ROUTE 460
LOCATION STUDY

VDOT PROJECT NUMBER 0460-969-101,P101

FEDERAL PROJECT NUMBER AC-STP-000S (166)

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Submitted Pursuant to:
42 U.S.C. 4332(2)(c) and 49 U.S.C. 303

Submitted by:
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
and
VIRGINIA DEPARTMENT OF TRANSPORTATION

05/25/05
Date of Approval

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05/26/05
Date of Approval

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The proposed action involves transportation improvements to the Route 460 corridor from the intersection of Routes 460 and I-295 in Prince George County to the interchange of Routes 460 and 58 along the Suffolk Bypass.

Comments on this draft EIS are due by July 25, 2005 and should be sent to VDOT to the attention of Mr. Earl T. Robb at the aforementioned address.

Cooperating Agencies:

Environmental Protection Agency

U.S. Army Corps of Engineers

U. S. Fish and Wildlife Service

EXECUTIVE SUMMARY

S.1 PROJECT DESCRIPTION

The proposed action involves the construction of an enhanced or new east-west transportation link between Route 58 in the City of Suffolk and I-295 in Prince George County, Virginia. The study area extends approximately 55 miles and includes the counties of Prince George, Sussex, Surry, Southampton, Isle of Wight and the City of Suffolk.

The study area is bordered by Route 10 to the north, the City of Hopewell and I-295 to the west, and Route 58 to the east. The southern boundary runs parallel and three miles south of the Norfolk Southern rail line. Figure S-1 depicts the location of the study area.

S.2 PURPOSE AND NEED FOR THE PROJECT

The purpose of the project involves the following eight key elements:

1. Address roadway deficiencies: Route 460 has design and operational deficiencies that cause safety and mobility problems.
2. Improve safety: Crash rates for Route 460 are higher than other rural principal arterial roadways in Virginia.
3. Accommodate increasing freight shipments: Truck percentages for Route 460 are significantly higher than national averages for rural roads with similar functional classification, and are forecasted to grow due to expansions at the Port of Virginia.
4. Reduce Travel Delay: Future traffic volumes will result in increased travel delays on Route 460 due to capacity limitations at traffic signals and the lack of access control.
5. Provide adequate hurricane evacuation capability: Route 460 is a designated hurricane evacuation route for Southside Hampton Roads communities, yet during two recent hurricanes, the road was closed due to effects caused by these storms.
6. Improve strategic military connectivity: Route 460 is a designated part of the Strategic Highway Network (STRAHNET) by the Department of Defense and FHWA.
7. Meet legislative mandate: Federal legislation as well as the Virginia Transportation Act of 2000 identified the roadway as a high priority corridor for improvement. Improvements to Route 460 are necessary to meet the intent of these acts.
8. Meet local economic development plans: Jurisdictions along the Route 460 study area have identified economic development priorities related to transportation improvements.

FIGURE S-1
REGIONAL MAP WITH STUDY AREA INSET

S.3 ALTERNATIVES CONSIDERED

In accordance with accepted NEPA practice and with 23 CFR 771.123 and FHWA Technical Advisory T 6640.8A, a broad range of preliminary alternatives was identified for consideration and development in the Route 460 Location Study.

S.3.1 Alternative Eliminated From Detailed Study

Mass Transit Alternative: Similar to many rural and exurban areas, the study area currently does not have mass transit service. Therefore, this alternative would involve introducing one or a combination of mass transit modes to meet the Purpose and Need.

The area's relatively low, widely-dispersed population precludes consideration of mass transit as a cost-effective solution. In 1993, the Federal Transit Administration published studies that concluded that public mass transit systems are only economically viable in areas with sufficient population densities and employment rates. The studies established standards-based criteria to evaluate an area's potential for mass transit. One standard is to have at least 7 dwelling units per acre linked to a Central Business District (CBD) with an employment base of at least 10,000 and a density of 20 employees per acre. The study area does not contain any CBDs that approach the 10,000 employee standard.

This alternative would not address roadway deficiencies, projected increases in freight traffic, legislative mandates or local economic development goals. Furthermore, the mass transit alternative would not improve hurricane evacuation capability. Since the alternative does not meet the Purpose and Need, and it was removed from further consideration.

S-3-2 Alternatives Retained

No-Build Alternative

The No-Build Alternative assumes that currently programmed committed and funded roadway projects in the VDOT Six Year Plan and the Constrained Long Range Plans (CLRPs) developed by the Metropolitan Planning Organizations (MPOs) will be implemented. The No-Build alternative does not address project needs such as improvements to roadway deficiencies, travel delay, hurricane evacuation, safety, and roadway infrastructure improvements. However, it has been retained to serve as a baseline for comparison with the build alternatives. The following is a list of currently committed projects to improve existing Route 460:

- City of Suffolk - arterial signal system - Kings Fork Road to west corporate limits;
- Sussex County - dual left turn lanes on VA 604;
- Prince George County - left turn lane signal modification on VA 156;
- Prince George County - left turn lane signal modification on VA 629/Quaker Road.

Transportation Systems Management Alternative

Transportation System Management (TSM) improvements are low cost system enhancements that improve the efficiency of the existing transportation system. A TSM alternative could include improvements such as high-occupancy vehicle lanes, ridesharing, signal synchronization, and other actions. TSM could also include strategies to add capacity and improve operational deficiencies of the existing transportation system, including: (1) intelligent transportation systems, (2) travel demand management, (3) access management, and (4) minor geometric improvements.

TSM enhancements identified for this project include the following:

- Add turning lanes at the intersection of Rt. 625.

- Add turning lanes at the intersection of Rt. 601 to the north and Rt. 624 to the south.
- Add right and left turn lanes to the intersection of Route 460 and Route 635.
- Add advance warning lights and/or rumble strips for stop light at the intersection of Route 460 and Route 616.
- Realign Route 460 and Route 618 intersection, with new right- and left-turn lanes.
- Install rumble strips along the existing Rt. 460 centerline.

These collective improvements provide only modest improvements to safety and roadway deficiencies and do not fully meet the Purpose and Need. However, the TSM Alternative has been retained for detailed study since it offers a low-cost option to improve transportation conditions in the study area.

Build Alternatives

Five conceptual alternatives (A through E) were developed to meet the project Purpose and Need. Alternative E and portions of Alternative D were eliminated from further study during an alternative screening process. Three Candidate Build Alternatives (CBAs) were carried forward for detailed study in the EIS (CBA 1, CBA 2, and CBA 3). The travel demand model analysis indicates that each of the CBAs result in travel time savings, reductions in delay, and capacity improvement. The CBAs are described below, and depicted in Figure S-2.

CBA 1 is a new alignment south of existing Route 460. The alternative starts along Route 460 in the Kings Fork area of the City of Suffolk. Nine interchanges would provide access to the new limited access roadway. The interchanges would be located at Route 58 Bypass in Suffolk, Route 258 in Windsor, Route 616 south of Ivor, Route 620 south of Wakefield, Route 40 south of Waverly, Route 602 in Sussex County, Route 625 south of Disputanta Route 156 in Prince George County, and Interstate 295.

CBA 2 follows the alignment of existing Route 460, but includes northern bypasses around Windsor, Zuni, Ivor, Wakefield, Waverly and Disputanta. East of Windsor and throughout the City of Suffolk CBA 2 is located on a new alignment (the same new alignment as CBA 1 & 3). Along each bypass there are access points to existing Route 460 and the secondary roads that lead to the towns: Route 258 in Windsor, Route 620 north of Ivor, Route 31 north of Wakefield, Route 40 north of Waverly, and Route 625 north of Disputanta Route 156 in Prince George County, and Interstate 295.

CBA 3 is a new alignment generally north of existing Route 460. The CBA 3 alignment is the same as CBA 2 from Suffolk to Windsor, where it continues north of existing Route 460. At Wakefield and Waverly the alignment joins the alignment of the bypasses for CBA 2. West of Waverly, the alignment continues north toward the center of the study area north of the Blackwater River. Nine interchanges would provide access to the limited access facility. The interchanges would be located at Route 58 Bypass in Suffolk, existing Route 460 near the Suffolk / Isle of Wight County border, Route 258 in Windsor, Route 616 north of Ivor, Route 31 north of Wakefield, Route 40 north of Waverly, and Route 625 north of Disputanta.

FIGURE S-2
CANDIDATE BUILD ALTERNATIVES

S.4 SUMMARY OF IMPACTS

Construction of any of the CBAs would satisfy the purpose & need elements identified in section S.2. Selection of a CBA would also provide benefits within the study area such as: improved mobility, enhanced access on existing Route 460 for local traffic, and reduced emergency service response times.

Potential impacts are described in the EIS using a 500-foot-wide Planning Corridor (PC); as well as a narrower Design Corridor (DC). The Design Corridor is 230 feet wide for CBAs 1, 3, and the sections of CBA 2 on new location, and 140 feet wide where CBA 2 follows the existing Route 460 alignment.

The greater width of the PC provides flexibility to further reduce or avoid impacts during final design as study information is collected for a wider area than needed for the actual footprint of the roadway. The impacts identified for the Design Corridor provide the best available estimate of what project impacts for each CBA may be at the current stage of project development. Table S-1 presents the primary consequences associated with the various alternatives within the study area.

TABLE S-1
ENVIRONMENTAL IMPACT ASSESSMENT MATRIX

Assessment Factor	Issue / Resource	No-Build	TSM	CBA 1	CBA 2	CBA 3
Land Use Impacts	Agriculturally Zoned (acres Planning Corridor/ acres Design Corridor)	0	0	965/ 517	1,237/ 557	1,229/ 707
	Residentially Zoned (acres PC/ DC)	0	0	195/ 113	340/ 129	155/ 74
	Commercially / Industrially Zoned (acres PC/ DC)	0	0	20/ 7	156/ 41	3/ 0
	Forest and Wetland (acres PC/ DC)	0	0	2,215/ 1,153	1,420/ 617	1,987/ 1,023
Farmlands	Prime Farmlands (acres PC/ DC)	0	0	2,108/ 1,146	1,779/ 833	1,762/ 978
	Agricultural and Forestal Districts (acres PC/ DC)	0	0	23/ 10	0	5/ 3
Public Parklands	Section 4(f) Parkland (acres)	0	0	0	0	0
Visual Impacts	Number of Adversely Affected Visually Sensitive Areas	0	0	4	3	3
Socioeconomics / Relocations	Capital Costs (2005 $million)	0	3	522	665	550
	Number of Residential Displacements	0	0	99/ 66	187/ 58	51/ 32
	Number Non-Profit/Community Facilities Relocated	0	0	2/ 2	9/ 5	1 /1
	Number of Commercial Businesses Relocated	0	0	5/ 3	36/ 18	5/ 0
	Lost Tax Revenue (dollars PC/ DC)	0	0	150, 441/ 93,375	241,761/ 92,414	99,601/ 57,430
	Number of Communities and Neighborhoods Affected	0	0	8	7	5
Environmental Justice	Disproportionately High and Adverse Effects to Minority Populations	0	0	0	0	0
	Disproportionately High and Adverse Effects to Low-Income Populations	0	0	0	0	0
Hazardous Materials	Number of Occurrences	0	0	34	104	29
	Number of Sites Identified for Further Evaluation	0	0	1	14	0
	Number of Fatal Flaw Sites	0	0	0	0	0
Cultural Resources[1]	Number of Prehistoric and Historic Archaeological Resources Affected [2]	0	0	TBD	TBD	TBD
	Number of Historic Architectural Resources Adversely Affected	0	0	0	0	0
Noise	Number of Residences Affected	N/A	N/A	156	91	182
	Number of Schools / Churches Affected	N/A	N/A	1/1	1/1	0/2

Assessment Factor	Issue / Resource	No-Build	TSM	CBA 1	CBA 2	CBA 3
Noise	Number of Feasible Noise Barriers	N/A	N/A	51	40	63
	Number of Cost Effective Noise Barriers	N/A	N/A	0	0	0
Streams	Perennial Streams Affected in linear feet (PC/DC)	0	0	20,406/ 11,529	27,406/ 10,661	19,016/ 11,001
	Intermittent Streams Affected in linear feet (PC/DC)	0	0	53,634/ 21,336	22,216/ 13,401	56,069/ 26,360
Groundwater Resources	Number of Sole Source Aquifers Affected	0	0	0	0	0
	Number of Regulatory Wellhead Protection Areas Affected	0	0	0	1	0
Floodplains / Floodways	100-Year Floodplain Encroachment in Planning Corridor (acres)	0	0	161	203	224
	100-Year Floodplain Encroachment in Design Corridor with bridges (acres)	0	0	58	63	85
	Number of Regulated Floodways Crossed	0	0	4	4	3
Terrestrial Ecology	Forest Land Habitat Affected (acres PC/ DC)	minor	minor	2,184/ 1,140	1,370/ 599	1,931/ 998
	Agricultural Land Habitat Affected (acres PC/ DC)	minor	minor	965/ 517	1,237/ 557	1,229/ 707
	Transitional Land Habitat Affected (acres PC/ DC)	minor	minor	4 / 3	4 / 3	4 / 3
Wetlands	Acreage of Wetlands Affected (PC / DC)	0	0	289/ 138	255/ 110	270/ 135
	Acreage of Estimated Compensation (acres PC/DC)	0	0	537/254	465/196	488/241
Wild & Scenic Rivers	Number of National Wild & Scenic Rivers Affected	0	0	0	0	0
	Number of State Wild & Scenic Rivers Affected	0	0	0	0	0
Threatened & Endangered Species	Potential Effects to Documented Habitat-Populations of Federally Listed T&E Species	0	0	0	0	0

1 All cultural resources identified in this table are NRHP-listed or NRHP-eligible.
2 Archaeological investigations will be conducted on the preferred alternative.

S.5. OTHER MAJOR ACTIONS

Other major actions proposed by other governmental agencies include the following:

- The Virginia Department of Rail and Public Transportation's Richmond/Hampton Roads Passenger Rail Study is pending and a preferred alternative has not been identified to date.
- Virginia Department of Aviation's Eastern Virginia Airport System Study was completed in July 2001. It identified the potential for the creation of a new Air Carrier Airport in Isle of Wight County. However, this proposed airport is not currently included in the Department's long-range plan.
- The County of Isle of Wight's current Comprehensive Plan identifies the need for a Route 258 Bypass. However, this project is not included in VDOT's 6-year Transportation Improvement Plan nor is it included in the Hampton Roads PDC's 2030 Constrained Long Range Plan.
- Prince George County, in conjunction with private developers, is developing a 1,800 industrial park for light manufacturing and distribution. This industrial park is located near the I-295 and Route 460 interchange. Anticipated build-out is within the next five to ten years.
- The Town of Waverly and the County of Sussex are discussing developing a regional industrial park on approximately 171 acres at the old Waverly Airport along Route 460.
- Within the next two to three years, the Town of Wakefield is planning to expand its town limits by annexing additional land. The size and the limits of the annexation are not currently known.
- The County of Isle of Wight owns approximately 400 acres to be developed for industrial use adjacent to the existing Shirley T. Holland Industrial Park (near the Town of Windsor).

S.6. AREAS OF CONTROVERSY

Some areas of controversy regarding the study include*:*

- Concept of Bypassed Communities

Several small communities along the existing Route 460 have expressed concerns about negative community and/or economic impacts from new location bypasses. These issues were researched and analyzed in context, and both positive and negative impacts from new location bypasses can be expected. Negative impacts include loss of traffic with corresponding loss of business for highway-related businesses. Positive impacts include improved safety, truck traffic reductions, and improved pedestrian mobility in downtown areas, with corresponding benefits to downtown businesses.

- Impacts to Wetlands and Streams

Throughout the Federal agency partnering process, resource agencies have noted the potential for new roadway alignments to cause impacts to wetlands and streams. The study team has identified numerous opportunities to minimize and avoid impacts to natural resources. Should any of the CBAs be selected, these efforts will continue throughout the design and construction phase of the project.

S.7. UNRESOLVED ISSUES

Selection of Alternative

After the Location Public Hearings are held and comments from the hearings and the DEIS comment period have been reviewed, the Commonwealth Transportation Board (CTB) will determine a preferred alternative. Responses to comments on the DEIS and documentation of the selected alternative will be provided in the Final Environmental Impact Statement (FEIS). Should any of the CBAs be selected, final mitigation measures will be coordinated with the appropriate jurisdictional authorities and documented in the FEIS.

Funding

There is no identified state or federal funding to implement improvements in the study area other than the projects identified in the VDOT six-year plan and the Constrained Long Range Plans (CLRPs) for the Hampton Roads MPO and the Tri-Cities MPO. . These projects are included in the No Build Alternative.

Tolls

A study was conducted in conjunction with the Location Study to evaluate issues related to implementing tolls on CBAs 1 and 3. CBA 2 is not a candidate for tolling because it is not entirely a limited access facility, and only 55 percent of its length may be effectively tolled. Given the preliminary nature of the Location Study, it is too early in the project development timeframe to determine if the selected alternative would be a toll facility.

Metropolitan Planning Organization (MPO) Actions

Subsequent to the selection of a preferred alternative, the two MPOs for the study area would revise their long range transportation plans to include the selected alternative. Currently the Hampton Roads MPO includes a new alignment alternative in the CLRP; however, funding for the project relies upon 50 percent toll revenue. The Tri-Cities MPO does not include a new location alignment in their CLRP.

S.5 APPROVALS REQUIRED

Construction of a build alternative would necessitate several actions requiring environmental regulatory permits. These include:

- Army Corps of Engineers authorization for work in waters of the U.S. (including wetlands) under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.
- Authorization from the Virginia Marine Resources Commission for construction in state subaqeuous lands under Title 62.1 of the Code of Virginia
- Virginia Department of Environmental Quality authorization for work in waters of the state under the Virginia Water Protection Permit program.
- A Stormwater Management Program Permit issued by the Virginia Department of Conservation and Recreation.
- In the event of adverse affects to historic properties, a Memorandum of Agreement would need be executed between the FHWA and the Virginia Department of Historic Resources.
- Conversion of lands within designated Agricultural / Forestal Districts associated with CBA 1 or CBA 3 may require approval from the Isle of Wight County Board of Supervisors. If so, VDOT would submit a "Notice of Intent to Acquire Land in Agricultural / Forestal District" to the County.

ROUTE 460 Location Study

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APPENDICES

- **Pertinent Correspondence (Included)**
- **Air Quality Technical Report (Under separate cover)**
- **Alternatives Development Technical Report (Under separate cover)**
- **Hazardous Materials Technical Report (Under separate cover)**
- **Indirect and Cumulative Technical Report (Under separate cover)**
- **Land Use, Parklands and Farmlands Technical Report (Under separate cover)**
- **Natural Resources Technical Report (Under separate cover)**
- **Noise Analysis Technical Report (Under separate cover)**
- **Purpose and Need Statement Technical Report (Under separate cover)**
- **Right of Way Cost Technical Report (Under separate cover)**
- **Socioeconomic Technical Report (Under separate cover)**
- **Traffic Transportation and Freight Technical Report (Under separate cover)**
- **Water Quality Technical Report (Under separate cover)**

1.0 PURPOSE OF AND NEED FOR ACTION

The following sections demonstrate the purpose and need for the project.

1.1 ADDRESS ROADWAY DEFICIENCIES

Route 460 has roadway design deficiencies that result in numerous problems related to safety, accommodation of truck traffic, hurricane evacuation and military preparedness. Route 460 does not comply with current VDOT design standards for roads of similar purpose and functional class. Route 460 is classified a rural principal arterial according to guidelines published by the American Association of State Highway and Transportation Officials (AASHTO). Using this classification, it does not meet VDOT's rural arterial design standards for lane width, median width, left turn lane protection, shoulder width, clear zone protection and access control. Details on these deficiencies are in the *Route 460 Location Study Purpose and Need Technical Report.*

1.2 IMPROVE SAFETY

Route 460 in the study area has higher accident, injury, and fatality rates than similar facilities statewide. Four-lane undivided roadways usually have higher than average crash rates due to the lack of median and access control and the impact that turning vehicles have on slowing traffic flows and increasing crash potential. Also, a high percentage of vehicles traveling on Route 460 are trucks. Larger vehicles operate less efficiently than standard passenger vehicles, increase roadway congestion, and increase accident severity. Of the 555 crashes documented by VDOT along the corridor from 1999 to 2001, 76 crashes involved tractor-trailers (14 percent). Approximately half of the fatal crashes in the Route 460 corridor involved tractor-trailers. Crashes involving tractor-trailers constituted approximately 28 percent of all property damage related to crashes.

A comparison between Route 460 and the average of four-lane roadways in Virginia confirmed Route 460's higher-than-average crash rates (see Table 1.2-1). The crash fatality rate for Route 460 in the study area is 220 percent greater than non-Interstate four lane freeways, with the injury crash rate 164 percent greater. Compared with divided roadways with no access control, the crash fatality rate in the Route 460 corridor is 137 percent greater; and the injury crash rate is 107 percent greater. The need to improve safety on Route 460 has been cited by the public via comments submitted to VDOT, and also by transportation managers of distribution centers located within the study area.

Table 1.2-1
CRASH RATES COMPARISONS – STUDY AREA TO OTHER FACILITY TYPES

Crash Rates by Facility Type	Route 460 Study Corridor	Rural Principal Arterials – Virginia Averages (2001)		
		4-Lane Divided No Access Control	4-Lane Divided; Partial Access Control	4-Lane Divided Full Access Control
# miles of Facility Type in VA	52	1,023	77	169
# Persons Killed (per 100 MVMT)	2.2	1.6	1.4	1.0
# Persons Injured (per 100 MVMT)	62.3	58.2	41.7	37.9
Total Crash Rate (per 100 MVMT)	77.7	83.1	64.2	54.1

1.3 ACCOMMODATE INCREASING FREIGHT TRAFFIC

Route 460 provides a link for seaport cargo and airfreight delivery between the ports and airports in both Hampton Roads and the Richmond - Petersburg Metropolitan Area. Therefore, it serves as an important shipping route and carries a large amount of truck traffic (see Table 1.3-1). Route 460 truck volumes within the study area currently range from approximately 2,600 to near 4,100 trucks per day, with through truck volumes near 3,700. This represents between six percent and 34 percent of all vehicles on Route 460. The percentage of through truck traffic along Route 460 is higher than and growing faster than on alternate routes such as Route 58 and Interstate 64. Along Route 460, the percentage of through trucks has increased by 13 percent since 1990. On Route 58 and Interstate 64, the percentage of through trucks has declined by 8 percent and 6 percent respectively.

Waterborne freight shipments to, from, and within Virginia are projected to increase from 24 million tons in 1998 to 40 million tons by 2020, an increase of 67 percent. The majority of this freight (59 percent) will be arriving and departing from the ports of Hampton Roads. To accommodate this increasing demand, two new port facilities will open in the future, increasing freight shipments from the ports. The increasing truck traffic on Route 460 combined with the geometric deficiencies of the existing roadway has led to operational problems.

Table 1.3-1
CHANGE IN ANNUAL AVERAGE DAILY TRAFFIC (AADT) AND TRUCK TRAFFIC ON MAJOR ROUTES

Major Freight Routes	1990 Data			2002 / 2003 Data		
	Total AADT	Truck AADT	Percent Trucks	Total AADT	Truck AADT	Percent Trucks
I-64 (at New Kent County / James City County Line)	27,130	3,230	12	42,000	2,520	6
US 460 (at Rt 616 in Ivor)	9,700	2,037	21	11,100 *	3,770 *	34 *
US 58 (at Rt 653 in Capron)	7,355	1,755	24	13,000	2,080	16

Source: VDOT, Average Daily Traffic Volumes with Vehicle Classification Data on Interstate, Arterial and Primary Routes, 1990 and 2002

* Route 460 traffic counts conducted summer 2003

1.4 REDUCE TRAVEL DELAYS

Future traffic volumes will result in increased travel delays on Route 460 due to capacity limitations at traffic signals and the lack of access control. Traffic forecasts for 2026 were based upon traffic growth and diversion of traffic from other facilities. The super-regional travel demand model (a combination of the Hampton Roads and Richmond regions' travel demand models) indicates annual traffic growth rates on Route 460 ranging from 1 percent to 2.5 percent. The 2026 forecasts accommodate diversion of traffic to and from other facilities such as Interstate 64, Route 10, and Route 35.

Forecasted travel time increases from 71 minutes to 79 minutes from existing conditions to Year 2026. The eight additional minutes required to travel from Route 58 to I-295 in the forecast year represents an increase of 11 percent, and a reduction in average travel speed from 42 mph to 38 mph. Details on travel time analyses are located in the *Route 460 Location Study: Traffic and Transportation Technical Report.*

1.5 PROVIDE ADEQUATE HURRICANE EVACUATION CAPABILITY

Route 460 is signed as a designated hurricane evacuation route for Southside Hampton Roads communities. Data from the Hurricane Emergency Response Plan indicates that the total number of people evacuating dwelling units south of the Hampton Roads Bridge Tunnel ranges from 103,200 to 421,000. The number of vehicles evacuating from these dwelling units ranges from 41,300 to 151,700. These figures do not include the employment based population and freight operations that may also be evacuating during an emergency. Additionally, these figures do not include the residents and tourist populations for northeastern North Carolina, including portions of the Outer Banks that would evacuate using Route 168 in Chesapeake. Clearance times estimated for these vehicles range from three to 26.75 hours for cities located in Southside Hampton Roads. Capacity improvements would reduce the clearance time during an emergency.

Despite Route 460's important role for hurricane and emergency evacuation, the roadway is susceptible to the effects of severe weather. During two recent hurricanes, this primary evacuation route for evacuating motorists was closed due to effects caused by these storms. The existing Route 460 has a narrow right-of-way that does not provide either a clear zone or shoulders adjacent to the travel lanes. The narrow right-of-way contributed to the amount of storm debris blocking the travel lanes during Hurricane Isabel in September 2003. In 1999, heavy rainfall from Hurricane Floyd caused flooding along the Blackwater River with the resulting river crest (about nine feet above the surface of the roadway) rendering Route 460 impassible for over a week.

1.6 IMPROVE STRATEGIC MILITARY CONNECTIVITY

Route 460 is a designated part of the 61,000-mile Strategic Highway Network (STRAHNET) by the Department of Defense and FHWA. Because Hampton Roads is home to several military installations, and the Petersburg area is home to Fort Lee, Route 460 (from Interstate 95 to Route 58) performs a critical role in preserving the nation's security and military preparedness.

The Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) is responsible for the use of transportation facilities by the military, and identified the STRAHNET system. All non-interstate roadways that are part of the STRAHNET such as Route 460 are part of the National Highway System, and therefore should follow design guidelines based upon the functional classification of the roadway. Route 460 currently does not meet design standards for a rural principal arterial highway.

1.7 MEET LEGISLATIVE MANDATE

Federal, state, and local legislation identified the roadway as a high priority corridor for improvement. Two Congressional acts and one state act support study and investment in the Route 460 corridor. As part of the "East-West Transamerica Corridor", Route 460 has been designated as a "National Highway System high priority corridor" (Intermodal Surface Transportation Efficiency Act of 1991, Section 1105(c)(3)). Such corridors are included on the National Highway System, and are provided funding (Intermodal Surface Transportation Efficiency Act of 1991, Section 1105 (b)). On the state level, the Virginia Transportation Act of 2000 (VTA) allocated $25 million for Route 460 improvements. Local governments have either included Route 460 improvements in their comprehensive plans, and/or passed resolutions supporting improvements by their respective Board of Supervisors or Town Councils.

1.8 MEET LOCAL ECONOMIC DEVELOPMENT GOALS

Localities along the Route 460 study area have identified economic development priorities related to transportation, and in some instances have made specific mention of Route 460 as part of their economic development plans. Some jurisdictions stress the need for upgrading Route 460 in their comprehensive plans; some localities emphasize their dependence on Route 460 for economic development (see the *Purpose and Need Technical Report*).

Some jurisdictions stress the need for upgrading Route 460 in their comprehensive plans. The City of Suffolk's *2018 Comprehensive Plan* states that the road is a vital connector used for "regional goods movement and some commuting movement to the Eastern portion of Hampton Roads." *The Prince George County Comprehensive Plan* recommends reconstruction of Route 460 within the boundary of the Tri-Cities Area Metropolitan Planning Organization.

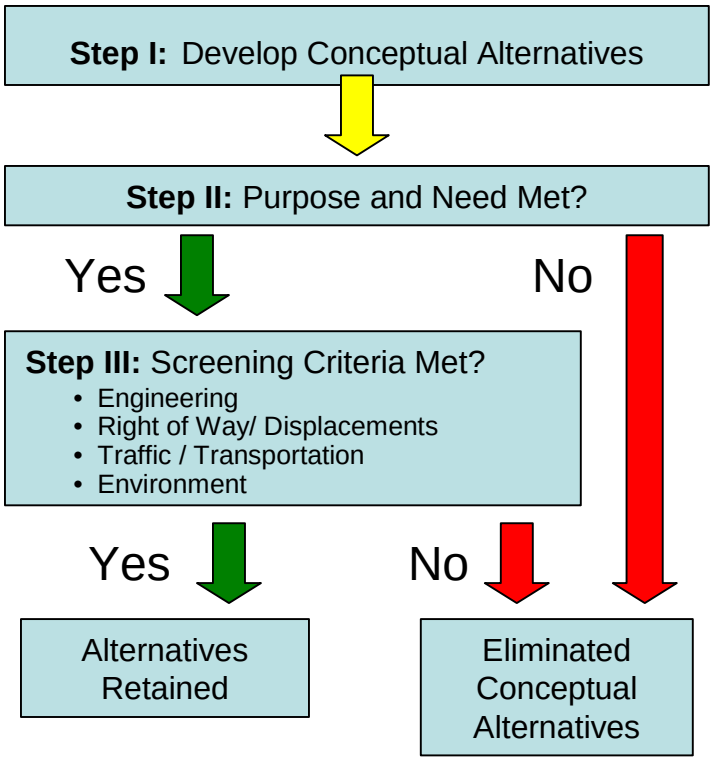
Other jurisdictions stress the importance of Route 460 to economic development. Sussex County's Comprehensive Plan Update recommends either commercial or industrial site development along Route 460. Prince George County's comprehensive Plan expects industrial and commercial development along Route 460. The Isle of Wight County Board of Supervisors passed a resolution in support of a "new limited access road in close proximity to the existing Route 460 corridor" to encourage moderate growth in the Town of Windsor. Southampton County's comprehensive plan cites the need to attract prospective industries with "accessibility to major thoroughfares." Accessibility, according to Surry County's *Land Development Plan*, is important for industrial development.

2.0 ALTERNATIVES

2.1 ALTERNATIVES DEVELOPMENT PROCESS

A three-step process was used to identify and screen project alternatives for the study, as shown in Figure 2.1-1. The first step developed conceptual alternatives based upon input from the public, local jurisdictions, and the Crater and Hampton Roads Planning District Commissions. The second step evaluated the conceptual alternatives' ability to meet the project's Purpose and Need as presented in Chapter One. Alternatives carried forward to the third step were then evaluated using engineering, right-of-way, transportation, and environmental criteria.

Figure 2.1-1
ALTERNATIVES SCREENING PROCESS



2.1.1 Step I— Development of Conceptual Alternatives

The process began with establishing design criteria and typical sections for facilities that would meet the study's Purpose and Need. These criteria are based on VDOT standards and guidelines as published in the VDOT Road Design Manual (1998), and meet the standards for the National Highway System. The VDOT standards and guidelines were developed using the 1990 edition of *A Policy on Geometric Design of Highways and Streets*, as published by AASHTO.

All conceptual build alternatives would connect the Route 58 Bypass in Suffolk to I-295 near Petersburg. These termini were selected in accordance with FHWA Technical Guidelines for logical termini selection and address the needs of the project, while allowing the evaluation of project alternatives that would function independently.

2.1.2 Step II—Purpose and Need Analysis

Step II evaluated the ability of each conceptual alternative to meet the Purpose and Need identified in Chapter One. Sections 2.2 and 2.3 describe the alternatives eliminated and retained.

2.1.3 Step III—Alternative Screening

Alternatives that were retained for Step III underwent more detailed analysis based on previously developed Screening Criteria. Screening criteria were divided into several categories: Engineering, Traffic/Transportation, Right of Way/Displacements, and Environment (see Table 2.1-1).

To screen the alternatives, travel demand estimates were prepared using a transportation model developed for the study. This "super-regional" model combines the Hampton Roads and Richmond regions' existing travel demand models (see the *Traffic and Transportation Technical Report* for more information). The model provided the study team with traffic volumes for each conceptual alternative. Preliminary cost estimates were based upon standard unit costs for materials used in highway construction, and include estimates for the bridges and interchanges. These preliminary cost estimates did not include estimates for right of way costs, relocation of utilities, landscape features, wetlands mitigation and other miscellaneous items.

Potential impact areas were identified for the conceptual alternatives based on 500-foot wide corridors. Impact areas for interchange or intersection locations consisted of circles with 2,000-foot diameters. Potential residential or commercial displacements were determined using high resolution aerial photography provided by the 2002 Virginia Base Mapping Program (VBMP). Impacts to other resources such as wetlands and protected species habitat were determined using existing digital mapping from VDOT's Geographic Information System (GIS). Impacts to known cultural resources were included in the Section 4(f) criterion. Selected environmental impacts were tabulated on a "per mile" basis, providing another means to compare alternative impacts. Later in the process, this approach also helped identify "hybrid" alternatives using crossover segments and /or portions of other alternatives. Section 2.3.3 provides more detail on build alternative development and screening.

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Table 2.1-1
SCREENING CRITERIA

Engineering	
Design Standards	Conform with desirable design standards
Preliminary Construction Costs	Anticipated relative construction cost
Traffic/Transportation	
Traffic Volumes	Local and through traffic demand
Transportation Network Compatibility	Conformance with existing and planned roadways
Right of Way/ Displacements	
Displacements	Number of residential and business displacements
Public Facilities and Services	Number of potential impacts
Environment	
Agricultural and Forestal Districts	Acres of potential impact
Wetlands	Acres of potential impact
Endangered Species	Number of potential habitat impacts
Cultural Resources	Number of potential impacts
Streams	Number and size of major stream crossing

2.2 ALTERNATIVE ELIMINATED

Table 2.2-1 shows the results of the Step II (Purpose and Need) analysis. A No-Build Alternative, a Transportation Systems Management (TSM) Alternative, a Mass Transit Alternative, and Conceptual Build Alternatives were evaluated in Step I. The table shows only the Conceptual Build Alternatives would meet the Purpose and Need. The Mass Transit Alternative has been eliminated from further consideration, while the TSM and No-Build Alternatives were retained for reasons discussed in Section 2.3.

Table 2.2-1
PURPOSE AND NEED ANALYSIS

Objective	No Build Alternative	TSM Alternative	Mass Transit Alternative	Conceptual Build Alternatives
Address Roadway Deficiencies	No	No	No	Yes
Improve Safety	No	No*	No	Yes
Accommodate Increasing Freight Traffic	No	No	No	Yes
Reduce Travel Delays	No	No*	No	Yes
Adequate Hurricane Evacuation Capability	No	No	No	Yes
Improve Strategic Military Connectivity	No	No*	No	Yes
Meet Legislative Mandate	No	No	No	Yes
Meet Local Economic Development Goals	No	No	No	Yes

*This alternative would result in modest improvements to these criteria.

2.2.1 Mass Transit Alternative

Similar to many rural and exurban areas, the study area currently does not have mass transit service. Therefore, this alternative would involve introducing one or a combination of mass transit modes to meet the Purpose and Need.

In 1993, the Federal Transit Administration published studies that concluded that public mass transit systems are only economically viable in areas with sufficient population densities and employment rates. The studies established standards-based criteria to evaluate an area's potential for mass transit. One standard is to have at least 7 dwelling units per acre linked to a Central Business District (CBD) with an employment base of at least 10,000 and a density of 20 employees per acre. The study area does not contain any CBDs that approach the 10,000 employee standard. Furthermore, employee densities are much less than the recommended 20 per acre. The Town of Windsor, for example had an employment density of 1.16 per acre (based on Census 2000 and 1999 town boundary).

The area's relatively low, widely-dispersed population precludes consideration of mass transit as a cost-effective solution. This alternative would not address roadway deficiencies, projected increases in freight traffic, legislative mandates or local economic development goals. Furthermore, the mass transit alternative would not improve hurricane evacuation capability. It does not meet the Purpose and Need, and was therefore removed from further consideration in Step I.

A separate study is underway regarding passenger rail service in the study area. The Federal Railroad Administration (FRA), in cooperation with the Virginia Department of Rail and Public Transportation (DRPT), will prepare a Tier I Environmental Impact Statement (EIS) for the Richmond to Hampton Roads Passenger Rail Corridor. The study will investigate potential routes and consider possible environmental impacts for higher-speed rail service. Issues regarding schedule, ridership, and operational and capacity constraints will also be examined. A variety of transit options gathered during the public input process will also be included.

2.3 ALTERNATIVES RETAINED

Alternatives retained for detailed analysis in the DEIS include the following:

2.3.1 No-Build Alternative

The No-Build Alternative assumes that currently programmed committed and funded roadway projects in the VDOT Six Year Plan and the Constrained Long Range Plan (CLRP) developed by the Metropolitan Planning Organizations (MPOs) will be implemented. The No-Build alternative does not address project needs such as improvements to roadway deficiencies, travel delay, hurricane evacuation, safety, and roadway infrastructure improvements. However, it has been retained to serve as a baseline for comparison with the build alternatives. The following is a list of committed projects to improve existing Route 460:

- City of Suffolk - arterial signal system - Kings Fork Road to west corporate limits;
- Sussex County - dual left turn lanes on VA 604;
- Prince George County - left turn lane signal modification on VA 156;
- Prince George County - left turn lane signal modification on VA 629/Quaker Road.

2.3.2 Transportation Systems Management Alternative

Transportation System Management (TSM) improvements are low cost system enhancements that improve the efficiency of the existing transportation system. A TSM alternative could include improvements such as high-occupancy vehicle lanes, ridesharing and signal synchronization. TSM could also include strategies to add capacity and improve operational deficiencies of the existing transportation

system, including: (1) intelligent transportation systems, (2) travel demand management, (3) access management, and (4) minor geometric improvements.

TSM enhancements identified for this project include the following:

- Add turning lanes at the intersection of Rt. 625
- Add turning lanes at the intersection of Rt. 601 to the north and Rt. 624 to the south
- Add right and left turn lanes to the intersection of Route 460 and Route 635
- Add advance warning lights and/or rumble strips for stop light at the intersection of Route 460 and Route 616
- Realign Route 460 and Route 618 intersection, with new right- and left-turn lanes
- Install rumble strips along the existing Rt. 460 centerline

These collective improvements provide only modest improvements to safety and roadway deficiencies and do not fully meet the Purpose and Need. However, the TSM Alternative has been retained for detailed study since it offers a low-cost option to improve transportation conditions in the study area.

2.3.3 Build Alternatives

According to AASHTO standards, rural principal arterials are characterized by corridor movements with trip length and density suitable for substantial statewide or interstate travel. The Conceptual Build Alternatives meet the Purpose and Need (Step I) and therefore were evaluated using the screening criteria in Step II. The build alternatives include sections on new alignment as well as sections on existing alignment; therefore two potential typical sections apply. All build alternatives have a design speed of 60 miles per hour.

Improvements on existing alignment would use a non-freeway rural principal arterial typical section (see Figure 2.3-1)**.** The VDOT *Road Design Manual* (1998) refers to this typical section as a GS-1 “other” roadway (“other” meaning “non-freeway”). With an average right of way width of 81 feet, this section uses either a center bi-directional turning lane (as shown) or a combination of raised and flush medians. Location-specific conditions would dictate shoulder width and/or the presence of curb and gutter sections. On cut and fill slopes, outside shoulders would be 10 feet wide and 13 feet wide, respectively.

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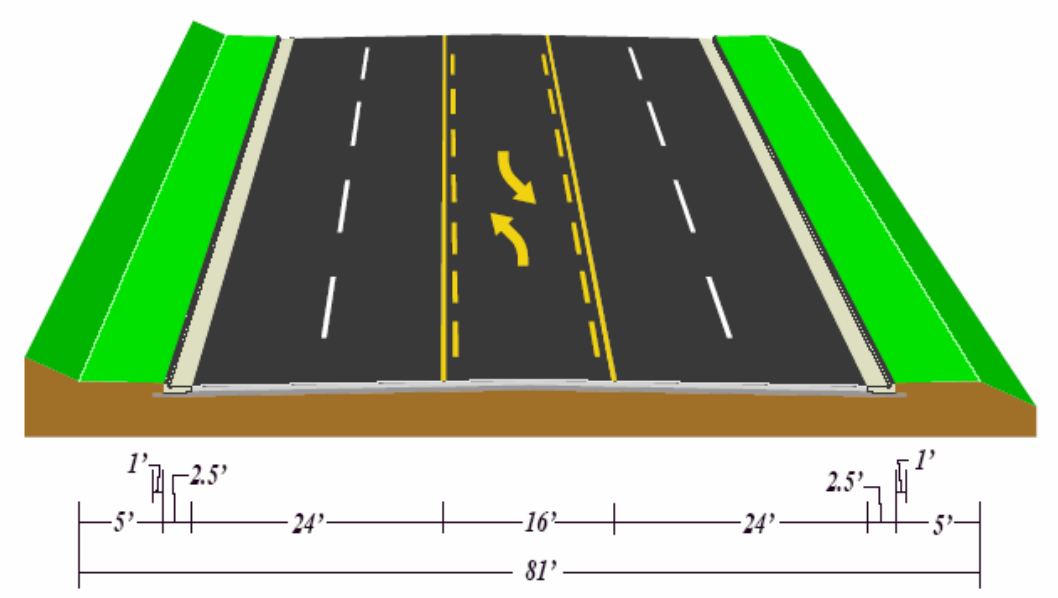
Figure 2.3-1
TYPICAL SECTION OF BUILD IMPROVEMENTS ON EXISTING ALIGNMENT



Build alternatives on new location would be classified as GS-1 (rural principal arterials) as stated in the VDOT *Road Design Manual*. Figure 2.3-2 depicts the typical section for the new location alternatives. The typical section consists of a four lane, divided highway with two 12-foot lanes in each direction. The divided highway section includes 40-foot wide depressed medians. Paved shoulders would be ten feet wide on the outside lane and four feet wide on the inside lane. On cut and fill slopes, outside shoulders would be 12 feet and 15 feet, respectively. The typical section would require an average right of way of 131 feet.

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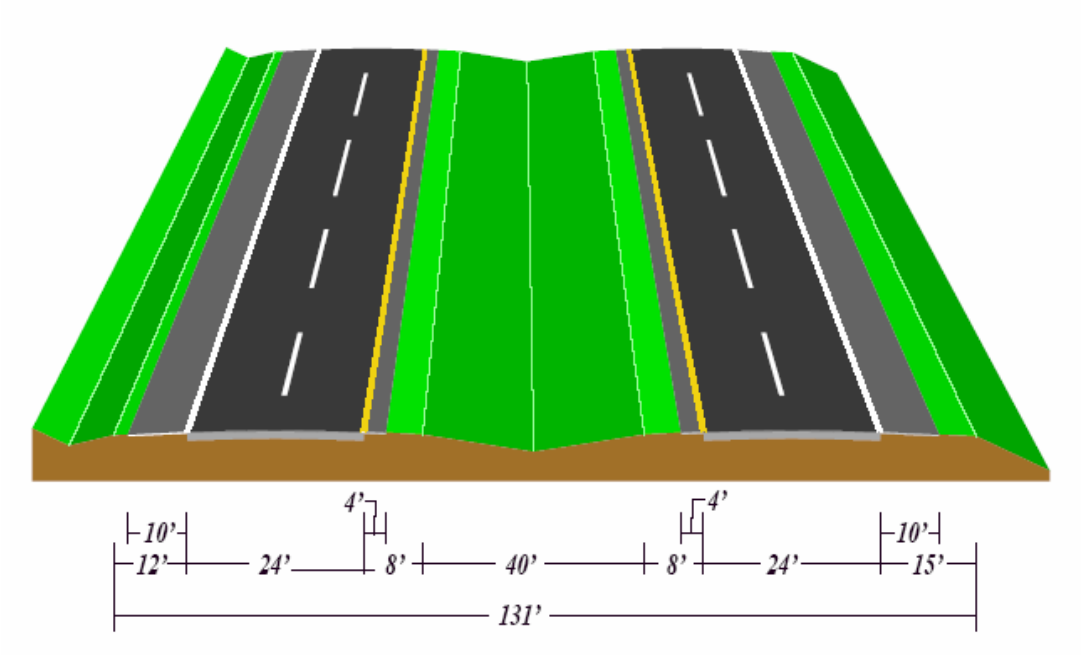
Figure 2.3-2
TYPICAL SECTION OF ALTERNATIVES ON NEW LOCATION



Source: Virginia Department of Transportation

The roadway network and traffic volumes in the study area were reviewed to determine appropriate access points for each conceptual alternative. This network would connect the conceptual alternatives with the communities at the following locations (listed from east to west):

- Route 258 to access Windsor and Smithfield
- Route 616 or 620 to access Ivor
- Route 31 to access Wakefield, Dendron, Surry and the Jamestown Ferry
- Route 40 to access Waverly
- Route 625 to access Disputanta
- Route 156 to access Prince George

Figure 2.3-3 displays the Conceptual Build Alternatives. The alternatives are described as follows:

- Alternative A starts at the Route 58 Bypass, south of the existing interchange with Route 460 and continues on the south side of existing Route 460 to I-295 in Prince George County. There is a bend in the alternative between Waverly and Wakefield to avoid the habitat of a federally protected species. Interchanges would be provided at the roadways identified above.
- The Improve Existing 460 Alternative follows the length of existing Route 460 within the study area. The narrow typical section depicted in Figure 2.3-1 would be used.
- Alternative B uses the alignment of existing Route 460 between the six communities located along the roadway, and includes northern bypasses around Windsor, Zuni, Ivor, Waverly, Wakefield, and Disputanta. The sections along the existing alignment would use the narrow typical section identified in Figure 2.3-1. The bypasses would use the typical section for new alignment alternatives. For each town bypass, there are three access points: one at each end of

the bypass where it joins with the existing Route 460, and one at the major perpendicular highway accessing the town (i.e. Route 258 near Windsor). Zuni's bypass does not have a third access point.

- Alternative C begins at the Route 58 Bypass, south of the existing interchange with Route 460 in Suffolk. The easternmost segment of the alternative is identical to Alternative A, however this alignment crosses to the north side of existing Route 460 near the Suffolk / Isle of Wight County border. The alignment remains north of the current Route 460 until just west of Waverly where it crosses over again and remains on the south side until the Interstate 295 interchange. Interchanges would be provided at the roadways identified above. Alternative C could also provide two interchanges with the existing Route 460 at the locations where it crosses the existing alignment (near the Suffolk / Isle of Wight County border, and west of Waverly).

- Alternative D is a limited access facility that begins in Suffolk at the Route 58 Bypass, south of the existing interchange with Route 460. The easternmost segment of this alternative is identical to Alternatives A & C; however Alternative D crosses to the north side of existing Route 460 in Isle of Wight County (slightly west of where Alternative C crosses Route 460). The alternative continues along an alignment north of Route 460, closer to the center of the study area than Alternative C. Between Route 31 and Interstate 295, the alternative moves further north into central Surry County before crossing into Prince George County. The alignment reconnects to the existing Route 460 alignment at the Interstate 295 interchange in Prince George County. Interchanges would be provided at the roadways identified above. Alternative D would also provide an interchange with the existing Route 460 in eastern Isle of Wight County, where the alignment crosses existing Route 460.

- Alternative E starts at the intersection of the Route 58 Bypass and runs north along a new alignment for approximately 1.8 miles before joining Godwin Boulevard (Route 10/32) near the intersection of Kings Fork Road. The alignment follows existing Godwin Boulevard for approximately 4 miles until near the Pembroke Lane intersection in Suffolk. New access points would be provided between the new alignment segment and the existing segment of Godwin Boulevard. The alternative continues northwest across central Isle of Wight, Surry, and Prince George Counties, following an alignment approximately seven miles north of the towns along existing Route 460. Interchanges would be provided at the roadways identified above. The alternative intersects Interstate 295 in a proposed new interchange located approximately four miles north of the existing Route 460 / I-295 interchange. Alternative E is the farthest alignment from the existing Route 460.

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Figure 2.3-3
CONCEPTUAL ALTERNATIVES

As mentioned previously, crossover segments and /or portions of other alternatives were examined to link portions of discrete alternatives. This process led to the addition of four "hybrid" conceptual alternatives (see Figure 2.3-4). These hybrid alternatives met the Purpose and Need while reducing impacts to one or more environmental constraints under study. The following list describes these alternatives:

- Hybrid Alternative AC combines Alternatives A and C. It follows the alignment of Alternative A from Suffolk to Waverly where, from Waverly and Interstate 295, it follows the alignment of Alternative C. This alternative is closer to existing Route 460 and yet has fewer displacements than Alternative A.
- Hybrid Alternative B1 is similar to Alternative B; however east of Windsor it is located on the new alignment south of existing Route 460 (the same alignment as Alternatives A and C). This hybrid alternative was created to reduce the number of potential displacements along the segment of existing Route 460 in Suffolk.
- Hybrid Alternative DC combines Alternatives C and D. It follows the alignment of Alternative C from Suffolk to Windsor, where it shifts to the Alternative D alignment. This alternative reduces impacts to Section 4(f) properties and Agricultural Forestal Districts, and also reduces the wetland impacts of Alternative C. However, because it follows the alignment of Alternative D on the west end, it does not provide convenient access to Waverly and Wakefield.
- Hybrid Alternative DC1 combines Alternatives C and D. The alignment follows Alternative C from Suffolk to Windsor, Alternative D from Windsor to Wakefield, Alternative C from Wakefield to Waverly, and Alternative D from Waverly to Interstate 295. Similar to Alternative DC, it reduces Section 4(f) and Agricultural Forestal impacts, but is closer to existing Route 460 towns such as Wakefield and Waverly.

Table 2.3-1 summarizes results of the conceptual alternatives evaluation.

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Figure 2.3-4
HYBRID ALTERNATIVES

Table 2.3-1
CONCEPTUAL ALTERNATIVE EVALUATION RESULTS

Objective	A	AC	Improve Existing	B	B1	C	D	DC	DC1	E
Engineering										
Design Standards: Conformance with desirable design standards	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Preliminary Construction Costs: (in millions)	$755	$786*	$445	$1,200	$1,159*	$865	$760	$790*	$809	$790
Hydraulic/ Hydrologic: number of stream crossings	29	27	36	39	40	24	29	32	33	37
Right of Way/ Displacements										
Displacements: Number of potential displacements	140	123	651	363	288	92	59	60	60	152
Public Facilities and Services: number of potential impacts	1	1	11	5	1	1	0	1	1	0
Environment										
Terrestrial Ecology: Acres of impacted Agricultural and Forestal Districts	23	23	0	0	0	5	50	5	5	359
Wetlands: acres of potentially impacted areas	352	366	236	347	349	362	299	284	341	279
Endangered Species: Number of potential habitat impacts	0	0	1	0	0	0	0	0	0	0
Section 4(f): acres of potential use	0	0	8	6	2	2	29	2	2	41
Traffic/Transportation										
Compatible with existing and planned highway facilities?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Traffic Volumes: Simulated Average Daily Traffic for 2026 Design Year										
West of Disputanta	31,100	30,200*	32,000*	32,000	32,000*	30,200	25,200	26,000*	29,000*	20,600
Waverly to Wakefield	25,800	25,800*	29,900*	29,900	29,900*	27,800	24,400	26,000*	26,000*	20,500
East of Windsor	31,500	31,500*	45,000*	48,200	45,000*	42,900	39,700	40,000*	40,000*	21,500

* Values estimated from analysis of original conceptual alternatives (A,B,C,D and E)

2.4 IDENTIFICATION OF CANDIDATE BUILD ALTERNATIVES

The screening process identified conceptual alternatives and combinations of alternatives that met project needs while reducing impacts to the human and natural environments. The ten alternatives listed in Table 2.3-1 were grouped by the study team according to their location in relation to the existing Route 460. The Improve Existing, B, and B1 Alternatives use some or all of the existing Route 460 alignment. Alternatives A and AC are both located south of the existing Route 460. The remaining alternatives (C, D, DC, DC1 and E) are each located north of the existing Route 460.

The Improve Existing 460 Alternative has the highest number of estimated displacements of the conceptual alternatives. Alternative B has the second highest number of displacements, and also has the highest cost estimate. The B1 hybrid was created to reduce the number of potential displacements compared to Alternative B.

The two alignments on the south side of existing Route 460 (Alternatives A and AC) have similar evaluation results. Alternative AC was created to reduce the number of displacements of Alternative A, and to develop an alignment closer to existing Route 460 near the western end of the study area.

Alternative E is located the farthest away from the existing communities along Route 460. It has the lowest forecast travel demand, and also a large number of displacements. Alternative D affects the most acres of Section 4(f) properties of all ten alternatives. Alternative C is close to the existing communities along Route 460; however it has a large number of potentially affected wetlands. Hybrid Alternative DC has a reduced number of Section 4(f) impacts, but also follows an alignment that takes it far away from Wakefield and Waverly. Alternative DC1 has similar characteristics of Alternative DC, but it provides better access to Waverly and Wakefield.

On April 2, 2004, the conceptual alternatives and screening results were presented at a federal agency Partnering Meeting. Agencies participating at the meeting included the US Army Corps of Engineers, the US Fish and Wildlife Service, the Environmental Protection Agency, and the Federal Highway Administration. Also, on April 14, 2004, the project Study Team, which includes staff from the Crater and Hampton Roads Planning District Commissions, met to further consider the alternative screening. Consideration of the public comments, input from the federal agencies during partnering, and technical review by the Study Team led to the elimination of some conceptual alternatives and retention of others for detailed study in the DEIS (see sections 2.2 and 2.3). The agencies involved agreed with eliminating Alternative E and the segments of Alternative D that were not associated with the DC1 Alternative. After consideration of this agency input, public comments, and technical review by the Study Team, the following alternatives were retained for detailed analysis the DEIS.

- Alternative AC, henceforth, **CBA One.**
- Alternative B1, henceforth, **CBA Two.**
- Alternative DC1, henceforth **CBA Three**.
- TSM Alternative
- No-Build Alternative

Figure 2.3-5 illustrates the Candidate Build Alternatives. Refinements to the alignment of each CBA have occurred to further reduce their impacts to the natural and built environment. These refinements have included shifts to avoid wetlands, properties eligible for listing on the National Register of Historic Places (NRHP), and planned development projects. These revised locations of each CBA alignment were used for impact analysis, and are depicted in the figures located in Chapter 4. For CBA 2, the centerline of proposed widening along the existing alignment was shifted to minimize potential displacements along the ROW. If CBA 2 is selected, more detailed consideration of improvements along the existing ROW would occur during final design. Improvements would be coordinated with local governments and would likely include access management to control the number of driveways and curb cuts along the route.

Figure 2.3-5
CANDIDATE BUILD ALTERNATIVES

2.5 ALTERNATIVE COMPARISONS FOR TRANSPORTATION FACTORS

The following sections summarize the differences among the alternatives with respect to transportation issues. The following information is also available in the Traffic and Transportation Technical Report.

2.5.1 Travel Demand

Table 2.5-1 depicts travel demand forecasts for the No Build and each CBA. This analysis assumes travel demand for the TSM and No-Build Alternatives are similar. The No Build/TSM forecast for 2026 indicates a growth in travel demand between 35 and 70 percent above existing conditions. Each CBA has a higher travel demand than the No Build/TSM forecast, indicating that a greater amount of travel is attracted with major improvements to the roadway corridor. Travel demand increases for CBA 2 range between 60 and 160 percent of existing travel demand. CBAs 1 and 3 attract the greatest increase in forecast travel demand, ranging between 160 and 425 percent of the existing travel demand.

Table 2.5-1
EXISTING AND FORECASTED TRAVEL DEMAND

From	To	Existing	Future Year (2026)							
		2003*	No Build/TSM	CBA 1		CBA 2		CBA 3	
				CBA 1	460	CBA 2	460	CBA3	460
I-295	VA 156	12,900	19,000	35,800	6,600	22,600	NA	30,100	9,400
VA 156	VA 625	14,900	20,700	33,300	6,500	24,600	NA	30,700	9,200
Disputanta Bypass		NA	NA	NA	NA	23,300	1,700	NA	NA
VA 625	VA 602	9,700	14,600	34,400	2,500	17,900	NA	30,800	4,400
VA 602	VA 40	8,600	13,600	34,300	1,400	17,100	NA	30,800	4,400
Waverly Bypass		NA	NA	NA	NA	21,300	1,900	NA	NA
VA 40	VA 31	12,900	18,600	30,600	4,000	20,700	NA	32,100	3,500
Wakefield Bypass		NA	NA	NA	NA	22,300	2,100	NA	NA
VA 31	VA 616/ VA 620	9,000	14,200	31,000	2,500	19,600	NA	33,000	2,200
Ivor Bypass		NA	NA	NA	NA	24,400	1,300	NA	NA
VA 616/ VA 620	VA 644	6,700	11,400	32,500	2,700	16,000	NA	33,400	1,400
Zuni Bypass		NA	NA	NA	NA	23,000	1,100	NA	NA
VA 644	US 258	8,500	13,600	32,500	1,600	18,900	NA	33,400	1,700
Windsor Bypass		NA	NA	NA	NA	27,700	5,000	NA	NA
US 258	WCL Suffolk	12,600	18,200	40,300	4,900	27,700	5,000	33,500	9,500
WCL Suffolk	Suffolk bypass	16,400	22,100	40,200	9,200	35,400	5,900	42,700	4,400

2.5.2 Roadway Capacity

The existing Route 460 is a four-lane undivided rural principal arterial. The No Build and TSM Alternatives do not increase through-roadway capacity in the study area. CBAs 1 and 3 add four new travel lanes (two per direction) between Suffolk and Petersburg. In addition, since CBAs 1 and 3 are proposed as limited access facilities, they would have more vehicular capacity than similar four-lane facilities lacking access control. Limited access facilities may carry up to 2,250 vehicles per hour per lane with free flow speeds of 55 miles per hour. At 65 miles per hour the capacity is 2,350 vehicles per hour per lane (Highway Capacity Manual, 2000). For a four-lane facility such as the ones proposed for CBAs 1 and 3, this equals the capacity to move over 100,000 vehicles per day per direction. CBA 2 adds bypasses to five of the communities along Route 460, thereby increasing capacity (at those locations) over the No Build alternative. CBA 2 also provides a new limited access alignment between the Route 58 bypass in Suffolk and Windsor, increasing capacity in this area. However, the capacity increase of CBA 2 is considerably less than CBA 1 and 3 because west of Windsor CBA 2 uses the same alignment as existing Route 460 (other than the new bypasses).

2.5.3 Level of Service (LOS)

Level of Service (LOS) measures how well traffic operates on the roadway. At intersections, LOS is a measure of the travel delay attributed to the traffic control devices (traffic signals). Along roadway segments, LOS is a measure of the roadway's ability to accommodate free-flowing traffic.

2.5.3.1 Intersection LOS

Table 2.5-2 illustrates intersection LOS along existing Route 460 in the study area for the PM peak hour. Existing LOS is generally acceptable, with a minimal delay at signalized intersections (LOS A , B and C). For the No Build Alternative, intersection LOS degrades from existing conditions due to greater traffic volumes and minimal improvements to the existing intersections in the future.

For the build condition, each CBA would improve LOS at the 12 existing Route 460 signalized intersections. This is due to the reduction in traffic on existing Route 460 compared to the no build and existing conditions. There are no new proposed traffic signals along the new alignments of the build alternatives (CBAs 1 and 3 or the bypass portions of CBA 2). CBA 2 would include a redesigned signalized intersection at Route 156 in Prince George County.

Table 2.5-2
INTERSECTION LEVEL OF SERVICE – EXISTING ROUTE 460

ID	Intersection	Existing	No Build	TSM	CBA 1	CBA 2	CBA 3
1	Route 630	A	B	B	N/A[1]	B	A
2	Route 156	B	C	C	B	C	B
3	Route 40	B	C	C	A	B	B
4	Route 31/628	A	B	B	A	A	A
5	Route 616	A	B	B	A	A	A
6	US 258	B	C	C	B	B	C
7	Route 610/603	C	D	D	C	C	C
8	Food Lion Access *	A	B	B	A	A	A
9	Dominion Way *	A	A	A	A	A	A
10	Route 604	B	B	B	B	B	B
11	Route 634	B	C	C	B	B	B
12	Robs Road/ Nansemond Suffolk Academy **	B	B	B	B	A	A

[1]CBA 1 would re-configure the existing intersection at Route 630, removing the existing traffic signal.

2.5.3.2 Roadway LOS

Roadway LOS along the alignment of existing Route 460 is depicted in Table 2.5-3 for the PM Peak Hour. From the west end of the study area to the Town of Windsor, Route 460 is considered a multilane highway by HCM standards. Due to the number of signalized intersections on the east end of the corridor, Route 460 is considered an arterial. Existing Route 460 operates at LOS A in the western rural area and LOS C to D in the eastern end of the corridor from Windsor to Suffolk. In the No Build Alternative, the roadway LOS degrades from existing conditions. The improvements proposed in the TSM Alternative would not greatly improve roadway LOS, therefore these results are similar to the No Build Alternative. Each build alternative would improve the roadway LOS on existing Route 460 due to the traffic diversion to the new alignment.

Table 2.5-3
ROADWAY LEVEL OF SERVICE – EXISTING ROUTE 460

Roadway Type	From	To	Existing LOS	No Build	TSM	CBA 1	CBA 2	CBA 3
Multilane Highways	I-295	Disputanta	A	B	B	A	B	A
	Disputanta	Waverly	A	A	A	A	A	A
	Waverly	Wakefield	A	A	A	A	A	A
	Wakefield	Ivor	A	A	A	A	A	A
	Ivor	Windsor	A	A	A	A	A	A
Urban Streets (arterials)	West of Windsor	East of Windsor	D	E	E	D	D	D
	East of Windsor	Route 58 Bypass	C	D	D	C	C	C

2.5.4 Travel Time Savings

Table 2.5-4 shows existing and forecasted travel times for eastbound travel through the study area from Petersburg to Wakefield and from Petersburg to Suffolk. Existing travel times for these two trips are 37 minutes and 73 minutes respectively. Travel times would increase in the No Build Alternative and TSM Alternative since factors leading to delay (additional traffic) increase without significant roadway improvements. Travel times for the No Build and TSM alternatives would increase by four minutes to Wakefield and eight minutes to Suffolk. This represents an 11 percent increase in travel times to these two communities from the existing travel time.

For CBA 2, travel time to Wakefield from Petersburg is forecasted to increase by two minutes over existing conditions. This represents a five percent increase in travel time. For through-travel to Suffolk from Petersburg, CBA 2 enables a two-minute time savings (3 percent improvement over existing conditions). When compared to the longer travel times forecast in the future (No Build), CBA 2 provides two minutes (five percent) travel time savings to Wakefield, and ten minutes (12 percent) travel time savings from Petersburg to Suffolk.

CBA 1 and CBA 3 both provide greater travel time savings than CBA 2. For travel from Petersburg to Wakefield, CBA 1 provides two minutes (5 percent) time savings compared to existing conditions, and six minutes (15 percent) reduction in travel time compared to the No Build Alternative. For travel to Suffolk, CBA 1 provides 13 minutes (18 percent) travel time savings compared to existing conditions, and 21 minutes (26 percent) time savings compared to the No Build Alternative. Similarly, CBA 3 provides three minutes (8 percent) time savings compared to the existing conditions for travel to Wakefield. CBA 3 also provides 13 minutes (18 percent) time savings compared to existing conditions for travel to Suffolk.

Table 2.5-4
EASTBOUND TRAVEL TIME COMPARISONS FROM PETERSBURG

Change in Travel Times	Petersburg to Wakefield (2003 Existing Conditions: 37 minutes)				Petersburg to Suffolk (2003 Existing Conditions: 73 minutes)			
	2026 No-Build & TSM	CBA 1	CBA 2	CBA 3	2026 No-Build & TSM	CBA 1	CBA 2	CBA 3
2026 Travel Time (minutes)	41	35	39	34	81	60	71	60
Change from Existing Conditions (minutes / %)	+4 (+11%)	-2 (-5%)	+2 (+5%)	-3 (-8%)	+8 (+11%)	-13 (-18%)	-2 (-3%)	-13 (-18%)
Change from 2026 No Build Conditions (minutes / %)	NA	-6 (-15%)	-2 (-5%)	-7 (-17%)	NA	-21 (-26%)	-10 (-12%)	-21 (-26%)

2.5.5 Hurricane Evacuation

Hurricane evacuation capability is directly related to roadway capacity. The No Build and TSM Alternatives do not improve the ability of the corridor to provide hurricane evacuation. As previously discussed above, CBAs 1 and 3 provide two new travel lanes per direction between the Suffolk Bypass and Interstate 295. Limited access roadways can accommodate up to 2,400 vehicles per direction per lane when operating in free flow conditions. Conceptually, it would be possible (using travel flow reversal) to have four lanes of highway capacity used to evacuate Hampton Roads and the Outer Banks from a hurricane. This additional capacity would considerably increase the ability of the Route 460 corridor to provide hurricane evacuation capability.

CBA 2 provides bypasses around the towns, providing some additional roadway capacity and removing the sources of delay from existing Route 460 (traffic signals, access points, and speed restrictions of the through town segments). Due to the time savings achieved for through corridor travel, CBA 2 would improve hurricane evacuation capability in relation to the existing conditions. However CBA 2 would not significantly enhance evacuation capacity in comparison to CBAs 1 and 3 because the additional roadway capacity does not extend along the entire length of the study corridor.

2.5.6 Freight Accommodation

Truck traffic currently constitutes a large percentage of total traffic along Route 460 and is expected to increase due to growth in the port facilities in Hampton Roads. The percent of trucks traveling along Route 460 is forecast to increase in the No Build, TSM, and for each build alternative. However, along existing Route 460, truck percentages are forecast to decrease substantially with each build alternative. See Table 2.5-5 for a summary of truck percentages for each alternative.

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Table 2.5-5
TRUCK PERCENTAGES

Location	2003 Existing Conditions	Future Year (2026)						
		No Build /TSM	CBA 1		CBA 2*		CBA 3	
	% truck	Truck %	CBA 1 truck %	460 truck %	CBA 2 truck %	460 truck %	CBA 3 truck %	460 truck %
West of Disputanta	30%	36%	38%	9%	35%		49%	9%
Disputanta to Waverly	28%	37%	32%	9%	35%		39%	9%
Waverly to Wakefield	28%	34%	35%	9%	34%		37%	9%
Wakefield to Windsor	28%	36%	34%	8%	34%		35%	8%
East of Windsor	23%	30%	28%	7%	30%		38%	7%

* Route 460 and CBA 2 share the same alignment outside of the bypasses. The forecast truck percentage through the towns on existing Route 460 ranges from 7 to 9%.

2.5.7 Safety

Each alternative would include safety improvements, including the No Build Alternative. The TSM alternative would involve additional improvements--improving sightlines at major intersections and providing additional turn lanes at select intersections along Route 460. CBA 2 provides limited access bypasses and new medians on the existing alignment of Route 460. However, the locations between the bypasses would still include numerous access points (driveways and side streets). CBAs 1 and 3 would be limited access highways on new location. These facility types are generally safer facilities than other non-divided roadways.

2.6 TOLL FEASIBILITY STUDY

A study was conducted in conjunction with the Location Study to evaluate issues related to implementing tolls on two of the build alternatives (CBA 1 and CBA 3). CBA 2 is not a candidate for tolling because (1) it is not entirely a limited access facility; and (2) only 55 percent of its length may be effectively tolled. Given the preliminary nature of the Location Study, it is too early in the project development timeframe to determine if the selected alternative would be a toll facility, or to determine a potential toll structure. Traffic forecasts and impact analysis that rely on traffic forecasts (e.g. air quality and noise) did not consider tolling.

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3.0 AFFECTED ENVIRONMENT

3.1 LAND USE

This section summarizes the existing and future land use in the study area. General land use descriptions are based on compiled information and field visits during 2003. Table 3.1-1 provides existing land use acreage totals for the study area; Figure 4.1-1 shows these land uses.

3.1.1 Existing Land Use

The study area lies between two major urban areas. Although mostly rural in character, there are emerging suburban areas towards the eastern and western edges. At the northwest end is Prince George County, near the cities of Hopewell, Petersburg, and Richmond. Isle of Wight County and the City of Suffolk are part of the Hampton Roads metropolitan area, lying at the southeast end of the study area. Three incorporated towns and four unincorporated towns are also within the study area.

A system that divides land into nine major groups was used to classify existing land uses in the study area. These nine groups include: Urban or Built-up Land, Agricultural Land, Rangeland, Forest Land, Water, Wetland, Barren Land, Tundra, and Perennial Snow or Ice. Residential, Commercial and Industrial Lands are subsets of Urban or Built-up Land (Anderson, et al., *A Land Use and Land Cover Classification System for Use with Remote Sensor Data*. Washington: GPO, 1976). This land use data was adjusted according to 2002 aerial photos prepared by the Virginia Geographic Information Network (VGIN). The adjustments were made to areas adjacent to towns in the study area, and reflected the conversion of farmland and forest land to urban or built-up land.

The study area consists mostly of forest, agriculture, and open space. Wetlands and preserves are also prevalent throughout the study area. The edges of the study area, Prince George County and the City of Suffolk have seen increases in suburban development. The Kings Fork/Red Top community in Suffolk is a growing suburban area. In this area, development is mostly confined to Route 460 and State Route 10/32, where shopping and public facilities are located. In Prince George County, clusters of residential development have been built south of the City of Hopewell and east of Fort Lee

Preserved areas include reservoirs. The study area portion of Suffolk has several lakes that help supply drinking water to Hampton Roads cities. The City of Norfolk owns three of these lakes: Lake Prince, the Western Branch Reservoir, and Lake Burnt Mills. The City of Portsmouth owns Lake Cohoon and Lake Meade.

Most commercial development is clustered within and near the towns. In Isle of Wight County, the towns of Smithfield and Windsor contain the bulk of the commercial and retail development with strip development along major highways. Windsor located along Route 460, recently annexed land for future development. The town population doubled and land area quadrupled when the annexation took place in 1999. The town of Ivor supplies the majority of goods and services for the northern half of Southampton County. Wakefield and Waverly are two of the three incorporated towns in Sussex County.

Industrial areas, such as the proposed Waverly Industrial Park, the Shirley Holland Commerce Park, and Prince George County's opportunity zones, are located along Route 460. The Surry County Industrial Park and the Prince George County Industrial Park are also in the study area, but not along Route 460.

Finally, there are multi-purpose land uses. Windsor, in Isle of Wight County, is within one of the County's "Development Service Districts" (DSDs). These areas "have served and are expected to continue to serve as the principal residential, commercial, and employment centers of the County" (Isle of Wight County). These Districts serve most of the County's development needs through the year 2020.

Table 3.1-1
EXISTING LAND USE

Land Use	Acres	Percent
Residential	13,267	2.78%
Commercial	733	0.15%
Industrial	362	0.08%
Agricultural*	144,674	30.35%
Forest and Wetland[§]	313,264	65.72%
Other[‡]	4,369	0.92%
Total	476,667	100.0%

Source: USGS, Commonwealth of Virginia (VGIN)

*includes Cropland and Pasture, Confined Feeding Operations, and Other Agricultural Land
[§] includes Evergreen Forest, Deciduous Forest, Mixed Forest Land, Forested Wetland and Non-forested Wetland.
[‡] includes all water bodies, strip mines, transitional areas, utilities, other urban/built-up land, strip mines, and unclassified lands as defined by *A Land Use and Land Cover Classification System for Use with Remote Sensing Data,* James R. Anderson, et al.

3.1.2 Future Land Uses

Future land use maps contained in local government comprehensive plans indicate most of the study area will remain rural, agricultural, or open space. Suffolk's Comprehensive Plan calls for downzoning the area that loosely borders Route 460 (Pruden Boulevard), to "rural estate" or "agricultural", thereby reducing the density of development. "Rural Estate" allows suburban residences with water utilities and septic systems (but no sewer connections) on one- or two-acre lots.

The land use plans call for concentrating development near existing communities and services. This would include development along most of Route 460. Many jurisdictions also call for the concentration of urban and built-up land uses within small town centers. Several unincorporated towns in Isle of Wight are classified as "Village Centers," where limited resources are located for the use of rural area residents. Zuni, Central Hill, Isle of Wight, Uzzle's Church, and Orbit are "village centers" within the study area. The towns of Dendron and Surry will have commercial centers surrounded by residential development.

Larger towns, especially those along Route 460, wish to intensify development, as illustrated in County and Town comprehensive plans. In Southampton County, the area immediately near Route 460 is the only area slated for non-agriculturally-based development. Residential development is proposed in areas to the north and south of the Town of Ivor. Near the Sussex county line is an industrial zone along Route 460. Only the portions near the county borders are zoned rural and/or agricultural. Commercial zones in Prince George County will be extended from existing locations. More industrial designation is planned along the length of Route 460. The county has identified "opportunity districts" which are "prime areas for intensive (industrial or commercial) development." The largest opportunity district is located at the Route 460/Interstate 295 interchange with one portion of the district extending along Route 460.

Commercial development is anticipated on the eastern and western sides of the Town of Ivor along Route 460, although the majority of the development is slated for the western side. The land use plan along Route 460 calls for industrial development between Wakefield and Waverly, and to the west of Waverly. Commercial uses are planned for the area east of Wakefield. Residential zones circle the town of Wakefield and are located along secondary highways north of Route 460.

3.1.2.1 Land Use and Transportation Plans and Policies

Based on their comprehensive plans, the study area jurisdictions collectively stress the need for safe and efficient modes of transportation and managed growth. All jurisdictions with the exception of the City of Suffolk call for "safe and efficient movement of people" (Isle of Wight County, Southampton County), or "a safe and efficient transportation system" (Surry County, Prince George County). Managed growth includes the concentration of more urban land uses (commercial, industrial, residential) near towns and along the Route 460 corridor. New development is encouraged, but only if supported by adequate infrastructure such as water and sewer lines. By concentrating such land uses, farmlands and the rural character of these areas are preserved.

3.1.2.2 Economic Investment Incentive Areas

Prince George County has an Enterprise Zone located on Route 460. Industries that locate within Enterprise Zones are eligible to receive special incentives, such as special financing or tax breaks. Sussex County has applied to the Commonwealth's Department of Housing and Community Development to have its industrial park considered for Enterprise Zone status. Isle of Wight County has an industrial park east of the Town of Windsor; Surry County has developed two industrial parks around the town of Surry.

3.1.2.3 Farmland and Forestry Preservation Policies

Isle of Wight County's plan calls for Rural/Agricultural Conservation Districts outside of village centers and Development Service Districts. Surry County's Land Development plan stresses the importance of agricultural preservation by restricting development on prime soil areas. The Plan does allow development of rural land, but that development must be "compatible" with agricultural uses. Isle of Wight County's Rural/Agricultural Conservation Districts contain Agricultural and Forestal Districts, which are recognized by the Commonwealth. Section 3.3 (Farmlands) and the *Land Use, Parklands, and Farmlands Technical Report* contains further details on Virginia's Agricultural and Forestal Districts located in Isle of Wight County.

3.2 FARMLANDS

3.2.1 Introduction

Approximately 30% of the study area is agricultural land. This section describes farmlands as defined by the Agriculture and Food Act of 1981 and the Farmlands Protection Policy Act (FPPA). More information on the regulatory context and the methodology is found in Section 4.2 as well as the *Land Use, Parklands, and Farmlands Technical Report*.

3.2.2 Prime Farmland

The FPPA provides protections to areas underlain by Prime, Unique, Statewide and Locally Important soils. Only prime farmland soils exist in Virginia, and are determined based on soil surveys published by the Natural Resources Conservation Service (NRCS). Figure 4.2-1 shows the locations of prime farmland soils in the study area.

3.2.3 Farmland Uses and Production

Data on farmland use and production is only available at the county level (i.e. not specific to the study area). According to the Virginia Agricultural Statistics Service (1997), there are over 1,000 farms in the six-jurisdiction area with over 520,000 acres of farmland. Of the available farmland, about half (about 254,000 acres) of it is used as harvested cropland. Among the largest crops are corn (for grain), soybeans, and peanuts.

Southampton County has the greatest amount of acreage devoted to agricultural purposes with over 185,000 acres. It also has the most harvested cropland according to the Virginia Agricultural Statistics Service for 1997. Surry County has the lowest figures of the jurisdictions.

3.2.4 Agricultural and Forestal Districts

Virginia's Agricultural and Forestal Districts Act allows for the establishment of Agricultural, Forestal, or Agricultural and Forestal (A&F) Districts. The A&F District program is designed to preserve and protect open spaces, forested areas and agricultural lands in the state of Virginia. Within the study area, only Isle of Wight County has A&F Districts. Table 3.2-1 lists the names of the A&F districts within the study area. Figure 3.2-1 shows the locations of the A&F districts in the study area.

Table 3.2-1
AGRICULTURAL AND FORESTALDISTRICTS

Jurisdiction	A&F District Name	Acreage (Square Miles)
Isle of Wight County	Courthouse	15,256.8 (23.8)
	Knoxville*	5,251.7 (8.2)
	Longview*	8,505.2 (13.3)

Source: Isle of Wight County
* The Knoxville and Longview A&F Districts have parcels located outside the study area.

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Figure 3.2-1
AGRICULTURAL AND FORESTAL DISTRICTS

3.3 PARKLANDS AND OPEN SPACE EASEMENTS

For purposes of the Study, parkland is defined as either: (1) any protected area under the jurisdiction of a municipal, state, federal, or conservation entity; or (2) a publicly-owned area where recreation or preservation is a primary function of resource; and (3) open to the public with little or deminimus fee. By definition, certain open spaces that may appear to be parklands are not because the land is privately owned. The following resources contributed information in locating and identifying types of parkland resources in the Route 460 study area:

- Internet websites
- the 2002 Virginia Outdoors Plan
- the Nature Conservancy
- the Virginia Department of Conservation and Recreation (DCR)
- the Virginia Department of Game and Inland Fisheries
- local comprehensive plans

The following general types of parklands were identified:

- Federal and State Parklands
- Regional and Local Parks
- Wildlife Management Areas (where recreational opportunities exist)

Parklands located in the study area are listed in Table 3.3-1 (see Route 460 Location Study Land Use, Parklands, and Farmlands Technical Report for details).

Table 3.3-1
PARKLANDS

Map ID	Name of Site Name of Jurisdiction	Authority	Acreage	Amenities
1	Lake Prince City of Suffolk	City of Norfolk	777.0	Boating, fishing, boat ramp
2	Western Branch Reservoir City of Suffolk	City of Norfolk	1,579.0	Boating, fishing, boat ramp
3	Lake Burnt Mills Isle of Wight	City of Norfolk	610.0	Boating, fishing
4	Lake Meade City of Suffolk	City of Portsmouth	512.0	Boat ramp, boating, fishing
5	Kings Fork Athletic Field City of Suffolk	City of Suffolk	5.0	Baseball field, softball field
6	Lone Star Lakes City of Suffolk	City of Suffolk	490.0	Boat ramps
7	Lake Cohoon City of Suffolk	City of Portsmouth	510.0	Boat ramp, boating, fishing
8	Antioch Pines Natural Area Preserve Isle of Wight	Virginia Department of Conservation and Recreation	400.0	Preserve, no public facilities
9	Central County Park Isle of Wight	Isle of Wight County	262.0	County Fairgrounds

Map ID	Name of Site Name of Jurisdiction	Authority	Acreage	Amenities
10	Municipal Park Town of Windsor, Isle of Wight	Town of Windsor	>1.0	Benches, picnic table, memorial†
11	Community Park Town of Windsor, Isle of Wight	Town of Windsor	>1.0	Gazebo†
12	Robinson Park Town of Windsor, Isle of Wight	Town of Windsor	0.33	Playground†
13	Windsor High School Town of Windsor, Isle of Wight	Isle of Wight County	3.0	Tennis Courts (lighted), baseball/softball field
14	Windsor Satellite School Town of Windsor, Isle of Wight	Isle of Wight County	3.0	Baseball/softball fields, 10,000 square foot building/gymnasium
15	Ballpark Town of Wakefield, Sussex	Town of Wakefield	11.4	Ballfield†
16	Dendron Swamp State Natural Area Preserve Surry	Virginia Department of Conservation and Recreation	179.0	Visitation by arrangement with steward.
17	Scott Memorial Park Prince George	Prince George County	8.0	Light baseball field, picnic pavilions, playground, basketball courts, open space†

Source: 2002 Virginia Outdoors Plan, Comprehensive Plans (†), correspondence with local and regional park authorities and resource websites.

3.4 VISUAL QUALITY

Viewsheds and visually sensitive areas have been identified within the study area in accordance with FHWA's Technical Advisory T6640.8A and FHWA's Visual Impact Assessment for Highway Projects (U.S. Department of Transportation, FHWA, 1999). Visual issues pertinent to determining effects on historic resources under the Historic Preservation Act of 1966 and the project's use under Section 4(f) of the Department of Transportation Act of 1966 have also been identified. These areas and methods employed to define and assess them based on that portion of the landscape that is visible or potentially visible from new roadways or from which the new roadways may be seen are discussed in greater detail in Section 4.4, Visual Quality.

3.4.1 Visual Setting

The regional landscape establishes the general visual environment of the study area. This is based upon the topography (landform) and land cover (water, vegetation, and manmade development) of the region, which distinguish it from other geographic regions. The study area lies within the Coastal Plain Physiographic Province of southeastern Virginia. This Province is characterized by a terraced landscape that slopes gently towards the coast in a stair-step fashion; the result of sea-level fluctuations over time which laid down marine deposits interlayered with fluvial, estuarine, and beach strata. This is represented by the Suffolk scarp which passes through the study area near the Town of Wakefield.

The landscape and land cover provide a unique visual environment, which includes farmland, forest and single-family development. The farmland consists mostly of peanut, cotton, corn, and soybean fields. Forests are located throughout the study area and are characterized by oak, maple and loblolly pine. These land uses contribute to the rural character of the region. Most of the residential, commercial, and industrial land uses are associated with towns located along Route 10 and Route 460. However, single-family homes are located throughout the area along primary and secondary roads. The study area is crossed by a number of streams and tributaries as well as extensive wetland systems. Reservoirs

located in the eastern edge of the study area provide scenic vistas, recreational opportunities, and wildlife habitat.

3.5 SOCIOECONOMIC SETTING

This section discusses the existing socioeconomic conditions of the study area, including population, (ethnic and income characteristics), communities and neighborhoods, public facilities, economic setting and travel patterns. Analysis methodology and additional data is located in the Route 460 Location Study Socioeconomic Technical Report.

3.5.1 Population

Table 3.5-1 provides population data from the 2000 US Census for the study area, in which there are over 45,000 residents.

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Table 3.5-1
POPULATION FOR THE STUDY AREA AND JURISDICTIONS

Jurisdiction or sub-Jurisdiction	Study Area	Jurisdiction Total	Percent population within Study Area (or jurisdiction)	Percent of Study Area Population
Isle of Wight County	13,086	29,728	40.6%	30.4%
Town of Windsor	933[1]	933[1]	100%	2.3%
Prince George County	13,987	33,047	37.8%	31.4%
Southampton County	1,110	17,482	4.2%	1.9%
Town of Ivor	315[2]	315[2]	100%	0.8%
Surry County	3,564	6,829	52.2%	9.0%
Sussex County	5,437	12,504	29.5%	9.3%
Town of Wakefield	1,045[3]	1,045[3]	100%	2.6%
Town of Waverly	2,360[3]	2,360[3]	100%	5.9%
City of Suffolk	8,407	63,677	11.2%	18.0%
Study Area Jurisdictions Total	45,591	163,267	24.3%	100%

[1] Included in Isle of Wight County population. Census 2000 population is before the town's annexation in 2001.
[2] Included in Southampton County population
[3] Included in Sussex County population
Source: US Census Bureau

3.5.2 Racial and Ethnic Characteristics

Title VI of the Civil Rights Act of 1964 states that, "No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance". Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," seeks to minimize disproportionate impacts of federal programs on minority populations and low-income populations. In December 1998, the FHWA published its "FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations". It defines minorities as Black, Hispanic, Asian American, American Indians, and Alaskan Natives (i.e., all persons other than White non-Hispanic). It defines low-income as "a person whose median household income is below the U.S. Department of Health and Human Services poverty guidelines". In accordance with Executive Order 12898, data on the presence of and impacts to minority and low-income populations were evaluated. The following sections provide information regarding the study area's minority and low-income populations.

Table 3.5-2 lists the ethnic composition of the study area. Minority is defined as all persons other than White non-Hispanic. The minority population in Virginia is approximately 28 percent of the state population. Minorities account for approximately 37 percent of the study area population. Although this number is higher than the statewide percentage, it is slightly lower than the minority percentage of the study area jurisdictions (44 percent). See the Socioeconomic Technical Report for more details about the racial and ethnic characteristics of study area jurisdictions.

Table 3.5-2
ETHNIC COMPOSITION OF STUDY AREA

Jurisdiction	Virginia	Virginia	Study Area	Study Area
All races	7,078,515	100%	45,591	100%
White, Not of Hispanic Origin	4,965,637	70.2%	28,680	62.9%
Total Minority	1,958,405	27.7%	16,911	37.1%
Black or African American [1]	1,376,378	19.4%	15,289	33.54%
American Indian and Alaska Native [1]	18,596	0.3%	108	0.24%
Asian [1]	259,277	3.7%	311	0.68%
Hawaiian, Other Pacific Islander[1]	3,380	0.0%	30	0.07%
Other race [1]	11,685	0.2%	170	0.37%
Two or more races[1]	114,022	1.6%	627	1.38%
Hispanic or Latino[2]	329,540	4.7%	783	1.72%

[1] Regardless of Hispanic/Latino designation.
[2] All Hispanics regardless of race. Note: results in double counting.
Source: US Census Bureau, Census 2000

African-Americans make up the largest minority group (33% of total population) in the study area. Figure 3.5-1 depicts the percentage of minority population in each study area Census Block.

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Figure 3.5-1
PERCENTAGE OF MINORITY RESIDENTS BY CENSUS BLOCK

3.5.3 Income Characteristics

Table 3.5-3 presents the 2000 Census data for low-income individuals in the study area. The study area's poverty ratio is slightly less than the Commonwealth's.

Table 3.5-3
POVERTY CHARACTERISTICS FOR THE STUDY AREA

Jurisdiction	Median Household Income	Persons for Whom Poverty Level is Determined[1]	People Below Poverty Level	Percent of People Below Poverty Level
Virginia	$46,677	6,844,372	656,641	9.6%
Study Area Jurisdictions Total	$41,500	44,311	4,143	9.3%

[1] Poverty status is determined for all people except institutionalized people, people in military group quarters, people in college dormitories, and unrelated individuals under 15 years old.

The median household income within the study area is $42,191, which is $4,500 lower than that of the Commonwealth ($46,667).Household incomes are higher towards the east and west boundaries of the study area and lower in the center of it. Figure 3.5-2 represents the percentage of each Census Block Group that is below the poverty level. The percentage of people below poverty level is generally higher towards the middle of the study area, including the study area portions of Sussex County. There are also Census block groups in Prince George County and near Smithfield with higher percentages of residents below poverty level.

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Figure 3.5-2
PERCENTAGE OF LOW INCOME RESIDENTS BY CENSUS BLOCK GROUP

3.5.4 Communities and Neighborhoods

Six communities are located along Route 460: Disputanta, Waverly, Wakefield, Ivor, Zuni, Windsor, and the Kings Fork area of the City of Suffolk. The majority of these communities came into existence as result of the Petersburg and Norfolk Railroad in 1858 (Southampton County). In the 1930s, Route 460 was built adjacent to the railroad line. The larger towns, such as Windsor, Waverly, Wakefield, and Ivor, have declined in population due to the loss of agricultural and timber jobs. Smaller towns, such as Disputanta and Zuni, are almost entirely residential.

Community cohesion is a function of the area residents' day-to-day interactions and the perceived unity of residents in a specific area. Shared community facilities and major services often act as community focal points. Waverly, Wakefield, and Windsor have the largest number of community facilities of the communities along Route 460. With populations between 1,000 and 2,500 people, these communities are served by a more diverse range of community facilities than the smaller communities.

The three larger communities (Waverly, Wakefield, and Windsor) have between five and 15 places of worship, a grocery store, emergency services, and a post office. Each of the three towns also has at least one school: Wakefield has one public elementary school and one private school; Windsor has one middle school and one high school. Although the public elementary schools in Sussex County will be consolidated into one facility outside the study area, the elementary schools in Waverly and Wakefield are slated for conversion into community centers.

Disputanta, in Prince George County, is a small community with a post office, one elementary school, one library, emergency services, and small cluster of religious facilities. Ivor, in Southampton County, has a post office, an emergency service, and a few religious facilities. Zuni, the smallest community, has a post office and a small number of churches. The Kings Fork section of the City of Suffolk has one public school, one private school, a few religious facilities, and baseball fields.

In addition to the communities along the existing Route 460, there are neighborhoods located within the study area but outside the communities described. These areas include subdivisions and manufactured home parks. Some of these developments are scattered throughout the County, such as in Prince George County. In this County, subdivisions are located off Routes 156 and 625. Other neighborhood areas, such as in Isle of Wight County and the City of Suffolk, are located near other towns, and established communities.

3.5.5 Public Facilities

Public facilities exist throughout the study area. These facilities provide essential municipal government services, education, and emergency services as well as provide for quality of life of the local residents.

Municipal government buildings, including town halls, are located within the towns of Windsor, Ivor, Waverly, Wakefield, Dendron, and Surry. Prince George, Surry, and Isle of Wight have County seats in the study area. The Virginia State Police (Waverly), the Virginia Department of Agricultural and Consumer Services, and the National Weather Service Forecast Office (Wakefield) also have offices located in the study area.

The study area contains a number of public school facilities, as well as two private schools, a vocational school, and a post-secondary school. There are two correctional facilities in the study area: the Petersburg Jail Farm and a juvenile detention center in Prince George County. Three library systems serve the study area: the Suffolk Public Library, the Blackwater Regional Library, and the Appomattox Regional Library Systems operate libraries in the study area. Sheriff's offices are located throughout the study area. Most operate from the county administration and/or an office in the county seat.

3.5.6 Economic Setting

According to local comprehensive plans, the main industries within the study area relate to agricultural and silvacultural uses. The timber industry plays a particularly important role in the local economies in Surry, Sussex, and Southampton Counties. Almost 80% of Sussex County is forest, and 76% of those forest resources are owned by private companies and individuals. The majority of the farmlands produce soybeans, peanuts, and corn (for grain).

Because of Route 460's access to markets, long-and short-haul distribution has been a growing industry in the study area. Existing distribution centers include the Food Lion distribution center in Disputanta and the Cost Plus World Market facility located outside of the Town of Windsor.

3.5.7 Travel Patterns

Travel patterns along Route 460 in the study area consist of both through trips and local trips between and among the communities described in section 3.5.4. Through trip travel was analyzed via an Origin–Destination (OD) survey conducted at two locations along the corridor in May 2003. (Refer to the Route 460 Location Study Traffic, Transportation, and Freight Technical Report for details). At the Prince George County survey location, the majority of eastbound trips (80 percent) originated in the Richmond – Petersburg Metropolitan Statistical Area. The majority of eastbound trips (60 percent) were destined for communities along Route 460 within the study area. An additional 15 percent of trips originated in other parts of Virginia, including southwestern, central and northern Virginia. Five percent of these eastbound trips along Route 460 originated in other states. At the Suffolk terminus, the majority (91 percent) of westbound trips originated in Hampton Roads. The majority of westbound trips (75 percent) were destined for communities along Route 460 within the study area. An additional 15 percent of westbound trips were destined for the Petersburg -Richmond MSA. Over 7 percent of westbound trips were destined for others parts of Virginia and approximately 3 percent of westbound trips were destined for outside of Virginia.

Local travel patterns along Route 460 were surveyed at two public meetings held for the Study in August 2003. Based upon the analysis of survey respondents, Route 460 is clearly an important transportation facility for the study area. The majority of survey respondents (58 percent) used Route 460 everyday. Eight-six (86) percent of respondents use Route 460 at least once per week.

The majority of respondents (70 percent) travel greater than eleven miles one-way on average trips along Route 460. Nineteen percent travel greater than 30 miles one way. Only seven percent of respondents indicated one-way travel distances of less than five miles.

Trip purposes mentioned by survey respondents covered every major category including: commuting to work (50 percent); shopping (38 percent); shipping goods (13 percent); and school trips (9 percent). Additionally, numerous "other" responses were given including dining/entertainment; visiting friends and family; and attending meetings and church. Several respondents indicated that every trip they make uses Route 460 because their driveway is located along the roadway.

3.6 HAZARDOUS MATERIALS

Several federal laws regulate the handling of hazardous materials and wastes. These include the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act (or Superfund), including the Superfund Amendments and Reauthorization Act, Toxic Substances Control Act, and Hazardous and Solid Waste Amendments of 1984.

3.6.1 Assessment

The United States Environmental Protection Agency (EPA) and Virginia Department of Environmental Quality (DEQ) regulate businesses and individuals that handle hazardous materials and wastes in Virginia. Both agencies maintain databases of the different types of regulated sites or facilities. A

hazardous materials assessment, which included database searches, was performed for each of the three build alternatives. See Section 4.6 for a summary of these searches.

3.6.2 Potential Geologic Hazards

No naturally occurring geologic hazards (such as karst formations (sinkholes), asbestos-containing rocks or sediments) which could pose a threat to human health or the environment during facility construction or operation are known to exist within the study area.

3.7 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Section 106 of the National Historic Preservation Act of 1966 (NHPA) as amended and implementing regulations(36 CFR 800), require that federal agencies consider the effects of their actions on significant historic properties included in or eligible for the National Register of Historic Places (NRHP). Meeting this requirement involves consultation with the State Historic Preservation Officer (SHPO) when identifying and determining the potential effects to historic resources. In the State of Virginia, the Director of the Virginia Department of Historic Resources (DHR) serves as the SHPO.

The study area counties include locations of some of the earliest settlement of Virginia. Lands along and near the James River have been attractive for settlement since the early seventeenth century, and structures from the late seventeenth century survive along the eastern boundary of the study area.

3.7.1 Architectural Resources

Previously recorded historic resources that are eligible or potentially eligible for the NRHP were identified in accordance with the provisions of Section 106 of the NHPA. A total of 379 resources have been previously recorded at Virginia DHR within the study area. They include homes, farms, historic districts, schools, and commercial resources. A total of 42 previously recorded resources located within the study area were determined eligible for the NRHP. These resources are listed in Table 3.7-1 and their general locations are shown on Figure 4.7-1.

3.7.2 Archaeological Resources

A total of 302 archaeological sites have been previously recorded within the study area. A total of only four previously recorded resources located in the study area were determined eligible for the NRHP. These resources are listed in Table 3.7-2. These sites have not been depicted on a study area map to protect them from vandalism and relic hunters.

Later in the study, efforts to identify significant archaeological sites will be conducted on the selected alternative and the Section 106 process will be concluded for the final EIS. Focusing efforts to identify significant archaeological properties on the selected alternative is justified due to the remote possibility that any resources will be found that are valued chiefly for preservation in place. Because of this, significant archaeological resources are unlikely to influence a location decision. In addition, 36 CFR 800.4(b)(2) allows for the phased identification of historic properties on projects "where alternatives under consideration consist of corridors or large land areas".

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Table 3.7-1
ARCHITECTURAL RESOURCES
LISTED ON OR ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES

VDHR #	City/County	Quad	Property Name	Comments
046-0086	Isle of Wight	Windsor	Roberts House (current) Scott Farmstead (historic)	NRHP Listed
133-0101	Suffolk	Windsor	Roundtree Farm	Eligible for NRHP
133-0692	Suffolk	Chuckatuck	Chuckatuck H. D.	NRHP Listed
133-0695	Suffolk	Chuckatuck	Phillips Farm	NRHP Listed; formerly 133-0034
091-0002	Sussex	Ivor	Bell Farm (historic) Bollingham (current)	Eligible for NRHP
091-0013	Sussex	Ivor	Wakefield High School	Eligible for NRHP
046-0082	Isle of Wight	Raynor	Joseph Jordan House (historic)	NRHP Listed
046-5033	Isle of Wight	Raynor	Plank Building	Eligible for NRHP
046-5034	Isle of Wight	Raynor	B. Chapman/Wm. Crocker Farm	Eligible for NRHP
087-0011	Southampton	Raynor	Clements	Eligible for NRHP
087-0014	Southampton	Raynor	Oak Grove (historic) Urquhart House (current)	Eligible for NRHP
046-0013	Isle of Wight	Smithfield	Hearn House	Eligible for NRHP
046-0026	Isle of Wight	Smithfield	Four Square	NRHP Listed
046-0028	Isle of Wight	Smithfield	Boykin Tavern	NRHP Listed
046-0070	Isle of Wight	Smithfield	Wolftrap Farm	NRHP Listed
046-0075	Isle of Wight	Smithfield	Chapman Farm (historic) Bill Sykes House (current)	Eligible for NRHP
300-0087	Smithfield	Smithfield	Smithfield HD	NRHP Listed
090-0040	Surry	Waverly	Snow Hill	NRHP Listed
090-0042	Surry	Waverly	Cedar Ridge	NRHP Listed
090-5011	Surry	Waverly	Rogers' Store	NRHP Listed
091-0073	Sussex	Waverly	Miles B. Carpenter House	NRHP Listed
091-0087	Sussex	Waverly	Burtland (historic) Mary Court (current)	Eligible for NRHP
090-5013	Surry	Dendron/Runnymeade	White Oak Farm	Eligible for NRHP
090-0039	Surry	Runnymeade/Surry	Enos House	NRHP Listed
046-0096	Isle of Wight	Bacon's Castle	Poplar Hill	NRHP Listed
090-0034	Surry	Bacon's Castle	Old Brick Church (historic) Lower Southwark Church (alt)	NRHP Listed; Also 44SY0121

VDHR #	City/County	Quad	Property Name	Comments
090-5003	Surry	Bacon's Castle	Oak Grove Dairy Farm	Eligible for NRHP
074-0059	Prince George	Prince George	Prince George Golf Club/Chester Plantation	Eligible for NRHP
074-5013	Prince George	Prince George	Prince George County Courthouse H.D.	Eligible for NRHP; includes 074-5013-0001 to 0015
074-0001	Prince George	Disputanta North	Aberdeen	Eligible for NRHP
074-0003	Prince George	Savedge	Martin's Brandon Church	NRHP Listed; borders Rt. 10
090-0014	Surry	Savedge	Montpelier	NRHP Listed
090-0012	Surry	Claremont	Glebe House of Southwark Parish	NRHP Listed; outside, but borders Rte. 10
308-0001	Surry	Surry	Surry County Clerk's Office	Eligible for NRHP; In Surry County Courthouse Complex
308-0008	Surry	Surry	Surry County Courthouse Complex	Eligible for NRHP
116-0002	Hopewell	Hopewell	Weston Manor	NRHP Listed
116-0008	Hopewell	Hopewell	City Point National Cemetery	NRHP Listed; includes 116-008-001
116-0010	Hopewell	Hopewell	Beacon Theatre	NRHP Easement; outside, but borders Rte. 10-in Hopewell H.D.
116-5001	Hopewell	Hopewell	Hopewell Municipal Building	NRHP Listed; in Hopewell H.D.
116-5030	Hopewell	Hopewell	Hopewell High School	Eligible for NRHP
116-5031	Hopewell	Hopewell	Hopewell Historic District	NRHP Listed
074-0009	Prince George	Westover	Merchant's Hope Church	NRHP Listed

Source: Virginia Department of Historic Resources, 2003.

Table 3.7-2
ARCHAEOLOGICAL RESOURCES
LISTED ON OR ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES

VDHR #	City/County	Quad	Site Description (NA=Native American; H=Historic Period)	Comments
44IW0148	Isle of Wight	Benns Church	H-17th c.	Eligible for NRHP
44SY0121	Surry	Bacons Castle	H-18th c.	NRHP-also 090-0034
44PG0317	Prince George	Hopewell	H-19th c. (Possibly Civil War)	Eligible for NRHP
44PG0381	Prince George	Hopewell	NA-Mid-Late Woodland H-18th-20th c.	Eligible for NRHP

3.8 AIR QUALITY

In accordance with the Clean Air Act of 1970 (42 USC 7609, as amended in 1997 and 1990) the EPA established National Ambient Air Quality Standards (NAAQS) for six major pollutants. These include: carbon monoxide (CO), lead (Pb), nitrogen oxides (NO_x), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur oxides (SO_x). These standards are also the official ambient air quality standards for the State of Virginia. The "primary" standards have been established to protect the public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. The "secondary" standards are intended to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare.

The only NAAQS pollutants that are normally associated with impacts from highway mobile source emissions are CO and O_3 and more recently PM 2.5. Of these pollutants, the FHWA requires a detailed evaluation of CO and broader area wide analysis of O_3 in certain areas. Automobiles contribute about 60 percent of all CO emissions nationwide and represent the major source of CO in the study area.

The state and federal ambient air quality standards for carbon monoxide are as follows:

- 1-hour - 35 parts per million (ppm) or 40 milligrams per cubic meter (mg/m^3); not to be exceeded more than once per year;
- 8-hour - 9 ppm or 10 mg/m^3; not to be exceeded more than once per year.

3.8.1 Existing Air Quality Levels and Compliance in the Study Area

Section 107 of the 1997 Clean Air Act Amendments requires the EPA to publish a list of all geographic areas in compliance with the NAAQS, as well as those not in attainment of the NAAQS. Areas not in compliance with the NAAQS are termed non-attainment areas. The designation of an area is made on a pollutant-by-pollutant basis. In July of 1997, EPA adopted an 8-hour standard for O_3 (0.08 ppm) and added $PM_{2.5}$ as a criterion pollutant to the NAAQS.

EPA evaluated the latest scientific data and developed a standard more protective of public health after discovering that adverse health effects resulting from ozone exposure occur at lower concentrations spread out over longer periods of time. However, litigation prevented the EPA from applying the new 8-hour standard for ozone. Finally, in spring of 2004, EPA designated areas in nonattainment with the 8-hour standard. Areas designated nonattainment under the 8-hour ozone standard have one year (until June 15, 2005) to demonstrate conformity in accordance with the procedures established by EPA at which time the 1-hour ozone standard will be revoked.

In July of 1997, EPA added $PM_{2.5}$ as a criterion pollutant to the NAAQS. For $PM_{2.5}$, EPA is currently coordinating with the states to determine which areas will be designated nonattainment. Currently, all of Virginia's monitors are in compliance with the $PM_{2.5}$ standard. EPA plans to finalize the $PM_{2.5}$ designations in November of 2004. If the counties comprising the study area are designated nonattainment for $PM_{2.5}$, then they will likely have at least one year from the designation to demonstrate conformity to the standard in accordance with the Clean Air Act.

The study area is currently classified as being in attainment of all NAAQS pollutants except for the one-hour and eight hour O_3 standard. The study area lies between two nonattainment areas and as such is classified as a maintenance, marginal, or a moderate nonattainment area depending on the county. The City of Suffolk is classified as a maintenance area for one-hour O_3 and as a marginal area for the eight-hour O_3 standard. Isle of Wight County is also classified as a marginal area for the eight-hour O_3 standard, while Prince George County is designated as a moderate area for the eight-hour O_3 standard. A maintenance area is defined as an area that was once classified as a nonattainment area but has shown, through monitored data, now to be in attainment of the applicable standard. A marginal or moderate area designation is based on the 8-hour design value calculated using the most recent three years of monitored data. Moderate areas must attain national air quality standards for eight-hour O_3 no

later than June 2010. Marginal areas must attain no later than June 2007. Regardless of its classification, the City of Suffolk, Isle of Wight, and Prince George Counties are all subject to the requirements of the EPA's Transportation Conformity Rule.

While a network of sampling stations monitors air pollutant levels throughout Virginia, currently there are no monitoring stations located within the study area. The closest monitoring stations are located in the City of Suffolk (Station 183-F) and Charles City County (Station 75-B). These monitoring stations, under the supervision of the Virginia Department of Environmental Quality (DEQ), measure for O_3, NO_2, SO_2 and $PM_{2.5}$. According to the *Virginia Ambient Air Monitoring 2003 Data Report*, the one-hour O_3 criteria (12 ppm) was exceeded at the Charles City County monitoring station and the eight-hour O_3 criteria (.08 ppm) was exceeded at both the City of Suffolk and the Charles City County monitoring stations. The methods employed to define and assess air quality within the study area are discussed in greater detail in Section 4.8, Air Quality, of this document and in the *Air Quality Technical Report* (VDOT, 2005).

3.9 NOISE

3.9.1 Noise Criteria

The noise impact of the proposed alternatives for the Route 460 Environmental Study was assessed in accordance with FHWA and Virginia Department of Transportation (VDOT) noise assessment guidelines. The FHWA standards are set forth in 23 CFR Part 772. VDOT's regulations are contained within the State Noise Abatement Policy, and are consistent with the FHWA standards. In order to determine the degree of impact of traffic noise on human activity, the Noise Abatement Criteria (NAC) established by the FHWA regulation were used. Table 3.9-1 shows categories of noise-sensitive land uses potentially affected by this project, along with corresponding NAC. Noise impact occurs when the predicted noise levels in the project area "approach or exceed" the NAC during the loudest hour of the day. Noise impact also occurs when predicted project noise levels substantially exceed existing noise levels. VDOT considers an increase of 10 decibels or more to be substantial.

For noise-sensitive land uses with interior activities such as schools and churches, noise impact was also evaluated with respect to the FHWA NAC for Activity Category E. Following FHWA guidelines, interior noise levels are computed by subtracting from the computed exterior noise levels the noise reduction factor of the building structure. For Category E land uses, noise impact occurs wherever the predicted noise levels (interior) during the loudest hour of the day "approach or exceed" 52 dBA L_{eq} (equal or exceed 51 dBA L_{eq}).

Table 3.9-1
FEDERAL HIGHWAY ADMINISTRATION NOISE ABATEMENT CRITERIA

Activity Category	$L_{eq}(h)$*	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

* Hourly A-Weighted Sound Level (dBA)

3.9.2 Existing Noise Conditions

Noise levels in the project study area were determined for the existing (2004) conditions, the design-year (2026) No-build conditions, and the design-year Build conditions. To assess existing conditions, noise measurements were conducted in the study area on weekdays during the months of July and August 2004. Short-term noise measurements were conducted at a total of 24 sites representative of noise-sensitive properties. Figure 3.9-1 shows the location of each of the noise measurements. The measured noise levels are listed in Table 3.9-2 and are expressed as equivalent sound levels (L_{eq}). Measured L_{eq}s ranged from a low of 40 dBA at Sites 6, 18, and 21 to a high of 57 dBA at Site 19. Detailed explanation of these measurements is located in the *Noise Technical Report*.

Table 3.9-2
SUMMARY OF MEASURED EXISTING NOISE LEVELS

Site Number	Build Alternative	Location	Date	Start Time	Leq	Dominant Noise Source
M1	Alt 3	5280 West Quaker Rd, Rte 629	7/21/04	9:21	50	Rte 629 Traffic
M2	Alt 3	8800 Bowbridge Rd	7/21/04	10:04	44	Non-Traffic (1)
M3	Alt 1	11797 Continental Forest Dr	7/21/04	12:00	47	Non-Traffic (1)
M4	Alt 1	5298 Beef Steak Rd, Rte 626	7/22/04	10:34	43	Non-Traffic (1)
M5	Alt 1	7299 Coppahaunk Rd, Rte 654	7/22/04	11:35	42	Rte 654 Traffic
M6	Alt 3	9246 Springhill Rd, Rte 603	7/22/04	13:03	40	Non-Traffic (1)
M7	Alt 1	13120 Courtland Rd, Rte 628	7/22/04	14:50	53	Rte 628 Traffic
M8	Alt 3	6413 Proctors Bridge Rd, Rte 616	7/28/04	10:28	46	Rte 616 Traffic
M9	Alt 3	7062 Dodge Ln	7/28/04	11:57	42	Non-Traffic (1)
M10	Alt 3	Clydesdale Mobile Prk, Quail Hollow Ln	7/28/04	14:38	50	Trailer Park Traffic
M11	Alt 1	36482 Seacock Chapel Rd, Rte 614	7/29/04	9:58	47	Rte 614 Traffic
M12	Alt 1	Presbyterian Homes & Family Services Thomas Woods Trail	7/29/04	13:00	41	Facility Traffic
M13	Alt 3	5466 Old Myrtle Rd, Rte 632	7/30/04	13:15	50	Rte 632 Traffic
M14	Alt 1	4412 Old Mill Rd, Rte 607	7/30/04	14:04	44	Rte 607 Traffic
M15	Alt 2	Harrison Elementary School 12900 West Quaker Rd, Rte 618	8/24/04	10:33	51	Rte 618 Traffic
M16	Alt 2	10320 County Dr	8/24/04	11:33	48	Rte 460 Traffic
M17	Alt 2 & 3	543 Jasper Road	8/24/04	12:47	45	Non-Traffic (1)
M18	Alt 2	571 Freeman Pond Rd, Rte 639	8/24/04	15:26	40	Non-Traffic (1)
M19	Alt 2	36361 Broadwater Rd, Rte 620	8/24/04	16:31	57	Rte 620 Traffic
M20	Alt 1	15150 Alden Rd, Rte 624	8/25/04	9:19	52	Rte 460 Traffic
M21	Alt 3	3195 Laurel Dr, Rte 601	8/25/04	10:17	40	Non-Traffic (1)
M22	Alt 2	Windsor Middle School 23320 North Court St	8/25/04	12:35	51	Rte 258 Traffic
M23	Alt 2	Twin Ponds Trailer Ct 10401 Courthouse Hwy, Rte 258	8/25/04	14:21	50	Trailer Park Traffic
M24	Alt 2	23366 Deer Path Trail, Rte 600	8/25/04	15:16	49	Rte 600 Traffic

Note: (1) Non-Traffic sources included distant planes and trains, wind, birds, insects, air-conditioning units, distant talking and dog barking, and other typical residential sources. No one of these sources was dominant at any site.

Figure 3.9-1
AMBIENT NOISE MEASUREMENT LOCATIONS

3.10 WATER QUALITY

3.10.1 Surface Water Resources

As identified by the Virginia Department of Environmental Quality (DEQ), Virginia encompasses all or part of 11 major river basins, along with eight minor river basins. The major river basins are subdivided into a number of hydrologic subareas according to a hydrologically based cataloging system developed by the USGS. Each of these hydrologic subareas is identified by an eight-digit hydrologic unit code (HUC). Figure 4.10-1 of Chapter 4 shows boundaries of river basin subareas along with major stream and water bodies within the study area.

The eastern and northwestern portions of the study area are contained within the James River Basin (see Figure 4.10-1 of Chapter 4). Portions of the study area lying within the James River Basin fall within the following hydrologic subareas:

- The Lower James River subarea (HUC 02080206)
- The Hampton Roads (or Southeastern Virginia) subarea (HUC 02080208)

Remaining portions of the study area (i.e., the central and southwestern portions) are contained within the Chowan River Basin (see Figure 4.10-1 of Chapter 4). Portions of the study area lying within the Chowan River Basin fall within the following hydrologic subareas:

- The Nottoway River subarea (HUC 03010201)
- The Blackwater River subarea (HUC 03010202)

The study area contains a large number of named and unnamed perennial and intermittent streams. Of these, the Blackwater River is the most prominent and longest stream course. The major surface water impoundments of Lake Burnt Mills, Lake Prince, Western Branch Reservoir, Lake Cahoon, and Lake Meade are located in the easternmost portion of the study area. In addition, the study area contains numerous small ponds – most of which are man-made.

3.10.1.1 Baseline Water Quality

To characterize existing water quality in the study area, baseline water quality data of surface water resources were compiled and assessed for highway-related contaminants over a period-of-record appropriate to each station. This was accomplished through use of data published for 18 selected state-maintained stream monitoring stations within the study area (see Figure 4.10-1 of Chapter 4). Baseline water quality and historic trends were determined for the 18 state-monitored streams through the review of Virginia Ambient Water Quality Monitoring Reports published by the Virginia DEQ (DEQ, 2003; DEQ, 2002; DEQ, 2001; DEQ, 1999; DEQ, 1997; and DEQ, 1995).

Between 1995 and 2003, trends for total phosphorus (a keystone nutrient indicative of overall non-point pollution, but not directly associated with highway runoff) decreased for six of the 18 stations and increased for five of the 18 stations. For the remaining seven stations, insufficient data is available to draw conclusions. This overall trend is consistent with long-term trends identified by the Virginia Water Resources Research Center for four study area monitoring stations, which found that total phosphorus declined at two of the stations, increased at one of the stations, and showed no change at the remaining station (Virginia Water Resources Research Center, 1998). Between 1995 and 2003, long-term trends for the total suspended solids (a pollutant for which highway runoff typically comprises a portion of the total concentration) decreased for five of the 18 stations and increased for six of the 18 stations. For the remaining seven stations, insufficient data is available to draw conclusions. By contrast, long-term trends identified by the Virginia Water Resources Research Center for three study area monitoring stations, indicate that non-filterable residue (a proxy for total suspended solids) declined at all three stations

(Virginia Water Resources Research Center, 1998). The Water Quality Technical Report (VDOT, 2004) provides more-detailed information pertaining to surface water quality.

3.10.1.2 Impaired Waters

When surface waters fail to meet water quality standards, they are typically designated as "impaired waters" under section 303(d) of the Clean Water Act. One major source of nonpoint pollution contributing to impairment of surface waters results when small amounts of contaminants from a large number of sources are carried by stormwater runoff into surface waters. Table 3.10-1 lists streams and other surface waters within the study area presently included on the Virginia 303(d) Priority List of Impaired Waters. Figure 4.10-1 of Chapter 4 shows the locations of state-listed impaired waters and representatively selected state-maintained surface water quality monitoring stations used as part of this study. Approximately 179 river miles of impaired waters currently exist within the study area. Of this total, fecal coliform contamination (a non-highway-related pollutant) is responsible for impairment of approximately 147 river miles (or 82 percent of the total). Of the 179-river-mile total, failure to meet the general standard for benthics is responsible for impairment of approximately eight river miles (or 4.5 percent of the total). Although roadway drainage could contribute incrementally to impairment with respect to benthics (due to siltation and dissolved solids) DEQ does not list roadway runoff as a specific component of any sources of impairment.

Table 3.10-1
IMPAIRED WATERS OF THE STUDY AREA

STREAM NAME	SEGMENT SIZE	UPSTREAM TO DOWNSTREAM LIMIT	IMPAIRMENT CAUSE
Blackwater Swamp, Warwick Swamp	43.83 miles	headwaters to Blackwater River	dissolved oxygen, pH, fecal coliform
Second Swamp	15.21 miles	headwaters to Blackwater River	dissolved oxygen, fecal coliform
Cypress Swamp	5.35 miles	Johnchecohunk Swamp to mouth at Blackwater River	fecal coliform
Blackwater River	24.55 miles	Warwick Swamp to Cypress Swamp, Route 617 Bridge	fecal coliform
Blackwater River	11.84 miles	Rt. 620 crossing to confluence with Antioch Swamp	sediments - organics
Spring Branch	3.52 miles	Borden Chemical Waverly Plant Discharge to Blackwater River	general standard (benthic)
Coppahaunk Swamp	12.49 miles	headwaters to mouth at Blackwater River	fecal coliform
Otterdam Swamp	11.53 miles	headwaters to mouth at Blackwater River	dissolved oxygen, pH, phosphorus, ammonia
Otterdam Swamp	5.58 miles	Averys Pond to mouth at Blackwater River	fecal coliform
Rattlesnake (Creek) Swamp	7.50 miles	5 mi. upstream and 5 mi. downstream of Rt. 625 crossing	dissolved oxygen, fecal coliform
Mill Swamp	10.13 miles	confluence with Moores Swamp to confluence with Rattlesnake Swamp	fecal coliform
Black Swamp	3.77 miles	headwaters to its mouth at Assamoosick Swamp	fecal coliform
Assamoosick Swamp	2.05	headwaters to mouth of Assamoosick Swamp	fecal coliform
Assamoosick Swamp	15.38 miles	headwaters to Rt. 607 bridge	fecal coliform
Assamoosick, Seacorrie, German, Pigeon Swamps	37.72 miles	headwaters to mouth of Assamoosick Swamp	dissolved oxygen, pH, fecal coliform, ammonia
Seacock Swamp	1.06 miles	headwaters to confluence with Seacock Swamp	dissolved oxygen, pH, fecal coliform

STREAM NAME	SEGMENT SIZE	UPSTREAM TO DOWNSTREAM LIMIT	IMPAIRMENT CAUSE
Brantley Swamp	7.05 miles	confluence with Lightwood Swamp to confluence with Seacock Swamp	dissolved oxygen, pH
Bailey bay, Bailey Creek (tidal), Cattail Creek (tidal)	0.29 sq. mi.	fall line to confluence with James River	dissolved oxygen, fecal coliform, fish tissue – PCBs, sediment – PCBs, chlordane, DDE, DDT, total DDT metabolites
Bailey Creek	6.54 miles	headwaters to fall line	fish tissue – PCBs, aldrin, heptachlor epoxide, dissolved oxygen, fecal coliform
Powell Creek	6.92 miles	headwaters to tidal limit	fecal coliform
Pagan River (upper)	0.75 sq. mi.	Tidal water 0.5 mi. downstream of Canal Run to intersection of Rt. 258 & Rt.10	fecal coliform, dissolved oxygen
Chuckatuck Creek	2.97 miles	headwaters to start at Godwins Millpond	general standard (benthics)
Carbell Swamp	2.57 miles	headwaters to start of unnamed pond	general standard (benthics)
Eley Swamp	4.4 miles	2.4 mi. upstream to 2.0 mi. downstream of Rt. 607 crossing	pH

Source: Virginia Department of Environmental Quality, 2004

3.10.1.3 Surface Drinking Water Supplies

The City of Norfolk owns and operates two surface drinking water supplies and intakes within the easternmost portion of the study area - the Lake Prince and Western Branch Reservoir public water supplies. The City of Portsmouth owns and maintains two surface drinking water supplies immediately east of (downstream of) the study area - the Lake Kilby and the Lake Meade public water supplies. The City of Portsmouth owns and operates an intake and water treatment plant just above the Lake Kilby dam. Also, immediately east of the study area, the City of Suffolk owns and operates the Millpond public water supply intake which withdraws waters from an impoundment on Chuckatuck Creek (a portion of which extends into the study area).

The study area also contains portions of surface water drainage areas determined by the Virginia Department of Health (VDH) to be important to the protection of public drinking water supplies. These drainage areas and the localities to which they are important are listed in Table 3.10-2.

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Table 3.10-2
DRAINAGE AREAS DETERMINED BY VDH TO BE IMPORTANT TO PUBLIC DRINKING WATER SUPPLIES

Drainage Area Name	Associated Locality
Lower Appomattox River	City of Hopewell
Middle Blackwater River	City of Norfolk (high flow augmentation)
Lake Prince	City of Norfolk
Western Branch	City of Norfolk
Millpond (Chuckatuck Creek)	City of Suffolk
Lone Star Lake	City of Suffolk
Lake Kilby	City of Portsmouth
Lake Meade	City of Portsmouth

Source: Virginia Department of Health, 2004.

3.10.2 Groundwater Resources

The primary groundwater resources within the project study area are derived from deep wells screened within Cretaceous-age sands, which underlie much of the study area. Wells screened within shallower Tertiary-age and Pleistocene-age sediments are also capable of providing somewhat lower yielding groundwater supplies.

A sole source aquifer, as defined under Section 1424(e) of the Safe Drinking Water Act, is an aquifer that has been designated as the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health. No aquifers within the project area have been designated by EPA as sole source aquifers.

Public drinking water systems, as defined by EPA, may be publicly or privately owned and serve at least 25 people or 15 service connections for at least 60 days per year. Within the study area, groundwater wells provide a sizeable proportion of the potable water supplied by public drinking water systems. The VDH maintains records of 23 municipal public groundwater supply wells and 79 community/institutional public groundwater supply wells within the study area. Public groundwater supply wells within the study area are shown on Figure 4.10-3 of Chapter 4. The name of the water supply system along with the community/municipality to which these wells belong are listed in the Water Quality Technical Report (VDOT, 2004).

EPA's Wellhead Protection Program is a community-based approach for the protection of groundwater that supplies drinking water to public water wells and wellfields. Wellhead protection areas are defined as the surface and subsurface area surrounding a water well or wellfield supplying a public water system through which contaminants are reasonably likely to move toward and reach such water well or wellfield. Because Virginia does not have an EPA-approved State Wellhead Protection Program, there are no official local wellhead protection programs in place within the Commonwealth.

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3.11 TERRESTRIAL ECOLOGY, WILDLIFE HABITAT, AND BIODIVERSITY

Portions of the study area have experienced noticeable alterations over the past several hundred years due primarily to human activity. Urbanization along Route 460 and other major thoroughfares has encroached on the various terrestrial and wildlife habitats found in the study area; however, many remain relatively unaltered. The major terrestrial systems identified within the study area include hardwood forests (oak-hickory), bottomland hardwood forests, pine forests, mixed hardwood-pine forests, agricultural lands (cropland and pasture), forestry management tracts, and brush/old field communities.

3.11.1 Ecology and Habitat of Forest Lands

The study area contains three main terrestrial forest types: (1) deciduous forest, (2) evergreen forest, and (3) mixed evergreen/deciduous forest. Forested wetlands are addressed as components of the riparian and aquatic ecological communities in sections 3.12 and 3.13 of this document. Terrestrial forest types comprise approximately 62 percent of the study area (or 295,695 acres). Of this 295,695-acre total, approximately nine percent (or 26,602 acres) is comprised of deciduous forest, approximately 19 percent (or 55,630 acres) is comprised of evergreen forest, and approximately 72 percent (or 213,463 acres) is comprised of mixed evergreen/deciduous forest. The majority of the forest lands in the study area are fragmented by agricultural lands and road corridors and, to a lesser extent, by residential and commercial development. See Figure 4.11-1 of Chapter 4 for locations of potentially affected forest lands. Characteristics of these forest types along with their correlation to community types defined under the Natural Communities of Virginia: Classification of Ecological Community Groups: Second Approximation (VDCR, DNH, 2004) are provided in the Natural Resources Technical Report (VDOT, 2005).

3.11.1.1 Wildlife Associated with Terrestrial Forest Habitat

Forest lands within the study area provide habitat for a large and diverse assemblage of wildlife species. Game species include white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris allopavo*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), and red fox (*Vulpes fulva*). Small mammal species include mice, moles, and shrews. Forest bird species include a variety of warblers (*Muscicapidae*), wrens (*Troglodytidae*), flycatchers (*Tyrannidae*), vireos (*Viriondae*), and woodpeckers (*Picidae*). Raptor species of the study area include barred owl (*Strix varia*), sharp-shinned hawk (*Accipiter striatus velox*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus lineatus*), bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus carolinensis*), and the American kestrel (*Falco sparverius sparverius*). Bald eagle nesting sites and habitat for the red-cockaded woodpecker (a federally listed endangered species) are addressed in section 3.15 of this document. Amphibians inhabiting the forests of the study area include American toad (*Bufo americanus*), Cope's gray treefrog (*Hyla chrysoscelis*), southeastern chorus frog (*Pseudacris feriarum*), northern redback salamander (*Ambystoma maculatum*), white-spotted slimy salamander (*Plethodon glutinosus*), northern dusky salamander (*Desmognathus fuscus fuscus*), northern red salamander (*Pseudotriton ruber*), spotted salamander (*Ambystoma maculatum*), and three-lined salamander (*Eurycea guttolineatal*). Reptiles inhabiting the forests of the study area include eastern box turtle (*Terrapene carolina*), northern fence lizard (*Sceloporus undulatus hyacinthinus*), northern black racer (*Coluber constrictor*), five-lined skink (*Eumeces fasciatus*), broadhead skink (*Eumeces laticeps*), black rat snake (*Elaphe obsolete obsolete*), corn snake (*Elaphe guttata*), eastern garter snake (*Thamnophis siralis*), eastern hognose snake (*Heterodon platalis*), eastern milk snake (*Lampropeltis triangulum*), eastern worm snake (*Carphophis amoenus*), northern brown snake (*Storeria dekayi*), northern ringneck (*Diadophis punctatus edwardsii*), and rough green snake (*Opheodrys aestivus*).

3.11.1.2 Migratory Birds Relying on Terrestrial Habitat

Certain bird species in the U.S. are protected by the Migratory Bird Treaty Act (MBTA) of 1918, which protects most species of birds that live, reproduce, or migrate within or across international borders at some point during their life cycles. The MBTA makes it unlawful to take, kill, or possess migratory birds,

which includes shipping transportation, or carrying any bird, bird part, nest, or egg. A list of bird species protected by the MBTA was compiled for all native and naturalized species occurring within the study area. Two hundred and sixty six species of migratory birds potentially exist within the study area (see Natural Resources Technical Report (VDOT, 2005)). One hundred fifty of these listed bird species are considered to be terrestrial species and do not require aquatic habitat for any portion of their life cycle. Of the 150 terrestrial species, 25 have been listed as "Species of Management Concern" for the northeast region (FWS, 1995). Of the 25 terrestrial "Species of Management Concern" within the region, the "reason for concern" for three of these species is reported to be "dependence on vulnerable or restricted habitats". For the remaining 22 species, the FWS-designated "reason for concern" is not directly linked to habitat loss. While the database search revealed that 150 terrestrial species potentially exist within the study area, only 86 terrestrial species have been observed within the study area. Of these 86 species, 11 are listed as "Species of Management Concern". Only one of these terrestrial "Species of Management Concern" is reported to be dependant upon vulnerable or restricted habitat (the grasshopper sparrow).

3.11.2 Ecology and Habitat of Agricultural Lands

Approximately 146,156 acres (59,147 hectares) of agricultural lands are located in the study area. Agricultural land uses include cropland (both row crops and non-row crops), confined feeding lots (primarily for pigs), and pastureland (for cattle and horses). Among the food crops grown within the study area are soybeans, corn, and peanuts. Cotton is the predominant non-food crop. Hay crops, grown as fodder for livestock, are interspersed throughout. Several nurseries are located in the study area. The majority of the non-cultivated agricultural land appears to be utilized by cattle and horses for grazing (i.e., pastures) and is dominated by various opportunistic grass (Poaceae) species and other common herbaceous species. A more-detailed discussion of agricultural lands is presented in the Natural Resource Technical Report (VDOT, 2005).

Wildlife habitat associated with agricultural lands is comparatively limited due to the lack of plant diversity and the relatively high frequency of disturbance (i.e., plowing, planting, fertilizing, grazing, and routine maintenance). Despite these factors, agricultural lands are used by wildlife on a limited basis, with the species composition often depending on the type of crop being cultivated, the time of year, and the methods of harvesting. Croplands provide refuge and foraging areas for a variety of small mammals, birds, reptiles and, following harvesting provide foraging for white-tailed deer and migrating waterfowl. Edge habitat between agricultural lands and adjacent forest lands provides habitat and foraging for a diverse assemblage of species.

3.11.3 Ecology and Habitat of Brush and Old Fields

Approximately 189 acres (76 hectares) of brush and old fields are located within the study area. Typically these areas have been timbered, grazed, or utilized as cropland in the recent past. Most of these areas have lain fallow for a number of years and have been left to revegetate through natural succession. The timbered areas are often dominated by the species that were harvested, along with opportunistic early successional species such as black locust (*Robinia pseudoacacia*), tree-of-heaven (*Ailanthus altissima*), Japanese honeysuckle (*Lonicera japonica*), blackberries (*Rubus* spp.), and greenbriers (*Smilax* spp). The agricultural lands are typically dominated by herbaceous plant species such as various grasses, goldenrods (*Solidago* spp.), dog fennel (*Eupatorium capillifolium*), common flax (*Linum usitatissimum*), Queen Anne's lace (*Daucus carota*), common ragweed (*Ambrosia artemissiifolia*), and thistles (*Carduus* spp.). See Figure 4.11-2 for locations of potentially affected brush and old field habitat (shown as "transitional lands"). A more-detailed discussion of brush and old field habitat is presented the Natural Resources Technical Report (VDOT, 2005).

Edge habitat between brush and old field communities and adjacent forest lands provides habitat and foraging for a diverse assemblage of species. The dense regrowth typical to many of these areas offers forage and cover for white-tailed deer and a variety of smaller mammals - including eastern cottontail (*Sylvilagus floridanus*), mice, moles, voles, and shrews. Predators and birds of prey frequent these communities in search of prey. Red fox, Cooper's hawk (*Accipiter cooperii*), broad-winged hawk (*Buteo platypterus*), red-shouldered hawk (*Buteo lineatus*), and the red-tailed hawk (*Buteo jamaicensis*) are

common predators. Various bird species, such as sparrows (*Emberizidae*), eastern bluebird (*Sialia sialis*), American goldfinch (*Carduelis tristis*), blackbirds (*Euphagus* spp.), and the brown-headed cowbird (*Molothrus ater*) also utilize the brush and old field communities in the study area.

3.11.4 Regional Biodiversity

Biodiversity generally decreases as the area of natural habitat is reduced, while biodiversity generally increases with greater landscape diversity and edge habitat (i.e. the transition between forest and fields). The patchwork of pastureland, abandoned fields, riparian corridors, and various forest types within the study area creates a relatively complex structure and habitat diversity which, on a regional basis, contributes to a relatively rich assemblage of plants and animals. Virginia DCR-DNH maintains a database of biodiversity-ranked (BRANK) communities that occur throughout the state. The BRANK is used to determine the significance of these communities. The significance of a community is based on its natural features or elements (e.g. species, community type, etc.) and the ability of DCR-DNH to protect the site. The following biodiversity ranks are used to determine a site's significance:

B1 Outstanding Significance: only site known for an element; excellent occurrence of a G1 species (Globally, Extremely Rare); or the world's best example of a community type.

B2 Very High Significance: excellent example of a rare community type; good occurrence of a G1 species; or excellent occurrence of a G2 or G3 species (Globally, Very Rare or Rare to Uncommon).

B3 High Significance: excellent example of any community type; good occurrence of a G3 species.

B4 Moderate Significance: good example of a community type; excellent or good occurrence of state-rare species.

B5 General Biodiversity Significance: good or marginal occurrence of a community type or state-rare species.

Sites ranked by DNH for their high to outstanding significance with respect to biodiversity consist of:

- the Upper Warwick Swamp Powerline located south of the Town of Disputanta in southeastern Prince George County (BRANK B3);
- the Disputanta Tract located approximately 4 miles northeast of the Town of Disputanta in central Prince George County (BRANK B2);
- the Manry 604-606 Tract located approximately 2.5 miles southwest of the Town of Wakefield in Sussex County (BRANK B3);
- the Manry/Wakefield Tract located just south of US 460 approximately 0.5 mile west of the Town of Wakefield in Sussex County (BRANK B3);
- Dendron Swamp located just west of the Town of Dendron in central Surry County (BRANK B3);
- the Terrapin Swamp Stream Conservation Unit located east-northeast of the Town of Wakefield in Surry and Southampton counties (BRANK B3);
- Hickaneck Swamp located northeast of the Town of Ivor in Southampton and Isle of Wight counties (BRANK B2);
- the Antioch Swamp Stream Conservation Unit located north and south of the Town of Zuni in Southampton County (BRANK B3);
- the Zuni Pine Barrens located south of the Town of Zuni in Southampton County (BRANK B2);
- Foursquare Ponds located west-southwest of the Town of Smithfield in north-central Isle of Wight County (BRANK B3);

- the Kilby Northwest Powerline Habitat Zone located just south of Lake Kilby in the City of Suffolk (BRANK B3); and
- the Lake Meade Seep located just north of Lake Meade in the City of Suffolk (BRANK B2).

See Figure 4.11-2 for locations of potentially affected biodiversity-ranked communities. A complete listing of rare or unique terrestrial habitats having a biodiversity ranking is provided in the Natural Resources Technical Report (VDOT, 2005).

Due to a long history of agricultural and sylvicultural activities, most uplands within the region are so highly fragmented that they afford little contribution with respect to wildlife corridors. Riparian corridors, on the other hand, have been less altered over history and presently serve as components of several prominent wildlife corridors within the study area. Research has shown that riparian corridors perform a valuable role in sustaining wildlife diversity, especially in areas that have a reduced amount of natural habitat. These riparian areas often provide the primary corridors for wildlife migration between isolated areas of natural habitat.

Prominent wildlife corridors generally greater than 0.5 mile in width consist of:

- an east-west riparian corridor along the middle to upper Blackwater River (extending roughly from the Town of Dendron westward into central Prince George County);
- an east-west riparian corridor formed by Otterman Swamp and the headwaters of Cypress Swamp (extending roughly from the Town of Surry westward to the Blackwater River in central Prince George County);
- a north-south riparian corridor formed by the headwaters of Wards Creek, Otterman Swamp tributaries, a portion of Warwick Swamp, Black Swamp, and the headwaters of Assamoosick Swamp (extending roughly from north-central Prince George County southward into northwestern Surry County); and
- a north-south riparian corridor along Cypress Swamp (in central Surry County).

Several other prominent wildlife corridors generally having a width *less* than 0.5 mile are located within the study area. These narrower wildlife corridors consist of:

- a north-south riparian corridor formed by Green Swamp, Mill Swamp, and Rattlesnake Swamp (extending roughly from the Town of Surry southward to the Blackwater River in northern Southampton County); and
- a north-south riparian corridor along the lower Blackwater River (extending roughly from the Town of Dendron southward to the City of Franklin).

In all cases, these prominent wildlife corridors are associated with contiguous or (where interrupted by existing rights-of-way) near-contiguous forest communities. See Figure 4.11-2 for prominent wildlife corridors informally identified as part of this study and their relationship to state-ranked biodiversity resources.

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3.12 AQUATIC ECOLOGY, WILDLIFE HABITAT, AND BIODIVERSITY

This section addresses habitats primarily pertaining to streams, rivers, open waters, and deepwater habitats; however, many of the species discussed in this section are also dependent on wetland habitats. Wetlands are discussed in greater detail in Section 3.13. A wide diversity of aquatic habitat is present within the study area. These habitats provide valuable resources for many aquatic and water-dependent species. Riparian corridors along the Blackwater River and larger tributaries cumulatively contribute to regional biodiversity. The biodiversity of certain stream segments has been adversely affected by nonpoint pollution (increased sedimentation, nutrient loading, and fecal coliform counts) over a long history of agricultural practices – particularly those associated with livestock management. The biodiversity of streams in urbanized areas has been affected by channel modifications and by point and nonpoint pollution. Biodiversity-ranked aquatic communities known as Stream Conservation Units (SCUs) designated by Virginia DNH are discussed in more detail in the Natural Resources Technical Report (VDOT, 2005). See Figure 4.11-3 for locations of potentially affected SCUs.

3.12.1 Fish Species and Associated Habitat

Many streams and ponds within the study area provide habitat for a wide variety of fish. Many of the perennial streams contain great diversity and large quantities of fish species. Members of the sunfish family (*Lepomis* spp.), the darter family (*Percina spp.* and *Etheostoma* spp.), the dace family (*Rhinichthys* spp. and *Clinostomus* spp.), the minnow family (*Pimephales* spp. and *Hybognathus* spp.), and the shiner family (*Notropis* spp., *Notemigonus* spp., *Cyprinella* spp., and *Luxilus* spp.) have been recorded in perennial streams. Game species such as largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and bluegill (*Lepomis macrochirus*) have been documented in many study area streams (VAFWIS, 2004). No Natural Trout Waters or Stockable Trout Waters, as listed in the Virginia Water Quality Standards, are located within the study area (Virginia State Water Control Board, 1997). Because they do not flow year round, intermittent streams typically do not support permanent populations of fish; however, they do provide seasonal breeding grounds for some fish species and temporary refuge for juveniles. Additionally, intermittent streams are important to fish resources primarily as seasonal sources of water and sediment delivered downstream to more suitable fish habitats. Intermittent stream channels contribute nutrients to downstream reaches from primary production and leaf litter. Productivity of perennial streams depends on delivery of materials from intermittent stream channels (Reid and Zeimer, 1994). Farm ponds are generally stocked with gamefish by landowners for private recreation. Commonly stocked fish include largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redbreast sunfish (*Lepomis auritus*), pumpkinseed (*Lepomis gibbosus*), black crappie (*Pomoxis nigromaculatus*), red-ear sunfish (*Lepomis microlophus*), and channel catfish (*Ictalurus punctatus*) (VDGIF, VAFWIS accessed 2004).

3.12.2 Benthic Communities

Benthic macroinvertebrates are common inhabitants of streams and ponds within the study area. These organisms usually inhabit bottom substrates for at least part of their life cycle. Macroinvertebrates observed in water bodies include mayflies (Order *Ephemeroptera*), stoneflies (Order *Plecoptera*), caddisflies (Order *Ephemeroptera*), hellgrammites (Order *Megaloptera*), dragonflies and damselflies (Order *Odonata*), midge larva (Order *Diptera*), and aquatic worms (Class *Oligochaeta*). Crayfish (Family *Cambaridae*) and freshwater mollusks including freshwater clams (Class *Pelecypoda*), aquatic snails (Families *Hydrobiidae*, *Pleuroceridae*, and *Viviparidaea*), and freshwater mussels (Family *Unionidae*) are also commonly found in streambeds (VDGIF, VAFWIS accessed 2004). Because different groups of macroinvertebrates have different tolerances to the chemical and physical characteristics of water bodies, the species compositions within different water bodies may differ depending on the bottom substrate and quality of the water.

3.12.3 Waterfowl and Other Water-Dependent Migratory Birds

A large variety of waterfowl depend on the aquatic habitats within the study area for food and nesting habitat. Riparian areas along both perennial and intermittent channels are particularly rich in insects and fruit, so these areas are important food sources. Many species include a patch of riparian vegetation as a part of their territory, even if they do not depend fully upon them. Additionally, the streams and ponds provide habitats for aquatic plants, aquatic invertebrates, fish, and amphibians, which in turn provide food resources for waterfowl. River segments with open tree canopy, farm ponds, and the wetlands surrounding these areas provide suitable habitat for a variety of waterfowl. Waterfowl species observed in the study area include double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias herodias*), green heron (*Butorides virescens*), little blue heron (*Egretta caerulea caerulea*), great egret (*Ardea alba egretta*), black-crowned night-heron (*Nycticorax nycticorax hoactii*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), American black duck (*Anas rubribes*), gadwall (*Anas strepera*), and wood duck (*Aix sponsa*), (VDGIF, VAFWIS accessed 2004). Although the majority of these species occur primary as winter residents or spring and fall migrants, Canada geese, mallards, and wood ducks nest within the study area.

Waterways, water bodies, and wetlands within the study area provide suitable habitat for a number of migratory bird species that are dependent on aquatic habitat for at least a portion of their life cycle. One hundred sixteen water-dependent migratory bird species listed for protection under the Migratory Bird Treaty Act potentially exist within the study area (VDGIF, VAFWIS accessed 2004) (see Appendix of Natural Resources Technical Report (VDOT, 2005)). Of these 116 species, seven have been listed as "Species of Management Concern" for the northeast region (FWS, 1995). Of the seven water-dependent "Species of Management Concern" within the region, the "reason for concern" for one of these species (least bittern) is reported to be "dependence on vulnerable or restricted habitats". For the remaining six species, the FWS-designated "reason for concern" is not directly linked to habitat loss. While VAFWIS indicates that 116 water-dependent species potentially exist within the study area, only 19 species have been observed within the study area. None of these 19 species are listed as "Species of Management Concern."

3.12.4 Other Wildlife Species Associated With Aquatic Habitat

Aquatic habitats (including open waters and wetlands) provide food sources and denning for water-dependent animals. Aquatic habitats may also be used as travel corridors within and between watersheds. Additionally, open water habitats may provide escape from terrestrial predators. Several water-dependent mammals including beavers (*Castor canadensis*), muskrats (*Ondatra zibethicus*), and river otters (*Lontra canadensis*) have been observed in streams and wetlands of the study area. The northern water snake (*Nerodia sipedon sipedon*) is commonly found in wetlands and several species of aquatic turtles have been recorded. These aquatic turtles include eastern mud turtle (*Kinosternon subrubrum subrubrum*), eastern musk turtle (*Sternotherus odoratus*), eastern painted turtle (*Chrysemys picta picta*), and spotted turtle (*Clemmys guttata)* (VDGIF, VAFWIS accessed 2004). Amphibians are also very common in aquatic habitats of the study area. Most amphibians require open water to breed, and some need open water throughout the year. Intermittent streams may be particularly important for young amphibians because these streams support fewer predators than perennial streams. Several species of frogs have been recorded or observed within the study area. These species include eastern cricket frog (*Acris crepitans crepitans*), Cope's gray tree frog (*Hyla chrysoscelis*), northern spring peeper (*Pseudacris crucifer crucifer*), southern chorus frog (*Pseudioacris feriarum*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans melanota*), and southern leopard frog (*Rana spenocephala*). Common toads are American toad (*Bufo americanus*) and Fowler's toad (*Bufo fowleri*). Salamander and newt species that have been recorded and observed include red-spotted newt (*Notophthalmus viridescens viridescens*), northern red-backed salamander (*Plethodon cinereus*), and spotted salamander (*Ambystoma maculatum*) (VDGIF, VAFWIS accessed 2004).

3.13 WATERS OF THE U.S., INCLUDING WETLANDS

Waters of the U.S. are described generically in EPA's 404(b) guidelines as rivers, streams, ponds, and special aquatic sites (e.g. wetlands, mud flats, vegetated shallows). Within the study area, waters of the U.S. include waterways (rivers and streams, excluding certain ephemeral streams), certain water bodies (reservoirs and ponds), wetlands, and deepwater habitats. The characteristics of streams within the study area, from the perspective of functions and values related to aquatic habitat and surface water resources, are discussed in greater detail in section 3.10 and 3.12. Palustrine wetlands are the dominant wetland type throughout the study area. In addition to palustrine wetlands, the study area includes lacustrine and riverine systems. Intertidal estuarine wetlands occur along the Pagan River and its tributaries in the southeastern-most portion of the study area (i.e., in the vicinity of Smithfield).

3.13.1 Navigable Waters of the U.S. (Section 10 Waters)

Navigable waters of the U.S within the study area (as determined by the Norfolk District COE) consist of the Blackwater River, the Pagan River, the Western Branch Reservoir, Lake Prince, Lake Cohoon, and Lake Meade (Norfolk District COE, 1988).

3.13.2 Deepwater Habitat

Deepwater habitats are permanently flooded lands lying below the deepwater boundary of wetlands. The boundary between wetland and deepwater habitat is generally considered to be at a depth of two meters (6.6 feet) below low water. Deepwater habitat within the study area is comprised of estuarine, lacustrine, riverine, and palustrine unconsolidated bottom habitats. Resource areas containing the largest proportion of deepwater habitat occur along the lower reaches of the Blackwater River and the several reservoirs located in the study area. Lacustrine habitats are comprised of abandoned millponds and other impoundments scattered throughout the study area, along with the public water supply reservoirs located in eastern Isle of Wight County and the City of Suffolk. Several ponds located along some of the larger perennial streams and larger farm ponds located throughout the study area may provide small areas of deepwater palustrine habitat. The only National Wetland Inventory (NWI) mapped riverine habitats within the study area are lower perennial habitats (R2) located along the main stem of the Blackwater River and Blackwater Swamp and where a utility line crosses Second Swamp just east of the Prince George/Sussex county line. A more-detailed discussion of deepwater habitats is found in the Natural Resources Technical Report (VDOT, 2005).

3.13.3 Wetlands

National Wetland Inventory maps published by U.S. Fish and Wildlife Service (FWS) provided an important information source for the wetland analyses conducted for this study. Palustrine wetlands are by far the predominant type of wetland system throughout the study area. Palustrine wetlands include all nontidal wetlands dominated by trees, shrubs, and persistent emergents, and all such wetlands that occur in tidal areas where the salinity is less than 0.5 parts per thousand (ppt). Palustrine wetlands also occur in association with water bodies less than 20 acres in size and less than two meters deep at low water. These palustrine wetlands generally occur along drainages, within floodplains of intermittent and perennial streams, in topographic depressions, and at slope breaks. All three vegetation community categories of palustrine wetlands (i.e., forested, scrub-shrub, and emergent) along with their respective subcategories are widespread through the study area. In turn, each of these categories are represented by the full range of hydrologic regimes (from temporarily flooded to permanently flooded), resulting in over two hundred specific types of palustrine wetlands within the study area. To accommodate a level of discussion reasonable for a NEPA document and to allow graphical representation, palustrine wetlands have been combined into the general categories of forested, scrub/shrub, and emergent for purposes of this study. Also, for purposes of this study, palustrine forested wetlands are further divided into the two dominant water regimes of seasonally saturated and seasonally flooded. Palustrine wetlands also

include areas classified as farmed wetlands. Although palustrine wetlands comprise the bulk of wetlands within the study area, intertidal emergent estuarine wetlands occur along the Pagan River and its tributaries (in the vicinity of Smithfield). In addition, the lacustrine limnetic habitats mapped by NWI within the large reservoirs in the City of Suffolk and eastern Isle of Wight County are fringed by lacustrine littoral wetlands along many reaches of the shoreline. Because these lacustrine littoral wetlands occur as narrow bands (generally less than twenty feet wide), they are of a scale too small to be depicted on NWI maps or figures presented in Chapter 4 this document. Figure 4.13-2 shows locations of potentially affected wetlands. A more-detailed discussion of wetlands is presented the Natural Resources Technical Report (VDOT, 2005).

3.14 FLOODWAYS AND 100-YEAR FLOODPLAINS

Executive Order 11988 (Floodplain Management) and the regulations of the National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA) establish avoidance of development in floodplains as federal policy. The regulatory 100-year floodplain is the area covered by a flood that has a one percent chance of occurring in any given year (often referred to as the "100-year flood event"). Floodplains provide natural means of detaining floodwaters and thus protect downstream properties from damage. Along certain waterways, the floodplain includes a *floodway*, which is the area that experiences the deepest water and the highest velocities.

The study area has experienced major storms since early settlement of the region. Historical accounts of severe storms date back several hundred years. The Blackwater River and the Blackwater Swamp (which forms its headwaters) is the longest and largest stream traversing the study area. Floodplain elevations (for the 100-year storm event) along the Blackwater River range from 32.8 feet (NGVD) where the river flows out of the study area in Isle of Wight County (FEMA, 2002) to approximately 112 feet (NGVD) where Blackwater Swamp flows in to the Route 460 study area in Prince George County (FEMA, 1979).

Shorelines of the eastern portion of the study area are vulnerable to tidal flooding from hurricanes and northeasters. Both storms produce winds that push large volumes of water against the shore. Hurricanes are the most severe storms to which the study area is subjected. While hurricanes may affect the area from May through November, nearly 80 percent occur during the months of August, September, and October (with approximately 40 percent occurring during September). The eastern portion of the study area also contains tributaries of the Nansemond River that are subject to tidal flooding in their lower reaches and fluvial flooding in the upper reaches. Flooding on the upper reaches of these streams and on tributaries of the Blackwater River and other streams in the City of Suffolk may be caused by heavy rains occurring any time of the year. Flooding may also occur as a result of intense rainfall produced by local summer thunderstorms or tropical disturbances such as hurricanes. Flood heights on these streams can rise from normal to extreme flood peaks in a relatively short period of time. During all major floods, high-velocity flood flows and hazardous conditions would exist in the main stream channel. The only FEMA regulated floodway within the eastern portion of the Route 460 study area occurs along the Blackwater River.

Major flooding in the central portion of the study area occurs on the Blackwater River and along other major tributaries of the Nottoway River, such as Stony Creek. There is no significant development along the Blackwater River; however, agricultural damage occurs. Flooding along the Blackwater River can occur during all seasons of the year. The drainage characteristics of the river basin is such that flooding is typically produced by a slow-rising flood wave followed by an even slower recession, thus causing flood stages for several days. Generally, the floodplain is vegetated and, in many areas, swampy. The central portion of the study area also contains portions of the Pagan River estuary, which is subject to tidal flooding in its lower reaches and fluvial flooding in the upper reaches. Flooding on the upper reaches of these streams, on tributaries of the Blackwater River, and other streams in Surry County may be caused by heavy rains occurring at any time during the year. Within the central portion of the study area, a FEMA regulated floodway has been designated along the Blackwater River.

The western portion of the study area has experienced flooding in varying degrees but has been fortunate in not receiving any major property damage (FEMA, 1979). Floods have occurred during all seasons of the year. Tropical storms are responsible for some of the larger floods, when flooding almost always occurs from May to November. Several small businesses and private structures in low-lying areas have flooded. Generally, flooding occurs near small, low-span bridges or inadequate culverts under roadways. Most of the interior streams have relatively wide floodplains that help to store or detain the storm runoff; however, during the warmer months when storms are more probable, the floodplains are overgrown with dense deciduous type vegetation that impedes storm runoff. Bailey Creek (which forms the westernmost boundary of the study area) drains the southern portion of Hopewell. Although no major flooding has been reported, new building of both single and multi-family units is starting to encroach on the stream floodplain. Within the western portion of the study area, FEMA has identified regulated floodways along the following streams: Bailey Creek, Blackwater Swamp, Chappell Creek, Manchester Run, Powell Creek, Walls Run, and Wards Creek.

See Figure 4.14-1 for locations of floodways and 100-year floodplains. A more-detailed discussion of floodplains and associated floodways (including a list of waterways along which they have been mapped by FEMA) is presented the Natural Resources Technical Report (VDOT, 2005).

3.15 THREATENED OR ENDANGERED SPECIES

The FWS and the National Marine Fisheries Service (NMFS) regulate and protect federally listed endangered and threatened species under the Endangered Species Act (ESA) of 1973. The Virginia Endangered Species Act of 1972 (amended in 1977) prohibits the taking, transportation, and sale of state listed threatened and endangered species except as permitted.

As discussed in following sections, three federal-listed threatened or endangered species and six state-listed threatened or endangered species have been reported within counties that lie partially within the study area. Because of the sensitivity of populations and suitable habitat and the resulting desire of state and federal agencies to not disclose specific locations of known occurrences, locations of presently documented populations or populations identified during ensuing phases of investigation have not been or will not be shown as part of this study. Instead, Conservation Sites and Stream Conservation Units defined by DCR-DNH will be used to depict critical areas within which threatened or endangered species have been reported. Although no reports of historic occurrences exist for the study area, FWS recommended that investigations targeted at identifying suitable habitat be conducted for the following four federal-listed threatened or endangered species: Roanoke logperch (*Percina rex*), dwarf wedgemussel (*Alasmidonta heterodon*), Michaux's Sumac (*Rhus michauxii*), and American chaffseed (*Schwalbea americana*). Information regarding these species is provided in the Natural Resources Technical Report (VDOT, 2005).

3.15.1 Federally Protected Species Documented in Study Area

This section describes species that have been documented in cities and counties within which the study area is contained. The investigation of federally listed threatened and endangered species within the study area was based on the listings provided by FWS (FWS; 13 December 2002 letter), DCR-DNH Natural Heritage Database for Route 460 Project (DCR-DNH, November 2003), and the registered subscriber database from the Virginia Fish and Wildlife Information Service maintained by VDGIF (VDGIF, accessed 17 May 2004). Locations of biodiversity ranked (BRANK) sites reported to contain federal listed threatened or endangered species somewhere within their boundaries are shown in Figure 4.15-1. More-detailed discussion of federal listed threatened or endangered species within the study area is provided in the Natural Resources Technical Report (VDOT, 2005).

3.15.1.1 Bald Eagle (Haliaeetus leucocephalus)

The bald eagle (*Haliaeetus leucocephalus*) is presently listed as threatened (proposed for de-listing) by the FWS and the Commonwealth of Virginia. The bald eagle is not common in the Coastal Plain and

Piedmont areas of Virginia; however, they are a fairly common summer and winter visitor in the Chesapeake Bay region and nearby counties. The bald eagle forages along coastal areas, rivers, and large bodies of water. Nesting sites are commonly located in large forested areas adjacent to marshes, on farmland, or in seed tree cut-over areas. Currently, threats to the bald eagle include poaching, loss of nesting trees, pollution of food sources, and waterfront development. According to the county-wide lists of natural heritage resources provided by DCR-DNH, the bald eagle has been documented in portions of the City of Suffolk, portions of the City of Hopewell, and portions of Isle of Wight, Surry, Sussex, and Prince George counties falling within the study area. In addition, the VDGIF database lists the bald eagle as occurring within the study area.

3.15.1.2 Red-Cockaded Woodpecker (Picoides borealis)

The red-cockaded woodpecker (*Picoides borealis*) has been on the Federal Endangered Species List since 1973. The species is native of the southeast U.S. and is non-migratory. The species was classified as endangered because of its perceived rarity, declines in local populations, and a presumed reduction in available nesting habitat. This species is limited to stands where mature pine (greater than 80 years old) occurs or predominates. This species shows a distinct preference for living versus dead and large versus small pines as foraging sites. This species shows a preference for open woods. It selects mature to over-mature, live pines often infected with red heart disease (*Fomes pini*) for cavity excavation. They are found in strictly open pinewoods and prefer longleaf pines. Loblolly pine is the tree most often used in southeastern Virginia. They forage for insects mainly within pines; the nest cavity is always in living trees. The red-cockaded woodpecker is a very rare permanent resident south of Chesapeake Bay and the James and Appomattox rivers. In Virginia, this species is extremely rare, with only five currently active colonies, all in Sussex County. It is estimated that there are less than 50 individuals in Virginia. The protection of existing habitat and the provision of addition habitat suitable for the red-cockaded woodpecker is a prime management goal for protection of the species.

3.15.1.3 Piping Plover (Charadrius melodus)

Piping plover (*Charadrius melodus*) was listed as federal endangered in the Great Lakes Region in 1985 and as federal threatened everywhere else. Piping plover is also listed as state threatened in Virginia. The species is native to Virginia; however, there are no records of piping plovers nesting on mainland beaches south of the Chesapeake Bay. Piping plovers are uncommon transients along the southern mainland coast and lower Chesapeake Bay. They are rare transients inland along the Potomac River and rare winter residents statewide. The species is limited by predators (such as gulls, raccoons, foxs, rats, and domestic cats and dogs); flooding of the nests by rain or tidal overwash; and development and shoreline stabilization efforts. Additionally, the presence of pets and increasing pedestrian and off-road vehicle traffic including beach-raking machines on nesting beaches may reduce plover productivity directly by the inadvertent crushing of eggs and chicks. Piping plovers may exhibit greater response behavior to humans than to potential predators or non-predatory species. These factors can affect breeding success indirectly by preventing birds from incubating eggs, reducing the time chicks spend feeding, or attracting predators to plover nesting habitats. The nests located in grazing areas may be trampled by cattle. Industrial pollution, intensive recreational development, and off-road vehicles are adverse to this species. Continued protection of the barrier islands and monitoring of piping plover breeding populations are essential to the recover of the species in Virginia. Within the study area, sightings of this species (transients) have been reported around the shoreline of Lake Kilby and the Northwest Reservoir in the City of Suffolk only.

3.15.1.4 Other Federally Protected Species Recommended for Possible Survey

This section describes species that have not been documented in cities and counties within which the study area is contained, but which have been mentioned by FWS as possibly being present within the region. Distance to nearest known populations and presence/absence of suitable habitat is described for each species in following sections.

3.15.1.5 Roanoke Logperch (Percina rex)

The Roanoke logperch (*Percina rex*) is a freshwater fish species that is presently listed as endangered by both the FWS and the Commonwealth of Virginia. The Roanoke logperch is endemic to the Roanoke River and Chowan River drainage basins, where it is encountered in relatively small numbers. Populations located to date are separated from one another by long segments of rivers or by large impoundments. The nearest known population is reported in the Nottoway River in Dinwiddie County approximately 30 miles southwest of the Route 460 study area. Due to low stream gradients, a predominance of low energy stream environment, and the lack of self-scouring deeper pools, no suitable habitat for the Roanoke logperch appears to be present within the Route 460 study area.

3.15.1.6 Dwarf Wedgemussel (Alasmidonta heterodon)

In April of 1990, the dwarf wedgemussel (*Alasmidonta heterodon*) was listed as Federally Endangered by the U.S. Fish & Wildlife Service (Federal Register 55: 9451). This species was listed as State Endangered in Virginia in 1987. Dwarf wedgemussel was believed to have been extirpated from the state by 1989, but was rediscovered in Aquia Creek and in the upper Nottoway River in 1990. The nearest known population of dwarf wedgemussel is reported in the Nottoway River in Sussex County approximately 16 miles south of the Route 460 study area. Due to low stream gradients, a predominance of low energy stream environment, and the lack of clean coarser-grained stream bottoms, no suitable habitat for the dwarf wedgemussel appears to be present within the Route 460 study area.

3.15.1.7 Michaux's Sumac (Rhus michauxii)

Michaux's sumac (*Rhus michauxii*) was federally listed as endangered on 28 September 1989. The species is endemic to the inner Coastal Plain and lower Piedmont of Georgia, the Carolinas, and Virginia, where it is currently known from about 26 extant occurrences (NatureServe, 2004). Overall, the species has been in decline. In the 100 years following its discovery in 1895, half of all the historic occurrences were extirpated, largely due to habitat conversion to agriculture and other uses. In Virginia, occurrences of Michaux's sumac have been reported for Brunswick County, Dinwiddie County, and Nottoway County. The only Virginia watershed it has been reported to occur within is the Nottoway River basing (HUC 03010201). The nearest known population of Michaux's sumac is reported on the Fort Pickett Military Reservation approximately 40 miles southwest of the Route 460 study area. The only portion of the study area where controlled burns is reported to occur is the Zuni Pine Barrens and Antioch Swamp Natural Area Preserves. Michaux's sumac does not occur within either of these areas. Other than upland portions of utility line clearings, where the species as not been reported, no other habitat suitable for Michaux's sumac has been observed within the Route 460 study area.

3.15.1.8 American Chaffseed (Schwalbea americana)

American chaffseed (*Schwalbea americana*) was federally listed as endangered on 29 September 1992. The species is endangered since only about 51 occurrences in fewer than fifteen populations survive, and most of these consist of relatively few individuals (NatureServe, 2004). Much of this species' former habitat has long-since been converted to farmland. Housing development, road building, over-collection, and succession of its open habitat to woody vegetation (due to fire suppression) are documented threats. American chaffseed was last observed near the Sussex/Greenville county line (approximately 33 miles south of the Route 460 study area) in 1938, and the species is now thought to be extirpated in Virginia.

3.15.2 State Protected Species Documented in Study Area

3.15.2.1 Eastern Big-Eared Bat (Plecotus rafinesquii)

The eastern big-eared bat (*Plecotus rafinesquii)* was designated State Endangered in Virginia in 1987 and as a Federal Candidate in 1994. The species is native to the U.S. Piedmont and occurs mainly in the southern Appalachians. *Plecotus rafinesquii macrotis* is most often found in houses, or sometimes in

hollow trees, behind loose bark, in culverts, or in caves and mines. The eastern big-eared bat is incidental in Virginia because it has adapted to temperate, arboreal zones found only in the extreme southeast. *Plecotus rafinesquii* is rare in Virginia and is particularly susceptible to human disturbance. Within the study area, the eastern big-eared bat is documented to occur in or near the Hickaneck Swamp conservation site northeast of Ivor in Isle of Wight County and in or near the Dendron Swamp conservation site just west of the community of Dendron (DCR-DNH, 2003).

3.15.2.2 Loggerhead Shrike (Lanius ludovicianus)

The loggerhead shrike (*Lanius ludovicianus*) is also known as the butcher bird. This species prefers areas of grassland that are grazed or mowed occasionally to keep the grass short. An abundance of perching sites, such as fences, woody vegetation or hedgerows is also important. This species usually nests in eastern red cedar or hawthorn. This species is native to the U.S. and is a year-round resident in most of its habitat. The loggerhead shrike is a widespread but rare bird in Virginia. The exact causes of the significant decline in population for this species are unclear, but the decline may be due to several factors such as: habitat loss - clearing hedgerows and reforestation; excessive winter mortality - predation by raptors in woodlots during severe cold or snow cover; pesticide contamination; and/or collisions with motor vehicles. Transient individuals have been observed and suitable habitat has been reported within the study area.

3.15.2.3 Barking Tree Frog (Hyla gratiosa)

The barking treefrog (*Hyla gratiosa*) was designated State Threatened on 1 January 1992. This species is known to be common in most other occupied states, but is very rare in Virginia. This species is threatened because of limited distribution and attractiveness in the pet trade. Tadpoles have been observed in the following habitats: temporary pools in powerline right-of-ways, forested wetland depressions, natural Carolina bays, and sinkhole or cypress ponds. Reproduction sites used in Virginia include pocosin wetlands, flooded weedy sites in agricultural areas, weedy flooded ponds under powerlines, and in coastal plain ephemeral ponds. This species occurs on the Coastal Plain and adjacent Piedmont from Mathews County south; however, it is known only from specimens from Mathews, Surry, Isle of Wight, and Chesterfield counties. Its exact range in Virginia has not been determined. Within the study area, the barking tree frog is documented to occur in the Hickaneck Swamp conservation site northeast of Ivor in Isle of Wight County and in the Beachland Habitat Zone conservation site located south-southeast of Surry in Surry County (DCR-DNH, 2003).

3.15.2.4 Mabee's Salamander (Ambystoma mabeei)

Mabee's salamander (*Ambystoma mabeei*) was listed as a State threatened species in 1987. Known populations are low in number and are highly threatened (primarily by urbanization). Mabee's salamander is found in savannas in burrows at the edges of bogs or ponds. They also occur in low wet woods and swamps. They are found in areas adjacent to water such as ditches and pools and have been found under pieces of paper or small logs in sandy areas adjacent to water. . Mabee's salamander is restricted to the lower Coastal Plain of the Carolinas and Virginia. The species is known from six localities in Virginia: one each in the cities of Hampton and Suffolk and the counties of York, Southampton, Gloucester, and Isle of Wight. They were also found in Newport News. Breeding sites in Virginia are fish-free vernal ponds. In Southampton County, the breeding pond is within a large clearcut. In Gloucester, York, and Isle of Wight counties the breeding sites are ephemeral Coastal Plain sinkhole ponds up to 1.5 meters deep with surrounding forests generally composed of hardwoods mixed with pine. Within the study area, Mabees' salamander is documented to occur in the Cat Ponds conservation site just west of Route 10 in northeastern Isle of Wight County and in the Hickaneck Swamp conservation site northeast of Ivor in Isle of Wight County (DCR-DNH, 2003).

3.15.2.5 Eastern Tiger Salamander (Ambystoma tigrinum)

Although this species may be more abundant than it appears, the Department of Game and Inland Fisheries recognized the eastern tiger salamander (*Ambystoma tigrinum*) as State Endangered in 1987. Its distribution is very restricted in Virginia. Because this species is known from only two breeding sites, it is recommended that the legal status of this species remain endangered. The eastern tiger salamander is native to Virginia and is known mainly from the Coastal Plain and lower Piedmont physiographic provinces. Industrial pollution and intensive agriculture have an adverse affect on this species. Within the Route 460 study area, the eastern tiger salamander is documented to occur in the Cat Ponds conservation site just west of Route 10 in northeastern Isle of Wight County (DCR-DNH, 2003).

3.15.2.6 Blackbanded Sunfish (Enneacanthus chaetodon)

The blackbanded sunfish (*Enneacanthus chaetodon*) was designated State Endangered in 1987. They are found in swampy, acid water of ponds and streams of the Atlantic Coastal Plain. This species is native and quite localized in Virginia. In Virginia, this species is known only from, and extremely localized in, the Blackwater and Nottoway systems of the Chowan drainage. This species was found in the Chowan River Drainage in Blackwater Swamp, a Blackwater River tributary, Prince George County, and Game Refuge Lake, and the Nottoway River watershed, Sussex County. They were recently reported in Dicks Branch, directly below Game Refuge Lake, Sussex County. Within the study area, blackbanded sunfish is documented to occur in the Blackwater Swamp near Prince George Courthouse, in Coppahaunk Swamp just southeast of Waverly, and in Cypress Swamp just north of Dendron (DCR-DNH, 2003.

3.16 WILD AND SCENIC RIVERS

3.16.1 Federal Wild and Scenic Rivers

According to the Virginia Outdoors Plan published by Virginia DCR in 2002, no Federal wild and scenic rivers are located in or immediately downstream of the Route 460 study area.

3.16.2 State Scenic Rivers

According to the Virginia Outdoors Plan published by Virginia DCR in 2002, no designated state scenic rivers are located in or immediately downstream of the Route 460 study area. The Blackwater River has, however, been determined to be a potential component of the Virginia Scenic Rivers program (VDCR, 2002).

3.17 COASTAL ZONE MANAGEMENT RESOURCES

The Coastal Zone Management Act of 1972 enabled the Commonwealth of Virginia to develop the Virginia Coastal Resources Management Program (CRMP) in 1986. The focus of the CRMP is to create more vital and sustainable coastal communities and ecosystems by using a network of state laws and policies. Because they are located east of the fall line, all localities located within the study area are covered under Virginia's CRMP. Coastal zone resources of the study area addressed under Virginia's CRMP include tidal and nontidal wetlands, underwater lands, and fisheries. Each of these coastal zone resources is addressed as wetlands, aquatic habitat/benthic communities, or fish habitat in corresponding sections of this document.

3.18 MINERAL RESOURCES AND UNIQUE GEOLOGIC FEATURES

The study area is located within the Coastal Plain Physiographic Province in a region of low to modest relief and gentle to moderately gentle slopes. The study area is underlain almost exclusively by sedimentary deposits of Tertiary (Neogene) and Quaternary age – the only exception being the westernmost portion, which is locally underlain by relatively small areas of Cretaceous-age sedimentary deposits. The geology consists largely of level, interbedded, and unconsolidated clays, silts, sands, and gravels that were laid down in fluvial/deltaic environments during periods of lower sea level and fluvial/estuarine/shallow marine environments during intervening rises in sea level. The only economic mineral resource occurring within the study area is sand and gravel which is used largely for aggregate. Active surface mining operations and other sites of economic mineral resources are shown on Figure 4.17-1. Sand and gravel operations are in a constant state of flux regarding closure of active operations and opening new operations, thus any locations shown may change over time.

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4.0 ENVIRONMENTAL CONSEQUENCES

This chapter addresses potential environmental consequences of the No-Build, TSM, and Candidate Build Alternatives (CBAs) and proposes measures to mitigate these impacts. For the CBAs, impact areas were determined based on two widths:

- a 500-foot wide Planning Corridor; and
- a smaller Design Corridor, estimated from the typical roadway section and proposed Right-of-Way limits.

The Design Corridor is 230 feet wide for CBAs 1, 3, and the sections of CBA 2 on new location. For sections of CBA 2 along the existing Route 460 alignment, the proposed Design Corridor is 140 feet wide. Both corridor widths increase at proposed interchanges (CBAs 1, 2 and 3) and at-grade intersections (CBA 2) to provide necessary access to cross streets and highways.

Impact analyses relied on methods and assumptions detailed in the associated technical reports referenced throughout this chapter. For resources that involve direct, quantitative measurements, impact estimates are provided for both the Planning Corridor and Design Corridor. The greater width of the Planning Corridor provides flexibility to further reduce or avoid impacts during final design. All study approvals, such as the location decision or the Record of Decision, would be based on this wider corridor. The impacts identified for the Design Corridor provide the best available estimate of what actual project impacts for each CBA at the current stage of project development. Resource impacts that are stated qualitatively do not include this breakdown and are presented for the CBAs only.

Section 2.6 discusses the toll feasibility study conducted in conjunction with the Location Study. If a tolled facility is ultimately built, there would be physical impacts associated with the toll plaza infrastructure (e.g. land necessary for toll collection plaza, administrative offices, and maintenance facilities). This chapter does not include impacts associated with these facilities; however, the width of the Planning Corridor should accommodate any such impact. Economic consequences of a tolled facility would be minimal since drivers could always opt to existing Route 460, which would not be tolled.

4.1 LAND USE

The following section identifies the land use consequences for the proposed alternatives. The land use discussion includes impacts to existing land uses. Discussion of proposed future land uses is located in the *Land Use, Parklands, Farmlands Technical Report* and in sections 4.18 (Indirect Effects) and 4.19 (Cumulative Impacts). Each alternative is also evaluated for its compatibility with the adopted comprehensive plan guiding land use in each jurisdiction.

4.1.1 Existing Land Use

The existing land use classifications were derived from the land use coverages provided by the USGS (Anderson, 1984). To accommodate recent changes in land use these classifications were adjusted using GIS software and 2002 aerial photos prepared by the VGIN. Table 4.1-1 indicates the acres of existing land use that would be converted to transportation use by each CBA. Figure 4.1-1depicts the locations of the existing land uses.

4.1.1.1 No Build and TSM Alternatives

No change in the existing land use would result from the No-Build or TSM Alternatives.

4.1.1.2 Build Alternatives

The total area of impacted land is similar for each alternative corridor due to the comparable lengths and identical widths of each CBA corridor. CBA 2 has a smaller total area of Design Corridor impacts (by over

270 acres) due to the narrower typical section of the proposed improvements located on the existing Route 460 alignment.

Table 4.1-1
IMPACTED LAND USE BY CANDIDATE BUILD ALTERNATIVE

Alternative	CBA 1		CBA 2		CBA 3	
Area of Impact Acres / Land Use	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor
Residential	195	113	340	129	155	74
Commercial	20	7	120	32	3	0
Industrial	0	0	36	9	0	0
Agricultural*	965	517	1,237	557	1,229	707
Forest and Wetland†	2,215	1,153	1,420	617	1,987	1,023
Other‡	62	31	294	205	66	37
Total	3,456	1,822	3,447	1,549	3,440	1,842

Source: USGS, Parsons Brinckerhoff

*includes Cropland and Pasture, Confined Feeding Operations, and Other Agricultural Land
† includes Forested Wetland and Non-forested Wetland, Evergreen Forest, Deciduous Forest, Mixed Forest Land.
‡ includes all water bodies, strip mines, transitional areas, utilities, other urban/built-up land, strip mines, and unclassified lands as defined by A Land Use and Land Cover Classification System for Use with Remote Sensing Data, James R. Anderson, et al.

4.1.2 Consistency with Comprehensive Plans

Consistency was assessed through review of published comprehensive plans. Meetings were also held with elected officials and/or planning staff representatives from each local jurisdiction. The meetings provided local government input regarding each CBA. See the *Land Use Technical Report* for a listing of goals and policies for each jurisdiction.

4.1.2.1 No-Build Alternative

The comprehensive plans for all the jurisdictions indicate the need for improvements to Route 460. The improvements cited are generally more than the enhancements to existing Route 460 that would occur with the No-Build Alternative. To address safety and/or hurricane evacuation concerns, comprehensive plans identify necessary improvements to the current Route 460 (turning lanes, medians, grading to prevent flooding, etc.).

4.1.2.2 TSM Alternative

Although the TSM Alternative includes additional improvements to existing Route 460 than those proposed under the No Build, the TSM Alternative does not provide enhancements to Route 460 similar to those cited within comprehensive plans.

4.1.2.3 Build Alternatives

Although none of the comprehensive plans were developed prior to development of the CBAs, general compatibility was assessed based upon policies stated in the plan regarding transportation, proposed land use changes, and economic development objectives. CBAs 1 and 2 would be generally compatible with five of the eight jurisdictions in the study area that have published comprehensive plans. CBA 3 would be generally compatible with four of the eight jurisdictions' plans. (See Land Use ,Parklands and Farmlands Technical Report for details).

Figure 4.1-1
EXISTING LAND USE

4.2 FARMLANDS

The following sections describe each alternative's impact to farmlands. Impacts were determined for prime farmland soils, impacts to farmland uses and production, economic consequences of farmland conversion, and impacts to agricultural and forestal districts. The No Build and TSM alternatives do not require additional land, and therefore would not impact existing farmlands. Impacts attributed to each CBA are described below. More information is available in the *Land Use, Parklands, Farmlands Technical Report* (VDOT, 2005).

4.2.1 Prime Farmland Consequences

The Farmland Protection Policy Act (FPPA) requires that federal actions identify and consider adverse affects on protected farmland. According to the FPPA, protected farmland includes prime farmland soils, unique soils, or statewide or locally important soils. For corridor farmland conversions typical in transportation projects, the NRCS makes no distinction between prime farmland soils and unique, statewide, or locally important soils.

VDOT coordinated with the NRCS to assess the impacts of the project to farmlands in the study area. NRCS-CPA-106 forms were completed to determine the Farmlands Conversion Impact Rating for the project. The Farmland Conversion Impact Rating is based on an assessment of the quality of the prime farmlands soils in the area of the project and an assessment of the suitability of the land in the corridor for protection of farmland. The FPPA states that "increasingly higher levels of consideration for protection" be given to farmlands impacted by projects that have a Farmland Conversion Impact Rating exceeding a total score of 160. Each alternative scored below 160 and, therefore, no further action is recommended to mitigate farmland conversion. The NRCS-CPA-106 forms are provided in the *Land Use, Parklands, and Farmlands Technical Report* (VDOT, 2005).

Construction of any of the CBAs would convert soils mapped as prime farmlands soils by the NRCS to roadway surface and right-of-way. Locations of prime farmland soils are depicted in Figure 4.2-1. Areas of prime farmland soils converted are presented in Table 4.2-1.

Table 4.2-1
ACRES OF PRIME FARMLAND SOILS CONVERTED

Jurisdiction	Converted Area (acres)					
	CBA 1		CBA 2		CBA 3	
	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor
Isle of Wight County	264	138	240	125	301	189
Prince George County	423	248	266	114	172	98
Southampton County	465	245	364	199	390	219
Surry County	0	0	34	17	197	90
Sussex County	725	411	705	300	533	303
City of Suffolk	231	104	170	78	170	78
TOTAL	2,108	1,146	1,779	833	1,762	978

Figure 4.2-1
PRIME FARMLAND SOILS

4.2.2 Impacts to Farmland Uses and Production

In addition to the conversion of prime farmland soils described above, each CBA would result in displacements of existing farms (see Table 4.2-2). Farm displacements would occur when the major buildings of the farm parcel would be displaced by the CBA. See the *Right of Way Cost Technical Report* for further information regarding farm displacements.

Table 4.2-2
DISPLACED FARMS

Jurisdiction	Number of Displaced Farms					
	CBA 1		CBA 2		CBA 3	
	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor
Isle of Wight County	3	0	1	1	3	3
Prince George County	0	0	2	2	0	0
Southampton County	3	0	0	0	1	1
Surry County	0	0	0	0	1	0
Sussex County	0	0	1	0	1	0
City of Suffolk	0	0	3	2	3	2
TOTAL	6	0	7	5	9	6

The loss of farmland production due to the conversion of farmland would result in a loss of economic revenue. Table 4.2-3 depicts the loss of economic revenue for each CBA. CBA 3 would result in the greatest loss of revenue due to farmland conversion with over $837,000 lost farmland revenue in the Planning Corridor ($533,000 in the Design Corridor). At the Planning Corridor level, CBA 1 would have the smallest impact with almost $590,000 in lost farmland revenue. At the Design Corridor level, CBA 2 would have the smallest impact with approximately $300,000 in lost farmland revenue.

Table 4.2-3
LOSS OF FARMLAND PRODUCTION

Jurisdiction	Loss of productivity					
	CBA 1		CBA 2		CBA 3	
	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor
Isle of Wight County	$134,051	$173,833	$282,300	$77,312	$247,720	$148,734
Prince George County	$14,180	$13,633	$35,045	$11,777	$10,647	$11,777
Southampton County	$117,277	$32,356	$24,731	$9,614	$138,300	$126,315
Surry County	$0	$0	$0	$0	$22,967	$10,479
Sussex County	$156,106	$29,847	$115,421	$49,206	$193,493	$83,987
City of Suffolk	$167,693	$76,183	$224,345	$152,244	$224,345	$152,244
TOTAL	$589,308	$325,851	$681,841	$300,153	$837,471	$533,535

4.2.3 Agricultural and Forestal District Consequences

Table 4.2-4 depicts the impacted acres of Agricultural and Forestal Districts. Three Agricultural and Forestal Districts are located within the study area in Isle of Wight County. No conversion of Agricultural and Forestal Districts is anticipated in the No Build and TSM Alternatives. CBA 1 would impact approximately 23 acres of the Knoxville District in the Planning Corridor (10 acres in the Design Corridor).

CBA 3 (Planning Corridor) would impact five acres of the Courthouse District (three acres in the Design Corridor). CBA 2 would not impact the Agricultural and Forestal Districts in Isle of Wight County. There are no impacts to the Longview Agricultural and Forestal District.

Table 4.2-4
AFFECTED AGRICULTURAL AND FORESTAL DISTRICTS

Agricultural and Forestal District Name	Impacted Area (acres) of Agricultural / Forestal Districts					
	CBA 1		CBA 2		CBA 3	
	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor
Courthouse	0	0	0	0	5	3
Longview	0	0	0	0	0	0
Knoxville	23	10	0	0	0	0
Isle of Wight County/Total	23	10	0	0	5	3

Figure 4.2-2 shows the locations of CBAs relative to A&F Districts. CBA 1 would impact a portion of the easternmost section of the Knoxville District. CBA 3 would impact a small portion of the Courthouse District.

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Figure 4.2-2
AFFECTED AGRICULTURAL AND FORESTAL DISTRICTS

4.3 PARKLANDS, RECREATION AREAS, AND OPEN SPACE EASEMENTS

The No Build and TSM Alternative would not impact any parklands or open space easements. Similarly, none of the CBAs would directly impact property used for parklands or open space easements. See the *Land Use, Farmlands, and Parklands Technical Report* (VDOT, 2005) for more information related to these resources.

4.4 VISUAL QUALITY

4.4.1 Methodology

The visual impact assessment was based on FHWA's *Visual Impact Assessment for Highway Projects*, 1999. The major components of this assessment include:

- Establishing the visual environment of the project.
- Assessing the visual resources of the project area.
- Identifying viewer response to those resources.

Once defined, these components establish the baseline conditions from which the degree of visual impacts can be assessed as well as the associated viewer response of the proposed project. This approach is similar to the visual resource management (VRM) system employed by several major federal agencies. In order to understand and predict the visual effects of the proposed project, it is important to determine those viewers that are likely to see it. Therefore, impacts will be assessed for two main viewers: those with a view from the proposed project and those with a view of the proposed project. A field review for the visual quality analysis was conducted on January 26, 2005. Visual impacts were quantified based upon the following categories to determine the project's relative involvement with visual resources located through out the study area:

- **No Impact –** Viewers will experience no visual involvement between the resource and the proposed project or that the view of the road would be so far in the background that it would go almost unnoticed.
- **Impact, Not Adverse -** there were dominating visual intrusions in the viewshed from other sources, such as topography, vegetation, structures, or distance; the sensitive resource's affected viewshed was limited in importance; the level and nature of viewer activity would not be adversely affected; or, there was a weak visual contrast between the proposed facility and the existing landscape.
- **Adverse Impact -** the visibility and proximity of the project would be inconsistent with the existing visual qualities that contribute to the site's importance; the proposed project would be inconsistent with the visual expectations of the public; the visibility and proximity of the project would be in strong contrast with the existing landscape; or the project would be in an area of substantial visual importance with limited other visual intrusions

4.4.2 Visual Resources

Visual resources were selected based on their visual proximity to the proposed CBAs as well as their associated viewer activity and frequency. To determine the visual context of each resource, the quality of the viewshed was evaluated based on that portion of the landscape that is visible or potentially visible from the proposed project or from which the proposed project may be seen. The visual context of each resource was evaluated based on four criteria:

- **Unique -** The resource exhibits qualities that are either naturally or culturally significant and are considered important to federal, state, and/or local jurisdictions.

- **Distinctive –** The resource clearly exhibits the natural or cultural characteristics of the region.
- **Common –** The resource is commonplace and/or representative of similar resources within the region.
- **Intrusive –** The resource exhibits low visual diversity and is not considered visually pleasing due to trash or man-made alternations to the surrounding landscape.

Application of these criteria considered characteristics such as vividness, intactness, and unity of the visual environment. Vividness is the visual strength or memorability of the landscape components as they combine in striking and distinctive visual patterns. Intactness is the visual integrity of the natural and man-made environment, especially as it relates to intrusive encroachment. Unity is the visual coherence and compositional harmony of the landscape.

The visual resources identified were grouped into several different resource types.

- **Agricultural** –Representative of the agrarian character of the region.
- **Community** –Representative of the social, economic, and cultural characteristics of the study area.
- **Cultural** –Associated with significant events, people, or architecture from our past. Additional cultural resources are also located within the various towns located along Route 460. Most of these communities have the potential for historic district designation.
- **Natural** –Important for their scenic and recreational value.
- **Recreational** –Important for their scenic, recreational and cultural value.

Table 4.4-1 list the visual resources evaluated for this analysis. The locations of these visual resources are shown in Figure 4.4-1.

Table 4.4-1
SELECTED VISUAL RESOURCES

Site No.	Visual Resource	Resource Type	Resource Importance	Visual Context
1	Lake Prince	Recreational	Recreation, Scenic, and Wildlife Habitat	Distinctive
2	Lake Cohoon	Recreational	Recreation, Scenic, and Wildlife Habitat	Distinctive
3	Nansemond Suffolk Academy	Community	Social and Cultural	Common
4	Farmland East of Windsor	Agricultural	Economic, Culture, Scenic, and Wildlife Habitat	Distinctive
5	Roberts House	Cultural	NRHP Listed	Distinctive
6	Windsor Athletic Association	Recreational	Social and Recreational	Distinctive
7	Town of Windsor	Community	Social, Economic, and Cultural	Common
8	Antioch Pines Natural Area Preserve	Natural	Scenic and Wildlife Habitat	Unique
9	Hobbs Property	Cultural	Eligible for NRHP	Distinctive
10	Zuni	Community	Social, Economic, and Cultural	Common
11	Blackwater River Scenic River (proposed)	Natural	Scenic, Recreation, and Wildlife Habitat	Distinctive

Site No.	Visual Resource	Resource Type	Resource Importance	Visual Context
12	Town of Ivor	Community	Social, Economic, and Cultural	Common
13	Pretlow Housel	Cultural	Eligible for NRHP	Distinctive
14	Leclare Brittle	Cultural	Eligible for NRHP	Distinctive
15	Goodrich House	Cultural	Eligible for NRHP	Distinctive
16	Town of Wakefield	Community	Social, Economic, and Cultural	Common
17	Wakefield Sportsmens Club	Cultural	Eligible for NRHP	Distinctive
18	Parker House	Cultural	Eligible for NRHP	Distinctive
19	Woodland Property	Cultural	Eligible for NRHP	Distinctive
20	Route 40 Scenic Byway	Recreational	Recreation and Culture	Distinctive
21	Town of Waverly	Community	Social, Economic, and Cultural	Common
22	Disputanta	Community	Social, Economic, and Cultural	Common
23	Prince George County Golf Course / Chester Plantation	Recreational / Cultural	Recreational / Eligible for NRHP	Common / Distinctive
24	New Bohemia	Community	Social, Economic, and Cultural	Common
25	Farmland near New Bohemia	Agricultural	Economic, Culture, Scenic, and Wildlife Habitat	Distinctive
26	Scared Heart Church	Cultural	Eligible for NRHP	Distinctive

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Figure 4.4-1
SELECTED VISUAL RESOURCES

4.4.3 Impacts

Table 4.4-2 summarizes the potential visual quality impacts associated with views of the road for each resource identified. The same visual resources were also evaluated based on the view from of each CBA. However, the analysis found no impacts associated with views from the CBAs. In addition, no impacts would be associated with the No-Build or TSM alternatives.

Table 4.4-2
VISUAL QUALITY IMPACTS AS SEEN FROM THE POINT OF ASSESSMENT

Site No.	Visual Resource	Alternative Candidate Build Alternatives		
		One	Two	Three
1	Lake Prince	N/A	No Impact	No Impact
2	Lake Cohoon	No Impact	N/A	N/A
3	Nansemond Suffolk Academy	Impact, Not Adverse	N/A	N/A
4	Farmland East of Windsor	Adverse Impact	Adverse Impact	Adverse Impact
5	Roberts House	N/A	Impact, Not Adverse	Impact, Not Adverse
6	Windsor Athletic Association	N/A	N/A	Impact, Not Adverse
7	Town of Windsor	Impact, Not Adverse	Impact, Not Adverse	Impact, Not Adverse
8	Antioch Pines Natural Area Preserve	No Impact	N/A	N/A
9	Hobbs Property	N/A	Impact, Not Adverse	N/A
10	Zuni	No Impact	Impact, Not Adverse	No Impact
11	Blackwater River Scenic River (proposed)	Adverse Impact	Adverse Impact	Adverse Impact
12	Town of Ivor	No Impact	Impact, Not Adverse	No Impact
13	Pretlow Housel	N/A	N/A	Impact, Not Adverse
14	Leclare Brittle	N/A	Impact, Not Adverse	N/A
15	Goodrich House	N/A	N/A	Impact, Not Adverse
16	Town of Wakefield	No Impact	No Impact	No Impact
17	Wakefield Sportsmens Club	Impact, Not Adverse	N/A	N/A
18	Parker House	Adverse Impact	N/A	N/A
19	Woodland Property	N/A	Impact, Not Adverse	Impact, Not Adverse
20	Route 40 Scenic Byway	Impact, Not Adverse	Impact, Not Adverse	Impact, Not Adverse
21	Town of Waverly	Impact, Not Adverse	Impact, Not Adverse	Impact, Not Adverse
22	Disputanta	No Impact	Impact, Not Adverse	No Impact
23	Prince George County Golf Course / Chester Plantation	N/A	Impact, Not Adverse	N/A

Site No.	Visual Resource	Alternative Candidate Build Alternatives		
		One	Two	Three
24	New Bohemia	Impact, Not Adverse	Impact, Not Adverse	Impact, Not Adverse
25	Farmland near New Bohemia	Adverse Impact	Adverse Impact	Adverse Impact
26	Scared Heart Church	Impact, Not Adverse	Impact, Not Adverse	Impact, Not Adverse

4.4.3.1 Mitigation

If a build alignment is selected efforts will be made to minimize impacts to these visual resources that may result from the construction of this project. These mitigation measures may include landscaping (i.e. plantings and/or berms) to screen the resource from the proposed roadway or lowering the elevation (depressing) of the roadway so that it will not be viewed from the resource. At the Blackwater River bridge, tree removal around the bridge approaches would be minimized to the extent possible. In addition, VDOT may consider a context sensitive design to minimize visual impacts from the river and help return the landscape to a more natural-looking setting. All mitigation efforts will be coordinated with the appropriate local, state, or federal agency as necessary.

4.5 SOCIOECONOMIC IMPACTS

This section addresses direct social and economic impacts including displacements, community impacts, impacts to environmental justice populations, and economic impacts. Indirect and cumulative social and economic impacts are summarized briefly in *Route 460 Socioeconomic Technical Report* and addressed in detail in the *Route 460 Indirect Effects and Cumulative Impacts Technical Report* and the Indirect Effects and Cumulative Impacts section of this document (Sections 4.18 and 4.19).

4.5.1 Displacements

4.5.1.1 No-Build and TSM Alternatives

The No-Build Alternative and TSM Alternative would not displace any residents, businesses, farms, or non-profit organizations.

4.5.1.2 Build Alternatives

For each CBA, Table 4.5-1 presents the number of households, businesses, farms, and non-profit organizations that would be displaced under each CBA. The width of the Design Corridor allows for the minimization of displacement impacts to residents, businesses, farms, and non-profit organizations when compared to the Planning Corridor. CBA 2 would displace the greatest number of households (187 Planning Corridor / 58 Design Corridor). CBA 3 would displace the fewest households, with only 51 in the Planning Corridor and 32 within the Design Corridor.

CBA 3 would not displace any businesses, while CBA 2 would displace the greatest number of businesses (32 Planning Corridor / 16 Design Corridor). CBA 1 would have the least displacement impact to farms (6 Planning Corridor / 0 Design Corridor), while CBA 3 would displace the greatest number of farms (9 Planning Corridor / 6 Design Corridor). CBA 2 would displace seven non-profit organizations in the Planning Corridor and four in the Design Corridor, while CBA 1 and 3 would each displace a single non-profit organization.

Most of the residential displacements for CBA 1 would occur in Isle of Wight, Prince George, and Sussex Counties. CBA 2 in the Planning Corridor would result in a higher percentage of displacements in Isle of Wight, Prince George, and Southampton Counties, while in the Design Corridor these displacements would be more focused in Isle of Wight County. CBA 3 in the Planning Corridor and Design Corridor

would result in a higher percentage of displacements in Isle of Wight and Prince George Counties. See the Socioeconomic Technical Report for more information.

Table 4.5-1
DISPLACEMENTS BY CBA

Alternative	Number of Households Displaced		Number of Businesses Displaced		Number of Farms Displaced		Number of Non-Profit Organizations Displaced	
	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor
CBA 1	89	53	5	1	6	0	1	1
CBA 2	187	58	32	16	7	5	7	4
CBA 3	51	32	0	0	9	6	1	1

Source: Michael Baker, Jr. February 2005

Table 4.5-2
HOUSEHOLD OCCUPANCY STATUS OF RESIDENTIAL DISPLACEMENTS

Build Alternative		Household Displacements				
		Total #	Owner Occupied		Renter Occupied	
			#	%	#	%
CBA 1	Planning Corridor	89	75	84%	14	16%
	Design Corridor	53	45	85%	8	15%
CBA 2	Planning Corridor	187	147	79%	40	21%
	Design Corridor	58	47	81%	11	19%
CBA 3	Planning Corridor	51	43	84%	8	16%
	Design Corridor	32	26	81%	6	19%

Source: 2000 Census, Michael Baker Jr.

Table 4.5-3
CHARACTERISTICS OF DISPLACED RESIDENTS

Build Alternative		Characteristics of Displaced Residents						
		Total #	Elderly		Minority		Low-Income	
			#	%	#	%	#	%
CBA 1	Planning Corridor	220	28	13%	76	35%	20	9%
	Design Corridor	130	18	14%	50	38%	13	10%
CBA 2	Planning Corridor	464	83	18%	244	53%	47	10%
	Design Corridor	136	31	23%	65	48%	13	10%
CBA 3	Planning Corridor	132	17	13%	36	27%	13	10%
	Design Corridor	85	11	13%	25	29%	9	11%

Source: 2000 Census, Michael Baker Jr.

The characteristics identified in the previous tables were used to identify relocation needs. Displaced property owners would be provided relocation assistance advisory services together with the assurance

of the availability of decent, safe, and sanitary housing. Implementation of the acquisition and relocation program developed by VDOT would be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended, 1987). Relocation resources would be made available to all displacees without discrimination. A detailed description of relocation options is provided in the *Right of Way and Cost Technical Report*. A summary of the available replacement housing and specific relocation concerns can be found in the *Socioeconomic Technical Report.*

Field review and discussions with local representatives suggest that adequate relocation options are available in each community for displaced businesses and non-profits. Based on the size of agricultural operations in the study area, most displaced farms will be able to relocate their farm structure on their existing property.

4.5.2 Social Consequences

4.5.2.1 No-Build and TSM Alternative Impacts

The No-Build and TSM Alternatives would not result in any displacements or visual impacts. Approximately 20 residences would experience noise impacts under the No-Build Alternative along Route 406, due to the increasing traffic volumes.

Currently, Route 460 bisects the communities of Disputanta, Waverly, Wakefield, Ivor, Zuni, and Kings Fork. Current traffic levels and lack of consistent shoulder limit bicycle and pedestrian mobility along Route 460 in each community. Also, due to increasing traffic volumes along Route 460, approximately 20 residences would experience noise impacts under the No-Build Alternative. This would be due to increasing traffic volumes along Route 460.

By the year 2026, average daily traffic volumes for the No-Build and TSM Alternatives are projected to increase between 34 and 70 percent over existing volumes. The national average for truck traffic on rural arterial highways is 10 percent (FHWA, 1996). In contrast, the percentage of truck traffic on Route 460 ranges from 18 to 30 percent under existing conditions and will increase to a range of 30 to 37 percent in 2026 with the No Build and TSM Alternatives. Due to the high percent of truck traffic, high travel speeds, and a lack of protected turning movements, residents have noted throughout the public involvement process their concerns with regard to safety when crossing or turning on Route 460. Local services such as emergency service response, mail delivery, and school bus routes are sensitive to these increases in traffic and truck volumes. The deterioration in local accessibility resulting from traffic conditions would further exacerbate the physical bisection of existing Route 460 on each of the communities. Compared to the No-Build Alternative, the TSM Alternative will provide modest safety improvements for travelers along Route 460. Details on roadway improvements associated with the TSM Alternative are discussed in Chapter 2, and in the *Alternatives Development Technical Report.*

4.5.2.2 Build Alternative Impacts

A summary of social impacts to the communities along Route 460 and neighborhoods within the study area is presented in Table 4.5-4 through Table 4.5-6. The *Socioeconomic Technical Report* discusses these impacts in detail. As noted in these tables, each CBA would result in displacements. Residents, businesses, and non-profit organizations may choose to relocate within their current community or may leave the community entirely. The degree to which residents, businesses, and non-profit organizations choose to relocate within the same community will influence the level of community disruption. To provide information on how certain areas would be affected, noise and visual impacts are included.

Table 4.5-4
SOCIAL CONSEQUENCES OF CBA 1

Community or Neighborhood	Total Number of Displacements*	Visual Impacts	Noise Impacts	Mobility**
New Bohemia (Prince George)	12 residences and 5 businesses (7 residences and 1 business)	Impact, not adverse	5	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route.
Farmington Estates (Prince George)	4 residences (1 residence)	--	6	No impact
Continental Forest (Prince George)	3 residences (2 residences)	--	7	No impact
Charleston Estates (Prince George)	No impact	--	11	Improved mobility for emergency vehicles due to direct interchange access. Direct access to additional hurricane evacuation route.
Disputanta (Prince George)	No impact	No impact	0	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route. Provides 18 minutes of travel time savings to Suffolk.
Waverly (Sussex)	11 residences and Shilo Holiness Church	Impact, not adverse	4	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Non-motorized travel would be affected by increased traffic levels on Route 40 at the interchange ramp areas. Direct access to additional hurricane evacuation route. Provides 12 minutes of travel time savings to Suffolk.
Wakefield (Sussex)	No impact	No impact	0	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route. Provides six minutes of travel time savings to Petersburg and eight minutes to Suffolk.
Ivor (Southampton)	No impact	No impact	0	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route. Provides nine minutes of travel time savings to Petersburg and seven minutes to Suffolk.
Tucker Swamp Road (Rt. 635) (Southampton)	3 residences (1 residence)	--	6	No impact
Zuni (Isle of Wight)	No impact	No impact	0	Provides 11 minutes of travel time savings to Petersburg and five minutes to Suffolk.
Thomas Woods Trail (Rt. 614) (Isle of Wight)	4 residences (2 residences)	--	5	No impact
Mill Creek Drive/ Barrett Town (Rts. 638 and 641) (Isle of Wight)	20 residences (12 residences)	--	33	No impact
Windsor (Isle of Wight)	2 residences	Impact, not adverse	12	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Non-motorized travel would be affected by increased traffic levels on Route 258 (Bank Street) at the interchange ramp areas. Direct access to additional hurricane evacuation route. Provides 15 minutes of travel time savings to Petersburg.
Kings Fork (Suffolk)	3 residences (2 residences)	--	10	Provides 18 minutes of travel time savings to Petersburg.

Source: Parsons Brinkerhoff and Michael Baker Jr., 2005.
-- Visual impacts not determined at the neighborhood level.
*When different, displacements impacts are provided for both Planning Corridor and Design Corridor, with Design Corridor totals in parenthesis.
**Travel time savings are compared to 2026 No Build

Table 4.5-5
SOCIAL CONSEQUENCES OF CBA 2

Community or Neighborhood	Total Number of Displacements*	Visual Impacts	Noise Impacts	Mobility
New Bohemia (Prince George)	14 residences, 14 businesses, Sacred Heart Church, and American Legion (2 residences, 4 businesses, and American Legion)	Impact, not adverse	0	No impact
Disputanta (Prince George)	4 residences	Impact, not adverse	3	Improved mobility for emergency vehicles and non-motorized travel within community due to decreased traffic on Route 460. Provides 11 minutes of travel time savings to Suffolk.
Waverly (Sussex)	No impact	Impact, not adverse	8	Improved mobility for emergency vehicles and non-motorized travel within community due to decreased traffic on Route 460. Provides 10 minutes of travel time savings to Suffolk.
Wakefield (Sussex)	No impact	No impact	0	Improved mobility for emergency vehicles and non-motorized travel within community due to decreased traffic on Route 460. Increased traffic through Mars Hill neighborhood on Rt. 31. Provides eight minutes of travel time savings to Suffolk.
Ivor (Southampton)	No impact	Impact, not adverse	0	Improved mobility for emergency vehicles and non-motorized travel within community due to decreased traffic on Route 460. Provides three minutes of travel time savings to Petersburg and six minutes to Suffolk.
Rts. 460 and 635 – east of Ivor (Southampton)	42 residences, 3 businesses (12 residences, 2 businesses)	--	5	Increased traffic on Route 460.
Zuni (Isle of Wight)	4 residences (3 residences)	Impact, not adverse	0	Improved mobility for emergency vehicles and non-motorized travel within community due to decreased traffic on Route 460. Provides four minutes of travel time savings to Petersburg and five minutes to Suffolk.
Windsor (Isle of Wight)	8 residences	Impact, not adverse	34 total, 22 in Twin Ponds MHP	Provides four minutes of travel time savings to Petersburg and five minutes to Suffolk.
Kings Fork (Suffolk)	3 residences (2 residences)	--	8	Provides nine minutes of travel time savings to Petersburg.

Source: Parsons Brinkerhoff and Michael Baker Jr., 2005.
-- Visual impacts not determined at the neighborhood level.
*When different, displacements impacts are provided for both Planning Corridor and Design Corridor, with Design Corridor totals in parenthesis.
**Travel time savings are compared to 2026 No Build

Table 4.5-6
SOCIAL CONSEQUENCES OF CBA 3

Community or Neighborhood	Total Number of Displacements*	Visual Impacts	Noise Impacts	Mobility
New Bohemia (Prince George)	2 residences	Impact, not adverse	5	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route.
Route 635 (Prince George)	6 residences (4 residences)	--	7	No impact
Disputanta (Prince George)	No impact	No impact	0	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route. Provides 18 minutes of travel time savings to Suffolk.
Waverly (Sussex)	No impact	Impact, not adverse	5	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route. Provides four minutes of travel time savings to Petersburg and 18 to Suffolk.
Wakefield (Sussex)	No impact	No impact	0	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route. Provides seven minutes of travel time savings to Petersburg and ten minutes to Suffolk.
White Marsh Road (Rt. 617) (Surry)	6 residences (5 residences)	--	7	No impact
Ivor (Southampton)	No impact	No impact	0	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route. Provides eight minutes of travel time savings to Petersburg and seven minutes to Suffolk.
Tomlin Hill Drive and Dodge Lane (Isle of Wight)	3 residences (1 residence)	--	9	No impact
Zuni (Isle of Wight)	No impact	No impact	0	Improved mobility for emergency vehicles and non-motorized travel on Route 460, due to reduced traffic.
Clydesdale Mobile Home Park	No impact	--	18	No impact
Windsor (Isle of Wight)	No impact	Impact, not adverse	42 (Windsor Woods)	Improved mobility for emergency vehicles and non-motorized travel on Route 460. Direct access to additional hurricane evacuation route. Provides 14 minutes of travel time savings to Petersburg and five minutes to Suffolk.
Shilo Drive (Isle of Wight)	5 residences (2 residences)	--	9	No impact
Kings Fork (Suffolk)	3 residences (2 residences)	--	9	Provides 18 minutes of travel time savings to Petersburg.

Source: Parsons Brinkerhoff and Michael Baker Jr., 2005.
-- Visual impacts not determined at the neighborhood level.
*When different, displacements impacts are provided for both Planning Corridor and Design Corridor, with Design Corridor totals in parenthesis.
**Travel time savings are compared to 2026 No Build

CBA 2 would displace the greatest number of non-profit organizations. These displacements in the Planning Corridor of CBA 2 include: Sacred Heart Catholic Church, American Legion, Disputanta Ruritan Club, Windsor Convenience Center (recycling), Marantha Bible Church, and three small family

cemeteries. The displacements in the Design Corridor include the American Legion, Windsor Convenience Center, and two small family cemeteries. CBA 1 and 3 each displace one non-profit organization, Shilo Holiness Church and Marantha Bible Church, respectively.

During coordination with representatives of Prince George and Sussex Counties, it was noted that CBAs 1 and 3 would potentially travel through planned and approved subdivision areas. As these subdivisions are not currently developed, their planned layout could potentially be adjusted should either of these CBAs be selected.

The CBAs would not result in adverse visual impacts to any of the communities along Route 460. A discussion of visual impacts is presented in Section 4.4. The number of noise impacts to homes within specific communities and neighborhoods varies according to location. Details regarding noise impacts are found in Section 4.9 and in the *Noise Analysis Technical Report*. The construction of noise barriers to mitigate noise impacts has been considered at every location where a noise impact has been predicted. Noise barriers will minimize noise impacts to communities and neighborhoods. FHWA and VDOT require that noise barriers be both "feasible" and "reasonable" to be recommended for construction. The feasibility of constructing noise barriers will be fully evaluated for those properties impacted by the preferred alternative later in the project development process.

Residents, businesses, and emergency response services would benefit from an additional hurricane evacuation route provided under either CBA 1 or 3. CBA 1 or 3 would provide an improved, safer, and faster hurricane evacuation route than currently exists on Route 460. Improved drainage design features and current roadway design standards would prevent roadway flooding that typically happens in the low-lying areas through which existing Route 460 traverses. While CBA 2 would provide travel time savings for hurricane evacuation, it would not provide an alternative and additional evacuation route for the region.

Residents and businesses would benefit from improved travel time savings associated with all three CBAs. Travel time savings are discussed in the *Indirect Effects and Cumulative Impacts Technical Report.* Residents near planned interchange areas would benefit from decreased travel times to employment centers in Petersburg and Suffolk. Residents and local representatives have expressed concern about the impact of the potential loss of traffic for local highway and tourist-related businesses located within the communities. These impacts are described in detail in the *Indirect and Cumulative Technical Report* and summarized in Sections 4.18 and 4.19.

Traffic volumes would be greatly reduced from existing Route 460 in each of the communities, ranging from 50 to 90 percent, depending on the CBA and the location. The percentage of truck traffic on Route 460 in the center of bypassed communities would be between 7 and 9 percent of total traffic volumes compared to 30 to 37 percent under the No-Build and TSM Alternatives. Given that the national average for truck traffic on similar rural arterials is 10 percent, these truck volumes would be more in keeping with the national average. The lower traffic volumes on Route 460 would directly benefit local services that travel daily along Route 460 such as emergency response services (police, fire, medical), school buses, and mail delivery.

The CBAs would have a similar effect on local accessibility and mobility. The reduction in automobile and truck traffic on Route 460 would make vehicular and non-motorized travel patterns safer within each community, and might result in more pedestrian/bicyclist crossings and interaction. The reduction in traffic levels and improved local accessibility would reduce the level of separation caused by Route 460 for the seven communities along the project corridor. Emergency response services would specifically benefit from improved local accessibility and mobility, potentially decreasing incident response times.

Interchange locations along secondary roadways will be grade separated, thus would not limit non-motorized travel along the existing secondary roads. However, the secondary roads with interchange locations would experience higher traffic levels than in the No-Build and TSM Alternatives. Potential mitigation measures to minimize the impact of increased traffic on secondary roads near interchange ramp locations may include the provision of sidewalks or other design features such as wide paved shoulders to improve safety conditions for pedestrians and bicyclists.

4.5.3 Environmental Justice Consequences

4.5.3.1 No-Build and TSM Alternatives

No direct effects on low-income or minority populations have been identified for the No-Build Alternative. The TSM Alternative would improve the safety of all travelers on Route 460, including low-income and minority residents of the area and through-travelers. This is a positive effect and would not disproportionately adversely affect either the low-income or minority concentrations or individuals in the study area. As discussed in Section 2.5, traffic volumes and the percentage of truck traffic will increase by the year 2026. This deterioration in local accessibility would further exacerbate the physical bisection of existing Route 460 on each of the seven communities, equally affecting minority and low-income populations and non-minority and non-low-income populations.

4.5.3.2 Build Alternatives

Table 4.5-3 shows the estimated number of minority and low-income residents that would be displaced by each CBA. The characteristics of these residents were estimated based on information from the 2000 Census, which were confirmed with meetings with local planners and during field review. CBA 2 would displace the highest number of minority persons with 224 in the Planning Corridor and 65 in the Design Corridor. Similarly, CBA 2 at the Planning Corridor would result in the greatest number of low-income residents displaced with 47 residents. All three CBAs at the Design Corridor would displace a much lower number of low-income residents (between 9 and 14 residents). The Design Corridor is able to minimize impacts to all residents, including minority and low-income residents. In general, the severity of the displacements impacts to minority and low-income populations is proportional to the occurrence of these populations throughout the study area. Minority residents account for 27 percent to 38 percent of the total displacements with CBA 1 or 3, compared to the study area minority population of 37 percent. The minority residential displacements associated with CBA 2 (48 percent to 53 percent) exceed the study area's 37 percent minority population. The low-income displacements associated with CBAs 1, 2, and 3 (ranging from 9 percent to 11 percent) are comparable to the study area average of 9 percent.

CBA 1 would have impacts on minority and low-income populations in Waverly and Windsor. In Waverly, CBA 1 in both the Planning and Design Corridors would displace 11 minority households and Shilo Holiness Temple, which serves minority community members. The access provided by the interchange ramps on Route 40 would increase traffic for remaining residents along Route 40 and Sussex Trace Apartments. As noted by local representatives, this community relies heavily on non-motorized transportation, so pedestrian safety features, such as sidewalks or wide paved shoulders, would be considered along Route 40 between the CBA interchange ramp locations to improve safety conditions for pedestrians and bicyclists. In Windsor, CBA 1 would provide interchange ramps on Bank Street (Route 258), displacing 2 households. This area along Bank Street (including Bear Trap Circle) was provided water and sewer with Community Block Development Grant funds in 1998.

CBA 2 would displace the American Legion and the Disputanta Ruritan Club. These clubs are predominantly comprised of minority members. It is likely that these community facilities will be able to relocate along Route 460 and continue serving minority residents in the New Bohemia and Disputanta communities. CBA 2 and 3 will alter traffic levels along Route 31 in the Mars Hill neighborhood. This neighborhood includes both minority and low-income populations. In Windsor, CBA 2 would provide interchange ramps on Route 258 between Twin Ponds MHP and Windsor Court Apartments and the Windsor Middle School. Pedestrian safety features, such as sidewalks or wide paved shoulders would be considered along Route 258 between CBA interchange ramp locations to improve safety conditions for pedestrians and bicyclist access from these residential areas to Windsor Middle School. Both residential areas include minority and low-income populations and Windsor Court Apartments includes residents who receive Section 8 housing assistance.

CBA 3 would alter traffic levels along Route 31 in the Mars Hill neighborhood. This neighborhood includes both minority and low-income populations.

As noted above, each of the CBAs would directly affect minority and low-income populations. All three CBAs would provide similar benefits to minority and low-income residents. CBA 3 would have the least adverse impacts to minority and low-income populations, while CBA 2 would have the greatest impact. This is consistent with the displacement and social impacts to the overall population. The impacts to minority and low-income populations from the CBAs are not considered disproportionately high and adverse since:

- The CBAs would provide offsetting economic and social benefits to the affected populations;
- Avoidance measures (Design Corridor) would be taken to reduce adverse impacts;
- Adverse impacts to minority and low-income populations would be proportional to impacts to the overall population;
- Minority and low-income populations have participated in and provided meaningful input throughout the transportation planning process; and
- Mitigation measures (see Section 4.5.6) would benefit minority and low-income populations as well as the overall population and continued outreach will identify measures to specifically benefit minority and low-income populations.

4.5.4 Economic Consequences

Economic impacts were addressed on several different levels. Direct impacts include the displacement of existing businesses and jobs and the loss of property tax revenues. Indirect and cumulative impacts include employment growth related to induced development, travel time savings and access benefits to industrial developments, and potential bypass effects to existing business districts. These indirect and cumulative economic impacts are discussed in detail in the Indirect and Cumulative Technical Report, summaries of these impacts are provided in the following sections.

Direct business and employment displacements and loss of property tax revenues were determined based on GIS analysis of aerial photography and field review. Both Planning and Design Corridor footprint impacts were evaluated. Due to the preliminary nature of the study, individual businesses were not contacted regarding potential displacements; therefore, it was not feasible to determine the specific relocation needs of these businesses. Secondary data sources and interviews with local officials were used to identify general characteristics.

4.5.4.1 No-Build Alternative and TSM Alternative

The No-Build and TSM Alternatives would not displace any businesses. No loss of local property tax revenues would occur as a result of the No-Build or TSM Alternatives.

Changes in planned land use are not expected under either the 2026 No-Build or the TSM Alternative. It is assumed that approved projects and land uses will develop as planned. However, the increasing travel-time delays do not benefit the planned economic development along the Route 460 corridor. Travel times from Petersburg to Suffolk are anticipated to increase by 8 minutes (11%) between 2000 and 2026. These alternatives would not improve regional access or provide travel time savings to any industrial park, enterprise zone, or shipping-related industry within the study area.

4.5.4.2 Build Alternatives

Displacement Impacts

CBAs 1 and 2 would displace businesses, while CBA 3 would not result in any business displacements. CBA 2 would result in the greatest number of estimated business displacements (32 Planning Corridor /

16 Design Corridor) and job displacements (255 Planning Corridor / 95 Design Corridor). A majority of these displacements would occur in Prince George County along Route 460 between I-295 and Disputanta. Table 4.5-7 presents the potential business displacements and employment loss by county for CBA 1 and 2. CBA 3 is not included in this table because there would not be any business displacements with this alternative. No displacements would occur within the business districts of the seven communities along Route 460. Displaced businesses would result in temporary losses of sales tax revenues. Discussions with local representatives and field review indicated that adequate relocation options are available for all displaced businesses to relocate within their current communities. Therefore, localities would not experience permanent sales tax revenue losses unless displaced businesses choose not to relocate in the same locality. This analysis does not attempt to estimate how many businesses would not relocate or reopen if displaced.

Table 4.5-7
POTENTIAL BUSINESS DISPLACEMENTS

Displacements	CBA 1		CBA 2	
	Planning Corridor	Design Corridor	Planning Corridor	Design Corridor
No. of Businesses	5	1	32	16
Estimated No. of Employees	40	10	240	90

Note: CBA 3 would not displace any businesses or employees. Therefore, it was not included in this table.
Source: Michael Baker, Jr., February 2005

Loss of Property Tax Revenues

Table 4.5-8 summarizes the fiscal impact of potential property tax revenue losses of the CBAs by jurisdiction. When land and improvements are acquired by VDOT from private property owners, the local governments no longer receive property tax revenues for that property. Properties include residences, businesses, farms, and non-profit organizations as well as undeveloped properties. While this potential loss of property tax revenues comprises a small proportion of each locality's budget, it is a direct economic impact of the construction of the CBAs. CBA 2 would have the greatest fiscal impact at a loss of $241,761 in property tax revenues in the Planning Corridor and $92,414 in the Design Corridor. CBA 3 would have the least fiscal impact with the loss of $99,601 in property tax revenues in the Planning Corridor and $57,430 in the Design Corridor. As with other impacts, the Design Corridor would greatly minimize potential fiscal impacts. These impacts do not account for the likely event that the improvements displaced (i.e., homes and businesses) will relocate/rebuild and, to some undetermined extent, offset the property tax losses with future gains.

As a percentage of total fiscal impact, Prince George County would sustain the greatest property tax losses under CBA 1 and CBA 2. Under CBA 3, the City of Suffolk would sustain the greatest property tax losses.

Table 4.5-8
FISCAL IMPACT TO JURISDICTIONS

Build Alternative	Corridor	Total Assessed Value of Land & Improvements Acquired	Fiscal Impact
CBA 1	Planning Corridor	$16,980,691	$141,426
	Design Corridor	$9,735,408	$80,695
CBA 2	Planning Corridor	$29,876,073	$241,761
	Design Corridor	$11,165,732	$92,414
CBA 3	Planning Corridor	$11,554,094	$99,601
	Design Corridor	$6,655,374	$57,430

Source: Michael Baker, Jr., February 2005

4.5.5 Benefit Cost Analysis : User Benefit and Cost

A Benefit-Cost Analysis (BCA) is a systematic economic means of measuring or comparing the economic feasibility of investments. A BCA measures the direct benefits and costs that a project causes or creates for highway agencies, travelers (users), and, to some non-users affected by the project. Direct benefits and costs are the first order or immediate impacts of the transportation project on users and non-users, and include changes in travel time, accidents, vehicle operating costs, agency construction costs, and pollution costs. The MicroBENCOST computer software was used to apply the BCA methodology.

Capital cost includes the cost of constructing the facility. Benefits represent the difference in travel time cost, vehicle operating cost and accident costs between the existing condition and each CBA. Agency cost is the cost incurred by VDOT, calculated as the total cost of construction plus maintenance and operation less the salvage value. NPV, net present value, is the difference between the discounted user benefit and discounted agency cost. BCR, benefit-cost-ratio, is the ratio derived by dividing the discounted user benefit by the discounted agency cost. The results of the BCA are shown in Table 4.5-9. A BCA ratio of 1 or greater indicates an option where the benefits outweigh the costs. All monetary figures are depicted in 2005 dollars.

Table 4.5-9
SUMMARY OF USER BENEFIT AND COST

Measures	CBA 1	CBA 2	CBA 3
Capital Cost	$470.27	$584.59	$490.08
Benefits	$498.87	$450.00	$515.29
Agency Cost	$428.87	$549.25	$451.60
NPV	$70.01	-$99.25	$63.69
BCR	**1.16**	**0.82**	**1.14**

Source: Parsons Brinckerhoff, March 2005

4.5.6 Potential Mitigation

Social/Community Mitigation

Impacts to social or community resources vary depending on the CBA. Potential minimization of the effects has been evaluated with Design Corridor options. VDOT will seek to minimize the number of displacements during final design as the Planning Corridor allows opportunities for avoidance within the 500-foot corridor. To minimize loss of residents, businesses, farms, and non-profit organizations from each community, VDOT ROW staff will coordinate closely with each locality to determine the feasibility of allowing displacees to relocate on their existing property, if they so desire. This will be addressed on a case-by-case basis and will be determined based on local regulations regarding minimum lot size, zoning, and availability of water and sewer.

To minimize impacts to active farming operations, VDOT will consider options to maintain agricultural access to bisected agricultural parcels. During final design, VDOT will work to minimize uneconomic remnants.

At interchange ramp locations where traffic increases and vehicle interaction might affect pedestrian or bicycle travel on crossroads, VDOT will consider the provision of sidewalks and/or bike paths. Opportunities exist to tie into existing or planned sidewalks within some communities.

VDOT will identify context sensitive design features such as landscaping, berms, and noise walls to reduce noise, visual, and community impacts. Noise barriers will be considered when deemed effective and cost feasible. VDOT will coordinate with the local governments and public to identify which features

would be appropriate for each community. VDOT acknowledges that different communities may have different mitigation needs or preferences and these specific measures will be identified after a preferred alternative is selected.

The CBAs would not result in disproportionately high and adverse impacts to minority or low-income populations and, therefore, specific environmental justice mitigation is not proposed. However, mitigation options presented in the previous section will benefit minority and low-income populations. Furthermore, VDOT's relocation policies provide an added benefit to low-income displacees, some of whom are also a minority. The relocation program outlines special cases where a displacee is eligible for a price differential payment in addition to the fair market value of the property to help defray the costs necessary to purchase a comparable, decent, safe, and sanitary replacement dwelling in a similar neighborhood or housing of last resort. This price differential payment may not exceed $22,500 for homeowners or $5,250 for renters and can also be used toward a down payment, increased mortgage interest costs, and incidental expenses associated with purchasing a home (e.g., title search, recording fees, and closing costs).

As the relocation analysis noted (see Socioeconomic Technical Report), an adequate supply of housing is available for sale or rent within a comparable price range. However, if appropriate housing cannot be found, VDOT can provide necessary housing in a number of ways through an administrative process known as housing of last resort. Housing of last resort may include relocation in a rehabilitated dwelling, construction of an addition to a relocation dwelling, purchase of land and construction of a new replacement dwelling, a replacement housing payment in excess of the price differential, or a direct loan that would enable the displaced person to construct or contract the construction of a replacement dwelling. This is not anticipated to be necessary on this project, but it remains a mitigation option should the need arise for relocation housing for low- to moderate-income households.

Economic Mitigation

Economic mitigation for the CBAs includes the following:

- VDOT's right-of-way acquisition and relocation program will be done in accordance with the Federal Uniform Relocation Assistance and real Property Acquisition Act of 1970, as amended and with the Surface Transportation and Uniform Relocation and Assistance Act of 1987 (STURRA). Relocation resources will be available without discrimination.
- VDOT will coordinate closely with each community to determine appropriate signage at interchange areas. The signage may designate historic or shopping districts and may be used to minimize potential bypass effects.
- To the extent possible, final design will consider plans for new industrial developments to minimize footprint impacts to these planned facilities.

4.6 HAZARDOUS MATERIALS SITES IDENTIFIED

4.6.1 Methods

A database search was conducted using standard environmental record sources (see Table 4.6-1). These databases contain the names and/or locations of reported hazardous waste sites, treatment, storage and disposal facilities, pollution and hazardous waste spills, including Leaking Underground Storage Tanks (LUSTs), and landfills in Virginia. Information from the databases identified properties for further evaluation. Any incident or facility identified within the search distance was reviewed to identify past activities that could potentially result in Recognized Environmental Conditions (RECs) at the subject property or within the search distance. The Hazardous Materials Technical Report describes more fully the approach and analysis methods used to determine identified hazardous material sites.

The database review identified sites that could potentially affect the three CBA corridors. Field review was conducted of these properties to review conditions at each site. At this stage of project development, the analysis focused on identifying sites that posed a so-called fatal flaw, potentially adding considerable cost, delay and/or influencing the selection of an alternative.

Table 4.6-1
STANDARD ENVIRONMENTAL RECORD SOURCES

Source	Search Distance (miles)
Federal and State Equivalent – National Priorities List (NPL)	1.0
Federal and State Equivalent - Comprehensive Environmental Response, Compensation and Liability System (CERCLIS)	0.5
Federal and State Equivalent - Comprehensive Environmental Response, Compensation, and Liability System (CERCLIS), No Further Remedial Action Planned (NFRAP)	Subject and Adjoining Properties
Federal List of Treatment, Storage and Disposal (TSD) Facilities Subject to Corrective Action (CORRACTS) under the Resource Conservation and Recovery Act (RCRA)	1.0
Federal RCRA Non-CORRACTS	0.5
Federal RCRA Generators List	Subject and Adjoining Properties
Federal Emergency Response Notification System (ERNS) List	Subject Property Only
State Landfill and/or Solid Waste Disposal Site Lists	0.5
State Leaking Underground Storage Tanks (LUST) List	0.5
State Registered Underground and Aboveground Storage Tanks (USTs/ASTs) List	Subject and Adjoining Properties

4.6.2 Results

Table 4.6-2 lists the number of mapped occurrences identified for each CBA considered. A total of 192 sites are located within the corridor. There are 131 mapped sites and 61 unmapped sites, with unmapped sites not located. Unmapped sites may no longer be in existence. Additionally, it is possible that the unmapped sites are the same as some of the mapped sites, with only a change of name. Only five of these unmapped sites are LUSTs. These sites are important because they pose a threat to groundwater quality. Of the total number of sites identified within the corridor, 26 are LUSTs. There are also a number of former and potential former gasoline stations, some with evidence that USTs are still in the ground. As there is greater potential for older tanks to leak, the former and potential former gasoline stations may affect construction.

The majority of the total occurrences identified are within or near CBA 2. Some of the LUSTs may affect more than one CBA, and are listed as such. There are fewer total occurrences for CBA 1 and CBA 3 as these areas are generally less developed and consist of more agricultural and private homes than commercial use.

Occurrences near a corridor, but not within the boundaries of the corridor, could result in potential contamination of the study area, depending on the site characteristics. Subsurface exploration or some other form of subsurface analysis would be required to assess the extent of any potential contamination.

Table 4.6-2
NUMBER OF HAZARDOUS MATERIALS OCCURRENCES IDENTIFIED BY CBA

Alternative	Number of Occurrences	
Candidate Build Alternative	LUST Sites	All Sites[1]
1	10	34
2	10	104
3	3	29

Source: Environmental Data Resources, Inc., June 2004.
Notes:
1. The total number of sites identified include USTs and LUSTs and may also include sites identified in the following databases: CERCLIS, NPL, CERCLIS-NFRAP, RCRIS-SQG, RCRIS-LQG, ERNS, SWF/LF, AST, VRP, FINDS.

4.6.3 Hazardous Material Sites Identified for Further Evaluation

Fifteen sites may warrant additional evaluation because of the proximity of the site to the corridor, and the type of hazardous materials contained at the site have the greatest potential to affect property acquisition and construction activities. These 15 sites are listed in Table 4.6-3 and depicted in Figure 4.6-1.

Table 4.6-3.
HAZARDOUS MATERIALS SITES IDENTIFIED FOR FURTHER EVALUATION

CBA	Hazardous Materials Site #	Description
1	24	Thomas Wright, ERNS site. LUST case.
2	30	Windsor Veterinary Hospital – appears to be a former gas station.
	35	Pangle's Auto Repair.
	37	Pearl Line Press – three vent pipes on west side of structure.
	38	Possible former gas station –one vent pipe and pump island.
	40	Former gas station, corner of Route 644 and Route 460 –pump island and bays, vent pipe behind structure.
	41	Former gas station, Route 460 – appears to have former pump island.
	43	Former gas station, 37262 Route 460 – pump island and four vent pipes.
	70	Adams Peanuts. Appears to be a former gas station – pump island and two vent pipes.
	93	Waverly Glass. Appears to be a former gas station.
	97	Van Cleef. Former gas station – pump island and two USTs.
	98	B&B Motors. Auto body repair and junkyard –potential hazardous materials.
	99	John's Auto Body. Appears to have former pump island & UST.
	101	Vacant former gas station.
	129	East Coast Gas Station. Open LUST case.

Note: No sites were identified along CBA 3

4.6.4 Fatal Flaws

Fatal flaws are those sites that would add considerable cost, delay and/or influence the selection of an alternative. Examples of potential hazardous materials fatal flaws include superfund sites, solid waste landfills and ordinance ranges. No fatal flaw sites were identified in any of the three CBAs.

4.6.5 Mitigation

In order to develop mitigation measures for identified hazardous materials additional evaluations will be required during final design of the proposed project. The level of detail required will depend on specific design criteria of the selected alternative. CBA 2 has hazardous materials site occurrences within the corridor boundaries. These sites provide potential sources of contamination that could affect property acquisition and construction activities. Accordingly, some sites may require some form of mitigation. The selection of mitigation measures for specific sites would include avoidance, minimizing impacts through redesign or alignment shift, and remediation/closure. Any site remediation/closure would be performed in accordance with applicable State and Federal laws. Performance of such measures would occur prior to or during the course of construction, depending on site conditions.

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Figure 4.6-1
HAZARDOUS MATERIAL SITES IDENTIFIED FOR FURTHER EVALUATION

4.7 HISTORIC AND ARCHAEOLOGICAL RESOURCES

The impacts of the project to historic and archaeological resources eligible for or potentially eligible for the NRHP will be assessed in accordance with the requirements of Section 106 of the NHPA. According to 36 CFR Part 800.5(a)(1), an adverse effect occurs when an undertaking "may alter, directly or indirectly, any of the historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association."

4.7.1 Architectural Resources

Figure 4.7-1 identifies the location of all NRHP-eligible architectural resources within the study area. Fifteen of these eligible resources are located within the Area of Potential Affect (APE). These resources include a church, railroad corridor, former school, community club, tourist court, and ten domestic buildings or farmsteads. Table 4.7-1 lists each resource by Candidate Build Alternative (CBA). The specific location of each resource in relation to the CBAs is shown in Figures 4.7-2 through 4.7-15. The figures show the boundaries of the eligible property in relation to the 500 foot planning corridor.

Table 4.7-1
ELIGIBLE RESOURCES BY OPTION

Resource Name	DHR #	CBA	Figure #
Sacred Heart Church	074-5021	1, 2, 3	4.7-2
Bond House/Estes School	074-5025	1	4.7-3
Parker House	091-5062	1	4.7-4
Wakefield Community Hunt Club/Wakefield Sportsmens Club	091-5058	1	4.7-5
Pulley Farm/Cedar Lawn Farm	087-5477	1	4.7-6
Norfolk & Petersburg Railway Corridor	091-5098	1	4.7-7
Prince George Golf Club / Chester Plantation	074-0059	2	4.7-8
Brittle House	087-5492	2	4.7-9
Hobbs Property	046-5101	2	4.7-10
Woodland Farm	091-5071	3	4.7-11
Morris-Goodrich Farm	090-5032	3	4.7-12
Bailey-Pretlow House	087-0073	3	4.7-13
Bailey-Holmes House	087-0001	3	4.7-14
William Scott Farm	046-0086	3	4.7-15

During the alternatives development process, alignment shifts were made to avoid direct use of each of these properties. Although some of the following diagrams show the planning corridor limits encroaching on the eligible boundaries, the project can be designed such that there is no Right-of-Way encroachment on the eligible property. Also, the potential crossings of the Railway Corridor, should CBA 1 be selected, will be developed in a manner that will not be a "use" of that property. Therefore, there would be no Section 4(f) involvements with any of these eligible historic properties.

Figure 4.7-1
NRHP-ELIGIBLE ARCHITECTURAL RESOURCES

Figure 4.7-2
SACRED HEART CHURCH

Figure 4.7-3
BOND HOUSE/ESTES SCHOOL

Figure 4.7-4
PARKER HOUSE

Figure 4.7-5
WAKEFIELD COMMUNITY HUNT CLUB/WAKEFIELD SPORTSMENS CLUB

Figure 4.7-6
PULLEY FARM/CEDAR LAWN FARM

Figure 4.7-7
NORFOLK & PETERSBURG RAILWAY CORRIDOR

Figure 4.7-8
PRINCE GEORGE GOLF CLUB / CHESTER PLANTATION

Figure 4.7-9
BRITTLE HOUSE

Figure 4.7-10
HOBBS PROPERTY

Figure 4.7-11
WOODLAND FARM

Figure 4.7-12
MORRIS-GOODRICH FARM

Figure 4.7-13
BAILEY-PRETLOW HOUSE

Figure 4.7-14
BAILEY-HOLMES HOUSE

Figure 4.7-15
WILLIAM SCOTT FARM

A final Determination of Effect for the project will be made and coordinated with the SHPO during the development of the FEIS. Section 106 effects to each resource potentially affected by the selected alternative will be evaluated. The No-Build and TSM Alternatives would not affect any eligible architectural resources.

4.7.2 Archaeological Resources

A limited number of archaeological sites have been previously recorded within the proposed corridor options (Table 4.7-2). CBA 1 contains four sites; CBA 2 contains one; and CBA 3 contains one site.

Table 4.7-2
PREVIOUSLY RECORDED ARCHAEOLOGICAL SITES

Site #	Quadrangle	Alternative and Segment (CBA)	Site Description (NA=Native American; H=Historic Period)	Previous Recommendations or NRHP Status, If Known
44PG0143	Prince George	1 3	NA-Late Archaic H-19th-20th c.	Not eligible
44IW0139	Windsor	1	NA-Unknown H-Mid 19th-20th c.	Not eligible
44IW0168	Zuni	1	H-19th-20th c.	Not eligible
44IW0169	Zuni	1	H-19th c.	Potentially eligible
44SX0320	Waverly	2	H-19th to 20th c.	Not eligible; 75-95% destroyed

An archaeological assessment was prepared to compare the three CBAs. The archaeological assessment addresses the potential of each of the three alternatives to contain archaeological sites. The assessment for each corridor included the identification of any archaeological sites or significant sites of events not manifested by material remains that may be affected and that may be valued chiefly for preservation in place. The review also assessed the potential for any corridors to contain sites meriting preservation in place or sites that would be extraordinarily complex and/or expensive to excavate.

Sites from all the major periods are represented in the general Study Area for the Route 460 Location Study, and with the exception of sites from the Paleoindian period, the potential for additional sites from each period is high. Native American sites are especially likely on terraces, ridges, or dry floodplain areas adjacent to major streams. The potential is moderate in interstream upland areas. The potential for Paleoindian sites is highest at crossings of major streams such as the Blackwater River and Blackwater Swamp, but due to the general rarity of these sites, the potential is more moderate overall. Archaic and Woodland period sites are more numerous in the Study Area and the potential for additional sites is high at stream crossings and somewhat lower in upland areas. Postcontact sites are numerous in the Study Area. Additional postcontact sites are expected along streams, along historic roadways, and in uplands made more accessible by expanding roadways. Postcontact sites from the Civil War may also be present. Not all sites, however, will have the potential to affect location decisions for the project.

The proportionate size of each segment within each alternative was calculated, and the numerical value assigned to the potential for each type of site was multiplied by this value. The weighted potentials for a particular site type for all the segments in an alternative were added together to arrive at a numerical value representing the average overall potential for encountering a particular type of site in each alternative. These numerical values were then reassigned their descriptive equivalents.

The results in Table 4.7-3 suggest that the potential for sites that could affect location decisions is low to moderate or moderate for all of the site types in all of the alternatives. For stratified sites with Paleoindian or pre-Paleoindian components, the potential ranges from low to moderate in CBA 1 to moderate in CBA 2 and 3. For Woodland period village sites with possible human burials, the potential ranges from low to moderate in CBA 2 to moderate in CBA 1 and 3. For historic cemeteries with large burial populations, the

potential is low to moderate in CBA 1 and 3 and moderate in CBA 2. Finally, there is low to moderate potential for Civil War earthwork sites in CBA 1 and 3 but moderate potential in CBA 2. The results suggest that the alternatives differ only slightly in their potential to contain significant sites.

Table 4.7-3
SUMMARY OF POTENTIAL FOR ARCHAEOLOGICAL SITES
FOR CANDIDATE BUILD ALTERNATIVES 1, 2, and 3

CBA #	Distance (miles)	Area (acres)	Stratified Sites with Paleo-Indian or pre-Paleo-Indian Occupations	Woodland Village Sites with Human Burials	Historic Cemeteries with Large Burial Populations	Civil War Earthworks
1	53	3455	low to moderate	moderate	low to moderate	low to moderate
2	55	3447	moderate	low to moderate	moderate	moderate
3	53	3440	moderate	moderate	low to moderate	low to moderate

In accordance with 36 CFR Part 800.4(b)(2) and by agreement executed between VDOT and the VDHR for large scale projects involving multiple alternatives, a Phase I archaeological survey will only be conducted on the selected alternative if that alternative is a build alternative.

4.7.3 Resolution of Potential Adverse Effects

The Section 106 process requires the FHWA to notify the Advisory Council on Historic Preservation (ACHP) if a project will adversely affect a historic property, so they can determine the need to be involved in consultation. If the selected concept adversely affects historic properties, a Memorandum of Agreement (MOA) must be executed which documents how the adverse effect will be taken into account. It the ACHP chooses not to participate in consultation, the Section 106 process is considered complete when an MOA has been executed between the FHWA and the SHPO and is filed with the ACHP. If the selected concept results in a no adverse effect on historic resources, the Section 106 process is considered complete when the FHWA and the SHPO concur on the no adverse effect determination.

4.8 AIR QUALITY

4.8.1 Methodology

A microscale air quality analysis was conducted to determine the potential effects of the CBAs on local air quality. The "worst-case" project level carbon monoxide (CO) concentrations were determined for the existing (2003), interim (2015), and design (2026) years. These CO concentrations were then compared to the National Ambient Air Quality Standards (NAAQS).

Microscale air quality modeling was performed using EPA's CAL3QHC program. Input emission factors were based on the EPA mobile source emission factor model (MOBILE 6.2). Dispersion parameters within the program are based on EPA's CALINE3 air quality dispersion model. Following the guidelines set forth in VDOT's Project *Air Quality Analysis Consultants Guide, Revision 13,* CO levels in the study area were estimated for each CBA, including the existing and No-Build scenarios. Sites were selected based on worst-case existing and estimated future traffic conditions and their location relative to the alignment where the highest CO concentrations could be expected and where the general public would have access during the analysis periods (i.e. sidewalks and bike lanes).

Maximum one-hour and eight-hour CO levels were estimated for each CBA for the existing year (2003), interim or completion year (2015 Build and No-Build scenarios) and the design year (2026 Build and No-Build scenarios).

Microscale modeling is used to predict CO concentrations resulting from emissions from motor vehicles using roadways immediately adjacent to the location at which predictions are being made. A CO "background level" must be added to this value to account for CO entering the area from environmental and other non-mobile sources upwind of the receptors. Based upon VDOT recommendations, a one-hour background and eight-hour background concentrations of 6 ppm and 3 ppm, respectively, were applied to all analysis sites.

Traffic data used for the air quality analysis was developed as part of an overall traffic analysis for this study. The microscale CO analysis was performed for the peak one-hour and eight-hour standard. These are the periods when the greatest air quality effects of the proposed project are expected. The average number of vehicles per hour during the peak eight-hour period was calculated as 0.6 percent of the average daily traffic. This persistence factor was recommended by VDOT. The persistence factor was recommended by VDOT and is based on guidance in FHWA's *Manual for Air Quality Considerations in Environmental Documents*.

4.8.2 Impacts

Maximum one-hour and eight-hour CO levels predicted for each CBA are shown in Table 4.8-1 and Table 4.8-2 respectively. These tables also include the predicted CO levels expected to occur under the existing and No-Build condition. All predicted concentrations are below the applicable one-hour (35 ppm) and eight-hour (9 ppm) Federal Standards established for this pollutant.

Table 4.8-1
ONE HOUR PREDICTED CO CONCENTRATIONS (PPM)

CBA	Location		Existing (2003)	No-Build (2026)	Interim (2015)	Build (2026)
	From	To				
1	Proposed Interchange at US 258, in Windsor	Eastern Terminus at US 58 Bypass	10.2	8.3	6.8	7.3
2	Proposed Interchange at Route 460 East of Windsor	Eastern Terminus at US 58 Bypass	10.2	8.3	6.8	7.1
3	Proposed Interchange at Route 460 East of Windsor	Eastern Terminus at US 58 Bypass	10.2	8.3	6.9	7.4

Table 4.8-2
EIGHT HOUR PREDICTED CO CONCENTRATIONS (PPM)

CBA	Location		Existing (2003)	No-Build (2026)	Interim (2015)	Build (2026)
	From	To				
1	Proposed Interchange at US 258, in Windsor	Eastern Terminus at US 58 Bypass	5.5	4.4	3.5	3.8
2	Proposed Interchange at Route 460 East of Windsor	Eastern Terminus at US 58 Bypass	5.5	4.4	3.5	3.7
3	Proposed Interchange at Route 460 East of Windsor	Eastern Terminus at US 58 Bypass	5.5	4.4	3.5	3.8

The highest predicted one-hour and eight-hour CO concentrations occur along CBA 1 between the City of Windsor and the US 58 Bypass at eastern terminus of the project. This location also has the highest hourly volume of vehicles (over 3,400 in all future scenarios) of all sites analyzed. Recognizing that the predicted concentrations of CO include background concentrations of 3 and 6 ppm for the eight- and one-hour levels, respectively, the proposed project will have little effect on existing levels of localized pollution. The CO concentrations for each CBA will decrease in the design year compared to the existing conditions and are well below the NAAQS for CO for each CBA. The temporary air quality impacts from construction are not expected to be significant. Construction activities are to be performed in accordance with VDOT's *Road and Bridge Specifications*. The Specifications are approved as conforming to the SIP and require compliance with all applicable local, state, and federal regulations.

4.8.3 Project-Level Conformity

The purpose and need of the study focuses on meeting the current and future regional transportation needs of the area. The Route 460 Location Study is currently included for construction in the constrained Long-Range Plan for the Hampton Roads and Richmond/Petersburg regions, and the plan has been found to conform to the State Implementation Plan under the 1-hour ozone standard by FHWA and FTA. However, according to the constrained long-range plan developed by the Tri-Cities MPO for the Richmond/Petersburg region, Route 460 is listed as a reconstruction project and not a new location project. Therefore, the selection of a new location alternative would require the need for a new conformity finding. The Route 460 Location Study is listed as a new location project in the Hampton Roads region constrained long-range plan of which 50 percent will be funded by tolls. No phases of the project are currently included in either region's Transportation Improvement Program with the exception of preliminary engineering and the environmental study.

4.9 NOISE

4.9.1 Methodology

Traffic noise levels were approximated at all noise-sensitive properties along the three CBAs using the latest versions of the FHWA Traffic Noise Model (TNM 2.5) and the TNM 2.5 Look Up Tables. A two-dimensional approach was used that allowed for comparisons of the alternatives. Using loudest hour design year 2026 traffic data for the CBAs and ten percent of design year ADTs for other primary roadways and secondary roadways, build case noise levels at various distances from the CBAs and other roadways were calculated. The distances from the CBAs and other roadways to all noise sensitive properties were approximated and the applicable noise levels were applied to each property. Existing noise levels were approximated in a similar manner, using ten percent of existing ADTs for primary and secondary roadways to calculate noise levels at various distances from the roadways. No-build traffic data was available only for existing Route 460 and other primary routes with ADTs greater than 1,000, and therefore, 2026 no-build noise levels could not be determined for most noise-sensitive properties using traffic projections. However, at those properties where the existing noise levels were approximated to be 66 dBA or greater, no-build levels were also assumed to equal or be greater than 66 dBA. Properties where existing levels reach 66 dBA or higher are in close proximity to existing roadways, and traffic on these roadways has been assumed to be at least the same in 2026 as it was in 2003.

4.9.2 Noise Impact Assessment

The potential noise impact of the CBAs for the Route 460 Location Study was assessed in accordance with FHWA and VDOT noise assessment guidelines, which are described in detail in Chapter 3.

In the following table and discussion, noise impact is summarized for three separate categories. "Approach or Exceed NAC Only" impact, or *"NAC"* impact occurs where project noise levels approach or exceed the FHWA Noise Abatement Criteria (see Chapter 3), but the increase above existing is less than 10 dB. "Substantial Increase Only" impact, or *"SI"* impact, occurs where the project alternative causes a

substantial increase in the existing noise level – 10 dB or more – but the future level is less than 66 dBA L_{eq}. *"Both"* impact, or "Both NAC and Substantial Increase" impact occurs where both conditions exist; i.e. a 10 dB or more increase above the existing noise level and the predicted future noise levels approach or exceed 67 dBA L_{eq}.

Table 4.9-1 provides a summary of the noise impacts for each CBA by impact category. Impact in areas where noise levels approach or exceed the NAC have also been tabulated for the 2003 existing condition and 2026 no-build alternative in the same study corridor as traversed by the associated build alternative. Properties displaced by proposed roadway improvements (whether new alignment or widening) were not included in the count of impacted properties for the existing or no-build conditions.

Table 4.9-1
SUMMARY NOISE IMPACT TOTALS

CBA 1				
Impact	Approach or Exceed NAC Only *"NAC"*	**Substantial Increase Only *"SI"***	**Both NAC and Substantial Increase *"Both"***	**TOTAL**
	None	124 Residences 1 Church 1 School	32 Residences	156 Residences 1 Church 1 School
Existing	None	NA	NA	None
No-build	None	NA	NA	None
CBA 2				
Impact	Approach or Exceed NAC Only *"NAC"*	**Substantial Increase Only *"SI"***	**Both NAC and Substantial Increase *"Both"***	**TOTAL**
	16 Residences 1 Church	71 Residences 1 School	4 Residences	91 Residences 1 Church 1 School
Existing	3 Residences	NA	NA	3 Residences
No-build	20 Residences	NA	NA	15 residences
CBA 3				
Impact	Approach or Exceed NAC Only *"NAC"*	**Substantial Increase Only *"SI"***	**Both NAC and Substantial Increase *"Both"***	**TOTAL**
	2 Residences 1 Church	162 Residences 1 Church	18 Residences	182 Residences 2 Churches
Existing	2 Residences	NA	NA	2 Residences
No-build	3 Residences	NA	NA	3 Residences

A comparison of noise impact by alternative indicates that more noise-sensitive properties will be affected by CBA 3 than by CBA 1 or CBA 2. A total of 182 residential properties and 2 churches will receive noise impact in design year 2026 with CBA 3. 162 of these residences and 1 church will receive *SI* impact only, while only 2 residences and the other church will be impacted only by noise levels approaching or exceeding the NAC. 18 of the residential properties will experience both types of impact. Two of these 184 properties currently receive noise levels approaching or exceeding FHWA Noise Abatement Criteria.

In the 2026 no-build condition, three properties will receive noise levels approaching or exceeding FHWA Noise Abatement Criteria.

A total of 156 residential properties, 1 church, and 1 school will receive noise impact in design year 2026 with CBA 1. All of these properties will be impacted as a result of substantial increases in noise levels, and 32 will also experience noise levels approaching or exceeding 67 dBA L_{eq}. None of these properties currently receive noise levels approaching or exceeding FHWA Noise Abatement Criteria. Similarly, in the 2026 no-build condition, no properties will receive noise levels approaching or exceeding FHWA Noise Abatement Criteria.

The least number of impacted properties will result with CBA 2. A total of 91 residential properties, 1 church, and 1 school will be impacted, with 71 residences and the school receiving only a substantial increase impact, and 16 residences and the church receiving only a *NAC* impact. Four of the residences will receive both types of impact. Three of these 93 properties currently receive noise levels approaching or exceeding FHWA Noise Abatement Criteria. In the 2026 no-build condition, twenty properties will receive noise levels approaching or exceeding FHWA Noise Abatement Criteria.

4.9.3 Noise Abatement

FHWA Policy requires that noise abatement measures be considered wherever noise impact is predicted to occur. Measures identified by FHWA for consideration include traffic management, alteration of horizontal and vertical alignment, and construction of noise barriers. Traffic management measures, which include speed reductions and truck restrictions, would compromise one of the main purposes of this project and have been eliminated from further consideration. Alignment shifts could be effective in reducing noise levels at some locations but could also create additional noise impact and result in additional property takings. Further consideration of this abatement measure will take place later in the project development process.

The construction of noise barriers has been considered at every location where noise impact has been predicted. FHWA and VDOT require that noise barriers be both “feasible” and “reasonable” to be recommended for construction. To be feasible, a barrier must be effective, that is it must reduce noise levels at noise sensitive locations by at least 5 decibels, thereby “protecting” or “benefiting” the property. A residential property is “protected” if it will be exposed to future noise impact and will receive at least 5 decibels of noise reduction from a barrier. By comparison, a residential property is “benefited” if it is not exposed to future noise impact, but will still receive at least 5 decibels of noise reduction from a barrier designed to protect impacted properties.

The noise analysis included a preliminary feasibility evaluation for noise barriers. In locations near impacted properties where roadway access must be maintained, the properties were considered “not protected” (see Table 4.9-3). Barrier lengths, heights, and locations have been estimated using TNM for all other impacted properties. None of the impacted properties associated with CBA 1 or CBA 3 require road access that would make noise barriers ineffective. However, with CBA 2, eight impacted residential properties will require such access and are listed as “not protected” in Table 4.9-2. The feasibility of constructing noise barriers will be fully evaluated for those properties impacted by the selected alternative during the design phase of the project.

Barrier reasonableness, which is partially based on cost-effectiveness, has not been fully evaluated in this analysis, since barrier costs cannot accurately be determined during the Location Study stage. However, preliminary cost estimates were calculated based on estimated barrier length and height. Before the design public hearing, the appropriate barrier costs specific to that location will be determined and barrier cost effectiveness will be evaluated. Costs can include but are not limited to costs for barrier materials and installation, for additional right-of-way to accommodate the barriers, for the resolution of utility and drainage conflicts with the barriers, and for dealing with safety issues created by the barriers. To be “reasonable,” a barrier cannot cost more than $30,000 per protected or benefited residential property. See the Noise Technical Report for a summary of proposed barriers and their approximate cost per protected or benefited residential property. A barrier found not to be reasonable due to cost can still be constructed if a third party (other than FHWA or VDOT) funds the amount above $30,000 per residential

property. The reasonableness determinations for non-residential properties such as schools and churches are made on a case-by-case basis. The determinations are based not only on the barrier cost, but also on the type and duration of the activity taking place, the size of the affected area, the severity of the impact, and the amount of noise reduction provided.

Table 4.9-2 provides a summary of the barriers with each of the three CBAs. Included are the number of barriers, the total length and surface area, and a very preliminary total cost for barrier materials and installation. CBA 3, which is predicted to impact the largest number of noise-sensitive properties, would require the largest number and square footage of noise barriers to provide noise protection to impacted properties. CBA 2, with the least number of impacted properties, would require the least number and square footage of barriers to protect impacted properties.

Table 4.9-2
SUMMARY NOISE BARRIER TOTALS

CBA	Number of Barriers	Total Linear Feet	Total Square Feet	Total Cost	Sites Protected	Feasible Barriers	Cost-Effective Barriers
CBA 1	51 Barriers	103,150	1,451,550	$30,482,550	156 Residences 1 Church 1 School	All	None
CBA 2	40 Barriers	37,650	562,100	$11,804,100	83 Residences 1 Church 1 School 8 Sites Not Protected	All (8 sites not protected)	None
CBA 3	63 Barriers	110,250	1,628,490	$34,198,290	182 Residences 2 Churches	All	None

Note: All results in this table have been based on preliminary noise analysis and design, and may change upon detailed analyses. The cost-effectiveness of barriers protecting churches and schools are based on cost and other factors as discussed in Section 4.9.3.

4.10 WATER QUALITY AND WATER RESOURCES

4.10.1 Surface Water Resources

Stormwater runoff from highways and associated rights-of-way typically contains a specific suite of pollutants which can occur in widely varying concentrations. Pollutants of concern associated with highway construction and use include a variety of substances from common organic materials to toxic metals. Some pollutants, such as herbicides, road salts, and fertilizers, are intentionally placed in the environment to promote safety or roadside vegetation. Other pollutants, such as the incidental release of small amounts of petroleum products and metals from trucks and cars, are the indirect effect of roadway utilization. A major factor that determines concentrations of pollutants in highway stormwater runoff is the volume of traffic carried by a particular segment of roadway.

4.10.1.1 Non-Point Source Effects

The magnitude of stormwater pollutant loading attributed to a particular construction activity along with the proximity of that activity to sensitive waters (such as public water supplies and special aquatic habitat) can factor into water quality. Should a build alternative be selected, the effects of pollutant loadings will vary along the corridor. Primary factors that will influence the effect of highway runoff pollutant loading within any particular surface water body include the type and size of the receiving water body, the

potential for dispersion, the size of the catchment area, the biological diversity of the receiving water body, and relative effectiveness of proposed mitigation measures.

Construction of a CBA would result in an increase in impervious surfaces – a situation which, without stormwater management, could increase peak rates of runoff within a given drainage area. To varying degrees, construction of a CBA would also result in the introduction of certain pollutants normally associated with vehicular traffic (a function of vehicle miles traveled or VMT). With respect to highway projects, stormwater pollution loading is the quantity of pollutants that are transported off the road surface before they reach a stormwater management facility. If not addressed through appropriate stormwater management, the combination of these factors could contribute to degradation of water quality through increases in nonpoint pollutant loading. Stormwater runoff pollution loadings for the No-Build Alternative and the CBAs are presented in Table 4.10-1. These quantities do not reflect overall reductions which can be expected to occur following implementation of best management practices identified in section 4.10.1.4. For purposes of comparison, the severity of effects with respect to water quality is expressed in terms of percent increase over 2004 base year conditions. Compared to 2004 baseline conditions, CBA 2 would result in the smallest percent increase of stormwater runoff pollutant loading (at 9.59 percent) relative to the other two CBAs. Compared to 2004 baseline conditions, CBA 1 and CBA 3 would result in relatively higher yet comparable percent increase of stormwater runoff pollutant loading (at 23.23 percent and 23.18 percent, respectively).

With respect to short-term effects, clearing and grubbing, earth moving and grading, and other construction-related activities can lead to erosion of soils. If unchecked, these activities can lead to the deposition of eroded sediments within nearby waterways and water bodies. Without implementation of appropriate mitigation measures, short-term effects to surface waters (i.e., during and immediately following construction) would include (1) a temporary increase in turbidity and sedimentation during and immediately following nearby land disturbances and (2) an increase risk of contamination associated with the presence of heavy equipment fluids (fuels, lubricants, etc.) and construction-related chemicals (paints, concrete additives, etc.).

With implementation of appropriate mitigation measures and BMPs (as discussed below), construction or operation of a CBA would not result in measurable degradation of water quality or affect changes to regional water quality trends (as presented in section 3.10.1.1).

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TABLE 4.10-1
STORMWATER RUNOFF POLLUTION LOADINGS

Pollutant	Daily Production Rate of Pollutant (mg/vehicle mile)[2]	Annual Pollutant Loadings (kg)							
		2004 - Base Year	No Build	CBA 1		CBA 2		CBA 3	
				Loading at 2026	Build/No Build Difference	Loading at 2026	Build/No Build Difference	Loading at 2026	Build/No Build Difference
Chemical Oxygen Demand	63.5	66,398.09	91,062.36	112,219.99	21,157.63	99,795.92	8,733.56	112,172.98	21,110.62
Suspended Solids	120	125,476.71	172,086.35	212,069.26	39,982.92	188,590.71	16,504.37	211,980.44	39,894.09
Floatable Solids	3.93	4,109.36	5,635.83	6,945.27	1,309.44	6,176.35	540.52	6,942.36	1,306.53
Settleable Solids	43.5	45,485.31	62,381.30	76,875.11	14,493.81	68,364.13	5,982.83	76,842.91	14,461.61
Oil	9.67	10,111.33	13,867.29	17,089.25	3,221.96	15,197.27	1,329.98	17,082.09	3,214.80
Chromium	0.0077	8.05	11.04	13.61	2.57	12.10	1.06	13.60	2.56
Copper	0.0696	72.78	99.81	123.00	23.19	109.38	9.57	122.95	23.14
Zinc	0.735	768.54	1,054.03	1,298.92	244.90	1,155.12	101.09	1,298.38	244.35
Lead	1.82	1,903.06	2,609.98	3,216.38	606.41	2,860.29	250.32	3,215.04	605.06
Nickel	0.062	64.83	88.91	109.57	20.66	97.44	8.53	109.52	20.61
Total Phosphorus	0.097	101.43	139.10	171.42	32.32	152.44	13.34	171.35	32.25
Total Nitrogen	3.4	3,555.17	4,875.78	6,008.63	1,132.85	5,343.40	467.62	6,006.11	1,130.33
TOTAL		258,054.66	353,911.77	436,140.41	82,228.64	387,854.56	33,942.78	435,957.73	82,045.96
% Increase Compared to No-Build					23.23		9.59		23.18
Vehicle Miles Traveled (millions of vehicles per day)		2,864,765	3,928,912		4,841,764		4,305,724		4,839,736

[1] Projected loading does not reflect reductions that would occur following implementation of best management practices.
[2] Reference: Sylvester and DeWalle, December 1972.

4.10.1.2 Impaired Waters

Figure 4.10-1 shows impaired waters (stream segments) that would be crossed by CBAs. Table 4.10-2 lists these impaired waters, sources of impairment, and those highway-related pollutants which could exacerbate or contribute to the existing impairment.

Relatively large portions of the Blackwater River watershed and a number of surface waters within the study area are classified as impaired on the basis of fecal coliform, sediments, and low dissolved oxygen. As set forth in the "305(b)/303(d) 2002 Integrated List of Assessed Waters in Virginia" (VDEQ, 2002), these impairments are related to agricultural runoff, concentrated livestock operations, and non-highway sanitation-related issues (such as failing septic systems). The major parameter of impairment in regional streams is fecal coliform – a parameter that would not be affected by highway construction. Another major parameter of impairment is dissolved oxygen. Since dissolved oxygen concentrations can become adversely low following algal blooms (typically a function of nutrient loading), VDOT would consider minimizing or restricting the use of nutrient-bearing fertilizers or would make use of stormwater management facilities that effectively prohibit nutrient loading of receiving waters for CBA crossings in the vicinity of streams heavily impaired due to low dissolved oxygen. Any increase in highway pollutant loading in the vicinity of Spring Branch is of particular concern due to the fact that Spring Branch currently fails to meet general benthic standards as a result of existing urban and industrial discharges. Any CBA crossing in the vicinity of Spring Branch would likely include stormwater management plans designed specifically to address these particular conditions.

Table 4.10-2
IMPAIRED WATERS CROSSED BY CBAS

Alternative	Impaired Waters Crossed	Sources(s) of Impairment	Highway-Related Pollutant(s) Which Could Contribute to Impairment
CBA 1	Eley Swamp	pH (natural conditions)	none
	Blackwater River between Route 460 and the state line	fish tissue - mercury	none
	Coppahaunk Swamp between headwaters & Blackwater River	fecal coliform	none
	Black Swamp between headwaters & Assamoosick Swamp	fecal coliform	none
	Warwick Swamp between headwaters & Blackwater River	dissolved oxygen, pH, fecal coliform	total phosphorus & total nitrogen loading effects upon dissolved oxygen
	Second Swamp between headwaters & Blackwater River	dissolved oxygen, fecal coliform	total phosphorus & total nitrogen loading effects upon dissolved oxygen
CBA 2	Eley Swamp	pH (natural conditions)	none
	Blackwater River between Route 620 & Antioch Swamp	dissolved oxygen, fecal coliform	total phosphorus & total nitrogen loading effects upon dissolved oxygen
	Coppahaunk Swamp between headwaters & Blackwater River	fecal coliform	none
	Spring Branch between Borden Chemical Plant discharge & Blackwater River (2 crossings)	general standard (benthic)	all
	Warwick Swamp between headwaters & Blackwater River	dissolved oxygen, pH, fecal coliform	total phosphorus & total nitrogen loading effects upon dissolved oxygen
	Second Swamp between headwaters & Blackwater River	dissolved oxygen, fecal coliform	none

Alternative	Impaired Waters Crossed	Sources(s) of Impairment	Highway-Related Pollutant(s) Which Could Contribute to Impairment
CBA 3	Eley Swamp	pH (natural conditions)	none
	Blackwater River between Route 620 & Antioch Swamp	dissolved oxygen, fecal coliform	total phosphorus & total nitrogen loading effects upon dissolved oxygen
	Coppahaunk Swamp between headwaters & Blackwater River	fecal coliform	none
	Spring Branch between Borden Chemical Plant discharge & Blackwater River	general standard (benthic)	all
	Blackwater River between Warwick Swamp & Cypress Swamp	dissolved oxygen, pH, fecal coliform	total phosphorus & total nitrogen loading effects upon dissolved oxygen
	Otterdam Swamp between headwaters & Blackwater River	dissolved oxygen, pH	total phosphorus & total nitrogen loading effects upon dissolved oxygen
	Blackwater Swamp between headwaters & Blackwater River	dissolved oxygen, pH, fecal coliform	total phosphorus & total nitrogen loading effects upon dissolved oxygen

4.10.1.3 Surface Drinking Water Supplies

Portions of watersheds deemed by the Virginia Department of Health to be important to public water supplies along with intakes for public drinking water supplies are shown in Figure 4.10-2. The easternmost 3.5 miles of each of the three CBAs would traverse a portion of the Lake Meade watershed which has been deemed by the Virginia Department of Health to be important to public water supplies owned by the City of Suffolk and the City of Portsmouth. Based on construction of a limited access highway on new alignment and a total pavement width of 76 feet (38 feet each direction), this 3.5-mile segment translates to 32.2 acres of impervious surface (2.7 percent of the 1,186-acre Lake Meade watershed). In addition, approximately 1.5 miles of CBA 2 and CBA 3 would traverse a portion of the Lake Prince watershed which has deemed by the Virginia Department of Health to be important to public water supplies owned by the City of Suffolk. This 1.5-mile segment translates to 13.8 acres of impervious surface (1.4 percent of the 1,011-acre Lake Prince watershed).

Intakes for public drinking water supplies located downstream of a CBA are listed in Table 4.10-3. Norfolk's Lake Prince intake is located 5.5 stream miles downstream of CBA 2 and CBA 3. Norfolk's Western Branch Reservoir intake is located 8.0 stream miles downstream of CBA 2 and CBA 3. Neither CBA would be located within the five-mile stream segment which the Virginia Department of Health generally considers critical to protection of intakes. On a long-term basis, construction of a CBA in the vicinity of a public water supply would increase the probability of contamination should pollutants be released as a result of traffic accidents or should pollutants typically carried as constituents of highway stormwater runoff be introduced via runoff. Considering (1) the relatively small increase of impervious surface with respect to total watershed acreage, (2) the distance of CBAs from nearest drinking water intakes, (3) the pollutant-lowering effects of natural attenuation and dilution that would occur over these distances, and (4) implementation of those mitigation measures discussed in section 4.10.1.4, the construction or operation of a CBA would not result in measurable degradation of surface water drinking supplies.

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FIGURE 4.10-1
IMPAIRED WATERS AND WATER QUALITY MONITORING STATIONS

FIGURE 4.10-2
SURFACE WATER RESOURCES

TABLE 4.10-3
POTENTIALLY AFFECTED PUBLIC SURFACE WATER SUPPLIES

Alternative	Facility Name / Facility Ownership	Distance Downstream to Nearest Intake
CBA 1	Lake Meade / City of Portsmouth	Not applicable – intake is upstream of receiving waters.
	Lake Cahoon / City of Portsmouth	Not applicable – no present intake
CBA 2	Lake Meade / City of Portsmouth	Not applicable – intake is upstream of receiving waters.
	Lake Cahoon / City of Portsmouth	Not applicable – no present intake
	Lake Prince / City of Norfolk	5.5 stream miles
	Western Branch Reservoir / City of Norfolk	8.0 stream miles
CBA 3	Lake Meade / City of Portsmouth	Not applicable – intake is upstream of receiving waters.
	Lake Cahoon / City of Portsmouth	Not applicable – no present intake
	Lake Prince / City of Norfolk	5.5 stream miles
	Western Branch Reservoir / City of Norfolk	8.0 stream miles

4.10.1.4 Mitigation Measures

Stormwater management facilities will be designed in accordance with specifications set forth in Section 3.14 of the Virginia Erosion and Sediment Control Handbook (1992) and VDOT's Annual Erosion and Sediment Control and Stormwater Management Standards and Specifications, as approved by VDCR. Detention/retention basins would be designed to function as temporary basins for sediment and erosion control during the construction of the CBA. After construction is complete, the basins would be restored to their original depth and converted into permanent stormwater management facilities. The number, locations, and abatement capacities of stormwater management facilities will be determined during later phases of project design. Pollutant removal efficiencies set forth in Table 4.10-4 will be used as a factor in determining the location and design of stormwater management facilities.

TABLE 4.10-4
EXPECTED POLLUTANT REMOVAL EFFICIENCY FOR STRUCTURAL BMPS

BMP Type	Typical Pollutant Removal (%)				
	Sediments	Nitrogen	Phosphorus	COD/BOD	Metals
Wet Ponds	90	48	65	30/*	*
Water Quality Inlets	20 - 40	< 10	< 10	< 10/< 10	< 10
Constructed Wetlands	50 - 80	< 30	15 – 45	*/*	50 - 80
Bioretention Facilities	90	68 – 80	70 – 83	*/*	93 - 98
Grassed Swales	70	25	30	25/*	50- 90
Extended Detention Ponds	68 - 90	28 -40	42 – 50	42 - 50/*	42 - 90
Infiltration Trenches	75 – 99	45 – 70	50 – 75	*/70 – 90	75 - 99
Hydrodynamic Separators	50 – 90	*	*	*/*	*
Infiltration Basins	75 – 99	45 – 70	50 – 70	*/70 – 90	50 - 90
Porous Pavement	82 – 95	80 – 85	65	*	*

* Insufficient data
Source: FHWA, 1996.

Certain components of the CBAs could be located near enough to public surface water supplies as to require special mitigation measures, both during and following construction. The exact nature of these

measures are dependent on the distance between the facility and nearest pathways to a surface water critical to a public drinking water supply and the future assessment of the pollutant-lowering effects of natural attenuation and dilution that would occur over these distances. Stormwater management basins located near public water supplies would likely be designed with adequate detention time to allow spilled contaminants to be pumped out before they can enter the water supply. Although a spill consisting of the entire contents of a tanker truck would be unlikely, runoff entering stormwater management basins could be routed from the inlet pipe to a dry sump area sized to capture the volume of a tanker truck (1,100 cubic feet). In the event of a spill, local spill response personnel would initiate a Level II response to contain the spill and prevent its spread through the use of absorbent booms and pads. Heavy trucks, such as those carrying hazardous materials, need longer highway stopping sight distances, particularly on crest vertical curves and horizontal curves. VDOT will consider enhanced design options along critical portions of a CBA - including shoulders on horizontal curves, both on the roadway and on ramps, which are common sites of accidents. VDOT will consider geometric design in environmentally sensitive areas based on higher-than-minimum standards to enhance truck safety, thereby further reducing the probability of a truck running off the road.

All CBAs will require a Stormwater Management Program Permit from VDCR for construction activities affecting greater than one acre and an approved erosion and sediment control plan. During and immediately following construction, multiple measures (such as erosion and sediment controls, a phased plan to limit the amount of exposed soil, and oversight by a full-time erosion and sediment control inspector) would likely be implemented in the vicinity of surface waters critical to public water supplies or special aquatic habitat. Erosion and sediment controls considered would consist of temporary filter barriers, temporary silt fences, temporary sediment traps, jute mesh and EC-3 mat erosion control ditches, Type II rock check dams, culvert inlet protections, diversion dikes, block and gravel sediment filter curb inlet protection, block and gravel sediment filter drop inlet protection, stone outlet protection, and Type II turbidity curtains. Design components intended to avoid, minimize, and mitigate adverse water quality effects will be considered for implementation during later phases of project design and development.

With implementation of appropriate mitigation measures and BMPs, the long-term operation and maintenance of a CBA would not result in measurably adverse impacts to public water supplies, water-related recreational opportunities, or aquatic habitat values due to degradation of water quality.

4.10.2 Groundwater Resources

Highway runoff can have a measurable effect on groundwater, including changes in water quality within the vadose zone and the saturated zone. Highway runoff effects on groundwater are often spatially limited, however, due to local hydrological conditions as well as pollutant sorption processes within and above the aquifer (Barrett, et al, 1993). For example, studies have demonstrated that the impact of deicing on the surrounding soil is limited to a distance of approximately 50 feet (15 meters) from the edge of pavement (California Department of Transportation, 1992). Roadway projects result in the introduction of pollutants normally associated with vehicular traffic. If not addressed through appropriate stormwater management, this situation can lead to water quality problems (an increase in nonpoint pollutant loading). If unabated, roadway runoff and other nonpoint source pollution can adversely impact water quality of nearby water supply wells or groundwater recharge areas. Infiltration could introduce contaminants typically carried in stormwater runoff (primarily salts and heavy metals) unless adequate BMPs are employed.

No sole source aquifers, as defined under Section 1424(e) of the Safe Drinking Water Act, have been designated in Virginia (EPA, 1999). The Commonwealth of Virginia currently has no approved wellhead protection program (EPA, 1999).

4.10.2.1 Effects

CBAs were assessed to determine whether they would be located within the currently recommended (i.e., non-regulatory) 1,000-foot (305-meter) wellhead protection radius set forth in the Virginia model

ordinance (Virginia Ground Water Protection Steering Committee, 1998) or the 100-foot (30.5-meter) wellhead setback zone specified in Virginia Waterworks Regulations (VR 355-18-000) for public groundwater supply wells. Public groundwater resources (i.e., public water supply wells and associated 1,000-foot wellhead protection radius) within the study area, are shown in Figure 4.10-3. As shown in Figure 4.10-3, CBA 2 would encroach upon the non-regulatory 1,000-foot wellhead protection radius at three well locations. CBA 2 would also encroach upon the 100-foot wellhead setback zone (specified in Virginia Waterworks Regulations) at one of the three aforementioned well locations. Neither CBA 1 nor CBA 3 would encroach upon a 1,000-foot wellhead protection radius or a 100-foot wellhead setback zone.

Effects on public groundwater supplies in the vicinity of the aforementioned CBA 2 encroachments could include potentially measurable increases in dissolved metals and chloride along with increased risk of spills during construction. In these areas, special mitigation measures, both during and following construction may be required. Similar to the situation with surface water supplies, construction of a CBA in the vicinity of a public groundwater supply well would increase the probability of contamination should contaminants be suddenly released as a result of a traffic accident.

4.10.2.2 Mitigation

Measures evaluated by VDOT during later design phases to avoid or minimize effects to groundwater supplies would include (1) pollution prevention plans implemented during critical phases of construction and (2) design of stormwater drainage systems to prevent the infiltration of liquid contaminants or contaminated runoff. Measures that VDOT will consider to protect nearby groundwater supply wells would include (1) routing of runoff laden with deicing agents away from well recharge zones, (2) stormwater management facilities developed during later design phases to optimize free ion retention through use of organic soil linings, etc., and (3) development of SPCC plans. Plans will likely be developed in accordance with Virginia Waterworks Regulations and any wellhead protection ordinances subsequently developed by local governments and service authorities. During later design phases, VDOT will evaluate the use of stormwater management facilities designed to intercept and retain spilled materials before they can reach a water supply well aquifer (through possible use of detention/ retention basins and stormwater conveyance routes which avoid direct infiltration to aquifer recharge areas and wellhead protection zones). VDOT will consider the use of stormwater facilities designed with adequate detention times to allow recovery of spilled contaminants before such contaminants can reach a critical groundwater supply area. The exact nature of these facilities are dependent on the distance between a CBA and the nearest pathways to recharge zones critical to a public drinking water supply and the future assessment of the pollutant-lowering effects of natural attenuation and dilution that would occur over these distances. To mitigate temporary construction impacts, an erosion and sediment control plan developed in accordance with the Virginia Sediment and Erosion Handbook and VDOT's Annual Erosion and Sediment Control and Stormwater Management Standards and Specifications (as approved by VDCR) will be implemented.

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FIGURE 4.10-3
PUBLIC GROUNDWATER SUPPLIES

4.11 TERRESTRIAL NATURAL COMMUNITIES, WILDLIFE HABITAT, AND BIODIVERSITY

4.11.1 Terrestrial Natural Communities

Figure 4.11-1 illustrates types of forest communities (as classified under the Anderson Land Use Classification) located within CBA assessment corridors. The majority of the forest lands in the study area are fragmented by agricultural lands, timbered clear-cuts, transportation corridors, utility easements, and, to a lesser extent, by residential and commercial development. Characteristics of these forest types along with their correlation to community types defined under the Natural Communities of Virginia: Classification of Ecological Community Groups: Second Approximation (VDCR, DNH, 2004) are provided in the Natural Resources Technical Report (VDOT, 2005). Forested wetlands are addressed as components of the riparian and aquatic ecological communities in sections 4.12 and 4.13 of this document.

Figure 4.11-1 also illustrates agricultural lands and transitional lands (primarily brush and old fields) located within CBA assessment corridors. A more-detailed discussion of ecological and habitat issues associated with agricultural lands and transitional lands is presented in the Natural Resources Technical Report (VDOT, 2005).

Construction of any of the CBAs would result in effects to the general ecology of forest lands, agricultural lands, and transitional lands. In addition, the wildlife habitat associated with these land cover types and the regional biodiversity would be affected by construction and operation of the roadway. The CBAs would affect terrestrial natural communities and associated wildlife habitat through conversion of existing land coverage to paved road surfaces and maintained right-of-way. This conversion would result in the permanent loss of wildlife habitat and could affect wildlife migration patterns. Using a 500-foot-wide Planning Corridor and a 230-foot-wide Design Corridor, terrestrial natural communities affected under each of the CBAs are provided according to land cover classification in Table 4.11-1.

Overall, CBA 3 would result in the greatest combined affects to terrestrial natural communities at 3,165 acres for the Planning Corridor and 1,709 acres for the Design Corridor. The 3,165 acres potentially affected within the Planning Corridor of CBA 3 comprise 0.72 percent of the total terrestrial natural communities occurring within the study area. The 1,709 acres potentially affected within the Design Corridor of CBA 3 comprise 0.39 percent of the total terrestrial natural communities occurring within the study area. Because CBA 2 would make use of a greater acreage of presently developed corridors (i.e., those along existing US 460), it would result in the least combined affects to terrestrial natural communities at 2,611 acres for the Planning Corridor and 1,159 acres for the Design Corridor. The 2,611 acres potentially affected within the Planning Corridor of CBA 2 comprise 0.59 percent of the total terrestrial natural communities occurring within the study area. The 1,159 acres potentially affected within the Design Corridor of CBA 2 comprise 0.26 percent of the total terrestrial natural communities occurring within the study area. Cumulative effects with respect to terrestrial natural communities of the region are discussed in section 4.19 (Cumulative Impacts). No National Forests, National Wildlife Refuges, or known unique or significant communities (“unique or state significant natural communities” of VDCR, Division of Natural Heritage terminology) would be affected by any of the CBAs.

It is reasonable to assume that a certain amount of minor effects to the general ecology and wildlife habitat values of forest lands, agricultural lands, and transitional lands will occur during implementation of programmed improvements associated wit the No-Build alternative; however, the current level of design for such improvements does not allow for quantification of such effects at this point in time.

FIGURE 4.11-1
TERRESTRIAL NATURAL COMMUNITIES

TABLE 4.11-1
POTENTIALLY AFFECTED TERRESTRIAL NATURAL COMMUNITIES

Alternative	Assessment Area	Forest Type (acres)								Agricultural Lands (acres)		Transitional Lands (acres)	
		Deciduous (Upland Hardwood)	% of total in study area	Evergreen (including planted pine variant)	% of total in study area	Mixed Hardwood/ Pine	% of total in study area	Total	% of total in study area		% of total in study area		% of total in study area
CBA 1	Planning Corridor	130.73	0.50	354.31	0.64	1,699.23	0.80	2,184.27	0.74	964.50	0.67	4.44	3.18
	Design Corridor	67.73	0.26	194.82	0.35	877.06	0.41	1,139.61	0.39	516.74	0.36	3.06	2.19
CBA 2	Planning Corridor	228.94	0.87	208.46	0.38	932.18	0.44	1,369.58	0.46	1,236.78	0.86	4.44	3.18
	Design Corridor	105.74	0.40	116.34	0.21	376.84	0.18	598.92	0.20	557.46	0.39	3.06	2.19
CBA 3	Planning Corridor	229.59	0.87	502.61	0.90	1,199.21	0.56	1,931.41	0.66	1,229.15	0.85	4.44	3.18
	Design Corridor	121.63	0.46	268.48	0.48	608.27	0.29	998.38	0.49	707.07	0.49	3.06	2.19
No-Build	not applicable	minor		minor		minor		minor		minor		minor	

4.11.2 Biodiversity

Figure 4.11-2 shows locations of potentially affected biodiversity-ranked (BRANK) communities. Figure 4.11-2 presents ranked terrestrial communities ("Conservation Sites" of DNH terminology) as well as ranked aquatic communities ("Steam Conservation Units" of DNH terminology, which are discussed in section 4.12 of this document). A complete listing of rare or unique terrestrial natural communities having a biodiversity ranking is provided in the Natural Resources Technical Report (VDOT, 2005).

Due to a long history of agricultural and sylvicultural activities, most uplands within the region are so highly fragmented that they afford limited contribution with respect to wildlife corridors. Riparian corridors, on the other hand, have been less altered over history and presently serve as components of several prominent wildlife corridors within the study area. For the purpose of this assessment, these prominent wildlife corridors have been considered to be those areas associated with contiguous forest communities and/or riparian zones which are wider than 0.5 miles throughout most of their length and are not presently bisected by major roadways or other impediments to migration. Prominent wildlife corridors informally identified as part of this study and their relationship to state-ranked biodiversity resources are shown on Figure 4.11-2. Prominent wildlife corridors generally greater than 0.5 mile in width consist of:

- an east-west riparian corridor along the middle to upper Blackwater River (extending roughly from the Town of Dendron westward into central Prince George County);
- an east-west riparian corridor formed by Otterman Swamp and the headwaters of Cypress Swamp (extending roughly from the Town of Surry westward to the Blackwater River in central Prince George County);
- a north-south riparian corridor formed by the headwaters of Wards Creek, Otterman Swamp tributaries, a portion of Warwick Swamp, Black Swamp, and the headwaters of Assamoosick Swamp (extending roughly from north-central Prince George County southward into northwestern Surry County); and
- a north-south riparian corridor along Cypress Swamp (in central Surry County).

Several other prominent wildlife corridors generally having a width *less* than 0.5 mile are located within the study area. These narrower wildlife corridors consist of:

- a north-south riparian corridor formed by Green Swamp, Mill Swamp, and Rattlesnake Swamp (extending roughly from the Town of Surry southward to the Blackwater River in northern Southampton County); and
- a north-south riparian corridor along the lower Blackwater River (extending roughly from the Town of Dendron southward to the City of Franklin).

Biodiversity of a particular area or region is determined by a number of complexly inter-related factors. For the purpose of this assessment, general effects to overall biodiversity is expressed as a function of (1) the number of acres of terrestrial natural communities affected, (2) the number of BRANK sites that would be encroached upon, and (3) the number of prominent wildlife corridors that would be further dissected. Results of this assessment are presented in Table 4.11-2. Compared to other CBAs and the No-Build, CBA 3 would result in the greatest probable effects to biodiversity of the study area. By contrast, CBA 2 would result in the least probable effects to biodiversity of the study area.

TABLE 4.11-2
SUMMARY OF BIODIVERSITY EFFECTS

Alternative	Absolute and Relative Effects						Relative Effect (No. units)
	Effects on Terrestrial Natural Communities (Acres)	Percent of Total	BRANK site Encroachment (No.)	Percent of Total	Wildlife Corridor Bisections (No.)	Percent of Total	
CBA 1	3,153	*0.35*	4	*0.36*	2	*0.29*	1.00
CBA 2	2,611	*0.29*	3	*0.28*	1	*0.14*	0.71
CBA 3	3,165	*0.36*	4	*0.36*	4	*0.57*	1.29
Total Effects	8,929		11		7		

Right-of-way necessary for a new or widened highway would convert a portion of forest lands and agricultural lands to successional herbaceous and shrub communities. This conversion will lead to the inadvertent creation of edge habitat that will intrinsically have certain attractive values to wildlife (particularly for bird species). Although edge habitat can beneficially contribute to biodiversity and provide certain wildlife habitat functions, its inadvertent creation along rights-of-way must be weighed against potential adverse effects (such as increased probability and frequency of wildlife vehicle collisions).

4.11.3 Migratory Birds Relying on Terrestrial Habitat

Eleven FWS-listed "Species of Management Concern" which rely entirely or primarily upon terrestrial habitat have been reported to occur within the study area (Virginia Department of Game and Inland Fisheries, VAFWIS, accessed April 2005). Only one of these terrestrial "Species of Management Concern", the grasshopper sparrow (*Ammodramus savannarum pratensis*) is reported to be dependant upon vulnerable or restricted habitat. The loss of habitat for the grasshopper sparrow is an effect that can be directly attributed to roadway construction and indirectly attributed to development potentially induced around interchanges, whereas listing of the other ten terrestrial "Species of Management Concern" is attributed to factors which cannot be shown to be associated with roadway projects. The grasshopper sparrow is a statewide summer resident which breeds statewide (Virginia Society of Ornithology, 1987). The species is usually encountered in xeric (drier) pastures sometimes interspersed with weeds or shrubs (Hamel, 1992; Rising, 1996), or in abandoned fields and stable grassland (Virginia Department of Game and Inland Fisheries, 2005). Despite availability of habitat, abundance of the grasshopper sparrow fluctuates from year to year for unknown reasons (Sprunt, 1954). Adverse management practices which could be contributing to fluctuations in abundance include (1) the application of pesticides and herbicides and (2) haying and mowing operations during times of residency (Virginia Department of Game and Inland Fisheries, 2005). Management practices identified as being beneficial to the species include (1) restricting or regulating human uses of habitat, (2) use of prescribed or controlled burns to create or maintain habitat during periods on non-residency, (3) controlling the grazing of domestic livestock, and (4) use of haying and mowing to create or maintain habitat during periods on non-residency (Virginia Department of Game and Inland Fisheries, 2005).

CBA 2 and CBA 3 would result in comparable direct losses of agricultural lands and transitional lands, some of which could serve as suitable habitat for the grasshopper sparrow (1,237 acres and 1,229 acres, respectively). By contrast, CBA 1 would result in the direct loss of 965 acres of agricultural lands and transitional lands, some of which could serve as suitable habitat for the grasshopper sparrow. With respect to intensity of effects, none of the CBAs would result in severe direct effects to suitable habitat on a regional basis (ranging between 0.67 percent and 0.86 percent of total agricultural lands and transitional lands within the study area). Cumulative effects with respect to terrestrial natural communities of the region are discussed in section 4.19 (Indirect Effects and Cumulative Impacts).

FIGURE 4.11-2
BIODIVERSITY RANKED SITES AND PROMINENT WILDLIFE CORRIDORS

4.11.4 Mitigation

Cut and fill will be minimized to the extent practicable to ensure structural stability of the roadway and associated structures (using steeper-than-conventional slopes in environmentally sensitive areas, etc.). In addition, the implementation of best management practices (BMPs) for erosion/sediment control and abatement of pollutant loading will minimize secondary impacts to adjoining communities and habitat. Best management practices and invasive species control measures will be implemented to control colonization and spread of terrestrial invasive plants.

Provision of right-of-way for a new or widened highway would convert a portion of forest lands and agricultural lands to successional herbaceous and shrub communities. As part of this conversion, features designed to intentionally provide wildlife habitat or to attract wildlife will not be included in vegetation establishment/management plans developed for rights-of-way; however, it is anticipated that provision of maintained rights-of-way will lead to the creation of forest edge habitat that will intrinsically have certain values to wildlife habitat (particularly for bird species). To mitigate potentially adverse effects associated the inadvertent attraction of wildlife to newly created edge habitat along rights-of-way, VDOT will consider excluding landscape options that would intentionally provide wildlife habitat or attract wildlife (such as the use of plant species having high wildlife feeding values) from vegetation establishment/management plans developed for rights-of-way and wildlife fencing will be installed as needed. As discussed below, the use of persistently tall herbaceous vegetation and shrubs will be considered to minimize the frequenting of rights-of-way by the grasshopper sparrow.

Where feasible, passageways for terrestrial and riparian wildlife will be maintained beneath proposed bridges and certain elevated structures to help minimize effects of wildlife corridor bisection. Fencing will be employed to help minimize vehicle-wildlife collisions and to help direct wildlife towards maintained passageways. Practicable mitigation measures to minimize effects of habitat fragmentation will be further developed and designed prior to preparation of permit applications.

In its 9 December 2004 letter to FHWA, FWS recommended that direct effects to terrestrial natural communities and associated adverse effects upon regional biodiversity be mitigated through such means as restoration or enhancement of habitat, conservation initiatives, riparian corridor restoration, establishing vegetated buffers along field edges for edge habitat, and upland forest corridor restoration. In addition, VDOT will consider preservation or creation of upland buffers around compensatory wetland mitigation sites – a measure that would also contribute to overall biodiversity. Use of such buffers would be evaluated during later phases of project design and permitting. Payment-in-lieu to VDGIF for purchase of lands for enlargement of Wildlife Management Areas will be considered as one means of mitigation that could be reasonably pursued under the current regulatory environment. Such acquisition would be targeted at restoring, enhancing, or preserving forest lands critical to establishment or maintenance of wildlife corridors and migratory bird habitat within the region, as set forth in the "Resource Protection" mission goal of the *Blueprint for the Future of Migratory Birds: Migratory Bird Program: Strategic Plan 2004-2014* (U.S. Dept. of the Interior, Fish and Wildlife Service, 2004). Mitigation measures such as expanding the size of existing Natural Area Preserves (NAPs) also will be considered in cooperation with VDCR-DNH and The Nature Conservancy.

With respect to management practices for the grasshopper sparrow:

- Landscaping options which would restrict or discourage the species from frequenting rights-of-way (thereby reducing the probability and frequency of wildlife/vehicle collisions) would be developed during late phases of project design and permitting. This could include methods such as (1) minimizing mowing operations in critical areas and (2) planting of wildflowers and shrubs rather than grasses within the right-of-way.
- To avoid or minimize adverse effects to nearby habitat, stormwater management facilities would be designed to detain and/or treat pesticides and herbicides applied within the right-of-way.
- It is not reasonable to expect that VDOT could restrict or regulate human uses of habitat resulting from land development patterns indirectly associated with construction of a new or improved

transportation corridor. Instead, potential indirect effects upon suitable habitat would be the responsibility of localities under respective zoning ordinances and land use policies.

4.12 AQUATIC NATURAL COMMUNITIES, WILDLIFE HABITAT, AND BIODIVERSITY

This section addresses aquatic habitat associated primarily with waterways and water bodies; however, many of the species discussed in this section are also dependent on wetland habitats. Wetlands are discussed in greater detail in Section 4.13.

4.12.1 Aquatic Habitat and Benthic Communities

4.12.1.1 Direct Effects

Without appropriate mitigation, CBA stream crossings have the likelihood of increasing stormwater pollutant loading and locally altering stream hydrology and bottom characteristics at culvert and bridging locations. Stormwater pollutant loading projected for each of the CBAs is presented in the Water Quality Technical Report (VDOT, 2005). Linear feet of streams affected at stream crossings is discussed below and in section 4.13 (waters of the U.S.). Stream bed and stream banks would be affected within those stream reaches addressed below and in section 4.13. Any CBA that crosses an impaired or degraded stream (see the Water Quality Technical Report for affected Impaired Streams) has a relatively greater likelihood of adversely affecting in-stream and benthic communities due to the already stressed nature of these aquatic habitats.

No designated Essential Fish Habitat (NOAA Fisheries Service, website accessed March 2005), trout waters, or anadromous fish runs (VDGIF, VAFWIS; accessed February, 2005) are located within areas potentially affected by the CBAs. As discussed in section 4.15, a state-listed endangered fish species (the blackbanded sunfish or *Enneacanthus chaetodon*) occurs in Blackwater Swamp (near Route 156 in Prince George County), in Cypress Swamp (just upstream of Route 616 in Surry County), and in Harrells Millpond and the headwaters of Coppahaunk Swamp (just south of Route 460 between Wakefield and Waverly). With the exception of the blackbanded sunfish, fish assemblages of study area streams are comprised of generally abundant and commonly occurring warmwater game and non-game species typical to eastern seaboard streams. Without implementation of best management practices or effective mitigation measures, direct effects to warmwater fisheries of the study area would include loss of habitat and impediments to upstream/downstream migration. Within the Planning Corridor, loss of in-stream fish habitat (excluding wetlands) would range from 49,622 feet of stream under CBA 2 to 75,085 feet of stream under CBA 3. Within the Design Corridor, loss of in-stream fish habitat (excluding wetlands) would range from 24,062 feet of stream under CBA 2 to 37,361 feet of stream under CBA 3. Given the large amount of streams conducive to warmwater fisheries within the region, these direct losses are not considered severe. With proposed spanning of major stream crossings on structure and minimizing the amount of fill placed in the vicinity of stream crossings to only that amount required to assure integrity of placed fill and/or structures, direct effects to warmwater fisheries habitat or fish populations will be minor.

Three common species of freshwater mussels (the yellow lance, the eastern elliptio mussel, and the paper pondshell mussel), although sparsely distributed within the study area, occur within certain segments of the Blackwater River and its major tributaries (such as Terrapin Swamp) (VDGIF, VAFWIS; accessed February, 2005) that would be crossed by a particular CBA. As previously stated, loss of stream bed within the Design Corridor would range from 24,062 feet of stream under CBA 2 to 37,361 feet of stream under CBA 3; however, due to high turbidity and presence of fine-grained sediment loading, only a small portion of affected stream bed serves as suitable habitat for mussels. Macrobenthic organisms are common to a wide range of streams within the study area, are not restricted to a particular type of stream bed, and would be negligibly affected by loss of stream bed proposed stream crossings.

Direct effects to aquatic organisms relying primarily on in-stream resources (i.e., habitat loss and degradation) are measured in terms of linear feet of streams affected within the Design Corridor. In the

absence of best management practices, implementation of a CBA would result in localized water quality degradation, habitat loss or degradation, and temporary to longer-term reductions in local populations. Expressed in terms of direct stream impacts to both perennial and intermittent streams within the Design Corridor, CBA 3 (at 37,361 feet of streams affected) would result in the greatest adverse effects to benthic and in-stream resources within the study area. CBA 1 (at 32,865 feet of streams affected) would result in the next greatest adverse effects to benthic and in-stream resources within the study area, while CBA 2 (at 24,062 feet of streams affected) would result in the least adverse effects to benthic and in-stream resources within the study area.

Direct effects to organisms which rely primarily on riparian habitat can be related to acres of riparian zone within the proposed construction footprint. At 189 acres, CBA 1 will result in the greatest impacts to riparian habitat within the study area. Riparian habitat losses of 61 acres would result from implementation of CBA 2, compared to 129 acres for CBA 3. In addition, the permanent removal of riparian vegetation along affected stream segments would pose a long-term adverse effect upon in-stream habitat by reducing or eliminating sources of snags and course bottom detritus (Angermeier, et al, 2004).

Adverse effects upon aquatic communities during construction would include temporary increases in turbidity, temporary removal of riparian vegetation, short-term migration of mobile species away from disturbance, and incidental mortality contributing to temporary decreases in local populations.

It is reasonable to assume that minor effects to the general ecology and wildlife habitat values of aquatic resources will occur during implementation of the No-Build and TSM alternatives; however, these effects would be minor in comparison to CBA effects.

4.12.1.2 Indirect effects

A net increase in impervious surfaces resulting from the construction of a CBA could increase peak rates of discharge to receiving waters, thus resulting in an increased amount of stormwater to retain and treat. Increased volumes of stormwater resulting from any additional infrastructure or impervious surfaces does not, however, necessarily translate into worse water quality in receiving waters when appropriate best management practices are employed. Indirect effects to fish and fish habitat would include sediment and pollutant loading of streams during construction and operation of the facility. Aquatic biota (especially sessile fauna such as macrobenthic organisms and shellfish) could be adversely affected by direct highway construction impacts and aquatic ecosystem degradation. In the absence of erosion and sediment control measures and stormwater best management practices, these groups would be particularly vulnerable to stream siltation and pollutant loading both during construction and facility operation. Indirect effects will be avoided or minimized through implementation of erosion and sediment control plans and stormwater management facilities.

For the No-Build Alternative, minor increases in volumes of stormwater could result from additional infrastructure or impervious surfaces (such as provision of turning lanes, widening of shoulders, adjusting grades to improve sightlines, etc.).

4.12.1.3 Mitigation

Options for mitigation include restoration and/or reforestation of habitat, riparian communities, and floodplain or the establishment of vegetated buffers along field edges. Opportunities for restoration of degraded stream segments exist along many study area streams where adjoining agricultural practices have channelized once-natural stream channels, removed riparian vegetation, or resulted in acute siltation. Examples of stream segments where such restoration could occur are listed in section 4.13.2.2. Should one of the CBAs be selected, areas suitable for riparian buffer establishment will be further evaluated during the preliminary design phase for purposes of on-site habitat restoration. General and specific design measures and construction techniques that will be considered include fencing, stream channel enhancements, and stream access.

All effects to aquatic habitat would not necessarily be permanent. Highway crossings of streams can obstruct movements of aquatic organisms by altering flow velocity, stream geometry, and gradients. With the counter-sinking road crossing culverts, hydrologic connectivity can be maintained so as to reduce the mortality of and increase mobility of affected aquatic organisms. Additionally, culverts would be designed to maintain low-flow channels to minimize the possibility of obstructing aquatic organism passage. Post-construction restoration measures will be employed to restore temporarily affected habitat to pre-construction conditions, thereby allowing the recovery and re-establishment of locally affected aquatic and benthic populations. The success of this recovery will be enhanced by implementation and maintenance of both erosion and sediment control and stormwater best management practices. To avoid or minimize localized temporary siltation of streams, site-specific measures to monitor and control siltation would be required as part of VDOT contract bid packages and water quality permits issued by the regulatory agencies. At the design phase, VDOT will assess appropriate means to incorporate cost-effective features into the highway design.

4.12.2 Waterfowl and Other Water-Dependent Migratory Birds

4.12.2.1 Effects

One hundred sixteen water-dependent migratory bird species listed for protection under the Migratory Bird Treaty Act potentially exist within the study area (VDGIF, VAFWIS accessed 2004) (see Appendix A of the Natural Resources Technical Report (VDOT, 2005)). Of these 116 species, seven have been listed as "Species of Management Concern" for the northeast region (FWS, 1995). Of the seven water-dependent "Species of Management Concern" within the region, the "reason for concern" for one of these species (the least bittern or *Ixobrychus exilis*) is reported to be "dependence on vulnerable or restricted habitats". For the remaining six species, the FWS-designated "reason for concern" is not directly linked to habitat loss.

The least bittern is a common transient and uncommon summer resident of the Coastal Plain of Virginia (Virginia Society of Ornithology, 1979). The species is usually encountered in freshwater marshes, but may also be found in brackish and salt water marshes (Harrison, 1975). Preferred habitat is wetlands with dense, tall emergent vegetation over relatively deep water interspersed with patches of open water (Schneider and Pence, eds., 1992). This preferred habitat most closely correlates to palustrine emergent wetlands and palustrine scrub-shrub wetlands of the study area. Adverse management practices which adversely affect habitat include (1) marsh drainage and other activities leading to loss of marsh lands, (2) pollution, (3) application of pesticides, and (4) development activities (Terres, 1982). Management practices identified as being beneficial to the species include (1) creating, maintaining, and protecting wetlands; (2) controlling sedimentation; (3) controlling pollution; (4) restricting and regulating human use of habitats; and (5) creating and maintaining ponds (Virginia Department of Game and Inland Fisheries, 2005).

Considering palustrine emergent and scrub-shrub wetlands as suitable habitat for the least bittern, CBA 3 would affect 40.95 acres, CBA 1 would affect 36.57 acres, and CBA 2 would affect 35.82 acres of suitable habitat. With respect to severity of effects, none of the CBAs would result in significant direct effects to suitable habitat on a regional basis (ranging between 0.24 percent and 0.26 percent of total emergent and scrub-shrub wetlands within the study area). Cumulative effects with respect to terrestrial natural communities of the region are discussed in section 4.19 (Indirect Effects and Cumulative Impacts).

4.12.2.2 Mitigation

With respect to management practices for the least bittern:

- Beyond those wetland avoidance and minimization measures identified as part of this planning study, other practicable means to avoid and further minimize effects to wetlands will be implemented during later phases of project design and permitting. Suitable habitat would be mitigated at a 1:1 ratio for emergent wetlands and 1.5:1 for scrub-shrub wetlands.

- To avoid or minimize adverse effects to nearby habitat, stormwater management facilities would be designed to detain and/or treat (1) pesticides and herbicides applied within the right-of-way, (2) highway-related pollutants conveyed in stormwater, and (3) sedimentation resulting form construction activities and facility operation.
- Means to restrict or limit landscaping activities having the potential of attracting the species to the highway corridor (thereby resulting in a higher probability of mortality due to wildlife/vehicle collisions) would be developed during late phases of project design and permitting. This could include methods to discourage the species from frequenting the highway corridor, such as (1) minimizing mowing operations in critical areas and (2) planting of wildflowers and shrubs rather than grasses within the right-of-way.
- It is not reasonable to expect that VDOT could restrict or regulate human uses of habitat resulting from land development patterns indirectly associated with construction of a new or improved transportation corridor (see section 4.19). Instead, potential indirect effects upon suitable wetlands habitat would be the responsibility of (1) localities under respective zoning ordinances and land use policies and (2) the Corps of Engineers under section 404 of the Clean Water Act, and (3) DEQ under the Virginia Water Protection Permit Program.

4.12.3 Biodiversity of Aquatic Habitat

4.12.3.1 Effects

Biodiversity-ranked aquatic communities known as Stream Conservation Units (SCUs) designated by Virginia DNH are discussed in more detail in the Natural Resources Technical Report (VDOT, 2005). Potentially affected SCUs are presented in Table 4.12-1 and are shown in Figure 4.11-2. The Antioch Swamp SCU is classified as a resource of "moderate significance" by DNH because it serves as a "good" example of a community of its type and exhibits "excellent to good" occurrence of state-rare species.

Table 4.12-1
BIODIVERSITY RANKED STREAM CONSERVATION UNITS AFFECTED

SCU AFFECTED	BIODIVERSITY RANKING	ENCROACHING ALTERNATIVE(S)
Antioch Swamp	B4 (Moderate Significance)	CBA 1 (3 Crossings) CBA 2 (1 Crossing) CBA 3 (3 Crossings)

Source: Virginia Department of Conservation and Recreation, Division of Natural Heritage, November 2002; PB, 2002.

Compared to adjoining uplands (which have been altered over a long history of agricultural and sylvicultural activities), riparian corridors have been less altered over history and presently serve as components of several prominent wildlife corridors within the study area. In all cases, these prominent wildlife corridors are associated with contiguous forest communities. Prominent wildlife corridors informally identified as part of this study and their relationship to state-ranked biodiversity resources are shown on Figure 4.11-2.

Biodiversity of a particular stream system or stream segment is determined by a number of complexly inter-related factors. For the purpose of this assessment, general effects to regional aquatic biodiversity is expressed as a function of (1) linear feet of perennial streams affected, (2) linear feet of intermittent streams affected, (3) the number of SCU crossings, (4) the number of prominent riparian wildlife corridors that would be further dissected, and (5) the acreage of riparian zone that would be affected. Results of this assessment are presented in Table 4.11-2.

TABLE 4.12-2
SUMMARY OF BIODIVERSITY EFFECTS (PLANNING CORRIDOR)

Alternative	Absolute and Relative Effects										Relative Effect (no units)
	Perennial Streams Affected (feet)	Percent of Total	Intermittent Streams Affected(feet)	Percent of Total	Number of SCU Crossings	Percent of Total	Number of Riparian Corridors Bisected	Percent of Total	Riparian Zone Affected (acres)	Percent of Total	
CBA 1	20,406	0.31	53,634	0.41	3	0.43	2	0.33	189	0.50	1.98
CBA 2	27,406	0.41	22,216	0.17	1	0.14	1	0.17	61	0.16	1.05
CBA 3	19,016	0.28	56,069	0.42	3	0.43	3	0.50	129	0.34	1.97
Total (Additive Effects)	66,828	n/a	131,919	n/a	7	n/a	6	n/a	379	n/a	n/a

Compared to other CBAs and the No-Build, CBA 1 would result in the greatest probable effects to biodiversity of the study area, although the difference with CBA 3 is negligible. By contrast, CBA 2 would result in the least probable effects to biodiversity of the study area.

4.12.3.2 Mitigation

A riparian ecosystem consists not only of the stream channel and banks, but also the adjacent floodplain and transitional upland fringe (USDA, NRCS, 1998). Mitigation of adverse effects upon regional biodiversity through riparian corridor restoration would have limited long-term effectiveness unless chronic land uses can be restricted or regulated within the entire watershed and unless *all* key elements of the riparian ecosystem (including headwaters) are afforded protection under the restoration plan (USDA, NRCS, 1998). Considering the fact that the vast majority of lands comprising the various watersheds within the study area are privately owned and, considering the infeasibility of VDOT being able to acquire expanses of land large and contiguous enough to render stream restoration effective, this option is not considered viable through direct implementation by VDOT. Should a CBA be selected, payment in-lieu into a comprehensive landscape management program administered by a local Soil and Water Conservation District, the Natural Resources Conservation Service, the Virginia Department of Conservation and Recreation, or The Nature Conservancy would instead be pursued as a form of mitigation which would benefit regional biodiversity. Preferred areas for mitigation efforts involving riparian corridor restoration and/or preservation are the Antioch Swamp SCU (located just upstream and downstream of Route 460 on the Blackwater River), the Hickaneck Swamp Conservation Site (located just upstream of Route 460 on the Blackwater River), and the Zuni Pine Barrens Conservation Site (located just downstream of Route 460 on the Blackwater River). These areas are characterized by relatively high species richness, support populations of several state-listed species, and contain stream segments that are impaired due to high fecal coliform counts and sedimentation resulting largely from agricultural runoff. Restoration and/or preservation would also be consistent with the "Resource Protection" mission goal of the *Blueprint for the Future of Migratory Birds: Migratory Bird Program: Strategic Plan 2004-2014* (U.S. Dept. of the Interior, Fish and Wildlife Service, 2004).

4.13 WATERS OF THE U.S., INCLUDING WETLANDS

Within the study area, "waters of the U.S." include waterways (perennial streams, intermittent streams, and certain ephemeral streams), water bodies (reservoirs and certain ponds), wetlands, and deepwater habitat (those portions of waterways and water bodies deeper than 6.6 feet). More-detailed discussion of waters of the U.S. is found in the *Natural Resource Technical Report* (VDOT, 2005).

To reduce impacts at major stream crossings, a number of bridges have been proposed. Estimating bridge locations and spans lengths during preliminary engineering is difficult, lacking detailed hydraulic and survey data. However, an approach was used that involved estimating bridge locations and minimum hydraulic openings to accommodate estimated 100-year storm flows. At the bridges identified, locations of seasonally flooded wetlands were reviewed and bridge lengths increased accordingly to further reduce impacts . These prospective bridge locations are presented in Table 4.13-1.

TABLE 4.13-1
PROSPECTIVE BRIDGE LOCATIONS

#	Jurisdiction	Stream Name	Bridge Length (ft.)
CBA 1			
1	Prince George	Second Swamp	870
2	Sussex	Warwick Swamp	1,105
3	Sussex	Coppahaunk Swamp	1,000
4	Southampton	Seacock Swamp	650
5	Isle of Wight, Southampton	Blackwater River	3,515
6	Isle of Wight	Antioch Swamp	1,200
7	Isle of Wight	Antioch Swamp	880
CBA 2			
1	Prince George	Second Swamp	940
2	Prince George	Second Swamp	2,955
3	Sussex	Warwick Swamp	1,970
4	Sussex	Coppahaunk Swamp	1,500
5	Isle of Wight, Southampton	Blackwater River	4,160
6	Isle of Wight	Burnt Mills Swamp	480
7	Isle of Wight	Ennis Pond	620
8	Isle of Wight	Ennis Pond	1,695
CBA 3			
1	Prince George	Blackwater Swamp	3,175
2	Surry, Sussex	Blackwater River	3,920
3	Sussex	Coppahaunk Swamp	2,440
4	Isle of Wight, Southampton	Blackwater River, Warwick Branch	3,050
5	Isle of Wight	Pope Swamp	820
6	Isle of Wight	Ennis Pond	620
7	Isle of Wight	Ennis Pond	1,695

4.13.1 Navigable Waters of the U.S. (Section 10 Waters)

Navigable waters of the U.S. within the study area (as determined by the Norfolk District COE) consist of the Blackwater River, the Pagan River, the Western Branch Reservoir, Lake Prince, Lake Cohoon, and Lake Meade (Norfolk District COE, 1988). All three of the CBAs entail crossings of the Blackwater River. A new bridge would be constructed should one of the three CBAs be selected as the preferred alternative. Bridges would be designed to accommodate boat traffic of the type currently using the river (small recreational craft) and a permit from the U.S. Army Corps of Engineers under Section 10 of the Rivers and Harbors Act of 1899 would be obtained prior to construction.

4.13.2 Waterways, Water Bodies, and Associated Deepwater Habitat

The study area contains a large number of named and unnamed perennial and intermittent streams. Of these, the Blackwater River is the most prominent and longest stream course. The major surface water impoundments of Western Branch Reservoir, Lake Prince, Lake Cahoon, and Lake Meade are located in

the easternmost portion of the study area. In addition, the study area contains numerous small ponds – most of which are man-made.

4.13.2.1 Effects

No estuarine or lacustrine deepwater habitat will be affected by any of the CBAs. Table 4.13-2 presents effects to perennial and intermittent streams within the Planning Corridor for each of the three CBAs. Table 4.13-3 presents effects to perennial and intermittent streams within the Design Corridor for each of the three CBAs. Preliminary project designs minimized and avoided impacts to streams by incorporating bridges at certain major stream crossings (see Table 2.1-1). Because they would be spanned on structure, the following direct impacts do not include stream segments that would be spanned via one of the bridges presented in Table 2.1-1.

TABLE 4.13-2
SUMMARY OF EFFECTS TO STREAMS (PLANNING CORRIDOR)

Alternative	Effects to Perennial Streams (feet)	Effects to Intermittent Streams (feet)	Total Stream Effects (feet)
CBA 1	20,406	53,634	74,040
CBA 2	27,406	22,216	49,622
CBA 3	19,016	56,069	75,085

TABLE 4.13-3
SUMMARY OF EFFECTS TO STREAMS (DESIGN CORRIDOR)

Alternative	Effects to Perennial Streams (feet)	Effects to Intermittent Streams (feet)	Total Stream Effects (feet)
CBA 1	11,529	21,336	32,865
CBA 2	10,661	13,401	24,062
CBA 3	11,001	26,360	37,361

The severity of stream effects within the Planning Corridor with respect to the total length of perennial and intermittent streams within the study area are provided Table 4.13-5. The severity of stream effects within the Design Corridor with respect to the total length of perennial and intermittent streams within the study area are provided Table 4.13-5. Within the Planning Corridor and the Design Corridor, CBA 3 would result in the greatest severity of effects to streams by affecting 1.65 percent and 0.82 percent, respectively, of the study area total.

TABLE 4.13-4
SEVERITY OF EFFECTS TO STREAMS - CBA PLANNING CORRIDOR

Wetland Type	Total Feet of Streams Within Study Area	CBA 1		CBA 2		CBA 3	
		Effects (ft)	% of Total	Effects (ft)	% of Total	Effects (ft)	% of Total
Perennial Streams	3,391,401	20,406	0.60	27,406	0.81	19,016	0.56
Intermittent Streams	1,446,954	53,634	3.71	22,216	1.54	56,069	3.87
Total Feet Affected	4,538,355	74,040	1.63	49,622	1.09	75,085	1.65

[1] Source: USGS National Hydrography Dataset (NHD) 2004.

TABLE 4.13-5
SEVERITY OF EFFECTS TO STREAMS - CBA DESIGN CORRIDOR

Wetland Type	Total Feet of Streams Within Study Area	CBA 1		CBA 2		CBA 3	
		Effects (ft)	% of Total	Effects (ft)	% of Total	Effects (ft)	% of Total
Perennial Streams	3,391,401	11,529	0.34	10,661	0.31	11,001	0.32
Intermittent Streams	1,446,954	21,336	1.47	13,401	0.93	26,360	1.82
Total Feet Affected	4,538,355	32,865	0.72	24,062	0.53	37,361	0.82

[1] Source: USGS National Hydrography Dataset (NHD) 2004.

4.13.2.2 Mitigation

Impacts to streams within the project study area will be avoided and minimized to the greatest extent practicable. Compensation will then be provided for any unavoidable impacts.

During the preliminary design process, impacts to streams will be avoided to the extent practicable based on the following general guiding principles:

- Attempt to avoid longitudinal impacts to perennial streams and riparian forests;
- Attempt to avoid transverse crossings of perennial streams in order to minimize the length of culverts and pipes.

Avoidance and minimization measures to be developed during this preliminary design process include adjustments to the location of the alignment (horizontal alignment) and the width of the construction limits (vertical alignment) where practicable. The horizontal and vertical alignments will be adjusted to avoid and/or minimize the number and length of relocations and enclosures; however, the adjustments may be constrained by the presence of other sensitive resources (e.g. adjacent streams, wetlands, known cultural resources, residences). Where practicable, the vertical alignment will be modified to reduce the width of the construction limits in order to avoid stream encroachments. Increasing the steepness of fill slopes also narrowed construction limits.

Specific avoidance and minimization measures will be evaluated and incorporated into the selected alternative following evaluation of surface water resource quality. The following sections summarize specific avoidance and mitigation measures that could reduce the physical and ecological impacts of the proposed project on surface waters within the immediate vicinity of the proposed facility.

Bridges

Tentative bridge locations for each of the CBAs are described in Table 4.13-1. Bridges, when compared to stream enclosures, avoid physical and ecological impacts to surface waters (e.g. alteration in hydrology and sedimentation, reduction in forested buffer strips, interference with movement of aquatic organisms). Bridges do, however, affect streams with respect to shading and localized sources of stormwater runoff. Because bridges cost substantially more to construct and maintain than do enclosures, the use of bridges for all stream crossings is neither cost effective nor practicable.

Enclosures

Should a CBA be selected, additional alignment-specific field reviews will focus on minimizing the length of physical impacts to surface water resources. This could include minor alignment shifts and reductions in construction limits, which, as a whole, will reduce the length of stream enclosures.

Relocations

Stream relocations can be minimized by shifting alignments, increasing slope angles, and use of retaining walls. For this project, all reasonable efforts will be made to limit relocations to smaller first and second order headwater streams. Should a CBA be selected, measures to minimize stream relocations will be identified, evaluated, and incorporated into the design of the facility.

General and specific design measures and construction techniques that will be considered for this project include fencing, stream channel enhancements, and stream access. In addition, other mitigation measures may include:

- The implementation of an Erosion and Sediment Control Plan.
- The use of properly sized and engineered culverts for stream crossings to minimize impacts attributed to flood height and flood duration.
- Construction of detention treatment facilities.
- The use of culverted stream crossings which are properly sized and engineered to provide unobstructed, continuous flow for fish and macroinvertebrates.
- Perpendicular stream crossings.
- Stream enhancement techniques which would include creation of pool and riffle zones, planting stream-shading vegetation, constructing low flow channels and pools, and to compensate for unavoidable stream relocations.
- Enhancement of disturbed first- and second-order stream systems as a result of loss of intermittent and perennial headwater stream habitat.

Prospective stream restoration and/or riparian zone restoration sites were identified which could serve as mitigation for unavoidable CBA stream encroachments (Figure 4.13-1). Large wetland systems and preserves are prevalent throughout the study area. A review of comprehensive plans indicates the majority of the study will remain rural, agricultural, or open space. The majority of study area farmland traverses streams with little riparian buffer area - leaving streams exposed to high soil and nutrient runoff during rain and storm events. In landscapes such as this, restoration strategies should evaluate potential mitigation sites which will help reduce soil and nutrient runoff to streams.

Prospective stream and/or riparian zone mitigation sites were identified within which riparian reforestation or the establishment of vegetated corridors between blocks of agricultural land and open space could provide for the reduction of soil and nutrients to aid in improved stream quality (Figure 4.13-1). In addition, due to the close proximity of these areas to existing streams and their generally low elevation, these areas could also serve as potential wetland mitigation sites, thereby also assisting in the reduction of soil and nutrients to stream systems.

Prospective stream restoration sites identified as part of the study are listed below and are shown in Figure 4.13-1. Prospective stream mitigation sites have been located within areas that would be consistent with long term land uses set forth in local comprehensive plans.

SITE 1. Unnamed tributary of an unnamed tributary to Lake Kilby. Located approximately one mile northwest of the Little Tabernacle Church on US Route 58 in Suffolk.

SITE 2. Unnamed tributary to Cahoon Creek. Located approximately 500 feet northwest of the intersection of SR 607 and 632 in Suffolk.

SITE 3. Unnamed tributary to Cahoon Creek in Suffolk. Located just north of the intersection of SR 608 and 632.

SITE 4. Unnamed tributary to Nuby Run in Isle of Wight County. Located approximately one mile southeast of the intersection of Route 258 and SR 605.

SITE 5. Unnamed tributary to Courthouse Millpond in Isle of Wight County. Located approximately one mile east of Central Hill along SR 637.

SITE 6. Unnamed tributary to Pope Swamp in Isle of Wight County. Located approximately one mile south of Central Hill along SR 647.

SITE 7. Unnamed tributary to Antioch Swamp in Isle of Wight County. Located between SR 646 and US Route 460.

SITE 8. Unnamed tributary to Hunters Swamp in Isle of Wight County. Located approximately ¾ mile west of the intersection of SR 643 and 603.

SITE 9. Unnamed tributary to Round Hill Swamp in Southampton County. Located ½ mile southwest of Seacock Corner along SR 614.

SITE 10. Unnamed tributary to Seacock Swamp in Southampton County. Located ¾ mile southwest of Camp Corner along SR 616.

SITE 11. Unnamed tributary to Brantley Swamp in Southampton County. Located just west of Saddlers Crossroads (intersection of SR 600 and 618).

SITE 12. Unnamed tributary to Coppahaunk Swamp in Sussex County. Located ¼ mile north of the intersection of SR 604 and 615.

Mitigation strategy for stream impacts will include detailed watershed analysis, stream classification, and stream channel stability assessment.

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FIGURE 4.13-1
PROSPECTIVE STREAM RESTORATION SITES

4.13.3 Wetlands

4.13.3.1 Effects

Acres of wetlands affected within each of the three CBAs (sorted by wetland type) are presented for the Planning Corridor in Table 4.13-6. Affected wetlands are shown in Figure 4.13-2.

Table 4-13-7 presents acres of wetlands potentially affected within the 230-foot-wide Design Corridor associated with CBA 1 and CBA 3 along with the 140-foot-wide Design Corridor associated with CBA 2. The effect of shifting the Design Corridor within the wider Planning Corridor is also presented in Table 4-13-7.

For the Planning Corridor, the severity of effects to wetlands relative to the total acreage of wetlands currently occurring within the study area are presented for each of the CBAs in Table 4.13-8. For the Design Corridor, the severity of effects to wetlands relative to the total acreage of wetlands currently occurring within the study area are presented for each of the CBAs in Table 4.13-9. Assuming use of bridges at major wetland crossings, use of the narrower Design Corridor, and use of applicable alignment shifts, the percent of total study area wetlands that would be affected is 0.21 percent for CBA 1, 0.17 percent for CBA 2, and 0.21 percent for CBA 3 (Table 4-13-9).

Each of the CBAs extend across three major watersheds or Hydrologic Unit Codes (HUCs): the Nansemond River (HUC 02080208), the Blackwater River (HUC 03010202), and the Nottoway River (HUC 03010201). Acres of wetlands affected within the Planning Corridor associated with each of the three CBAs are presented in Table 4.13-10 for each watershed (HUC).

4.13.3.2 Mitigation

Executive Order 11990 (Protection of Wetlands) states that wetland Impacts must be avoided and minimized to the maximum extent practicable. To address avoidance and minimization, three measures were incorporated into the planning effort. The first effort was to locate the CBAs such that the corridors crossed the major wetland systems at a narrow location. The second measure was to incorporate bridges over FEMA-designated floodplains. Executive Order 11988 (Floodplain Management) states that floodplain impacts must be avoided wherever there is a practicable alternative. Incorporation of the bridges, reduced the impacts by 46.81 acres for CBA 1, 87.90 acres for CBA 2 and 91.40 acres for CBA 3. A distribution of the impact reductions by wetland habitat type is presented in Table 4.13-4 for each CBA. The third measure was to shift the Design Corridor for CBAs 1 and 3 north or south within the Planning Corridor to avoid additional wetland areas. These shifts for CBA 1 and 3 would result in the avoidance of 13.4 acres of wetlands and 10.5 acres of wetlands, respectively. The types of wetlands comprising these areas is presented in Table 4.13-7. CBA 2 is centered on the existing roadway alignment for the entire length of the corridor; therefore, it was not possible to minimize effects to wetlands by shifting the centerline of this CBA.

Once wetland impacts have been avoided and minimized to the maximum extent practicable, compensation must be provided to mitigate for the remaining unavoidable impacts. Compensation typically takes the form of wetland replacement through the restoration of wetlands where a parameter has been removed or the creation of wetlands from non-wetland areas. Compensation requirements were calculated by utilizing the standard ratios of 2:1 for forested, 1.5:1 for scrub shrub, 1:1 for emergent, and 1:1 for unconsolidated bottom. See Table 4.13-10 for a summary of the compensation requirements. The project impacts were sorted by Hydrologic Unit Code (HUC) to determine compensation requirements within each of the three watersheds; Nansemond River, Blackwater River, and Nottoway River (Table 4.13-11).

TABLE 4.13-6
WETLANDS AFFECTED AND IMPACT MINIMIZATION (DUE TO BRIDGES) WITHIN CBA PLANNING CORRIDORS

Wetland Type	Area Affected (acres)								
	CBA 1			CBA 2			CBA 3		
	Effects without Bridge	Effects with Bridge	Net Reduction	Effects without Bridge	Effects with Bridge	Net Reduction	Effects without Bridge	Effects with Bridge	Net Reduction
Palustrine Forested Seasonally Inundated	177.42	133.44	43.98	196.86	117.68	79.18	172.76	87.32	85.44
Palustrine Forested Seasonally Saturated	106.64	106.09	0.55	82.38	81.52	0.86	116.35	114.86	1.49
Palustrine Scrub Shrub	18.6	16.32	2.28	30.05	26.46	3.59	33.4	29.82	3.58
Palustrine Emergent	20.25	20.25	0	13.63	9.36	4.27	11.8	11.13	0.67
Palustrine Unconsolidated Bottom/Shore	13.36	13.36	0	19.87	19.87	0	27.55	27.33	0.22
Total Acreage Affected	336.27	289.46	46.81	342.79	254.89	87.9	361.86	270.46	91.4

TABLE 4.13-7
WETLANDS AFFECTED WITHIN DESIGN CORRIDORS
ALONG WITH MINIMIZATION ATTRIBUTED TO ALIGNMENT SHIFTS WITHIN THE PLANNING CORRIDORS [1]

Wetland Type	Area Affected (acres)								
	CBA 1 (230 ft)			CBA 2 (140 ft)			CBA 3 (230 ft)		
	Effects without alignment shift	Effects with alignment shift	Net reduction	Effects without alignment shift	Effects with alignment shift	Net reduction	Effects without alignment shift	Effects with alignment shift	Net reduction
Palustrine Forested Seasonally Inundated	68.52	60.02	8.50	46.15	N/A	N/A	48.75	38.75	10.00
Palustrine Forested Seasonally Saturated	55.05	51.45	3.60	33.55	N/A	N/A	59.95	59.95	0
Palustrine Scrub Shrub	9.77	8.47	1.30	12.84	N/A	N/A	13.57	13.57	0
Palustrine Emergent	10.75	10.75	0	6.86	N/A	N/A	7.48	7.48	0
Palustrine Unconsolidated Bottom/Shore	7.70	7.70	0	10.52	N/A	N/A	16.01	15.51	0.50
Total Acreage Affected	151.79	138.39	13.40	109.92	N/A	N/A	145.76	135.26	10.5

[1] Data also includes bridges.

TABLE 4.13-8
SEVERITY OF EFFECTS TO WETLANDS - CBA PLANNING CORRIDOR

Wetland Type	Total Acreage Within Study Area	CBA 1				CBA 2				CBA 3			
		Effects without Bridge	% of Total	Effects with Bridge	% of Total	Effects without Bridge	% of Total	Effects with Bridge	% of Total	Effects without Bridge	% of Total	Effects with Bridge	% of Total
Palustrine Forested Seasonally Inundated	33,640.17	177.42	0.53	133.44	0.4	196.86	0.59	117.68	0.35	172.76	0.51	87.32	0.26
Palustrine Forested Seasonally Saturated	20,962.36	106.64	0.51	106.09	0.51	82.38	0.39	81.52	0.39	116.35	0.56	114.86	0.55
Palustrine Scrub Shrub	5,773.82	18.6	0.32	16.32	0.28	30.05	0.52	26.46	0.46	33.4	0.58	29.82	0.52
Palustrine Emergent	2,323.32	20.25	0.87	20.25	0.87	13.63	0.59	9.36	0.41	11.8	0.51	11.13	0.48
Palustrine Unconsolidated Bottom/Shore	2,580.74	13.36	0.51	13.36	0.51	19.87	0.77	19.87	0.77	27.55	1.07	27.33	1.06
Total Acreage Affected	65,280.41	336.27	0.51	289.46	0.44	342.79	0.53	254.89	0.39	361.86	0.55	270.46	0.41

TABLE 4.13-9
SEVERITY OF EFFECTS TO WETLANDS - CBA DESIGN CORRIDOR [1]

Wetland Type	Total Acreage Within Study Area	CBA 1				CBA 2				CBA 3			
		Effects without Alignment Shift	% of Total	Effects with Alignment Shift	% of Total	Effects without Alignment Shift	% of Total	Effects with Alignment Shift	% of Total	Effects without Alignment Shift	% of Total	Effects with Alignment Shift	% of Total
Palustrine Forested Seasonally Inundated	33,640.17	68.52	0.20	60.02	0.18	46.15	0.14	N/A	N/A	48.75	0.14	38.75	0.12
Palustrine Forested Seasonally Saturated	20,962.36	55.05	0.26	51.45	0.24	33.55	0.16	N/A	N/A	59.95	0.29	59.95	0.29
Palustrine Scrub Shrub	5,773.82	9.77	0.17	8.47	0.15	12.84	0.22	N/A	N/A	13.57	0.26	13.57	0.26
Palustrine Emergent	2,323.32	10.75	0.46	10.75	0.46	6.86	0.29	N/A	N/A	7.48	0.32	7.48	0.32
Palustrine Unconsolidated Bottom/Shore	2,580.74	7.70	0.30	7.70	0.30	10.52	0.41	N/A	N/A	16.01	0.62	15.51	0.60
Total Acreage Affected	65,280.41	151.79	0.23	138.39	0.21	109.92	0.17	N/A	N/A	145.76	0.22	135.26	0.21

[1] Data also includes bridges.

FIGURE 4.13-2
WATERS OF THE U.S., INCLUDING WETLANDS

Table 4.13-10
ESTIMATED COMPENSATION REQUIREMENTS (DESIGN CORRIDOR)

Wetland Habitat Type	CBA 1 (230 ft)		CBA 2 (140 Ft)		CBA 3 (230 ft)	
	Effects (acres)	Mitigation Required (acres)	Effects (acres)	Mitigation Required (acres)	Effects (acres)	Mitigation Required (acres)
Palustrine Forested Seasonally Inundated	60.02	120.04	46.15	92.30	38.75	77.50
Palustrine Forested Seasonally Saturated	51.45	102.90	33.55	67.10	59.95	119.90
Palustrine Scrub/Shrub	8.47	12.71	12.84	19.26	13.57	20.36
Palustrine Emergent	10.75	10.75	6.86	6.86	7.48	7.48
Palustrine Unconsolidated Bottom/Shore	7.70	7.70	10.52	10.52	15.51	15.51
Total	138.39	254.1	109.92	196.04	135.26	240.75

Compensation strategies would be determined during project permitting; however, four conceptual alternatives were evaluated at this stage of the study:

1. On-site and Off-site Wetland Restoration/Creation Opportunities. A site search was conducted. (The results are provided in following sections).
2. Applicable VDOT Mitigation Banks. VDOT has two banks servicing the study area, the Goose Creek Bank, has a small number of credits, less than 30-acres available for use and the Benjamin Nottoway River Mitigation bank with less than 3 credits available.
3. Commercial Wetland Mitigation Banks. There are six commercial mitigation banks servicing HUC 02080208, Nansemond River. There are no commercial banks servicing HUC Codes 03010202, Blackwater River and 03010201, Nottoway River currently providing credits, however there is one large bank (just approved) with the potential for 100-125 credits.
4. Contributions to the Nature Conservancy Virginia Wetland Restoration Trust Fund. Should it not be feasible to mitigate all project impacts through compensation items 1 through 3, above, the balance would be provided through payment in to the Trust Fund

Each site evaluated was assigned a numeric value (1 to 3) to each of the nine compensation site search criteria, based upon the presence, nature and relative quality of the factors described above. The most a site could score is 27 points. Scores of 20 points and above would be considered for further evaluation. Thirty sites scored 20 or higher - 12 in the Nansemond River watershed, ten in the Blackwater River watershed, and eight in the Nottoway River watershed. The numeric results for the sites evaluated in this study are provided in Appendix D.

The 12 sites in the Nansemond River watershed that scored 20 or higher have an approximate acreage of 196. The ten sites that scored 20 or higher in the Blackwater River watershed have an approximate acreage of 301. The eight sites that scored 20 or higher in the Nottoway River watershed has an approximate acreage of 2,432. The total approximate acreage from the three watersheds in the study area is 2929. See Table 4.13-11 for a comparison of mitigation requirements and potential mitigation identified by CBA and watershed. There will be a temporal loss of wetland functions and values while the wetland compensation sites develop to maturity; however with the compensation ratios of 2:1 for forested, 1.5:1 for scrub shrub, 1:1 for emergent, and 1:1 for unconsolidated bottom should provide additional functions and values as the overall wetland acreage in each watershed increases.

TABLE 4.13-11
MITIGATION REQUIREMENTS AND AVAILABLE MITIGATION ACRES BY WATERSHED

Watershed	Mitigation Required (acres)			Potential Mitigation Available (acres)
	CBA 1	CBA 2	CBA 3	
Nansemond	90.12	59.50	28.36	196
Blackwater	144.51	136.58	212.39	301
Nottoway	20.30	0	0	2,432
Totals	254.10	196.04	240.75	2,929

Sufficient mitigation was identified in the Nansemond and Nottoway Rivers to compensate for proposed impacts. The search within the Blackwater River watershed was deficient by 32 to 60 acres depending on which CBA was selected. The Blackwater River watershed mitigation deficit can be resolved by providing the balance of mitigation in adjacent watersheds (especially the Nottoway River watershed which, like the Blackwater, is a tributary to the Chowan River).

With total mitigation requirements within the Design Corridor of 254.10 acres for CBA 1, 196.04 acres for CBA 2, and 240.75 acres for CBA 3, sufficient restoration and creation acreage to compensate for unavoidable wetland impacts has been identified within study area watersheds. In addition, the following options can also provide compensation: 1) VDOT mitigation bank credits, 2) commercial banks, and 3) contributions to the Virginia Wetland Restoration Trust Fund. Payment in-lieu to the Trust Fund would be made only after a determination had been made that it is not feasible to provide all necessary mitigation through restoration or creation. Should it be determined at a later phase of project design that wetland impacts will be greater that estimates given herein for Design Corridor CBA concepts, the wetlands mitigation site search conducted as part of this study verifies that adequate acreage of suitable mitigation sites exists within study area watersheds (see Table 4.13-11).

4.14 FLOODWAYS & 100 YEAR FLOODPLAINS

See Figure 4.14-1 for locations of floodways and 100-year floodplains. A more-detailed discussion of floodplains and associated floodways is presented the *Natural Resources Technical Report* (VDOT, 2005).

4.14.1 Effects

Each CBA would span floodways and encroach upon 100-year floodplains at multiple locations. Four regulated floodways would be crossed under CBA 1, four under CBA 2, and three under CBA 3. Table 4.14-1 presents floodway crossings by CBA, stream, and watershed. Floodway crossings are depicted in Figure 4.14-1. Without construction of those bridges presented in Table 4.13-1, 72.55 acres of floodplain would be affected under CBA 1, 71.78 acres under CBA 2, and 99.53 acres under CBA 3 within the Design Corridor. With construction of those bridges presented in Table 4.13-1, 58.19 acres of floodplain would be affected under CBA 1 (a 20 percent reduction in floodplain encroachment), 63.42 acres under CBA 2 (a 12 percent reduction in floodplain encroachment), and 84.75 acres under CBA 3 (a 15 percent reduction in floodplain encroachment) within the Design Corridor. Table 4.14-1 presents floodplain encroachment estimates by CBA, stream, and watershed. Floodplain encroachments are depicted in Figure 4.14-1.

With CBAs being centered within the Planning Corridor, three near-parallel floodplain encroachments would result from development of CBA 1, five from CBA 2, and six from CBA 3. If, during later design

phases, it is feasible to shift centerlines away from floodplains, these near-parallel floodplain encroachments could be reduced to two for CBA 1, four for CBA 2, and four for CBA 3. Although estimates presented in Table 4.14-1 for the Design Corridor reflect preliminary efforts to avoid and minimize impacts, additional lateral encroachments where new roadway would span or extend perpendicular to an existing floodplain may become necessary; however, this possibility cannot be definitively assessed at the current level of conceptual design. Future design efforts will attempt to minimize impacts to all floodplains, particularly near-parallel encroachments which might otherwise require fill by placing the roadbed on structure (depending on the degree of lateral encroachment and associated costs of providing structure).

Although small amounts of new right-of-way may be required for implementation of programmed improvements associated with the No-Build Alternative, no major impacts to floodplains are anticipated; however, evaluation of the potential effects to floodplains may be required if any programmed improvement involves major new construction.

4.14.2 Mitigation

Based on preliminary engineering, 7 bridges would be constructed along CBA 1, 8 along CBA 2, and 7 along CBA 3 to minimize the amount of solid fill that would be place within 100-year floodplains. Future design would focus on avoiding and minimizing floodplain encroachment to ensure that CBAs are consistent with Executive 11998 and FHWA policy as set forth in 23 CFR 650. The design would include detailed hydraulic evaluation to ensure that increases in flood risk and impacts to floodplain values would not result from construction. At proposed bridge crossings, the minimum number of piers to ensure structural stability will be placed within floodways. Feasible construction methods that would not require the placement of construction causeways would be evaluated during the design phase. Should it become necessary, fill placed for temporary construction causeways or work bridges would be removed and preconstruction floodplain conditions will be restored immediately following construction. Breastwalls and fill placed within floodplains for bridge abutments would be minimized.

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TABLE 4.14-1
FLOODWAY CROSSINGS AND FLOODPLAIN ENCROACHMENTS

Alternative	Waterway or Water Body	HUC	Planning Corridor		Design Corridor		
			Floodway Crossings (#)	Floodplain Encroachments (acres)	Floodway Crossings (#)	Floodplain Encroachments without Bridges (acres)	Floodplain Encroachments with Bridges (acres)
CBA 1	Blackwater Swamp / Warwick Swamp	03010202	2	47.42	2	22.35	18.13
	Middle Blackwater River	03010202	1	73.57	1	33.66	29.43
	Seacock Swamp	03010202	1	19.39	1	8.10	6.41
	Speights Run / Lake Cahoon / Lake Meade / Lake Kilby	02080208	0	12.21	0	5.73	3.62
	Upper Blackwater River / Cypress Swamp	03010202	0	7.42	0	2.71	0.60
	Western Branch Reservoir	02080208	0	0.58	0	0	0
Total			4	160.59	4	72.55	58.19
CBA 2	Blackwater Swamp / Warwick Swamp	03010202	3	79.17	3	20.72	18.14
	Middle Blackwater River	03010202	1	70.58	1	30.07	27.49
	Speights Run / Lake Cahoon / Lake Meade / Lake Kilby	02080208	0	11.17	0	5.21	3.92
	Upper Blackwater River / Cypress Swamp	03010202	0	8.61	0	1.33	0.71
	Western Branch Reservoir	02080208	0	33.22	0	14.45	13.16
Total			4	202.75	4	71.78	63.42
CBA 3	Blackwater Swamp / Warwick Swamp	03010202	1	52.75	1	22.98	20.87
	Middle Blackwater River	03010202	1	56.79	1	25.39	23.28
	Speights Run / Lake Cahoon / Lake Meade / Lake Kilby	02080208	0	11.17	0	5.21	3.10
	Upper Blackwater River / Cypress Swamp	03010202	1	70.07	1	32.30	28.07
	Western Branch Reservoir	02080208	0	33.35	0	13.65	9.43
Total			3	224.13	3	99.53	84.75

Note: Calculations presented above do not include final efforts to avoid or minimize impacts because there are no preliminary engineered drawings of the proposed highway sections yet prepared. Engineering and design efforts to minimize or avoid impacts could result in reductions to encroachment acreages.

FIGURE 4.14-1
FLOODWAY CROSSINGS AND FLOODPLAIN ENCROACHMENTS

Within the Planning Corridor, two to three major near-parallel floodplain encroachments would result from development of CBA 1, four to five from CBA 2, and four to six from CBA 3. Encroachments of this type can be minimized or avoided during engineering and design of the roadway prism through use of steeper-than-convention road embankments, use of vertical retaining walls, further alignment adjustments, etc. All remaining encroachments are near-perpendicular and the floodplain would be spanned by bridging at these locations.

In addition to mitigation measures designed to reduce the amount of floodplain encroachment, sections 107 and 303 of VDOT's highway construction specifications require implementation of stormwater management practices to address concerns such as post-development runoff associated with storm events and downstream channel capacity. These standards require that stormwater management facilities be designed to reduce stormwater flows to pre-construction conditions for up to a 10-year storm event. VDOT and its construction contractors will adhere to the specifications to prevent an increase in flooding risks associated with proposed highway construction. For the majority of encroachments, it is anticipated that backwater elevations and waterbody flow velocity increases at the floodplain encroachments would be minimal or non-existent.

During final design, a detailed hydraulic survey and hydrology study would evaluate the effect of the proposed roadway improvements on stormwater discharge. The hydraulic study would ensure that no substantial increase in downstream flooding would occur. Design modifications to eliminate or minimize encroachments to the extent practicable are required by Executive Order 11988. For these reasons, it is likely that the CBAs would have negligible impacts to natural and beneficial floodplain values.

4.15 THREATENED OR ENDANGERED SPECIES

As discussed in section 3.15, three federal-listed threatened or endangered species and six state-listed threatened or endangered species have been reported within counties that lie partially within the study area. More-detailed discussion of threatened or endangered species is found in the Natural Resources Technical Report (VDOT, 2005).

4.15.1 Federally Protected Species Documented in Study Area

Locations of biodiversity ranked (BRANK) sites reported to contain federally listed threatened or endangered species somewhere within their boundaries are shown in Figure 4.15-1.

4.15.1.1 Bald Eagle (Haliaeetus leucocephalus)

Known bald eagle nesting sites are shown in Figure 4.15-1. None of the CBAs would directly affect any bald eagle nesting sites, nor would they encroach upon any Zone 2 protection zone extending 0.25-mile radius around a nest. At their western termini, each of the CBAs would include interchange improvements just outside Zone 2 of nesting sites within the Walton Habitat Zone; however considering the distance for known nesting sites and the presence of the existing I-295.U.S. 460 interchange, no adverse effects are anticipated. Although effects to the Walton Habitat Zone is unlikely considering these circumstances, ongoing coordination with FWS and VDGIF would be occur prior to construction of any CBA.

4.15.1.2 Red-Cockaded Woodpecker (Picoides borealis)

The red-cockaded woodpecker was classified as endangered because of its perceived rarity, declines in local populations. The protection of existing habitat and the provision of addition habitat suitable for the red-cockaded woodpecker is a prime management goal for protection of the species.

Within the study area, a population of red-cockaded woodpecker occurs several miles south of CBA 1 (distance given in general terms only to prevent disclosure of specific location) on a state-owned tract known as the Manry 604-606 Conservation Site. In January of 2005, field investigation was conducted

along a recently shifted portion of CBA 1 roughly falling between the communities of Wakefield and Waverly. The alignment of CBA 1 within the aforementioned segment was shifted in late 2004 to avoid affects to a known historic architectural resource (the Parker House) and to avoid encroachment within the 0.5-mile radius of a historic sighting of the species within the Manry Wakefield Conservation Site. The January 2005 field investigation was conducted to determine whether suitable habitat for the red-cockaded woodpecker is present within or adjoining the 500-foot-wide assessment area of the proposed shifted alignment. Criteria used in determining the presence of suitable habitat are those set forth in the Recovery Plan for the Red-cockaded Woodpecker (*Picoides borealis*), Second Revision (U.S. Fish and Wildlife Service, 2003). Based on these criterion, no habitat suitable for the red-cockaded woodpecker was observed within the Planning Corridor of re-aligned CBA 1 or other areas in the vicinity of the assessment area. In summary, few pine trees of sufficient age and/or structure to serve as potential cavity trees are located within the CBA 1 Planning Corridor. Where potential cavity trees were observed, surrounding conditions (such as proximity to human-made disturbances, undesirable height of midstory, preponderance of hardwood species, absence of a sufficiently wide forested buffers, etc.) severely compromised or obviated the ability of the few mature pine trees to serve as potential cavity trees.

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FIGURE 4.15-1
NATURAL HERITAGE SITES CONTAINING FEDERAL AND STATE PROTECTED SPECIES

During field investigation, only one area in the vicinity of the shifted portion of CBA 1 was observed which could be considered to be *marginally* suitable habitat for the red-cockaded woodpecker; however, no birds or cavities were observed. Marginal suitability of the area in question is due to taller than desirable midstory, greater than desirable basal area, and scarcity of potential cavity trees. The area is question is approximately one mile east of the Manry 604-606 Conservation Site and 400 feet west of CBA 1. Effects to this species or its habitat is highly unlikely considering the large distance of any CBA from known populations and the lack of suitable habitat within areas affected by CBAs; however, further coordination with the U.S. Fish and Wildlife Service will occur prior to construction of any CBA.

4.15.1.3 Piping Plover (Charadrius melodus)

Within the study area, sightings of this species have been reported around the shoreline of Lake Kilby and the Northwest Reservoir in the City of Suffolk and within the Cat Ponds conservation site just west of Route 10 in northeastern Isle of Wight County. At their nearest location, the CBAs would be located approximately four miles south of shorelines of Lake Kilby and the Northwest Reservoir where sightings have been reported. Effects to this species or its habitat is unlikely to non-existent considering the large distance of any CBA from reported sightings and the lack of suitable habitat within areas affected by CBAs.

4.15.2 Other Federally Protected Species Recommended for Possible Survey

4.15.2.1 Roanoke Logperch (Percina rex)

The nearest known population is reported in the Nottoway River in Dinwiddie County approximately 30 miles southwest of the Route 460 study area. Due to low stream gradients, a predominance of low energy stream environment, and the lack of self-scouring deeper pools, no suitable habitat for the Roanoke logperch appears to be present within the Route 460 study area. Effects to this species or its habitat is unlikely to non-existent considering the large distance of any CBA from known populations and the apparent lack of suitable habitat within areas affected by CBAs. Based on this finding, no additional survey is proposed.

4.15.2.2 Dwarf Wedgemussel (Alasmidonta heterodon)

The nearest known population of Roanoke logperch is reported in the Nottoway River in Sussex County approximately 16 miles south of the Route 460 study area. Due to low stream gradients, a predominance of low energy stream environment, and the lack of clean coarser-grained stream bottoms, no suitable habitat for the dwarf wedgemussel appears to be present within the Route 460 study area. Effects to this species or its habitat is unlikely to non-existent considering the large distance of any CBA from known populations and the apparent lack of suitable habitat within areas affected by CBAs. Based on this finding, no additional survey is proposed.

4.15.2.3 Michaux's Sumac (Rhus michauxii)

The nearest known population of Michaux's sumac is reported on the Fort Pickett Military Reservation approximately 40 miles southwest of the Route 460 study area. The only portion of the study area where controlled burns is reported to occur is the Zuni Pine Barrens and Antioch Swamp Natural Area Preserves and portions of the Manry 604-606 Conservation Site (known by some as the "Piney Grove" site). Michaux's sumac does not occur within either of these areas. Other than upland portions of utility line clearings, where the species as not been reported, no other habitat suitable for Michaux's sumac has been observed within the Route 460 study area. Effects to this species or its habitat is unlikely to non-existent considering the large distance of any CBA from known populations. Based on this finding, no additional survey is proposed.

4.15.2.4 American Chaffseed (Schwalbea americana)

Much of this species' former habitat has long-since been converted to farmland. Housing development, road building, over-collection, and succession of its open habitat to woody vegetation (due to fire suppression) are documented threats. American chaffseed was last observed near the Sussex/Greenville county line (approximately 33 miles south of the Route 460 study area) in 1938, and the species is now thought to be extirpated in Virginia. Effects to this species or its habitat is non-existent considering the aged nature of the last sighting and the large distance of any CBA from the point of that sighting. Based on this finding, no additional survey is proposed.

4.15.3 State Protected Species Documented in Study Area

Locations of biodiversity ranked (BRANK) sites reported to contain state listed threatened or endangered species somewhere within their boundaries are shown in Figure 4.15-1.

4.15.3.1 Eastern Big-Eared Bat (Plecotus rafinesquii)

Plecotus rafinesquii is rare in Virginia and is particularly susceptible to human disturbance. Within the study area, the eastern big-eared bat is documented to occur in or near the Hickaneck Swamp conservation site northeast of Ivor in Isle of Wight County and in or near the Dendron Swamp conservation site just west of the community of Dendron (DCR-DNH, 2003). None of the CBAs would encroach upon either of these two conservation sites as delineated by DCR-DNH. CBA 3, the nearest CBA, would be located approximately 1.25 miles to the south of the Hickaneck Swamp conservation site. At their nearest location, CBA 2 and CBA 3 would be located approximately four miles south of the Dendron Swamp conservation site, while CBA 1 would be located approximately 4.5 miles to the south. Although effects to this species or its habitat is unlikely considering these distances, continued coordination with the Virginia Department of Game and Inland Fisheries will occur prior to construction of any CBA.

4.15.3.2 Loggerhead Shrike (Lanius ludovicianus)

This species is a year-round resident in most of its habitat. The loggerhead shrike is a widespread but rare bird in Virginia. The exact causes of the significant decline in population for this species are unclear, but the decline may be due to several factors such as: habitat loss - clearing hedgerows and reforestation; excessive winter mortality - predation by raptors in woodlots during severe cold or snow cover; pesticide contamination; and/or collisions with motor vehicles.

At least one general occurrence and one resident occurrence of the loggerhead shrike has been reported in each of the localities comprising the study area. In addition, suitable habitat is observed within the study area. CBA 2 and CBA 3 would result in comparable direct losses of agricultural lands and transitional lands, some of which could serve as suitable habitat for the loggerhead shrike (1,237 acres and 1,229 acres, respectively). By contrast, CBA 1 would result in the direct loss of 965 acres of agricultural lands and transitional lands, some of which could serve as suitable habitat for the loggerhead shrike. With respect to severity of effects, none of the CBAs would result in significant direct effects to suitable habitat on a regional basis (ranging between 0.67 percent and 0.86 percent of total agricultural lands and transitional lands within the study area). Means to restrict or limit landscaping activities having the potential of attracting the loggerhead shrike to the highway corridor (thereby resulting in a higher probability of mortality due to wildlife/vehicle collisions) would be developed during late phases of project design and permitting. This could include methods to discourage the species from frequenting the highway corridor, such as (1) minimizing mowing operations in critical areas and (2) planting of wildflowers and shrubs rather than grasses within the right-of-way. To avoid or minimize adverse effects to nearby habitat, stormwater management facilities would be designed to detain and/or treat pesticides and herbicides applied within the right-of-way. Although effects to this species or its habitat are not considered to be severe, continued coordination with the Virginia Department of Game and Inland Fisheries will occur prior to construction of any CBA.

4.15.3.3 Barking Tree Frog (Hyla gratiosa)

This species is threatened because of limited distribution and attractiveness in the pet trade. Within the study area, the barking tree frog is documented to occur in the Hickaneck Swamp conservation site northeast of Ivor in Isle of Wight County and in the Beachland Habitat Zone conservation site located south-southeast of Surry in Surry County (DCR-DNH, 2003). None of the CBAs would encroach upon either of these two conservation sites as delineated by DCR-DNH. CBA 3, the nearest CBA, would be located approximately 1.25 miles to the south of the Hickaneck Swamp conservation site and approximately ten miles south of the Beachland Habitat Zone conservation site. Although effects to this species or its habitat is unlikely considering these distances, continued coordination with the Virginia Department of Game and Inland Fisheries will occur prior to construction of any CBA.

4.15.3.4 Mabee's Salamander (Ambystoma mabeei)

Known populations are low in number and are highly threatened (primarily by urbanization). Breeding sites in Virginia are fish-free vernal ponds. In Southampton County, the breeding pond is within a large clearcut. In Isle of Wight County, the breeding sites are ephemeral Coastal Plain sinkhole ponds up to 1.5 meters deep with surrounding forests generally composed of hardwoods mixed with pine. Within the study area, Mabee's salamander is documented to occur in the Cat Ponds conservation site just west of Route 10 in northeastern Isle of Wight County and in the Hickaneck Swamp conservation site northeast of Ivor in Isle of Wight County (DCR-DNH, 2003). None of the CBAs would encroach upon either of these two conservation sites as delineated by DCR-DNH. At their nearest location, the CBAs would be located approximately eight miles south of the Cats Pond conservation site. CBA 3, the nearest CBA, would be located approximately 1.25 miles to the south of the Hickaneck Swamp conservation site. Although effects to this species or its habitat is unlikely considering these distances, continued coordination with the Virginia Department of Game and Inland Fisheries will be occur prior to construction of any CBA.

4.15.3.5 Eastern Tiger Salamander (Ambystoma tigrinum)

Industrial pollution and intensive agriculture have an adverse affect on this species. Within the Route 460 study area, the eastern tiger salamander is documented to occur in the Cat Ponds conservation site just west of Route 10 in northeastern Isle of Wight County (DCR-DNH, 2003). None of the CBAs would encroach upon the conservation site as delineated by DCR-DNH. At their nearest location, the CBAs would be located approximately eight miles south of the Cats Pond conservation site. Effects to this species or its habitat is highly unlikely considering this distance.

4.15.3.6 Blackbanded Sunfish (Enneacanthus chaetodon)

Within the study area, blackbanded sunfish is documented to occur (1) in Cypress Swamp just north of Dendron, (2) in the Blackwater Swamp near Prince George Courthouse, and (3) in Harrells Millpond and the headwaters of Coppahaunk Swamp just south of Route 460 between Wakefield and Waverly (DCR-DNH, 2003).

At their nearest location, CBA 1 and CBA 2 would be located approximately seven miles south (downstream) of the Cypress Swamp population, while CBA 1 would be located approximately 10.5 miles south (downstream). Effects to the Cypress Swamp population or its habitat is non-existent considering the large downstream distance of the CBAs.

The nearest CBA with respect to the Prince George Courthouse occurrence (CBA 3) would be located 0.25 mile south of the DNH-delineated conservation site radius and would cross a unnamed tributary of the Blackwater River approximately one mile upstream of the Blackwater River. Although no direct effects to the current population is anticipated stormwater management facilities would be designed to reduce stormwater pollutant loading.

CBA 1 would encroach upon the 0.5-mile-radius of the unnamed conservation site within which Harrells Millpond and the headwaters of Coppahaunk Swamp are located. Should CBA 1 be constructed, aquatic

habitat critical to the population would be avoided through spanning-on-structure. Should spanning-on-structure prove to be infeasible, measures to minimize unavoidable effects will be developed in coordination with the Virginia Department of Game and Inland Fisheries prior to construction. In addition, stormwater management facilities would be designed to reduce stormwater pollutant loading.

4.15.3.7 Southeastern Dismal Swamp Shrew

Although taken off the federal list in 2000 because of findings of occurrence more widespread than previously thought, the southeastern Dismal Swamp shrew remains listed as threatened by Virginia (which contends that the species remains threatened due to habitat drainage, development, and natural catastrophe). Within the study area, the southeastern Dismal Swamp shrew is documented to occur in the Hickaneck Swamp conservation site located northeast of Ivor in Isle of Wight County (DCR-DNH, 2003). None of the CBAs would encroach upon the conservation site as delineated by DCR-DNH. CBA 3, the nearest CBA, would be located approximately 1.25 miles to the south of the Hickaneck Swamp conservation site. Although effects to this species or its habitat is unlikely considering this distance, consultation with the Virginia Department of Game and Inland Fisheries will be initiated prior to construction of any CBA.

4.16 WILD AND SCENIC RIVERS

4.16.1 Federal Wild and Scenic Rivers

According to the *2002 Virginia Outdoors Plan* (Virginia Department of Conservation and Recreation, 2002) and the Philadelphia Support Office of the National Park Service (U.S. Department of the Interior, 2004), no Federal wild and scenic rivers are located in or immediately downstream of the study area.

4.16.2 State Scenic Rivers

According to the *2002 Virginia Outdoors Plan* (Virginia Department of Conservation and Recreation, 2002), no legislatively designated state scenic rivers are presently located in or immediately downstream of the study area. The Blackwater River is, however, identified in the 2002 Plan as a potential future component of the Virginia Scenic Rivers program. All three CBAs would cross the Blackwater River within that segment determined to be a potential component of the Virginia Scenic Rivers program.

With implementation of appropriate mitigation measures (as discussed in associated portions of this EIS), those attributes of the Blackwater River which currently merit its consideration for possible future state inclusion (i.e., recreational boating opportunities, natural heritage resources, scenic qualities, and warmwater fisheries) would not be substantially affected by construction of a CBA. If any river segment within the corridor is designated as a component of the Virginia Scenic Rivers Program prior to construction or within the foreseeable future of construction, permanent impediments to natural flows would be prohibited (unless authorized by the General Assembly) and all use and development of water and water-related resources would be evaluated to ensure that they do not significantly alter or destroy the scenic or ecological character of the designated segment.

Although small amounts of new right-of-way may be required for implementation of programmed improvements associated with the No-Build Alternative, no major impacts to potentially eligible segments of the Blackwater River are anticipated; however, evaluation of the potential effects to the aforementioned resource attributes may be required if any programmed improvement involves major new construction.

4.17 MINERAL RESOURCES AND UNIQUE GEOLOGIC FEATURES

The only economic mineral resource occurring within the study area is sand and gravel which is primarily used largely as aggregate for regional construction. Exploitable sand and gravel deposits occurring on the surface are typically associated with (1) relict shorelines such as the Suffolk scarp and the Surry scarp (the Shirley Formation (Qsh) and the Moorings unit (Tm) of the Geologic Map of Virginia) and relict fluvial/deltaic terrace deposits restricted largely to the western portion of the study area (the Bacons Castle Formation (Tb^1) of the Geologic Map of Virginia). Exploitable sand and gravel deposits occurring beneath the surface are typically encountered at or near the base of fining-upward estuarine and marine deposits (generally tens of feet beneath the surface) which underlie large expanses of the central and eastern portions of the study area. Because of the relatively widespread occurrence of identified mineral resources (sands and gravels), the regional distribution of geomorphic features (as determined from published geologic maps) was considered pursuant to assessing the magnitude and severity of effects.

Because of their relative abundance within the study area (both on the surface and in the subsurface), sand and gravel deposits are not considered to be a unique or limited resource. Should a CBA be constructed, a maximum of 1,842 acres of land would be unavailable to sand and gravel exploitation (assuming implementation of CBA 3 within the Design Corridor). These 1,842 acres comprise only 0.39 percent of the total land surface within the study area (much of which contains surficial or subsurface sand and gravel deposits) and, as such, their conversion to transportation corridor would not adversely affect the potential for future economic exploitation of these mineral resources. Provision of a new regional transportation facility could serve to establish new markets or enhance existing markets for local sand and gravel reserves.

Active surface mining operations and other sites of economic mineral resources are shown on Figure 4.17-1. Sand and gravel operations are in a constant state of flux regarding closure of active operations and opening of new operations, thus any locations shown may change over time. During later phases of project design, access would be designed and traffic maintenance plans developed to avoid or minimize adverse effects to active mining/borrow operations.

No unique geologic features (such as fault lines, type locality stratigraphic sections, etc.) would be affected and any of the CBAs or programmed improvements included as part of the No-Build Alternative.

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FIGURE 4.17-1
ECONOMIC MINERAL RESOURCE OPERATIONS

4.18 INDIRECT EFFECTS

Sections 4.18 and 4.19 discuss findings of the Indirect (4.18) and Cumulative Impacts (4.19) assessment. In compliance with the National Environmental Policy Act (NEPA) and the President's Council on Environmental Quality (CEQ) regulations (40 CFR 1508.25 (c)), the potential indirect effects and cumulative impacts are examined along with the direct impacts of the 2026 No-Build Alternative, the TSM Alternative, and the CBAs. The purpose of the indirect and cumulative impact assessment is to ensure that federal actions consider the full range of potential environmental consequences. When assessing the indirect impacts and cumulative effects of a proposed action, it is important to effectively identify the potential consequences of human activities on the natural and built environment.

Direct, indirect, and cumulative impacts are assessed for this project in accordance with the following definitions provided in the Council on Environmental Quality (CEQ) regulations:

- Direct impacts are "caused by the action and occur at the same time and place" (40 CFR 1508.8);
- Indirect impacts are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable". Indirect effects are synonymous with secondary effects and "may include growth inducing effects and other effects related to potential changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508.8); and
- Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" (40 CFR 1508.7).

The indirect and cumulative impact analysis for this project has been developed according to the guidance presented in the 1997 Council on Environmental Quality publication, Considering Cumulative Effects; the U.S. Environmental Protection Agency (EPA) publication, Consideration of Cumulative Impacts in EPA Review of NEPA Documents (May 1999); and the FHWA's 1992 Position Paper and 1996 handbook on Community Impact Assessment. Additional case studies, theoretical assumptions, and evaluation methods used in this analysis are stated within the *Indirect and Cumulative Impacts Technical Report.*

4.18.1 Indirect Land Use Impacts

As current research suggests, accessibility is the key factor in assessing the potential impact of a transportation project on land use. When a transportation project makes it easier to access certain locations, "these places become more attractive to more or different types of development. However, improving accessibility does not guarantee that land use change will follow." *(Land Use Impacts of Transportation: A Guidebook)* This indirect land use analysis considered induced development at interchange areas as well as the potential for sprawl development throughout the study area.

Because counties and incorporated areas have jurisdiction over land use, the land use plans and regulations and the economic development plans of localities were the primary basis for determining the future land use for the No-Build/TSM and CBA alternatives. However, local plans were not prepared with the CBAs in mind; therefore, analysis was conducted to estimate possible levels of interchange development, taking into account the local context and the results of interviews with local officials. The findings were reviewed by local officials.

Changes in planned land use are not expected under either the 2026 No-Build or the TSM Alternative. It is assumed that approved projects and land uses will develop as planned. However, the increasing travel-time delays could hinder the planned economic development along the Route 460 corridor. Travel times from Petersburg to Suffolk are anticipated to increase by 8 minutes (11 percent) between 2000 and 2026.

4.18.1.1 Potential Development at Interchange Areas

The CBAs will affect accessibility by physically changing access (i.e. providing new interchange and intersection locations) and lowering regional travel times between Petersburg and Suffolk. The application of an empirically-based framework (i.e., Hartgen model) for interchange area development lends consistency and objectivity to the indirect land use impact analysis, while the extent of local coordination maintains the focus of the analysis on local jurisdiction decision-making. The Hartgen model correlates development factors to estimate the potential level for development at rural interchanges on limited access highways (Hartgen, 1992). This model, coupled with information provided by local officials, was used to identify land use changes attributable to the CBAs. As noted in Hartgen's model, the likelihood of an interchange or intersection area experiencing changes in land use is based on a number of factors, including:

1. Traffic volumes on the proposed alternative and crossroad;
2. Population of the nearest and surrounding communities;
3. Distance to major urban centers;
4. Distance between interchanges;
5. Current land use; and
6. Site factors at the interchange or intersection (availability of water and sewer, planned land uses, local land use policies, visibility, environmental constraints).

Based on these factors and information provided by local officials, it is possible to estimate the likely type of development that can be anticipated at each interchange area. Impacts were assessed for each of the CBA interchange areas. A zone of potential influence having a one-mile radius (2,000 acres) around each interchange was considered for indirect land use impacts. In this analysis, this area is referred to as the interchange area, which is synonymous with CEQ's project impact zone. Based on the rural nature of this area and local areas' varying expectations for growth, not all interchange areas were anticipated to have indirect land use changes.

For those interchange areas projected to alter future development patterns, a GIS review of existing land uses and comprehensive land use planning within each interchange area identified the amount of developable land available to accommodate the anticipated development. It was assumed that the scale of the potential development would be similar in magnitude to existing and planned development within the study area. Acres of potential development were projected based on existing land use densities and reviewed by local officials. The potential acreage of potential development was hand-allocated to the appropriate interchange area. The likelihood of impacts to sensitive resources from potential development was assessed based on the amount of land consumed by new development relative to the amount of available, developable land in the interchange areas.

As shown in Figure 4.18-1 to Figure 4.18-3, all CBAs have the potential to induce land use changes when compared to the 2026 No-Build and TSM Alternatives. The potential for development and associated land use changes would occur as follows:

- CBA 1 - Of the nine interchange locations, four have the potential for induced development. These land use changes are anticipated to occur in the interchange area at Route 156 in Prince George County, Route 40 in Waverly, Route 620 in Wakefield, and Route 58 bypass in Suffolk for a total of 340 acres.
- CBA 2 – Of the 19 interchange and intersection locations, four have the potential for induced development. These land use changes are anticipated to occur in the interchange area at Route 40 in Waverly, Route 620 in Ivor, Route 460 at the Isle of Wight/Suffolk line, and Route 58 bypass in Suffolk for a total of 50 acres.

- CBA 3 – Of the nine interchange locations, seven have the potential for induced development. These land use changes are anticipated to occur in the interchange area at Route 156 in Prince George County, Route 40 in Waverly, Route 31 in Wakefield, Route 620 in Ivor, Route 258 in Windsor, Route 460 at the Isle of Wight/Suffolk line, and Route 58 bypass in Suffolk for a total of 380 acres.

Overall, the likelihood for potential land use changes would be greatest under CBAs 1 and 3 and, somewhat lesser under CBA 2. Interchange area potential development is discussed in detail in the Indirect and Cumulative Technical Report. Potential levels of interchange related development identified in Figure 4.18-1 to Figure 4.18-3 include:

- No change in planned land use – land use is the same as the 2026 No-Build land use conditions.
- No change in the type and scale of planned land use compared to No-Build, but alternative may increase the rate and timing of development.
- Residential – residential development at scale and density currently allowed by local plans.
- Light tourist/commercial – consists of 10 acres of development at the interchange area, may include one or more gas stations and/or a fast food restaurant.
- Economically competitive – consists of 20 acres of development at the interchange area, may include two to four gas stations and one to two fast food restaurants.

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Figure 4.18-1
CBA 1 POTENTIAL LAND USE CHANGES COMPARED TO NO BUILD AND TSM

Figure 4.18-2
CBA 2 POTENTIAL LAND USE CHANGES COMPARED TO NO BUILD AND TSM

Figure 4.18-3
CBA 3 POTENTIAL LAND USE CHANGES COMPARED TO NO BUILD AND TSM

4.18.1.2 Land Use Changes beyond Interchange Areas

An increasing rate of conversion of land to residential uses may also occur beyond the proposed interchange locations. These land use changes beyond the existing suburban development would likely be the cumulative result of regional population growth, market trends, and travel time savings.

For this analysis, this potential indirect land use impact is termed "sprawl development" and is defined as new low-density residential development in existing rural areas. Existing commuting patterns reveal that Prince George residents mainly commute to employment centers west of the study area, while Isle of Wight, Suffolk, and Surry residents are commuting to major employment centers east or northeast of the study area. In order for areas further to the interior of the Route 460 corridor (i.e., Waverly, Wakefield, and Ivor) to become instantly attractive for these same commuter-sheds upon construction of a CBA, travel times would need to decrease relative to the 2026 No-Build condition sufficiently to offset the increased distance from the employment centers. If this were to occur, it would suggest a dramatic change in residential development pressures could occur with the CBA(s).

Based on an analysis of commuting patterns, land use plans, and existing and planned development patterns, the eastern and western commuter-sheds for the 2026 No Build Alternative were identified. Travel times with the CBAs from each interchange along the corridor were compared to the No-Build travel times. According to the travel time analysis, the travel time savings of the CBAs would not draw the interior counties' interchanges into the commuter sheds, therefore, the development pressures for sprawl development in the study area are not expected to be great.

However, suburban and exurban development patterns elsewhere in the state, such as Stafford and Fauquier Counties in northern Virginia, suggest that some residential development will eventually reach beyond the existing commuter-sheds, and the travel time savings of the CBAs will make this somewhat more likely to occur. Development and its impacts will, however, also depend on local actions including planning regulations and the provision of infrastructure. Sprawl development impacts cannot be measured, but based on local coordination and existing comprehensive plans, the lack of impetus from travel time savings, and the modest population growth rates expected in the interior of the study area (less than 0.5 percent annually), sprawl development effects are anticipated to be minor in extent.

4.18.1.3 Summary of Indirect Land Use Changes

Adequate developable land is located within each one-mile interchange area to absorb the acres of anticipated potential development. CBAs 1 and 3 would result in the greatest amount of indirect land use impacts as a result of the conversion of an additional 340 and 380 acres, respectively. CBA 2 would result in the conversion of 50 acres of agricultural and forestlands. The effect of these additional land use impacts to agricultural and forestland will be discussed in further detail in Sections 4.18.4 and 4.18.5.

4.18.2 Indirect Social Impacts

This analysis considers different factors that have the potential to affect social interaction and stability in the seven communities along Route 460 in the study area. The direct and indirect community impacts considered include: displacements, safety, travel patterns and accessibility, economic impacts, and indirect change to land use in the seven communities.

Based on the relative severity of the five factors identified above, and considering existing levels of community cohesion, a rating of low, low-moderate, moderate, or high is identified for each community. Social adaptation can be both negative and positive; but the main concern is the sustainability of the community as a whole. In general, these social impacts are considered low in communities with no displacements, no new traffic patterns, and no land use changes at interchange areas. Conversely, communities experiencing considerable changes with regard to these factors would be expected to have a moderate or high indirect social impact.

4.18.2.1 2026 No-Build and TSM Alternatives

The No-Build and TSM Alternatives would not result in any displacements or changes in local travel patterns. Currently, Route 460 bisects the communities of Disputanta, Waverly, Wakefield, Ivor, Zuni, and Kings Fork. Current traffic levels and lack of consistent shoulder limit bicycle and pedestrian mobility along Route 460 in each community. Future traffic increases, which include increases in truck traffic could further limit bicycle and pedestrian mobility and increase the degree to which Route 460 bisects the communities. By the year 2026, average daily traffic volumes for the No-Build and TSM Alternatives are projected to increase between 34 and 70 percent over existing volumes.

The national average for truck traffic on rural arterial highways is 10 percent (FHWA, 1996). In contrast, the percentage of truck traffic on Route 460 ranges from 18 to 30 percent under existing conditions and will increase to a range of 30 to 37 percent in 2026 with the No Build and TSM Alternatives. Due to the high percent of truck traffic, high travel speeds, and a lack of protected turning movements, residents have noted throughout the public involvement process their concerns with regard to safety when crossing or turning on Route 460. Local services such as emergency service response, mail delivery, and school bus routes are also sensitive to these increases in traffic and truck volumes.

4.18.2.2 Candidate Build Alternatives

Table 4.18-1 summarizes the direct and indirect factors that influence social interaction and stability under each CBA. The adverse social impacts of the CBAs include displacements and / or introduction of new impediments to non-vehicular traffic. The positive impacts include improved access for emergency vehicles, reduced travel times, and increases in local employment. Additional social impacts that cause change that may ultimately be either positive or negative include “bypass effects” that will cause change in local business districts and indirect land use impacts at interchanges that will change community dynamics. As illustrated in Figure 4.18-4 through Figure 4.18-6, all three CBAs have similar indirect social impacts with two exceptions:

- CBA 1 would result in moderate changes to levels of community cohesion in Waverly.
- CBA 2 would result in low-moderate changes in community cohesion in Zuni.

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Table 4.18-1
SUMMARY OF SOCIAL EFFECTS

Community	CBA 1		CBA 2		CBA3	
	Impact to Community Cohesion	Basis for Impact	Impact to Community Cohesion	Basis for Impact	Change in Community Cohesion	Basis for Impact
Disputanta	Low	No negative impacts; minimal change in land use dynamics	Low	No negative impacts; minimal change in land use dynamics	Low	No negative impacts; minimal change in land use dynamics
Waverly	Moderate	Displacements (12), increased traffic on Route 40, potential development at interchange	Low-Moderate	Potential development use at interchange	Low-Moderate	Potential development use at interchanges
Wakefield	Low-Moderate	Potential development at interchanges	Low-Moderate	Increased traffic on Route 31, possible effects to rate/timing of planned land use near interchange	Low-Moderate	Increased traffic on Route 31, potential development at interchange
Ivor	Low-Moderate	Possible effects to rate/timing of planned land use near interchange	Low-Moderate	Potential development at interchange	Low-Moderate	Potential development at interchanges
Zuni	Low	No negative impacts; minimal change in land use dynamics	Low-Moderate	Displacements (4), proximity impacts	Low	No negative impacts; minimal change in land use dynamics
Windsor	Low-Moderate	Displacements (2), increased traffic on Route 258; possible effects to rate/timing of development near interchange	Low-Moderate	Displacements (8), increased traffic on Route 258	Low-Moderate	Increased traffic on Route 258, Potential development at interchange
Kings Fork	Low	Displacements (2-3)	Low	Displacements (2-3)	Low	Displacements (2-3)

Source: Parsons Brinkerhoff and Michael Baker Jr. 2005

Figure 4.18-4
CBA 1 INDIRECT SOCIAL IMPACTS TO COMMUNITIES

Figure 4.18-5
CBA 2 INDIRECT SOCIAL IMPACTS TO COMMUNITIES

Figure 4.18-6
CBA 3 INDIRECT SOCIAL IMPACTS TO COMMUNITIES

4.18.3 Indirect Economic Impacts

Indirect economic impacts include the economic effects from potential land use changes, bypassing communities, and benefits of travel time savings to industrial developments in the study area. The analysis assumes that the traffic on Route 460 and any CBAs is a major determinant of the location of some businesses. This analysis considers the likely employment impacts that would result from different traffic levels along Route 460 as well as the employment changes in from potential land use changes in interchange areas, and the general extent to which those impacts may be offsetting.

Due to the speculative nature of predicting employment losses and gains, the analysis of indirect employment impacts is mainly qualitative, with general quantitative results that enable comparisons. The analysis is based on existing and planned land use and the indirect land use impact analysis. The analysis of the economic effects to bypassed communities relies on empirical research reported in transportation literature and application of that research to the travel time and bypass characteristics of the CBAs relative to each bypassed community.

The No-Build and TSM alternatives would not bypass the existing business districts along Route 460, nor would development at new-location interchanges occur. The maintenance and growth of traffic levels along Route 460 would support existing and future automobile-based businesses. However, the high levels of truck traffic and high traffic volumes by 2026 could discourage the development of non-automobile-dependent businesses due to access and safety concerns by motorists and pedestrians. Average daily traffic volumes for these two alternatives increase between 34 to 70 percent over existing volumes. With an increase in traffic volumes on Route 460 comes an increasing percentage of truck traffic, ranging from a 6 to an 11 percent increase over current truck volumes. On rural arterial highways like Route 460, the national average for truck volumes is 10 percent (FHWA). Under the No-Build and TSM Alternatives, the truck volumes would range from 30 to 37 percent of total traffic. With this substantial volume of truck traffic passing through the downtowns of communities along Route 460, access to local businesses will become more difficult, the visibility of local businesses will be reduced, and noise levels will increase.

Travel times under the No-Build and TSM Alternatives would also increase. Between Petersburg and Suffolk, travel times would increase by 11 percent (8 minutes) over the existing condition. This increased travel time places an increasing burden on commuting workers, the delivery of goods and services, and the desirability of the Route 460 corridor for development purposes.

4.18.3.1 Indirect Economic Benefits of the CBAs

Indirect economic benefits of the CBAs include development of businesses at new interchange areas, as described under indirect land use impacts, and travel time savings for industrial areas with access to the CBA. The indirect economic benefits of the CBAs in terms of the number of interchanges with induced commercial development and the number of industrial areas with improved access are as follows:

- CBA 1 – Three interchanges and five industrial areas.
- CBA 2 – Four interchanges and five industrial areas.
- CBA 3 – Six interchanges and three industrial areas.

The interchange areas are discussed in more detail in 4.18.1.1 and the planned industrial areas are described in more detail in 4.19.2. A negative consequence of the economic benefits in interchange areas could be the failure of businesses in existing business districts along Route 460 to remain profitable when traffic levels decline. This is discussed in the following section. However, total traffic on Route 460 and the CBAs is higher with the CBAs than it is with the No Build Alternative, which suggests that there will be a net increase in economic opportunities for automobile-dependent businesses with the CBAs. Overall, the benefits to existing and planned employment and industrial areas would be maximized under

CBAs 1 and 3 because they are on new alignment, are limited access via interchanges, and provide for the safe, free-flow of traffic at much higher speeds.

4.18.3.2 Bypass Effects of the CBAs

To determine the potential impacts to communities bypassed by either CBA 1, 2, or 3, it was necessary to establish criteria and general assumptions. An extensive literature review of analyses of small town bypasses was conducted for this study. The general findings of the literature review are best summarized by Weisbrod:

> The many highway bypass studies carried out around the country provide a generally consistent story. They indicate new highways bypassing the central business district of a community are seldom devastating or the savior of the area. The locational shift in traffic can cause some existing businesses to close up or relocate, but it can also create some new business opportunities. Net economic impacts on the broader community are usually relatively small (negative or positive). Downtown business districts having a strong identity as a destination for visitors or for local shoppers are the ones most likely to be strengthened due to the reduction in traffic delays through their centers. However, there is also a broad perception that adequate signage to the bypassed business center is an important need (and concern) for ensuring its continued success.
>
> Across the case studies, some positive and negative factors are common. The positive benefits of bypassing downtown areas commonly include the removal of heavy truck traffic from central areas and the opening up of additional industrial sites along the new route, thus attracting new investment from outside the region. The negative impacts sometimes include increases in sprawled, low density commercial and residential development that entail additional environmental and infrastructure costs.

In general, the degree to which bypassed communities are affected is best reflected in the following categories: travel time savings, reduction in overall traffic volumes and percentage of truck traffic, accessibility to or distance from the new bypass interchange to a community's downtown area, and type of businesses within each bypassed community's' downtown area.

Travel Time Savings

Travel time savings for CBA 1 or 3, from Petersburg to Suffolk, would be approximately 21 minutes (26 percent) compared to the No-Build Alternative. Under CBA 2, this savings would be approximately 10 minutes (12 percent). Existing at-grade intersections along Route 460, many of which are signalized, are maintained under CBA 2. As a result, travel time savings would not be as great as they would be for CBA 1 or 3. Workers commuting from any of the six bypassed communities would benefit the most from the travel time savings afforded under CBA 1 or 3. One of the adverse impacts associated with travel time savings is that CBA 1, 2, or 3 could facilitate the shift of local shoppers from the smaller local communities to the larger urban centers. However, as noted in the literature review, business districts having a strong identity as a destination for visitors or for local shoppers are the ones most likely to be strengthened due to the reduction in traffic delays through their centers.

Reduction in Traffic Volumes and Truck Traffic

Reducing traffic volumes through a community's downtown area creates both positive and negative impacts. The quality of life through the bypassed downtown area is improved substantially as congestion and vehicular noise are reduced, visibility and safety improved, and accessibility to local businesses and services is greatly improved. However, travel-oriented businesses such as gas stations, truck stops, motels, fast-food restaurants, and tourist-oriented shops could suffer from the shift in travel patterns and reduction in traffic passing by their respective businesses. On Route 460 through the downtown areas of Disputanta, Waverly, Wakefield, Ivor, Zuni, and Windsor, overall average daily traffic (ADT) volumes under the No-Build Alternative would be between 14,400 to 19,500. The CBAs would substantially

reduce traffic volumes on existing Route 460 through the bypassed downtown areas relative to the No-Build Alternative:

- Under CBA 1, existing Route 460 would have an ADT of 1,500 to 4,500 (76 to 90 percent reduction in ADT),
- Under CBA 2, existing Route 460 would have an ADT of 1,500 to 4,500 (73 to 90 percent reduction in ADT), and
- Under CBA 3, existing Route 460 would have an ADT of 1,400 to 8,000 (49 to 90 percent reduction in ADT).

The percentage of truck traffic on existing Route 460 in the downtowns of bypassed communities would be between 7 and 9 percent of total traffic volumes with all CBAs compared to 30 to 37 percent under the No-Build Alternative. The national average for truck traffic on similar rural arterials is 10 percent.

Accessibility to Downtown Areas via Bypass

A distance of approximately 1 to 1.5 miles is assumed to be the threshold for whether a traveler on the bypass would exit onto a secondary road in order to obtain goods and services in the nearby town. As shown in Table 4.18-2, all of the proposed interchanges under CBA 2 are within this range. Given the proximity of the bypassed communities from the bypass, it is more likely that travelers on CBA 2 would travel into the downtown area to obtain goods and services. Under CBA 1 or 3, the farther the bypass interchange is from the downtown area, the more likely it is that through-traffic would continue to the next exit that offers goods and services within this 1 to 1.5 mile range. Two interchanges in each of CBA 1 and 3 are greater than two miles from the bypassed community. A detailed analysis of potential land use changes and the likelihood of new interchange areas being developed is provided in Indirect Effects and Cumulative Impacts Technical Report. CBA 1 has three interchange areas with potential commercial development, while CBA 2 has four areas and CBA 3 has six.

Table 4.18-2
DISTANCE OF BYPASS INTERCHANGE TO ROUTE 460 IN DOWNTOWN AREA

BYPASSED COMMUNITY	CBA 1	CBA 2	CBA 3
Disputanta	1.5 miles	0.5 mile	3.3 miles
Waverly	1.6 miles	1.2 miles	1.2 miles
Wakefield	2.9 miles	1.3 miles	1.3 miles
Ivor	2.3 miles	0.9 mile	2.5 miles
Zuni*	---	---	---
Windsor	0.5 miles	0.8 mile	1.5 miles

* No interchange access would be provided to Zuni via CBA 1, 2, or 3. However, CBA 2 would provide at-grade intersections on existing Route 460 at the western and eastern sides of Zuni.

Summary of Bypass Effects

The CBAs are anticipated to have similar bypass effects to existing downtown businesses on the basis of changes in traffic levels. CBA 3 would have the most new, competing commercial development areas at interchanges, while CBA 1 would have the least. The distance of the bypass interchanges to the existing downtown areas is small enough at all interchanges with CBA 2 to infer that drivers would visit the downtown areas from the bypasses. With CBAs 1 and 3, there are two interchanges where this distance

exceeds the assumed threshold of through-travelers' willingness to venture into downtown areas for goods and services.

Given that all six of the bypassed communities have some sort of highway-related business, such businesses would likely experience a short-term decline in revenues due to the shift of through-traffic. The towns of Waverly, Wakefield, and Windsor have the greatest number of highway-related businesses. Therefore, these towns could be the most adversely affected in this regard. However, these towns are also the largest of the communities along the Route 460 corridor and are more self-sufficient than communities such as Disputanta, Ivor, and Zuni. This self-sufficiency and local support of these highway-related businesses could offset the reduction in through-traffic business. With the shifting of traffic to CBA 1, 2, or 3, access to businesses in the downtown areas would become easier and more convenient.

4.18.4 Indirect Farmlands Impacts

Indirect impacts to farmlands include farmland fragmentation and impacts to farmland from potential development. The No-Build and TSM Alternatives would not include roadway on new location. Therefore, farmland fragmentation impacts would not occur with these alternatives. Potential development is not anticipated with the No-Build or TSM Alternative. The No-Build and TSM Alternatives would not affect the economic sustainability of agriculture within the study area.

Farmland fragmentation is assumed to have the potential to occur where an alternative is proposed on new location in agricultural areas. Where the roadway is proposed to be widened in place, agricultural acres may be impacted but no new fragmentation of farmland would occur. Therefore, CBAs 1 and 3 have the potential to fragment farmland anywhere that they pass through agricultural areas, whereas CBA 2 has the potential for these impacts only in the area of the bypasses. Therefore, CBA 2 would be expected to have the least indirect impacts to farmland fragmentation and CBA 1 and CBA 3 would be expected to have higher farmland fragmentation impacts because the scale of their new location impacts on agricultural land is similar.

Impacts to agricultural and forestal districts have been minimized in the proposed CBA alignments; therefore, indirect impacts to farmlands have already been minimized to some degree. During final design, the parcel-level impacts to farms will be minimized, which will further reduce farmland fragmentation. If a CBA is selected, any uneconomic remnants of land that would be created by the selected alternative would be purchased during right-of-way acquisition.

Additional indirect impacts to agricultural land will occur where indirect land use change take place on and displaces agricultural land use. The CBAs are estimated to have the following indirect impacts to agricultural land in interchange areas:

- CBA 1 – 115 acres
- CBA 2 – 30 acres
- CBA 3 – 150 acres

The interchange area at CBA 1 includes 40 acres of land within the Knoxville District Agricultural and Forestal Districts. As long as this land remains within the district, it will not be developed for more intensive land uses. In addition to zoning restrictions, should localities want to limit potential development at associated interchange areas and preserve agricultural land uses, they can consider supporting or encouraging agricultural and forestal districts to preserve and protect open spaces, forested areas, and agricultural lands.

The potential for these impacts in combination with direct project impacts and the past, present and future actions in the study area to impact the sustainability of agriculture is assessed in Table 4.19-4.

4.18.5 Indirect Terrestrial Communities, Habitat, and Biodiversity impacts

For purposes of this assessment, forestland is used as the primary indicator of terrestrial wildlife habitat and biodiversity. Indirect impacts evaluated in this analysis include incremental habitat loss, forest fragmentation, and resulting effects upon regional biodiversity. As reported in the *Natural Resources Technical Report*, uplands within certain portions of the study area are so highly fragmented that they afford limited contribution with respect to wildlife corridors; however, riparian corridors and a number of headwater areas in the western portion of the study area have been less disturbed and presently serve as components of several prominent wildlife corridors within the region.

The No-Build and TSM alternatives would result in some indirect impacts to wildlife habitat, but these effects would occur within or adjacent to the existing de-forested corridor and are expected to be negligible.

CBA 1 would result in the conversion of 225 acres of forestland uses as a result of indirect land use impacts near interchanges; this acreage is less than 0.1 percent of the forestland in the study area. None of the CBA 1 interchanges or potential development would bisect a wildlife corridor or affect a BRANK area.

CBA 2 would result in the conversion of 20 acres of forestland uses as a result of indirect land use impacts in interchange areas, which is less than 0.01 percent of forestland in the study area. CBA 2 would affect neither wildlife corridors nor BRANK areas in the interchange areas that are anticipated to have potential development impacts.

CBA 3 would result in 230 acres of converted forestland as a result of indirect land use impacts at interchange areas. This is less than 0.1 percent of the forestland in the study area. While one CBA 3 interchange (Route 625 near Disputanta) is in the vicinity of a wildlife crossing and BRANK area, no change in future land use is anticipated to occur at this interchange as a result of CBA 3.

4.18.6 Indirect Impacts to Waters of the U.S., Including Wetlands, and Associated Aquatic habitat

Indirect impacts to navigable waterways, streams, ponds, and wetlands may occur as a result of indirect land use impacts or downstream effects from the direct impacts of project alternatives. The severity of these impacts along with appropriate mitigation measures will be regulated by state and federal permitting processes that will minimize impacts from the proposed roadway project. State, federal, and additional local regulations would apply to most indirect land use changes. Regulatory permit programs and agencies that will serve to regulate the degree and extent of future indirect impacts include: the Virginia Pollutant Discharge Elimination System (VDPES), the Virginia Water Protection Permit (VWPP), Section 404 of the Clean Water Act of 1977, and the Virginia Marine Resources Commission (VMRC).

If individual construction components associated with the No-Build and TSM Alternatives (such as turn lanes, shoulder widening, etc.) required encroachment upon wetlands or streams, such encroachments can be expected to be relatively minor in extent and severity. The No-Build and TSM Alternatives would not resolve any existing stormwater management problems or bring existing stormwater treatment facilities along the Route 460 corridor up to current standards.

CBA 1 and CBA 3 would have comparable levels of indirect impacts to waters of the U.S and associated habitat as a result of indirect land use impacts. Indirect land use impacts are anticipated to impact 340 acres with CBA 1 and 380 acres with CBA 2. However, wetland impacts in these development areas would be expected to be minimal due to the avoidance and minimization requirements of wetland regulations as well as the ample availability of non-jurisdictional developable land. CBA 2 would impact fewer acres (50) as a result of potential development, and the same results with regard to indirect impact minimization would occur with CBA 2 as were described for CBAs 1 and 3.

As detailed in the *Natural Resources Technical Report*, CBA 3 has the greatest quantity of wetland and stream crossing impacts, followed by CBA 1. CBA 2 has the least impacts to these resources. Indirect impacts associated with these encroachments, such as pollutant loading, thermal and sedimentation effects at stream crossings, streambed erosion, effects to downstream aquatic habitat, and impacts to

downstream wetland hydrology, would be minimized by the use of best management practices during construction and the collection and retention of storm water according to best management practices and as required by VDEQ. Indirect impacts to stream beds and aquatic habitat located downstream of streams crossed by a CBA would be mitigated through restoration of disturbed stream banks/substrate and land surfaces immediately following construction and through provision of storm water management facilities designed to address both water quantity and water quality. In addition to having fewer crossings and encroachments on waters of the U.S., CBA 2 would provide a beneficial indirect impact along the existing Route 460 corridor by affording the opportunity to improve any deficient stormwater management facilities and reduce pollutant loading in streams currently crossed by Route 460.

4.18.7 Indirect Impacts to Water Quality from Indirect land use changes

Indirect impacts to water quality could occur as a result of the increases in impervious surface from development that could be induced by a project alternative. A quantitative analysis of impervious surface increases for direct and indirect project impacts as well as planned future actions is presented in Section 4.19.5.

Individual construction components associated with the No-Build and TSM Alternatives (such as turn lanes, shoulder widening, etc.) may require increases in impervious surface. However, these increases would be relatively minor in extent and severity.

CBA 1 and CBA 3 would have comparable levels of indirect impacts to water quality as a result of potential development. The increased impervious surface associated with potential development (94 acres of impervious surface and 128 acres, respectively) would increase stormwater runoff; however, certain design criteria associated with this development would be governed by VDEQ permits in that they would be required to follow best management practices (BMP) for stormwater retention and treatment and erosion/siltation control. CBA 2 would result in 42 acres of additional impervious surface as a result of potential development, but the same minimization of impacts through permitting requirements would be anticipated.

4.18.8 Indirect Impacts to Floodplains

Development in floodplains is governed by federal and state statutes through the Virginia Department of Conservation and Recreation (VDCR) Floodplain Management Program and by local Flood Insurance Programs administered by localities and overseen by FEMA.

If individual construction components associated with the No-Build and TSM Alternatives (such as turn lanes, shoulder widening, etc.) required encroachment within floodplains or regulated floodways, such encroachments would be relatively minor in extent and severity. Indirect impacts to floodplains and floodways would be negligible for all CBAs as a result of floodplain regulations and VDOT's bridge design standards. Regulatory restrictions and performance standards set forth in local floodplain ordinances and FEMA regulations would apply to potential development. Therefore, no indirect impacts to floodplains are anticipated to occur with this project.

4.18.9 Indirect Impacts to Threatened and Endangered Species

Federally-listed threatened or endangered species in the study area include the bald eagle, the red-cockaded woodpecker, and the piping plover. Indirect impacts to these species could occur if the project's indirect land use impacts were anticipated to occur in the vicinity of these species' habitats. However, indirect land use impacts are limited to the areas around interchanges of the CBAs, and none of these species' habitats exist in these areas. Therefore, no indirect impacts to federally-listed threatened and endangered species are anticipated to occur with this project.

4.18.10 Indirect Noise Impacts

Indirect land use impacts would change the patterns of traffic both on Route 460 and in adjacent activity areas. Indirect noise impacts could occur where new activity areas are created, if the nature or intensity of such areas were anticipated to add to local sound levels. According to the indirect land use impact analysis, the No-Build and TSM alternatives would not create any new activity areas. The new activity areas (i.e., commercial development) with the CBAs would be small in scale – no larger than 20 acres in size and consisting of gas stations, restaurants and small tourist-related businesses. The level of economic activity anticipated is directly related to the anticipated traffic levels of the CBA and cross-roads, which were considered in the direct noise impact analysis. Based on the indirect land use analysis, the type and scale businesses in new activity centers would not be expected to contribute substantially to increased noise in the interchange areas beyond that of the projected traffic.

4.18.11 Indirect Air Quality Impacts

Regional air quality conformity analysis considers the projected increases in regional population and employment, which are included in the non-attainment regions' travel demand models. The two non-attainment regions are the Richmond-Petersburg region at the west end of the project and the Hampton Roads region at the east end of the project. The indirect land use impacts of the CBAs and any net increase in employment, with associated travel, would not necessarily be included in the regional air quality conformity analysis. However, the Route 460 Location Study is included in the conformity analysis for these regions, so the only incremental impact for air quality would be the indirect land use changes. The majority of CBA land use impacts would occur at the ends of the project that are within these non-attainment areas. This includes 300 acres of low-density residential development in Prince George County with CBAs 1 and 3, as well as 20-30 acres of commercial development at the eastern end of the project with all three CBAs. These impacts are insignificant when one considers that the Richmond-Petersburg region has a population of approximately one million and the Hampton Roads region has approximately 750,000 jobs. The minute proportion of regional development that would be increased by the project's indirect land use impacts is not anticipated to affect air quality conformity in either non-attainment region.

4.18.12 Indirect impacts to Cultural Resources

Unlike streams and jurisdictional lands, cultural resources may be encroached upon or displaced, through private land transactions, where indirect land use impacts occur. Thus, the indirect impact analysis to cultural resources focuses on the presence of National Register listed or eligible sites in the areas where potential development is anticipated to occur.

- CBA 1 – The interchange with Route 620 south of Wakefield is anticipated to have 10 acres of commercial development. This is in the vicinity of the Wakefield Sportsmen's Club (DHR 091-5058). This is the location of the annual "Shad Planking" political event.
- CBA 2 – At the Isle of Wight County/Suffolk City line, 10 acres of commercial development are anticipated to be induced by a new interchange. This is in the vicinity of Saunders House (DHR 046-0006).
- CBA 3 – The interchange noted for CBA 2 is also part of CBA 3. In addition, at the new interchange on Route 620 north of Ivor is anticipated to have 10 acres of induced commercial development, Oak Grove (DHR 087-0014) is located in the vicinity of this interchange.

The potential impact areas are 1-mile in radius around the CBA interchanges. GIS analysis indicates that ample developable land is available for the 10 acres of development anticipated at these sites without encroaching upon the historic sites. Also, this development could require development approvals from local government, and effects to historic properties could be considered during this process. The decisions of landowners will also factor into the preservation of these historic sites.

4.19 CUMULATIVE IMPACTS

In accordance with CEQ guidance, the cumulative effects analysis was limited through the NEPA scoping process to effects that can be evaluated meaningfully and that are of concern to resource agencies, local officials, and/or the public. Issues of concerns evaluated in the cumulative effects analysis include:

- Impacts to historically diminishing farmlands;
- Economic impacts to communities;
- Impacts to water quality and aquatic habitat;
- Impacts to already-fragmented forested lands, affecting terrestrial communities and habitat; and
- Impacts to wetlands

The existing and future No-Build land use scenarios assumed for this project are considered the cumulative baseline condition. The direct and indirect impacts of the proposed CBAs, when added to impacts of other past, present, or future actions, were assessed to identify the cumulative effects to resources of concern and the incremental impact of the proposed project. Cumulative project impacts were quantified in GIS or qualitatively discussed for each issue of concern.

Evaluation of cumulative impacts was completed in by first identifying past, present, and reasonably foreseeable future actions.

Team members then reviewed the long-term productivity or sustainability of resources potentially affected by the Route 460 project and other planned actions to identify the incremental effects of the proposed project.

4.19.1 Past and Present Actions

Past and present actions affecting the resources, ecosystems, and human communities of concern include:

Period: 1900 – 1950s

- Towns of Windsor and Wakefield incorporated – 1902
- Development of large-scale agricultural processing industries based on peanuts, pork processing, and paper products (e.g., Smithfield Foods -1936, Union Camp/International Paper - 1937, Planters Peanuts – 1906.)
- Development of Fort Lee in Prince George County – 1917 – quartermaster and logistics training disciplines.
- Development of I-64 – From Hampton Roads to Richmond, completed between 1957 and 1968
- Development of I-95 – 1958

Period: 1960 – 1980s

- Development of Surry Nuclear Power plant (Virginia Electric and Power Company (VEPCO) – now Dominion Power) – 1973
- City of Suffolk merged with Nansemond County - 1974
- Norfolk Southern ceased passenger rail service between Petersburg and Suffolk in the early 1970's
- Food Lion distribution Center established in Prince George County

Period: 1990 - Present

- Development of I-295 in Prince George – 1992
- Development of I-664 in Suffolk – Construction started 1979 and ended in 1992 with completion of the Monitor-Merrimack Memorial Bridge-Tunnel.
- Boundary adjustment to the Town of Windsor, increasing land area from 653 acres to 2,578 acres July 2001.
- Development of Prince George's SouthPoint Industrial Park – 2000 - ongoing
- Atlantic Waste Landfill – Sussex County – Permitted in 1993 (landfill expected to be full in 2006)
- Sussex I and II State Prisons – over 2,400 prisoners, security levels 4 and 5, opened 1998-1999
- Preservation of Piney Grove Preserve (Nature Conservancy) – 1998. Piney Grove harbors Virginia's last breeding population of red-cockaded woodpeckers.
- Hurricane Isabel – September 2003

4.19.2 Other Major Future Actions:

Through review of existing plans and coordination activities, major planned actions in or affecting the study area were identified. Most of the development information was provided by local planning and economic development officials. Table 4.19-1, Table 4.19-2, and Table 4.19-3 show the major, future actions and the location and timing of these actions. Table 4.19-1 identifies transportation projects, Table 4.19-2 presents commercial development and Table 4.19-3 presents residential development. All of the developments in Table 4.19-2 and Table 4.19-3 were directly considered in the cumulative impact analysis as reasonably foreseeable future development that will occur with our without the proposed improvements to Route 460. The projects in Table 4.19-1 were evaluated with regard to planning status and were not found to be reasonably foreseeable for the reasons described in the table. The developments in Table 4.19-2 and Table 4.19-3 are presented graphically in Figure 4.19-1 by the numbers indicated in the left-hand column of each table.

Table 4.19-1
FUTURE MAJOR TRANSPORTATION PROJECTS

Action	Agency/ Owner/ Manager	Location	Timing and/or Description of Action*
Route 258 Bypass	VDOT	Isle of Wight County	Identified as a needed, long-term roadway improvement in county's comprehensive plan. However, it is not included in VDOT's 6-Year Transportation Improvement Plan nor is it included in the Hampton Roads PDC's 2030 Constrained Long-Range Plan.
Passenger Rail	VDRPT	Richmond – Hampton Roads	Richmond/Hampton Roads Passenger Rail Study pending. Preliminary alignment alternatives in two corridors (Route 460 and I-64) are under consideration. As a preferred alternative has not been selected, this project is not incorporated in this cumulative analysis. Additionally, the alternative selected would not make a discernable difference to the traffic forecasts for the CBAs.
Eastern Virginia Airport	Virginia Department of Aviation	Surry, Isle of Wight, or Suffolk	Virginia Department of Aviation was investigating the possibility of constructing a regional super airport or additional airport in one of these localities. However, this new airport is not included in the Department of Aviation's long-range plan.

Source: Michael Baker Jr., Inc. 2005

Table 4.19-2
FUTURE MAJOR COMMERCIAL DEVELOPMENT ACTIONS

No.	Action	Agency/ Owner/ Manager	Location	Timing and/or Description of Action*
1	New container terminal	A.P. Moller / Maersk Group (APM Terminals North America, Inc.)	Portsmouth on the west side of the Elizabeth River.	Anticipated completion 2007
2	New container terminal	Port of Virginia	East side of Craney Island in Portsmouth.	EIS pending – due December 2005. Facility is located outside the study area. Projected increases in port activity are included in the traffic analysis for this EIS. The Port Authority is proposing improvements and expansion to accommodate the more than 16 million tons of general cargo by the year 2010.
3	New Intermodal Facility – Norfolk Southern South Central Virginia Intermodal Terminal	Norfolk Southern Railroad	New Bohemia, Prince George County	Shipping/warehouse development on approximately 22 acres bounded by Lamore Drive, Norfolk Southern railroad tracks. Facility is anticipated to serve 200 trucks per day in the first phase and, may expand to accommodate approximately 500 trucks daily.
4	Development of Norfolk Southern property	Norfolk Southern Railroad / Isle of Wight County	East and west of Windsor in Isle of Wight County	Norfolk Southern property east of Windsor is 1,600-acre undeveloped tract; one of largest tracts on East Coast. Very desirable property since the tract has rail access and is reasonably accessible to ports. It is assumed to be developed as an inland port facility with multimodal industrial park by 2026 with an anticipated 5,600 jobs created (assumes all jobs are automated and that it is all warehouse type of development).
5	Southpoint Industrial Park – Build-out	Private Developers and Prince George County	Prince George County, adjacent to I-295 and Route 460	1,800 acre industrial park for light manufacturing and distribution. Anticipate build-out in 5 to 10 years.
6	Moving Southside Regional Medical Center to Reves Road	Petersburg Hospital Company, LLC	Prince George County	Plans to relocate Southside Regional Medical Center and add two operating rooms. The current facility is a 408-bed acute care medical center with two professional schools.
7	Five Forks Energy Power Plant	Dominion Virginia Power	Sussex County, along Norfolk Southern rail line, on the north side of Route 602 and south of Route 460	Potential location of a cogeneration power plant. Size of parcel approximately 1,000 acres. If cogeneration power plant is not developed, this site remains a prime location for other industrial development due to rail access.
8	Regional Industrial Park	Town of Waverly and Sussex County	Old Waverly Airport along Route 460	Proposed industrial park on approximately 171 acres.
9	Expansion of the Town of Wakefield	Town of Wakefield	West of town along Route 460	Annexation of land planned in next 2-3 years
10	Strip Shopping Center	Private	Windsor, between railroad tracks and Route 460	Proposed 30,000 square feet retail and fast food restaurant with 15 to 20 commercial units and a fast food establishment. Total area approximately 2.5 acres
11	Retail Development	Private	Windsor, along Route 460 near Food Lion	Proposed commercial development on 21 acres with 50,000 square feet of retail space.

Source: Michael Baker Jr., Inc. 2005

Table 4.19-3
FUTURE MAJOR COMMUNITY AND RESIDENTIAL DEVELOPMENT

No.	Action	Agency/ Owner/ Manager	Location	Timing and/or Description of Action*
12	Church	Private	Windsor	10-acre site for new church
13	Single Family Residential	Private	Windsor	Second phase of Windsor Woods Subdivision. Additional 52 units to be built.
14	Single Family Residential	Private	Windsor, along Route 603	Proposed Holland Meadows subdivision with 100-units.
15	Single Family Residential	Private	Isle of Wight County near Route 460 and the Cost Plus Distribution Center	Proposed 200 unit subdivision (1 unit per 5 acres). Total acreage likely to be 1,000 acres
16	Single Family Residential	Private	Prince George County near Route 156	Lamar Drive subdivision with 24 units.
17	Single Family Residential	Private	Prince George County near Route 625 north of Route 460	60 acre parcel (12 units on 5 acres each) Arwood Road. 125 acre Warwick Acres (24 lots at 5 acres each)
18	Single Family Residential	Private	Prince George County near Route 625 south of Route 460	500 acre parcel (150 units) for residential development.
19	Single Family Residential	Private	Prince George County along Route 611	235 acre Pleasant Grove Estates (47 lots at 5 acres each)
20	Single Family Residential	Private	City of Suffolk, Kings Fork Road to Route 460	382 units at Kings Fork Farms (approximately 400 acres)
21	Expansion of Retirement Community	Private	City of Suffolk, near Lake Prince	Lake Prince Retirement Community expanding with additional 60 to 70 residential lots (approximately 70 acres)
22	Single Family Residential	Private	Sussex County, along Route 40	Waverly Meadows Subdivision on approximately 18 acres (70 units on ¼ acre lots)
23	Single Family Residential	Private	Sussex County, along Route 617	3 acre development with 10 units on ¼ acre lots
24	Single Family Residential	Private	Sussex County, along Route 628	Drumwright Mill Subdivision. 500 lot subdivision with lot size varying from ¼ to 5 acres. Planned urban development (PUD) with golf course.
25	Single Family Residential	Private	Prince George County, along Routes 635 & 636	24 units at Centennial Acres 24 units at Centennial/Lawyers Road

Source: Michael Baker Jr., Inc. 2005

Figure 4.19-1
FUTURE PLANNED ACTIONS

4.19.3 Cumulative Farmland Impacts

Cumulative impacts to agricultural lands may result from the conversion of agricultural lands from the proposed project, potential development, and private actions. The cumulative impacts to farmlands will occur as a result of 1) direct project impacts, 2) the project's indirect land use impacts in interchange areas, and 3) other planned actions. Cumulative impacts cannot be directly estimated for actively farmed parcels due to lack of GIS information. However, impacts to land classified as agricultural serves as a proxy. This classification includes cropland and pasture, confined feeding operations and "other" agricultural land.

A GIS analysis of the location of agricultural land uses and agricultural/forestal districts was compared to the location of indirect land use changes. As discussed in Section 4.18.1, each 2,000-acre interchange area was reviewed for the amount and type of developable land. Anticipated land use changes were allocated to available land, outside of agricultural and forestal districts, based on the assumption that, accessible, agricultural land would develop first, followed by accessible forested non-wetland acres. In every case, these two land types were more than sufficient to absorb the projected development.

Reasonably foreseeable future actions within the study area from Table 4.19-2 and Table 4.19-3 were reviewed, and wherever possible, acres were estimated for the development. For the other planned actions, many of the sites are not identified at a parcel level or within large parcels, so a worst-case scenario of farmland impacts was assessed.

Based on the land use impact analysis in the *Land Use, Parklands, and Farmlands Technical Report,* 30.4 percent of the study area (144,671 acres) is in agricultural land use. Historically, the study area has been predominantly rural, and while some residential and industrial developments have reduced the agricultural land in the study area, these developments are small in number and generally small in scale. The future No Build scenario, or baseline, for farmland impacts includes the impacts of planned actions, including industrial, commercial and residential development. The analysis accounted for all planned developments within the study area. These planned actions are estimated to consume an additional 8,600 acres of land in a worst case scenario. If all of this land were agricultural, that would consume six percent of the agricultural land in the study area.

Direct agricultural land use impacts range from the conversion of 517 acres to 707 acres in the Design Corridor of the CBAs. Indirect land use changes to agricultural land uses are estimated to result in the conversion of an additional 115 acres with CBA 1, 30 acres with CBA 2, and 150 acres with CBA 3. Total direct and indirect impacts would account for less than 0.5 percent of total agricultural land uses in the study area with the Design Corridors of CBAs 1 and 2 and less than 0.6 percent with the Design Corridor of CBA 3.

Thus, the project-related impacts to agricultural land are estimated to consume up to one percent of agricultural land. The worst case scenario for total cumulative effects to agricultural land is estimated to be less than seven percent of all agricultural land in the study area. Given the scale of these impacts, cumulative impacts to this resource do not appear to be sufficiently extensive to threaten its sustainability.

Additionally, local programs and policies provide incentives to preserve agricultural lands. These include Agricultural and Forestal Districts and a rural economic development manager on staff in Isle of Wight County and a growth management policy in the City of Suffolk.

Table 4.19-4
DIRECT AND INDIRECT FARMLAND IMPACTS

Alternative		Direct Agricultural Impacts (acres)	Indirect Agricultural Impacts (acres)	Total Direct and Indirect Agricultural Impacts (acres)	Percent of Agricultural Land in Study Area
CBA 1	Planning Corridor	965	115	1,080	0.75%
	Design Corridor	517	115	632	0.44%
CBA 2	Planning Corridor	1237	30	1,267	0.88%
	Design Corridor	557	30	587	0.41%
CBA 3	Planning Corridor	1229	150	1,379	0.95%
	Design Corridor	707	150	857	0.59%

Source: Parsons Brinckerhoff and Michael Baker Jr. 2005

4.19.4 Economic Impacts to Communities

Economic conditions in the study area vary – past and present actions include both economic growth and isolated economic decline. The future economic setting without the proposed project would include economic growth at planned industrial parks and at port terminals. This growth would bring more jobs to study area residents, but also would add truck traffic to the existing Route 460 facility, exacerbating concerns such as safety and local pedestrian movement that pose difficulties for local business districts. Other economic forces in the study area include the trend towards "big box" retail which, while not evident within most of the study corridor today, nevertheless threatens local business districts from the locations where this development does occur at the east and west ends of the study area and beyond. The economic future for study area communities is therefore a mixture of good and bad without the proposed improvements to Route 460.

Table 4.19-5 presents the collective economic impact findings from direct and indirect impacts of the CBAs. The direct impacts are explained in detail in the *Right of Way and Relocation Technical Report* and the *Socioeconomic Technical Report*. These findings show that negative direct impacts in the form of job losses and lost property tax revenues will generally be offset with indirect impacts from commercial growth at interchange areas and enhanced attractiveness to planned industrial areas as a result of travel time savings. However, a concern voiced by communities along the corridor is the continued sustainability of existing downtown areas once they are bypassed. This issue is addressed in Section 4.18.3 Indirect Economic Impacts, and the analysis finds that the bypass effects also have both positive and negative impacts to communities. The opportunity created by the reduction in traffic in business districts and the proximity to the improved Route 460 interchanges can actually enhance the economic sustainability of the towns.

From a cumulative standpoint, the communities will face economic challenges with or without the proposed improvements to Route 460. However, the opportunity for economic benefits appears greater with the CBAs because of the travel time savings to industries and the potential for bypassed

communities to create more attractive and sustainable downtown business districts than would be possible if truck traffic remained on the existing route.

Table 4.19-5
ESTIMATED ECONOMIC EFFECTS OF THE CBAS

Locality Direct	Employment Lost[1]	Direct Loss of Property Tax Revenues[1]	Location and Degree of Potential Commercial Development	Existing and Planned Industrial Areas Benefiting from Improved Accessibility
CBA 1				
Prince George County	10 jobs	$32,762	No commercial development anticipated, but induced residential development would occur at Route 156	Southpoint Industrial Park Planned Norfolk Southern facility
Sussex County	0	$9,150	Potential for light tourist / commercial services at the interchange areas in Waverly and Wakefield	Existing and planned industrial development along Route 602 Town of Waverly's industrial area on Route 40
Surry County	0	$0	None anticipated	None anticipated
Southampton County	0	$2,608	None anticipated	None anticipated
Isle of Wight	0	$22, 993	None anticipated	Town of Wakefield's industrial zoned area on Route 258
City of Suffolk	0	$13,182	Potential for economically competitive development at Route 58 Bypass area	None anticipated
Total CBA 1	**10 jobs**	**$80,695**	**Three Locations Of Induced Commercial Development**	**Five industrial areas with improved access**
CBA 2				
Prince George County	80 jobs	$32,294	None anticipated	Southpoint Industrial Park Planned Norfolk Southern facility
Sussex County	<10	$7,177	Potential for light tourist / commercial services at the interchange area in Waverly	Planned Regional Industrial Park (airport site)
Surry County	0	$445	None anticipated	None anticipated
Southampton County	0	$7,502	Potential for light tourist / commercial services at the interchange area in Ivor	None anticipated
Isle of Wight	0	$26,933	Potential for light tourist / commercial services at the interchange area east of Windsor	Shirley T. Holland Industrial Park Planned development of Norfolk Southern parcel (1,600 acres)
City of Suffolk	0	$18,063	Potential for economically competitive development at Route 58 Bypass area	None anticipated

Locality Direct	Employment Lost[1]	Direct Loss of Property Tax Revenues[1]	Location and Degree of Potential Commercial Development	Existing and Planned Industrial Areas Benefiting from Improved Accessibility
Total CBA 2	**90 jobs**	**$92,414**	**Four locations of induced commercial development**	**Five Industrial Areas With Improved Access**
CBA 3				
Prince George County	0	$16,971	No commercial development anticipated, but induced residential development would occur at Route 156	Planned Norfolk Southern facility
Sussex County	0	$3,515	Potential for light tourist / commercial services at the interchange areas in Waverly and Wakefield	None anticipated
Surry County	0	$2,756	None anticipated	None anticipated
Southampton County	0	$3,023	Potential for light tourist / commercial services at the interchange area in Ivor	None anticipated
Isle of Wight	0	$13,101	Potential for economically competitive development on Route 258 in Windsor Potential for light tourist / commercial services at the interchange area east of Windsor	Shirley T. Holland Industrial Park Planned development of Norfolk Southern parcel (1,600 acres)
City of Suffolk	0	$18,063	Potential for economically competitive development at Route 58 Bypass area	None anticipated
Total CBA 3	**0**	**$57,430**	**Five Locations Of Induced Commercial Development**	**Three Industrial Areas With Improved Access**

[1]Design Corridor estimates are shown for comparison purposes

Source: Michael Baker Jr., 2005

4.19.5 Cumulative Impacts to Water Quality and Aquatic Habitat

Due to its very nature, assessing cumulative impacts to water quality and aquatic habitat is a complex and highly speculative undertaking. Notwithstanding, this analysis focuses on an important variable related to water quality that can be assessed using the methods described below—impervious surface. Increases in impervious surface relative to natural areas in the study area are assumed to be an indicator of cumulative impacts to water quality.

Increases in impervious surfaces resulting from development can affect the physical and chemical characteristics of streams, potentially altering aquatic habitat. If not effectively attenuated through use of BMPs, increases in impervious surface can increase runoff volume, which in turn can lead to erosion, stream widening, and incision, as well as increased contributions of pollutants (particularly sediment) to surface waters. Increases in concentrations of these pollutants in surface water can result in disruption of life processes for aquatic organisms, can be toxic to aquatic life, or can decrease habitat suitability.

According to empirical research, when impervious surface cover exceeds ten percent within a given watershed, negative effects on in-stream habitat are typically observed; at 25 percent, the watershed becomes severely degraded (Center for Watershed Protection, 2003). These thresholds are based on

areas where much of the development occurred before existing stormwater management practices were in place. Therefore, these thresholds would be higher in areas developed using these practices.

While the study area appears to be below the 10 percent threshold based on analysis that follows, it is nevertheless the case that past actions have caused extensive degradation of water quality in the study area. As detailed in the *Water Quality Technical Report*, extensive portions of the Blackwater River and numerous aquatic systems in the study area are considered impaired on the basis of fecal coliform, sediments, and other pollutants. These impairments are related to agricultural runoff, intensive livestock operations, and sanitation-related issues rather than impervious surfaces based on the extent of fecal coliform impairments.

Increases in impervious surface relative to natural areas in the study area are assumed to be indicators of cumulative impacts to water quality. However, the amount of impaired waters in the study area suggests that stormwater management for any amount of development will be important to the future water quality in the study area.

In existing conditions, natural areas represented between 92 to 100 percent of the four watersheds. This demonstrates the vastness of natural land uses relative to the built environment. Negative impacts to stream habitat are not anticipated in existing conditions due to the level of impervious surface within each watershed. However, as noted above, there are extensive portions of the Blackwater River and numerous swamps that currently are impaired waters for a variety of reasons.

Reasonably foreseeable future actions within the study area identified in Table 4.19-2 and Table 4.19-3 were disaggregated according to watershed. Wherever possible, acres were estimated for the development and assigned a ratio of impervious surface based on planned land use. These other planned actions are estimated to consume an additional 8,600 acres of land resulting in an addition of approximately 2,300 acres of impervious surface in the Blackwater River watershed, 1,900 acres in the Nansemond River watershed, and 400 acres in the Nottoway River watershed. No major projects were identified for the Lower James River watershed within the study area. All of these watersheds would have less than 10 percent impervious surfaces within the planned future developments (Table 4.19-6). Thus, the future baseline condition without the proposed Route 460 improvements would fall below the most conservative threshold that indicates degradation of aquatic habitat. However, the waters impaired by pollutants in the current condition would be sensitive to any development impacts. The permitting process discussed in the indirect impact analysis in Sections 4.18.6 and 4.18.7 serve to protect the receiving waters from any further impairment.

As noted in Table 4.19-7, all three CBAs have similar direct and indirect impacts to water quality on the basis of the levels of impervious surface in the Blackwater River and Nansemond River watersheds. As CBA 1 is the only alternative to affect the Nottoway River watershed, it is the only one to result in impervious surface changes in that watershed. The direct and indirect impacts of CBA 1 increase the percent of impervious coverage from 0.9 percent to 1.3 percent in the Blackwater River watershed, from 2.5 percent to 3.0 percent in the Nansemond River watershed, and from 0.2 percent to 1.4 percent in the Nottoway River Watershed. The direct and indirect impacts of CBA 2 increase the percent of impervious coverage from 0.9 percent to 1.2 percent in the Blackwater River watershed and from 2.5 percent to 3.1 percent in the Nansemond River watershed. The direct and indirect impacts of CBA 3 increase the percent of impervious coverage from 0.9 percent to 1.4 percent in the Blackwater River watershed and from 2.5 percent to 3.0 percent in the Nansemond River watershed.

As noted in Table 4.19-8, the direct and indirect impacts of each CBA in addition to the land use conversions associated with other major actions would result in similar changes to impervious surface in the Lower James River, Blackwater River, and Nansemond River watershed. As previously noted, CBA 1 is the only alternative to affect the Nottoway River watershed and results in higher cumulative changes to impervious surface area when compared to CBAs 2 and 3.

Table 4.19-6
EXISTING AND PROJECTED IMPERVIOUS SURFACE COVERAGE IN THE STUDY AREA BY WATERSHED

	Lower James River Watershed	Blackwater River Watershed	Nansemond River Watershed	Nottoway River Watershed
Existing Impervious Surface Coverage (acres)	514	2,703	1,626	16
Existing Impervious Surface Coverage (percent of watershed in study area)	0.5%	0.9%	2.5%	0.2%
Impervious Surface Coverage of Planned Actions (acres)	0	2,300	1,900	400
Impervious Surface Coverage of Planned Actions (percent of watershed in study area)	0	0.7%	2.9%	3.9%

Source: Michael Baker Jr., 2005.

Table 4.19-7
DIRECT AND INDIRECT IMPACTS TO IMPERVIOUS SURFACE COVERAGE IN THE STUDY AREA BY WATERSHED

	Lower James River Watershed	Blackwater River Watershed	Nansemond River Watershed	Nottoway River Watershed
CBA 1 (acres)	0	1,333	307	125
CBA 1 (percent of watershed in study area)	0%	0.4%	0.5%	1.2%
CBA 2 (acres)	0	898	367	0
CBA 2 (percent of watershed in study area)	0%	0.3%	0.6%	0.0%
CBA 3 (acres)	0	1,510	293	0
CBA 3 (percent of watershed in study area)	0%	0.5%	0.5%	0.0%

Source: Michael Baker Jr., 2005.

Table 4.19-8
CUMULATIVE IMPACTS TO IMPERVIOUS SURFACE COVERAGE IN THE STUDY AREA BY WATERSHED

	Lower James River Watershed	Blackwater River Watershed	Nansemond River Watershed	Nottoway River Watershed
CBA 1 (acres)	514	6,312	3,802	517
CBA 1 (percent of watershed in study area)	0.5%	2.0%	5.9%	5.0%
CBA 2 (acres)	514	5,876	3,862	391
CBA 2 (percent of watershed in study area)	0.5%	1.9%	6.0%	3.8%
CBA 3 (acres)	514	6,489	3,788	391
CBA 3 (percent of watershed in study area)	0.5%	2.1%	5.9%	3.8%

Source: Michael Baker Jr., 2005.

Increased volumes of stormwater resulting from any additional infrastructure or impervious surfaces does not necessarily translate into worse water quality in receiving waters when appropriate best management practices are employed. As noted in the *Water Quality Technical Report* and *Natural Resources Technical Report*, with implementation of appropriate mitigation measures and best management practices (BMPs), the construction and operation of a CBA is not expected to result in measurable degradation of water quality or affect changes to regional water quality. The cumulative amounts of impervious surface in all three CBAs are well below the threshold of 10 percent and, as such, no negative cumulative effects to aquatic habitat are anticipated.

4.19.6 Cumulative Impacts to Terrestrial Communities and Habitat

The cumulative impacts to forestlands would occur as a result of 1) direct project impacts, 2) the project's indirect land use impacts in interchange areas, and 3) other planned actions. The analysis assumes that potential development associated with the CBAs and other planned actions that are not identified at the parcel level would convert agricultural or forestland uses to developed uses. The amount of agricultural land use conversion versus forestland conversion depends on its location and availability within each interchange area. It was assumed that agricultural lands were slightly more attractive as potential development locations than forestlands. For the other planned actions, many of the sites are not identified at a parcel level or within large parcels, so a worst-case scenario of forestland impacts was assessed.

The majority of the forestlands in the study area are fragmented by agricultural lands, timbered clear-cuts, transportation corridors, utility easements, and, to a lesser extent, residential and commercial development. Based on the land use impact analysis in the *Land Use, Parklands, and Farmlands Technical Report,* 61.8 percent of the study area (294,671 acres) is in forestland use.

Direct and indirect forest impacts are presented in Table 4.19-9. Direct forestland use impacts range from the conversion of 599 acres to 1,140 acres in the Design Corridor of the CBAs. Total direct and indirect

impacts would account for less than 0.5 percent of total forestland uses in the study area with the Design Corridors of CBAs 1 and 3 and 0.2 percent with the Design Corridor of CBA 2. The project's direct and indirect impacts, at worst, would be 2,409 acres, which comprises 0.82 percent of the forestland in the study area (Planning Corridor of CBA 1). The *Natural Resources Technical Report* identifies the areas where direct impacts would occur in riparian corridors or key biodiversity areas, and the indirect impacts on these areas are discussed in 4.18.5.

Other planned actions, independent of the proposed project, are estimated to consume an additional 8,600 acres of land. If all of this land were forested, that would consume three percent of the total forestland in the study area. Because the forested areas are highly fragmented in the base condition, the areas most sensitive to habitat impacts are the riparian corridors that enable mobility and large contiguous forest tracts having a high rating for biodiversity. Comparing Figure 4.19-1 to the prominent wildlife corridors and the biodiversity-ranked communities, the areas that may be affected in the future baseline (No-Build) condition include development sites along Route 625 north of Disputanta (actions 17-19) and the Warwick Swamp area (action 7).

In summary, the project-related impacts to forestland are estimated to consume up to one percent of forestland, and the worst case scenario for total cumulative effects to forestland is estimated to be less than four percent of all forestland. The majority of forested areas are not high quality with regard to species mobility and biodiversity; and the known important sites for wildlife movement and biodiversity to not appear to be generally at risk as a result of cumulative impacts. Mitigation for impacts to terrestrial habitat are detailed in the *Natural Resources Technical Report*.

Table 4.19-9
FOREST IMPACTS TO TERRESTRIAL NATURAL COMMUNITIES

Alternative		Direct Forest Impacts (Acres)	Indirect Forest Impacts (Acres)	Total Direct and Indirect Forest Impacts (Acres)	Percent of Forestland in Study Area
CBA 1	Planning Corridor	2,184	225	2,409	0.82%
	Design Corridor	1,140	225	1,365	0.46%
CBA 2	Planning Corridor	1,370	20	1,390	0.47%
	Design Corridor	599	20	619	0.21%
CBA 3	Planning Corridor	1,931	230	2,161	0.73%
	Design Corridor	998	230	1,228	0.42%

Source: Parsons Brinckerhoff and Michael Baker Jr.

4.19.7 Cumulative Impacts to Wetlands

Historically, the wetlands in the study area have been drained and filled extensively for agriculture and other land uses. Given that wetlands are widespread in the study area, locations of future development are only generally identified, and indirect land use impacts also are only generally identified, a quantitative analysis of cumulative wetland impacts is not feasible. Instead, this section provides a qualitative assessment of cumulative wetland effects in light of current wetland regulations.

The regulatory processes governing wetlands are discussed in the *Natural Resources Technical Report*. Commercial and industrial development, as well as planned subdivision-style residential development, will be governed by these processes to prevent the loss of wetlands. Therefore, small-scale and individual lot residential development is the type of development that is most likely to cause unmitigated wetland impacts through use of nationwide permits. In the future baseline or No-Build condition, these impacts will occur throughout the corridor, but are not expected to be widespread based on population forecasts

of less than 0.5 percent in Southampton, Surry and Sussex counties and less than one percent per year in Prince George County. Chesapeake Bay regulations (adopted by each study area locality by ordinance) as well as separate, Suffolk and Isle-of-Wight County land use regulations incorporate additional measures to protect sensitive lands beyond that regulated strictly by VWPP and COE wetland permits.

In contrast to the general residential development that will occur in the baseline scenario, the direct and indirect wetland impacts of the CBAs would be subject to regulations requiring avoidance, minimization, and mitigation of wetland impacts. Thus, the net future wetland impacts with and without the proposed action are assumed to be virtually the same and are not anticipated to threaten the sustainability or function of wetland systems in the study area.

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5.0 LIST OF PREPARERS

This document was prepared by the Federal Highway Administration of the U.S. Department of Transportation and the Virginia Department of Transportation, with assistance from consulting engineers and planners from Parsons Brinckerhoff Quade & Douglas, Inc.; Coastal Carolina Research, Inc.; Cordell and Crumley; Harris Miller Miller & Hanson Inc., Intermodal Engineering; Landmark Design Group; and Michael Baker Jr., Inc.

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Martin L. Mitchell, P.G.	M.A. Marine Science; B.S. in Geology; 22 years experience in environmental sciences, planning, NEPA documentation	Reviewer of natural resources and hazardous materials sections of EIS
John Hendrickson, AICP	M.S. Urban and Regional Planning, B.S. Geography; 12 years experience	Traffic operations analysis
Kristin Belfield, E.I.T.	M.S. Transportation Engineering; B.S. Civil Engineering; 8 year experience	Traffic operations analysis
Jihong Cao, E.I.T	M.S Transportation Engineering, B.S Civil Engineering, 1 year experience	Assisted in traffic operations analysis
Chris Coleman	B.S. Land Reclamation; 17 years experience in environmental science, transportation planning, and NEPA documentation	Air Quality, Noise
Joseph Curtis, AICP	MCP, City Planning; BA, Geography; 3 years experience in urban & transportation planning	Land Use and Socioeconomic portions of the EIS
Matthew Coffin	B.S. Geography; 3 years GIS experience	GIS analyses
Gregg Cornetski	B.A. Foreign Affairs; Post-graduate courses in computer science; 5 years experience in GIS and computer programming	GIS analyses
Marilyn Campbell	Clerical; 20 years experience in Document preparation	Document Preparation, Administrative Record
Todd Steiss, AICP	M.S. Urban Planning; B.S. Urban Affairs; 15 years experience	Freight analysis

Coastal Carolina Research

Name	Experience	Responsibility
Loretta Lautzenheiser	M.A. Anthropology; 23 years experience in Cultural Resource Management	Cultural resources manager
Jennifer Stewart	M.F.A. Historic Preservation, 5 years experience in Architectural History	Architectural Historian
Susan Bamann	Ph.D., Anthropology, 13 years experience in archaeological research	Archaeological Principal Investigator
Bill Hall	B. A. History, 7 years experience in historical research	Historian

Cordell and Crumley

Name	Experience	Responsibility
Janette Crumley	B. S. A. Accounting degree; 20 years in public involvement and accounting fields	Public participation
Deborah Cordell	B.S. Communication Arts; 18 years in Communications field	Public participation
Deborah DeMarco	B.S. Secondary Education, Marketing Education; M.T.A, Destination Management; 17 years communications experience	Public participation

Harris Miller Miller & Hanson Inc.

Name	Experience	Responsibility
Cary B. Adkins	M.S. and B.S., Civil Engineering 27 years experience highway noise analysis	Noise Analysis
Christopher Menge	B.S., Physics 32 years experience highway noise analysis	Noise Analysis

Intermodal Engineering

Name	Experience	Responsibility
Valerie Henchel	B.S., Civil Engineering, MBA 22years experience	Managed collection of traffic count data
David Benn	3 years traffic data collection	Collected traffic count data

LandMark Design Group.

Name	Experience	Responsibility
John Lowenthal	B.S. and M.S. in Biology 16 years experience	Wetlands and Waters of the U.S.

Michael Baker Jr. Inc.

Paul Prideaux, P.E.	B.S. in both Civil Engineering; 15+ years of transportation planning experience,	Deputy Project Manager;
Vic Siaurusatis	M.S. in Transportation Engineering, B.S. in Urban Planning; 19 years of experience in demand forecasting,	Travel demand forecasting oversight, review of traffic analysis.
Bill Thomas	B.S. Engineering and Mathematics; 18 years experience in travel forecasting	Travel Forecasts
Tony Hofmann	M.S. in Transportation Engineering, B.S. in Civil Engineering; 10 years experience in transportation planning and travel demand forecasting	Travel demand forecasting
Claudette Jenkins, Ph.D.	Ph.D., Biological Oceanography; M.S. in Oceanography, Biological; B.S. in Chemical Oceanography; 13 years experience in environmental planning	Stream Evaluations, Secondary and Cumulative Impacts, and Mitigation Planning

Lorna Parkins, AICP	M.S. in Applied Economics; B.A. in Urban Planning; 16 years experience in transportation planning and NEPA document preparation	Land Use, Socioeconomics, and Secondary and Cumulative Impacts.
Mary Keith Floyd, AICP	B.A. in Environmental Science; 5 years experience in transportation planning and NEPA documentation	Right-of-Way & Relocation Report; Land Use and Socioeconomic
Susan Manes	M.S. in Parks, Recreation, and Tourism Management; B.A. in Economics; 18 years experience in environmental planning NEPA documentation.	Bypass Effects and Secondary and Cumulative Impacts

6.0 DISTRIBUTION LIST

The following is a list of agencies, organizations, and persons to whom the DEIS was distributed for comment.

Virginia State Delegates

Honorable J. Paul Council, Jr.
Honorable Jonny S. Joannou
Honorable S. Chris Jones
Honorable Robert F. McDonnell
Honorable Leo C. Wardrup, Jr.

Virginia State Senate

Honorable Henry L. Marsh, III
Honorable Yvonne B. Miller
Honorable Frederick M. Quayle
Honorable Kenneth W. Stolle

Federal Agencies

Advisory Council on Historic Preservation
Federal Emergency Management Agency
Federal Highway Administration, Virginia Division
Federal Transit Administration:
National Marine Fisheries Service, Northeast Region
National Oceanic and Atmospheric Administration
National Park Service, Petersburg National Battlefield
Natural Resources Conservation Service
U.S. Army Corps of Engineers
U. S. Department of Interior
U. S. Fish and Wildlife Service
U.S. Environmental Protection Agency

Virginia Agencies

Commonwealth of Virginia Transportation Board
Virginia Department of Agriculture and Consumer Services
Virginia Department of Aviation
Virginia Department of Conservation and Recreation
Virginia Department of Emergency Services
Virginia Department of Environmental Quality
Virginia Department of Forestry
Virginia Department of Game and Inland Fisheries
Virginia Department of Health
Virginia Department of Historic Resources
Virginia Department of Housing and Community Development
Virginia Department of Rail and Public Transportation
Virginia Department of Transportation
Virginia Marine Resources Commission
Virginia Outdoors Foundation

Regional Agencies

Richmond Regional Planning District Commission
Crater Planning District Commission
Tri-Cities Metropolitan Planning Organization
Hampton Roads Planning District Commission
Hampton Roads Metropolitan Planning Organization

Local Governments

Isle of Wight County Board of Supervisors
Isle of Wight County Administrator
Prince George County Board of Supervisors
Prince George County Administrator
Southampton County Board of Supervisors
Southampton County Administrator
Surry County Administrator
Surry County Board of Supervisors
Sussex County Administrator
Sussex County Board of Supervisors
City of Suffolk City Manager
City of Suffolk City Council
Wakefield Mayor's Office
Waverly Mayor's Office
Town of Windsor Mayor
Town of Windsor Town Manager
Town of Windsor Town Council
Ivor Mayor's Office

7.0 COMMENTS AND COORDINATION

For this study, VDOT has coordinated extensively with local, state, and federal agencies, and implemented a public involvement program to provide information and solicit comment. This chapter describes the results of these efforts.

7.1 AGENCY SCOPING

In July 2003, VDOT invited federal and state agencies to attend a 17 July 2003 Agency Scoping Meeting. Also, scoping letters were distributed to several agencies, including 13 federal agencies (including their various divisions and field offices), three regional agencies, 16 state agencies (including their various divisions and field offices), and 17 local agencies (including City and County Councils and Boards of Supervisors).

7.2 WRITTEN COMMENTS

The following section summarizes those written comments received as part of the scoping process and during preparation of the DEIS.

7.2.1 U.S. Department of the Army, Corps of Engineers

In a letter dated 19 December 2003, the Corps commented on the draft Purpose and Need. Comments included concerns in reference to the 2026 projections of freight traffic "may be optimistic," and the Draft EIS "should evaluate the validity of the projections." The Corps also recommends widening the study area to the south and west to allow for more southern alternatives. (The study area's boundary was expanded from one mile south of the Norfolk Southern railway to three miles south).

In a letter dated 7 January 2004, the Corps recommended an option whereas the existing facility remained with widened right-of-way and bypasses around the existing towns (similar to CBA 2). The Corps stated that the impacts would likely be less than on a new location.

The Corps also recommended that the rail study conducted by VDRPT should be done in conjunction with the Route 460 Location Study.

In a letter dated 29 April 2004, the Corps agreed to the elimination of Conceptual Alternative E and a portion of Alternative D (see Chapter Two). The Corps recommended analyzing all possible combinations of segments for a thorough comparison of segments. The Corps concluded by reiterating the need for an alternative involving a widened existing Route 460 with bypasses, as well as a reduction of the number of interchanges for each alternative.

In a letter dated 16 December 2004, the Corps requested:

- a reduction of the study corridor widths to 250 feet or less;
- placement of the 250-foot-wide corridor within the 500-foot study corridors to maximize avoidance of wetlands, streams and riparian zones;
- preparation of maps for review by the Corps and our advisory agencies that demonstrate how the 250-foot corridor has been shifted to avoid aquatic resources; and
- incorporation of anticipated bridge locations based on watershed size and hydraulic factors as well as wetlands of particularly high value.

7.2.2 U.S. Department of the Interior, Fish and Wildlife Service

In a letter dated 13 December 2002, the Fish and Wildlife Service made the following comments:

Fish and Wildlife Coordination Act—VDOT (at the time of this letter) is only considering a new facility within an area ten miles north of the current 460. FWS "strongly disagrees with this approach" and recommends (1) a rail alternative; (2) an alternative where the existing Route 460 is widened; and (3) an alternative with an existing Route 460 with bypasses around the towns.

Endangered Species Act—endangered species in the study area are as follows: the Dwarf wedgemussel (*Alasmidonta heterodon*), Roanoke logperch (*Percina rex*), Red-cockaded woodpecker (*Picoides borealis*), Michaux's sumac (*Phus michauxii*), and the American chaffseed (*Schwalbea americana*). The Bald eagle (*Haliaeetus leucocephalus*) is a threatened species in the study area.

Generic Scoping—the Service outlines its Mitigation Policy (FR Part III, Vol. 46, No. 15, Jan. 23, 1981, p. 7660) stating that wetland impacts should be avoided or minimized to the maximum extent practicable and should be mitigated in a sequential fashion.

In a letter dated 18 December 2003, the Fish and Wildlife Service recommended for the study area to be expanded to the south and to the west, "approximately three to four miles," to allow for an alternative south of the existing Route 460.

In a letter dated 12 April 2004, the Service agrees with the elimination of Conceptual Alternative E. Due to the estimated indirect and cumulative impacts to fish and wildlife resources associated with the increased distance from the existing Route 460, the Service also recommended the elimination of the western portion of Alternative D.

In a letter dated 9 December 2004, the Service outlines the basic principles of Executive Order 13186 entitled, Responsibilities of Federal Agencies to Protect Migratory Birds (FR Vol. 66, No. 11, Jan. 17, 2001) and Executive Order 13274. The Service recommends the application of the Habitat Evaluation Procedures (HEP) to offset negative impacts to fish and wildlife resources and to comply with the Executive Orders mentioned. In a letter dated 17 March 2005, the Service restated its request for application of HEP and asked for a written response to this request.

7.2.3 U.S. Environmental Protection Agency

In a letter dated 21 November 2002, the EPA expressed concern about wetland impacts resulting from the project. From the Scoping Meeting dated 19 November 2002, the EPA believes that VDOT has selected a freeway option without considering the option of upgrading the existing Route 460. Because truck traffic is an impetus for the Route 460 Location Study, the study should evaluate "existing and parallel" rail options as alternatives to a new highway facility. The EPA recommends (1) an alternative with bypasses around the existing towns; (2) an alternative of an upgraded existing facility with increased rail service; and (3) for such alternatives be evaluated before reaching a conclusion on the Purpose and Need for the Study.

In an e-mail dated 11 May 2004, the EPA agreed with partnering agency's decision to drop Conceptual Alternative E and a portion of Conceptual Alternative D. Should VDOT decide to look at additional segments, the EPA requested another opportunity to comment on them.

In an e-mail dated 14 December 2004, the EPA recommended (1) the use of no wider than 250 foot wide corridors for impact evaluation purposes; (2) on the selected alternative, shifting the alignment within the corridor to further minimize impacts to wetlands and streams; and (3) EPA review study area maps in order to see how the 250 foot wide corridors were threaded through the study area to avoid wetland and stream resources.

7.2.4 Isle of Wight County

On 7 August 2003, the Board of Supervisors of Isle of Wight County passed a resolution in support of an alignment that is in proximity to the current alignment and existing towns along the Corridor.

In a Memorandum dated 9 October 2003, Patrick Small, Director of Economic Development for Isle of Wight County, recommended the study area to be "constrained to a parallel alignment, in a corridor extending roughly three miles to both north and south of the existing Route 460."

In a Memorandum dated 24 October 2003, Jonathan Hartley, Director of Planning and Zoning for Isle of Wight County, recommended:

- "…maintaining a new limited access road in close proximity to the existing Route 460 corridor, as stated in the Resolution adopted by the Board of Supervisors on August 7, 2003."
- Revising the study area to three miles north and south of the existing Route 460, citing consistency with the County Comprehensive Plan.

On 18 March 2004, the Board of Supervisors of Isle of Wight County passed a resolution in support of Conceptual Alternative A.

7.2.5 Town of Windsor

On 13 April 2004, the Town Council of Windsor passed a resolution in support of Conceptual Alternative A. It also resolved to modify Alternative A to avoid the Commonwealth Cotton Gin.

7.2.6 Southampton County

On 25 August 2003, the Board of Supervisors of Southampton County passed a resolution in support of an alignment "in close proximity to the current alignment and existing towns along the Route 460 corridor."

7.2.7 Surry County

On 24 July 2003, the Board of Supervisors of Surry County passed a resolution supporting the improvement of Route 460 "as a new interstate quality roadway…to link Interstate 295 to Interstate 664." The Board also supported an alignment to be located to the north of the existing one. Finally, the Board supported the use of tolls to expedite the road's construction.

7.2.8 Sussex County

On 18 March 2004, the Board of Supervisors of Sussex County passed a resolution in opposition of a change of alignment to Route 460:

The Sussex County Board of Supervisors does not support changing the location of Route 460 within the County of Sussex, within or around the Town of Wakefield, and within or around the Town of Waverly.

7.2.9 Hampton Roads Planning District Commission

On 14 November 2003, Arthur Collins, Executive Director for the Hampton Roads Planning District Commission, sent a letter conveying the Commission's support for improvements to Route 460. The Commission supports a limited access facility within close proximity, north and south of the existing corridor.

7.2.10 Virginia Port Authority

On 1 December 2003, Robert Bray, Executive Director for the Virginia Port Authority, recommended a limited access highway close to the existing Route 460 and expanding the study area further south.

7.3 FEDERAL AGENCY PARTNERING MEETINGS

Four federal agency partnering meetings have taken place for this study to date. All meetings took place in Gloucester, Virginia at the U.S. Department of the Interior, Fish and Wildlife Service office. Attendees at these meetings included the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the Environmental Protection Agency, and the Federal Highway Administration.

7.3.1 Partnering Meeting, 21 November 2002

The U.S. Army Corps of Engineers (COE) asked about the safety issues with the 460 Study. VDOT described the existing crash rates and concluded that driving conditions along the road are dangerous in comparison to other similar roadway facilities in Virginia. The Corps also asked why there was no rail alternative. VDOT mentioned that rail service would only meet a portion of the Purpose and Need Statement.

The Federal Highway Administration asked about a toll feasibility study. VDOT replied that it is looking into tolls as a way to fund the project's construction.

7.3.2 Partnering Meeting, 2 April 2004

The study team presented the five Conceptual Alternatives depicted at the Citizen Information Meetings in February 2004. The team presented screening-level analysis results for each. The team recommended three CBAs be analyzed in the DEIS. The CBAs were developed from hybrid combinations of the Conceptual Alternatives. Conceptual Alternative E was removed from further consideration in the study.

7.3.3 Partnering Meeting, 30 November 2004

The U.S. Department of the Interior, Fish and Wildlife Service mentioned that the Nature Conservancy has inquired about the project. The Conservancy is developing possible mitigation sites within the study area. A concern for the Conservancy is habitat associated with the Blackwater River.

The U.S. Army Corps of Engineers asked if the study team is conducting wetlands field delineations. VDOT replied that field determinations at representative sites were being conducted. Field delineations would take place later in the project development process.

7.3.4 Partnering Meeting, 05 April 2005

VDOT followed up with agencies regarding information sent prior to the meeting. This information included results of wetland avoidance and minimization efforts requested by the agencies.

7.4 PUBLIC COORDINATION

7.4.1 Public Scoping Meetings, August 2003

Two scoping meeting were held in August 2003 for the study. A total of 231 persons attended the meetings. One meeting took place at the Windsor High School in Windsor, Virginia on 6 August 2003. There were 152 attendees. Fifty-six comments were received at the meeting. A second public scoping meeting took place at the Prince George municipal center in Prince George, Virginia on 18 August 2003. There were a reported 79 sign-ins and 35 comments were received at the meeting.

7.4.2 Citizen Information Meetings, February 2004

Two Citizen Information Meetings were held in February 2004, with a total attendance of 378. One Citizen Information Meeting took place at the Windsor High School in Windsor on 24 February 2004. There were a reported 213 attendees at the meeting, with 127 (60%) of those attendees submitting surveys. A second Citizen Information Meeting took place at the J.E.J Moore Middle School near Disputanta on 26

February 2004. There were a reported 165 attendees at the meeting, with 105 (64%) of those attendees submitting surveys.

7.4.3 Route 460 Communications Committee

The Communications Committee was established by the 2001 General Assembly through passage of House Joint Resolution 684. The Committee acts as a link among the citizens and businesses of the Richmond-Petersburg metropolitan area, the Port of Hampton Roads, General Assembly members, and VDOT. The Communications Committee is comprised of five members of the Virginia House of Delegates and four members of the Virginia Senate. It also includes ex-officio membership from the Virginia Port Authority, VDEQ, and the Hampton Roads and Crater Planning District Commissions.

The committee met regularly to hear presentations on project status and schedule. Meetings occurred on

- 29 September 2003
- 10 March 2004
- 2 August 2004
- 13 January 2005.

7.4.4 Additional Local Meetings

Meetings were held throughout the study area with local groups and organizations. For each meeting, study team members provided an overview of the Location Study and the NEPA process. The presentation included a project status briefing, and a project schedule update. Examples of these meetings include:

- the Town of Wakefield, Wakefield, 30 March 2004
- Isle of Wight / Smithfield / Windsor Chamber of Commerce, Smithfield, 29 July 2004
- Surry County Board of Supervisors, Surry, Virginia, 5 August 2004
- Sussex County Board of Supervisor, Sussex Courthouse, Virginia, 19 August 2004
- the Ivor Ruritan Club, Ivor, 19 October 2004
- the Wakefield Women's Club, 2 November 2004

Addition meetings were held to address specific issues within the project. Those meetings are as follows:

- Isle of Wight County, 23 August 2004
- Sussex County Administrator, 19 December 2004
- Prince George County Planning Commission, 23 May 2005

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