Tri-County Parkway Location Study

INDIRECT EFFECTS AND CUMULATIVE IMPACTS TECHNICAL REPORT

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The Virginia Department of Transportation

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S.0 EXECUTIVE SUMMARY

Project History and Overview

The Tri-County Parkway Location Study evaluates a new north/south transportation link in northern Virginia that will connect the City of Manassas with Interstate 66 (I-66) and the Dulles corridor. The corridor begins in the north at the intersection of US 50 and Route 606 (Old Ox Road) and extends to the south at the interchange of VA 28/VA 234 Bypass. It is approximately 15 miles long and traverses portions of the counties of Prince William, Fairfax, and Loudoun along with the cities of Manassas and Manassas Park. The three counties that the Tri-County Parkway will traverse are among the top ten fastest growing counties in the Commonwealth of Virginia. The City of Manassas and the City of Manassas Park have also experienced substantial population growth over the last ten years. Much of the growth in Northern Virginia can be attributed to the emergence of high-tech industries near the Washington Dulles International Airport. A second rapid growth corridor within the region is the I-66 corridor. The primary problem the Tri-County Parkway is intended to address is the lack of adequate north-south transportation facilities linking the I-66 corridor with the Dulles area and VA 267. East of US 15 and west of the I-495 (Capital Beltway), only three principal urban arterials link the spokes together - VA 28 (Sully Road), Route 7100 (Fairfax County Parkway), and VA 123. These north-south facilities are heavily congested and will deteriorate further by the year 2025.

Purpose and Need

The study area presently lacks adequate north-south transportation facilities linking the I-66 corridor with the Dulles area and VA 267. The purpose and need for the Tri-County Parkway is comprised of four key elements, namely:

1. Improve transportation mobility and capacity and, by doing so, improve access and reduce congestion.
2. Enhance the linkage of communities and the transportation system that serves those communities.
3. Accommodate social demands, environmental goals, and economic development needs.
4. Improve safety and, by doing so, reduce the average crash, injury, and accident rates on the roadway network.

Each of the elements has equal value and importance in the overall transportation, environmental, economic, and quality of life objectives for the communities being served under the proposed action.

Alternatives

In accordance with NEPA requirements, alternatives initially considered for the Tri-County Location Study included the No-Build, Mass Transit, Transportation System Management (TSM), and Candidate Build Alternatives (CBAs). Each alternative was evaluated with respect to its potential impacts and its ability to address the project's purpose and need.

Alternatives Eliminated from Detailed Study

Assessments conducted as part of the Tri-County Parkway Location Study determined that the nature of the study area makes the identification of a mass transit alternative that can address the corridor's purpose and need problematic. No transit authority exists whose service area covers or would cover the entire study area, nor are there plans to establish such an authority. In addition, the development patterns and traffic patterns and volumes within the study corridor do not favor north-south through movement along the corridor. The majority of trips and greatest volumes are to points outside the study area or along only a portion of the corridor (i.e., from the Manassas and Centerville areas to I-66 and points east, from the South Riding area to the Dulles corridor). The through volumes are by far the weakest in the study area and would not attract sufficient transit riders to make such service viable; therefore, the mass transit alternative was eliminated from further consideration.

There are no practicable Transportation System Management (TSM) measures beyond those already proposed in the CLRP and VDOT Six Year Plan which could reasonably be implemented to satisfy the

purpose and need for the Tri-County Parkway. TSM-type improvements programmed into the aforementioned plans do not satisfy the project's purpose and need when considered as a stand-alone alternative; therefore, the TSM Alternative was eliminated from further consideration.

The No-Build Alternative

The No-Build Alternative includes currently programmed committed and funded roadway and transit projects in the Virginia Department of Transportation (VDOT) Six Year Plan and the CLRP developed by the MWCOG. The No-Build Alternative, while having no direct construction costs, would result in other economic, environmental, and quality of life impacts that can be expected from the continuation of roadway system deficiencies. While the No-Build alternative does not meet the project needs for traffic, safety, and roadway infrastructure improvements, it provides a baseline condition with which to compare the improvements and consequences associated with the Candidate Build Alternatives.

Candidate Build Alternatives (CBAs)

Three Candidate Build Alternatives (CBAs) have been identified for further evaluation in a Draft Environmental Impact Statement (EIS). These CBAs are referred to hereinafter as: (1) the "Comprehensive Plan" CBA, (2) the "West Two" CBA, and (3) the "West Four" CBA. Each of the CBAs is expected to be comprised of two or more facility types according to localized needs and goals. To assess environmental effects associated with a particular facility type along each CBA, three general design segments were developed. These general design segments and their relationship to each alternative assessed are described in the body of this Technical Report.

The Comprehensive Plan CBA

The Comprehensive Plan CBA would be located east of the Manassas National Battlefield. The Comprehensive Plan CBA would provide a new urban principal arterial roadway from the northern terminus at the intersection of US 50 and Route 606 (Old Ox Road) and the southern terminus at the Route 28 and Route 234 Bypass Interchange, and would consist of Segments F', F, and E. Segment F' between Route 50 and Route 620 would be comprised of improvements along an existing four-lane divided facility within an existing right-of-way on an existing alignment. Segment F' south of Route 620 would be a new four-lane divided facility within a new right-of-way on a new alignment. Three separate sections characterize segment E. The portion of Segment E between I-66 and the Fairfax/Prince William county line would be a new six-lane divided facility within a new right-of-way on a new alignment. The portion of segment E from the Fairfax/Prince William county line south to VA 234 would be a new six-lane divided facility within an existing right-of-way on an existing alignment. The portion of Segment E from VA 234 to the VA 234 Bypass would be comprised of improvements along an existing four-lane divided facility called Godwin Drive and would be widened to a six-lane divided facility within the existing right-of-way and on an existing alignment.

The West Two CBA

The West Two CBA is located west of the Manassas National Battlefield. The West Two CBA would provide a new urban principal arterial roadway from the northern terminus near the intersection of US 50 and Route 877 (Racefield Lane) and the southern terminus at the I-66 and Route 234 Interchange. The West Two CBA would be a new four-lane divided facility within a new right-of-way and on a new alignment, and would consist of Segments D and C.

The West Four CBA

The West Four CBA is also located west of the Manassas National Battlefield. The West Four CBA would provide a new urban principal arterial roadway from the northern terminus at the intersection of US 50 and Route 606 (Old Ox Road) and the southern terminus at the I-66 and Route 234 Interchange. The West Four CBA would consist of Segments F', G, and C. Segment F' between Route 50 and Route 620 (Braddock Road) would be comprised of improvements along an existing four-lane divided facility within an existing right-of-way on an existing alignment. Segment F' south of Route 620 would be comprised of a new four-lane divided facility within a new right-of-way on a new alignment.

Affected Environment

Given the history of the Tri-County region, it is clear that much of the natural environment in the study area has been and continues to be substantially degraded as a result of past and present actions. The conversion of the natural environment (i.e., forests, etc.) to the built environment (i.e., residential development, etc.) is strongly correlated with population growth trends.

Environmental Consequences

With the projected increases in employment, resource use, and population within the Tri-County Parkway study area, there is significant pressure to continue the existing trend for additional commercial, industrial, and residential development. In order to meet the increasing need for services such as transportation, water, sewer, utilities, housing, etc., a large number of public and private projects are currently planned or underway within the study area. Given that access is already provided to undeveloped lands, most of this development has already been planned and will occur regardless of whether or not the proposed action is implemented. There is little development that will occur solely as a result of the project. Although the proposed project may accelerate planned development within the study area, should it be implemented, this development would still be expected to occur within the analysis years of this study. Because much of the natural environment has been and continues to be substantially degraded by past and present actions, it is expected that this trend will continue as reasonably foreseeable future actions are implemented. Therefore, the incremental (cumulative) effects associated with the proposed action, when taken into consideration with the cumulative effects from all other past, present, and reasonably foreseeable future actions, would be minimal with the exception of park impacts. The overall general socioeconomic benefit of improving the regional transportation system is critical for satisfying the purpose and need of the proposed action, while meeting the projected traffic demands wrought by other projects currently underway or planned by VDOT and others.

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION AND HISTORY

The Tri-County Parkway Location Study evaluates a new north/south transportation link in northern Virginia that will connect the City of Manassas with Interstate 66 (I-66) and the Dulles corridor. The corridor begins in the north at the intersection of US 50 and Route 606 (Old Ox Road) and extends to the south at the interchange of VA 28/VA 234 Bypass. It is approximately 15 miles long and traverses portions of the counties of Prince William, Fairfax, and Loudoun along with the cities of Manassas and Manassas Park.

The Tri-County Parkway was first identified during the development of the transportation element of the comprehensive plans for Prince William, Fairfax, and Loudoun counties. The Tri-County Parkway has been the subject of many local studies and plans and has been known by many names throughout the years. In Prince William County, it has been referred to as the "Route 28 Bypass" and, in Loudoun County, the Tri-County Parkway has been known as the "Loudoun County Parkway". Several conceptual alignments were considered through Fairfax County even before it was first proposed in their comprehensive plan. The Tri-County Parkway has been incorporated in the three counties' comprehensive plans for over ten years. The Tri-County Parkway was adopted by the Metropolitan Washington Council of Governments (MWCOG) and included in their Constrained Long-Range Plan (CLRP) and Transportation Improvement Program (TIP) in the early to mid 1990s. Figure 1.1-1 illustrates the Tri-County Parkway project from a regional perspective, while Figure 1.1-2 depicts the study area within which Tri-County Parkway alternatives will be evaluated.

The three counties that the Tri-County Parkway will traverse are among the top ten fastest growing counties in the Commonwealth of Virginia. According to the 2000 Census, Loudoun County's population grew by 97 percent from 1990 to 2000. Prince William County's and Fairfax County's population grew by 30 percent and 19 percent, respectively, during those same years. The City of Manassas and the City of Manassas Park are also located within the Tri-County Parkway study area. Both of these cities have experienced substantial population growth over the last ten years. The City of Manassas had a population growth of 26 percent and the City of Manassas Park grew by 53 percent.

Much of the growth in Northern Virginia can be attributed to the emergence of high-tech industries near the Washington Dulles International Airport. By the year 2025, employment in the Dulles/Tysons corridor is expected to reach 280,000 jobs - 71 percent more than current conditions. The Dulles/Tysons corridor will become the second largest employer in the Washington Metropolitan region, second only to downtown Washington D.C. Prince William County and the City of Manassas have also experienced significant high-tech industry growth. The Dulles area consists of the Dulles Greenway, VA 7, VA 28, and US Route 50.

A second rapid growth corridor within the region is the I-66 corridor. Transportation improvements for the I-66 corridor from Interstate 495 (I-495) to the Gainesville area were evaluated in January 1999 as part of a comprehensive study entitled "The I-66 Corridor Major Investment Study (I-66 MIS)." Information from that study revealed that population in the I-66 corridor located within Fairfax, Prince William, and Loudoun counties is projected to increase from 269,000 persons in 1999 to 466,000 persons in 2020. This represents a 73 percent increase in population over the 22-year time frame. Employment is estimated to increase 83 percent in this same time period (from 162,000 jobs in 1999 to 296,000 jobs in 2020).

The primary problem the Tri-County Parkway is intended to address is the lack of adequate north-south transportation facilities linking the I-66 corridor with the Dulles area and VA 267. East of US 15 and west of the I-495 (Capital Beltway), only three principal urban arterials link the spokes together - VA 28 (Sully Road), Route 7100 (Fairfax County Parkway), and VA 123. These north-south facilities are heavily congested and will deteriorate further by the year 2025.

Level of service on VA 28 is currently deficient in the a.m. and p.m. peak periods. By 2025, most segments of VA Route 28 northbound in the a.m. and southbound in the p.m. are expected to operate at LOS F or G (a severely congested state). Traveling south in the p.m. between the Fairfax County line

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FIGURE 1.1-1
REGIONAL LOCATION MAP

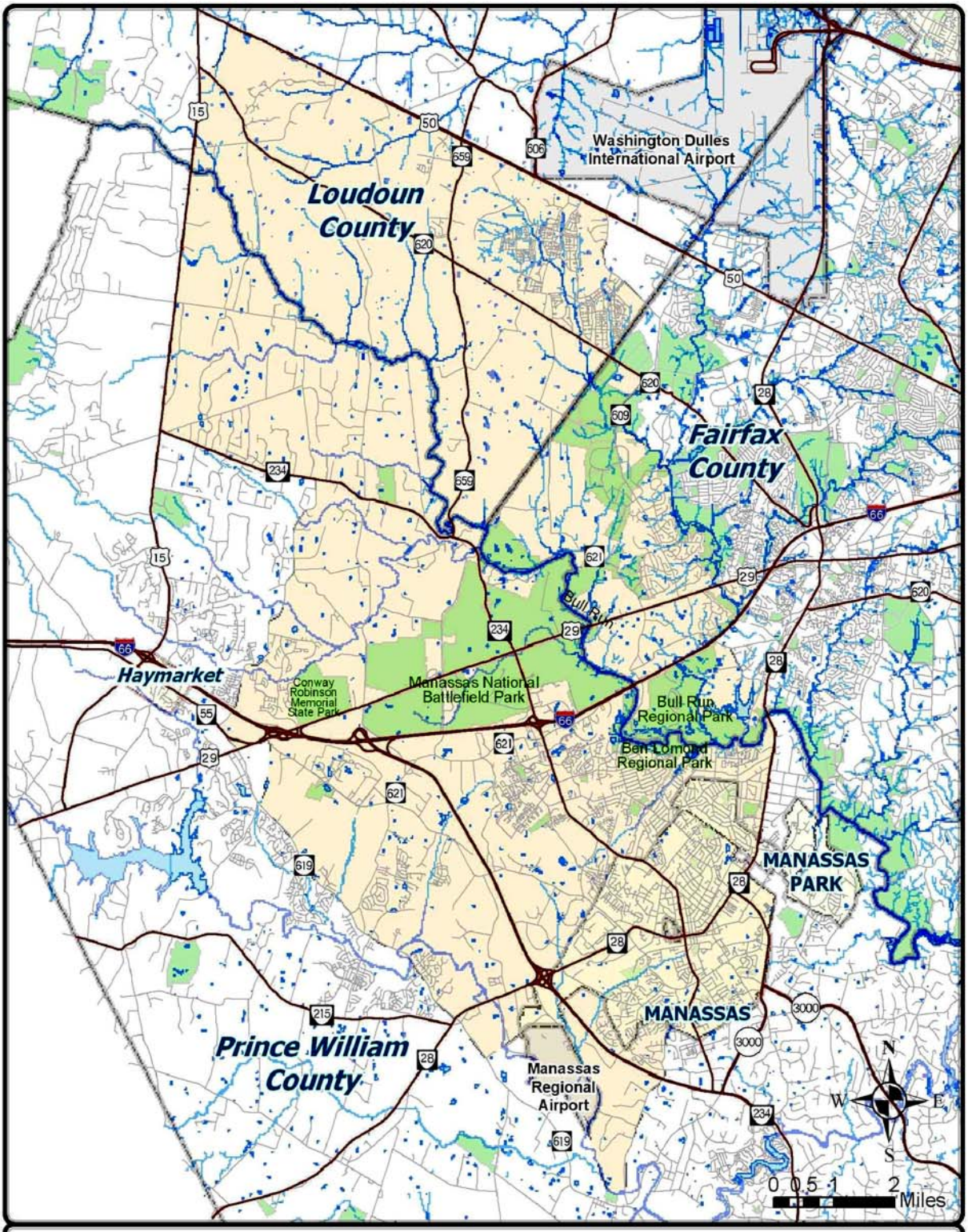

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FIGURE 1.1.2
STUDY AREA

and I-66, speeds are estimated to drop along VA 28 from an already slow 18 miles per hour (mph) to 13 mph between 2000 and 2025. The posted speed limit in this area is 45 mph. By 2025 the peak periods for a.m. and p.m. traffic on VA 28 could extend for over three hours each; however, improvements to VA 28 have been proposed under the Virginia Public-Private Transportation Act (VPPTA) of 1995 to convert the 14-mile stretch of VA 28 between I-66 and Route 7 to a limited access freeway. That project would involve widening VA 28 to an eight-lane section, as well as replacing up to ten signalized intersections with grade-separated interchanges. If the VA 28 improvements project is completed as planned, the added capacity should increase speeds and reduce congestion along VA 28 - in effect improving operating speeds in the a.m. and p.m. peak periods.

1.2 PURPOSE AND NEED

The study area presently lacks adequate north-south transportation facilities linking the I-66 corridor with the Dulles area and VA 267. The purpose and need for the Tri-County Parkway is comprised of four key elements. Each of the elements is a critical and salient factor to be addressed by the transportation alternatives. There is no attempt to weight one element over the others. Each of the elements has equal value and importance in the overall transportation, environmental, economic, and quality of life objectives for the communities being served under the proposed action. The four elements are listed below and are further elaborated in Sections 1.3 through 1.7 of the associated document titled Purpose and Need Statement (VDOT, 2003):

1. Improve transportation mobility and capacity and, by doing so, improve access and reduce congestion.
2. Enhance the linkage of communities and the transportation system that serves those communities.
3. Accommodate social demands, environmental goals, and economic development needs.
4. Improve safety and, by doing so, reduce the average crash, injury, and accident rates on the roadway network.

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2.0 ALTERNATIVES CONSIDERED

In accordance with NEPA requirements, alternatives initially considered for the Tri-County Location Study included the No-Build, Mass Transit, Transportation System Management (TSM), and Candidate Build Alternatives (CBAs). Each alternative was evaluated with respect to its potential impacts and its ability to address the project's purpose and need.

2.1 ALTERNATIVES ELIMINATED FROM DETAILED STUDY

Assessments conducted as part of the Tri-County Parkway Location Study determined that the nature of the study area makes the identification of a mass transit alternative that can address the corridor's purpose and need problematic. No transit authority exists whose service area covers or would cover the entire study area, nor are there plans to establish such an authority. In addition, the development patterns and traffic patterns and volumes within the study corridor do not favor north-south through movement along the corridor. The majority of trips and greatest volumes are to points outside the study area or along only a portion of the corridor (i.e., from the Manassas and Centerville areas to I-66 and points east, from the South Riding area to the Dulles corridor). The through volumes are by far the weakest in the study area and would not attract sufficient transit riders to make such service viable; therefore, the mass transit alternative was eliminated from further consideration.

There are no practicable Transportation System Management (TSM) measures beyond those already proposed in the CLRP and VDOT Six Year Plan which could reasonably be implemented to satisfy the purpose and need for the Tri-County Parkway. TSM-type improvements programmed into the aforementioned plans do not satisfy the project's purpose and need when considered as a stand-alone alternative; therefore, the TSM Alternative was eliminated from further consideration.

2.2 THE NO-BUILD ALTERNATIVE

Consistent with the requirements of the NEPA and related FHWA guidelines, full consideration is given to the environmental consequences of taking no action to meet future travel demand (hereinafter referred to as the "No-Build Alternative"). The No-Build Alternative includes currently programmed committed and funded roadway and transit projects in the Virginia Department of Transportation (VDOT) Six Year Plan and the CLRP developed by the MWCOG. The No-Build Alternative, while having no direct construction costs, would result in other economic, environmental, and quality of life impacts that can be expected from the continuation of roadway system deficiencies. While the No-Build alternative does not meet the project needs for traffic, safety, and roadway infrastructure improvements, it provides a baseline condition with which to compare the improvements and consequences associated with the Candidate Build Alternatives. The following is a list of major projects identified in the CLRP which influence the Tri-County Parkway study area:

- Dulles/VA 7 Corridor
- VA 28 Corridor
- Prince William Parkway (VA 3000) Corridor
- Fairfax County Parkway (VA 7100) Corridor
- I-66/US 29/US 50 Corridor
- I-495 (Beltway) Corridor
- Manassas National Battlefield Park Bypass
- Western Transportation Corridor

2.3 CANDIDATE BUILD ALTERNATIVES

Three Candidate Build Alternatives (CBAs) have been identified for further evaluation in a Draft Environmental Impact Statement (EIS). These CBAs are referred to hereinafter as: (1) the

"Comprehensive Plan" CBA, (2) the "West Two" CBA, and (3) the "West Four" CBA. The process leading to the identification of these three CBAs is discussed in greater detail in the associated document tilted Alternatives Identification, Development, and Screening Technical Report (VDOT, 2004). The northern and southern termini for these CBAs have been selected in accordance with FHWA Technical Guidelines for termini development and are discussed in greater detail in the associated document titled Logical Termini Technical Memorandum (VDOT, 2003).

Each of the CBAs is expected to be comprised of two or more facility types according to localized needs and goals. To assess environmental effects associated with a particular facility type along each CBA, three general design concepts have been developed:

- General Design Segment 1 (hereinafter referred to as "Segment 1").
- General Design Segment 2 (hereinafter referred to as "Segment 2").
- General Design Segment 3 (hereinafter referred to as "Segment 3").

The process leading to the development of these general design segments is presented in the associated document tilted Study Location Report (VDOT, 2004). The three general design segments developed for purposes of this assessment are depicted in Figure 2.3-1 and are described as follows:

- *Segment 1*. *Segment 1* will provide a controlled access facility with four 12-foot lanes divided with a 42-foot graded grass median and 10-foot multi-use trail. The 42-foot wide median will allow for expanding to six lanes in the future. Segment 1 could either include (1) paved shoulders in areas where right-of-way is needed or (2) curb and gutter in areas where portions of the facility have been partially constructed and right-of-way exists. These design options are represented as Option 1 and Option 2, respectively. The median width will be transitioned to include additional width at all intersection approaches to allow for construction of dual left turn lanes, as necessary.
- *Segment 2*. *Segment 2* will provide a limited access facility with four 12-foot lanes divided with a 42-foot graded grass median, paved shoulders, and 10-foot multi-use trail. The median width will be transitioned to include additional width at all intersection approaches to allow for construction of dual left turn lanes, as necessary.
- *Segment 3*. *Segment 3* will provide a limited access facility with six lanes (four 12-foot outside lanes and two 13-foot inside lanes) divided with a 42-foot graded median, paved shoulders, and a 10-foot multi-use trail. The 13-foot inside lanes are adjacent to curbed median only.

2.3.1 The Comprehensive Plan CBA

The Comprehensive Plan CBA is so named because it incorporates certain alignments recognized in local Comprehensive Plans. The Comprehensive Plan CBA would be located east of the Manassas National Battlefield. The Comprehensive Plan CBA would provide a new urban principal arterial roadway from the northern terminus at the intersection of US 50 and Route 606 (Old Ox Road) and the southern terminus at the Route 28 and Route 234 Bypass Interchange, and would consist of Segments F', F, and E (see Figure 2.3-2). Segment F' between Route 50 and Route 620 would be comprised of improvements along an existing four-lane divided facility within an existing right-of-way on an existing alignment. Segment F' south of Route 620 would be a new four-lane divided facility within a new right-of-way on a new alignment. Three separate sections characterize segment E. The portion of Segment E between I-66 and the Fairfax/Prince William county line would be a new six-lane divided facility within a new right-of-way on a new alignment. The portion of segment E from the Fairfax/Prince William county line south to VA 234 would be a new six-lane divided facility within an existing right-of-way on an existing alignment. The portion of Segment E from VA 234 to the VA 234 Bypass would be comprised of improvements along an existing four-lane divided facility called Godwin Drive and would be widened to a six-lane divided facility within the existing right-of-way and on an existing alignment. The Comprehensive Plan CBA would consist of three of the aforementioned general design segments in the following areas:

- *Segment 1 (Options 1 and 2)* will extend from the intersection of US 50 and Route 606 (Old Ox Road) in Loudoun County to the Fairfax County Line.

- *Segment 2* will extend from the Fairfax County Line to I-66 (east of the Manassas National Battlefield).
- *Segment 3* will extend from I-66 in Fairfax County to Route 234 in Prince William County.

2.3.2 The West Two CBA

The West Two CBA is located west of the Manassas National Battlefield. The West Two CBA would provide a new urban principal arterial roadway from the northern terminus near the intersection of US 50 and Route 877 (Racefield Lane) and the southern terminus at the I-66 and Route 234 Interchange. The West Two CBA would be a new four-lane divided facility within a new right-of-way and on a new alignment, and would consist of Segments D and C (see Figure 2.3-2). The West Two CBA would consist of two of the aforementioned general design segments in the following areas:

- *Segment 1 (Option 1)* will extend from the intersection of US 50 and 877(Racefield Road) in Loudoun County to the Prince William County Line.
- *Segment 2* will extend from the Prince William County Line to the interchange of I-66 and Route 234 (west of the Manassas National Battlefield).

2.3.3 The West Four CBA

The West Four CBA is also located west of the Manassas National Battlefield. The West Four CBA would provide a new urban principal arterial roadway from the northern terminus at the intersection of US 50 and Route 606 (Old Ox Road) and the southern terminus at the I-66 and Route 234 Interchange. The West Four CBA would consist of Segments F', G, and C (Figure 2.3-2). Segment F' between Route 50 and Route 620 (Braddock Road) would be comprised of improvements along an existing four-lane divided facility within an existing right-of-way on an existing alignment. Segment F' south of Route 620 would be comprised of a new four-lane divided facility within a new right-of-way on a new alignment. The West Four CBA would consist of two of the aforementioned general design segments in the following areas:

- *Segment 1 (Option 1)* will extend from the intersection of US 50 and Route 606 (Old Ox Road) in Loudoun County to the Prince William County Line.
- *Segment 2* will extend from the Prince William County Line to the interchange of I-66 and Route 234 (west of the Manassas National Battlefield).

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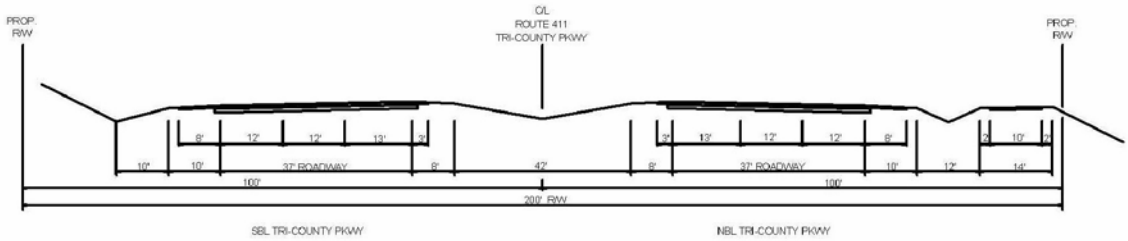
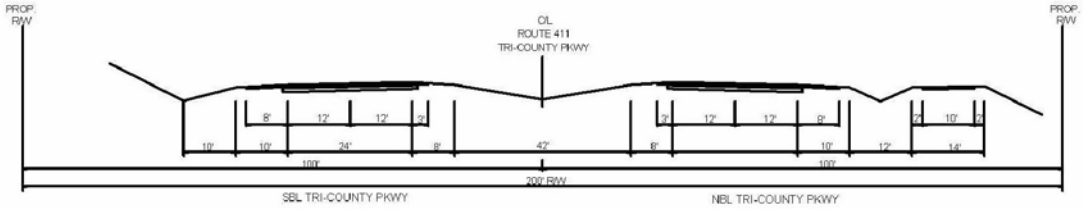
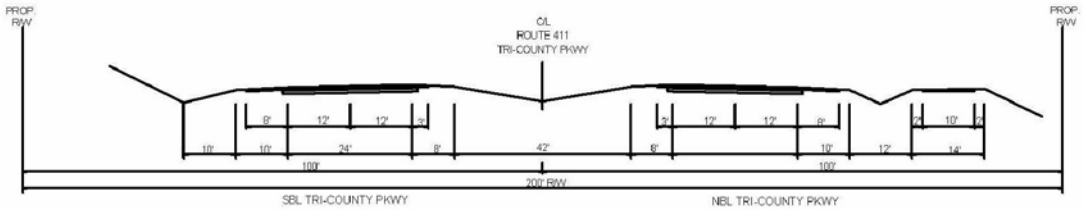


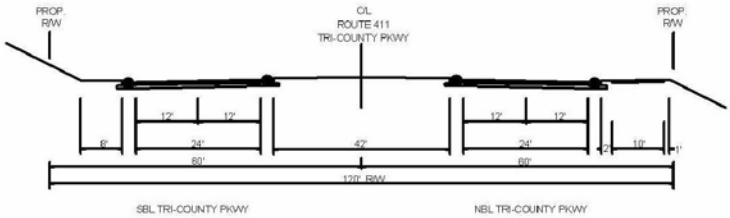
GENERAL DESIGN SEGMENT 3



GENERAL DESIGN SEGMENT 2



GENERAL DESIGN SEGMENT 1, OPTION 1



GENERAL DESIGN SEGMENT 1, OPTION 2

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FIGURE 2.4-1
GENERAL DESIGN SEGMENTS
TYPICAL SECTIONS

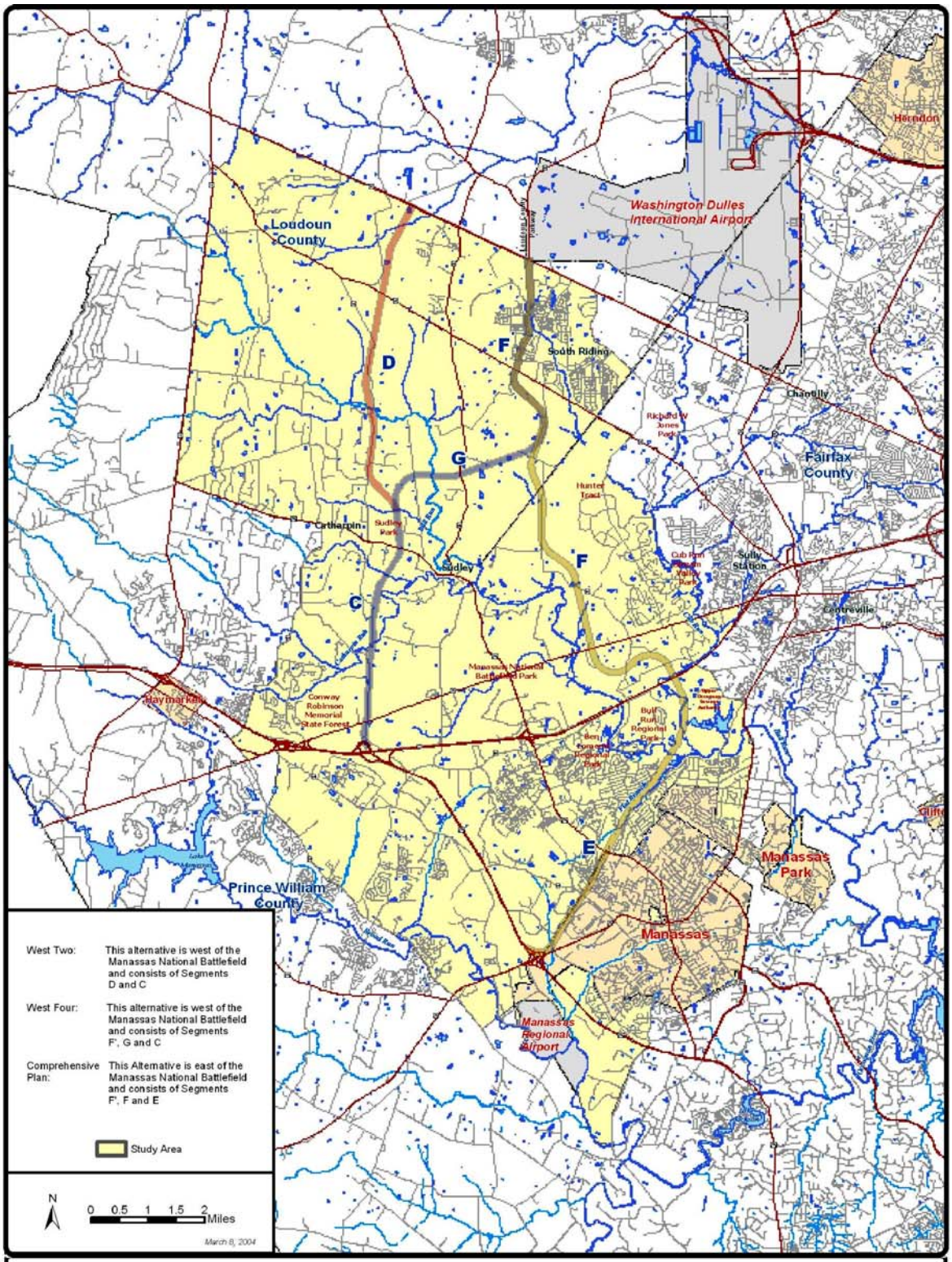

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FIGURE 2.4-2
CANDIDATE BUILD ALTERNATIVES

3.0 CUMULATIVE IMPACTS OF PAST ACTIONS

Council of Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR §§ 1500-1508) require federal agencies to address and consider cumulative impacts of proposed actions. In order to determine the cumulative impacts associated with a proposed action, an understanding of past cumulative impacts is needed to asses the incremental effects of the proposed action.

3.1 PAST POPULATION GROWTH TRENDS

The following is a summary of past population growth trends and resulting development that has occurred within the study area and surrounding region. This discussion serves as a baseline for the determination of cumulative impacts associated with present and foreseeable future actions. The conversion of the natural environment (i.e., forests, etc.) to the built environment (i.e., residential development, etc.) is strongly correlated with those population growth trends shown in Table 3-1.

TABLE 3.1-1
HISTORIC CENSUS DATA

Year	Jurisdiction				
	Fairfax	Loudoun	Prince William	City of Manassas	City of Manassas Park
1790	12,320	18,962	11,615	- -	- -
1800	13,317	20,523	12,733	- -	- -
1810	13,111	21,338	11,311	- -	- -
1820	11,404	22,702	9,419	- -	- -
1830	9,204	21,939	9,330	- -	- -
1840	9,370	20,431	8,144	- -	- -
1850	17,430	22,079	8,129	- -	- -
1860	11,834	21,774	8,565	- -	- -
1870	12,952	20,929	7,504	- -	- -
1880	16,025	23,634	9,180	- -	- -
1890	16,655	23,274	9,805	- -	- -
1900	18,580	21,948	11,112	- -	- -
1910	20,536	21,167	12,026	- -	- -
1920	21,943	20,577	13,660	- -	- -
1930	25,264	19,852	13,951	- -	- -
1940	40,929	20,291	17,738	- -	- -
1950	98,557	21,147	22,612	- -	- -
1960	275,002	24,549	50,164	- -	- -
1970	455,021	37,150	111,102	- -	- -
1980	596,901	57,427	144,703	15,438	6,524
1990	818,584	86,129	215,686	27,957	6,734
2000	969,749	169,599	280,813	35,135	10,290

US Historical Census Browser, Geospatial and Statistical Data Center, University of Virginia Library (http://fisher.lib.virginia.edu/collections/stats/histcensus/), Accessed June 2004.
US Bureau of the Census, Population of Counties by Decennial Census: 1900 to 1990 – VIRGINIA, Richard L. Forstall, Washington, DC 20233. Accessed June 2003

3.2 PRE-CONTACT

Human occupation of the study area dates back to the Paleoindian period, which began about 10,000 B.C.; however, it was not until the Late Woodland period (from 900 A.D. to 1600 A.D.) that settlement patterns became more sedentary and populations began to dramatically grow. During this period, the landscape was dominated by forests. These forests were often interspersed with large expanses of prairies, fields, or meadows. This pattern of forest and open space was the result of land management practices of the Native Americans who used fire as the chief land management tool. Fire was used to clear land for settlements, provide a buffer for defense, clear land for farming, and create wildlife habitat for hunting.

3.3 1607 TO 1800 – EARLY SETTLEMENT

At the time of European contact, the region was occupied by a number of Native American tribes. By 1766 few of the Native American villages observed by Captain John Smith in 1608 still existed. The development of land-companies and stock-companies for trading and colonizing, and significant business expansion occurred in the region during the mid-seventeenth century. Native American uprisings limited settlement in much of the region until the eighteenth century; however, an agreement signed in 1722 effectively ended the threat of attack by Native Americans in the Piedmont frontier. With this threat removed, the settlement of the region accelerated.

The Carolina Road (whose path is roughly traced by US 15 today) was originally a path taken by groups of Native Americans traveling between the Potomac River area, through Virginia, to the Carolinas. It later became one of the major roads taken by early settlers as the frontier was pushed further inland (Ratcliffe 1978). Many of the plantations established along Bull Run were served by the Carolina Road (Prince William County Historical Commission 1996). Because the many rivers made it possible for ships to reach plantations, there was little need to develop towns as trading centers during the early years of settlement (Clark and Arrington 1933). Dumfries, which is southeast of the study area, was possibly the earliest town established in Prince William County. This town was formally established in 1749 and served as the county seat for many years (Clark and Arrington 1933; Hagemann 1988). Prince William County was formed in 1730 and included the area from Aquia Creek to the Potomac River (Clark and Arrington 1933). Although the population in the western portion of Prince William County was still sparse, the eastern portion of the county was sufficiently populated to justify the construction of a mill some time before 1749.

By 1755, the tobacco fields of the lower portion of the Northern Neck were becoming exhausted, and families began moving west (Russell and Gott 1976). During this period, the populationof much of the region grew substantially. By 1756, the population of Fairfax County was 7,628. In 1757, Loudoun County was formed and the population of Fairfax County dropped to 4,283. By 1782, however, the population of Fairfax County was up to 8,763 (Sweig 1992). Virginia had depended on an extensive river system to facilitate commercial interests throughout the state; however, navigation inland was halted at the fall line. This prevented service to the west both in receiving goods or bringing them to markets. The growing movement west after the Revolutionary War, (often away from the waterways) necessitated an organized program of canals, river navigations, railroads, turnpikes, and bridges. The lack of adequate roads was still a hindrance to settlement during this period. As late as 1751, records indicate that a road had yet to be cleared from the Little River in Alexandria to Ashby's Gap less than 20 miles to the west (Scheel 1987). This road (now US 50) had been constructed by the time Loudoun County was formed, but by 1758 the population of the southern portion of Loudoun County is estimated to have reached only approximately six people per square mile and only one town (Leesburg) had been established in the county (Scheel 1987; Osbourn 1998).

Many of the roads constructed during this period were designed to link one water-powered mill with another (Marsh 1998). The construction of mills and the roads to them was of primary importance since farmers growing corn and wheat required access to grist mills (Scheel 1987). In Loudoun County after the Revolutionary War, grains surpassed tobacco in economic importance (Scheel 1987:26). Overland transportation through some parts of the project area was improving during this time period, and the

eastern portions of the region began experiencing an increase in population (Clark and Arrington 1933; Hagemann 1988). By the end of the eighteenth century, Fairfax County had grown from a sparsely populated rural area to an area supporting an affluent colonial society (Sweig 1992). By the close of the Revolutionary War, the activities of the county centered around the town of Alexandria. All of the major roads of the region passed through Alexandria, and commercial opportunities were abundant (Sweig 1992). By the end of the 1700's, Alexandria and Fairfax County had grown substantially.

3.4 1800-1900 – AGRARIAN TO INDUSTRIAL

During the beginning of this period, the upper Piedmont of Virginia was becoming less exclusively rural and agricultural. Towns and villages grew in size and, as a result, public buildings associated with governmental, religious, and educational activities became more common. Overland transportation in the more heavily populated part of the area improved dramatically during the late eighteenth and early nineteenth centuries. The earliest private turnpike charter (the Fairfax and Loudoun Turnpike Road) was granted in 1796 (Sweig 1992:148); however, this road was not actually built until after the turn of the century. Roads in more sparsely populated regions were still a major concern around the turn of the century. The Little River Turnpike, one of the oldest roads in the United States, was completed in 1806. The road extended west from Washington through the lower portion of Loudoun County, passing the northern boundary of the current study area where US 50 is located today (Virginia Historic Landmarks Commission Staff, 1970). Railroads reached Virginia in 1827 when the Baltimore and Ohio Railroad Company entered the state. During the last decade of the eighteenth century and into the early nineteenth century, Fairfax County and Alexandria continued to grow. This development was not necessarily concentrated in the current study area, but economic change and population growth in the western part of the county was undoubtedly tied to growth in the Alexandria area.

During this period, improvements to transportation brought about by railroads were heavily influencing growth of the region. Gainesville was originally established as a railroad depot when the railroad built its line through the region. The Orange and Alexandria Railroad reached Tudor Hall (later known as Manassas) in 1852 (Evans 1989). The junction of the Manassas Gap and Orange and Alexandria railroads at this location spurred the growth of this hamlet (Salmon 1994; Evans 1989). Although an inn and a tavern were built at the junction during the 1850s, it was not until after the Civil War that the town saw significant growth. Dairy farming began to gain in importance in Prince William County during the 1850s, with the railroad facilitating the distribution of products (Ratcliffe 1978). Prince William County was devastated by the Civil War and reconstruction required considerable effort. The location of Manassas at the junction of two important railroads allowed the town to prosper and grow rapidly at a time when other towns in Virginia were still struggling with the aftereffects of war (Evans 1989). The establishment of several rail lines through the county provided a major boost for the economy. By the early 1870s, three rail companies had established lines in Fairfax County (Reed 1992a). Although wagons continued to carry large quantities of goods to the markets in Washington, the railroads played a major role in the economic development of the county.

3.5 1900 TO 1925 – INDUSTRIAL URBANIZATION

During the first several decades of the twentieth century, much of the region was still primarily rural. Although farming was the main occupation, the lumbering industry was also important to local economies. During the first two decades of the twentieth century, the Fairfax County economy began to grow. The emergence of the county as a leading dairy producer spawned the construction of better roads and rail services to enhance the business connection with the Washington, D.C., area. As late as the time of World War I, however, cattle herds were still moved along roads in Fairfax and Loudoun counties. The new transportation services brought more residents and businesses to Fairfax County and, by 1925, it was a top producer of dairy products and its economy was stabilizing (Steadman 1964). In 1900, the population of Prince William County was approximately 11,000 people, no larger than it had been in 1790 (Evans 1989).

3.6 1925 TO 1950 – AUTOMOTIVE URBANIZATION

As the region emerged from the depression of the 1920s and 1930s, the agricultural economy was faltering and there was an influx of residents due to the expansion of the federal bureaucracy. By 1945, land in Fairfax County was being appraised on residential rather than farm value (Netherton 1992). During the Depression, agricultural prices dropped, and many residents of Prince William County were forced to find work to supplement their farm incomes. Some residents were employed building roads, such as Route 55 through Haymarket. After the effects of the Depression had subsided, many residents of the area found work in the city of Washington, and the region became home to a large population of commuters (Bowers 1990).

3.7 1950 TO 1975 – HIGHWAY URBANIZATION

By 1950, the population of Prince William County had grown to approximately 21,000 people. This represented a growth of nearly 100 percent over the population at the turn of the century. The growth of suburbs in the county was facilitated by the construction of Interstate 95 in the 1950s (Evans 1989). After World War II, the city of Fairfax and the surrounding county were transformed into one of the major suburbs of the Washington, D.C. area. Family farms began disappearing, and commercial farming and urban lifestyles become more widespread. During the 1940s and 1950s, the county's population grew from 40,900 to 98,500. New subdivisions were constructed, especially to the east of the current study area in areas closer to the capital, and the demand for paved streets, schools, libraries, sewer systems, and other amenities increased. By the mid-1960s, Fairfax County had 454,300 residents and was continuing to attract newcomers. By the early 1970s, the county's population stood at nearly half a million people, and a mass transportation system became a necessity. Satellite/commuter parking lots were established and bus/commuter lanes were designated on the major highways (Netherton and Netherton 1992). In the 1950s Loudoun County contained areas of "outer suburbia" with relatively expensive land, as well as significant areas with rural types of settlement. The county experienced population growth of 40 percent in the 1960s, however, with parts of the county experiencing more intensive suburban growth related to the Washington, D.C. metropolitan area. Though the growth rate has been comparably less than that of Prince William and Fairfax counties, suburban sprawl and the addition of major zones of development associated with the Dulles International Airport have contributed to losses in the rural character of some parts of Loudoun County (Gottmann 1969).

3.8 1975 TO PRESENT – SUBURBAN DEVELOPMENT

For most of its history, the study area was dominated by forest. Although small suburban settlements were common by the early 1900's, the economy of the study area was based on agricultural and forestry products until the middle of the century. The population boom in the post-World War II years, the growth of the federal government, and the advent of the automobile as the primary mode of personal transportation spurred the suburbanization process and much of the study area evolved into residential communities for Washington, D.C. Today, much of the study area is densely populated and is fully integrated into the regional economy.

4.0 INDIRECT EFFECTS AND CUMULATIVE IMPACTS

Indirect effects and cumulative impacts associated with the construction of the proposed Tri-County Parkway have been assessed in accordance with the Council of Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR §§ 1500-1508).

4.1 INDIRECT EFFECTS

Primary factors affecting growth and land management practices specific to the proposed action were identified in order to guide an analysis of reasonably foreseeable indirect effects at each proposed interchange/intersection location within the study area. Existing land use maps were reviewed to identify a general inventory of currently developed and undeveloped land within the project impact zone. The most recently updated county comprehensive plans were used to estimate future land uses within the study area through year 2030. Coordination with the local government representatives was also conducted to obtain any information that might not be addressed in the most recently available comprehensive plans.

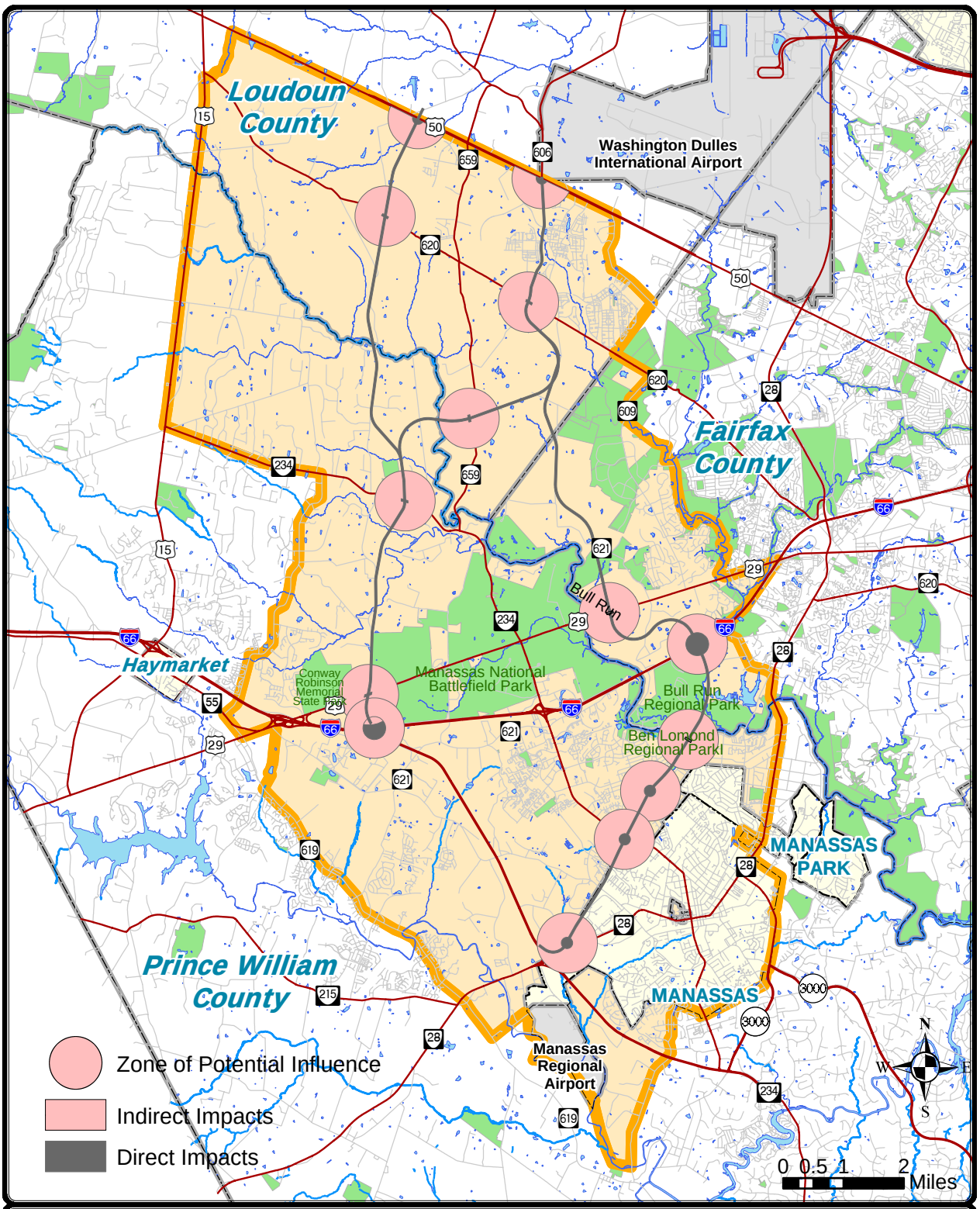
It is reasonable to assume that a certain degree of development will ultimately occur in the vicinity of those interchanges/intersections proposed within the study area. A zone of potential influence having a one-half-mile radius around each proposed interchange/intersection was used to estimate the amount of undeveloped land that could be developed for non-highway use that is not accounted for in the various county comprehensive plans. As previously discussed, each county is responsible for zoning and their decisions pertaining to allowable population density will be the primary determinant of the magnitude of future growth within the study area.

Seven grade-separated interchanges and seven at-grade intersections have been assessed with respect to indirect effects and cumulative impacts for the various CBAs. The locations of these interchanges/intersections are shown in Figure 4.1-1. In order to determine the indirect effects associated with these interchanges/intersections, the direct effects associated with the construction of the proposed roadway and interchange ramps (where applicable) must be accounted for. The total amount of land required for each interchange/intersection is then subtracted from each zone of potential influence to determine the amount of undeveloped land that could be developed for non-highway use. The amount of direct effects associated with these interchanges/intersections is dependant upon the type of interchange/intersection proposed and the alignment of the roadway.

The locations of assessed grade-separated interchanges and the CBA(s) under which they are proposed are as follows:

- VA 234 (Comprehensive Plan CBA, Segment E)
- VA 234 Business (Comprehensive Plan CBA, Segment E)
- Lomond Drive (Comprehensive Plan CBA, Segment E)
- I-66 east of the MNBP (Comprehensive Plan CBA, Segments E and F)
- US 50 east of the MNBP– (Comprehensive Plan CBA and West Four CBA, Segment F')
- I-66 east of the MNBP (West Two CBA and West Four CBA, Segment C)
- US 50 east of the MNBP (West Two CBA,, Segment D)

The direct effects associated with these interchanges assume an average limit of construction width of 200 feet for the proposed roadway and a 500-foot radius for the construction associated with the interchange itself; however, the radius associated with the construction of the I-66 interchanges assumes a 1,000-foot radius which accounts for the larger area required to construct the ramps associated with these interchanges.



Tri-County PARKWAY Location Study

FIGURE 4.1-1
PROPOSED INTERCHANGE LOCATIONS

The direct effects associated with the at-grade intersections also assume an average limit of construction width of 200 feet for the proposed roadway. Since these intersections do not involve the construction of ramps, no radius was needed to account for additional impacts; however, in order to account for additional turning lanes associated with these intersections, a 200-foot-wide limit of construction was applied to the existing crossroads for a distance of 200 feet on either side of the proposed roadway. The seven at-grade intersections proposed for the various CBAs would be located at:

- Ben Lomond Park Access (Comprehensive Plan CBA, Segment E)
- US 29 east of the MNBP (Comprehensive Plan CBA, Segment F)
- Braddock Road east of the MNBP (Comprehensive Plan CBA and West Four CBA, Segment F')
- US 29 west of the MNBP (West Two CBA and West Four CBA, Segment C)
- Sudley Road (West Two CBA and West Four CBA, Segment C)
- Gum Spring Road (West Four CBA, Segment G)
- Braddock Road west of the MNBP (West Two CBA, Segment D)

4.1.1 Land Use Conversions

Existing land use within each intersection/interchange assessment area (zone of potential influence) described above is provided in Table 4.1-1. Direct effects associated with construction of intersections/interchanges under consideration are shown in Table 4-1-2. The remaining area within each zone of potential influence was then analyzed to determine the amount of undeveloped land that could be developed for non-highway use in accordance with local comprehensive plans (Table 4.1-3). Table 4.1-4, Table 4.1-5, and Table 4.1-6 show indirect effects associated with induced or accelerated development (i.e., the conversion of forests to commercial areas, etc.) that construction of intersections or interchanges might bring under implementation of the West Two CBA, the West Four CBA, and the Comprehensive Plan CBA, respectively. Differences shown reflect the relative degree of current land development within portions of the study area traversed by each of the CBAs (with the West Two CBA corridor currently being the least developed and the Comprehensive Plan CBA corridor currently being the most developed).

Under the build condition, the amount of undeveloped land that would be available for other types of development is less than what is currently available because construction of an intersection or an interchange would consume a portion of this land. The conversion of remaining undeveloped land is not a result of the proposed project, but rather the result of the future land use proposed by the various county and city comprehensive plans. Given the degree of land use conversions projected under local comprehensive plans (i.e., from undeveloped to developed), the nature of land use would not change substantially following implementation of a CBA and the type of projected development would occur with or without the project.

Although provision of intersections or interchanges may serve to accelerate land conversions shown in Table 4.1-4, Table 4.1-5, and Table 4.1-6, it is concluded that land use conversions in the vicinity of intersections/interchanges proposed under each of the CBAs will be comparable to those projected under the No-Build condition. As such, indirect effects is not a critical factor in selecting an alternative. While development will occur at a slower rate for undeveloped lands located further away from existing or proposed roadways, development is expected to continue as it has for the past several decades. This trend is expected to continue regardless of whether the Tri-County Parkway is constructed or not.

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TABLE 4.1-1
EXISTING LAND USE WITHIN INTERSECTION/INTERCHANGE ASSESSMENT AREAS

Land Use	Proposed Intersection or Interchange													
	VA 234	VA 234 Business	Lomond Drive	*Ben Lomond Park Access*	I-66 (East of MNBP)	*US 29 (East of MNBP)*	*Braddock Road (East of MNBP)*	US 50 (East of MNBP)	I-66 (West of MNBP)	*US 29 (West of MNBP)*	*Sudley Road*	*Gum Spring Road*	*Braddock Road (West of MNBP)*	US 50 (West of MNBP)
Agriculture	158.0	42.3	34.9	0.1	50.5	89.0	135.6	156.3	94.9	73.6	153.0	203.4	302.9	120.0
Commercial	11.0	95.3	1.5	0.5	0	20.9	0	0.6	3.6	9.8	11.5	0	46.0	18.7
Forest	0	19.9	3.7	0.5	47.8	8.9	138.7	29.2	130.1	48.0	70.7	87.8	82.1	31.3
Industrial	208.2	4.4	0	32.9	46.8	111.7	0	16.6	85.5	0	0	96.7	0	0
Park	0	15.2	19.9	241.5	166.9	47.2	6.2	0	108.1	269.9	0	0	0	0
Public	62.6	37.5	29.5	0	7.5	16.6	0.7	0	0.7	0.8	3.2	0	6.1	0
Residential	24.1	251.8	377.2	201.3	96.5	182.0	194.3	23.0	0	74.5	238.4	88.8	40.3	53.0
Transitional	38.5	36.0	35.7	25.6	86.4	26.1	26.9	17.4	79.5	25.8	25.6	25.7	25.0	18.6
Total	502.4	502.4	502.4	502.4	502.4	502.4	502.4	243.1	502.4	502.4	502.4	502.4	502.4	241.6

Note: Headings shown in italics denote at-grade intersections. Non-italicized headings denote interchanges on structure.

TABLE 4.1-2
DIRECT EFFECTS WITHIN INTERSECTION/INTERCHANGE ASSESSMENT AREAS

Land Use	Proposed Intersection or Interchange													
	VA 234	VA 234 Business	Lomond Drive	*Ben Lomond Park Access*	I-66 (East of MNBP)	*US 29 (East of MNBP)*	*Braddock Road (East of MNBP)*	US 50 (East of MNBP)	I-66 (West of MNBP)	*US 29 (West of MNBP)*	*Sudley Road*	*Gum Spring Road*	*Braddock Road (West of MNBP)*	US 50 (West of MNBP)
Agriculture	17.4	19.8	13.6	0	33.8	13.2	8.6	17.2	4.3	3.5	11.0	7.3	15.4	13.5
Commercial	0.4	4.2	0	0	0	1.1	0	0	0	0.1	0	0	5.8	0.6
Forest	0	0	13.6	3.5	5.3	0	12.7	0	70.0	13.4	0.6	4.6	4.4	2.7
Industrial	5.2	2.1	0	1.4	2.1	0	0	0	0	0	0	0	0	0
Park	0	0.3	6.5	9.7	41.2	0	0.3	0	5.7	3.3	0	0	0	0
Public	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	8.7	11.2	4.0	11.6	5.1	12.4	5.9	0.4	0	6.1	14.7	14.4	0	0.3
Transitional	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	31.7	37.6	37.7	26.2	87.5	26.7	27.5	17.6	80	26.4	26.3	26.3	25.6	17.1

Note: Headings shown in italics denote at-grade intersections. Non-italicized headings denote interchanges on structure.

TABLE 4.1-3
INDIRECT EFFECTS TO FUTURE LAND USE WITHIN INTERSECTION/INTERCHANGE ASSESSMENT AREAS

Land Use	Proposed Intersection or Interchange													
	VA 234	VA 234 Business	Lomond Drive	*Ben Lomond Park Access*	I-66 (East of MNBP)	*US 29 (East of MNBP)*	*Braddock Road (East of MNBP)*	US 50 (East of MNBP)	I-66 (West of MNBP)	*US 29 (West of MNBP)*	*Sudley Road*	*Gum Spring Road*	*Braddock Road (West of MNBP)*	US 50 (West of MNBP)
Agriculture	0	0	0	0	0	4.3	0	0	0	83.8	397.5	0	0	0

Land Use	Proposed Intersection or Interchange													
	VA 234	VA 234 Business	Lomond Drive	*Ben Lomond Park Access*	I-66 (East of MNBP)	*US 29 (East of MNBP)*	*Braddock Road (East of MNBP)*	US 50 (East of MNBP)	I-66 (West of MNBP)	*US 29 (West of MNBP)*	*Sudley Road*	*Gum Spring Road*	*Braddock Road (West of MNBP)*	US 50 (West of MNBP)
Commercial	300.6	123.3	0	0	0	0	0	225.1	87.4	101.7	4.2	0	0	110.0
Forest	13.8	30.5	31.2	0	0	0	0	0	0	2.6	9.0	2.6	0	0
Industrial	40.7	0	0	58.9	0	12.5	0	0.4	222.3	0	0	21.6	0	0
Park	14.2	11.8	31.2	228.6	206.8	95.6	0	0	111.5	282.8	65.3	0	0	0
Public	30.4	49.9	21.9	6.1	33.4	0	0.1	0	1.1	5.0	0	0	1.1	0
Residential	0	229.7	380.4	182.6	146.3	353.1	235.6	0	0	0	0	0	113.2	0
Transitional*	71.0	19.6	0.03	0	28.4	10.2	239.2	0	0.1	0.1	0.1	451.9	362.5	114.5
Total	470.7	464.8	464.73	476.2	414.9	475.7	474.9	225.5	422.4	476	476.1	476.1	476.8	224.5

* - Only the future land use associated with each county's comprehensive plan includes a category for transitional land.
Note: Headings shown in italics denote at-grade intersections. Non-italicized headings denote interchanges on structure.

TABLE 4.1-4
UNDEVELOPED LANDS SUBJECT TO INDUCED OR ACCELERATED DEVELOPMENT *
WEST TWO CBA

Land Use	Proposed Intersection or Interchange					
	I-66 (West of MNBP)	*US 29 (West of MNBP)*	*Sudley Road*	*Braddock Road (West of MNBP)*	US 50 (West of MNBP)	TOTAL
Agriculture	0	83.8	397.5	0	0	481.3
Forest	0	2.6	9.0	0	0	11.6
Park	111.5	282.8	65.3	0	0	459.6
Transitional*	0.1	0.1	0.1	362.5	114.5	477.3
Total	422.4	476	476.1	476.8	224.5	2075.8

* In conformance with local comprehensive plans.
Note: Headings shown in italics denote at-grade intersections. Non-italicized headings denote interchanges on structure.

TABLE 4.1-5
UNDEVELOPED LANDS SUBJECT TO INDUCED OR ACCELERATED DEVELOPMENT *
WEST FOUR CBA

Land Use	Proposed Intersection or Interchange						
	Braddock Road (East of MNBP)	US 50 (East of MNBP)	I-66 (West of MNBP)	*US 29 (West of MNBP)*	*Sudley Road*	*Gum Spring Road*	TOTAL
Agriculture	0	0	0	83.8	397.5	0	481.3
Forest	0	0	0	2.6	9.0	2.6	14.2
Park	0	0	111.5	282.8	65.3	0	459.6
Transitional*	239.2	0	0.1	0.1	0.1	451.9	691.4
Total	239.2	0	111.6	369.3	471.9	454.5	1646.5

* In conformance with local comprehensive plans.
Note: Headings shown in italics denote at-grade intersections. Non-italicized headings denote interchanges on structure.

TABLE 4.1-6
UNDEVELOPED LANDS SUBJECT TO INDUCED OR ACCELERATED DEVELOPMENT *
COMPREHENSIVE PLAN CBA

Land Use	Proposed Intersection or Interchange								
	VA 34	VA 234 Business	Lomond Drive	*Ben Lomond Park Access*	I-66 (East of MNBP)	*US 29 (East of MNBP)*	*Braddock Road (East of MNBP)*	US 50 (East of MNBP)	TOTAL
Agriculture	0	0	0	0	0	4.3	0	0	4.3
Forest	13.8	30.5	31.2	0	0	0	0	0	75.5
Park	14.2	11.8	31.2	228.6	206.8	95.6	0	0	588.2
Transitional*	71.0	19.6	0.03	0	28.4	10.2	239.2	0	368.43
Total	99	61.9	62.43	228.6	235.2	110.1	239.2	0	1036.43

* In conformance with local comprehensive plans.
Note: Headings shown in italics denote at-grade intersections. Non-italicized headings denote interchanges on structure.

4.1.2 Effects On Water Quality

Urban development affects the physical and chemical characteristics of streams, thereby altering aquatic habitat. Increases in impervious surface result in proportional increases in runoff volume, thus, leading to erosion, stream widening, and incision, as well as increased contributions of pollutants (particularly sediment) to surface waters. In northern Virginia, pollutants and nutrients from nonpoint sources have been directly identified or indirectly suspected as potential causes for loss of biotic integrity in urban and suburban streams. Pollutants most often present in stormwater runoff from highways, roads, and bridges include: sediment; nutrients; toxic metals (including zinc, copper, cadmium, lead, chromium, and mercury); polycyclic hydrocarbons (PAH); oil and grease; MTBE (a gasoline additive); chloride, sodium, and calcium (incident to salting and sanding processes); pesticides; and road debris. Increases in concentrations of these pollutants in surface water can result in disruption of life processes for aquatic organisms (including reproduction), can be toxic to aquatic life, or can decrease habitat suitability.

The proposed action has the potential to result in indirect effects related to increases in impervious cover accelerating and minimally inducing development adjacent to a selected alternative and within the study area as a whole. When impervious cover exceeds ten percent within a given watershed, negative effects on in-stream habitat are typically observed; at 25 percent, the watershed becomes severely degraded (Center for Watershed Protection, 2003). Using roadways along with residential, commercial, industrial, and institutional development as an indicator of net impervious coverage, the watershed comprising nearly all of the study area (the Middle Potomac-Anacostia-Occoquan Subarea or Hydrologic Unit Code 02070010), is presently comprised of 30,660 acres (or 43 percent) of land uses that substantially contribute to impervious surface. Although the majority but not all of this 30,660-acre total is comprised of impervious surface, it is reasonable to assume that the ten percent threshold and possibly the 25 percent threshold have already been exceeded for the watershed. Based on future land use projected under local comprehensive plans, portions of this watershed potentially affected by intersection/interchange zones of influence will be comprised of 592.1 acres of impervious surface contributing land uses under implementation of the West Two CBA (for a net increase of 1.9 percent), 848.7 acres of impervious surface contributing land uses under implementation of the West Four CBA (for a net increase of 2.8 percent), and 2,055 acres of impervious surface contributing land uses under implementation of the Comprehensive Plan CBA (for a net increase of 6.7 percent) by year 2030. Although these increases in impervious land surfaces are projected to occur under local comprehensive plans with or without the project, any inducement or acceleration of land conversions associated with the provision of new intersections or interchanges would be of greatest concern under implementation of the Comprehensive Plan CBA.

4.1.3 Effects On Wildlife Habitat

Indirect effects to aquatic habitat would consist of stormwater runoff from the new roadway along with potential long-term increases in impervious surfaces resulting from development accommodated by or accelerated by roadway construction. Indirect impacts to aquatic habitat located downstream of streams affected by the road would be mitigated through restoration of disturbed stream banks/substrate and land surfaces immediately following the construction of any of the CBAs and through provision of stormwater management facilities designed to address water quantity and water quality both. Mitigation of effects associated with subsequent development will be spatially and temporally variable, and will be the responsibility of localities under each of their respective ordinances. Mitigation of effects attributable to roadway construction can be assured under the build scenario; however, under the No-Build scenario, such areas could be subject to types of development that may not require comparatively stringent mitigation measures and the requirement for such mitigation would be totally within the control of local jurisdictions.

Of those bisected wildlife corridors discussed in the Natural Resources Technical Report (VDOT, 2005), the following would be further affected by accelerated or minimally induced development due to their proximity to a proposed intersection or interchange:

- Bull Run Regional Park from Bull Run north to Interstate 66 in Fairfax County,
- Bull Run east to Route 659 in Prince William County, and
- to a lesser degree, Bull Run north to Route 705 in Loudon County.

Using forest lands as a primary indicator, portions of wildlife corridors potentially affected by intersection/interchange zones of influence will be 11.6 acres under implementation of the West Two CBA, 14.2 acres under implementation of the West Four CBA, and 75.5 acres under implementation of the Comprehensive Plan CBA by year 2030. Although a certain proportion of these effects to wildlife habitat and corridors are projected to occur under local comprehensive plans with or without the project, any inducement or acceleration of land conversions associated with the provision of new intersections or interchanges would be of greatest concern under implementation of the Comprehensive Plan CBA. Over this time, it can be expected that the frequency of wildlife-vehicle collisions would increase as additional roadway is added to the regional transportation network and additional land is converted as a result of secondary development. Other indirect effects would consist of increased noise pollution associated with vehicle traffic and accelerated or minimally induced development in them vicinity of new intersections and interchanges..

4.1.4 Effects On Wetlands, Floodplains, and Other Environmentally Sensitive Areas

As a function of those land use conversions discussed above, it is reasonable to expect that increased development would, over time, place additional stressors on environmentally sensitive areas through:

- encroachment into wetland buffers and increase the probability of applications requesting authorization to fill wetlands;
- encroachment into 100-year floodplains;
- encroachment into buffers of riparian systems and waters critical to populations of threatened or endangered species located downstream.

Although the aforementioned land use conversions are projected to occur under local comprehensive plans with or without the project, any inducement or acceleration of land conversions within buffers or floodplains (associated with the provision of new intersections or interchanges) would be of greatest concern under implementation of the Comprehensive Plan CBA.

4.2 CUMULATIVE IMPACTS

Past, present, and foreseeable future actions have been investigated in order to determine the cumulative impacts associated with construction of the Tri-County Parkway. Cumulative impacts have been evaluated for those resources for which sufficient information exists regarding future conditions to draw meaningful conclusions. The evaluation of these cumulative impacts has been limited to the study area.

Past actions have previously been discussed in Section 3.0 (Cumulative Impacts of Past Actions) of this report. Present and foreseeable future actions located in the study area are discussed below. Cumulative impacts are assessed from the perspective of reasonably foreseeable major public projects (as identified in regional transportation plans and local master plans) and from the perspective of reasonably foreseeable residential, commercial, and industrial development (as identified in local comprehensive plans and by local planning departments).

4.2.1 Current and Reasonably Foreseeable Actions

A proposed action must be far enough along in the planning process that its implementation is reasonably foreseeable. For this analysis, a reasonably foreseeable action is one that is funded regardless of whether it has obtained local, state, or federal approval. Table 4.2-1 presents major transportation projects listed in the 2003 Constrained Long Range Plan (CLRP) scheduled to be constructed by the design year for the project. Table 4.2-2 presents platted or locally approved subdivisions currently listed by local planning departments. Current growth trends within the study area are expected to continue throughout the next several decades: therefore, it is expected that many if not all of those residential developments listed in Table 4.2-2 will be constructed prior to construction of the Tri-County Parkway. Because development within the study area is continually changing at a substantial rate and because growth is expected to continue at or near current rates, it is reasonable to expect that residential, commercial, and industrial growth areas shown in local comprehensive plans reflect reasonably foreseeable cumulative impacts with respect to overall development. As with indirect effects (discussed in the preceding section), land use patterns projected under local comprehensive plans have been used as a measure of cumulative impacts for certain resources.

TABLE 4.2-1
2003 CLRP TRANSPORTATION PROJECTS LOCATED WITHIN THE STUDY AREA

Facility	Improvement	Location		Number of Lanes		Completion Date
		From	To	From	To	
Major Highway Improvements						
I-66 Interchange	Reconstruct	@ US 29 (Gainesville)	- -	- -	- -	2011
US 29	Widen	Pleasant Valley Drive	VA 28	4	6	2010
US 29	Widen	Virginia Oaks Drive	I-66	4	6	2011
US 29 Interchange	Construct	@ VA 55/VA 619	- -	- -	- -	2011
US 29 (add NB Lane)	Construct	I-66	Entrance to Conway Robinson MSF	4	6	2011
VA 55	Widen	Gainesville UM Church	US 29 @ VA 619	2	4	2011
East-West Connector	Construct	VA 674 (Wellington Road)	US 29 @ Entrance to Conway Robinson MSF	- -	4	2011
US 29 Grade Separation	Construct	@ N-S Railroad	- -	- -	- -	2011
US 50	Reconstruct	@ VA 609 Pleasant Valley Road	- -	4	4	2005
US 50	Widen	Loudon County Line	VA 661 (Lee Road)	4	6	2020
VA 28	Widen	N. City Limits of Manassas Park	Old Centerville Road	4	6	2025
VA 28	Widen	Residency Road	WCL of Manassas	2	4	2002

Facility	Improvement	Location		Number of Lanes		Completion Date
		From	To	From	To	
			(Vicinity of VA 234 Bypass)			
VA 28	Reconstruct /Widen	Bridge over Broad Run	Replace/Widen to Ultimate Width	2	6	2005
VA 28	Widen	VA 215 (Vint Hill Road)	Residency Road	2	4	2005
VA 28	Widen	VA 215 (Vint Hill Road)	VA 234 Bypass	4	6	2015
VA 234 (Manassas Bypass)	Widen/Upgrade	VA 234 S. of Manassas	I-66	4	6	2020
VA 234 (Manassas Bypass)	Construct	I-66	Loudon County Line	- -	4	2010
Major HOV and Transit Improvements						
I-66 HOV During Peak	Widen	US 15 (includes interchange reconstruction)	US 29 (Gainesville)	4	6	2015

TABLE 4.2-2
REASONABLY FORESEEABLE RESIDENTIAL DEVELOPMENT IN THE STUDY AREA

Development	Housing Types	Development	Housing Types
Baker Division [1]	Single Family	Lenah Run Hamlet E [1]	Single Family
Blue Spring Farm [1]	*	The Marches [1]	Single Family
Buck Division of Land [1]	*	MBP, LLC [1]	Single Family
Byrne Division [1]	Single Family	McIntosh Division [1]	Single Family
Cedar Crest [1]	Single Family	Miller Division [1]	Single Family
Duffield Division [1]	Single Family	Owens Division [1]	Single Family
Fox Division [1]	Single Family	Rendzio Division [1]	Single Family
Fox Division [1]	Single Family	Rexrode Division [1]	Single Family
Fraser Division [1]	Single Family	Ridings at Blue Spring [1]	Single Family
Gulick Division Of Land [1]	*	Savoy Woods Estates [1]	*
Harmon Easement [1]	Single Family	Smith Division [1]	*
Herndon Subdivision [1]	Single Family	South Auburn [1]	*
Hoffberger Family Subdivision [1]	Single Family	Twin Pond Acres [1]	*
Huntingdonshire Hills [1]	*	Wates Family Subdivision [1]	*
Hutcheson Subdivision [1]	*	Woodburn Division [1]	*
Hutchinson Division [1]	*	Bull Run Development Corp.	*
Hutchison Family Subdivision [1]	*		
Latham Division [1]	*		

[1] Source: Loudoun County parcel data
[2] Source: Prince William County parcel data

* Information unavailable at the time of this study..

4.2.2 Evaluation of Cumulative Impacts

The evaluation of the cumulative impacts associated with the proposed action has considered the total impacts to each resource that have occurred, are occurring, and will likely occur as a result of the proposed project. This evaluation also includes both indirect and direct effects, which are a subset of cumulative impacts. Finally, this evaluation needs to be considered in conjunction with Section 3.0 which addresses cumulative impacts from past and present actions in the study area, thereby establishing the context of the cumulative impacts. The following is a discussion of the cumulative impacts that are likely to occur as a result of constructing the Tri-County Parkway assuming that no other regional highway projects would be co-located upon any portion of the project alignment. Cumulative impacts considering possible co-location of the Manassas National Battlefield Park Bypass and the Route 234 North Bypass Extension are presented in section 4.2.3.

4.2.2.1 Land Use Impacts

Tri-County Parkway may influence the location, intensity, and nature of development that could occur near the proposed interchanges; however, based on future land uses projected under local comprehensive plans, the type of projected development would occur with or without the project. Specifically, land use conversions from (undeveloped to developed) is projected to be 30,660 acres by year 2030. By comparison the amount of land use conversion resulting from implementation of a CBA will comprise 1.1 percent of this total (or 348 acres) for the West Two CBA, 1.2 percent of this total (or 370 acres) for the West Four CBA, and 1.7 percent of this total (or 532 acres) for the Comprehensive Plan CBA. This project has been developed and designed to address the cumulative impact from land use decisions which have placed increasing pressure on the existing transportation system and the need for additional development.

4.2.2.2 Socioeconomic Impacts

The construction of the Tri-County Parkway will not result in a disproportionate impact to either minority or low-income populations in the study area. Based on population and employment projections, the type of projected changes would occur with or without the project. By connecting various commerce centers, each of the CBAs would cumulatively enhance economic development of the study area to varying degrees.

4.2.2.3 Energy Impacts

Although energy use for the existing roadway network and the network that can be expected to be in place over the reasonably foreseeable future was not calculated, the energy that is expected to be used to construct, maintain, and operate the proposed project is considered to be a minor contribution to the cumulative energy usage for this roadway network given the number of lanes miles and vehicle miles traveled associated with it.

4.2.2.4 Farmland Impacts

It is expected that the Tri-County Parkway will influence the location, intensity, and nature of development that could occur near the proposed interchanges but as the distance from the interchange grows, the influence of the Tri-County Parkway on development will decrease as existing roads and access exercise greater influence over developmental location, intensity, and nature. Based on future land uses projected under local comprehensive plans, the type of projected development would occur with or without the project. Specifically, farmland loss is projected to be 7,865 acres by year 2030. By comparison the amount of land use conversion resulting from implementation of a CBA will comprise 1.7 percent of this total (or 132 acres) for the West Two CBA, 1.3 percent of this total (or 101 acres) for the West Four CBA, and 1.0 percent of this total (or 79 acres) for the Comprehensive Plan CBA. Further, in Section 3.13, it was documented that there has been a significant reduction in agricultural lands due to past and present actions.

4.2.2.5 Relocation Impacts

Under the No-Build Alternative (which assumes that all roadway and transit projects programmed for construction in the region's CLRP will be implemented except the Tri-County Parkway), it is expected that there will be numerous relocations of residences and businesses in the study area; however an exact number cannot be determined because all of those projects have not gone forward for development yet. Construction of the Tri-County Parkway would result in the relocation of residences and businesses also. Because of all of the residential and commercial development that is occurring in the study area and is planned to occur, there will be a net increase in residential and commercial property; it is expected that any individual or family relocated as a result of this project will have ample opportunity to find replacement housing in the study area if they so desire.

4.2.2.6 Air Quality Impacts

The air quality conformity analysis that was prepared for the Washington, D.C. Metropolitan Area by the Transportation Planning Board (MPO) is a cumulative impact analysis. This analysis takes into account the existing transportation network consisting of highway, transit, and bicycle/pedestrian components (which is a result of past and present actions), and determines through modeling the level of volatile organic compounds and nitrous oxides (ozone precursors) that can be expected to be produced on a regional basis if all reasonably foreseeable regionally significant future transportation improvements are made to the transportation network. The Tri-County Parkway was included in the most recent conformity analysis for the region. That analysis showed that, when all of the reasonably foreseeable regionally significant future transportation improvements are taken into account, the cumulative impact in terms of the regional air quality emissions that will result from their implementation will not exceed the SIP budgets established for the area under the Clean Air Act. As a result, it has been concluded through the conformity process that the cumulative air quality impact from the implementation of these improvements will not increase the number or severity of violations which have caused the area to be designated nonattainment. Further, the conformity analysis lists hundreds of transportation improvements that are taken into account by the analysis. The Tri-County Parkway is just one improvement and its contribution to regional vehicle miles traveled is insignificant compared to the cumulative total of vehicle miles traveled forecasted for the region.

4.2.2.7 Noise Impacts

Existing noise levels at noise-sensitive sites adjacent to each corridor were calculated as part of the noise analysis up to 1,000 feet from the proposed location of each CBA. These noise levels essentially represent the cumulative localized impact on noise levels from past and present transportation-related actions and local land use decisions. The proposed project would add to these existing noise levels and in some instances, create localized noise impacts. In some rare instances, the project may even reduce noise levels at some noise receptors by moving traffic further away from it. Whether or not the contribution that the Tri-County Parkway will have on localized noise levels is an issue depends upon these existing noise conditions. For example, generally speaking, the increase from the construction of the project on localized noise levels will likely not be significant for those receptors that are located adjacent to or in close proximity to existing and high-volume roadways and/or areas characterized by commercial development. In contrast, noise increases from the project will have a greater impact on those receptors that are not located near high volume roads or existing commercial development where existing noise levels approach ambient noise levels. See the Noise Technical Report (VDOT, 2005) for more-specific details for localized noise impacts that can be expected as a result of the project. On a regional basis, major contributors to existing noise levels in the study area include Washington Dulles International Airport (located at the northern end of the project) and quarry operations located off Route 29 and east of Manassas National Battlefield Park (towards the southern end of the study area). Other major contributors to existing noise levels in the study area include the Interstate and primary highway systems - consisting of Interstate 66, Route 29, Route 28, Route 50, and Route 234. The Tri-County Parkway would become part of the primary system; however, its contribution to cumulative noise levels will be minor on a regional basis given the number of lane miles that it would add to the highway network compared to the number currently available.

4.2.2.8 Water Quality Impacts

Based on future land uses projected under local comprehensive plans, the type of projected development would occur with or without the project, albeit, probably at a different pace should a CBA be implemented. Specifically, land use conversions (from undeveloped parcels to developed parcels contributing to net increase in impervious surfaces) is projected to be 30,660 acres by year 2030. By comparison the amount of new impervious surface resulting from implementation of a CBA will comprise 1.1 percent of this total (or 348 acres) for the West Two CBA, 1.2 percent of this total (or 370 acres) for the West Four CBA, and 1.7 percent of this total (or 532 acres) for the Comprehensive Plan CBA. Secondary development that will likely occur at interchanges or be accelerated at those locations because of the project will add to this total. Many past actions occurred at a time when no consideration was given to stormwater runoff and water quality impacts nor allowances made for them. As already documented in Section 3.0, past and present actions are responsible for the conversion of a large percentage of forest land, which historically exposed soils to runoff, as well as the conversion of wetlands, which significantly reduced the function and effectiveness of nutrient removal and floodflow alteration that these wetlands addressed, in part. Consequently, the cumulative impact of past and present actions have already resulted in serious water quality degradation. Mandatory requirements for stormwater management presently implemented at both the state and local level would help to reduce cumulative impacts that can be expected in the study area over the life of the project.

4.2.2.9 Wildlife Habitat

Based on future land uses projected under local comprehensive plans, the type of projected development would occur with or without the project. Using forest lands as the single-most important component of regional wildlife habitat, forest loss within the study area is projected to be 8,979 acres by year 2030. By comparison the amount of forest loss resulting from implementation of a CBA will comprise 3.8 percent of this total (or 338 acres) for the West Two CBA, 3.1 percent of this total (or 278 acres) for the West Four CBA, and 4.9 percent of this total (or 440 acres) for the Comprehensive Plan CBA. Secondary development that will likely occur at interchanges or be accelerated at those locations because of the project will add to this total. As documented in Section 3.0, between 1937 and 1998, forest cover in the study area has fell from approximately 70 percent to 20 percent.

4.2.2.10 Wetland Impacts

Under the No-Build Alternative (which assumes that all roadway and transit projects programmed for construction in the regions CLRP will be implemented except the Tri-County Parkway), it is expected that there will be wetland impacts in the study area; however, an exact number cannot be determined because all of those projects have not yet gone forward for development. Additionally, wetland impacts can be expected to occur from the residential, commercial, and retail development that is planned for the study area. The loss of wetlands on a national scale (as well as a statewide scale) has been well documented, although the rate of loss has slowed considerably the past fifteen years. Prior studies by the U.S. Fish and Wildlife Service and others indicate that the contiguous United States has lost over 50 percent of its wetlands since the 1780's. These studies also indicate that Virginia has lost approximately 42 percent of its wetlands over that same time period. Construction of the Tri-County Parkway would result in additional impacts to wetlands. Assuming a 200-foot-wide average limits of construction, the proposed project would affect between 10 and 18 acres of wetlands (0.2 percent and 0.4 percent, respectively, of the regional wetlands total) depending which CBA is selected.

4.2.2.11 Floodplain Impacts

Historically, people have congregated around water because it provided a convenient means of transportation and became a source of commerce. Naturally, development occurred around water and spread out from there and, with this development, came impacts to floodplains and wetlands. Because wetlands are often associated with floodplains, the trend in floodplain impacts has followed the trend in wetland impacts. The Comprehensive Plan CBA would impact 287.8 acres of floodplains (4.1 percent of the total study area floodplain acreage) compared to 26.9 acres (0.4 percent of the total study area floodplain acreage) for the West Two CBA, and 39.4 acres (0.6 percent of the total study area floodplain acreage) for the West Four CBA.

4.2.2.12 Park, Recreation, & Open Space Impacts

Parkland acreage within the study area is projected to increase by 2,378 acres by year 2030. The amount of parkland loss resulting from implementation of a CBA will comprise a 1.8 percent decrease in this proposed of this total (or 42 acres) for the West Two CBA, a 1.8 percent decrease in this total (or 42 acres) for the West Four CBA, and a 8.9 percent decrease in this total (or 212 acres) for the Comprehensive Plan CBA (using the 600-foot study corridor). While it is true that the percent decrease is minor compared to the total acreage of parkland that will be available in the study area, the impact attributed to the Tri-County Parkway for purposes of cumulative impacts is significant because historically, there have been few impacts to established parks in the study area. Impacts that have occurred have been minor and in the form of sliver takes to accommodate minor roadway improvements. Historically, parks have been established and greenspace has been protected as people and concerned citizens saw the need to preserve land for future generations as development put increasing pressure on existing resources. Cultural Resource Impacts

Construction of the Tri-County Parkway has the potential to impact architectural and archaeological sites located within the study area. Depending on the alternative selected, the Putnam-Patton House and Manassas Battlefield Historic District could be directly impacted by the project. In addition, the Dulles International Airport Historic District and Gallagher Farm could be effected by the project because of its proximity to these resources. Several archeological sites deemed important primarily for the information that can be gathered from them also have the potential of being impacted by each CBA. Past and present actions in the form of roadway projects and residential, commercial, and industrial development have eliminated many architectural and archeological resources in the study area. Reasonably foreseeable future actions will place additional pressure on those resources that remain as development occurs around them - compromising their setting. As the study area continues to evolve from one characterized by rural development, agriculture, and forested lands to one characterized by residential, commercial, and industrial development, the area will continue to lose its sense of history, which will be increasingly confined to isolated locations. Construction of the Tri-County Parkway will certainly facilitate this evolution.

4.2.3 Shared Location Effects

The cumulative effects associated with reasonably foreseeable actions were analyzed with regard to two transportation projects that share a portion of their alignment with the CBAs proposed for the Tri-County Parkway. These projects include the Manassas National Battlefield Park Bypass and the Route 234 North Bypass Extension.

The Manassas National Battlefield Park (MNBP) Bypass will reroute portions of Route 29 and Route 234 around Manassas National Battlefield Park and provide alternatives for the traffic traveling through the Park. Only four alternatives being studied for of the MNBP Bypass share a portion of their alignment with Tri-County Parkway's West Two and West Four CBAs. Alternatives A and C of the MNBP Bypass will extend north along Pageland Lane and then turn to the east along the western edge of the Park. Alternatives B and D of the MNBP Bypass will also extend north along Pageland Lane, but will continue north until they intersect Route 234 before turning east along Bull Run. All alternatives being studied for of the MNBP Bypass project share a portion of their alignment with Tri-County Parkway's Comprehensive Plan CBA. Alternative A, B C, and D of the MNBP Bypass would intersect the Comprehensive Plan CBA north of Route 29 and Alternative G of the MNBP Bypass would intersect the Comprehensive Plan CBA south of Route 29.

The Route 234 Bypass North Extension is proposed as a continuation of the Route 234 Bypass to a point just east of Sudley Park in Prince William County. The Route 234 Bypass North Extension would share the same alignment with Tri-County Parkway's West Two and West Four CBAs, extending north along Pageland Lane to Route 234. The Route 234 Bypass Northern Extension is included in the Prince William Comprehensive Plan and on regional transportation plans.

The Manassas National Battlefield Park Bypass and the Route 234 North Bypass Extension have the greatest potential for cumulative effects to socioeconomic and natural resources located in the study area and as such are assumed to be built in the future conditions under the No-Build condition. The shared

location effects associated with these projects are shown in Table 4.2-3 (West Two CBA), Table 4.2-4 (West Four CBA), and Table 4.2-5 (Comprehensive Plan CBA). Review of findings set forth in Tables 4.2-3 through 4.2-5 indicate that it could be beneficial to co-locate portions of facilities to reduce overall regional cumulative effects.

4.2.4 Conclusion

Given the history of the area (as presented in Section 3.0 of this report), it is clear that much of the natural environment in the study area has been and continues to be substantially degraded as a result of past and present actions. With the projected increases in employment, resource use, and population within the Tri-County Parkway study area, there is significant pressure to continue the existing trend for additional commercial, industrial, and residential development. In order to meet the increasing need for services such as transportation, water, sewer, utilities, housing, etc., a large number of public and private projects are currently planned or underway within the study area. Given that access is already provided to undeveloped lands, most of this development has already been planned and will occur regardless of whether or not the proposed action is implemented. There is little development that will occur solely as a result of the project. Although the proposed project may accelerate planned development within the study area, should it be implemented, this development would still be expected to occur within the analysis years of this report. Because much of the natural environment has been and continues to be substantially degraded by past and present actions, it is expected that this trend will continue as reasonably foreseeable future actions are implemented. The overall general socioeconomic benefit of improving the regional transportation system is critical for satisfying the purpose and need of the proposed action, while meeting the projected traffic demands wrought by other projects currently underway or planned by VDOT and others.

TABLE 4.2-3
CUMULATIVE EFFECTS ASSUMING SHARED LOCATION WITH WEST TWO CBA

Resource	MNBP Bypass		Route 234 Bypass	TCP West Two CBA	
	Alternative	Impacts Shared with TCP	Impacts Shared with TCP	Project Impacts if MNBP and Route 234 Bypasses are not Constructed	Project Impacts if MNBP and Route 234 Bypasses are Constructed
Residential Relocations	Alternative A	0	7	22	22
	Alternative B	7			15
	Alternative C	0			22
	Alternative D	7			15
	Alternative G	7			15
Commercial Relocations	Alternative A	0	0	0	0
	Alternative B	0			0
	Alternative C	0			0
	Alternative D	0			0
	Alternative G	0			0
Rural / Undeveloped Land (acres)	Alternative A	46.7	83.6	572.1	525.4
	Alternative B	83.6			488.5
	Alternative C	46.7			525.4
	Alternative D	83.6			488.5
	Alternative G	85.9			486.2
Parklands	Alternative A	0	0	0	0

Resource (acres)	MNBP Bypass		Route 234 Bypass	TCP West Two CBA	
	Alternative	Impacts Shared with TCP	Impacts Shared with TCP	Project Impacts if MNBP and Route 234 Bypasses are not Constructed	Project Impacts if MNBP and Route 234 Bypasses are Constructed
	Alternative B	0			0
	Alternative C	0			0
	Alternative D	0			0
	Alternative G	0			0
MNBP	Alternative A	10.8	11.2	42.1	31.3
	Alternative B	11.2			30.9
	Alternative C	10.8			31.3
	Alternative D	11.2			30.9
	Alternative G	11.2			30.9
Stream Crossings (linear feet)	Alternative A	930	2854	24,077	23,147
	Alternative B	2854			21,223
	Alternative C	930			23,147
	Alternative D	2854			21,223
	Alternative G	2854			21,223
100-Year Floodplains (acres)	Alternative A	0	3.6	26.9	26.9
	Alternative B	3.5			23.4
	Alternative C	0			26.9
	Alternative D	3.6			23.3
	Alternative G	3.6			23.3
Resource Protection Areas (acres)	Alternative A	0	2.7	55.3	55.3
	Alternative B	2.7			52.6
	Alternative C	0			55.3
	Alternative D	2.7			52.6
	Alternative G	2.7			52.6
Farmlands (acres)	Alternative A	14.8	36.6	132.1	117.3
	Alternative B	36.6			95.5
	Alternative C	14.8			117.3
	Alternative D	36.6			95.5
	Alternative G	35.6			95.5

TABLE 4.2-4
CUMULATIVE EFFECTS ASSUMING SHARED LOCATION WITH WEST FOUR CBA

Resource	MNBP Bypass		Route 234 Bypass	TCP West Four CBA	
	Alternative	Impacts Shared with TCP	Impacts Shared with TCP	Project Impacts if MNBP and Route 234 Bypasses are not Constructed	Project Impacts if MNBP and Route 234 Bypasses are Constructed
Residential Relocations	Alternative A	0	7	18	18
	Alternative B	7			11
	Alternative C	0			18
	Alternative D	7			11
	Alternative G	7			11
Commercial Relocations	Alternative A	0	0	0	0
	Alternative B	0			0
	Alternative C	0			0
	Alternative D	0			0
	Alternative G	0			0
Rural / Undeveloped Land (acres)	Alternative A	46.7	83.6	582.4	535.7
	Alternative B	83.6			498.8
	Alternative C	46.7			535.7
	Alternative D	83.6			498.8
	Alternative G	85.9			496.5
Parklands (acres)	Alternative A	0	0	0	0
	Alternative B	0			0
	Alternative C	0			0
	Alternative D	0			0
	Alternative G	0			0
MNBP	Alternative A	10.8	11.2	42.1	31.3
	Alternative B	11.2			30.9
	Alternative C	10.8			31.3
	Alternative D	11.2			30.9
	Alternative G	11.2			30.9
Stream Crossings (linear feet)	Alternative A	930	2854	22,196	21,266
	Alternative B	2854			19,342
	Alternative C	930			21,266
	Alternative D	2854			19,342
	Alternative G	2854			19,342
100-Year Floodplains (acres)	Alternative A	0	3.6	39.4	39.4
	Alternative B	3.5			35.9
	Alternative C	0			39.4

Resource	MNBP Bypass		Route 234 Bypass	TCP West Four CBA	
	Alternative	Impacts Shared with TCP	Impacts Shared with TCP	Project Impacts if MNBP and Route 234 Bypasses are not Constructed	Project Impacts if MNBP and Route 234 Bypasses are Constructed
	Alternative D	3.6			35.8
	Alternative G	3.6			35.8
Resource Protection Areas (acres)	Alternative A	0	2.7	58.5	58.5
	Alternative B	2.7			55.8
	Alternative C	0			58.5
	Alternative D	2.7			55.8
	Alternative G	2.7			55.8
Farmlands (acres)	Alternative A	14.8	36.6	101.1	86.3
	Alternative B	36.6			64.5
	Alternative C	14.8			86.3
	Alternative D	36.6			64.5
	Alternative G	35.6			65.5

TABLE 4.2-5
CUMULATIVE EFFECTS ASSUMING SHARED LOCATION WITH COMPREHENSIVE PLAN CBA

Resource	MNBP Bypass		TCP Comprehensive Plan CBA	
	Alternative	Impacts Shared with TCP	Project Impacts if MNBP Bypass is not Constructed	Project Impacts if MNBP Bypass is Constructed
Residential Relocations	Alternative A	0	23	23
	Alternative B	0		23
	Alternative C	0		23
	Alternative D	0		23
	Alternative G	4		19
Commercial Relocations	Alternative A	1	1	0
	Alternative B	1		0
	Alternative C	1		0
	Alternative D	1		0
	Alternative G	0		1
Rural / Undeveloped Land (acres)	Alternative A	24.9	701.1	676.2
	Alternative B	24.3		676.8
	Alternative C	4.1		697.0
	Alternative D	4.1		697.0
	Alternative G	17.8		683.3
Parklands (acres)	Alternative A	8.5	202.7	194.2
	Alternative B	8.5		194.2
	Alternative C	0		202.7
	Alternative D	0		202.7

Resource	MNBP Bypass		TCP Comprehensive Plan CBA	
	Alternative	Impacts Shared with TCP	Project Impacts if MNBP Bypass is not Constructed	Project Impacts if MNBP Bypass is Constructed
	Alternative G	0		202.7
MNBP	Alternative A	0	9.5	9.5
	Alternative B	0		9.5
	Alternative C	0		9.5
	Alternative D	0		9.5
	Alternative G	2.5		7.0
Stream Crossings (linear feet)	Alternative A	2981	43,367	40,386
	Alternative B	1300		42,067
	Alternative C	670		42,697
	Alternative D	670		42,697
	Alternative G	1301		42,066
100-Year Floodplains (acres)	Alternative A	7.8	287.8	280.0
	Alternative B	7.7		280.1
	Alternative C	0		287.8
	Alternative D	0		287.8
	Alternative G	3.5		284.3
Resource Protection Areas (acres)	Alternative A	8.9	240.5	231.6
	Alternative B	8.7		231.8
	Alternative C	0		240.5
	Alternative D	0		240.5
	Alternative G	0.7		239.8
Farmlands (acres)	Alternative A	6.1	79.0	72.9
	Alternative B	10.6		68.4
	Alternative C	0		79.0
	Alternative D	0		79.0
	Alternative G	0.6		78.4

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APPENDIX A:
IMPERVIOUS SURFACES WITHIN INTERSECTION/INTERCHANGE ASSESSMENT AREAS

Tri-County Parkway Location Study

Natural Resources
Technical Report

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IMPERVIOUS SURFACES WITHIN INTERSECTION/INTERCHANGE ASSESSMENT AREAS - West Two CBA

Land Use	Proposed Intersection or Interchange													
	I-66 (West of MNBP)	*US 29 (West of MNBP)*	*Sudley Road*	*Braddock Road (West of MNBP)*	US 50 (West of MNBP)									
Commercial	3.6	9.8	11.5	46.0	18.7									
Industrial	85.5	0	0	0	0									
Public	0.7	0.8	3.2	6.1	0									
Residential	0	74.5	238.4	40.3	53.0									
Total	89.8	85.1	253.1	92.4	71.7	592.1								

IMPERVIOUS SURFACES WITHIN INTERSECTION/INTERCHANGE ASSESSMENT AREAS - West Four CBA

Land Use	Proposed Intersection or Interchange													
	Braddock Road (East of MNBP)	US 50 (East of MNBP)	I-66 (West of MNBP)	*US 29 (West of MNBP)*	*Sudley Road*	*Gum Spring Road*								
Commercial	0	0.6	3.6	9.8	11.5	0								
Industrial	0	16.6	85.5	0	0	96.7								
Public	0.7	0	0.7	0.8	3.2	0								
Residential	194.3	23.0	0	74.5	238.4	88.8								
Total	195	40.2	89.8	85.1	253.1	185.5	848.7							

IMPERVIOUS SURFACES WITHIN INTERSECTION/INTERCHANGE ASSESSMENT AREAS – Comprehensive Plan CBA

Land Use	Proposed Intersection or Interchange													
	VA 234	VA 234 Business	Lomond Drive	*Ben Lomond Park Access*	I-66 (East of MNBP)	*US 29 (East of MNBP)*	*Braddock Road (East of MNBP)*	US 50 (East of MNBP)						
Commercial	11.0	95.3	1.5	0.5	0	20.9	0	0.6						
Industrial	208.2	4.4	0	32.9	46.8	111.7	0	16.6						
Public	62.6	37.5	29.5	0	7.5	16.6	0.7	0						
Residential	24.1	251.8	377.2	201.3	96.5	182.0	194.3	23.0						
Total	305.9	389	408.2	234.7	150.8	331.2	195	40.2	2055					