

ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter presents the direct, indirect, and cumulative effects of the alternatives, which include a No-build Alternative and five Candidate Build Alternatives (CBA) (1, 2, 2A, 3, and 4), as discussed in Chapter 2. Impacts analyses are based on “planning corridors” that are 500 feet wide, except along most of Route 276 (Cross Keys Road) where the planning corridor is constrained to the existing 80-foot-wide right of way (to minimize effects on the Cross Keys Battlefield). The 500-foot-wide corridors are wide enough to encompass potential variations in actual alignments and design features during the design phase, should a build alternative be selected, and to illustrate the maximum potential impacts of the alternatives. However, more-refined estimates of impacts also are provided for illustrative purposes. These are based on a narrower “design corridor” for each CBA derived from generalized cross section templates that more closely represent what the actual impacts may be. **Table 4-1** lists the planning and design corridor widths for the CBAs. Sections 4.2 through 4.16 present the direct effects of the CBAs. Section 4.17 discusses indirect effects and Section 4.18 discusses cumulative effects.

**Table 4-1
PLANNING AND DESIGN CORRIDOR WIDTHS**

	CBA 1	CBA 2	CBA 2A	CBA 3	CBA 4
Planning Corridor Width	<ul style="list-style-type: none"> • 500 feet between I-81 and Rte 276 • 80 feet along Rte 276 between Rtes 682 and 689 • 500 feet between Rtes 689 and 33 	500 feet	500 feet	500 feet	500 feet
Design Corridor Width	<ul style="list-style-type: none"> • 240 feet between I-81 and Rte 681 • 120 feet between Rtes 681 and 276 • 80 feet along Rte 276 between Rtes 682 and 689 • 240 feet between Rtes 689 and 33 	<ul style="list-style-type: none"> • 240 feet between Rtes 11 and 253 • 120 feet between Rtes 253 and 33 	240 feet	240 feet	240 feet

4.2 LAND USE

4.2.1 Land Use Conversions

Any of the five Candidate Build Alternatives would require land acquisition and conversion of existing uses to highway use. **Table 4-2** shows the acreages of direct land use conversions for each alternative for both the planning corridor and the design corridor. Displacements of homes and businesses resulting from the land use conversions are discussed in Section 4.3.1. Section 4.17 discusses indirect land use impacts.

Table 4-2
LAND USE CONVERSIONS (ACRES)

Corridor	CBA 1	CBA 2	CBA 2A	CBA 3	CBA 4
Planning Corridor	314	373	386	357	182
Design Corridor	131	146	190	178	93

4.2.2 Compatibility with Local Land Use and Transportation Planning

The city and county comprehensive plans designate most of the study area for planned growth and development. To serve this development, both comprehensive plans also include concepts for new and improved transportation facilities to serve the traffic that will be generated and to facilitate mobility throughout the study area (see Figure 2-2 in Chapter 2 for illustration of highway facilities included in Rockingham County’s comprehensive plan). The Candidate Build Alternatives are responsive to the transportation goals and visions outlined in the local comprehensive plans. Some segments of the alternatives are identical or similar to segments depicted in the comprehensive plans. Therefore, the alternatives generally can be considered to be consistent with the local comprehensive plans.

The following bullets summarize elements of the alternatives compared to elements of the *2030 Transportation Plan* adopted by the Harrisonburg-Rockingham Metropolitan Planning Organization (HRMPO) (see Figure 2-2 in Chapter 2 for graphic of projects in the *Plan*). In order for FHWA to complete the environmental documentation process and issue a Record of Decision, the selected alternative must be included in the “2030 [Financially] Constrained Long Range Plan” portion of HRMPO’s *Plan*, which in the case of some portions of the alternatives would require amendments to the current *Plan*.

CBA 1

- 4-lane section between I-81 and Rte 681, redesignate as primary, access management plan to be developed. • *Plan* includes construction of 2-lane widening and reconstruction as secondary road.
- 2-lane section between Rte 681 and Rte 995, redesignate as primary, access management plan to be developed. • *Plan* includes 2-lane widening and reconstruction as secondary road.
- 2-lane relocation section of Rte 682, limited access. • *Plan* includes 2-lane straightening of this section of Rte 682 only in the Vision Plan (i.e., not funded for preliminary engineering or construction due to inadequate funding).
- 2-lane widening section of Rte 682 to Route 276, redesignate as primary, access management plan to be developed. • *Plan* includes 2-lane widening of Rte 682 all the way to Rte 276 only in the Vision Plan.
- Widening of Route 276 to add shoulders, access management plan to be developed. • No comparable element in *Plan*.

- Widening of Route 276 between Rte 689 and Rte 33 to 4 lanes.
 - No comparable element in *Plan*.
- CBA 2**
- 4-lane-divided on new location, except for sections that overlap Rte 704.
 - *Plan's* Vision Plan component includes nearly identical facility, however, no funding is identified for preliminary engineering or construction.
- CBA 2A**
- 4-lane-divided on new location, except for sections that overlap Rte 704, between Rte 11 and Rte 679.
 - *Plan's* Vision Plan component includes nearly identical facility for portion between Rte 11 and Rte 679; however, no funding is identified for preliminary engineering or construction.
 - 4-lane-divided on new location between Rte 679 and Rte 710.
 - No comparable element in *Plan*.
 - 4-lane-divided along Rte 710 between Rte 709 and Rte 253.
 - *Plan* includes construction of comparable section as part of a Rte 726 extension.
 - 4-lane-divided on new location between Rte 253 and Rte 33.
 - *Plan* includes preliminary engineering for this section as part of extension of Rte 726 between Rte 253 and Rte 33, with construction included only in the Vision Plan due to inadequate funding.
- CBA 3**
- 4-lane-divided on new location, except for sections that overlap Rte 710.
 - *Plan* includes preliminary engineering for section between Rte 253 and Rte 33. No comparable element in *Plan* for section between I-81 and Rte 710 in vicinity of Rte 709.
- CBA 4**
- 4-lane-divided on new location, except for sections that overlap Rte 710.
 - *Plan* includes construction of Rte 726 extension between existing Rte 726 and Rte 253.
 - *Plan* includes preliminary engineering for extension of Rte 726 between Rte 253 and Rte 33, with construction included only in the Vision Plan due to inadequate funding.

4.3 SOCIOECONOMICS

4.3.1 Potential Relocations

The estimated numbers of homes, businesses, farms, and nonprofit organizations that are within the corridors for each alternative, and that could potentially be displaced or relocated, are reported in **Table 4-3**. These numbers are from estimates contained in the *Stage I Relocation Assistance Report* prepared by VDOT. Based on current real estate multiple listings services (MLS), there appears to be adequate housing and business replacement sites in the Harrisonburg/Rockingham area. VDOT has the ability and, if necessary, is willing to provide housing of last resort, including the purchase of land or dwellings; repair of existing dwellings to meet decent, safe, and sanitary conditions; relocation or remodeling of dwellings purchased by VDOT; or construction of new dwellings. Assurance is given that all displaced families and individuals would be relocated to suitable replacement housing, and that all replacement housing would be fair housing available to all persons without regard to race, color, religion, sex, or national origin and would be within the financial means of the displacees. Each person would be given sufficient time to negotiate for and obtain possession of replacement housing. No residential occupants would be required to move from property needed for the project until comparable decent, safe, and sanitary replacement dwellings have been made available to them.

Table 4-3
 POTENTIAL RELOCATIONS

Corridor	CBA 1	CBA 2	CBA 2A	CBA 3	CBA 4
RESIDENTIAL					
Planning Corridor	51	93	57	60	19
Design Corridor	32	38	26	29	10
BUSINESSES					
Planning Corridor	2	2	2	14	0
Design Corridor	2	1	2	12	0
FARMS					
Planning Corridor	7	3	4	1	1
Design Corridor	6	2	3	0	1
NONPROFITS (e.g., churches, community service clubs, etc.)					
Planning Corridor	0	2	0	0	0
Design Corridor	0	0	0	0	0

If a build alternative is selected, VDOT would develop a detailed relocation plan upon completion of a more in-depth design to ensure that orderly relocation of all displacees can be accomplished in a satisfactory manner. The acquisition of right of way and the relocation of displacees would be in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Assurance is given that relocation resources would be available to all residential, business, farm, and nonprofit displacees without discrimination.

4.3.2 Changes to Neighborhoods and Community Cohesion

The alignments of the Candidate Build Alternatives have been located to avoid splitting communities and residential subdivisions and they would not isolate any portions of communities or ethnic groups.

4.3.3 Changes in Travel Patterns and Accessibility

Under all of the alternatives, connections to existing roads would be maintained or relocated such that no substantial disruptions to neighborhood access would be imposed. The No-build Alternative would include widening and upgrading the portion of Route 682 (Friedens Church Road) between I-81 and Route 995 (Koiners Ford Road), thereby increasing the attractiveness of that route for travel between I-81 and Route 33. CBA 1 also would upgrade Route 682, but to higher design standards than would the No-build Alternative. In addition, CBA 1 would involve changing the designation of Route 682 from a secondary road to a primary road. CBA 1 also would involve adding paved shoulders to both Route 682 and Route 276, which would make both routes safer and also would facilitate bicycle travel (cyclists could use the paved shoulder). Currently, there is no space on Route 682 or Route 276 to safely accommodate cyclists. A portion of CBA 1 on new location would eliminate the dogleg and 90-degree turn on Route 682

at Friedens Church. Finally, CBA 1 also would involve developing an access management plan to try to reduce the future proliferation of new driveways as development occurs over time.

CBA 2 and CBA 2A would increase accessibility to and through the central portion of the study area, and provide a more direct connection between Routes 11 and 33. These alternatives also would increase accessibility to the proposed relocation site of the regional hospital.

CBA 3 would upgrade the interchange of I-81 with Route 11 in the Pleasant Valley vicinity, thereby improving access into industrial areas adjacent to I-81 and Route 11. The connection that would be provided between the interchange and Route 33 would facilitate travel from the Route 11/I-81 area to Route 33 and also improve accessibility to the relocated regional hospital. In addition, the portion of CBA 3 that overlaps CBA 4 would provide a relief route to Route 33 for travelers going from areas west and south of downtown Harrisonburg to areas east of Harrisonburg, including the new regional hospital.

CBA 2, 2A, 3, and 4 would have “controlled access,” that is, access to the road from adjacent properties would be limited to designated points, which would be established during the design phase, should one of these alternatives be selected. This controlled access feature may entail some minor inconvenience to certain property owners, who may have to access their properties via a more circuitous route (e.g., by a service road or an access point that consolidates entrances to multiple properties). Additional details about the traffic consequences of the alternatives are provided in Chapter 2.

4.3.4 Effects on Community Facilities

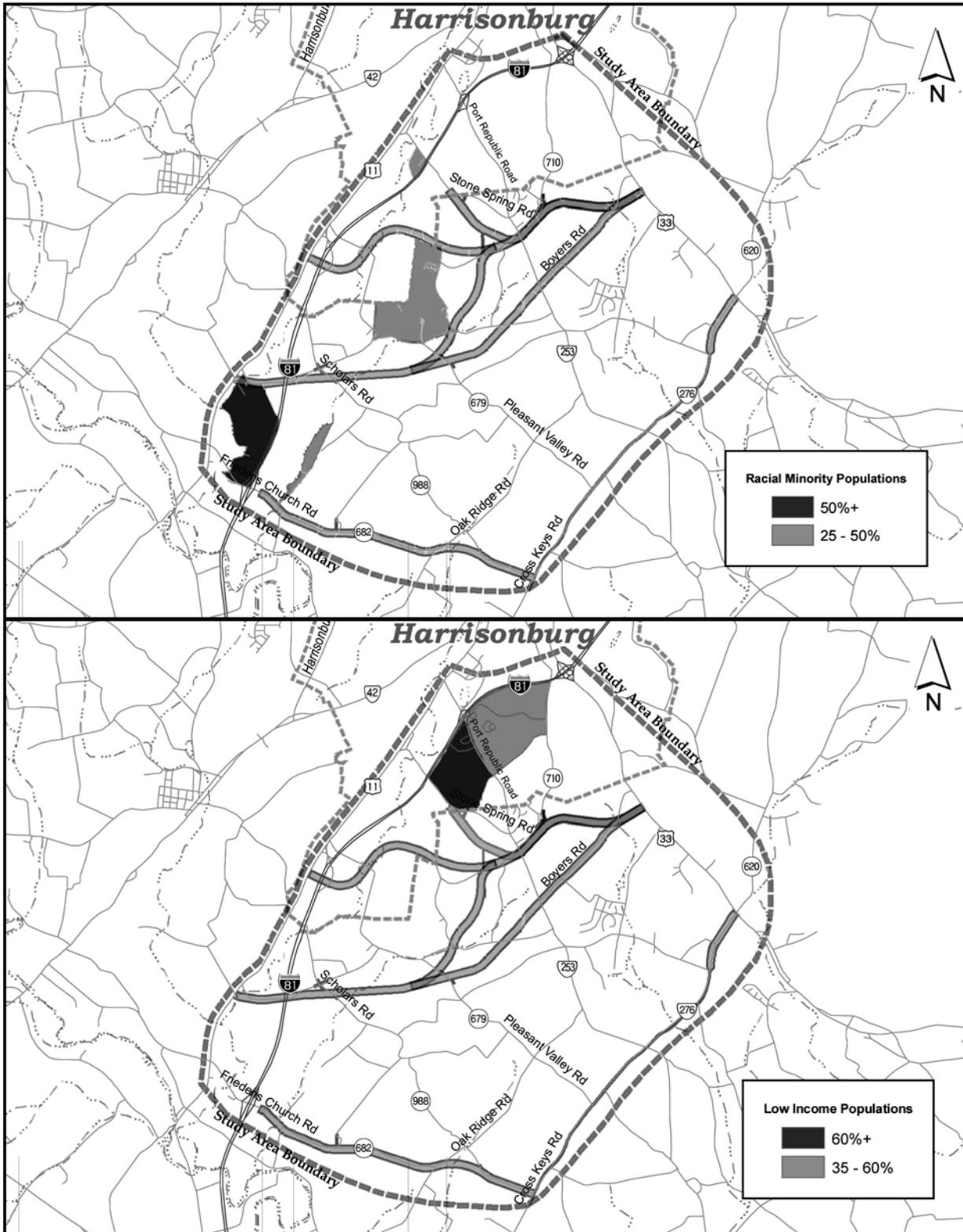
No community facilities would be displaced by any of the alternatives. As noted above, the No-build alternative and CBA 2, 2A, 3, and 4 would improve accessibility to the new regional hospital. All of the alternatives would improve the ability to provide emergency services, particularly those that would be located near existing emergency response stations.

4.3.5 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to promote nondiscrimination in federal programs affecting human health and the environment and to consider disproportionately high and adverse human health or environmental effects of their actions on minority and low-income communities. These populations were identified within the study area by census block, as shown on **Figure 4-1**. None of the environmental effects of any of the alternatives would be predominantly borne by a minority or low-income population. Nor would the effects to be suffered by the minority population or low-income population be appreciably more severe or greater in magnitude than the adverse effects that would be suffered by non-minority or non-low income populations. None of the alternatives would affect natural resources that minority or low-income populations rely on for subsistence.

4.4 PARKS AND RECREATION AREAS

No land from any existing publicly owned public parks or recreation areas would be used by any of the alternatives. There is currently a conceptual Greenway plan for portions of Blacks Run in the City of Harrisonburg. The *Blacks Run Greenway Master Plan* was developed by a private group through a grant from the Virginia Department of Forestry and with assistance from City of



Source: 2030 Transportation Plan. Harrisonburg-Rockingham Metropolitan Planning Organization

**Harrisonburg Southeast Connector
 Location Study**

**SOCIOECONOMIC POPULATION
 CHARACTERISTICS**

Figure 4-1

Harrisonburg staff. The *Plan* envisions voluntary easements from landowners along Blacks Run to implement a trail system that would be available for public use. CBA 3 crosses Blacks Run within the proposed Greenway corridor. This area crossed by CBA 3 in the vicinity of Blacks Run currently is zoned for industrial use and already is heavily developed with industrial uses. Because the land within the proposed Blacks Run Greenway is privately owned, it is not subject to the provisions of Section 4(f) of the Department of Transportation Act.

4.5 HAZARDOUS MATERIALS

Table 4-4 shows the numbers of potential hazardous material sites that might be affected by the alternatives. **Figure 4-2** shows the locations of the sites. These sites were identified using a commercially available database search, supplemented by field reconnaissance. The sites include industrial properties, petroleum product storage facilities, and other properties potentially containing materials that are flammable, toxic, corrosive, or reactive. Typically, the major issue associated with such sites on most highway projects is the cost of investigations and remediation to ensure that no human health risks remain following completion of the construction. Prior to the acquisition of right of way and construction, thorough site investigations would be conducted to determine whether any of the sites are actually contaminated, and, if so, the nature and extent of that contamination. All necessary remediation would be conducted in compliance with applicable federal, state, and local environmental laws and would be coordinated with the U.S. Environmental Protection Agency (EPA), the Virginia Department of Environmental Quality (VDEQ), and other federal or state agencies as necessary. Additional details of the hazardous materials investigations are provided in the *Hazardous Materials Technical Memorandum*, which is available for review upon request.

Table 4-4
POTENTIAL HAZARDOUS MATERIAL SITES

Corridor	CBA 1	CBA 2	CBA 2A	CBA 3	CBA 4
Planning Corridor	9	1	1	11	1
Design Corridor	2	0	0	4	0

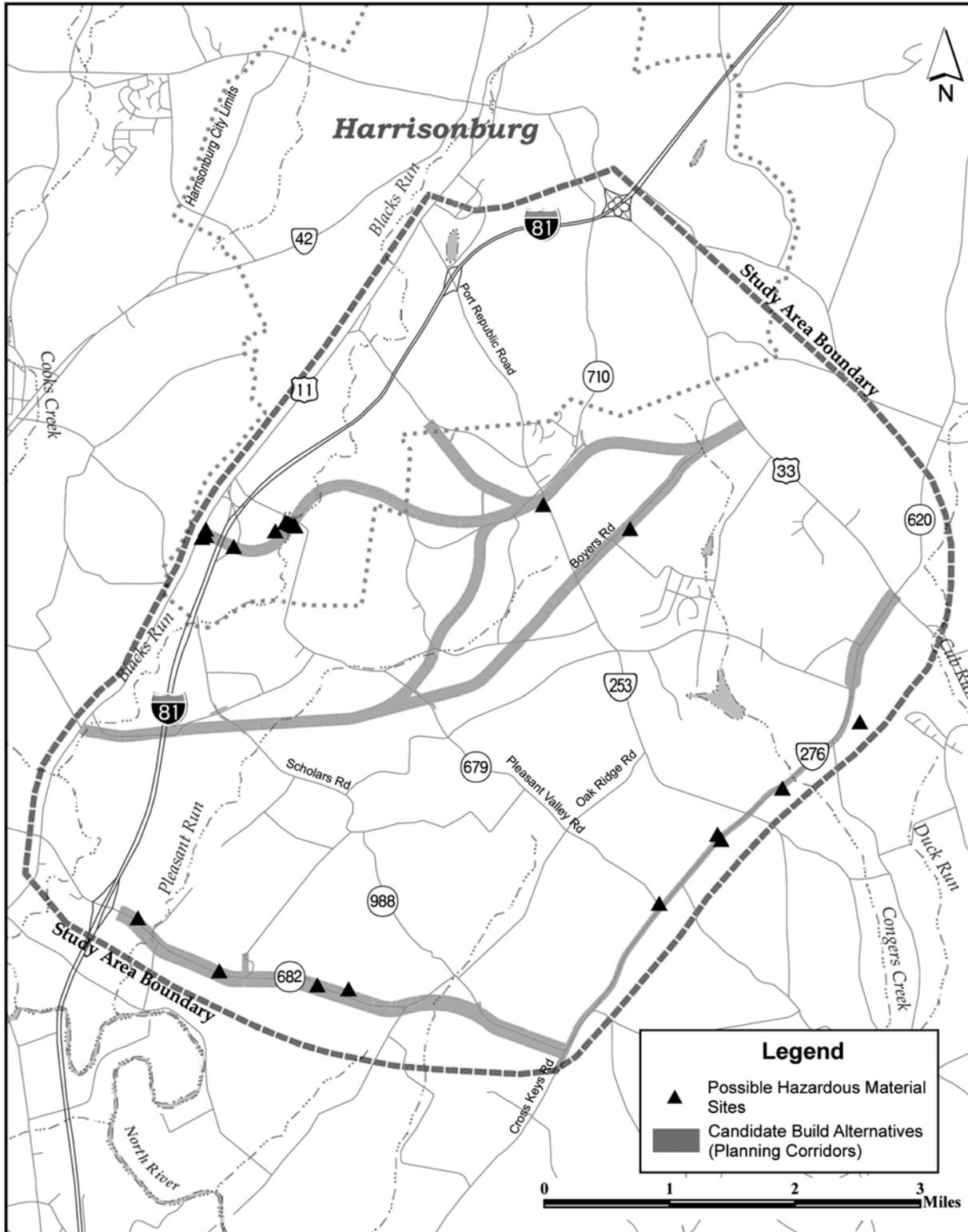
4.6 FARMLAND

4.6.1 Farmland Conversions

Contacts with Natural Resources Conservation Service District Conservationists and offices of planning and geographic information systems mapping in Rockingham County were made in order to identify prime farmland soils and/or the presence and location of any unique farmlands, or farmlands of statewide or local importance for Farmland Protection Policy Act (FPPA) compliance. No farmland located within the study area was classified as unique farmland. As required by FPPA, Form CPA-106, Farmland Conversion Rating, was submitted to the District Conservationist. No reply was received. The potential impacts to prime farmland and farmland of statewide importance are shown in **Figure 4-3** and listed in **Table 4-5**.

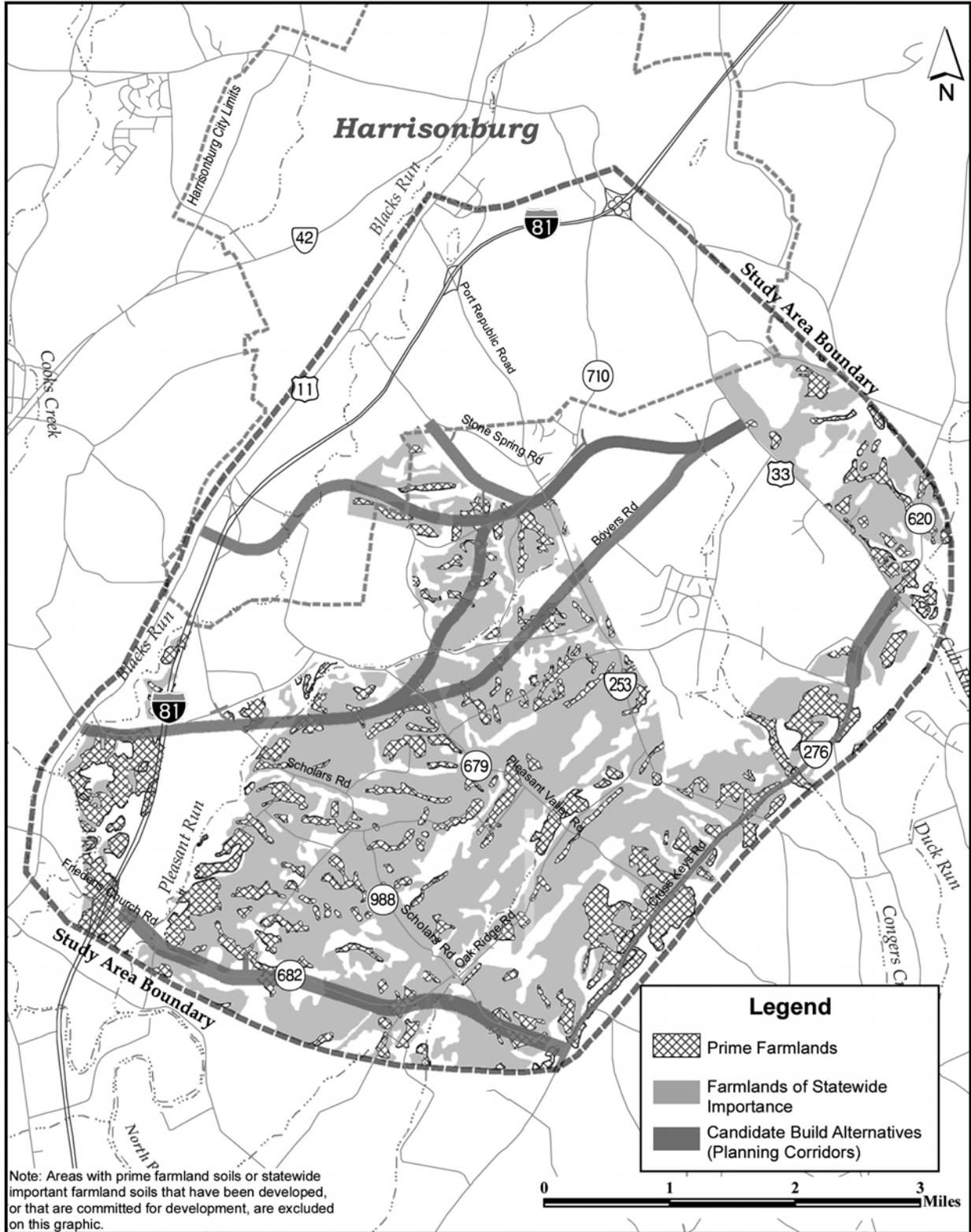
4.6.2 Agricultural and Forestal Districts

There are four Agricultural and Forestal Districts in or adjacent to the study area. **Figure 4-4** shows the relationships of the districts to the Candidate Build Alternatives. **Table 4-6** shows the

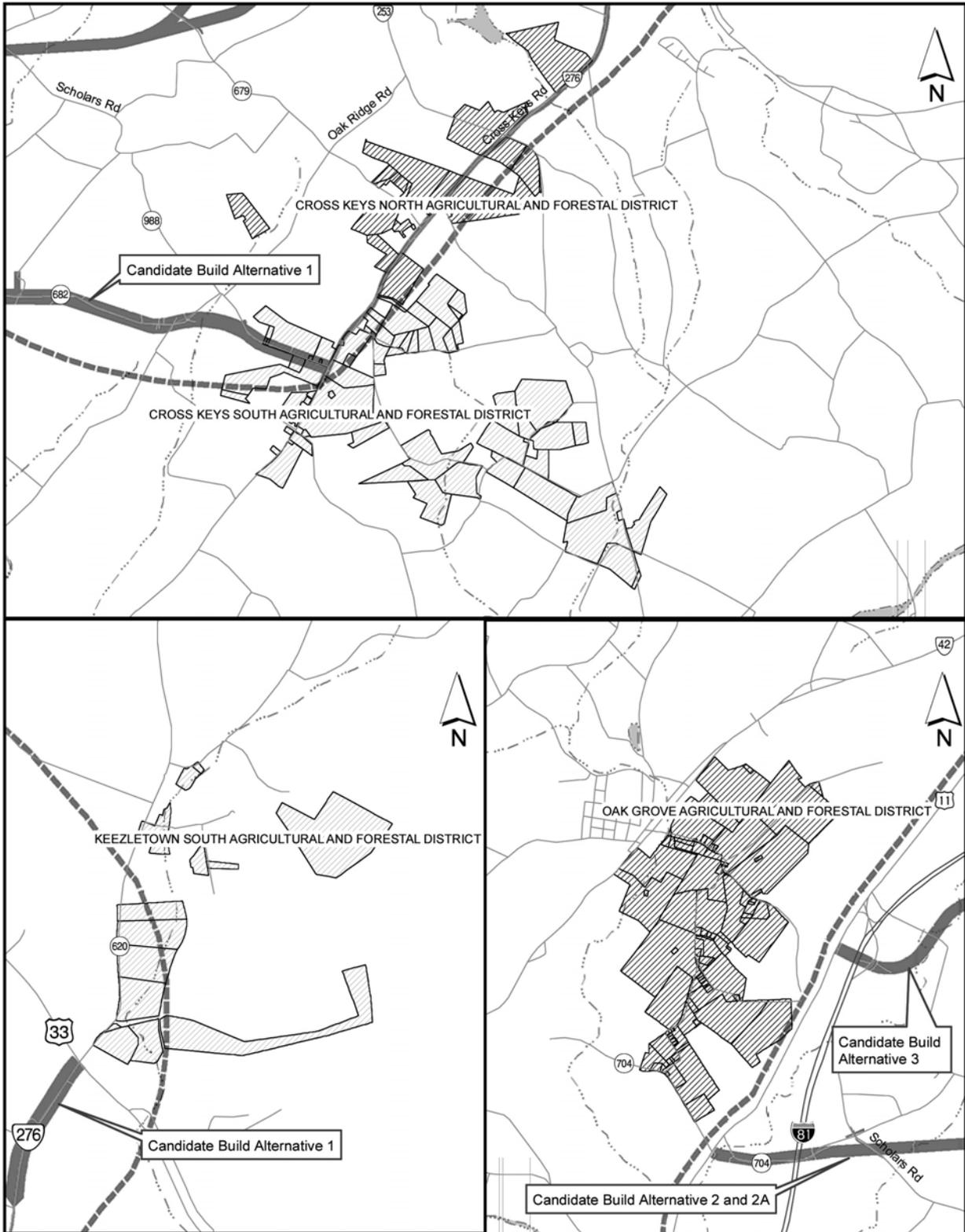


Harrisonburg Southeast Connector
 Location Study

HAZMAT SITES WITHIN
 PLANNING CORRIDORS
 Figure 4-2



Harrisonburg Southeast Connector PRIME AND STATEWIDE IMPORTANT FARMLAND Location Study
Figure 4-3



Note: Maps are at different scales Source: Rockingham County GIS Department

**Harrisonburg Southeast Connector
 Location Study**

**AGRICULTURAL AND FORESTAL
 DISTRICTS
 Figure 4-4**

**Table 4-5
PRIME FARMLAND AND FARMLAND OF STATEWIDE IMPORTANCE (ACRES)**

	CBA 1		CBA 2		CBA 2A		CBA 3		CBA 4	
	Planning Corridor	Design Corridor								
Prime Farmland Conversion	78	43	42	19	43	20	9	3	1	1
Statewide-Important Farmland Conversion	129	39	136	67	145	71	54	23	2	2
Total Farmland Conversion	207	82	178	86	188	91	63	26	3	3

**Table 4-6
IMPACTS TO AGRICULTURAL AND FORESTAL DISTRICTS (ACRES)**

Ag/Forest District	CBA 1		CBA 2		CBA 2A		CBA 3		CBA 4	
	Planning Corridor	Design Corridor								
Cross Keys South	30.8	11.2	0	0	0	0	0	0	0	0
Cross Keys North	0	0	0	0	0	0	0	0	0	0
Keezletown South	0	0	0	0	0	0	0	0	0	0
Oak Grove	0	0	0	0	0	0	0	0	0	0
Total Impacts	30.8	11.2	0	0	0	0	0	0	0	0

potential impacts of the alternatives on the Districts. CBA 1 would impact the Cross Keys South District, mostly along Route 682 (Friedens Church Road) because the section along Route 276 (Cross Keys Road) would be constrained within existing right of way. The roadway would be upgraded but would remain a two-lane facility. The other Candidate Build Alternatives would not impact any Agricultural and Forestal Districts.

4.7 AIR QUALITY

Air quality is defined by ambient atmospheric concentrations of specific pollutants determined by EPA to be of concern with respect to the health and welfare of the general public. These pollutants are ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), respirable particulate matter (PM₁₀ and PM_{2.5}), and lead (Pb). EPA established National Ambient Air Quality Standards (NAAQS) for these pollutants. The City of Harrisonburg and Rockingham County are located in an area determined by EPA to be in attainment of the NAAQS. The effects on air quality by the alternatives are illustrated by an assessment of CO concentrations. CO is a stable pollutant for which atmospheric concentrations are easily modeled using the FHWA-approved CAL3QHC computerized CO dispersion model (Version 2.0). Output from the model is expressed as the maximum 1-hour and 8-hour downwind

concentrations of CO in parts per million (ppm). **Table 4-7** shows the three highest CO concentrations output from the model. These results, which are well below the NAAQS, represent the worst impacts anywhere along any of the alternatives. The *Air Quality Technical Report*, which is available for review upon request, provides details on the air quality analyses.

Table 4-7
CARBON MONOXIDE CONCENTRATIONS

Location	Alternative	Year	Maximum 1-hour Concentration (ppm)	Maximum 8-hour Concentration (ppm)
CBA 1 Receptor 2 Residential	No-build	2002	8.0	5.6
		2015	7.1	5.0
		2030	7.1	5.0
	Build	2015	7.1	5.0
		2030	7.1	5.0
	CBA 2 Receptor 4 Residential	No-build	2002	6.7
2015			6.5	4.6
2030			7.0	4.9
Build		2015	7.0	4.9
		2030	7.3	5.1
CBA 2 Receptor 5 Residential		No-build	2002	9.0
	2015		8.0	5.6
	2030		8.6	6.0
	Build	2015	6.8	4.8
		2030	6.8	4.8
	National Ambient Air Quality Standards (NAAQS)			35.0

None of the alternatives would cause a violation of the NAAQS for CO. A comparison of the alternatives shows that the CO concentrations would be similar for the No-build Alternative and all the Candidate Build Alternatives. The CO analysis demonstrates that none of the alternatives would have substantial adverse effects on air quality and none would cause or contribute to a violation of the NAAQS.

During scoping, a citizen expressed concern that air quality in Shenandoah National Park could be adversely affected by constructing a project in the study area. None of the alternatives are expected to have any measurable effects on the air quality in Shenandoah National Park because the distance between the study area and the Park is too great.

4.8 NOISE

The potential noise impacts caused by the alternatives have been assessed in accordance with FHWA guidelines published in Volume 7, Chapter 7, Section 2 of the Federal Aid Policy Guide (FAPG 7-7-2) and with the State Noise Abatement Policy. Included in FAPG 7-7-2 are noise abatement criteria (NAC), which are noise levels (in decibels, denoted as dBA) representing the

threshold at which noise impact is considered to occur, and at which noise abatement measures must be considered. The NAC apply to areas where regular human use occurs. If, for a given area having applicable human activity, the noise levels in the design-year (2030 for this study) for a build alternative “approach or exceed the NAC,” then an impact is said to occur and abatement measures must be considered. “Approach” has been defined by VDOT as 1 dBA less than the NAC. A noise impact also is deemed to occur if the design-year-build noise levels are substantially higher than existing levels, even though the levels may not reach the NAC, and abatement measures must be considered. The State Noise Policy defines a substantial increase as 10 or more dBA. Final decisions on whether to provide noise abatement measures take into account design feasibility, cost, and the opinions of property owners impacted by the noise.

4.8.1 CBA 1

Of 102 noise-sensitive properties evaluated for CBA 1, two would incur substantial increase impacts under design-year 2030 build conditions with noise levels increasing 10 or more dBA over existing levels. Four properties would incur noise impacts under design year 2030 build conditions due to noise levels approaching or exceeding the NAC impact criterion of 66 dBA. Noise abatement measures do not appear feasible due to access constraints.

4.8.2 CBA 2

The traffic noise impact analysis for CBA 2 evaluated 85 noise-sensitive properties. The results indicate that 58 would incur substantial-increase impacts under design-year 2030 build conditions with noise levels increasing 10 or more dBA over existing levels. Two properties would incur noise impacts under design year 2030 build conditions with noise levels approaching or exceeding the NAC impact criterion of 66 dBA, and 10 properties would experience both types of noise impact. Noise abatement measures do not appear feasible due to access constraints.

4.8.3 CBA 2A

The traffic noise impact analysis for CBA 2A evaluated 60 noise-sensitive properties. The results indicate that 17 properties would incur substantial-increase impacts under design-year 2030 build conditions with noise levels increasing 10 or more dBA over existing levels. Four properties would incur noise impacts under design year 2030 build conditions with noise levels approaching or exceeding the NAC impact criterion of 66 dBA, and eight properties would experience both types of noise impact. One potential noise barrier appears to be feasible, based on preliminary evaluation. It would cost approximately \$250,000.

4.8.4 CBA 3

The traffic noise impact analysis for CBA 3 evaluated 64 noise-sensitive properties. The results indicate that 16 properties would incur substantial-increase impacts under design-year 2030 build conditions with noise levels increasing 10 or more dBA over existing levels. Three properties would incur noise impacts under design year 2030 build conditions with noise levels approaching or exceeding the NAC impact criterion of 66 dBA, and 11 properties would experience both types of noise impact. One noise barrier appears to be feasible, based on preliminary evaluation. It would cost approximately \$125,000. [Note: for purposes of the noise analysis, a conceptual configuration for the interchange at I-81 was assumed. However, while

suitable for estimating impacts for environmental documentation purposes, that configuration is preliminary and may not represent the actual design should CBA 3 be selected for further development. If CBA 3 is selected, additional noise analyses would be conducted based on the actual configuration to be developed during the design phase, and the actual noise impacts may be higher or lower depending on the ultimate design.]

4.8.5 CBA 4

The traffic noise impact analysis for CBA 4 evaluated 37 noise-sensitive properties. The results indicate that five properties would incur substantial-increase impacts under design-year 2030 build conditions with noise levels increasing 10 or more dBA over existing noise levels. Four properties would incur noise impacts under design-year 2030 build conditions with noise levels approaching or exceeding the NAC impact criterion of 66 dBA. Noise abatement measures do not appear feasible due to access constraints.

4.8.6 Noise Study Summary

A comparison of noise impacts by alternative indicates that CBA 2 would affect more noise-sensitive properties than the other alternatives. The noise analysis also indicates that the use of sound barriers to mitigate the noise impacts was not feasible due to access constraints for properties within this corridor. The alternative comparison also indicates that CBA 1 would have the least amount of noise impacts. Due to access constraints, noise barriers do not appear feasible on CBA 1. **Table 4-8** provides a summary of noise impacts in three categories: Substantial-increase impacts (SI), NAC Impacts (NAC), and both impact criteria combined (NAC & SI). **Table 4-9** summarizes potential noise barriers.

**Table 4-8
 SUMMARY OF NOISE IMPACTS**

	Approach or Exceed NAC Only "NAC"	Substantial Increase Only "SI"	Both NAC and Substantial Increase "NAC & SI "	TOTAL
CBA 1				
Existing	None	None	None	None
No-build (2030)*	None	None	None	None
Build (2030)	4	2	None	6
CBA 2				
Existing	None	None	None	None
No-build (2030)*	1	None	None	1
Build (2030)	2	58	10	70
CBA 2A				
Existing	None	None	None	None
No-build (2030)*	None	None	None	None
Build (2030)	4	17	8	29

**Table 4-8
SUMMARY OF NOISE IMPACTS**

	Approach or Exceed NAC Only "NAC"	Substantial Increase Only "SI"	Both NAC and Substantial Increase "NAC & SI"	TOTAL
CBA 3				
Existing	None	None	None	None
No-build (2030)*	None	None	None	None
Build (2030)	3	16	11	30
CBA 4				
Existing	None	None	None	None
No-build (2030)*	None	None	None	None
Build (2030)	4	5	None	9
*Note: for purposes of the noise analysis, "No-build" refers only to not building the particular Candidate Build Alternative, not to the entire No-build Alternative as defined in Chapter 2.				

**Table 4-9
PRELIMINARY NOISE BARRIER SUMMARY**

CBA 2A							
Barrier Name	Location	Average Height (feet)	Length (feet)	Square Feet	No. Sites Protected	No. Sites Benefited	Total Cost
Barrier 2A-1	Route 704 Sites 38-42	14	800	11,200	4	1	\$250,000
TOTALS			800	11,200	4	1	\$250,000
CBA 3							
Barrier 3-1	Route 711 Sites 1, 2, 3	14	400	5,600	1	2	\$125,000
TOTALS			400	5,600	1	2	\$125,000

4.9 VISUAL QUALITY AND AESTHETICS

The visual resources of the study area consist of two notable aspects [note: visual effects on historic properties in the context of Section 106 of the National Historic Preservation Act are discussed in Section 4.15]:

- The views of distant mountains to the east, particularly Massanutten Mountain approximately two miles east of the study area. None of the Candidate Build Alternatives would affect this aspect of visual resources of the study area because the mountains are too distant.
- The picturesque qualities of farmland, which include open-space vistas, punctuated by farm buildings and grazing livestock. This aspect of visual resources is not unique to the study area, but is common throughout the Shenandoah Valley. It is, however, an attraction that draws people to reside in the study area to enjoy the views while remaining close to

employment, entertainment, and other opportunities. The following discussion outlines the effects of the alternatives on this aspect of visual resources.

CBA 1 is located in the portion of the study area most removed from the developing urbanized area of Harrisonburg and adjoining portions of Rockingham County. It also is the longest alternative. Therefore, the landscape surrounding it contains more farmland than is present in the vicinity of alternatives closer to Harrisonburg. However, because CBA 1 follows existing roads and only provides for two lanes along most of its length, the landscape would not be substantially altered and viewers of the landscape (residents adjacent to the alternative and potential travelers along the alternative) would continue to see essentially what they see now.

CBA 2 and **CBA 2A** would have four lanes and a median and would be largely on new location across existing farmlands for substantial portions of their lengths. Of all the alternatives, they have the greatest potential for affecting the views of adjacent residents by introducing a new highway where currently none exists. Potential travelers along these alternatives would enjoy views similar to those currently experienced along existing Route 704.

CBA 3 and **CBA 4** pass through areas that are, or soon will be, developed into industrial, commercial, or residential uses, and therefore should have little effect on the visual character of the area. Residents adjacent to the alternatives and potential travelers along the alternatives would see a mix of industrial, commercial, residential, and institutional (schools, churches, proposed hospital) land uses.

Comments received during scoping indicated concerns about visual impacts to Shenandoah National Park and Skyline Drive. The nearest boundary of the Park is approximately eight miles from the study area; the nearest point on Skyline Drive is approximately 14 miles from the study area. At those distances, it is unlikely that any of the alternatives would be readily distinguishable from other highways in the region or from the general urbanized appearance of the Harrisonburg metropolitan area. Consequently, no visual impacts on the Park or Skyline Drive are anticipated.

4.10 GEOLOGY AND GROUNDWATER

4.10.1 Karst Terrain

None of the alternatives would impact any known caves, sinkholes, or other karst features within the study area.

4.10.2 Groundwater

A considerable portion of the project area is served, or is planned by Rockingham County's government to be served, by public water supply systems. However, the supply sources for those systems are outside the study area. Therefore, domestic drinking water resources drawn from public water supplies by a large segment of the public would not be affected. Currently, however, residents of a substantial portion of the study area obtain potable water from wells established in shallow aquifers (wells less than 100 feet deep). Construction of cut slopes sometimes can result in localized lowering of very shallow groundwater levels. Increases in impervious surfaces may marginally decrease the amount of infiltration of precipitation into the ground. However, the sizes of paved portions of the alternatives are small relative to the size of the study area. Therefore, the additional increments of impervious surfaces attributable to the

alternatives are not expected to substantially diminish the amount of water infiltrating the ground to recharge the regional water table.

Highway-related pollutants commonly associated with groundwater contamination can include deicers, herbicides used for roadside vegetation management, accidental spills of hazardous materials during transportation, pavement tars, oils and grease, metals, and emissions from vehicles using the roadways. It is expected that stormwater management ponds that would be implemented with any of the alternatives would collect runoff from the roadway areas, thus reducing the potential for that runoff to infiltrate into the groundwater. Some contamination due to seepage from the stormwater management ponds might occur; however, it would not be expected to have more than minimal localized effects on groundwater quality.

Generally, the displacement of wells is considered a design-related issue; therefore, no estimates are available at this time on the number of wells that may need to be closed. Any such well closures would be completed in accordance with VDOT's *Road and Bridge Specifications*, which require compliance with Virginia Department of Health Private Well Regulations and all other applicable state and local regulations.

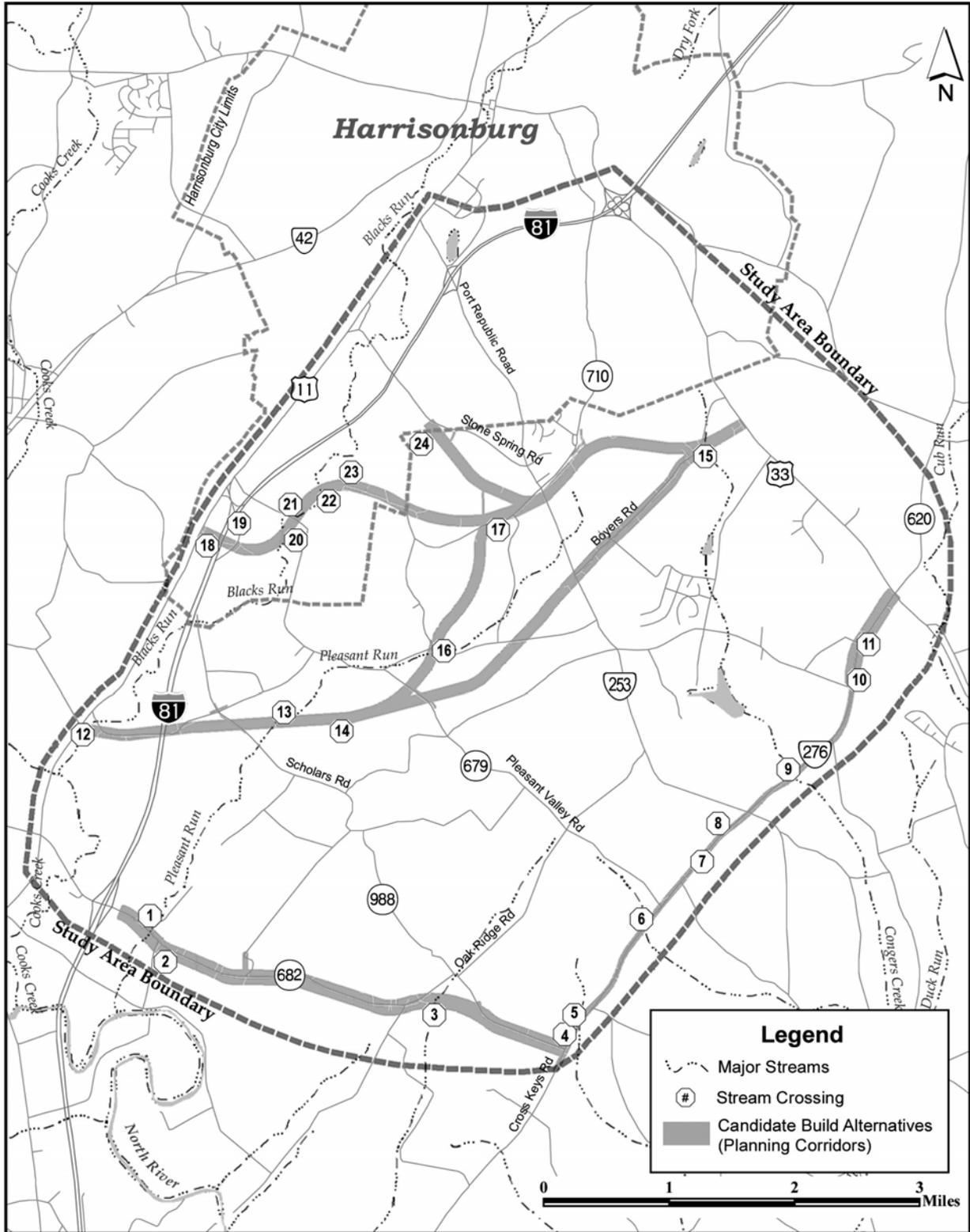
4.11 SURFACE WATERS, INCLUDING WETLANDS

4.11.1 Surface Waters

Figure 4-5 shows the locations of stream crossings by the five Candidate Build Alternatives. **Table 4-10** outlines the lengths of streams within the planning and design corridors for the alternatives. At this stage of project development, detailed hydraulic studies have not been done to conclusively determine the sizes and types of drainage structures that would be needed. However, pipe culverts likely would be VDOT's preferred method of carrying the smallest streams under the roadway. Box culverts may be more appropriate at several of the larger crossings. If pipe or box culverts are used, they would be countersunk to provide for low flow conditions and so that natural bottoms could reestablish inside the culverts. Bridges likely would be used at the largest stream crossings, such as those involving Blacks Run and the lower reaches of Pleasant Run. Any unavoidable stream relocations will be performed using natural stream design, which means that the channel should mimic the dimension, pattern, and profile of a representative reference stream reach.

At this preliminary stage of development, sufficient design has not been developed to determine the precise locations of stormwater management facilities such as detention ponds. However, all practicable efforts will be made to ensure that such facilities would not be located in streams. Any requests for authorization under the requisite federal and state water quality permits to place these facilities or portions of them in streams would be accompanied by an analyses of why alternative upland sites are not practicable.

Compensation for stream impacts may be provided as part of the permit conditions for any authorizations issued by the U.S. Army Corps of Engineers and the Virginia Department of Environmental Quality. Because these agencies determine the compensation requirements for stream impacts on a case-by-case basis, the quantitative requirements for the selected alternative would be negotiated with them as part of the permit application process. Compensation may involve enhancement or restoration to stream and riparian areas, use of credits from an approved stream mitigation bank, or payments to the Virginia Wetlands Restoration Trust Fund.



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SURFACE WATERS

Figure 4-5

Table 4-10
STREAM IMPACTS

Site Number	Description	Drainage Area (sq. mi.)	Length within Planning Corridor (feet)	Length within Design Corridor (feet)
CBA 1				
1	Pleasant Run, perennial stream, crosses Route 682 perpendicularly; 3' - 8' wide; 0.5' - 2' deep; silt/sand/gravel/cobble substrate	7.5	581	262
2	Intermittent tributary of Pleasant Run, parallels south side of Route 682 between confluence with Pleasant Run and crossing of Route 682, crosses Route 682 perpendicularly and runs alongside north side of road to headwaters; 1' - 3' wide; 0' - 1' deep; silt substrate	0.4 (0.07 above Rte 682 crossing)	3,285	1,320
3	Intermittent Tributary of North River, crosses new-location portion of corridor at approx. 40° angle; 1' - 3' wide; 0.1' - 1' deep; silt/sand/gravel/cobble substrate	0.8	647	134
4	Intermittent tributary of North River, crosses Route 276 perpendicularly; 1' - 3' wide; 0.1' - 1.5' deep; silt substrate	0.5	84	84
5	Intermittent tributary of North River, crosses Route 276 at approx. 45° angle; 2' - 3' wide; 0.5' - 1' deep; silt substrate	0.5	104	104
6	Mill Creek, intermittent stream, crosses Route 276 at approx. 20° angle; 1' - 3' wide; 0.5' - 1' deep; silt substrate	0.9	117	117
7	Intermittent tributary of Mill Creek, crosses Route 276 perpendicularly; 2' wide; 0.1' - 1' deep; silt substrate	0.4	91	91
8	Intermittent tributary of Mill Creek, crosses Route 276 perpendicularly; 1' - 2' wide; 0.5' - 1' deep; silt/sand/gravel substrate	0.8	84	84
9	Congers Creek, perennial stream, crosses Route 276 perpendicularly; 7' - 12' wide; 0.5' - 2' deep; silt/sand/gravel/cobble substrate	4.5	81	81
10	Intermittent tributary of Cub Run, crosses Route 276 perpendicularly; 5' - 7' wide; 0.5' deep; silt/sand substrate	0.5	81	81
11	Intermittent tributary of Cub Run, crosses Route 276 perpendicularly and then runs alongside Route 276 a short distance before turning away again; 2' - 3' wide; 0.5' deep; silt/sand substrate	0.2	158	158
Total CBA 1			5,313	2,516
CBA 2				
12	Blacks Run, perennial stream, parallels east side of Route 11, crosses CBA 2 perpendicularly; 30' - 40' wide; 1' - 4' deep; silt/sand/gravel/cobble substrate	18.7	501	240

Table 4-10
STREAM IMPACTS

Site Number	Description	Drainage Area (sq. mi.)	Length within Planning Corridor (feet)	Length within Design Corridor (feet)
13	Pleasant Run, perennial stream, crosses CBA 2 at approx. 50° angle from perpendicular; 15' - 20' wide; 0.5' - 2' deep; silt/sand/gravel substrate	3.8	1,082	654
14	Intermittent tributary of Pleasant Run, crosses CBA 2 at approx. 55° angle from perpendicular; 2' - 5' wide; dry at time of field review; silt/sand/gravel/cobble substrate	0.1	853	569
15	Intermittent tributary of Congers Creek, crosses CBA 2 at approx. 30° angle from perpendicular; 2' - 3' wide; 0' - 0.5' deep; silt substrate	0.3	665	192
Total CBA 2			3,101	1,655
CBA 2A				
12	Blacks Run, perennial stream, parallels east side of Route 11, crosses CBA 2A perpendicularly; 30' - 40' wide; 1' - 4' deep; silt/sand/gravel/cobble substrate	18.7	501	240
13	Pleasant Run, perennial stream, crosses CBA 2A at approx. 50° angle from perpendicular; 15' - 20' wide; 0.5' - 2' deep; silt/sand/gravel substrate	3.8	1,082	654
14	Intermittent tributary of Pleasant Run, crosses CBA 2A at approx. 55° angle from perpendicular; 2' - 5' wide; dry at time of field review; silt/sand/gravel/cobble substrate	0.1	853	569
16	Pleasant Run, perennial stream, crosses CBA 2A at approx. 15° angle from perpendicular; 5' - 8' wide; 0.1' - 1' deep; silt/sand substrate	2.5	553	261
17	Intermittent tributary of Pleasant Run, crosses CBA 2A at approx. 30° angle from perpendicular	0.2	406	227
15	Intermittent tributary of Congers Creek, crosses CBA 2A at approx. 15° angle from perpendicular; 2' - 3' wide; 0' - 0.5' deep; silt substrate	0.3	555	264
Total CBA 2A			3,950	2,215
CBA 3				
18	Intermittent tributary of Blacks Run; 2' - 8' wide; 0' - 1.5' deep; silt/gravel/cobble substrate	0.2	706	336
19	Intermittent tributary of Blacks Run; 2' - 12' wide; 0' - 2' deep; silt/gravel/cobble substrate	0.7	403	243

Table 4-10
STREAM IMPACTS

Site Number	Description	Drainage Area (sq. mi.)	Length within Planning Corridor (feet)	Length within Design Corridor (feet)
20	Blacks Run, perennial stream, crosses CBA 3 perpendicularly, then turns and runs parallel, entering into the planning corridor again at two locations just north of the crossing (Sites 21 & 22); 20' - 35' wide' 1' - 5' deep; silt/ sand/gravel/cobble substrate	14.0	750	240
21	Blacks Run, perennial stream, crosses a portion of CBA 3 perpendicularly and a portion at approx. a 70° angle to perpendicular; 20' - 35' wide' 1' - 5' deep; silt/ sand/gravel/cobble substrate	14.0	910	480
22	Blacks Run, perennial stream, crosses CBA 3 perpendicularly; 20' - 35' wide' 1' - 5' deep; silt/sand/gravel/cobble substrate	14.0	515	250
23	Intermittent tributary of Blacks Run, generally parallels CBA 3 alignment; 2' - 5' wide; 0.5' - 2' deep; silt/sand/gravel/cobble substrate	0.2	2,447	1,865
17	Intermittent tributary of Pleasant Run, crosses CBA 3 at approx. 15° angle to perpendicular; 1' - 3' wide; 0.1' - 0.3' deep; silt substrate	0.2	522	252
15	Intermittent tributary of Congers Creek, crosses CBA 3 at approx. 15° angle from perpendicular; 2' - 3' wide; 0' - 0.5' deep; silt substrate	0.3	555	264
24	Intermittent tributary of Blacks Run, crossing of CBA 3/4 varies from near perpendicular to near parallel; 1' - 2' wide; 0' - 0.4' deep; silt substrate	0.2	890	716
Total CBA 3			7,698	4,646
CBA 4				
24	Intermittent tributary of Blacks Run, crossing of CBA 3/4 varies from near perpendicular to near parallel; 1' - 2' wide; 0' - 0.4' deep; silt substrate	0.2	890	716
15	Intermittent tributary of Congers Creek, crosses CBA 3 at approx. 15° angle from perpendicular; 2' - 3' wide; 0' - 0.5' deep; silt substrate	0.3	555	264
Total CBA 4			1,445	980

Minor long-term water quality effects could occur as a result of increases in impervious pavement surfaces, increases in traffic volumes, and consequent increases in pollutants washed from the road surface into receiving streams. Pollutants would include grease, oil, metals, nutrients, nitrogen, deicing salts, roadside vegetation management chemicals, and suspended solids. Because none of the receiving streams are elements of local public water supplies, the

potential for human health effects from roadway runoff is minimal. Moreover, temporary and permanent stormwater management measures, including detention basins, vegetative controls, and other measures, would be implemented to minimize potential degradation of water quality. These measures would reduce or detain discharge volumes and remove pollutants. The requirements and special conditions of any required permits for work in and around surface waters would be incorporated into construction contract documents. The construction contractor would be required to comply with those conditions and with pollution control measures specified in VDOT's *Road and Bridge Specifications*.

4.11.2 Wetlands

Wetlands along the alternatives are small in size and scattered in distribution; most are limited to narrow and disjunct bands of emergent vegetation [common species include New York ironweed (*Vernonia noveboracensis*), swamp aster (*Aster puniceus*), fox sedge (*Carex vulpinoidea*), pale sedge (*Carex lurida*), soft rush (*Juncus effusus*) and a variety of bulrushes (*Scirpus spp.*)] or shrubs along the banks of streams [mainly common alder (*Alnus serrulata*), and shrub-sized black willow (*Salix nigra*) and sycamore (*Platanus occidentalis*)]. The Cowardin¹ classifications for these wetlands are: palustrine emergent (PEM) systems with persistent vegetation and palustrine scrub-shrub (PSS) systems with broad-leaved deciduous vegetation, both with temporary (A) or seasonal (C) flooding regimes. Their locations generally coincide with the stream locations depicted on Figure 4-5. The amounts and types of wetlands within the CBA planning and design corridors are tabulated in **Table 4-11**. The types of wetlands affected are not unique to the project area. The functions of these wetlands include groundwater discharge, sediment/toxicant retention, nutrient removal, sediment stabilization, and wildlife habitat.

Table 4-11
WETLANDS WITHIN ALTERNATIVES

Wetland Area (Acres)									
CBA 1		CBA 2		CBA 2A		CBA 3		CBA 4	
Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor
0.04	0.00	1.05	0.43	1.41	0.48	1.36	0.84	0.60	0.08

At this preliminary stage of development, sufficient design has not been developed to determine the precise locations of stormwater management facilities such as detention ponds. However, all practicable efforts will be made to ensure that such facilities would not be located in wetlands. Any requests for authorization under the requisite federal and state water quality permits to place these facilities in wetlands would be accompanied by an analyses of why alternative upland sites are not practicable.

¹ Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of wetlands and deepwater habitats of the United States*. U.S. Fish and Wildlife Service FWS/OBS - 79/31. 131 pp. A hierarchical system for classifying waters and wetlands based on hydrological and ecological characteristics, widely used by state and federal agencies in mapping and evaluating water resources and adopted by the Federal Geographic Data Committee as a Data Classification Standard.

All available measures to avoid and minimize impacts to wetlands would be implemented where feasible. For unavoidable wetland losses, VDOT will develop compensatory mitigation in cooperation with the federal and state water quality permitting agencies. Such compensation would account for lost wetland types and functions and could include construction of replacement wetlands onsite or offsite, enhancement of existing wetlands, use of credits from an approved wetlands mitigation bank, or payments to the Virginia Wetlands Restoration Trust Fund.

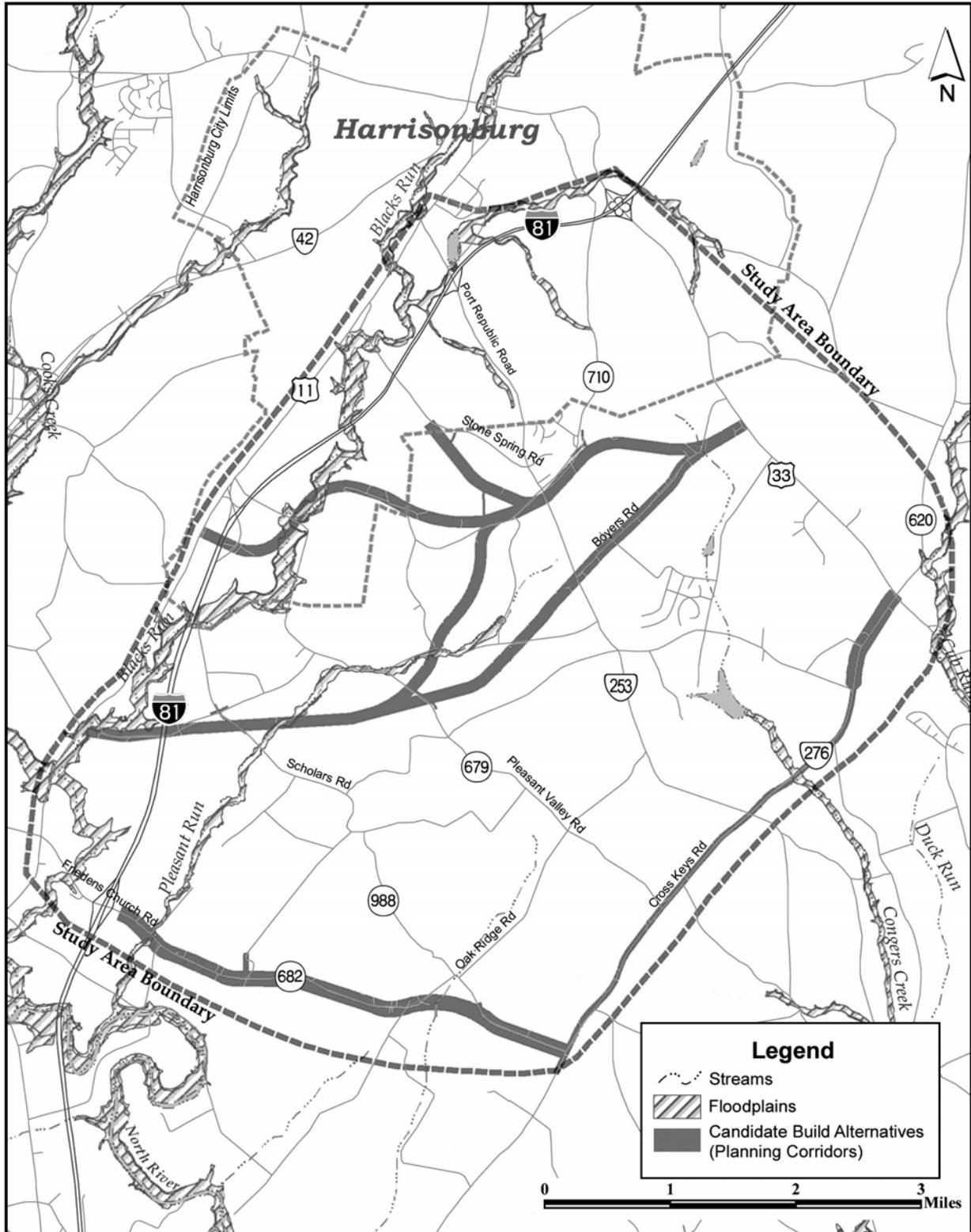
4.12 FLOODPLAINS

The boundaries of 100-year floodplains were obtained from the National Flood Insurance Maps (FIRM) prepared by the Federal Emergency Management Agency (FEMA). Determining floodplain impacts involved superimposing the alternative designs onto the 100-year floodplain digital mapping. The impacts are tabulated in **Table 4-12** and shown in **Figure 4-6**.

Table 4-12
FLOODPLAIN ENCROACHMENTS

Alternative		Planning Corridor (acres)	Design Corridor (acres)
CBA 1	Pleasant Run	2	1
	Congers Creek	1	1
	Total CBA 1	3	2
CBA 2	Pleasant Run	6	3
	Blacks Run	9	3
	Total CBA 2	15	6
CBA 2A	Pleasant Run	9	5
	Blacks Run	9	3
	Total CBA 2A	18	8
CBA 3	Blacks Run/Total	25	12
CBA 4	No Impacts	0	0

All drainage structures would be designed so that potential increases in flood levels would be minimal. There is no evidence that any of the floodplain encroachments would increase the probability of flooding or the potential for property loss and hazard to life during the service lives of any bridges or other drainage structures and their roadway approaches. Therefore, none of the alternatives would have any effect on flooding risks. None of the alternatives would be expected to have substantial effects on fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, groundwater recharge, and other natural and beneficial floodplain values. The project would not encourage, induce, allow, serve, support, or otherwise facilitate additional or incompatible base floodplain development. The floodplain encroachments would not be “significant encroachments” (as defined in 23 CFR 650.105(q)) because:



Source: Federal Emergency Management Agency

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FLOODPLAINS

Figure 4-6

- They would pose no significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or that provides a community's only evacuation route.
- They would not pose significant flooding risks.
- They would not have significant adverse impacts on natural and beneficial floodplain values.

Therefore, the project is consistent with Executive Order 11988, *Floodplain Management*, which prohibits federal support of incompatible floodplain development unless there is no practical alternative, and no Floodplain Finding in accordance with Executive Order 11988 is required.

Sections 107 and 303 of VDOT's specifications require the use of stormwater management practices to address concerns such as post-development stormflows and downstream channel capacity. These standards require that stormwater management ponds be designed to reduce stormwater flows to pre-construction conditions for up to a 10-year storm. VDOT would adhere to its specifications to prevent an increase in flooding risks associated with the improvements. It is expected that backwater elevations and velocity increases at the floodplain encroachments would be nonexistent or minimal. During final design, a detailed hydraulic survey and study would evaluate effects on stormwater discharges. This evaluation would help ensure that no substantial increases in downstream flooding would occur.

Through coordination with City of Harrisonburg and Rockingham County local floodplain management officials, the local floodplain ordinances were obtained and reviewed. Both ordinances require that any proposed development not result in increasing the elevation of the 100-year flood by more than one foot at any point.

Based on the above, none of the alternatives would be expected to have substantial impacts to floodplains or the natural and beneficial values of floodplains.

4.13 WILDLIFE AND HABITAT

4.13.1 Aquatic Habitat

Placement of culverts to carry streams under any of the alternatives would result in minor losses of stream-bottom habitat and the resident benthic (bottom-dwelling) organisms. However, most of the streams in the study area already have diminished benthic communities because of agricultural runoff. The major receiving tributaries (Blacks Run, Pleasant Run, and Mill Creek) are all classified by EPA as impaired waters due to fecal coliform bacteria contamination (from livestock operations). Because of the small size and intermittent flow of most of the streams, their fisheries value is considered low. Localized water quality impacts of runoff from the alternatives could further suppress benthic populations due to stresses caused by contaminants in highway runoff. However, most of the impact sites already are crossed by existing roads, or are near existing road crossings. Moreover, the impacts of habitat loss and contamination would be offset by implementation of mitigation measures, such as countersinking of culverts (so that natural bottom could reestablish within the culvert and the movement of aquatic organisms would not be obstructed) and installation and management of proper stormwater management facilities. Given the absence of existing stormwater controls, it is possible that the overall water quality of receiving streams could actually improve following the installation of stormwater management facilities as part of the implementation of any road construction. Additional mitigation measures would be developed during design development in cooperation with the U.S. Army Corps of Engineers, EPA, and USFWS. Such measures could include stream

restoration, establishment of riparian buffers, use of credits from a stream mitigation bank, or payments into the Virginia Aquatic Resources Trust Fund.

4.13.2 Terrestrial Habitat

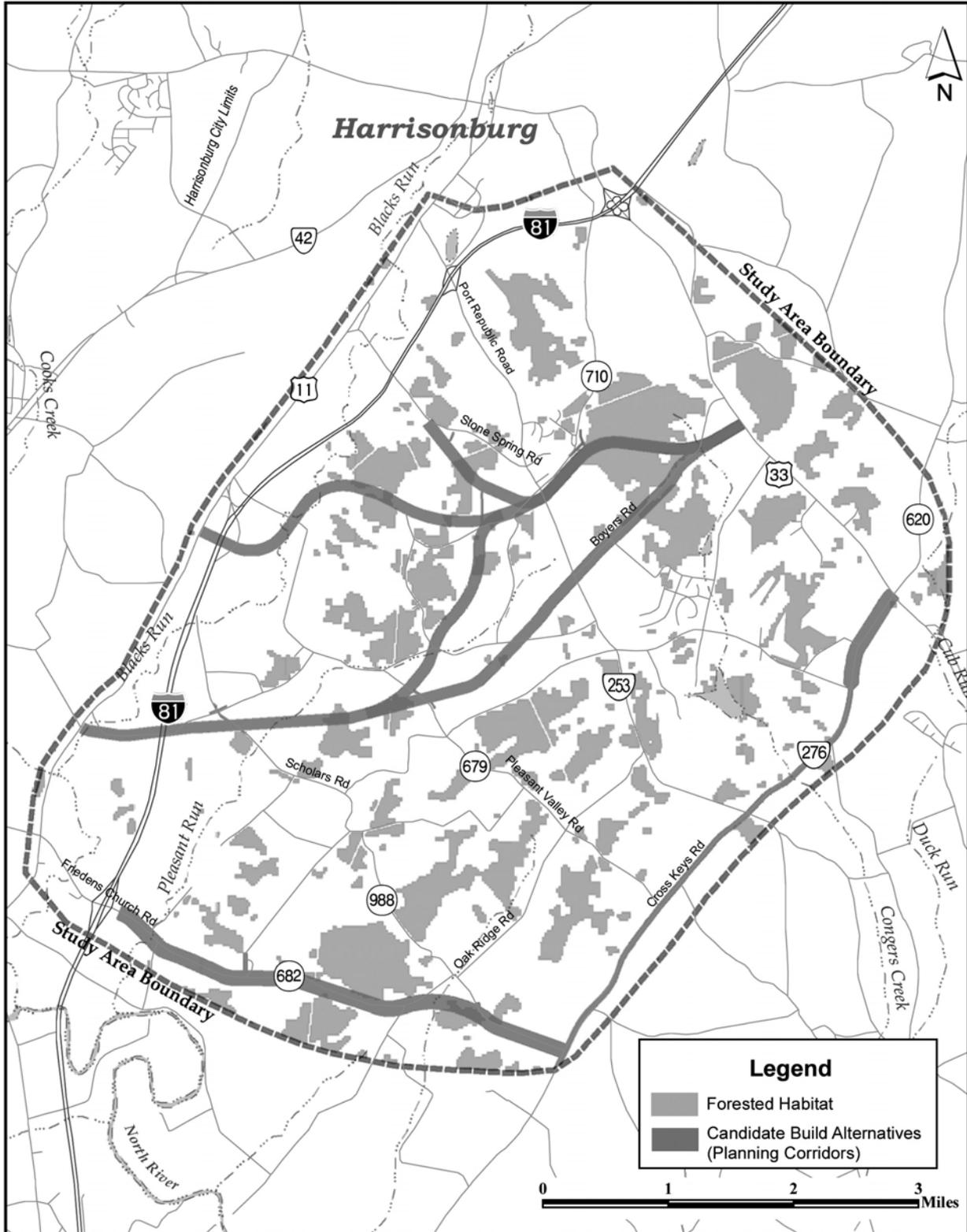
Terrestrial habitat within the study area already has been extensively fragmented by agricultural activities, residential development, powerlines, and roads. As a result, most remaining forested areas consist of “islands” on hilltops that are too steep to farm. Such areas also generally are too steep for roads, resulting in relatively low forestland impacts for all the alternatives (see **Table 4-13** and **Figure 4-7**). Although pasture land, cropland, and residential land have habitat values for a number of wildlife species, the losses of these areas to highway right of way would not constitute severe losses of available habitat or wildlife populations. Segments of alternatives that would be on new location would marginally increase the fragmentation of habitat. Most of these segments pass through areas of open unforested lands.

Table 4-13
IMPACTS TO FORESTED HABITAT (ACRES)

Corridor	CBA 1	CBA 2	CBA 2A	CBA 3	CBA 4
Planning Corridor	8.8	22.1	45.8	42.3	28.9
Design Corridor	1.9	9.0	22.7	18.4	12.9

4.13.3 Migratory Birds

Migratory birds include hundreds of species of songbirds, waterfowl, raptors (birds of prey), and others as listed under various international conventions, such as the Migratory Bird Treaty Act of 1918, and other treaties and legislation that are aimed at conserving bird populations. More particularly, “neotropical” migratory birds are those that breed in or migrate through the United States and spend the nonbreeding season in Mexico, Central America, the Caribbean and/or South America. Migratory birds provide various environmental, economic, recreational, and aesthetic benefits. The migratory birds of primary concern for this study are songbirds, which include thrushes, warblers, vireos, grosbeaks, and many other familiar species. Research indicates that the most important stopover habitat for most migratory songbirds consists of forest with dense undergrowth. This type of habitat provides many different types of feeding and resting areas and good cover from predators. Many neotropical songbirds also require large areas of forest to raise their young. For example, some warblers need at least 250 acres of forest for successful nesting. However, there are no large blocks of forest within the study area. The small fragmented areas of forest in the study area also do not provide the multiple vegetative layers optimal for migratory songbird habitat. In contrast, the George Washington National Forest to the west and Shenandoah National Park to the east provide vast federally protected and managed forestlands that provide suitable migratory bird habitat. As shown in Table 4-13, the effects of the alternatives on forestland would be minimal, and, consequently, the effects on forest-dwelling migratory birds would be minimal as well. Some migratory birds, such as meadowlarks and several species of sparrows, require grassland habitats for courtship, nesting, foraging, rearing young, and roosting or resting. Grasslands are plentiful in and around the study area and include agricultural lands, old fields, pastures, orchards, parks, golf courses, and cut-over forests. Each of the alternatives would impact grassland habitats to the extent of the highway right of way acreages across pastures or croplands and similar areas. These acreages are relatively small in comparison to the total acreage in the study area.



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FORESTED HABITAT

Figure 4-7

4.13.4 Invasive Species

In accordance with Executive Order 13112, *Invasive Species*, the potential for the establishment of invasive animal or plant species during construction of any of the Candidate Build Alternatives would be minimized by following provisions in VDOT's *Road and Bridge Specifications*. These provisions require prompt seeding of disturbed areas with seeds that are tested in accordance with the Virginia Seed Law and VDOT's standards and specifications to ensure that seed mixes are free of noxious species. While the right of way is vulnerable to colonization by invasive plant species from adjacent properties, implementation of the stated provisions will reduce the potential for the establishment and proliferation of invasive species within highway right of way.

4.14 THREATENED AND ENDANGERED SPECIES

Early in the study, the U.S. Fish and Wildlife Service (USFWS) and the Virginia division of Natural Heritage provided lists of endangered and threatened species that occur or may occur in Rockingham County. In addition, input was solicited and received from the Virginia Department of Conservation and Recreation's Karst Protection Coordinator with respect to species associated with karst terrain.

According to the Karst Protection Coordinator: "The Madison Cave isopod, a subterranean aquatic crustacean, is endemic to karst aquifers of the Shenandoah Valley. One of the 11 documented locations is the nearby Massanutten Caverns. The species may well be present beneath the surface of the entire study area. Protecting the species requires maintaining the pre-development hydrology and maintaining or improving the water quality. In particular, water should not be diverted to or away from sinkholes or drainageways terminating in sinkholes. Water ultimately discharged to sinkholes should enter a detention basin prior to release."

None of the alternatives would affect any of the threatened or endangered species, or the habitat of such species, noted by the state or federal resource agencies. None of the alternatives traverse any sinkholes, caves, fissures, or other features leading to potential subterranean Madison Cave isopod (*Antrolana lira*) habitat. Stormwater runoff would not be diverted to sinkholes or drainageways terminating in sinkholes. Therefore, no effects are anticipated on this federally listed threatened species. Nor would any effects be anticipated on the Madison Cave amphipod (*Stygobromus stegorum*), which is listed as threatened under the Virginia Endangered Species Act. None of the alternatives affect any caves that could potentially serve as hibernacula for the Indiana bat (*Myotis sodalis*), a federally listed endangered species. Nor would any densely wooded areas or riparian or floodplain forests that might serve as Indiana bat foraging areas be affected by any of the alternatives. Due to the extensive agricultural land uses and development activities, optimal foraging and roosting habitat for this species is virtually nonexistent throughout the entire study area. Based on this information, no effects on the Indiana bat are anticipated. None of the alternatives cross any suitable habitat for Northeastern bulrush (*Scirpus ancistrochaetus*), federally listed as endangered, and Virginia sneezeweed (*Helenium virginicum*), federally listed as threatened.

Correspondence from USFWS received in December 2005 indicates that none of the alternatives are "likely to affect federally listed or proposed species or adversely modify critical habitat. Therefore, no Biological Assessment or further Section 7 consultation is required with the Service."

4.15 HISTORIC PROPERTIES

“Historic property” means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria. (36 CFR 800.16(l)(1)).

4.15.1 Historic Architectural Properties

Identification of historic architectural properties. In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 CFR 800 (the federal Advisory Council on Historic Preservation’s regulations implementing the Act), historic architectural properties within the areas of potential effects² (APE) were identified and evaluated for each alternative. These efforts included:

- A review of properties in the study area that previously had been listed in, or determined eligible for listing in, the National Register of Historic Places (NRHP).
- Field surveys within the APE of each Candidate Build Alternative to identify other districts, buildings, structures, or objects potentially eligible for the NRHP.
- Detailed evaluation of potentially eligible properties to conclusively determine their eligibility.
- Coordination with the Virginia Department of Historic Resources (VDHR) and consulting parties.

A series of reports documents the historic architectural property identification and evaluation efforts.³ The findings have been coordinated with VDHR, which is the State Historic Preservation Office for Virginia, and with Section 106 consulting parties in accordance with the regulations.⁴ VDHR concurred with the findings of the identification and evaluation efforts. The Shenandoah Valley Battlefields Foundation and the Civil War Preservation Trust concurred with the Cross Keys Battlefield boundaries. **Table 4-14** lists the historic properties within the areas of potential effects of the alternatives (listed by alternative, in order from west to east and south to north); **Figure 4-8** shows the locations of the properties, along with the locations of other historic properties outside the areas of potential effects but within the study area.

² Area of Potential Effect: the geographic area within which an undertaking directly or indirectly may cause alterations in the character or use of historic properties (36 CFR 800.16(d)). For architectural properties, it is defined as a 1,000-foot-wide corridor along each CBA alignment, plus other resources adjacent to or visible from the corridor. For archaeological resources, it is defined as the planning corridor, which varies from 80 to 500 feet wide (see Table 4-1).

³ *Cultural Resources Constraints Report, Architectural Identification Survey Management Summary, and Architectural Evaluation Survey.*

⁴ Consulting parties included the Shenandoah Valley Battlefields Foundation, the Civil War Preservation Trust, and the Harrisonburg-Rockingham Historical Society.

Table 4-14
NRHP-LISTED OR ELIGIBLE HISTORIC PROPERTIES

VDHR File # ^a	Resource Name & Location	Description	NRHP Status & Criteria ^b
CBA 1			
082-5298	Flory Farm, 3550 Friedens Church Road	Ca. 1854 house, late nineteenth century additions, outbuildings, and millrace	Eligible, A & C
082-0102	Friedens Church	Ca. 1819 church	Eligible, A, C
082-5096	Peter Heil House (Springdale Farm), 4090 Cross Keys Road	Ca. 1850 house	Eligible, C
082-5204	German Reformed Church Parsonage, 4067 Cross Keys Road	Late 18th century parsonage	Eligible, C
082-0376	Cross Keys Battlefield Historic District, straddles eastern study area boundary	5,400-acre 1862 Civil War Battlefield, including contributing resources	Eligible, A
082-0369	Kublinger-Crow Farm, 3591 Cross Keys Road	Ca. 1835 house and outbuildings	Individually ineligible, but contributing resource to Cross Keys Battlefield Historic District
082-0368	Dr. J.B. Webb House, 3327 Cross Keys Road	Late 1850s house and early 20 th century barn	Eligible, C; contributing resource to Cross Keys Battlefield Historic District
082-0053	Meadowview Farm, 1776 Cross Keys Road	Ca. 1870 house and outbuildings	Eligible, C
082-5075	Kyles Mill Farm, 1764 Cross Keys Road	Mid 18th century farm complex	Listed, C
082-0032	Peale House (Crossroads Farm), 67 Cross Keys Road at intersection of Route 33	Ca. 1845 house and servants quarters	Eligible, A & C
CBA 2 and 2A			
082-5351	Myers Farmstead, 5536 South Valley Pike	Ca. 1840 house	Eligible, C
082-5134	Pleasant Valley School No. 2, 1827 Cecil Wampler Road	Ca. 1905 school	Individually ineligible, but contributing to Pleasant Valley Historic District
082-0641	Pleasant Valley Historic District	Mid-late 19 th century district	Eligible, A
082-5155	Byerly House, 1819 Pleasant Valley Road	Ca. 1845 dwelling and outbuildings	Eligible, A, C
082-0509	Massanetta Springs Historic District	Ca. 1909 historic district	Listed, A, C
CBA 3			
082-5156	Dundore House, 1582 Ridgedale Road	Ca. 1873 house	Eligible, C
115-5055	Argubright Barn	Ca. 1850 barn	Eligible, A, C
CBA 4			
115-5055	Argubright Barn	Ca. 1850 barn	Eligible, A, C
^a VDHR (Virginia Department of Historic Resources) is the office of the State Historic Preservation Officer (SHPO), who has responsibilities under the National Historic Preservation Act for administering the state historic preservation program. ^b 36 CFR 60.4, National Register Eligibility Criteria: A. Associated with important historical events, which could be of local, statewide, or national significance (e.g., Civil War battle); B. Associated with important historical persons (e.g., Stonewall Jackson); C. Embody distinctive characteristics of a type, period, or workmanship (usually architecture, e.g., 19th century Federal-style dwelling); D. Contains information important in history or prehistory (archaeological sites, e.g., Indian campsites).			

Effects. Effects of the alternatives on historic properties have been evaluated by VDOT staff meeting the Secretary of the Interior’s professional qualifications standards for architectural history (48 FR 44739) by applying the definition of effect and the criteria of adverse effect as stated in the regulations implementing Section 106 of the National Historic Preservation Act. These regulations define an effect as an “alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register” [36 CFR 800.16(i)]. The effect is adverse when the alteration of a qualifying characteristic occurs in a “manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association” (36 CFR 800.5(a)). The potential effects of the alternatives on historic properties are discussed below. A final Determination of Effect will be made and coordinated with the State Historic Preservation Officer after identification of a preferred alternative and during development of the Final Environmental Impact Statement.

CBA 1.

082-5298, Flory Farm: Though within the planning and design corridors for CBA 1 (see **Figure 4-9**), encroachment on the resource can be avoided by realigning the alternative to pass north of the site while staying within the planning corridor. The alternative may be visible from the resource and, if so, could have a visual impact. **Potential adverse effect.**

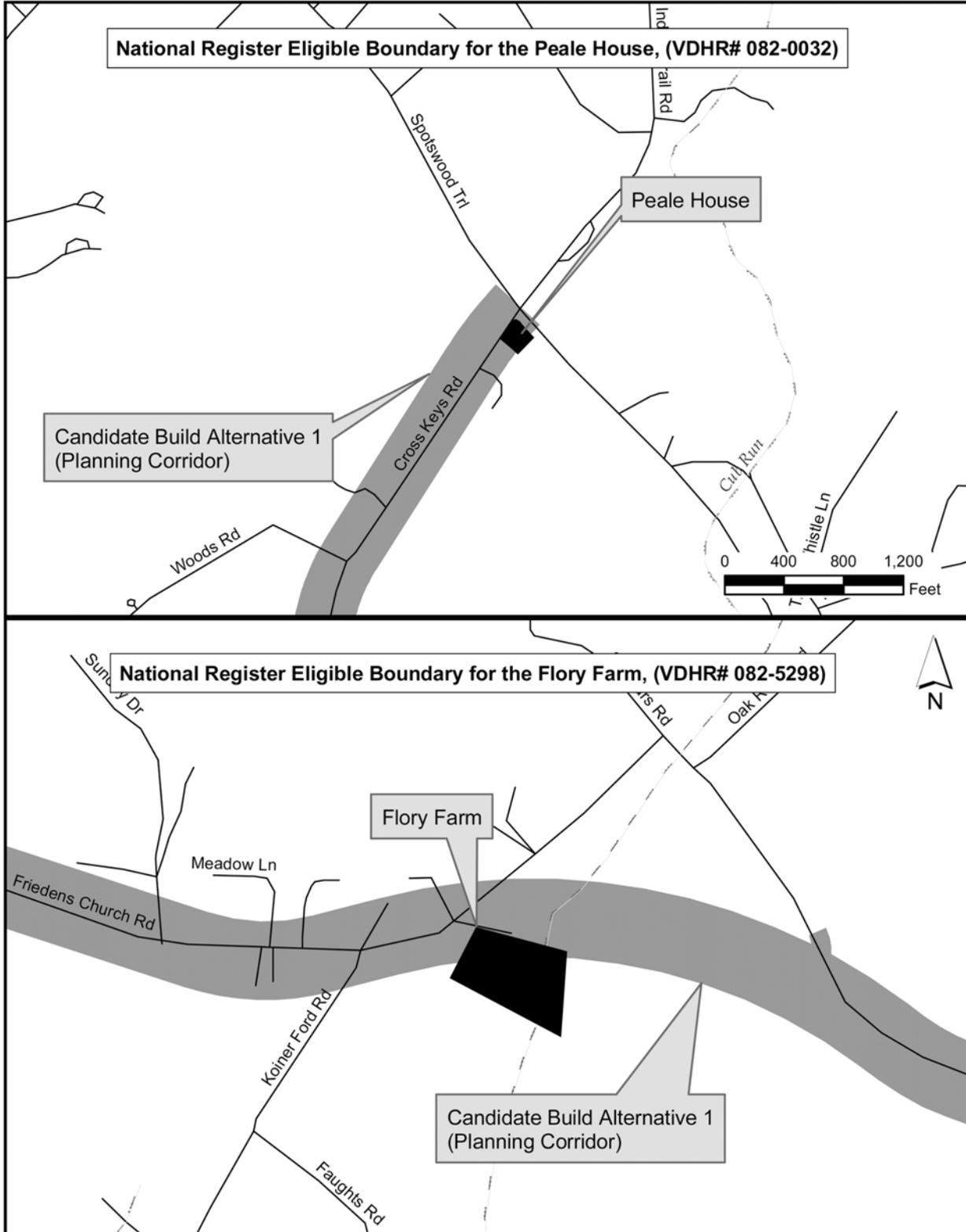
082-0102, Friedens Church: CBA 1 would avoid the resource. The alignment would move a considerable distance away from the current alignment of Route 682. CBA 1 would not be within the viewshed of the church and would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-5096, Peter Heil House: CBA 1 would avoid the resource. The dwelling is set a considerable distance back from Route 276, with driveway access with modern dwellings on either side. CBA 1 would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-5204, German Reformed Church Parsonage: CBA 1 would avoid the resource and would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-0376, Cross Keys Battlefield Historic District: Construction activities through this portion of CBA 1 would be limited to areas within the existing 80-foot-wide right of way, avoiding elements contributing to the significance of the resource. The appearance of the road would change from a road with little or no shoulder and no paved portion of shoulder to one with full standard shoulders, with an eight-foot-wide paved shoulder on both sides of the road. There are numerous modern residences and some commercial buildings within the district. CBA 1 would not alter any character-defining features qualifying the battlefield for the National Register. **No adverse effect.**

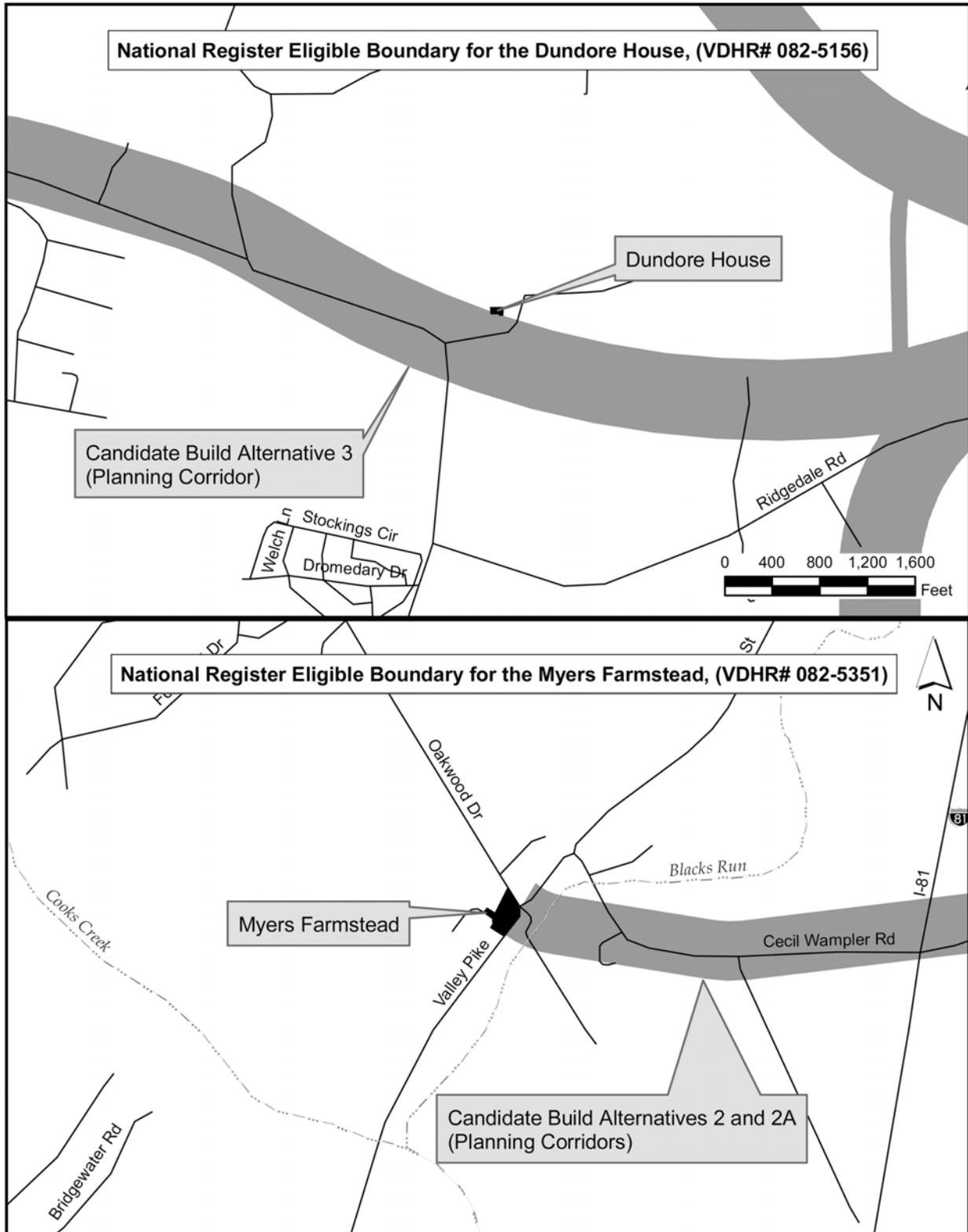
082-0369, Kublinger-Crow Farm: CBA 1 would avoid the resource, which is also within the Cross Keys Battlefield Historic District. Construction activities through this portion of CBA 1 would be limited to areas within the existing 80-foot-wide right of way. The immediate setting of the property itself has been compromised with the construction of a swimming pool next to the dwelling. CBA 1 would not alter any character-defining features qualifying the resource for the National Register. **No effect.**



Source: Rockingham County GIS Department Historic Resources: Coastal Carolina Research, Inc.

**Harrisonburg Southeast Connector
Location Study**

**PEALE HOUSE &
FLORY FARM
Figure 4-9**



Source: Rockingham County GIS Department Historic Resources: Coastal Carolina Research, Inc.

**Harrisonburg Southeast Connector
Location Study**

**DUNDORE HOUSE &
MYERS FARMSTEAD
Figure 4-10**

082-0368, Dr. J. B. Webb House: CBA 1 would avoid the resource, which is also within the Cross Keys Battlefield Historic District. Construction activities through this portion of CBA 1 would be limited to areas within the existing 80-foot-wide right of way. The house is across Route 276 from multiple modern residences. CBA 1 would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-0053, Meadowview Farm: CBA 1 would avoid the resource. Although not a contributing resource, the resource is located within the Cross Keys Battlefield Historic District. Construction activities through this portion of CBA 1 would be limited to areas within the existing 80-foot-wide right of way. The house is elevated above the existing roadway and would continue to be so for CBA 1. CBA 1 would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-5075, Kyles Mill: CBA 1 would avoid the resource. The property is also within the Cross Keys Battlefield Historic District and construction activities through this portion of CBA 1 would be limited to areas within the existing 80-foot-wide right of way. The house and its few outbuildings are set back from the existing roadway, behind a modern pond. Access to the house is through a drive between two parcels under separate ownership. CBA 1 would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-0032, Peale House: Though within the planning and design corridors (see Figure 4-9), encroachment on the resource can be avoided by holding the existing right of way on the southeast side of Route 276 and constructing all the widening to the northwest, requiring reconstructing the intersection with Route 33. The setting of the house has been progressively changed over the years, with Routes 33, 276 and their intersection immediately adjacent to the house. A modern church is located across four-lane-divided Route 33, in the east quadrant of the existing intersection. Additionally, there is a very large recent residential development across Route 276 from the house; construction of additional residences is ongoing, as is construction of a large commercial building in the west quadrant of the intersection. A large portion of the residential development is on rising ground, clearly visible from the house. There is a large boxwood hedge that screens the existing roadway from the house; that screen would not be impacted by CBA 1. Constructing all widening to the northwest would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

CBA 2 and CBA 2A.

082-5351, Myers Farmstead: CBA 2 and 2A would avoid the resource. The farmstead is on the west side of Route 11, at its intersection with Route 704 (see **Figure 4-10**). The farmstead currently fronts four-lane-divided Route 11, and there is a large commercial building southwest, adjacent to the house yard, along with modern residences along Route 11. CBA 2 and 2A would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-5134, Pleasant Valley School No. 2: CBA 2 and 2A would avoid the resource, which is not individually eligible, but considered contributing to the Pleasant Valley Historic District. The district's setting is compromised by encroaching, large-scale industrial development around it and the school is in an area of modern residences. Route 704 and the development along it lie between the school and the alternatives. The alternatives would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-0641, Pleasant Valley Historic District: CBA 2 and 2A would avoid the resource. The district's setting is compromised by encroaching, large-scale industrial development around it. Route 704 and development along that road lie between the district and the alternatives, which are more than 2,000 feet away. CBA 2 and 2A would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-5155, Byerly House: CBA 2 and 2A would avoid the resource. The property's integrity of setting has been compromised by a large distribution center within its immediate viewshed. CBA 2 and 2A would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

082-0509, Massanetta Springs Historic District: CBA 2 would avoid the resource. The alignment is separated from the district by a large wooded area and would not be within the district's viewshed. CBA 2 and 2A would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

CBA 3 and 4.

082-5156, Dundore House: CBA 3 would avoid the resource. This property is eligible for the NRHP solely for the construction techniques used to build the dwelling. The resource can be avoided (see Figure 4-10). CBA 3 would not alter any character-defining features qualifying the resource for the National Register. This property is not within the APE of CBA 4. **No effect.**

115-5055, Argubright Barn: CBA 3 and CBA 4 would avoid the resource. Located out of the resource's viewshed, the alternatives would not alter any character-defining features qualifying the resource for the National Register. **No effect.**

4.15.2 Archaeology

An assessment of potential for the presence of archaeological resources within the APE of each Candidate Build Alternative.⁵

An archaeological assessment was conducted along the Candidate Build Alternatives to evaluate any appreciable differences among alternatives in terms of the potential range, quantity, and integrity of archaeological resources. The assessment also included evaluation of the potential for any alternatives to contain sites meriting preservation in place, or sites that would be extraordinarily complex and/or expensive to excavate. The following discussion summarizes the results of the assessment.

Sites from all time periods have at least some potential of being encountered in unsurveyed areas of the alternatives. While most of the potential pre-contact (before Colonial settlement) and post-contact (after Colonial settlement) site types would be unlikely to affect decision making (because such sites generally are important, not for preservation in place, but for the information they contain, which can be recovered), some Civil War-related site types could merit preservation in place or be costly and complex to document or excavate. The potential for Civil War-related sites is moderate to high in CBA 1, moderate in CBA 2, low in CBA 2A, and low to moderate in CBAs 3 and 4. The portion of CBA 1 along Route 276 has high potential due to the fact that it passes through the Cross Keys Battlefield Historic District. However, construction

⁵ Because the alternatives under consideration consist of corridors covering large land areas, field archaeological surveys will be conducted after the identification of a preferred alternative, as provided for in 36 CFR 800.

activities on undisturbed ground through this portion of CBA 1 would be limited and constrained to areas within the existing 80-foot-wide right of way.

Table 4-15 presents the potential for encountering sites from different time periods for each of the Candidate Build Alternatives. The results are based on consideration of the previously recorded sites in the study area, settlement patterns for each period, and the nature of the terrain crossed by each alternative.

Table 4-15
POTENTIAL FOR ENCOUNTERING ARCHAEOLOGICAL SITES FROM SPECIFIC TIME PERIODS

Alternative	Paleo-Indian Period	Archaic Period	Woodland Period	Post-contact Period
No-build	Low	Low	Low	High
CBA 1	Low	Low to moderate	Low	High
CBA 2	Low	Low to moderate	Low	High
CBA 2A	Low	Low to moderate	Low	High
CBA 3	Low	Low to moderate	Low	High
CBA 4	Very low	Low	Very low	High

Upon identification of a preferred alternative, detailed archaeological studies will be undertaken to identify all archaeological sites on or eligible for the National Register of Historic Places within the APE for the preferred alternative. This work will be conducted in two phases:

- **Phase I** - Conduct field survey by visually inspecting the ground surface and digging test pits by shovel at regularly spaced intervals, with additional shovel testing in locations where archaeological artifacts or features are discovered, in order to identify archaeological sites. For any identified sites, the approximate horizontal and vertical boundaries will be estimated, artifacts will be defined as to type and time period, and a recommendation of potential for National Register eligibility and whether additional work is warranted will be developed. All findings will be documented in a report and coordinated with VDHR.
- **Phase II** - For those sites determined to be potentially eligible for the National Register, additional excavations and analyses will be conducted to conclusively establish their eligibility for the National Register. All findings will be documented in a report and coordinated with VDHR.

For archaeological sites that are determined eligible for the National Register, and which cannot be avoided by the preferred alternative and therefore would incur an adverse effect, VDOT and FHWA will undertake additional consultations with VDHR and other consulting parties to develop a Memorandum of Agreement outlining how the adverse effects will be resolved (e.g., through data recovery excavations).

4.15.3 Cross Keys Battlefield

A 2.8-mile portion of CBA 1 along Route 276 passes through the Cross Keys Battlefield, as shown on **Figure 4-11**. An evaluation and determination of the NRHP-eligible boundaries of the Cross Keys Battlefield Historic District was conducted (*Cross Keys Battlefield Boundary Review*) and VDHR reviewed and concurred with the boundaries.

The construction along this section would entail widening the shoulders on both sides of the existing road to meet minor rural arterial standards (10 feet wide, with 8 of the 10 feet paved), reworking drainage ditches where needed, and extending culverts where necessary to accommodate the shoulder improvements, all within existing right of way. Although the visual character of Cross Keys Road would be altered by the addition of shoulders and other minor work, no character-defining features qualifying the battlefield for the National Register would be altered. Therefore, there would be no adverse effect on the Battlefield.

The Cross Keys Battlefield also is an element of the Shenandoah Valley Battlefields National Historic District established by Congress in the Shenandoah Valley Battlefields National Historic District and Commission Act of 1996. The eight-county District contains 10 Civil War battlefields mapped by the National Park Service. The Act created a planning process for the oversight and preservation of battlefields included in the District. The Shenandoah Valley Battlefields National Historic District is an entity established by Congress and is not the same as a historic district established under the criteria used to determine eligibility for the National Register of Historic Places under the National Historic Preservation Act. For purposes of Section 106, effects only on the National Register-eligible boundaries of the Cross Keys Battlefield are of concern for any of the alternatives. No other National Register-eligible battlefields within the Shenandoah Valley Battlefields National Historic District are in the vicinity of the study area. Coordination with the Shenandoah Valley Battlefields Foundation was begun shortly after initiation of the Harrisonburg Southeast Connector Location Study. A copy of the *Cross Keys Battlefield Boundary Review* report was provided to the Foundation for review and comment. The Foundation concurred with the findings of the report and the recommended National Register-eligible boundaries for the Battlefield. The Foundation is a consulting party for purposes of Section 106.

The Civil War Preservation Trust also has been consulted and also was provided a copy of the *Cross Keys Battlefield Boundary Review* report. The Trust concurred with the recommended National Register-eligible boundaries and expressed its chief concern as the integrity of the Cross Keys Battlefield. The Trust also is a consulting party under Section 106.

4.16 CONSTRUCTION IMPACTS

Construction impacts are short-term effects resulting from the process of building a project. Construction impacts can involve temporary changes in land use and community access, water quality, air quality, and noise levels.

4.16.1 Land Use and Access

Access to businesses and homes could be temporarily disrupted due to temporary detours that are necessary to allow ample space for equipment staging and construction. These temporary disruptions are unavoidable and would be minimized to the extent possible by carefully planning for maintenance of traffic during the process and incorporating maintenance of traffic details into the design plans.

4.16.2 Wildlife and Habitat

The clearing of vegetated cover within the construction footprint would displace temporarily certain habitat areas that would become reestablished over time with the revegetation of cut and fill slopes and other areas within the construction limits but outside of paved areas and the

required clear zone. Grasses would be reestablished quickly and volunteer trees and shrubs would colonize disturbed areas over a period of years. The mechanical removal of cover would cause animal migration away from the disturbance, resulting in a temporary decrease in available habitat and increased competition for remaining habitat. Construction activities also may cause direct mortality of wildlife unable to move out of the way of construction equipment. Opportunistic or invasive plant species may have a competitive advantage in colonizing bare areas during early construction activities; however, temporary and permanent revegetation establishment in accordance with VDOT's *Road and Bridge Specifications* would minimize the extent and duration of undesirable plant growth.

4.16.3 Water Quality

Short-term water quality impacts may result from erosion and siltation following ground disturbance and earthmoving operations. After entering streams, the eroded material may increase turbidity levels and sedimentation downstream. Excessive quantities of suspended solids can harm fish and other aquatic life. Deposition of suspended solids may alter the substrate of streambeds, interfere with plant production and fish spawning, smother benthic fauna, and reduce substrate utilization. Eroded material also may contain organic matter and nutrients, such as nitrogen and phosphorus. Inputs of organic matter could result in increases in biochemical oxygen demand and decreases in dissolved oxygen concentrations. Inputs of nutrients can increase both turbidity and eutrophication by increasing algae production.

A project-specific Erosion and Sediment Control Plan will be prepared in accordance with VDOT's *Erosion and Sediment Control Annual Plan*, which encompasses all of VDOT's erosion and sediment control standards, specifications, policies, and design guidelines as outlined in the *Road and Bridge Standards, Road and Bridge Specifications, Drainage Manual, Instructional and Informational Memoranda*, and other associated directives. The *Annual Plan* is submitted each year for review and approval by the Virginia Department of Conservation and Recreation. Implementation of the Plan would be expected to minimize impacts of erosion and sedimentation during construction. Erosion and sediment control measures would be implemented throughout the construction period to minimize water quality impacts from increased levels of sedimentation and turbidity. Control measures may include berms, dikes, sediment basins, fiber mats, straw silt barriers, netting, mulch, temporary and permanent seeding, and other methods. Construction impacts to in-stream aquatic habitats would be minimized to the extent practicable by avoiding stream relocations and by crossing streams at right angles where possible. To the extent possible, construction equipment would be restricted from fording and otherwise disrupting in-stream habitats.

4.16.4 Air Quality

Construction impacts on air quality include exhaust emissions from construction equipment and dust generated by construction activities on disturbed earth. These impacts would be minimized by enforcement of construction specifications and adherence to VDEQ regulations. VDOT's *Road and Bridge Specifications* require the contractor to comply with all applicable local, state, and federal laws, ordinances, regulations, orders, and decrees. This includes compliance with emissions standards for construction equipment and adherence to regulations for burning of materials from clearing and grubbing, demolition, or other operations. The *Specifications* were reviewed by the VDEQ and were found to conform to the State Implementation Plan. The *Specifications* prohibit burning of tires, asphalt materials, used crankcase oil, or similar materials

that produce dense smoke. Provisions would be included in the contract for allaying dust from bare ground and from construction traffic.

4.16.5 Noise

Noise receptors that would be sensitive to highway traffic noise also would be sensitive to noise from construction equipment. To minimize the effects of construction noise, VDOT's *Road and Bridge Specifications* contain noise control provisions, which include the following:

- Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.
- The contractor's operations shall be performed such that the exterior noise levels measured at a noise-sensitive activity shall not exceed 80 dBA during periods of such activity.
- VDOT reserves the right to prohibit or restrict to certain portions of the project any work that produces objectionable noise during normal sleeping hours, 10 p.m. to 6 a.m., unless other hours are established by local ordinance, in which case the local ordinance shall govern.

4.17 INDIRECT EFFECTS

Indirect effects (40 CFR 1508.8(b)) occur later in time and farther in distance than direct effects, and can include changes in land use patterns, population density, or development rates, and related effects on air, water, and other natural systems. Such effects are not directly attributable to project construction, but, rather, are attributable to other development that may be induced by changes to land accessibility or travel patterns brought about by a project. Quantifying indirect effects often is difficult due to the inability to precisely foresee relationships between a given project and future development, as well as the interplay of factors other than transportation (e.g., overall economic conditions, availability of other infrastructure such as water and sewer systems, growth policies and plans of local governments, rezoning decisions by local governments, and inclinations of individual landowners) that play large roles in development decisions. An additional element is whether the development is planned (i.e., consistent with local comprehensive plans and policies) or unplanned (i.e., not consistent with local comprehensive plans and policies).

During the scoping process for this study, several citizens expressed concerns that certain alternatives, particularly those on new location, might stimulate unwanted development. No such concerns have been expressed by county planners or officials. All portions of the study area within the Harrisonburg city limits and most of the Rockingham County portion of the study area are designated in the local comprehensive plans for development. All portions of the study area currently are accessible by existing roads, although most are secondary roads. Rockingham County plans to extend sewer and water services throughout most of the study area over the next several decades. Recent growth trends in Harrisonburg and Rockingham County suggest that the Harrisonburg region will remain an attractive place to live and work for the foreseeable future, and that the influx of new residents will continue. The proximity of the undeveloped lands within the study area to Harrisonburg and to other activity centers inside and outside the study area make these lands attractive for development. The goals stated in Rockingham County's comprehensive plan include the encouragement of development in areas such as that encompassed by the study area boundaries, rather than in outlying portions of the county well beyond existing residential and employment centers. Based on the above, development in the study area will continue, regardless of whether any of the Candidate Build Alternatives are

implemented. Indeed, one of the major purposes of the alternatives is to respond to travel needs arising from such planned development. Therefore, any of the alternatives could play a small incremental role in influencing development decisions. However, other factors, such as availability of water and sewer services, economic conditions and trends, local government land use decisions, and landowner initiatives, all would play much larger roles. Consequently, it appears unlikely that any of the alternatives would be a major causal factor in stimulating unwanted or unplanned development in the study area, and therefore, no substantial indirect effects are anticipated.

4.18 CUMULATIVE EFFECTS

Cumulative effects (40 CFR 1508.7) result from the incremental impacts of an alternative when added to other past, present, and reasonably foreseeable future actions that affect the same resources. To alleviate confusion regarding the nature of cumulative impacts, the Council on Environmental Quality has issued recent guidance on consideration of past actions.⁶ According to the guidance, a cumulative effects analysis is not merely a cataloging of the environmental impacts of past actions. Rather, the analysis considers “the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the agency proposal for action and its alternatives may have a continuing, additive, and significant relationship to those effects.” The aggregate environmental effects of past actions in the study area are reflected in the current state of the affected environment, as described in Chapter 3.

Present and reasonably foreseeable future actions include ongoing development activities in the study area by private enterprise and public infrastructure installations by local governments and VDOT, as reflected in local comprehensive plans, VDOT’s Six-year Improvement Program, and HRMPO’s financially constrained *2030 Transportation Plan*. Described below are other recent or reasonably foreseeable projects within the study area that could affect the same resources that would be affected by one or more of the Candidate Build Alternatives. Cumulative effects occur when there is an additive and a causative relationship attributable to the alternative being considered.

4.18.1 Private Projects

- Rockingham Memorial Hospital will relocate from downtown Harrisonburg to a 254-acre site bounded by Routes 253, 704, and 710 near the center of the study area (currently mostly farmland).
- Tenneco/Walker Manufacturing Company will expand its current Harrisonburg automotive exhaust systems manufacturing facility in the vicinity of Alternative 3 near the I-81 interchange. The expansion would include construction of a minimum of 70,000 square feet of new space, resulting in a total of approximately 700,000 square feet within its Harrisonburg campus.
- The Crossroads subdivision at the intersection of Routes 33 and 276 is under construction at the time of preparation of this document.

⁶ June 24, 2005. Memorandum from James L. Connaughton, Chairman, Council on Environmental Quality, Executive Office of the President, to Heads of Federal Agencies. Re: Guidance on the Consideration of Past Actions in Cumulative Effects Analysis.

- Wal-Mart has just opened a major warehouse/distribution center at the Route 682/I-81 interchange.
- Other industrial development is ongoing in the existing industrial area along the east side of I-81 between Routes 704 and 679.

4.18.2 City and County Projects

- Water and sewer lines and pumping stations are being installed in areas between Route 253 and 33.
- Rockingham County has adopted a Battlefield Preservation Plan for lands in the vicinity of the Cross Keys Battlefield.

4.18.3 VDOT Projects

- All projects within the study area in HRMPO’s *2030 Transportation Plan* that are funded for construction (see Figure 2-4 in chapter 2 for locations of these projects):
 - Route 682 widening and reconstruction from the I-81 interchange to Route 995.
 - Route 726 widening and reconstruction.
 - Route 253 widening and reconstruction from Neff Avenue to Boyers Road (Route 704).
 - Route 33 widening and reconstruction.
 - Country Club Road left-turn lane.
 - Various transportation system management and transit projects.

Table 4-16 shows the combined estimated impacts of these programmed projects, based on planning and design corridor widths similar to those used for the Candidate Build Alternatives.

Table 4-16
ENVIRONMENTAL EFFECTS OF OTHER FORESEEABLE VDOT PROJECTS

Category	Planning Corridor	Design Corridor
Land used for highway right of way	410	129
Potential Hazardous Material Sites	17	5
Prime Farmland (acres)	32	10
Statewide-important Farmland (acres)	99	29
Stream Impacts (linear feet)	1,803	757
Wetlands (acres)	0.07	0.03
Floodplains (acres)	20	8
Forestland (acres)	37	10

- These other recent construction projects occurred in the study area; however, their impacts were inconsequential:
 - Route 704 just east of I-81.
 - Turn lanes and signal at intersection of Routes 253 and 276.
 - Turn lanes and signal at intersection of Routes 253 and 689.
 - Route 679 widening.

4.18.4 Discussion of Cumulative Effects

The following discussion addresses cumulative effects of the alternatives:

Farmland. It is likely that much of the farmland in the study area gradually will transform into developed areas. However, this transformation is in accordance with planning and development goals of local governments. Some farmers have indicated during public meetings that they and their children intend to continue farming for the foreseeable future, regardless of what development occurs around them. Even with the conversions of farmland in the study area to other uses, Rockingham County would remain a leading agricultural center in Virginia. None of the alternatives would be a substantial causal factor in ongoing conversions of farmland to other uses in the study area. Moreover, the total impacts to farmland by the alternatives amount to a relatively small fraction of total farmland in the study area or in the Rockingham County.

Water quality and floodplains. Water quality in study area streams already is impaired primarily because of agricultural land uses. The conversion of agricultural lands to other uses may actually improve water quality by eliminating or reducing sources of fecal coliform bacteria and nutrient contamination in these streams. However, the agricultural sources of pollutants may ultimately be replaced by development sources as additional homes, businesses, and other structures and uses are introduced into the area. The collection of effluent from human developments into sewer systems that the county plans for the area, and conveyance of that effluent to a treatment plant, would offset the potential increases in pollutant discharges from new development. Both Harrisonburg's and Rockingham County's floodplains ordinances prohibit any new construction or development unless it is demonstrated that the cumulative effect of the proposed development, when combined with other existing and anticipated development, will not increase the elevation of the one hundred year flood more than one foot at any point. Both ordinances contain other provisions that control and restrict development within floodplains. Therefore, none of the alternatives would be expected to result in any substantial cumulative effects on floodplains. Any of the alternatives would have to comply with VDOT's *Road and Bridge Specifications* for stormwater treatment, which would mitigate any cumulative adverse effects on water quality and may ultimately improve quality in some areas.

Wildlife and habitat. Natural terrestrial habitat in the project area is not optimal and is limited due to extensive impacts from agriculture and development. Aquatic habitat has been degraded by pollution from agricultural activities. Few forested areas would be impacted by the alternatives or by other foreseeable projects. None of the alternatives would be expected to cause substantial cumulative effects to terrestrial or aquatic biota and their habitats. There are no documented occurrences of threatened or endangered species in the project study area, so no cumulative effects to those species would occur.

Historic resources. There are no other foreseeable projects that would adversely affect historic resources in the study area. Rockingham County's Board of Supervisors has approved a Preservation Plan developed jointly by the Shenandoah Valley Battlefields Foundation, Rockingham County, and a Citizens Steering Committee for the Cross Keys Battlefield to help preserve its integrity and prevent conversions of Battlefield lands to development. Though not binding on the county or landowners, the plan lays out strategies and actions that can be taken to preserve the Battlefields. Current county zoning for the Battlefield area is agriculture. The county's comprehensive plan explicitly states a policy of support for the Preservation Plan and strategies for sustaining such support, including continuance of planning and zoning of

Battlefield areas for agricultural use, refraining from extending water and sewer service into the Battlefield area, and applying preservation measures as appropriate (e.g., purchase of development rights and promoting the establishment of agricultural and forestal districts). The comprehensive plan contains other provisions promoting the preservation of other historic properties throughout the county.

Should CBA 1 be selected, an access management plan would be developed as part of the implementation of that alternative to help discourage proliferation of new driveways into lands along that alternative, particularly the portion through the Battlefield. The identification of historic properties as part of this study may have a beneficial effect on historic properties, making local residents more aware of the historic properties and perhaps stimulating more preservation efforts for those properties.

4.19 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Local short-term uses of the environment principally include the construction impacts described in Section 4.16 and the resources that would be used in the construction of any of the Candidate Build Alternatives, including materials, energy, and labor. The short-term environmental impacts and use of resources must be balanced against long-term transportation benefits. The local short-term impacts and use of resources for the project are consistent with the maintenance and enhancement of long-term productivity.

4.20 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Construction of any of the Candidate Build Alternatives would require a commitment of natural, physical, human, and fiscal resources. Land used for project right of way would be considered an irreversible commitment during the time period that the land is used for highway facilities. However, if a greater need arises for use of the land or if the completed roadway no longer is needed, the land could be converted to another use. At present, there is no reason to believe such a conversion would ever be necessary or desirable.

Considerable amounts of fossil fuels, labor, and highway construction materials, such as cement, aggregate, asphalt, and steel, would be expended. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials generally would not be retrievable; however, they are not in short supply and their use would not have an adverse effect on the continued availability of these resources. Any construction also would require a substantial one-time expenditure of state and federal funds that would not be retrievable. The commitment of these resources is based on the concept that residents in the immediate area and the region would benefit from the improved quality of the transportation system and improved mobility and transportation capacity.