to Section 5.1.4 for additional information.
Noise	An initial inventory of noise-sensitive and vibration-sensitive buildings and activity areas adjacent to the study areas was completed. Detailed noise modeling, quantification of potential impacts from individual projects, and identification of appropriate abatement measures will be conducted during Tier 2. The noise analyses for the I-66 corridor would be performed in accordance with FHWA 23 CFR 772 and VDOT noise policy. For the VRE Extension corridor, rail sources are the dominant component to the noise and vibration environment and therefore the noise and vibration analyses for the VRE corridor would be conducted according to FTA criteria. Refer to Section 5.1.5 for additional information.
Visual Quality	The transit improvement concepts (**Metrorail Extension**, **Light Rail Transit**, and **Bus Rapid Transit**) would introduce a new visual element that suggests a more urban environment. Widening of the roadway as part of the capacity improvement concepts (**General Purpose Lanes, Managed Lanes, Metrorail Extension**, **Light Rail Transit**, and **Bus Rapid Transit**) as well as the **Improve Spot Location/Chokepoint** improvement concept would potentially impact views of parkland and farmland through the conversion of open space to a more expansive transportation facility. The intensity of potential impacts would be greatest for the Outside Maximum template. Refer to Section 5.1.6 for additional information.
Water Quality	The I-66 corridor crosses four impaired water bodies as identified in the 303(d) VDEQ 2010 list. The Build Improvement Concepts have the potential to increase stormwater runoff velocities and roadway contaminants received by these impaired water bodies, and other water resources in the study area. To minimize these potential impacts, appropriate erosion and sediment control practices would be implemented for the individual Tier 2 projects, if a build improvement concept is advanced, in accordance with the Virginia Erosion and Sediment Control Regulations, the Virginia Stormwater Management Law and regulations, and VDOT's Road and Bridge Specifications. More detailed analyses of water quality impacts and necessary stormwater management controls would be conducted for the individual Tier 2 projects when additional design details would be available.
Coastal Zone Management Areas	The entire study area is located within the coastal zone. The Build Improvement Concepts would be constructed to be consistent with the established Virginia Coastal Zone Enforceable Policies, and with implementation of mitigation measures, the Build Improvement Concepts would not impair resources protected by the Virginia Coastal Zone Enforceable Policies, including wetlands, dunes, and aquatic animals. Refer to Section 5.2.1 for additional information.

RESOURCE	SUMMARY OF POTENTIAL IMPACTS - QUALITATIVE FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)
Wild and Scenic Rivers	There are no designated wild and scenic rivers located within the study area. One stream is listed in the National Rivers Inventory and as a potential component of the state Scenic River Inventory; however, as the proposed crossing of the river would be at the existing crossing location, the scenic nature of the river would not be substantially altered. Refer to Section 5.2.1 for additional information.
Wildlife Habitat	While there are some natural lands adjacent to I-66, the Build Improvement Concepts would only potentially affect small amounts of these natural habitats. No substantial fragmentation or disruption of large habitat areas or potential movement corridors would occur because potential impacts would take place along existing facilities. Therefore, the effects of the Build Improvement Concepts should not be substantial. Refer to Section 5.2.2 for additional information.
Threatened and Endangered Species	Based on the habitat model used in the USFWS Information Planning and Conservation (IPAC) online review, potential habitat may exist within the templates for two federally listed plants and one-federally listed mollusk. Correspondence with the VDGIF indicates suitable habitat may occur for two state-listed species. According to the VDGIF Species Observation Database (SppObs), no known occurrences of federal or state listed wildlife species would be impacted by any Build Improvement Concepts based on the templates. Refer to Section 5.2.2 for additional information.
Invasive Species	While highway right-of-way is vulnerable to colonization by invasive plant species from adjacent properties, implementation of the provisions of VDOT's Road and Bridge Specifications would reduce the potential for the establishment and proliferation of invasive species within the study area. Refer to Section 5.2.2 for additional information.
Energy	The capacity improvement concepts range in their rate of energy consumption with average British Thermal Units (BTUs) per passenger mile ranging from 2520 to 4118 for the various modes. However, the **Improve Spot Locations/Chokepoints**, **Safety Improvements**, **Intermodal Connectivity**, and **Transportation Communication and Technology** improvement concepts cannot be computed at the passenger mile level, but are likely to have minimal energy expenditures. Refer to Section 5.3 for additional information.

5.1 HUMAN ENVIRONMENT

This section discusses potential impacts to the human or built environment, including land use, social and economic resources, farmlands and agricultural/forestal districts, air quality, noise, visual quality, parks, recreation areas, open space easements, historic properties, and hazardous materials.

5.1.1 LAND USE

This section addresses the potential impacts of the No-Build Concept and the Build Improvement Concepts on land use and development patterns, and the consistency of these concepts with local land use objectives and planned growth areas.

5.1.1.1 No-Build Concept

The No-Build Concept would not result in direct impacts to existing or planned land uses; however, it would conflict with local comprehensive plan objectives which identify the need to improve transportation facilities in the I-66 corridor to reduce congestion and air pollution.

5.1.1.2 Build Improvement Concepts

LAND USE AND DEVELOPMENT PATTERNS

The Build Improvement Concepts involve modifications to existing transportation facilities, i.e., I-66 and the Norfolk Southern "B" Line Branch. Most of the concepts would require widening of

these facilities to accommodate proposed capacity increases. Widening of I-66 and the Norfolk Southern "B" Line Branch would result in potential direct impacts to a wide variety of land uses including residential, vacant land, commercial, industrial, parkland, institutional and agricultural areas. The transit capacity concepts (**Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**) would move the largest number of people while resulting in the least direct impacts to land uses. The highway capacity concepts (**General Purpose Lanes** and **Managed Lanes**) and the **Improve Spot Location/Chokepoint** improvement concept would generally require more right-of-way than the transit capacity concepts and thus would have larger direct land use impacts. As described in Chapter 3, the **Managed Lanes** improvement concept would maximize the person-trip capacity relative to space requirements when compared to other highway capacity improvement concepts.

Potential direct impacts may include relocations of residences and businesses. The potential social and economic effects of such relocations are discussed further in Section 5.1.2. Regional shopping centers, transit stations, and learning institutions located within or immediately adjacent to the corridor may experience loss or relocation of parking facilities and modifications to pedestrian bridges to accommodate potential widening of I-66.

As discussed further in Section 5.1.2, the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**) and the **Improve Spot Location/Chokepoint** improvement concept would have beneficial economic effects locally and regionally by reducing congestion in the I-66 corridor.

The **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology** improvement concepts would generally require minimal, if any, right-of-way and would therefore have minimal direct land use impacts. Because much of the corridor is developed, the addition of new parking lots as part of the **Intermodal Connectivity** improvement concept may also result in direct impacts to residential, commercial, and other land uses.

LAND USE OBJECTIVES / PLANNED GROWTH AREAS

Right-of-way requirements for the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**) and the **Improve Spot Location/Chokepoint** improvement concept may potentially conflict with planned developments adjacent to I-66 and the Norfolk Southern "B" Line Branch if these developments were constructed without sufficient buffer space to allow for future expansion of the transportation facilities. In addition, right-of-way impacts to existing residential areas may conflict with land use objectives regarding protection of existing residential neighborhood character.

Despite local land use conflicts arising from right-of-way requirements, the Build Improvement Concepts are generally consistent with local comprehensive plan objectives which identify the need to improve transportation facilities along the I-66 corridor to reduce congestion and air pollution. The transit improvement concepts (i.e., **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension)** and the **Managed Lanes** improvement concepts within the

I-66 corridor are compatible with transportation policies of local jurisdictions located along the corridor as these policies cite the need to move large numbers of people within relatively confined spaces. The **VRE Extension** improvement concept is consistent with the City of Manassas Comprehensive Plan, which seeks to expand the service and promote infill and transit-oriented development.

The City of Fairfax, Fairfax County, and the City of Manassas identify the need to improve accessibility to transportation facilities along I-66, including bicycle and pedestrian connectivity; these policies are consistent with the **Intermodal Connectivity** improvement concept.

The **Safety Improvements** and **Transportation Communication and Technology** improvement concepts would further contribute to the local transportation objectives of reducing congestion that is associated with non-recurring events, such as crashes or disabled vehicles, by lowering crash rates and providing tools to inform drivers of traffic flow problems and advise them of alternative routes and/or travel modes.

5.1.2 Social and Economic Resources

This section discusses the potential impacts of the No-Build and Build Improvement Concepts on communities, neighborhoods, community facilities, and environmental justice communities. Estimates of residential, business, and non-profit relocations are also included.

5.1.2.1 No-Build Concept

The No-Build Concept does not impact communities or neighborhoods, does not affect community facilities, would not result in residential or business relocations and would not affect environmental justice communities.

5.1.2.2 Build Improvement Concepts

Communities and Neighborhoods

The estimated numbers of residential relocations within the templates are presented in **Table 5-4**. These quantities are estimates based on aerial photography and county parcel data. Single and multi-family residences were differentiated; the number of units per multi-family residence was not, however, tabulated. Additional parcels or portions of parcels that do not require relocation of a residence, business, or other structure may be required for construction of the Build Improvement Concepts.

Under the Build Improvement Concepts, residential displacements potentially would occur along the length of the project. Because adjacent communities have grown and developed with I-66 in place, the relatively minimal increase in the encroachment of I-66 into the individual neighborhoods and the relocation of a limited number of residents is unlikely to have an effect on community cohesion.

There are no residential relocations associated with the Median template. Relocations are minimal with the Outside Minimum and Outside Medium templates and the VRE template. As expected, the greatest number of potential residential relocations would occur with the Outside Maximum and the Interchange templates.

Table 5-4. Potential Residential Relocations

LOCATION	POTENTIAL RESIDENTIAL RELOCATIONS FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Fairfax County	0 (0)	0 (0)	1 (0)	12 (7)	13 (0)	0 (0)
City of Fairfax	0 (0)	0 (0)	2 (0)	7 (0)	0 (0)	0 (0)
Prince William County	0 (0)	1 (0)	1 (0)	9 (1)	1 (0)	1 (0)
City of Manassas	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	0 (0)	1 (0)	4 (0)	28 (8)	14 (0)	1 (0)

Note: Relocations are shown for single family structures and, in parentheses, multi-family structures.
Source: 2011 VDOT Aerial Photography, Tax Assessment Databases

If a build improvement concept is advanced to Tier 2 and relocations are necessary as part of individual projects, the acquisition of right-of-way and the relocation of displacees would be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Information regarding right-of-way requirements and relocations would be updated during the Tier 2.

The following community facilities are directly adjacent to the corridors and would potentially be impacted by the Build Improvement Concepts:

- George G. Tyler Elementary;
- Manassas Mosque;
- DeVry University;
- ECPI College of Technology Northern Virginia Campus;
- University of Northern Virginia – Manassas;
- Sully Senior Center (formerly Centreville Methodist Church);
- Providence Elementary School;
- Stenwood Elementary School;
- Manassas Pentacostal Church;
- New Directions Alternative Education Center;
- Church of God;
- Stonewall Jackson High;
- Dunn-Loring Merrifield Metro Station; and
- Vienna/Fairfax-GMU Metro Station.

Relocations are not anticipated for any of these facilities. The potential impacts would consist of the potential need to acquire limited amounts of land. The building that houses the Manassas

Mosque is potentially directly affected; the mosque itself, however, is at the distant end from the potential impacts and would not likely need to be relocated. The Dunn-Loring Merrifield and Vienna/Fairfax-GMU Metro Stations would be impacted with the Median and all Outside templates. **Table 5-5** summarizes the potential community facility impacts for each template.

Table 5-5. Potential Community Facility Impacts

TYPE OF FACILITY	POTENTIAL COMMUNITY FACILITY IMPACTS FOR BUILD IMPROVEMENT CONCEPTS (BASED ONTEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Schools	0	6	6	6	0	2
Places of Worship	0	1	1	1	1	2
Cemetery	0	0	0	0	0	0
Metro Station	2	2	2	2	0	0
Other	0	1	1	1	1	0
Total	2	10	10	10	2	4

ECONOMICS AND EMPLOYMENT

The Build Improvement Concepts would have potential direct impacts on the economy through business relocations, as shown in **Table 5-6**.

Table 5-6. Potential Business Relocations

LOCATION	POTENTIAL BUSINESS RELOCATIONS FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Fairfax County	0	0	0	2	1	0
City of Fairfax	0	0	0	0	0	0
Prince William County	0	0	0	2	4	3
City of Manassas	0	0	0	0	0	3
Total	0	0	0	4	5	6

Source: 2011 VDOT Aerial Photography, Tax Assessment Databases

The potential business relocations along I-66 are primarily commercial facilities while the businesses that would be affected in the VRE corridor are more industrial in nature. No non-profit facilities are anticipated to be impacted by any of the build improvement concepts.

As with residential relocations, the acquisition of right-of-way and the relocation of displacees would be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Assurance is given that relocation resources would be available to all residential, business, farm, and nonprofit displacees without discrimination.

ENVIRONMENTAL JUSTICE

Demographic data for the Fairfax County, City of Fairfax, Prince William County and City of Manassas were analyzed to determine whether the Build Improvement Concepts would have

disproportionately high and adverse human health or environmental effects on minority populations, low-income populations, or LEP populations. **Table 5-7** includes the number of census tracts potentially impacted that have been identified with higher than average low-income, minority, or LEP populations. As discussed in Section 4.1.2, the identified environmental justice census tracts of concern have higher than 50% minority, low-income, or LEP populations or are 10% higher than the average Environmental Justice populations within the region.

Table 5-7. Potential Residential and Business Relocations by Census Tract

LOCATION	POTENTIAL RESIDENTIAL AND BUSINESS RELOCATIONS FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Minority Census Tracts						
Fairfax County						
4913.03	0	0	0	0	0	0
4915.01	0	0	0	1	0	0
4917.05	0	0	0	0	2	0
4917.04	0	0	0	4	0	0
4612.02	0	0	0	0	0	0
4619.02	0	0	0	0	0	0
4619.01	0	0	1	5	0	0
4616.02	0	0	0	2	0	0
Other Tracts	0	0	0	9	12	0
Total	0	0	1	21	14	0
City of Fairfax						
Other Tracts	0	0	2	7	0	0
Prince William County						
9014.08	0	0	0	0	0	0
9014.07	0	0	0	2	3	0
9014.03	0	0	0	0	0	0
Other Tracts	0	1	1	10	2	4
Total	0	1	1	12	5	4
City of Manassas						
9104.01	0	0	0	0	0	0
Other Tracts	0	0	0	0	0	3
Total	0	0	0	0	0	3
Low-Income Census Tracts						
Fairfax County						
4912.02	0	0	0	0	0	0
Other Tracts	0	0	1	21	14	0
Total	0	0	1	21	14	0

LOCATION	POTENTIAL RESIDENTIAL AND BUSINESS RELOCATIONS FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
City of Fairfax						
Other Tracts	0	0	2	7	0	0
Prince William County						
9014.08	0	0	0	0	0	0
Other Tracts	0	1	1	12	5	4
Total	0	1	1	12	5	4
City of Manassas						
9104.01	0	0	0	0	0	0
Other Tracts	0	0	0	0	0	3
Total	0	0	0	0	0	3
Limited English Proficiency						
Fairfax County						
4913.03	0	0	0	0	0	0
4915.01	0	0	0	1	0	0
4619.02	0	0	0	0	0	0
4619.01	0	0	1	5	0	0
4918.01	0	0	0	0	1	0
Other Tracts	0	0	0	15	13	0
Total	0	0	1	21	14	0
City of Fairfax						
Other Tracts	0	0	2	7	0	0
Prince William County						
9014.08	0	0	0	0	0	0
9014.07	0	0	0	2	3	0
9014.09	0	0	0	0	0	0
Other Tracts	0	1	1	10	2	4
Total	0	1	1	12	5	4
City of Manassas						
9104.01	0	0	0	0	0	0
Other Tracts	0	0	0	0	0	3
Total	0	0	0	0	0	3

Note: This table does not include the total number of units for multi-family residences.

Source: 2011 VDOT Aerial Photography, Tax Assessment Databases

Table 5-7 tabulates the relocations by census tract for the identified minority, low-income and LEP census tracts of concern. These relocations are not necessarily minority, low-income, or LEP households but are located within those census tracts with higher than average levels of those populations. Relocations outside of identified minority, low-income and LEP census tracts are

provided in the Other Tracts row. When compared to the total number of potential relocations, no disproportionate impacts to low-income, minority, or LEP populations are expected to occur with any of the Build Improvement Concepts.

Tolling, which is under consideration for advancement to Tier 2 studies, has the potential to impact low-income populations within the study area. The preliminary analysis performed for Tier 1 (described in the *Transportation Technical Report*) indicates that, while diversions from I-66 in response to tolling are not expected to be substantial, there are potentially numerous travel options that those not wishing to pay tolls could avail themselves of, including using roads that run parallel to I-66, untolled general purpose lanes, median-running transit services (including the **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit** improvement concepts), and transit services that would run within the **Managed Lanes** improvement concept (such as commuter buses). More detailed assessments of the potential effects of tolls on all travelers, including low-income populations, will depend greatly on the improvement concept(s) that are advanced to Tier 2, and such detailed analysis would be included in Tier 2 studies.

5.1.3 Farmland and Agricultural/Forestal Districts

This section discusses potential impacts of the No-Build and Build Improvement Concepts on farmlands and agricultural/forestal districts. Potential impacts were determined through the use of GIS mapping from state and local sources.

5.1.3.1 No-Build Concept

The No-Build Concept would not impact prime farmlands, farmlands or statewide importance or agricultural/forestal districts.

5.1.3.2 Build Improvement Concepts

The Build Improvement Concepts would not impact any agricultural/forestal districts. **Table 5-8** summarizes the potential impacts to prime farmlands and farmlands of statewide importance by templates. Potential impacts to farmlands range from less than 0.1 acres for the VRE template to 22.4 acres for the Outside Maximum template. Additional coordination with the NRCS regarding farmland impacts would take place during the Tier 2 analysis.

Table 5-8. Potential Farmland Impacts

FARMLANDS	POTENTIAL IMPACTS (ACRES) FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Prime Farmlands	3.0	5.9	8.5	16.2	8.2	<0.1
Farmlands of Statewide Importance	3.5	4.2	4.7	6.2	7.9	0.0
Total	6.5	10.1	13.2	22.4	16.1	<0.1

Source: Natural Resource Conservation Service

5.1.4 AIR QUALITY

The I-66 Study Area and VRE Extension Corridor are located in an EPA designated non-attainment area for small particulate matter ($PM_{2.5}$) and the 1997 and 2008 eight-hour O_3 standard. The area is designated as attainment for all other NAAQS. Demonstration of conformity with the State Implementation Plan (SIP) in accordance with the Clean Air Act will occur during Tier 2 when individual projects are analyzed.

Full compliance with the NEPA and the Clean Air Act will be required under the Tier 2 analysis. Part of the NEPA compliance is to determine the potential impacts on air quality from the changes in the transportation network and conformity with the applicable SIP for any EPA criteria pollutant in a non-attainment or maintenance area.

5.1.4.1 No-Build Concept

The No-Build Concept assumes no improvements to the corridor beyond those already programmed. Regional air quality is addressed through regional planning by the Metropolitan Planning Organization, including conformity analyses for projects included in the CLRP. The aim of such planning efforts is to avoid violations of the NAAQS attributable to transportation projects within the region.

5.1.4.2 Build Improvement Concepts

While potential air quality impacts are affected to some extent by the footprint of a Build Improvement Concept, the amount and type of traffic plays a more significant role in these types of potential impacts. Air quality impacts were, therefore, assessed primarily on the type of capacity improvements proposed and not on the templates. A summary of the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**) as they pertain to vehicular traffic and potential air quality implications is presented below. The **Safety Improvements**, **Transportation Communication and Technology**, and **Intermodal Connectivity** concepts were not included in this discussion as those types of improvements would have minimal effect on air quality.

GENERAL PURPOSE LANES

This improvement concept includes construction of up to nine additional highway lanes (in each direction) that would be open to all traffic. The additional capacity afforded by the new highway lanes would improve traffic flow and increase vehicle speeds, thereby reducing vehicle idling and stop-and-start driving conditions that are associated with higher levels of air emissions. In general, reducing vehicle delay and increasing travel speeds results in lower emissions. However, an increase in vehicles speeds may have different effects for different pollutants, depending on the rate of speed. For instance, volatile organic compounds (VOCs) emissions will generally decline with increasing vehicle speeds, however, CO and nitrogen oxide (NOx) emissions may increase slightly with higher vehicle speeds. It should be noted that mobile source emissions are expected to decline in future years compared to present-day emissions even though there are anticipated to be more vehicles and more miles traveled. Some of the reasons for these reductions are due to federal and state regulations, fuel efficiency standards and improved engine technology, and the removal of older, less efficient motor vehicles.

MANAGED LANES

This concept includes conversion of the existing HOV lane into either one or two managed (HOV and/or toll lanes) in each direction. Similar to the addition of the general purpose lanes, the **Managed Lanes** concept would remove traffic from the highway by encouraging carpooling. This concept is designed to improve traffic flow by reducing congestion, thereby increasing vehicle speeds. As noted previously, increases in travel speeds will have different effects on different pollutants depending on the vehicle speed; however, the reduction in vehicle trips should mitigate any slight increase in emissions. If tolls are implemented, travelers may shift to general purpose lanes, change travel times, and shift travel modes; there is, however, also the possibility of diversion effects where motorists may seek to avoid paying tolls and use local roads to bypass I-66. This diversion effect could lead to additional traffic volumes along the local roads, thereby reducing peak hour vehicle speeds, degrading LOS, and increasing delays. Preliminary analysis (described in the *Transportation Technical Report*) indicates that diversions are not expected to be substantial and more detailed tolling analysis would be performed during Tier 2 if consideration of tolls is advanced.

METRORAIL EXTENSION

This concept involves extending the Metrorail service from Vienna to either Centreville or Haymarket. The extension of the Metrorail would result in fewer vehicles on the roadways and a reduction in air emissions. The Metrorail cars operate using electric direct current; therefore, direct emissions from the rail cars are negligible. Removing vehicles from the roadway would assist in alleviating roadway congestion on I-66, particularly during peak periods. This would allow for higher average operating speeds which would generally reduce air emissions. As noted previously, increases in travel speeds will have different effects on different pollutants depending on the vehicle speed; the reduction in vehicle trips, however, should mitigate any slight increase in emissions. There may be some additional traffic to local roadways accessing the train stations; this impact, however, is not expected to be substantial and it would be analyzed during Tier 2 if this improvement concept is advanced.

LIGHT RAIL TRANSIT

This concept involves light rail service from Vienna to either Centreville or Haymarket. Air quality benefits are expected to be similar to those described for the **Metrorail Extension**.

BUS RAPID TRANSIT

This concept involves a separate guideway bus rapid transit extending west from Vienna to Haymarket; service could also extend east from Vienna. The current Metrobus fleet operates on compressed natural gas (CNG), advanced diesel technology, or diesel/electric hybrids. The remaining buses operate on ultra-low sulfur diesel oil and are equipped with exhaust treatment to lower emissions (per WMATA's Clean Fleet program). The air quality benefits of extending the bus line would be similar to the **Metrorail Extension** and **Light Rail Transit** in terms of removing vehicles from the roadway and thereby reducing potential vehicular emissions. Similar to automobile emissions, emissions from buses are expected to decline in future years compared to the existing fleet due to changes in emission standards, improved technology, cleaner fuels, and the retiring of older less efficient buses. As noted above, WMATA is

committed to cleaner burning buses with its Clean Fleet program; these types of programs along with continued advancements in technology are expected to increase the percentage of the bus fleet that will incorporate cleaner burning fuels, thereby further reducing air emissions over the long term.

VRE EXTENSION

This option involves extension of the existing VRE service from Manassas to Haymarket. Similar to the **Metrorail Extension**, **Light Rail Transit,** and **Bus Rapid Transit** improvement concepts, it is anticipated that for the **VRE Extension** improvement concept, vehicles would be removed from the roadway and vehicle emissions would decrease within the study area. Unlike Light Rail and Metrorail which operate using electricity, VRE operates diesel powered locomotives; as such, there are direct air emissions (i.e., PM and NOx) associated with VRE locomotives. However, future emissions from diesel locomotives are expected to decrease from existing levels due to emission standards recently implemented. In March of 2008, the EPA finalized a three part program to reduce diesel locomotive emissions. The longer term standards, referred as Tier 4, are expected to reduce PM emissions by 90 percent and NOx emissions by 80 percent when fully implemented compared to existing Tier 2 standards. Furthermore, by 2030, the program is expected to reduce annual emissions of NOx by 800,000 tons and PM emissions by 27,000 tons and the program will continue to grow beyond 2030 as the fleet turnover is completed. The Final Rule with amendments was published in November 2010.

IMPROVE SPOT LOCATIONS/CHOKEPOINTS

This option includes improvements that address operations constraints at discrete locations (chokepoints) such as individual interchanges or specific junction points within the interchanges (i.e., merge, diverge, weaving areas). Improvements to chokepoints to reduce congestion and allow traffic to flow more efficiently would generally result in lower air emissions compared to the existing conditions. It is assumed that improvements to these areas would result in reduced congestion, allowing vehicle speeds to increase during peak hours and generally resulting in lower air quality emissions in the area.

The current methodologies for carbon monoxide (CO), particulate matter (PM), and Mobile Source Air Toxics (MSATs) are discussed below.

Carbon Monoxide - On February 27, 2009, the FHWA and VDOT issued an updated memorandum of understanding (MOU) addressing requirements for project-level air quality analyses. Under this agreement, project-level air quality qualitative (or quantitative, i.e., Hot Spot) analyses are conducted for CO for projects that meet traffic and related criteria as specified in the agreement. An air quality impact assessment of CO traffic emissions would be based on the traffic data estimated for each build and no-build condition in Tier 2 analyses. If projected traffic volumes exceed VDOT and FHWA quantitative criteria, then a hot spot analysis would be required for specific intersections/interchanges. A quantitative analysis typically includes a microscale air dispersion modeling analysis to demonstrate that impacts from the project do not exceed the CO NAAQS. A quantitative analysis would also include modeling protocol which must be approved by VDOT; this documents the methodologies and

assumptions for conducting microscale analysis. Otherwise, a qualitative analysis is required which documents that the project would not significantly impact air quality.

Particulate Matter - Fairfax and Prince William Counties are designated by EPA as a non-attainment area for $PM_{2.5}$; therefore, an analysis would be required to determine if the project is considered a "project of air quality concern" under EPA defined criteria. A "project of air quality concern" is one that meets one or more of the following criteria:

1. A new or expanded highway project that serves a significant volume of or will result in a significant increase in diesel vehicles, such as facilities with greater than 125,000 annual average daily traffic (AADT) and 8% or more of such AADT is diesel truck traffic.

2. A project that creates a new, or expands or improves accessibility to an existing bus or rail terminal or transfer point that will have a significant number of diesel vehicles congregating at that location, or that is defined as regionally significant.

3. A project that affects intersections that are at LOS D, E or F with a significant number of diesel vehicles, or that will change to LOS D, E or F because of increased traffic volumes from a significant number of diesel vehicles related to the project.

4. A project otherwise considered a project of "air quality concern" as outlined in 40 CFR 93.123 (b)(1)(i),(ii),(iii) or (iv).

If the project does not meet any of the thresholds above, it must include adequate documentation to support the conclusion, otherwise a quantitative hot-spot analysis must be conducted. This decision would be made upon final review of the traffic results in Tier 2 studies.

Mobile Source Air Toxics - In December 2012, the FHWA issued updated interim guidance regarding MSAT impacts and the levels of analysis required to address MSATs in a NEPA analysis. The levels addressed were for projects with no meaningful MSAT effects, low potential MSAT effects, and high potential MSAT effects. A qualitative analysis is required for projects which meet the low potential MSAT effects criteria while a quantitative analysis is required for projects meeting the high potential MSAT effects criteria.

Projects with Low Potential MSAT Effects are described as:

- Those that serve to improve operations of highway, transit, freight without adding substantial new capacity or without creating a facility that is likely to significantly increase emissions. This category covers a broad range of project types including minor widening projects and new interchanges, such as those that replace a signalized intersection on a surface street or where design year traffic is not projected to meet the 140,000 to 150,000 AADT criteria.

Projects with High Potential MSAT Effects include those that:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location;

- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 or greater by the design year; and
- Propose to locate in proximity to populated areas.

No analysis is required for projects meeting one or more of the following:

- Any project qualifying as a categorical exclusion under 23 CFR 771.117(c);
- Any project exempt under the Clean Air Act conformity rule under 40CFR 93.126; or
- Any other project with no meaningful impacts on traffic volumes or vehicle mix.

The Tier 2 analysis will include a detailed air quality assessment once an improvement concept or set of improvement concepts is selected. At that time, a project-specific air quality analysis will be conducted for carbon monoxide (CO), particulate matter (PM), and Mobile Source Air Toxics (MSATs). The methodologies and assumptions for addressing the type of analysis for each pollutant will be consistent with the latest EPA and FHWA guidance.

5.1.5 NOISE

This section includes a screening-level noise and vibration assessment commensurate with a Tier 1 study that addresses a wide range of multimodal improvement concepts. A screening level noise assessment identifies whether noise sensitive land uses are within the area within which future noise conditions associated with the Build Improvement Concepts may exceed the FHWA NAC or FTA impact criteria. Detailed noise modeling, quantification of impacts from individual projects, and identification of appropriate abatement measures would be conducted during Tier 2. Such detailed analyses are anticipated for the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, and **VRE Extension**), and individual interchange projects associated with the **Improve Spot Locations/Chokepoints** improvement concept. The **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology** improvement concepts, however, are anticipated to involve negligible if any impacts on the noise environment and therefore would not likely require detailed noise analyses.

5.1.5.1 No-Build Concept

The No-Build Concept would not result in any increase in noise or vibration levels within the I-66 or Norfolk Southern "B" Line Branch corridors.

5.1.5.2 Build Improvement Concepts

Since the I-66 corridor includes both highway and rail components and FHWA is the lead agency, the noise screening assessment for this corridor has been performed in accordance with FHWA 23 CFR 772 and VDOT noise policy. For the VRE Extension corridor, rail sources are the dominant component to the noise and vibration environment and therefore the noise and vibration screening assessment for this corridor has been conducted according to FTA criteria.

I-66 Corridor Noise Assessment Screening

As with air quality impacts, noise impacts extend beyond the immediate template footprints that were correlated with the various Build Improvement Concepts. For the noise impact assessments, land uses within approximately 500 feet of I-66 were identified to represent the areas of potential noise impact in the I-66 corridor. Land uses categories B, C, D and E have associated NAC and the potential for noise impact. Common Noise Environments (CNEs) have been identified in the study area with similar land uses and sources of noise.

An inventory of noise-sensitive buildings and activity areas within the CNEs is presented in **Table 5-9**. Single- and multi-family residential (Category B) buildings have been separated in this inventory. Some of the recreation areas listed are directly associated with the residential communities they are within, and they are listed if it is clear that they are intended for use by the residential community at large.

Table 5-9. Inventory of Noise-sensitive Land Uses Potentially impacted in the I-66 Corridor

CNE	ACTIVITY CATEGORY	CATEGORY B BUILDINGS		CATEGORY C, D, E USES
		SINGLE-FAMILY	MULTI-FAMILY	
1	D			1 (D) Medical Facility
2	B, C	115		1 (C) Park/Rec.
3	B, C	45	65	1 (C) Park/Rec.
4	C			1 (C) School
5	B, C	1		1 (C) Park/Rec.
6	C, D			1 (C) School, 5 (D) Medical Facilities
7	F			
8	F			
9	F			
10	B	4		
11	F			
12	D, F			3 (D) Places of Worship
13	E			1 (E) Hotel/Motel
14	B	3		
15	B	8		
16	D			1 (D) School
17	B	4		
18	B	1		
19	C			1 (C) Park/Rec.
20	F			
21	B	3		
22	C			1 (C) Park/Rec.
23	B, C	10		1 (C) Park/Rec.
24	B, C	35	90	1 (C) Park/Rec.
25	F			
26	E			1 (E) Commercial
27	B, C		315	3 (C) Park/Rec.
28	B, C		6	1 (C) Park/Rec.

CNE	ACTIVITY CATEGORY	CATEGORY B BUILDINGS		CATEGORY C, D, E USES
		SINGLE-FAMILY	MULTI-FAMILY	
29	C			1 (C) Park/Rec.
30	B, C		185	4 (C) Park/Rec.
31	B	100	3	
32	F			
33	B		55	
34	B	70		
35	F			
36	F			
37	E			1 (E) Hotel/Motel
38	B		10	
39	E			No exterior use
40	B, C		17	2 (C) Park/Rec.
41	B		4	
42	C			1 (C) Park/Rec.
43	E			No exterior use
44	E			No exterior use
45	B		3	
46	B, C		18	2 (C) Park/Rec.
47	B	20	30	
48	B, C		5	1 (C) Park/Rec.
49	B	40	5	
50	E			No exterior use
51	C			1 (C) School
52	B	70		
53	B, C		380	2 (C) Park/Rec.
54	B, C	155	12	1 (C) Park/Rec.
55	D			1 (D) School
56	B	20	3	
57	B		18	
58	F			
59	F			
60	B, C	100	160	1 (C) Park/Rec.
61	B	85		
62	B, C	10		1 (C) Park/Rec.
63	B	140		
64	E			No exterior use
65	C, D			1 (C, D) School
66	B,C		20	1 (C) Park/Rec.
67	B	45		
	Totals	**1084**	**1404**	

If a Build Improvement Concept were advanced to Tier 2, noise analyses for individual projects would involve detailed noise modeling with FHWA's Traffic Noise Model (TNM) and quantification of noise impacts by individual receptors and activity category.

I-66 Corridor Noise Abatement Concepts

FHWA has identified certain noise abatement measures that may be incorporated in projects to reduce traffic noise impact. In general, mitigation measures can include alternative measures (traffic management, and the alteration of horizontal and vertical alignment), in addition to the construction of noise barriers. The Noise Policy Code of Virginia (HB 2577, as amended by HB 2025) requires VDOT to give first consideration to alternative abatement measures before considering noise barriers. Alternative abatement measures are most commonly not practical, due to project constraints, the limited availability of right of way, and the minimal degree of noise mitigation that can be achieved.

Noise barriers (walls, berms, or a combination) as a means of noise abatement are used commonly in Virginia. FHWA regulations require that noise barriers be shown to be feasible and reasonable before they may be approved for construction. VDOT has established feasibility and cost-reasonableness criteria for noise barriers. To be feasible, a barrier must be able to benefit at least half of the impacted receptors it is intended to benefit and it must be physically constructable. To be reasonable, a barrier must provide a minimum of seven decibels of noise reduction to at least one impacted receptor; it must provide a minimum of five decibels of noise reduction to all benefited receptors; and it must not be more than 1600 square feet in size per benefited receptor. Finally, the views of the benefited residents must be considered; benefited residents and property owners must approve a barrier being proposed for their community for it to be considered reasonable.

Noise barriers are most often located adjacent to the roadway where the road is at grade or on fill, and near the top of slope where the road is in a cut. Barrier heights vary significantly, from only a few feet up to VDOT's maximum height of 30 feet.

If a Build Improvement Concept is advanced to Tier 2, detailed noise abatement analysis would be conducted for individual projects; the analysis would examine the feasibility and reasonableness of noise abatement for all impacted receptors.

VRE Extension Noise and Vibration Assessment Screening

The noise and vibration screening procedure for assessing the potential impact of the **VRE Extension** between Manassas and Haymarket is based on methodology described in the FTA Noise and Vibration Impact Assessment guidance manual (FTA Report FTA-VA-90-1003-06, May 2006). The screening procedures are designed to identify locations where a project has the potential to cause noise impact and locations where impact is not expected and further assessment is not necessary. The screening procedures are based on high-capacity scenarios for a given project type and are therefore sufficiently large to encompass all potential impacts. If the **VRE Extension** improvement concept is advanced, detailed noise analysis for individual projects would be conducted which determines specifically where impacts would occur and what mitigation would be needed.

Noise screening distances for the **VRE Extension** improvement concept have been defined for new commuter rail mainline segments and at highway-rail grade crossings which includes the use of train horns. The screening distance for mainline segments is 375 feet where there are intervening buildings between the commuter rail tracks and sensitive receptors and 750 feet where there are no obstructions. These distances are based on assumptions that there would be 66 daytime and 12 nighttime train operations and that each train, consisting of one locomotive and six coaches, typically travels 55 mph. The screening distance near grade crossings is 1,200 feet from the tracks where there are intervening buildings and 1,600 feet from the tracks where there are no obstructions. **Table 5-10** presents the noise screening distances for the **VRE Extension** improvement concept.

Table 5-10. VRE Extension Noise Screening Distances

TYPE OF PROJECT	NOISE SCREENING DISTANCE (FT)	
	UNOBSTRUCTED	INTERVENING BUILDINGS
Commuter Rail Mainline	750	375
Commuter Rail with Horn Blowing at Grade Crossings	1,600	1,200

Vibration screening distances for the **VRE Extension** improvement concept have been defined for the type of land use adjacent to the rail corridor since the impact criteria vary for different land use categories. For commuter rail projects, the vibration screening distance for Category 1 (High Sensitivity) land use is 600 feet; Category 2 (Residential) land use is 200 feet; and Category 3 (Institutional) land use is 120 feet. **Table 5-11** presents the vibration screening distances for the VRE Extension.

Table 5-11. VRE Extension Vibration Screening Distances

PROJECT CONDITIONS	VIBRATION SCREENING DISTANCE (FT)		
	FTA VIBRATION CATEGORY 1 LAND USE (HIGH SENSITIVITY)	FTA VIBRATION CATEGORY 2 LAND USE (RESIDENTIAL)	FTA VIBRATION CATEGORY 3 LAND USE (INSTITUTIONAL)
Commuter Rail Mainline	600	200	120

Sensitive land uses within the noise and vibration screening distances have been identified using land use data and aerial photography. Noise and vibration-sensitive land uses within the screening distances have been tabulated for the **VRE Extension** improvement concept. **Table 5-12** presents the number of buildings and number of residential units within those buildings that are within the noise screening distances. There are 178 residential buildings with the potential for noise impact in Manassas City and 345 residential buildings in Prince Williams County.

Table 5-12. Category 2 (Residential) Noise Screening Results

LOCATIONS	RESIDENTIAL UNITS	BUILDINGS
Manassas City	533	178
Prince Williams	1,121	345

Table 5-13 presents the number of institutional buildings within the noise screening distances. There are four institutional land uses within the noise screening distances in Prince Williams County including Hygeia Academy (Historic), St. Paul Church, Gainesville United Methodist Church and Stonewall Jackson High School. There are no institutional land uses within the noise screening distances in Manassas City.

Table 5-13. Category 3 (Institutional) Noise Screening Results

LOCATIONS	BUILDINGS
Manassas City	None
Prince Williams	4 (Hygeia Academy (Historic), St. Paul Church, Gainesville United Methodist Church, Stonewall Jackson High School)

Table 5-14 presents the number of FTA vibration Category 2 buildings and residential units within those buildings that are within the vibration screening distance. There are four single-family residences with the potential for vibration impact within Manassas City and 72 residential buildings with the potential for vibration impact within Prince Williams County.

Table 5-14. Category 2 (Residential) Vibration Screening Results

LOCATIONS	RESIDENTIAL UNITS	BUILDINGS
Manassas City	4	4
Prince Williams	105	72

Table 5-15 presents the number of FTA vibration Category 1 (High Sensitivity) buildings within the applicable vibration screening distance. The BAE Systems building, which is within the applicable vibration screening distance, may contain vibration-sensitive equipment which would qualify as a FTA vibration Category 1 land use. There are no vibration Category 1 land uses within Manassas City. Stonewall Jackson High School is within the vibration screening distance for potential vibration impact for FTA vibration Category 3 land use.

Table 5-15. Category 1 (High Sensitivity) and 3 (Institutional) Vibration Screening Results

LOCATIONS	CATEGORY 1	CATEGORY 3
Manassas City	1 (BAE Systems)	None
Prince Williams	None	1 (Stonewall Jackson High School)

VRE EXTENSION NOISE AND VIBRATION ABATEMENT CONCEPTS

If the **VRE Extension** improvement concept is advanced, the need for noise and vibration mitigation would be determined upon completion of detailed noise and vibration assessments during the Tier 2 analysis of individual projects. General information on typical noise and vibration mitigation for rail projects is provided below.

Noise mitigation is considered depending on the need, feasibility, reasonableness and effectiveness of potential options. FTA states that in considering potential noise impact, severe

impacts should be mitigated if at all practical. At the moderate impact level, more discretion should be used, and other project-specific factors should be included such as the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, the acoustical effectiveness of mitigation options and the cost-effectiveness of mitigating the noise.

To mitigate noise impact from train operations, noise control can be considered at the source, along the sound path, or at the receiver. An example of source noise control is the use of special hardware at turnout locations (e.g. flange-bearing or spring-rail frogs in place of standard rigid frogs) and using continuous welded rail. Noise barrier construction is the most common sound path noise control treatment and can be effective at reducing noise levels in the community. Noise control at the receiver can also be achieved by providing sound insulation improvement treatments at residences and institutional buildings.

There is more variability in the approach to vibration mitigation and the specific measures implemented than there is for noise mitigation. The effectiveness of vibration mitigation depends on several factors such as the specific mitigation design, installation techniques, axle loads of the trains and frequencies of concern. The following are common vibration mitigation options:

- Resilient rail fasteners are specially-designed fasteners between the rails and the ties;
- Ballast mats are rubber or other elastomer pads placed in between the ballast and the sub-grade or ground;
- Resiliently supported ties are a rubber or other resilient material placed between the ties and the ballast;
- Floating slabs consist of a concrete slab supported on resilient elements such as rubber or elastomer pads. Drawbacks towards floating slabs include difficulties in designing for heavy axle loads, outdoor exposure to the elements and the relatively high cost;
- Mitigation of special trackwork includes using special hardware (e.g flange-bearing or spring-rail frogs), relocating special trackwork away from sensitive areas and using continuous welded rail rather than jointed rail; and
- Maintenance programs can help control noise and vibration such as minimizing wheel flats by truing wheels and minimizing rail corrugation through rail grinding.

5.1.6 Visual Quality

This section addresses the potential impacts to views from I-66 and views of I-66 and the Norfolk Southern "B" Line Branch from the Build Improvement Concepts. As noted in Section 4.1.6, views from the Norfolk Southern "B" Line Branch are not evaluated since there are no existing passengers currently on the rail line to experience a change in view.

5.1.6.1 No-Build Concept

The No-Build Concept would not require expansion of existing transportation facilities, removal of trees, or introduction of additional noise barriers along I-66 or the Norfolk Southern

"B" Line Branch. Thus, no impacts to views from I-66, or views of I-66 and the Norfolk Southern "B" Line Branch would occur.

5.1.6.2 Build Improvement Concepts

VIEWS FROM I-66

Widening of I-66 as part of the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, and **Bus Rapid Transit**) would require removal of trees along the highway's edge for much of the I-66 corridor and the possible introduction of noise barriers to mitigate noise impacts. Because there exists only a narrow band of trees adjacent to the highway at some locations, especially the eastern portion of the corridor, tree removal would noticeably alter views at these locations as adjacent residential, commercial, or office structures or noise barriers would become the dominant visual elements within the views from I-66. Essentially these areas would resemble portions of the I-66 corridor where existing noise barriers and adjacent development dominate views from the highway. The **Improve Spot Locations/Chokepoints** improvement concept may also require tree removal and installation of noise walls; changes to the views from I-66 at these locations would be less noticeable, however, as drivers would be more focused on maneuvering through the interchange ramps and merging into traffic.

Changes to the visual environment would likely be most noticeable within the western portion of the I-66 corridor where the existing visual character is more rural and where views of Manassas National Battlefield Park and Bull Run Regional Park exist. The introduction of transit stations and fencing within the median for the **Metrorail Extension**, **Light Rail Transit** or **Bus Rapid Transit** improvement concepts would introduce a new visual element that suggests a more urban environment. Widening of the roadway as part of the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit** and **Bus Rapid Transit**) would potentially impact views of parkland and farmland through the conversion of open space to a more expansive transportation facility. The intensity of impacts would be greatest for the Outside Maximum template. If a Build Improvement Concept is advanced, more detailed visual analysis of sensitive resources will be conducted during Tier 2 as part of the evaluation of individual projects.

The **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology** improvement concepts would generally require minimal tree removal or introduction of noticeable visual features within the I-66 corridor and are therefore anticipated to have minimal visual impacts.

VIEWS OF I-66

Tree removal required for implementation of the capacity improvement concepts could potentially eliminate much of the existing visual buffers between parklands and I-66, introducing views of a large transportation facility where none had previously existed. Widening of I-66 as part of the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, and **Bus Rapid Transit**) would increase the visual dominance of transportation facilities within the views from Manassas

National Battlefield Park and Bull Run Regional Park. Similarly, people traveling by boat along Bull Run would see a larger I-66 bridge crossing.

VIEWS OF NORFOLK SOUTHERN "B" LINE BRANCH

The introduction of commuter rail stations would be the most noticeable visual feature associated with the **VRE Extension** improvement concept. The addition of another mainline track would be relatively unnoticeable given the minimal footprint, flat grade and lack of sensitive visual resources nearby. New commuter rail stations would be largely consistent with the overall urban/suburban and industrial visual character of the Norfolk Southern "B" Line Branch corridor. Potential visual impacts may occur within views from US 15 toward the rail line if a station were to be placed near this crossing. Station locations have not been identified, and a more detailed visual analysis of station locations would be conducted, as necessary, during the Tier 2 environmental review of individual projects.

5.1.7 PARKS, RECREATION AREAS, AND OPEN SPACE EASEMENTS

This section discusses the potential direct impacts to publicly-owned federal, state, and local parks and recreation areas, and open-space easements. The impact analysis used the inventory of public parks, recreation areas, and open space easements described in Chapter 4 which included available GIS mapping of approximate property boundaries. The six templates were overlaid on the GIS resource mapping in order to identify properties that would be potentially impacted, in whole or in part, by the Build Improvement Concepts. For the purposes of this Tier 1 study, parks, recreation areas, and open-space easement resources that are completely or partially within a template footprint are assumed to be potentially impacted by the applicable Build Improvement Concept. An impact assessment of public trails in the study area was not completed as part of this analysis because the needed level of engineering design information for each concept is not available at the Tier 1 stage. A detailed analysis would be completed during Tier 2 if a build improvement concept is advanced.

Later in this chapter, Section 5.1.9 provides additional discussion of Section 4(f) and Section 6(f) resources including publicly-owned parks and recreation areas.

5.1.7.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-66 with the exception of the programmed highway improvements as described in Chapter 3. For purposes of this Tier 1 study, it is assumed that potential impacts to parks and recreation area associated with these improvements have either been addressed or will be addressed in NEPA documents prepared independently of this EIS. Therefore, it is assumed that the No-Build Concept would not affect public parks and recreation areas, or open-space easements.

5.1.7.2 Build Improvement Concepts

The potential direct impacts (reported as total impacted acreage) to public parks and recreation areas from each of the six templates are summarized in **Table 5-16**. Since the **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology** improvement concepts would likely require minimal, if any, rights-of-way, no substantial impacts to public park and recreation area or open space easement resources are anticipated for these

concepts. In the event that these concepts are moved forward, potential impacts to resources would be further evaluated in Tier 2 studies when more detailed information is available.

Table 5-16. Potential Impacts to Public Parks and Recreation Areas

PARK AND RECREATION AREA RESOURCES	POTENTIAL IMPACTS (ACRES) FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Federal/State/Regional:						
Manassas National Battlefield Park[1]	<0.1	1.8	3.7	6.9	-	-
Bull Run Regional Park[2]	0.8	3.8	6.1	9.5	-	-
Local:						
Arrowhead Park	-	-	-	-	-	-
Briarwood Park	-	-	-	-	0.5	-
Centre Ridge North Park	-	-	-	-	<0.1	-
Cub Run Stream Valley Park	-	0.7	1.6	3.0	-	-
East Blake Lane Park	-	-	-	-	-	-
Ellanor C. Lawrence Park	-	-	-	-	-	-
Lane's Mill Park	-	-	-	-	-	-
Mayhew Sports Complex Park	-	-	-	-	-	-
Providence Elementary School	-	-	-	-	-	-
Rocky Run Stream Valley Park[2]	<0.1	0.3	0.8	1.5	0.2	-
Southside Park	-	-	<0.1	0.3	-	-
Stenwood Elementary School	-	-	-	-	-	-
Total	0.9	6.6	12.2	21.2	0.7	0

[1] Given the nature of Manassas National Battlefield Park as a federally owned national park, it is very likely that direct impacts to the Park will be avoided.

[2] Impacts reported as a single acreage for resource areas that may be bisected by I-66.

Source: Conservation Lands Database, May 2011, Virginia Department of Conservation and Recreation

FEDERAL, STATE, AND REGIONAL PARKS AND RECREATION AREAS

As shown in Table 5-16, Bull Run Regional Park could potentially be directly impacted with the Median template and the Outside Minimum, Outside Medium, and Outside Maximum templates. Bull Run would not be directly impacted with either the Interchange template or the VRE Extension template. Based solely on the templates, Manassas National Battlefield Park could potentially be impacted by the Build Improvement Concepts. However, given the nature of the property as a national park and the fact that it is federally owned, it is very likely that direct impacts to the Park would be avoided.[3]

[3] This likelihood is reinforced by the National Park Service's letter dated December 23, 2011, which emphasizes their desire to protect the park's character and their opposition to the acquisition of any additional right-of-way from the battlefield park for transportation improvements in the I-66 corridor.

LOCAL PARKS AND RECREATION AREAS

As shown in Table 5-16, of the twelve existing local public parks and recreation areas, five would potentially experience direct impacts with at least one of the templates:

- The Median template would potentially have a slight impact on one park (Rocky Run Stream Valley Park).
- The Outside Minimum, Medium, and Maximum templates would potentially directly impact two parks (Cub Run Stream Valley Park and Rocky Run Stream Valley Park). The Outside Medium and Outside Maximum templates would potentially impact one additional park (Southside Park).
- The Interchange template would potentially directly impact three parks (Briarwood Park; Centre Ridge North Park, and Rocky Run Stream Valley Park).

The VRE Extension template would not directly impact any park or recreation area resources. No other public parks or recreation areas are expected to be directly impacted by the Build Improvement Concepts based on the template analysis.

OPEN SPACE EASEMENTS

As reported in Section 4.1.7, no open space easements are located in either the I-66 Study Area or the VRE Extension Corridor; as such, there are not anticipated to be any potential direct impacts to open space easements as a result of the Build Improvement Concepts.

5.1.8 HISTORIC PROPERTIES

Potential impacts of the improvement concepts to historic properties were assessed based on overlaying the templates on mapping databases of architectural and archaeological resources using GIS. Consistent with the inventory of resources provided in Section 4.1.8, this analysis focuses on potential impacts to known historic resources that are either listed on the NRHP, or have been determined eligible for the NRHP, or potentially eligible for such listing. Additional information regarding potential impacts to properties that have yet to be evaluated is provided in the *Historic Properties Technical Report*.

For the purposes of this impact analysis, architectural and archaeological resources that are completely or partially within a template are assumed to be potentially directly impacted by the corresponding improvement concepts. Architectural resources that are not within a template, but are within 500 feet of a template were assumed to be potentially indirectly impacted by the applicable improvement concepts.

It should be noted that the level of historic resource identification and impact analysis within this Tier 1 EIS does not fully satisfy the requirements of Section 106 of the National Historic Preservation Act or the implementing regulations at 36 CFR 800. If a Build Improvement Concept is advanced to Tier 2, and once individual projects (or "undertakings" in Section 106 terminology) have been identified, a more detailed identification of historic properties would occur in consultation with the SHPO and other consulting parties. Subsequent to the identification of historic properties for individual undertakings, the undertaking's effects on historic properties would be determined and appropriate mitigation measures would be developed.

5.1.8.1 No-Build Concept

The No-Build Concept would not impact known architectural or archaeological resources that are listed, eligible, or potentially eligible for listing in the NRHP.

5.1.8.2 Build Improvement Concepts

NRHP-Listed or Determined Eligible Architectural Resources

As shown in **Table 5-17**, all of the capacity improvement concepts (**General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, and **Bus Rapid Transit**) along the I-66 corridor (i.e., Median and Outside templates) would involve potential direct impacts to three known architectural resources that are either listed, eligible, or potentially eligible for listing in the NRHP. One architectural resource would be potentially directly impacted with the Interchange template. The VRE template would result in potential direct impacts to one architectural resource. A list of the architectural resources potentially directly impacted with each of the templates is provided in **Table 5-18** through **Table 5-20**.

Table 5-17. Potential Impacts to NRHP-Listed or Determined Eligible Architectural Resources

ARCHITECTURAL RESOURCES	POTENTIAL IMPACTS FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Direct Impacts	3	3	3	3	1	1

Source: Virginia Department of Historic Resources Data Sharing System

Table 5-18. NRHP-Listed or Determined Eligible Architectural Resources within I-66 Median and Outside Templates

RESOURCE NO.	RESOURCE NAME	QUAD	ELIGIBILITY
076-0147; 44PW0080	Monroe House (Poplar Spring)	Gainesville	Eligible: 11/12/1991
076-0271	Manassas National Battlefield Park Historic District & Expansion	Gainesville; Manassas	VLR Listing 1973, 2004; NRHP Listing 1966, 2004, and 2006
076-5036; 076-5168	Manassas Station Operations Battlefield/Bristoe Station Battlefield/Kettle Run Battlefield	Manassas; Nokesville	DHR Staff: Potentially Eligible 1/24/2007

Table 5-19. NRHP-Listed or Determined Eligible Architectural Resources within Interchange Template

RESOURCE NO.	RESOURCE NAME	QUAD	ELIGIBILITY
076-5036; 076-5168	Manassas Station Operations Battlefield/Bristoe Station Battlefield/Kettle Run Battlefield	Manassas; Nokesville	DHR Staff: Potentially Eligible 1/24/2007

Table 5-20. NRHP-Listed or Determined Eligible Architectural Resources within VRE Template

RESOURCE NO.	RESOURCE NAME	QUAD	ELIGIBILITY
076-5036; 076-5168	Manassas Station Operations Battlefield/Bristoe Station Battlefield/Kettle Run Battlefield	Manassas; Nokesville	DHR Staff: Potentially Eligible 1/24/2007

Since the **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology** improvement concepts would likely require minimal, if any, right-of-way and they would not likely introduce substantial visual features within the I-66 vicinity, no substantial impacts to architectural resources are anticipated for these improvement concepts.

NRHP-LISTED OR DETERMINED ELIGIBLE ARCHAEOLOGICAL RESOURCES

As shown in **Table 5-21,** no known archaeological resources that are listed, eligible, or potentially eligible for listing in the NRHP would be impacted with the Median and VRE templates. The Outside Minimum and Outside Medium templates would potentially directly impact one eligible archaeological resource (Resource No. 44FX1965). The Outside Maximum and Interchange templates would potentially also directly impact this resource as well as another potentially eligible resource (Resource No. 44FX1966). Information regarding these archaeological resources is provided in **Table 5-22**.

Table 5-21. Potential Impacts to NRHP-Listed and Determined Eligible Archaeological Resources

ARCHAEOLOGICAL RESOURCES	POTENTIAL IMPACTS FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Direct Impacts	0	1	1	2	2	0

Source: Virginia Department of Historic Resources Data Sharing System

Table 5-22. NRHP-Listed and Determined Eligible Archaeological Resources within Outside and Interchange Templates

RESOURCE NO.	THEME	TIME PERIOD	ELIGIBILITY	ELIGIBILITY DATE
44FX1965	Domestic	19th Century, Prehistoric/Unknown	Eligible	2/1/1994
44FX1966	Domestic	19th Century	Potentially Eligible	11/24/1992

Since the **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology** improvement concepts would likely require minimal, if any, right-of-way, no significant impacts to archaeological resources are anticipated for these concepts.

5.1.9 SECTION 4(F)/6(F) DISCUSSION

This section discusses potential uses of Section 4(f) properties and potential impacts to Section 6(f) properties. Section 4(f) refers to Section 4(f) of the U.S. Department of Transportation Act of 1966, as amended, and as codified at Title 49, United States Code, Section 303, and at Title 23, United States Code, Section 138. Specifically, Section 4(f) states that the Secretary of Transportation may approve the use of publicly owned land of a publicly owned park, recreation area, wildlife and waterfowl refuge of national, state, or local significance, or land of a historic site[4] of national, state, or local significance, only if a determination is made that:

[4] "Historic site" means "…any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register [of Historic Places]." 23 CFR 774.17. This definition is identical to the definition of "historic

a) There is no feasible and prudent alternative to the use of the land from the property;

b) The action includes all possible planning to minimize harm to the property resulting from such use; or,

c) The use of Section 4(f) property will have a *de minimis* impact on the property.

"Use" occurs when land is permanently incorporated into a transportation facility; when temporary occupancy (e.g., during construction) compromises the land in terms of the statute's preservation purpose; or when the proximity impacts of the project are so severe that they substantially impair the protected activities, features, or attributes that qualify the property for Section 4(f) protection. A *de minimis impact* for historic sites means that, as determined in accordance with 36 CFR part 800, no historic property is affected by the project or the project will have "no adverse effect" on the historic property in question. For parks, recreation areas, and wildlife and waterfowl refuges, a *de minimis* impact is one that will not adversely affect the features, attributes, or activities qualifying the property for protection under Section 4(f).

Section 6(f) applies to parkland and recreation facilities that have used funds authorized under Section 6(f) of the Land and Water Conservation Fund Act. Under provisions of the Act, conversions of land to other than park or recreational uses (e.g., for project right of way) would require that replacement lands of approximately equivalent utility and value be provided.

Potential impacts to public parks and recreation areas are discussed in Section 5.1.7 and potential impacts to known historic sites that are on or eligible for the National Register are described in Section 5.1.8. This section specifically summarizes the Section 4(f) and Section 6(f) issues at a conceptual level appropriate for this Tier 1 analysis. Consistent with 23 CFR 774.7(e), no preliminary Section 4(f) determination is being made at this time because the detailed information necessary to complete a Section 4(f) approval is not available at this stage in the development of the action. Instead, any necessary Section 4(f) Evaluations and approvals would be completed during the Tier 2 analysis of individual projects. Notwithstanding, potential impacts of the improvement concepts on Section 4(f) properties have been identified and information is provided regarding whether those impacts could have a bearing on the Tier 1 decisions to be made.

5.1.9.1 Potential Impacts to Section 4(f)/6(f) Resources

PARKS AND RECREATION AREAS

Section 5.1.7 described the potential direct impacts to publicly-owned federal, state, and local parks and recreation areas, and open-space easements. The impact analysis was conducted using available GIS mapping of approximate property and historic district boundaries; the level of engineering design information required to complete a Section 4(f) approval is not available at the Tier 1 stage. A detailed analysis of impacts would be conducted during Tier 2 if a Build

property," as defined at 36 CFR 800.16(l)(1) in the Advisory Council on Historic Preservation's regulations implementing the National Historic Preservation Act (16 U.S.C. 470). Section 4(f) does not apply to archaeological sites on or eligible for inclusion in the National Register of Historic Places if FHWA "concludes that the archeological resource is important chiefly because of what can be learned by data recovery and has minimal value for preservation in place." 23 CFR 774.13(b)(1).

Improvement Concept is advanced. Potential impacts of the Build Improvement Concepts on park and recreation areas are summarized in **Table 5-23** and reiterated below.

Table 5-23. Potential Impacts to Section 4(f) Properties

SECTION 4(F) PROPERTIES	POTENTIAL IMPACTS (ACRES) FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Manassas National Battlefield Park[1]	<0.1	1.8	3.7	6.9	-	-
Bull Run Regional Park[2]	0.8	3.8	6.1	9.5	-	-
Briarwood Park	-	-	-	-	0.5	-
Centre Ridge North Park	-	-	-	-	<0.1	-
Cub Run Stream Valley Park	-	0.7	1.6	3.0	-	-
Rocky Run Stream Valley Park[2]	<0.1	0.3	0.8	1.5	0.2	-
Southside Park	-	-	<0.1	0.3	-	-
Manassas Battlefield Historic District (VDHR #076-0271) (Portion outside Park Boundaries)	0.1	2.4	5.0	8.9	-	-
Monroe House (Poplar Spring) (VDHR #076-0147; 44PW0080)	0.3	0.6	1.0	1.8	-	-
Manassas Station Operations Battlefield/Bristoe Station Battlefield/Kettle Run Battlefield (VDHR #076-5036; 076-5168)	19.8	23.0	25.3	31.0	40.8	19.5
Total	21.2	32.6	43.5	62.9	41.5	19.5

[1] Given the nature of Manassas National Battlefield Park as a federally owned national park, it is very likely that direct impacts to the Park will be avoided.

[2] Impacts reported as a single acreage for resource areas that may be bisected by I-66.

Source: VDOT Project GIS Databases, Conservation Lands Database, May 2011, Virginia Department of Conservation and Recreation

Since the **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology** improvement concepts would likely require minimal, if any, rights-of-way, no substantial uses of Section 4(f) properties are anticipated for these concepts. The VRE template would also not directly impact any park or recreation area resources. In the event that any of these concepts are moved forward, potential impacts to resources will be further evaluated in Tier 2 studies when more detailed information is available.

As shown in Table 5-16, Bull Run Regional Park could potentially be directly impacted with the Median template and the Outside Minimum, Outside Medium, and Outside Maximum templates. Bull Run Regional Park would not be directly impacted with either the Interchange template or the VRE template. Based solely on the templates, Manassas National Battlefield Park could also potentially be impacted by the Build Improvement Concepts. However, given the nature of the property as a national park and the fact that it is federally owned, it is very likely that direct impacts to the Park would be avoided.

Land from five local public parks would potentially be used by one or more of the templates:

- The Median template would potentially have a slight impact on one park (Rocky Run Stream Valley Park). The Outside Minimum, Medium, and Maximum templates would potentially directly impact two parks (Cub Run Stream Valley Park and Rocky Run Stream Valley Park). The Outside Medium and Outside Maximum templates would potentially impact one additional park (Southside Park).
- The Interchange template would potentially directly impact three parks (Briarwood Park, Centre Ridge North Park, and Rocky Run Stream Valley Park).

Of the potentially impacted parks, only Bull Run Regional Park is listed as receiving funds authorized under Section 6(f) of Land and Water Conservation Fund Act. If a Build Improvement Concept is advanced that would impact this park, further coordination would take place in relation to Section 6(f).

HISTORIC PROPERTIES

Section 5.1.8 described the potential direct impacts to historic properties, which were assessed based on overlaying the template widths for the various improvement concepts on mapping databases of architectural and archaeological resources using GIS. Up to three known architectural resources that are either listed, eligible, or potentially eligible for listing in the NRHP would be directly impacted by the Build Improvement Concepts, as listed in Table 5-23 above. As described above and in Section 5.1.8, for purposes of this Tier 1 EIS, only those NRHP or NRHP-eligible properties already recorded in VDHR's records have been considered historic properties. Detailed surveys would be conducted as appropriate during Tier 2 studies and the applicability of Section 4(f) to historic properties identified in the surveys would be determined at that time.

The Tier 1 decision to advance an improvement concept would not preclude the avoidance of individual Section 4(f) properties as part of the Tier 2 analysis of individual projects. Therefore, the potential impacts to Section 4(f) properties do not have a direct bearing on the Tier 1 decisions to be made.

5.1.9.2 Section 4(f) Process During Tier 2

FHWA's and FTA's Section 4(f) regulations at 23 CFR 774 and the Section 4(f) Policy Paper issued on July 20, 2012 set forth the process, which is described further below, that would be followed during Tier 2 for potential uses of Section 4(f) properties.

CONFIRMATION OF SECTION 4(f) APPLICABILITY

For purposes of Section 4(f), the significance of publicly owned parks, recreation areas, and wildlife refuges is determined in consultation with the national, state, or local officials having jurisdiction over the property. In the absence of significance determination by such officials, each resource is assumed to be significant. For purposes of this Tier 1 EIS, each potentially impacted park and recreation area was assumed to be of either national, state, or local significance. If a build improvement concept is advanced, coordination regarding significance would occur during the Tier 2 evaluation of individual projects to confirm the applicability of Section 4(f). In addition, during Tier 2, more detailed information on parks and recreation area boundaries and activities occurring on the properties would be obtained.

For purposes of Section 4(f), the significance of historic properties is determined through the Section 106 process. Any property eligible for listing or listed on the NRHP is considered significant. Archaeological sites eligible or listed on the NRHP are only considered Section 4(f) properties if they warrant preservation in place. For purposes of this Tier 1 EIS, only those NRHP or NRHP-eligible properties already recorded in VDHR's records have been considered Section 4(f) properties. Detailed surveys would be conducted as appropriate during Tier 2 studies and the applicability of Section 4(f) to historic properties identified in the surveys would be determined at that time.

DE MINIMIS FINDING

As described above, a *de minimis impact* for historic sites means that no historic property is affected by the project or the project will have "no adverse effect" on the historic property in question. For parks, recreation areas, and wildlife and waterfowl refuges, a *de minimus* impact means that the project will not adversely affects the features, attributes, or activities qualifying the property for protection under Section 4(f). During Tier 2 studies, prior to making *de minimis* impact determinations under §774.3(b), the following coordination would be undertaken:

- For parks, recreation areas, and wildlife and waterfowl refuges:
  - Public notice and an opportunity for public review and comment concerning the effects on the protected activities, features, or attributes of the property would be provided.
  - The official(s) with jurisdiction over the property would be informed of the intent to make a *de minimis* impact finding and, following an opportunity for public review and comment, would need to concur in writing that the project will not adversely affect the activities, features, or attributes that make the property eligible for Section 4(f) protection.
- For historic properties:
  - The consulting parties identified in accordance with 36 CFR part 800 would be consulted.
  - Written concurrence from the SHPO and from the Advisory Council on Historic Preservation (ACHP), if participating in the consultation process, in a finding of "no adverse effect" or "no historic properties affected" would have to be received in accordance with 36 CFR part 800. These officials would be informed of FHWA's intent to make a *de minimis* impact determination based on their concurrence in the finding of "no adverse effect" or "no historic properties affected."
  - Public notice would be given.

IF *DE MINIMIS* IS NOT APPLICABLE – ALTERNATIVES ANALYSIS

If the criteria for a *de minimis* finding cannot be met, then appropriate alternatives analyses would be conducted to determine whether there is a feasible and prudent avoidance alternative. A feasible and prudent avoidance alternative avoids using Section 4(f) property and does not cause other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) property. In assessing the importance of protecting the Section 4(f)

property, it is appropriate to consider the relative value of the resource to the preservation purpose of the statute. An alternative is not feasible if it cannot be built as a matter of sound engineering judgment. An alternative is not prudent if:

- It compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need;
- It results in unacceptable safety or operational problems;
- After reasonable mitigation, it still causes:
  - Severe social, economic, or environmental impacts;
  - Severe disruption to established communities;
  - Severe disproportionate impacts to minority or low income populations;
  - Severe impacts to environmental resources protected under other Federal statutes;
  - It results in additional construction, maintenance, or operational costs of an extraordinary magnitude;
  - It causes other unique problems or unusual factors; or
  - It involves multiple factors that, while individually minor, cumulatively cause unique problems or impacts of extraordinary magnitude.

If FHWA concludes that there is no feasible and prudent alternative to the use of Section 4(f) property, then it may approve only the alternative that causes the least overall harm in light of the statute's preservation purpose. The least overall harm is determined by balancing the following factors:

- The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property);
- The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection;
- The relative significance of each Section 4(f) property;
- The views of the official(s) with jurisdiction over each Section 4(f) property;
- The degree to which each alternative meets the purpose and need for the project;
- After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f); and
- Substantial differences in costs among the alternatives.

AVOIDANCE AND MINIMIZATION

Alternatives that completely avoid Section 4(f) resources would be developed and evaluated prior to the use of any Section 4(f) resources. Potential impacts to Section 4(f) resources along the mainline of I-66 may be further minimized and/or avoided by shifting the center line away from the resource, maximizing use of the median for widening, reducing the typical highway right-of-way adjacent to the resource, or applying construction techniques that minimize the

extent of cut and fill activities. Given their proximity to I-66 or location on both sides of I-66, some parks, trails, and historic sites pose greater design constraints than others.

5.1.10 HAZARDOUS MATERIALS

This section discusses potential impacts of the No-Build and Build Improvement Concepts on hazardous materials sites. Potential impacts to hazardous materials sites were quantified by overlaying the templates on digital mapping data obtained from a reputable commercial database search firm.

5.1.10.1 No-Build Concept

The No-Build Concept would not impact any known hazardous materials sites.

5.1.10.2 Build Improvement Concepts

Table 5-24 lists the sites located within each of the templates.

There are no CERCLIS, VRP, or Unidentified HAZMAT sites within the templates for any of the Build Improvement Concepts.

The number of petroleum release sites ranges from one to five sites, with the Outside Maximum template encompassing the largest number of facilities. Petroleum release sites include areas of petroleum spills and leaking storage tanks. Many of the sites listed have been 'closed'; however, this is only an indication of no further action required as the site stands at the time of closure. 'Closed' sites do not indicate remediation was completed, and excavation in such areas may uncover contaminated soil. Soil sampling in these areas is recommended to determine risk of exposure.

Table 5-24. Potential Hazardous Materials Sites

	POTENTIAL IMPACTS FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
CERCLIS Sites	--	--	--	--	--	--
VRP Site	--	--	--	--	--	--
Unidentified HAZMAT Sites	--	--	--	--	--	--
Petroleum Release Sites	1	2	2	5	1[1]	3
Solid Waste Facilities	--	--	--	--	--	1

[1] The facility located in the interchange concepts is also located within and accounted for in each of the Build Improvement Concepts.

Source: Environmental Data Resources (2012)

There is one solid waste facility located within the VRE template. The facility listed is a yard waste composting company and does not handle hazardous materials.

Several registered facilities that handle hazardous materials or have petroleum storage tanks are also located within the templates but do not have any history of contamination.

5.2 NATURAL ENVIRONMENT

This section discusses potential impacts to the natural environment. It is divided into two main areas; water resources and wildlife habitat. The water resources section includes discussion of potential impacts to water quality, wetlands, streams, coastal zone management areas, floodplains and wild and scenic rivers. The wildlife habitat section includes discussion of potential impacts to wildlife habitat, natural heritage resources, threatened and endangered species, anadramous fish use areas, trout streams and invasive species.

5.2.1 WATER RESOURCES

This section identifies the potential impacts to water resources of the No-Build Concept and the Build Improvement Concepts.

5.2.1.1 No-Build Concept

The No-Build Concept would not impact water quality, wetlands, streams, coastal zone management areas, floodplains or wild and scenic rivers.

5.2.1.2 Build Improvement Concepts

WATER QUALITY

Four impaired waterbodies, Bull Run, Cub Run, Big Rocky Run, and Holmes Run are crossed by the I-66 corridor as previously identified in Section 4.2.1. The Build Improvement Concepts have the potential to increase the stormwater runoff velocities and roadway contaminants received by these impaired water resources and other water resources in the study area.

Construction of the Build Improvement Concepts could result in potential short-term impacts to water quality such as increased sedimentation, increased turbidity from in-stream work, and possible spills or non-point source pollutants entering groundwater or surface water from stormwater runoff. To minimize these potential impacts, appropriate erosion and sediment control practices would be implemented in accordance with the Virginia Erosion and Sediment Control Regulations, the Virginia Stormwater Management Law and regulations, and VDOT's Road and Bridge Specifications. These specifications also prohibit contractors from discharging any contaminant that may affect water quality. In the event of accidental spills, the contractor is required to immediately notify all appropriate local, state, and federal agencies and to take immediate action to contain and remove the contaminant. Additionally, the requirements and special conditions of any required permits for work in and around surface waters would be incorporated into construction contract documents, so that the contractor would be required to comply with such conditions.

Minor long-term water quality effects could occur as a result of increases in impervious surfaces, increases in traffic volumes, and consequent increases in pollutants washed from the road surface into receiving water bodies. Stormwater management measures, including detention basins, vegetative controls, and other measures, would be implemented to minimize potential water quality impacts. These measures would reduce or detain discharge volumes and remove pollutants, thus avoiding substantial further degradation of impaired water bodies in the study area vicinity. More detailed analyses of water quality impacts and necessary

stormwater management controls would be conducted for the individual Tier 2 projects when additional design details would be available.

WETLANDS

Palustrine forested wetlands are the predominant wetland type in both the I-66 Study Area and the VRE Extension Corridor. Potential direct impacts to wetlands for each of the Build Improvement Concepts have been quantified through the use of National Wetland Inventory GIS information. **Table 5-25** identifies these potential impacts based on the templates.

Table 5-25. Potential Wetlands Impacts by Type

WETLAND TYPE	POTENTIAL IMPACTS (ACRES) FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Palustrine Forested	3.1	6.0	8.5	15.4	8.1	6.0
Palustrine Scrub Shrub	0.4	0.6	0.7	1.1	0.5	0.5
Palustrine Emergent	0.1	0.2	0.4	0.9	0.8	0.7
Total	3.6	6.8	9.6	17.4	9.4	7.2

Source: National Wetlands Inventory

Potential impacts range from 3.60 acres for the Median template to 17.35 acres for the Outside Maximum template. It is important to note that Table 5-25 does not distinguish between temporary or permanent impacts. If a Build Improvement Concept is advanced to Tier 2, additional measures will be considered during the design of individual projects to avoid and minimize wetland impacts to the greatest extent practicable such as bridging, steeper side slopes and retaining walls.

Impacts to wetlands would require submittal of a Joint Permit Application (JPA) to the USCOE, VDEQ, and VMRC. Due to the linear nature and size of the Build Improvement Concepts, however, unavoidable impacts are anticipated. Mitigation for unavoidable wetland impacts would be developed in coordination with the aforementioned agencies during the permitting process, and may include onsite or offsite wetland and/or stream creation, restoration or enhancement activities, use of credits from an approved mitigation bank, or payments to the Virginia Wetlands Restoration Trust Fund.

Wetland mitigation requirements vary by wetland type: palustrine emergent (1:1), palustrine scrub-shrub (1:1.5), and palustrine forested (1:2). These ratios are typical; however compensation is approved on a case-by-case basis and requirements may vary. In most situations, mitigation should occur within the same watershed. The majority of the study area is located within the Middle Potomac-Occoquan watershed and all of the wetland impacts are within this watershed.

STREAMS

Potential stream impacts were quantified using GIS. **Table 5-26** depicts the potential impacts to streams for each of the Build Improvement Concepts based on templates.

As expected the Outside Medium and Outside Maximum templates have the highest potential impacts due the greater width of the corridor for improvements associated with these templates. These estimates are based on an assumption that each stream crossing would be a permanent impact rather than spanned via a bridge. If a Build Improvement Concept is advanced, a more detailed assessment of stream impacts and avoidance and minimization efforts would be performed during the design of individual projects. Stream mitigation requirements vary depending on existing stream conditions and level of disturbance. In conjunction with the wetlands, impacts to streams would require submittal of a JPA. Potential stream impacts occur in both the Middle Potomac-Occoquan and the Middle Potomac-Catoctin watersheds.

Table 5-26. Potential Stream Impacts

	POTENTIAL IMPACTS (LINEAR FEET) FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Stream Impacts	5,172	6,354	7,636	9,703	5,634	1,048

Source: National Wetlands Inventory

COASTAL ZONE MANAGEMENT AREAS

Both the I-66 Study Area and the VRE Extension Corridor are located within the coastal zone. The Build Improvement Concepts would be consistent with the established Virginia Coastal Zone Enforceable Policies as related to fisheries management, subaqueous lands management, wetlands management, dunes management, nonpoint source pollution control, point source pollution control, shoreline sanitation, air pollution control, and coastal lands management. With implementation of mitigation measures, the Build Improvement Concepts would not impair resources protected by the Virginia Coastal Zone Enforceable Policies, including wetlands, dunes, and aquatic animals. The Build Improvement Concepts would be designed and constructed in accordance with the Virginia Erosion and Sediment Control Law and the terms and conditions of water quality permits required by USACE, VDEQ, VMRC, and VDCR.

FLOODPLAINS

As indicated in **Table 5-27**, the potential impacts to floodplains range from 13.5 acres to 45.4 acres, with the Outside Maximum template potentially impacting the greatest acreage.

Table 5-27. Potential Floodplain Impacts

	POTENTIAL IMPACTS (ACRES) FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
TYPE	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
100-Year Floodplain	22.0	28.3	33.2	45.4	15.4	13.5

Source: VDOT GIS Data

If a build improvement concept is advanced, the design of individual projects during Tier 2 would be consistent with federal policies and procedures for the location and hydraulic design of highway

encroachments on floodplains contained in 23 CFR 650 Subpart A. The individual projects would not, therefore, increase flood levels and would not increase the probability of flooding or the potential for property loss and hazard to life. Further, the Tier 2 projects would not be expected to have substantial effects on natural and beneficial floodplain values. Individual projects would be refined so as not to encourage, induce, allow, serve, support, or otherwise facilitate incompatible base floodplain development. It is anticipated that the potential floodplain encroachments would not be a "significant encroachment" (as defined in 23 CFR 650.105(q)) because:

- It would pose no significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or that provides a community's only evacuation route;
- It would not pose significant flooding risks; and
- It would not have significant adverse impacts on natural and beneficial floodplain values.

If a Build Improvement Concept is advanced to Tier 2, floodplain impacts would be refined during the Tier 2 analyses. Sections 107 and 303 of VDOT's specifications require the use of stormwater management practices to address concerns such as post-development storm flows and downstream channel capacity. These standards require that stormwater management be designed to reduce stormwater flows to preconstruction conditions for up to a 10-year storm event. As a part of these regulations, the capture and treatment of the first half inch of run-off in a storm event is required, and all stormwater management facilities must be maintained in perpetuity. During final design of individual projects, a detailed hydraulic survey and study would evaluate specific effects on stormwater discharges. This evaluation would adhere to the aforementioned specifications to prevent substantial increases of flood levels.

WILD AND SCENIC RIVERS

The Build Improvement Concepts would not have any impacts to federally designated wild and scenic rivers as there are none located within the I-66 Study Area or VRE Extension Corridor. Bull Run is identified in the National Rivers Inventory and is listed as a potential component of the state Scenic River Inventory. Potential impacts to Bull Run range from 235 feet with the Median template to 355 feet with the Outside Maximum template. Since the crossing of Bull Run would be at the existing location of I-66, the scenic nature of the river should not be substantially altered.

5.2.2 WILDLIFE HABITAT, INCLUDING THREATENED AND ENDANGERED SPECIES

This section identifies the potential impacts of the No-Build and Build Improvement Concepts on threatened and endangered species and other wildlife habitat.

5.2.2.1 No-Build Concept

The No-Build Concept would not impact wildlife habitat, natural heritage resources, threatened and endangered species, anadramous fish use areas or trout streams and it would not increase the spread of invasive species.

5.2.2.2 Build Improvement Concepts

WILDLIFE HABITAT

The effects of the Build Improvement Concepts on wildlife habitat should not be substantial. While there are some natural lands adjacent to I-66, the Build Improvement Concepts would only potentially affect small amounts of these natural habitats. No large habitat areas would be impacted nor would any potential movement corridors be substantially disrupted since any potential impacts would take place along the existing facilities of I-66 and the Norfolk Southern rail line.

The Build Improvement Concepts would not impact any trout streams or anadramous fish use areas.

NATURAL HERITAGE RESOURCES

There are five natural heritage resource locations within the study area. **Table 5-28** summarizes the potential impacts to these resources in terms of acreage. No threatened or endangered species have been documented within the templates located within the resource areas.

Table 5-28. Potential Natural Heritage Resource Impacts

NATURAL HERITAGE RESOURCE AREA	POTENTIAL IMPACTS (ACRES) FOR BUILD IMPROVEMENT CONCEPTS (BASED ON TEMPLATES)					
	MEDIAN	OUTSIDE MINIMUM	OUTSIDE MEDIUM	OUTSIDE MAXIMUM	INTERCHANGE	VRE
Long Branch Stream Conservation Unit	0.2	0.2	0.2	0.2	0.0	0.0
Cub Run Slopes	0.0	0.8	1.6	3.6	0.0	0.0
General Locations	152.7	174.0	189.1	224.8	164.8	14.5
Total	152.8	175.0	190.9	228.7	164.8	14.5

Source: Virginia Department of Conservation and Recreation

THREATENED AND ENDANGERED SPECIES

Based on the habitat model used in the USFWS IPAC online review, potential habitat may exist within the templates for two federally listed plants; harperella (*Ptilimnium nodosum)* and small-whorled pogonia (*Isotria medeoloides*), and one-federally listed mollusk; dwarf wedgemussel (*Alasmidonta heterodon)*. Additionally, correspondence with the VDGIF indicates suitable habitat may occur for the state-listed wood turtle *(Glyptemys insculpta*) and brook floater (*Alasmidonta varicose*). According to the VDGIF SppObs, no known occurrences of federal or state listed wildlife species would be impacted by any build improvement concepts based on templates.

If a Build Improvement Concept is advanced, the USFWS, VDGIF, VMRC and the VDCR would be consulted during Tier 2 to determine if surveys would be required for threatened and endangered species and/or to incorporate avoidance and minimization measures to ensure that projects would not jeopardize any listed species or their critical habitat.

INVASIVE SPECIES

In accordance with Executive Order 13112, *Invasive Species*, the potential for the establishment of invasive animal or plant species during construction of any of the Build Improvement Concepts

would be minimized by following provisions in VDOT's *Road and Bridge Specifications*. These provisions require prompt seeding of disturbed areas with seeds that are tested in accordance with the Virginia Seed Law and VDOT's standards and specifications to ensure that seed mixes are free of noxious species. In addition, in order to prevent the introduction of new invasive species and to prevent the spread of existing populations, best management practices would be followed, including washing machinery before it enters the area, minimizing ground disturbance, and reseeding of disturbed areas. While the right-of-way is vulnerable to colonization by invasive plant species from adjacent properties, implementation of the stated provisions would reduce the potential for the establishment and proliferation of invasive species within highway right-of-way.

5.3 ENERGY

Environmental Impact Statements for transportation improvements assess the degree to which the improvements would result in an increase or decrease in overall energy efficiency. A qualitative assessment of the study's effects on energy resources was performed for this Tier 1 study. The existing I-66 corridor handles high traffic volumes during peak commuting hours. Substantial delays and traffic backups occur regularly. In 2011, nearly half the segments of I-66 within the study area operate at a LOS of E or F in the peak direction during peak hours. This delay is forecasted to increase to almost 100% of the segments by 2040.

5.3.1 NO-BUILD CONCEPT

Under the No-Build Concept, there would be no energy expended associated with construction; however, inefficiencies in energy usage would continue due to congestion and vehicle idle time.

5.3.2 BUILD IMPROVEMENT CONCEPTS

As discussed in Chapter 3, a number of Build Improvement Concepts are being evaluated, ranging from technology improvements to bus/rail improvements to additional lanes. These concepts range in their rate of energy consumption. **Table 5-29** depicts the British Thermal Units (BTUs) per passenger mile for the different modes of transportation under consideration.

Inherent differences among the transportation modes in the nature of services, routes available, types of vehicle, and other factors, can greatly affect energy usage. The values in the table below are averages and highly variable.

Table 5-29. Comparative Energy Usage

MODE	BTU PER PASSENGER MILE	BTU/PASSENGER FOR I-66 CORRIDOR (25 MILES)	BTU/PASSENGER FOR VRE CORRIDOR (11 MILES)
Cars/Personal Trucks (General Purpose and Managed Lanes)	3,447-3,848	86,175-96,200	n/a
Bus (Bus Rapid Transit)	4,118	102,950	n/a
Rail Transit (Light Rail Transit)	2,520	63,000	n/a
Commuter Rail (VRE, Metrorail)	2,897	72,425	31,867

Source: U.S. Department of Energy, Transportation Energy Data Book, Table 2.12

The **Improve Spot Locations/Chokepoints**, **Safety Improvements**, **Intermodal Connectivity Improvements**, and **Transportation Communication and Technology** improvement concepts cannot be computed at the passenger mile level. These improvements would likely provide small improvements to traffic flow with minimal energy expenditures.

If a Build Improvement Concept is advanced, the energy usage of individual projects would be examined as necessary in Tier 2.

5.4 INDIRECT IMPACTS

Indirect effects are defined as those effects "which are caused by an action and are later in time or farther removed in distance [than direct effects], but are still reasonably foreseeable" (40 CFR 1508.8(b)). These effects may include growth induced effects or other effects on the natural, social, or physical environments due to changes in land use, population growth, or changes in access to transportation facilities. Indirect effects can influence the location and/or rate of development in a particular location. In the case of the potential transportation improvements evaluated in this study, growth induced effects within the analysis area are partially controlled and guided by the individual jurisdictions through zoning ordinances, land use goals, and master plans. However, the final decisions in land use and the built environment can be driven by the real estate market and heavily influenced by the decisions of property owners and developers.

Current development patterns, land use plans, and planned projects were reviewed in order to assess the potential for indirect effects on the human and built environment. For this Tier 1 EIS, a broad perspective is used to assess these potential effects. If a Build Improvement Concept is advanced to Tier 2, more detailed analysis would occur during the evaluation of individual projects. For this Tier 1 EIS, the design year of 2040 and the analysis area were used to define in time and in distance the indirect effects.

5.4.1 NO-BUILD CONCEPT

One long-term indirect effect of the No-Build Concept is the projected continued increase in capacity constraints for all modes of travel. Intensified congestion could influence commuters to move closer to places of employment or shift modes of transportation. In addition, the lack of predictability for travel in the corridor also adversely affects the quality of life for travelers in the corridor and makes it difficult for travelers to make decisions about when to travel and which mode to take.

5.4.2 BUILD IMPROVEMENT CONCEPTS

5.4.2.1 Human Environment

The Build Improvement Concepts occur in a geographic area where land use is primarily residential or preserved open space in the counties, and a mixture of commercial, office, and residential uses within and adjacent to the municipalities. Commercial, industrial, and office uses tend to be clustered at the highway interchanges. Induced development demand is regulated and controlled by the individual jurisdictions through their zoning and land use and comprehensive plans. A more complete discussion of land use occurs in Sections 4.1.1 and

5.1.1. In the towns of Haymarket and Vienna and the City of Fairfax, there are no large-scale projects planned, approved, or under construction in or adjacent to the I-66 corridor. In Fairfax and Prince William counties, several large-scale projects are approved or under construction in close proximity to I-66. These would occur regardless of the implementation of any of the improvement concepts. Any effects of these large-scale development projects would be directly attributable to the projects themselves, not indirect effects of any roadway projects associated with the improvement concepts.

Within the VRE Extension Corridor, there are no large-scale planned developments anticipated to occur in the Town of Haymarket and the City of Manassas.

Because I-66 and the VRE already traverse the analysis area, the implementation of any of the Build Improvement Concepts would not provide new access to developable lands in the analysis area.

Based on the level of study for this Tier 1 EIS, it is not expected that any of the Build Improvement Concepts would substantially encourage or accelerate any changes in land use that are not already expected in any of the jurisdictions within the analysis area. In fact, improvements to both the I-66 corridor and the VRE Extension corridor are included in the comprehensive plans of the jurisdictions within the analysis area (Section 4.1.1). Therefore, the Build Improvement Concepts are a part of the future condition of land use within the respective jurisdictions and changes in land use and/or population growth are not necessarily directly attributable to the improvement concepts alone and are already anticipated and planned for by the jurisdictions.

5.4.2.2 Natural Environment

Potential direct effects of the Build Improvement Concepts on the natural environment are detailed in Sections 5.2 through 5.4. If a Build Improvement Concept is advanced, more detailed assessments of all impacts to the natural environment and avoidance and minimization efforts would be performed during Tier 2.

Water Quality. Potential impacts to wetlands from the Build Improvement Concepts range from 3.6 to 17.35 acres due to the improvement concepts. Indirect effects on water quality due to the loss of these wetlands, as well as the increase in impervious surfaces within the corridors, could therefore potentially diminish the capacity of wetlands to provide habitat and water filtration within the Middle Potomac-Occoquan and the Middle Potomac-Catoctin watersheds.

Streams. There are ten named streams and several unnamed smaller tributaries within the study area. Potential stream impacts range from 1,048.3 acres to 9,703.16 acres and are based on an assumption that each stream crossing would be a permanent impact rather than spanned via a bridge. If a Build Improvement Concept is advanced to Tier 2, a more detailed assessment of stream impacts for individual projects, as well as avoidance and minimization efforts, would potentially result in a decrease in the amount of impacted acres. The potential stream impacts occur in both the Middle Potomac-Occoquan and the Middle Potomac-Catoctin watersheds and could further impair the water quality within the watershed and potentially impair the watersheds' ability to provide habitat.

Floodplains. Bull Run, Cub Run, and Big Rocky Run have extensive floodplains that are located adjacent and parallel to I-66, but the Build Improvement Concepts would not increase flood levels and would not increase the probability of flooding or the potential for property loss and hazard to life. Further, the Build Improvement Concepts would not be expected to have substantial effects on natural and beneficial floodplain values. Also, the Build Improvement Concepts would not encourage, induce, allow, serve, support, or otherwise facilitate incompatible base floodplain development. Therefore, indirect effects due to floodplain encroachment would not be expected.

Wildlife. The Build Improvement Concepts should have minimal effect on wildlife habitat. While there are some natural lands adjacent to I-66, the Build Improvement Concepts would only affect small amounts of these natural habitats. No large habitat areas would be impacted nor would any potential movement corridors be substantially disrupted since potential impacts would take place along the existing facilities of I-66 and the Norfolk Southern rail line.

Threatened and Endangered Species. The Build Improvement Concepts would not affect any known locations of threatened or endangered species. However, potential habitat may exist for three federal and two state listed species. Substantial indirect effects on threatened and endangered species would not be expected.

5.5 CUMULATIVE IMPACTS

Cumulative effects are defined as "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… [and] can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). The Council on Environmental Quality (CEQ) has written guidance documents for identifying and assessing these impacts. The understanding of what are past, present, and reasonably foreseeable future actions is key to the assessment of these impacts.

The affected environment or existing conditions in the study area reflects the collective impacts of all past actions, e.g., the growth and development of all of the analysis area. Present impacts include those caused by current, ongoing construction of any projects in the area, public or private. Reasonably foreseeable future impacts include those caused by implementation of the improvement concept, other planned and programmed transportation projects, and other planned development that is likely to occur in the area. These impacts are relevant to this assessment if they impact the same resources as those potentially directly affected by an improvement concept. Additional information regarding other planned projects in the analysis area appears in Section 4.1.1.

Cumulative effects are assessed through review of the impacts caused by the implementation of an improvement concept within the context of all impacts to the same resource resulting from all actions (public, private, planned). Thus, an improvement concept can only have a cumulative effect on an environmental resource if it has a direct or indirect effect on that same resource. The scope of cumulative effect issues associated with any of the improvement concepts is therefore based on the social, natural, and physical environmental consequences

described previously in this chapter when considered in conjunction with other development actions. In a manner similar to indirect effects assessment, for this Tier 1 EIS, the horizon year of 2040 and the analysis area were used to define in time and in distance the cumulative effects.

The first segments of I-66 west of I-495 were opened between 1958 and 1964. Since its original construction, access and capacity along the interstate west of the Capital Beltway have been expanded numerous times as detailed in Section 2.2. The affected environment, as described in Section 4, includes the long-term effects of the development of I-66 as well as the effects of all other alterations to the human and natural environments resulting from public and private projects and development.

5.5.1 HUMAN ENVIRONMENT

The implementation of any of the Build Improvement Concepts would directly affect the human environment through changes in access to different modes of travel. In addition, potential relocations due to the Outside Maximum template and the Interchange template are also potential direct effects to the human environment. However, at this level of study, these potential direct effects are not expected to contribute to any past, present, or reasonably foreseeable future actions to result in substantial cumulative effects. In addition, indirect effects on the human environment are not expected to substantially encourage or accelerate any changes in land use that are not already expected by any of the jurisdictions within the analysis area.

As detailed in Section 5.1.3, the Build Improvement Concepts would not impact any agricultural/forestal districts. However, potential direct impacts to farmland range from 0.01 acres for the VRE template to 22.40 acres for the Outside Maximum template. The cumulative effects of conversion of farmland to a transportation use has resulted in loss of farmland throughout the analysis area. However, the conversion of these lands to other uses such as residential, commercial, and industrial uses in a major urban area such as Washington DC has resulted in more acreage lost than due to conversion to a transportation use. The conversion of these lands to other uses has resulted in a cumulative loss of farmland.

5.5.2 NATURAL ENVIRONMENT

Minor long-term water quality effects could include increases in impervious surfaces, increases in traffic volumes, and consequent increases in pollutants washed from the road surface into receiving water bodies. When added to other past actions including construction of and subsequent widening of I-66 and the spread of development west from Washington DC, these result in cumulative impacts to water quality. If a Build Improvement Concept is advanced, avoidance, minimization, and mitigation measures for wetlands, streams, and stormwater impacts would be evaluated during the design of individual projects and would potentially minimize water quality impacts. These measures would reduce or detain discharge volumes and remove pollutants, thus avoiding substantial further degradation of impaired water bodies in the study area vicinity.

5.6 CONSTRUCTION IMPACTS

Construction impacts associated with a transportation project are by definition those impacts that are temporary or short term and that occur only during construction, and can involve temporary

changes in land use and access, air quality, noise levels, water quality, and wildlife habitat. This section provides an overview of the types and extent of potential construction impacts that may occur if a Build Improvement Concept is advanced and individual projects are constructed.

5.6.1 HUMAN ENVIRONMENT

5.6.1.1 Land Use and Access

Construction activities could result in temporary and localized detours, modifications to access, and increases in truck traffic. Access to businesses and homes could be temporarily disrupted due to temporary detours that are necessary to allow ample space for equipment staging and construction. These temporary disruptions are unavoidable, but would be minimized to the extent possible by carefully planning for maintenance of traffic during the process and incorporating maintenance of traffic details into the design plans. Potential impacts would be further defined as necessary during subsequent Tier 2 studies.

5.6.1.2 Air Quality

Air quality in the I-66 Study Area and VRE Extension Corridor would not be substantially affected by construction because of the temporary nature of highway construction and the confined right-of-way. Emissions from the operation of construction machinery (nitrogen oxides, sulfur oxides, carbon monoxide, and particulate matter) are short term and not generally considered substantial. Emissions from reduced traffic speeds through construction zones, combined with fugitive dust and smoke produced during burning, would result in a temporary degradation of air quality. Mitigating fugitive dust emissions involves minimizing or eliminating its generation. Mitigation measures that may be used for construction include wetting and stabilization to suppress dust generation, cleaning paved roadways, and scheduling construction to minimize the amount and duration of exposed earth.

Construction activities and practices to minimize construction impacts on air quality would be performed in accordance with VDOT's *Road and Bridge Specifications*. These specifications are approved as conforming with the SIP and require compliance with all applicable local, state, and federal regulations. Further assessment of temporary air quality impacts would be assessed during Tier 2 as necessary. In most instances, once improvements are completed, emissions would decrease as traffic speeds are resumed to normal conditions.

5.6.1.3 Noise

Noise levels in the I-66 Study Area and VRE Extension Corridor would not be substantially affected by construction, which include noise generated by heavy equipment during construction activities. The potential for noise impacts during construction is correlated to the proximity of sensitive noise receptors to the proposed construction activity. The potential for noise impacts during construction typically increases in urban and suburban areas because of the higher population densities found in those areas. However, construction noise impacts are temporary and, typically, progress linearly along transportation corridor construction projects. As construction approaches an area, noise impacts to receptors in that area would begin to increase, reach a peak, and then dissipate as the construction moves past the area. Abatement measures may be implemented as needed, and long-term noise impacts may be minimized

through the addition of abatement measures adjacent to the roadway. Practices to minimize the effects of construction noise would be in accordance with Section 107.14(c)(3) of VDOT's *Road and Bridge Specifications*.

While construction noise is unavoidable in most cases, steps can be taken to minimize the impact, such as the following:

- Keep all equipment well-maintained, tuned, and properly lubricated to minimize at-source noise production;
- Use sound attenuation devices on exhaust ports;
- Substitute the use of flag persons to control construction vehicle movements, instead of using audible back-up alarms for vehicles;
- Minimize unnecessary idling of heavy equipment and machinery, especially diesel engines and generators, when not actively in use; and
- Prohibit construction during sensitive nighttime, early evening, and early morning hours.

5.6.2 NATURAL ENVIRONMENT

5.6.2.1 Water Resources

All temporary and permanent impacts to wetlands and water resources, such as those associated with construction activities, are regulated by the USACE and the VDEQ through Sections 404 and 401 of the Clean Water Act, as well as by the Virginia Water Protection Program.

For construction within the study areas, staging areas for heavy equipment and short-term field offices can be chosen carefully, situated away from sensitive areas within interchange loops or in previously cleared areas used for agriculture. Nevertheless, the scale of the projects would potentially result in some largely irreversible impacts to wetlands and waters of the U.S. Hydrophytic vegetation and wetland soils may be disturbed by adjacent work, or may be temporary receptors of stormwater and sediment while the site is cleared, grubbed, and graded. Culvert installation may require pump-around methods to be executed properly, resulting in a temporary cessation of flow through stream segments.

Potential construction impacts to wetlands and water resources are temporary and typically are associated with stormwater runoff from the construction site. Stormwater runoff includes sediment resulting from inadequate erosion and sediment control (ESC) measures, chemical compounds and other debris, such as litter. Stormwater discharges to jurisdictional wetlands and waterways, such as discharges from construction sites, are regulated through the National Pollutant Discharge Elimination System (NPDES) Stormwater program. An NPDES Construction permit would be required for any construction site that disturbs more than one acre (including sites that are smaller than one acre but are included as part of a larger project or development). Through issuance of an NPDES Stormwater permit, the regulating agency would ensure that sufficient erosion and sediment control measures are specified for the activity, and that impacts are further reduced by using construction Best Management Practices (BMPs).

Erosion and sedimentation control plans for highway and rail improvements would be required for work that would include ground disturbance, and would describe the measures to be employed as erosion control, sedimentation control, temporary stormwater management measures, and dust control. Erosion control plans would also address in-water work at stream crossing locations. These plans must be approved before site construction could proceed and would be developed in accordance with regulations set forth by VDCR. Implementation of the project-specific plan would be expected to minimize impacts of erosion and sedimentation during construction. Erosion and sediment control measures would be implemented throughout the construction period to minimize water quality impacts from increased levels of sedimentation and turbidity. Control measures may include berms, dikes, sediment basins, fiber mats, straw silt barriers, netting, mulch, temporary and permanent seeding, and other methods. Construction impacts to in-stream aquatic habitats would be minimized to the extent practicable by avoiding stream relocations and by crossing streams at right angles where possible. To the extent possible, construction equipment would be restricted from fording and otherwise disrupting instream habitats.

5.6.2.2 Wildlife and Habitat

It is anticipated that construction would be regulated to adhere to a strict schedule to avoid disrupting the breeding or migrating patterns of threatened and endangered species. Agencies that may become involved in this process include the USACE, the USFWS, the VDEQ, and the VDGIF. Human presence during construction and the associated construction noise, such as from passing equipment, piling emplacement, and blasting of bedrock, may temporarily displace some species of wildlife. The noises associated with construction may also mask territorial vocalizations of birds, interfering at least temporarily with breeding. Amphibians, which breed more commonly at dusk or night, are less likely to be affected. Construction in forested areas may result in mortality of amphibians, reptiles and small mammals within the work zone, and the loss of nesting birds, if construction is initiated during nesting season. The clearing of vegetated cover within the construction footprint would displace temporarily certain habitat areas that would become reestablished over time with the revegetation of cut and fill slopes and other areas within the construction limits but outside of paved areas and the required clear zone. Grasses would be reestablished quickly and trees and shrubs would colonize disturbed areas over a period of years. The mechanical removal of cover would cause animal migration away from the disturbance, resulting in a temporary decrease in available habitat and increased competition for remaining habitat. Opportunistic or invasive plant species may have a competitive advantage in colonizing bare areas during early construction activities; however, temporary and permanent revegetation establishment in accordance with VDOT's *Road and Bridge Specifications* would minimize the extent and duration of undesirable plant growth.

5.7 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Local short-term impacts and uses of the environment are generally associated with the construction phase of the project, as described in Section 5.6; these short-term impacts have been identified and general mitigation measures discussed. Additionally, local resources would

be used in the construction of any projects associated with the Build Improvement Concepts, including materials, energy, and labor.

These short-term environmental impacts and use of resources must be balanced against long-term transportation benefits. Although localized and temporary impacts would occur during construction, it would be consistent with the goals for improved long-term productivity and mobility for the study area, the region, and the Commonwealth of Virginia. The local short-term impacts and use of resources would be offset by the increased long-term mobility and decreased travel times associated with improved capacity, and are consistent with the maintenance and enhancement of long-term productivity.

Therefore, the benefits such as improved mode choice, reduced travel time, increased safety, and general economic enhancement of the area offered by the long-term productivity of the project should offset any short-term inconvenience and effects on the human and natural environments.

5.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Construction of any projects associated with the Build Improvement Concepts within the I-66 Study Area and VRE Extension Corridor would require a commitment of natural, physical, human, and fiscal resources that would be irreversible and irretrievable:

- Land used in the construction of the improvements is considered an irreversible commitment during the time that the land is used for transportation facilities. Land within the roadway and rail line is already used for transportation facilities and is not anticipated to change from either the maintenance or improvement of the facility. If a greater need arises for use of the land or if the transportation facility is no longer needed, the land can be converted to another use. At present, there is no reason to believe that such a conversion would ever be necessary or desirable.
- Considerable amounts of fossil fuels, labor, and rail and highway construction materials, including but not limited to cement, aggregate, asphalt, and steel would be expended for the improvements. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable; however, they are not in short supply and their use would not have a material effect on the continued availability of these resources. All applicable energy conservation measures would be utilized and energy resource consumption would not be excessive in terms of region wide usage. None of the natural resources associated with lands that would be committed to the improvements or used in preparation/fabrication of construction materials are in short supply nor would their use have a substantial effect on the continued availability of those resources.
- Commitment of human and fiscal resources would also be required. Any construction would require a substantial one-time expenditure of local, state, and federal funds that are not retrievable. During construction, members of the labor force, including construction crews, government staff, consultants, and engineers,

would be dedicated to the project. Fiscal resources used to purchase construction materials and pay the labor force would also constitute an irretrievable commitment of resources.

The commitment of these resources is based on the concept that residents in the immediate area and the region would benefit from the improved quality of the transportation system and improved mobility and transportation capacity. The irreversible and irretrievable commitment of resources by projects associated with the improvement concepts within the I-66 corridor and on the Norfolk Southern rail line would be offset by both the short- and long-term improvements to the regional economic base and achievement of goals to improve mobility options and overall transportation services in the local areas, the region, and the Commonwealth of Virginia.

6 TIER 1 DECISIONS TO BE MADE

6.1 INTRODUCTION

As indicated in Chapter 1, a MOA established in June 2011 between VDOT, FHWA, VDPRT, and FTA, outlines the roles of each agency in the Tier 1 NEPA process for the I-66 corridor improvements and the decisions to be made following completion of the Tier 1 study. Upon completion of Tier 1, decisions will be made on:

- The concepts to be advanced for the I-66 corridor, including transit improvements, transportation demand management strategies, and/or roadway improvements. Within these concepts, consideration will be given to managed lanes and tolling;
- The general location for studying future highway and transit improvements in Tier 2 NEPA document(s);
- Identification of projects with independent utility to be evaluated in Tier 2 NEPA document(s) and evaluated pursuant to other environmental laws; and
- Advancing tolling for subsequent study in Tier 2 NEPA document(s).

The following sections discuss the decisions to be made at the conclusion of the Tier 1 NEPA process. These decisions will be made with consideration of the information presented or referenced in the Tier 1 EIS as well as the comments received.

6.2 IMPROVEMENT CONCEPTS TO BE ADVANCED

Improvement concepts that were considered include **General Purpose Lanes**, **Managed Lanes**, **Metrorail Extension**, **Light Rail Transit**, **Bus Rapid Transit**, **VRE Extension**, **Improve Spot Locations/Chokepoints**, **Intermodal Connectivity**, **Safety Improvements**, **Transportation Communication and Technology** and the No-Build. If one or more of the Build Improvement Concepts are advanced to Tier 2, subsequent Tier 2 NEPA documents prepared for individual, independent projects would address site specific details before specific location decisions could be made. Decisions on lane configurations, station locations, parking lot capacity and other details – which are dependent upon the selection of the improvement concept(s) in Tier 1 – will not be made until Tier 2.

6.3 GENERAL LOCATION

The general locations of each Build Improvement Concept are limited by the location of the existing infrastructure, the purpose and need identified in Chapter 2 and the desire of the agencies, as expressed through the outreach and coordination opportunities identified in this EIS, to limit impacts. Because of this, each of the capacity improvement concepts is proposed to be located in the existing corridor in which it currently exists or operates, rather than on new location corridors.

The specific locations of the **Intermodal Connectivity**, **Safety Improvements**, and **Transportation Communication and Technology** improvement concepts (i.e., the non-capacity improvement concepts) are not identified in the Tier 1 EIS because their locations will be influenced by the decisions made in Tier 1 about the capacity improvement concepts. If advanced, the location of these improvements will be within the study areas identified in this EIS and will be defined and evaluated in Tier 2.

6.4 PROJECTS WITH INDEPENDENT UTILITY

A practical approach to improving I-66 in the study area is to break the corridor into components and undertake more detailed environmental studies on a series of projects that are consistent with the overall purpose and need of this Tier 1 EIS. Based on mode choice, traffic break points, service demand, and other factors, each project is independent, useful and stands on its own merits within the framework of this Tier 1 EIS.

Identifying or framing individual projects must be conducted in accordance with certain principles and criteria. Three criteria outlined in the FHWA/FTA NEPA implementing regulations are used to frame or define a project. To ensure meaningful evaluation of alternatives, and to avoid commitments related to transportation improvements before they are fully evaluated, the action evaluated in an environmental document shall:

- Connect logical termini and be of sufficient length to address environmental matters on a broad scope[1];
- Have independent utility or independent significance, i.e. be useable and be a reasonable expenditure even if no additional transportation improvements in the area are made; and
- Not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.

Because multiple modes are being considered, it is possible that there will be different Lead Agencies for the projects that are studied in Tier 2. The Lead Agencies will be responsible for ensuring that the Tier 2 projects meet the above criteria.

Federal regulations implementing NEPA provide project sponsors with three different types of documents for complying with NEPA. The determination of the appropriate type of NEPA document to be used for each individual project depends on the nature of the improvement and the significance of the impacts of the improvements. The three types of NEPA documents are: Categorical Exclusion (CE), Environmental Assessment (EA) and Environmental Impact Statement (EIS). These documents are described as follows:

- Categorical Exclusion (CE): CEs are categories of actions that individually or cumulatively do not have a significant effect on the environment and for which

[1] An FHWA memorandum, dated November 5, 1993, provides information to guide the establishment of logical termini for proposed actions.

neither an Environmental Assessment nor an Environmental Impact Statement is required.

- Environmental Assessment (EA): An EA is a concise document designed to provide sufficient information and analysis to determine whether to prepare an EIS or a Finding of No Significant Impact (FONSI). EAs are prepared when the significance of the impacts is unknown.
- Environmental Impact Statement (EIS): An EIS is a detailed written statement required when there is a proposal for a major federal action significantly affecting the environment.

6.5 TOLLING

One of the Tier 1 decisions to be made is whether to advance the consideration of tolls as a funding source for the I-66 corridor. It is important to note that a decision to toll I-66 is not being made as part of this study. It is also important to note that a decision is not being made as part of this study on the toll rate, location or method of collection. Additional federal approvals would be required in order to toll I-66. If a decision is made to advance the consideration of tolls as a funding source, the effects of various toll scenarios would be studied again in Tier 2.

Tolls were studied at a broad level in conjunction with those improvement concepts that are compatible with tolling to examine their impact on future traffic volumes. This analysis is included in the *Transportation Technical Report*. The analysis indicated that, dependent on the improvement concept, anticipated changes in traffic due to tolling would result in changes of plus or minus 12 percent or less on I-66, with potential diversions resulting in a shift of traffic from tolled lanes to general purpose lanes.

7 COMMENTS AND COORDINATION

This study was conducted pursuant to the provisions of 23 U.S.C. 139. The *I-66 Coordination Plan*, outlining the agency coordination and public involvement process, was prepared early in the project development process. Agency coordination and public outreach and involvement were conducted in accordance with the process set forth in the coordination plan.

7.1 PUBLIC OUTREACH AND INVOLVEMENT

An extensive public involvement program was utilized to ensure that concerned citizens, interest groups, civic organizations, and businesses were provided opportunities to express their views throughout the environmental review process for the Tier 1 Draft EIS. The objectives of the public involvement program are as follows:

- Educate the public regarding the existence, purpose, and scope of the study;
- Encourage and provide opportunities for public participation throughout the study process;
- Report findings of technical analyses at key project milestones; and
- Document how public suggestions and concerns have been considered and incorporated into the study's planning process.

Various communication media, including newsletters, brochures, questionnaires, informational videos, a project website, and public meetings were used to provide information about the project and gather input from citizens and other interested parties. In addition, VDOT and VDRPT representatives met personally with numerous interest groups, civic associations, and businesses to discuss the study and answer questions about the potential improvements and the environmental review process. Individual citizens contacting VDOT about the project were referred to the project website for further information and encouraged to subscribe to receive e-mail updates on the project as well as to participate in public meetings.

7.1.1 MAILING LIST AND NEWSLETTERS

A mailing list was created at the beginning of the study; this was used to distribute periodic study updates, as well as announcements of upcoming public meetings and project newsletters. The mailing list includes entries for local, state, and federal elected officials; representatives from local, regional, state, and federal government agencies; interested citizens; civic associations in Fairfax and Prince William counties; local transportation and planning agencies; and the news media. The mailing list was updated throughout the study to include citizens who asked to be included, attendees at public information meetings, and attendees at meetings with interest groups, civic associations, and businesses.

Newsletters. Three project newsletters were prepared during the course of the Tier 1 Draft EIS study to keep interested parties informed about its status and progress. Topics in these newsletters included: the tiering process, VDOT's public involvement program, public meeting announcements and agendas, improvement concepts being considered, the scope of environmental analyses, and the project schedule. Each newsletter also included an e-mail address that readers could use to send questions, comments, and information requests to the study team. Newsletters were mailed to all individuals, organizations, and agencies on the mailing list; and were also made available at public meetings. Copies of the newsletters were also provided to public officials and civic associations upon request.

7.1.2 WEBSITE/E-MAIL LINK

Information was available on the study website at www.helpfix66.com. Information on the website includes an overall study summary; project background; information on the environmental review process, improvement concepts being considered, and traffic and transportation issues; as well as Frequently Asked Questions (FAQs). The project website invites the interested public to subscribe to receive project updates. The project website also includes electronic versions of project newsletters, public meeting displays, conceptual plans, and other project documents.

7.1.3 MEDIA RELEASES

Efforts were made throughout the study to engage the media and local transportation stakeholders in helping to build awareness of the study with residents. Prior to public meetings, such efforts were intensified to "spread the word" about the times and locations of the public meetings and the issues that were to be covered in the meetings. Additionally, all appropriate public agencies, public officials, county representatives and the general public throughout the corridor were notified using various tools, including electronic flyers distributed via e-mail, project newsletters and the project website, newspaper advertisements, and direct media contacts via meeting advisories and direct telephone calls.

7.2 SCOPING PROCESS

VDOT and VDRPT, in cooperation with the FHWA, have coordinated extensively with local, state, and federal agencies on the I-66 Tier 1 EIS study in accordance with 40 CFR 1501.7. VDOT, VDRPT, and FHWA have also conducted an inclusive public involvement program. Local, state, and federal agencies and the general public were contacted early in the study to identify issues of concern and to provide information about environmental resources within the study area. FHWA published a Notice of Intent in the Federal Register on April 18, 2011 to announce its intent to prepare this Tier 1 EIS. The public was notified about the study and given opportunities to provide comments about transportation needs, potential alternatives, and environmental concerns during multiple public meetings. The agency and public comments received in response to these coordination efforts were instrumental in defining improvement concepts and environmental issues to be addressed in this Tier 1 Draft EIS.

Details on the scoping process are included the *Scoping Technical Memorandum*; a summary of the process, which included participation from agencies as well as the general public, is included below.

Agency Scoping Meeting: Representatives from federal, state, regional, and local agencies were invited to participate in the scoping process through attendance at a scoping meeting and/or by providing comments and suggestions in writing to the study team. Fourteen agencies participated in the June 7, 2011 scoping meeting that was held at the VDOT Northern District Office in Fairfax. Information presented at the meeting included a summary of the tiering process along with study background and schedule. Major areas of discussion at the meeting included existing and future problems in the study corridor (purpose and need), potential solutions to meet those needs, and environmental resources along the corridor that could potentially be affected by those solutions.

Feedback received at the meeting, and in writing following the meeting, addressed issues across a broad range of modes, such as including expansion of commuter rail, Metrorail, express bus service and the need for efficient intermodal transfer facilities with enhanced pedestrian and bicycle access; the importance of travel demand measures as well as capacity improvements; the need to incorporate projects and recommendations from local planning documents; and the need to consider the full range of potential effects of any improvements. A total of 19 agencies submitted scoping comments.

Public Scoping Meetings: A total of four public scoping/citizen information meetings were held in Fairfax and Prince William counties in June 2011 and January/February 2012. The purpose of the meetings was to obtain public input on the transportation problems and needs in the corridor, identify options to address those needs, and gain input on any key environmental considerations in the corridor. Meeting notifications were published in both regional and local newspapers along the corridor, including the *Washington Post*, *Patches*, and *Connection* newspapers. Meeting notices were also placed on the VDOT website indicating the time, date and location for each meeting, as well as a link to other useful and informative sites.

At the meetings, study information (process, schedule, and study purpose) was presented and VDOT, VDRPT, and FHWA representatives were available to discuss the study and answer questions. A court reporter was present to take oral comments and comment sheets were available for written comments (comments could be submitted at the meetings, mailed, or e-mailed after the meetings). A brief summary of these meetings is included below; details on the public comments and the responses are included in the *Scoping Technical Memorandum* and are also available on the project website.

June 2011 Citizen Information Meetings. These meetings were held on June 8 and June 9, 2011 at the Four Points Sheraton in Manassas and the Northern Virginia District Office of VDOT in Fairfax. A total of 39 people, including citizens, agency representatives, consultants, and local officials, attended the two meetings. Comments from 63 different individuals or groups were received during and following the meetings.

January/February 2012 Citizen Information Meetings. These meetings were held on January 31 and February 2, 2012 at the Four Points Sheraton in Manassas and the Northern Virginia District Office of VDOT in Fairfax. A total of 98 people, including citizens, agency representatives, consultants, local reporters and public officials and representatives, attended the two meetings.

Comments from 114 different individuals or groups were received during and following the meetings.

The major issues and concerns identified by the public during the scoping process included highlighting and emphasizing problems related to traffic congestion and safety in the corridor (key areas include US 50 to I-495 and at VA 28 and VA 123); the need for safe pedestrian and bicycle travel in the region and within the broader corridor; and the need for increased transit service (including extending Metrorail), improving HOV operations and configurations, and converting the shoulder lanes into permanent lanes for either general or HOV use. Concerns were also stated with respect to the potential effects of improvements on the environment, including the potential for increased noise and the need for abatement measures with respect to noise.

7.3 AGENCY COORDINATION

Coordination with various federal, state, and local agencies on the scope of this project began early and continued throughout the study. The agency meetings described in the previous section were supplemented by regular meetings of the I-66 Study Team, interagency coordination meetings, and meetings with individual agencies.

Three federal agencies are serving as Cooperating Agencies for this Tier 1 EIS study: Army Corps of Engineers, Environmental Protection Agency, and FTA.

Of the twenty-three federal, regional, state or local agencies that were invited to be Participating Agencies for this study, fourteen agencies, as listed in **Table 7-1**, requested to be Participating Agencies.

Table 7-1. Participating Agencies

TRANSPORTATION AGENCIES	COUNTIES, CITIES, TOWNS	OTHER AGENCIES
Northern Virginia Transportation Authority	City of Fairfax	Metropolitan Washington Council of Governments
Northern Virginia Transportation Commission	Fairfax County	National Park Service
Potomac and Rappahannock Transportation Commission	Prince William County	Northern Virginia Regional Commission
Washington Metropolitan Area Transit Authority	Town of Haymarket	Northern Virginia Regional Park Authority
Virginia Railway Express	Town of Vienna	

Meetings with the Cooperating and Participating agencies were held at three key milestones over the course of the study. The purpose of each meeting is described below.

November 29, 2011: Gaining feedback on the preliminary purpose and need, as well as input on the range of concepts to be considered, was the primary purpose of this first formal assembly of the study's Cooperating and Participating agencies. Thirty-six individuals representing 15 different agencies attended.

March 19, 2012: This meeting was convened to review the range of concepts to be evaluated, focusing specifically on the transportation improvement elements ("building blocks") and the assumptions associated with each. Agency feedback resulted in adjustments and refinements to the analysis process.

May 31, 2012: This meeting served as a follow-up to the March 19, 2011 meeting and provided an opportunity to review how previous agency comments and recommendations were incorporated into the revised analysis process. Additional agency input on the analysis assumptions was obtained.

7.4 PUBLIC REVIEW OF TIER 1 DRAFT EIS

This Tier 1 Draft EIS is being made available to the public for review and comment and distributed to agencies and stakeholders with jurisdiction, expertise, or interest in the issues involved in the study. Printed copies of this document will be available for review at local libraries and government centers within the project corridor, VDOT's Northern Virginia District and Richmond offices and at the Public Hearing. Digital copies of the document will be available on the project website. All substantive review comments received on the Tier 1 Draft EIS will be addressed in the Tier 1 Final EIS.

8 LIST OF PREPARERS

This Tier 1 Draft Environmental Impact Statement was prepared by the Virginia Department of Transportation in close coordination with the Federal Highway Administration and the Virginia Department of Rail and Public Transportation. Personnel from these agencies who were instrumental in the preparation of this document and related technical studies include:

VIRGINIA DEPARTMENT OF TRANSPORTATION

Environmental Division, 1401 East Broad Street, Richmond, Virginia 23219

NAME	EDUCATION AND EXPERIENCE	PROJECT ROLE
Angel Deem	B.S. Biology 17 years in preparation and review of NEPA documentation and environmental data management	VDOT Project Manager
Chris Collins	M.S. Biology B.S. Biology 20 years in preparation and review of NEPA documentation; technical studies, and; project management.	VDOT Project Manager

Northern Virginia District, 4975 Alliance Drive, Fairfax, Virginia 22030

NAME	EDUCATION AND EXPERIENCE	PROJECT ROLE
William Cuttler, P.E.	B.S. Civil Engineering 25 years in transportation engineering, planning and program management.	VDOT Deputy District Administrator

FEDERAL HIGHWAY ADMINISTRATION

Virginia Division, 400 North 8th Street, Suite 750, Richmond, Virginia 23219

NAME	EDUCATION AND EXPERIENCE	PROJECT ROLE
John Simkins	M.S. Environmental Sciences B.S. Biology 15 years in NEPA documentation preparation, review, and approval.	FHWA Environmental Project Manager

VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION

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NAME	EDUCATION AND EXPERIENCE	PROJECT ROLE
Kimberly Pryor, AICP	M.S. Urban Systems Engineering B. A. Environmental Sciences 15 years in environmental regulatory impact analysis; air quality analysis; transportation, multimodal and freight planning; NEPA; and transportation funding and program management.	VDRPT Project Manager
Chris Arabia	B.A. Economics 22 years in transit and TDM operations and planning	VDRPT Project Planner

The following consultants were involved in the preparation of this Tier 1 Draft Environmental Impact Statement, and related technical reports. A brief resume for each consultant and his/her role in the study are listed below.

PARSONS TRANSPORTATION GROUP

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NAME	EDUCATION AND EXPERIENCE	PROJECT ROLE
Stephen Walter, CEP	M.S. Environmental Studies B.S. Environmental Conservation 35 years in environmental/transportation planning and NEPA documentation.	Project Manager
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J. Stuart Tyler, P.E.	M.S. Civil Engineering B.A. Environmental Science 35 years in environmental/transportation planning and NEPA documentation.	Principal Author of the Draft EIS
Susan Roux, RLA	B.S. Landscape Architecture 30 years in NEPA documentation.	Principal Author of the Draft EIS
Susan Bupp, RPA	M.A. Anthropology B.A. Anthropology 36 years in cultural resource analysis and management.	Principal Author of the Draft EIS

Robert Reed, P.E.	M.E. Engineering B.S. Civil Engineering 39 years of experience in civil engineering and design.	Concept Development; Preliminary Engineering
Ruth Estero	B.S. Civil Engineering 26 years in civil engineering and design.	Concept Development; Preliminary Engineering
Krishna Potturi, P.E.	M.S. Civil Engineering B.S. Civil Engineering 7 years in civil engineering and design.	Concept Development; Preliminary Engineering
Jessica Dewispelaere	M.S. Civil Engineering B.S. Civil Engineering 12 years in environmental and transportation planning.	Purpose and Need
Jim Curren, P.E.	M. Eng. Project Management B. Eng. Civil Engineering B. Sc. Engineering 35 years in engineering and transportation.	Transportation Analysis
Robert Brander, P.E.	M.S. Transportation Engineering B.S. Civil Engineering 14 years in transportation analysis.	Transportation Analysis
Michael Vitek, EIT	M.S. Civil Engineering B.S. Civil Engineering 5 years in civil engineering and transportation analysis.	Transportation Analysis
Michelle Fall, AICP	M.S. Environmental Engineering B.S. Biology 18 years in environmental and transportation planning.	Land Use; Socioeconomics
Danielle Gresham	M.S. Renewable Resources, Wildlife and Fisheries Science B.S. Biology 20 years in natural resources analysis and management.	Natural Resources
Rebecca Chojnacki	B.S. Biotechnology and Biology 5 years in natural resources and field biology.	Natural Resources
Margaret Moore	M.A. Public Administration M.S. Environmental Science B.A. History 18 years in environmental and transportation planning.	Comments and Coordination

KIMLEY-HORN AND ASSOCIATES, INC.

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Paul Elman, P.E.	M.S. Engineering Management B.S. Civil Engineering 25 years in rail & transit planning and engineering.	Concept Development and Evaluation - Transit
David Whyte, P.E.	B.S. Civil Engineering 16 years in planning and engineering.	Concept Development and Evaluation - Transit
Mike Harris	M.S. Urban Systems Engineering B.S. Civil Engineering 27 years in planning and engineering.	Concept Development and Evaluation
Tim Burkhardt, AICP	M.A., Environmental Health B.A. English 20 years in environmental and transportation planning.	Concept Development and Evaluation - Transit
David Cheeney, AICP	Masters of Public Administration, Planning B.A. Planning 26 years in planning.	Concept Development and Evaluation - Transit
Derek Toups, AICP	Master of City Planning B.S. Sustainable Development 11 years in planning.	Concept Development and Evaluation -Highway and TDM
Erin Murphy, EIT	M.S. Civil Engineering B.S. Civil and Environmental Engineering 6 years in transit planning and engineering.	Concept Development and Evaluation - Transit
Ryan Birdseye	Master of Regional Planning, Urban Planning B.S. Geography 21 years in planning.	Purpose and Need
Edgar Torres, P.E.	M.S. Civil Engineering B.S. Civil Engineering 6 years in transit planning and engineering.	Purpose and Need; Concept Development

FITZGERALD & HALLIDAY

926 Haddonfield Road, Suite E #349, Cherry Hill, New Jersey 08002

Kristen Ahlfeld, AICP	Master of City Planning B.A. Marine Affairs 15 years in transportation planning.	Parklands; Section 4(f); Land Use
Carol Gould, AICP	B.A. Environmental Studies 30 years in land use analysis.	Land Use

David Laiuppa, CSS	B.S. Natural Resource Management and Engineering 13 years in GIS mapping.	GIS Mapping

HARRIS MILLER MILLER & HANSON

77 South Bedford Street, Burlington, Massachusetts 01803

Christopher Menge, INCE	Grad. Study Mechanical Engineering B.S. Physics 40 years in noise analysis.	Noise
Phil DeVita, CCM	M.S. Environmental Studies B.S. Meteorology 22 years in air quality analysis.	Air Quality

DOVETAIL CULTURAL RESOURCES GROUP I, INC.

300 Central Road, Suite 200, Fredericksburg, Virginia 22401

Michael Carmody, RPA	M.A. Anthropology B.A. Anthropology/Archaeology 18 years in cultural resources analysis and management.	Cultural Resources-Archaeology
Kerri Barile, RPA	Ph.D. Anthropology M.A. Anthropology M. Cert. Museum Management B.A. Historic Preservation 19 years in cultural resources analysis and management.	Cultural Resources-Architectural History
Dana Peckler	M.H.P Historic Preservation M. Cert. Transportation Systems Management B.A. History 8 years in historic preservation.	Cultural Resources-Architectural History

STRATACOMM

One Thomas Circle, N.W., 10th Floor, Washington, DC 20015

John Undeland	B.A. Politics and Government 27 years in public outreach.	Public Outreach
Colleen Spitz	B.A. Communications B.S. Public Science 7 years in communications and public outreach.	Public Outreach

9 DISTRIBUTION LIST

The following agencies and organizations were provided copies of this Tier 1 Draft Environmental Impact Statement for review and comment.

9.1 FEDERAL AGENCIES

Advisory Council on Historic Preservation

- Office of Federal Agency Programs

U.S. Department of Agriculture

- Natural Resource Conservation Service

U.S. Department of the Army

- Corps of Engineers – Norfolk District

U.S. Department of Health and Human Services

- Office of Public Health and Science

U.S. Department of Housing and Urban Development

- District of Columbia Office

U.S. Department of Interior

- Fish and Wildlife Service, Virginia Field Office
- National Park Service, Manassas National Battlefield Park
- National Park Service, National Capital Region
- Office of Environmental Project Review

U.S. Department of Transportation

- Federal Transit Administration
- Federal Railroad Administration

U.S. Environmental Protection Agency

- NEPA Compliance Section

9.2 COMMONWEALTH OF VIRGINIA AGENCIES

Virginia Department of Agriculture and Consumer Services

Virginia Department of Conservation and Recreation

- Chesapeake By Local Assistance Department
- Virginia Natural Heritage Program
- Planning and Recreation

Virginia Department of Environmental Quality

- Air Program Coordination
- Office of Waste Programs
- Water Division

Virginia Department of Forestry

Virginia Department of Game and Inland Fisheries

Virginia Department of Health

- Office of Drinking Water

Virginia Department of Historic Resources

Virginia Department of Housing and Community Development

Virginia Department of Mines, Minerals, and Energy

Virginia Economic Development Partnership

Virginia State Forester

Virginia Institute of Marine Science

Virginia Marine Resources Commission

- Habitat Management Division

Virginia Outdoors Foundation

9.3 REGIONAL AGENCIES AND ORGANIZATIONS

Metropolitan Washington Council of Governments

Northern Virginia Chamber of Commerce

Northern Virginia Building Industry Association

Northern Virginia Regional Commission

Northern Virginia Regional Park Authority

Northern Virginia Soil and Water Conservation District

Northern Virginia Transportation Alliance

Northern Virginia Transportation Authority

Northern Virginia Transportation Commission

Potomac and Rappahannock Transportation Commission

Virginia Railway Express

Washington Airports Task Force

Washington Metropolitan Area Transit Authority

9.4 FAIRFAX COUNTY AGENCIES/OFFICIALS

Fairfax County Board of Supervisors

Fairfax County Department of Neighborhood and Community Services

Fairfax County Department of Health

Fairfax County Department of Housing and Community Development

Fairfax County Department of Planning and Zoning

Fairfax County Department of Public Works and Environmental Services

Fairfax County Department of Transportation

Fairfax County Economic Development Authority

Fairfax County Trails and Sidewalk Committee

Fairfax County Office of the Executive

Fairfax County Park Authority

Fairfax County Public Schools

Fairfax County Planning Commission

Fairfax County Transportation Advisory Commission

9.5 PRINCE WILLIAM COUNTY AGENCIES/OFFICIALS

Prince William County Economic Development Authority

Prince William County Office of Executive Management

Prince William County Office of Planning

Prince William County Park Authority

Prince William County Planning Commission

Prince William County Public Works Department

Prince William County Department of Transportation

9.6 OTHER LOCAL GOVERNMENTS

City of Fairfax

City of Manassas

City of Manassas Park

Town of Haymarket

Town of Vienna

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