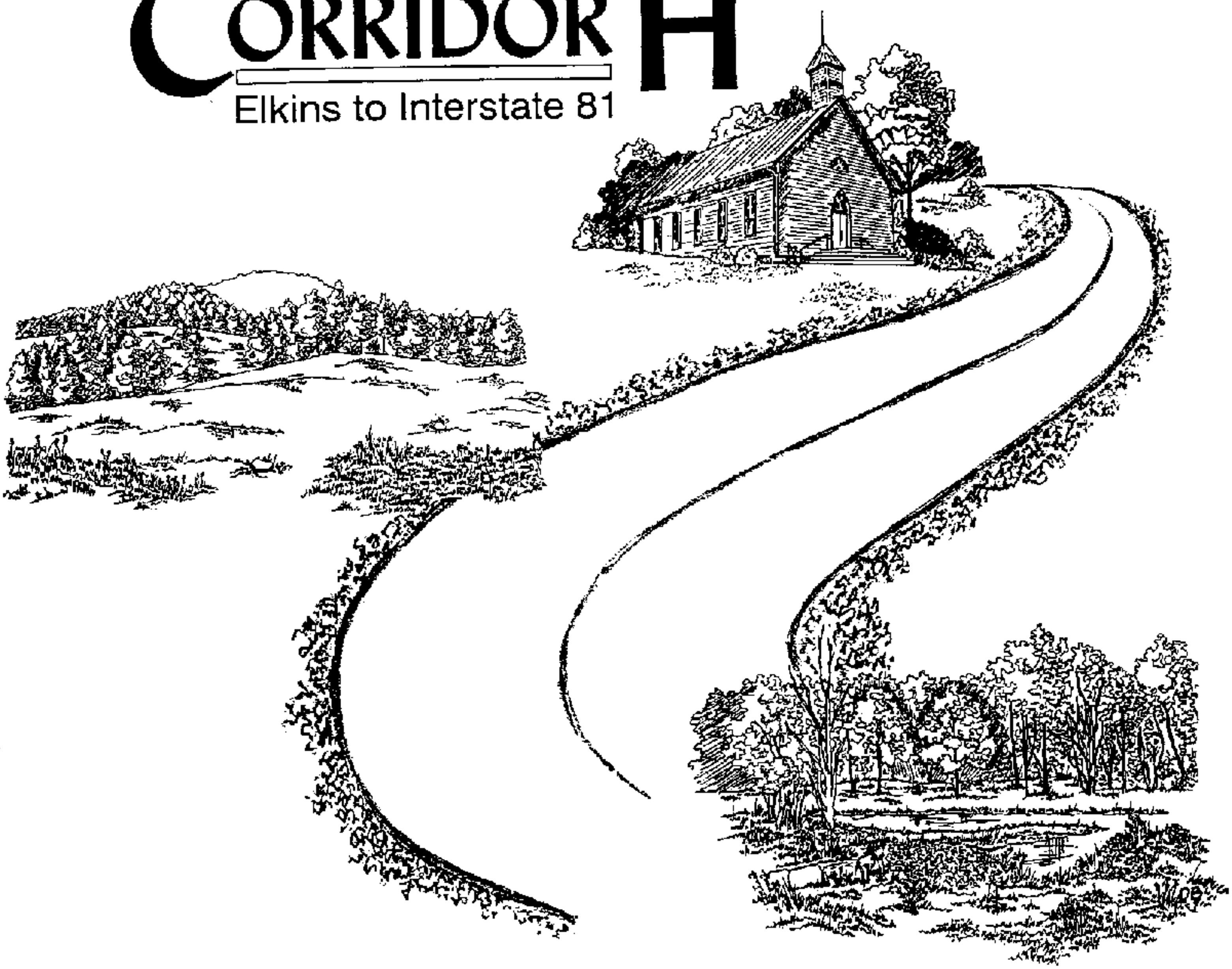
State Project: X142-H-38.99
Federal Project: ADP-484 (59)

Alignment Selection
SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

APPALACHIAN CORRIDOR H

Elkins to Interstate 81



West Virginia Department of Transportation

Baker
Michael Baker Jr., Inc.

FHWA-WV-EIS-92-01-SD
State Project: X142-H-38.99 C-2
Federal Project: APD-484 (59)

APPALACHIAN CORRIDOR H
Elkins, West Virginia to Interstate 81, Virginia

Alignment Selection Supplemental Draft Environmental Impact Statement

Submitted Pursuant to : 42 U.S.C. 4332(2)(c), 23 U.S.C. 128(a),
49 U.S.C. 303(c), and 16 U.S.C. 470(f)
80 Stat. 931, Public Law 89-670

US Department of Transportation - Federal Highway Administration
and
West Virginia Department of Transportation - Division of Highways

Cooperating Agencies:
US Environmental Protection Agency, US Fish and Wildlife Service, US Forest Service, US Army Corps of Engineers - Pittsburgh District and Norfolk District, US Park Service, US Soil Conservation Service, Virginia Department of Transportation, Virginia Council on the Environment

10/27/94
Date of Approval — For West Virginia Department of Transportation

10/28/94
Date of Approval — For Virginia Department of Transportation

11/9/94
Date of Approval — For Federal Highway Administration

The following persons may be contacted for additional information concerning this document:

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This project consists of a proposal to construct an approximately 183 kilometer (114 mile) highway; completing Corridor H of the Appalachian Development Highway System from Elkins, West Virginia to Interstate 81 in Strasburg, Virginia. The proposed Corridor H facility would provide a four-lane highway with partial control of access on new and existing location. This alignment-level study evaluates the detailed engineering, economic, social, cultural and environmental impacts associated with the construction of the proposed project.

Comments on this SDEIS are due by **January 23, 1995** and should be sent to:

Mr. Randolph T. Epperly, Jr.
Director, Roadway Design Division
WVDOT - Division of Highways
State Capitol Complex, Building Five
Charleston, West Virginia 25305

GLOSSARY OF COMMONLY USED TERMS

30-Minute Contour: Boundary line or counter created by connecting the end points of all 30-minute vehicular trips along existing roadways within the study area; used as project area of influence.

Acid Mine Drainage: Acid drainage from bituminous coal mines containing a high concentration of acidic sulfates, especially ferrous sulfate.

Alignment: Refers to the proposed routing of either the Improved Roadway Alternative (IRA) or the Build Alternative and associated option areas.

Alternative: General term that refers to possible approaches to meeting the project purpose and need. Typically refers to the No-Build Alternative, the Improved Roadway Alternative (IRA), and the Build Alternative.

Anticline: A convex fold in bedrock.

Aquifer: A water-bearing unit of permeable rock, sand or gravel which yield considerable quantities of water to springs and wells.

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

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

Biotic: Of or pertaining to life and living organisms.

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

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

Karst: The occurrence of limestone as the first bedrock unit beneath the soil in which cavities form due to the solubility of limestone under certain conditions. Surface characteristics include sinkholes and sinking streams.

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

Line: Refers to a specific, designated alignment under the Build Alternative (e.g., Line A, Line S, etc.)

Local Project Watershed: The subwatershed which directly "surrounds" the alignments.

Nitrogen Oxide (NO_x): Colorless, sweet-tasting gas emitted directly by automobiles and trucks.

Option Area: Area in which two or more alignments are under consideration for the Build Alternative.

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

Regional Project Watershed: The portion of the major river watershed bounded by the 30-Minute-Contour.

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

Syncline: A concave fold in bedrock.

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

Zones of Sensitivity: Water recharge areas underlain by a combination of limestone and sandstone; the sensitivity of such recharge areas was classified as high, moderate, or low.

GLOSSARY OF COMMONLY USED ACRONYMS

AASHTO American Association of State Highway Transportation Officials
ACHP Advisory Council on Historic Preservation
ACOE United States Army Corps of Engineers
ADP Appalachian Development Highway System
ADT Average Daily Traffic
ARC Appalachian Regional Commission
BNA Block Numbering Area (US Census)
CEQ President's Council on Environmental Quality
CHA Corridor H Alternatives
CMS Congestion Management System
CTB Virginia Commonwealth Transportation Board
DOI United States Department of the Interior
EPA United States Environmental Protection Agency
FEIS Final Environmental Impact Statement
FHWA Federal Highway Administration
FWS United States Fish and Wildlife Service
GIS Geographic Information Systems
GWNF George Washington National Forest
HEP Habitat Evaluation Procedure
HUD United States Department of Housing and Urban Development
IRA Improved Roadway Alternative
ISTEA Intermodel Surface Transportation Efficiency Act
LOS Level of Service
CFR Code of Federal Regulations
LWCFA Land and Water Conservation Fund Act
MIS Major Investment Study
MNF Monongahela National Forest
MPO Metropolitan Planning Organization
NRHP National Register of Historic Places
O/D Origin and Destination
ROD Record of Decision
SCS United States Soil Conservation Service
SDEIS Supplemental Draft Environmental Impact Statement
SOV Single Occupancy Vehicle
TAZ Traffic Analysis Zone
TMA Transportation Management Areas
TMV Turning Movement Volumes
TSM Transportation Systems Management
USDA United States Department of Agriculture
VAC Virginia Advisory Committee
VDCR Virginia Department of Conservation and Recreation
VDEQ Virginia Department of Environmental Quality
VDGIF Virginia Department of Game and Inland Fisheries
VDHR Virginia Department of Historic Resources

GLOSSARY OF COMMONLY USED ACRONYMS (CONT)

VDOT Virginia Department of Transportation
VMRC Virginia Marine Resources Commission
WHPA Wellhead Protection Area
WVDCH West Virginia Division of Culture and History
WVDEP West Virginia Division of Environmental Protection
WVDHHS West Virginia Department of Health and Human Services
WVDNR West Virginia Division of Natural Resources
WVDOT West Virginia Department of Transportation

COMMONLY USED METRIC CONVERSIONS

QUANTITY	METRIC UNIT	ENGLISH UNIT	FACTOR TO CONVERT ENGLISH UNITS TO METRIC UNITS	FACTOR TO CONVERT METRIC UNITS TO ENGLISH UNITS
LENGTH	Kilometer (km)	Mile (mi)	Miles x 1.61 = Kilometers	Kilometers X 0.62 = Miles
	Meter (m)	Foot (ft)	Feet x 0.30 = Meters	Meters X 3.28 = Feet
AREA	Square Kilometer (km^2)	Square Mile (sq mi)	Sq. Mile x 2.59 = Sq. Kilometer	Sq. Kilometers X 0.39 = Sq. Miles
	Hectare (ha)	Acre (ac)	Acres x 0.40 = Hectares	Hectares X 2.47 = Acres
VOLUME	Liter (l)	Gallon (gal)	Gallons x 3.79 = Liters	Liters x 0.26 = Gallon
MASS	Kilogram (kg)	Pound (lb)	Pound x 0.45 = Kilograms	Kilograms x 2.21 = Pounds
VELOCITY	Kilometer per Hour (kph)	Mile per Hour (mph)	mph x 1.61 = kph	kph X 0.62 = mph

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PREFACE

PROJECT HISTORY

This portion of the Appalachian Corridor H project, from Elkins, West Virginia to Interstate 81 in Virginia, has a long history. Numerous studies have been conducted to evaluate the potential impacts of the proposed project since its inception in 1965 as part of the Appalachian Development Highway System (APD System). The first alignment and impact studies were initiated in the late 1970s and culminated in the 1981 *Appalachian Corridor H: Elkins WV to Interstate 81, Virginia - Draft Environmental Impact Statement* (DEIS). In 1984, the project was put on hold and a Final EIS (FEIS) and a subsequent Record of Decision (ROD) were never prepared.

In 1990, the West Virginia Department of Transportation - Division of Highways (WVDOT) and the Federal Highway Administration (FHWA) resumed the project. Following the initial reevaluation efforts, WVDOT and FHWA agreed that subsequent project development would require the preparation of a Supplemental Draft Environmental Impact Statement (SDEIS). Recognizing that this portion of Appalachian Corridor H is a large, complex transportation project and realizing the immense size of the project study area, WVDOT and FHWA agreed that an effective method of assessing the environmental impacts for the SDEIS had to be developed.

CORRIDOR H STUDY PROCESS

On the basis of guidelines established in the Council on Environmental Quality's (CEQ) *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR Parts 1500 - 1508) and FHWA's *Environmental Impact and Related Procedures* (Federal Register, Vol. 52, No. 167; August 28, 1987, Section 777.111), WVDOT and FHWA agreed that a "tiered" approach to the project would break the project into manageable steps. Issues would be addressed at appropriate levels of detail at each step in the process. As the CEQ regulations state, "tiering" refers to the coverage of general matters in broad environmental impact statements with subsequent, narrower environmental impact statements incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared. Tiering is appropriate when it helps the lead agency focus on the issues that are ripe for decision and exclude from consideration issues that have already been decided or are not yet ripe. (40 CFR Part 1508.28).

STEP 1: CORRIDOR SELECTION

Following these guidelines, the Corridor H study was divided into two steps (Exhibit P-1). Step 1 (Corridor Selection) was initiated in 1990 and began at the corridor location planning stage. The purpose of Step 1 was to provide a corridor-level evaluation in which sensitive resources within both the existing (No-Build) condition and the 24 potential 2,000 foot-wide corridors were inventoried and the potential project-related involvements were identified and compared. By identifying sensitive resources and potential involvements before the development of specific alignments, roadway designers could more easily avoid such resources during the project design stage

(Step 2 - Alignment Selection). The Step 1 environmental inventories and comparisons are documented in the 1992 *Appalachian Corridor H: Corridor Selection Supplemental Draft Environmental Impact Statement/Section 4(f)/6(f) Evaluation* (SDEIS) and the supporting Technical Reports.

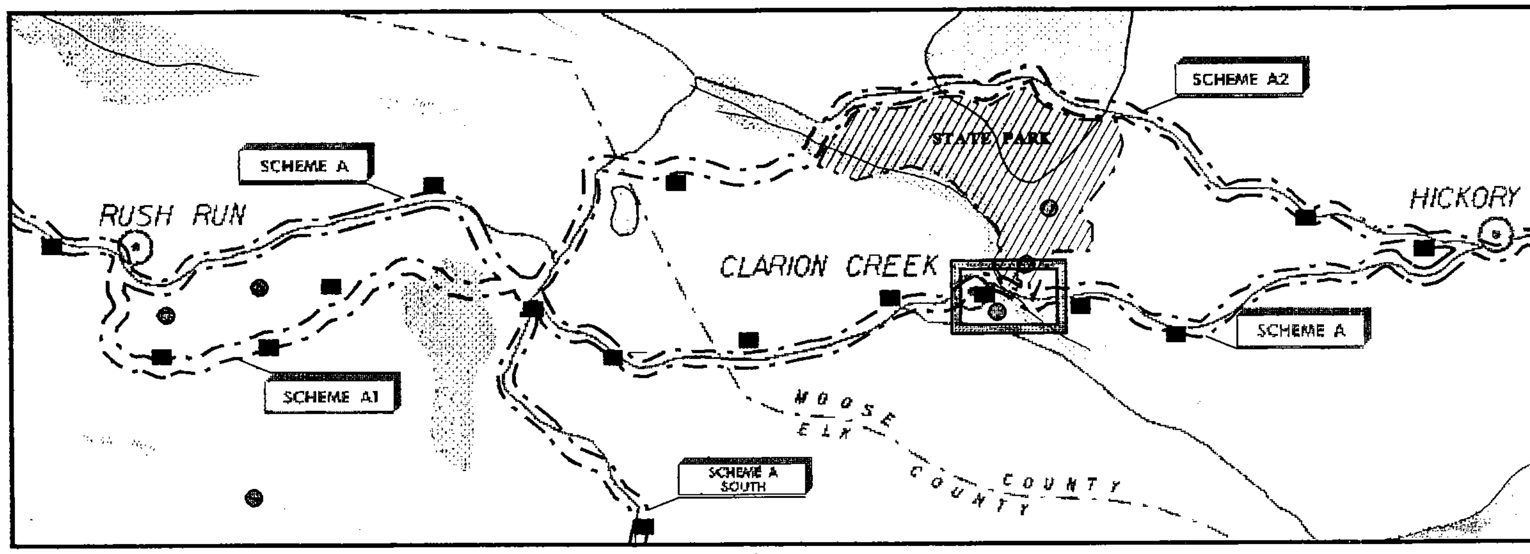
Step 1 served as a way to identify the single most prudent and feasible corridor that best met the project need with the least degree of sensitive resource involvement. On the basis of information in the 1992 *Corridor Selection SDEIS* and associated Technical Reports, comments from the public involvement process, and comments and coordination with cooperating and other resource agencies, WVDOT recommended Scheme Option D5 as the preferred corridor for the future development of Appalachian Corridor H from Elkins, West Virginia to Interstate 81 in Virginia (Exhibit P-2). The basis for the selection of Scheme Option D5 is presented in the 1993 *Corridor Selection Decision Document*: a document that WVDOT, FHWA, and the Cooperating Agencies identified as a logical transition from Corridor Selection (Step 1) to Alignment Selection (Step 2). On May 20, 1993, Virginia's Commonwealth Transportation Board adopted a resolution concurring with WVDOT's recommendation for further evaluation of Scheme Option D5 and, on July 26, 1993, FHWA approved WVDOT's recommendation.

STEP 2: ALIGNMENT SELECTION

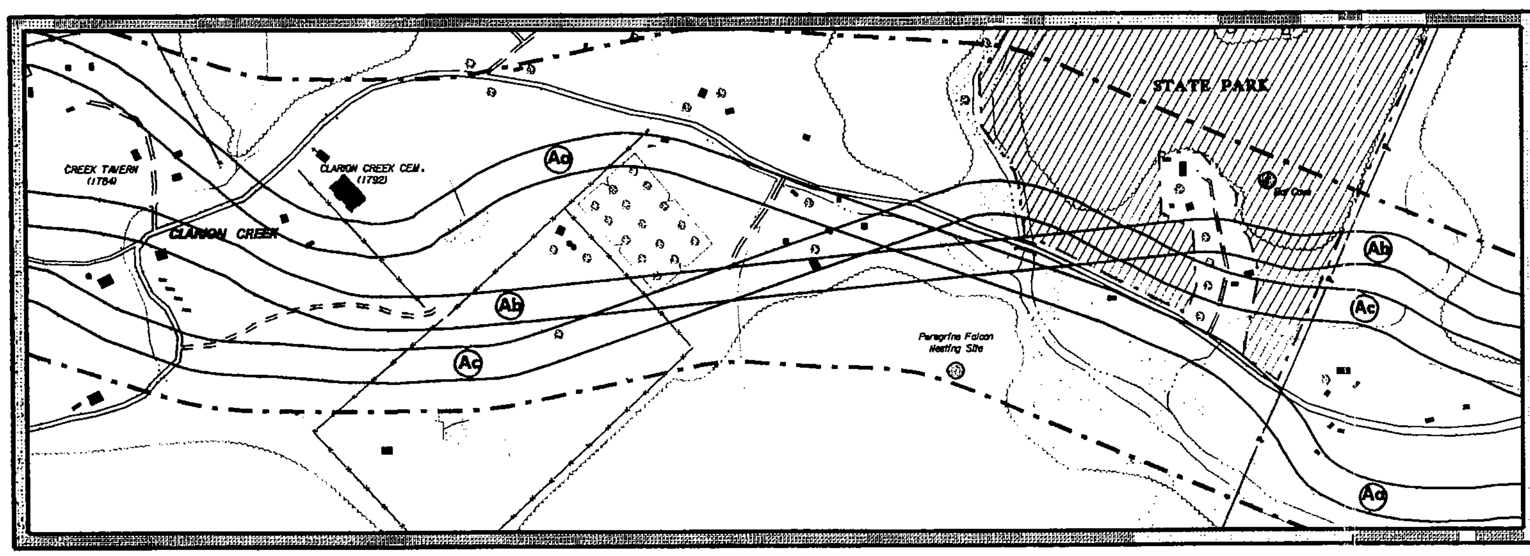
This document, the *Alignment Selection SDEIS* is the culmination of the studies and processes undertaken for Step 2. With the study area narrowed to a single, 2,000 foot-wide corridor, it is feasible to develop specific alignments within the preferred corridor (Scheme Option D5), taking into account the sensitive environmental resources identified in Step 1. This document presents the following efforts and studies undertaken in the Step 2 process:

- The development of feasible highway alignments within the general limits of Scheme Option D5 that would most avoid or minimize adverse impacts to sensitive resources.

CORRIDOR SELECTION (STEP 1)



ALIGNMENT SELECTION (STEP 2)



APPROACH

A. 2000' Wide Corridors
B. Resource Inventory within each Corridor
C. Broad Corridor Comparisons of Resources
D. Preferred Corridor Selection

A. 200'- 350' Wide Alignments
B. Site Specific Resource Analyses (HEP, WET 2.0, STAMINA, etc.)
C. Alignment Impact Comparisons
D. Preferred Alignment Selection

DOCUMENTS

SDEIS I

Corridor Selection Decision Document

SDEIS 2

FEIS

Record of Decision (ROD)

LEGEND

- 2000' Corridor Boundary
- Alternative Alignments
- Wetlands
- Historic/Archaeological Resources
- Section 4f Resources
- Special Botanical Areas
- Threatened/Endangered Species
- Orchard

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit P-1
CORRIDOR H
STUDY PROCESS

Baker

SCALE:AS SHOWN

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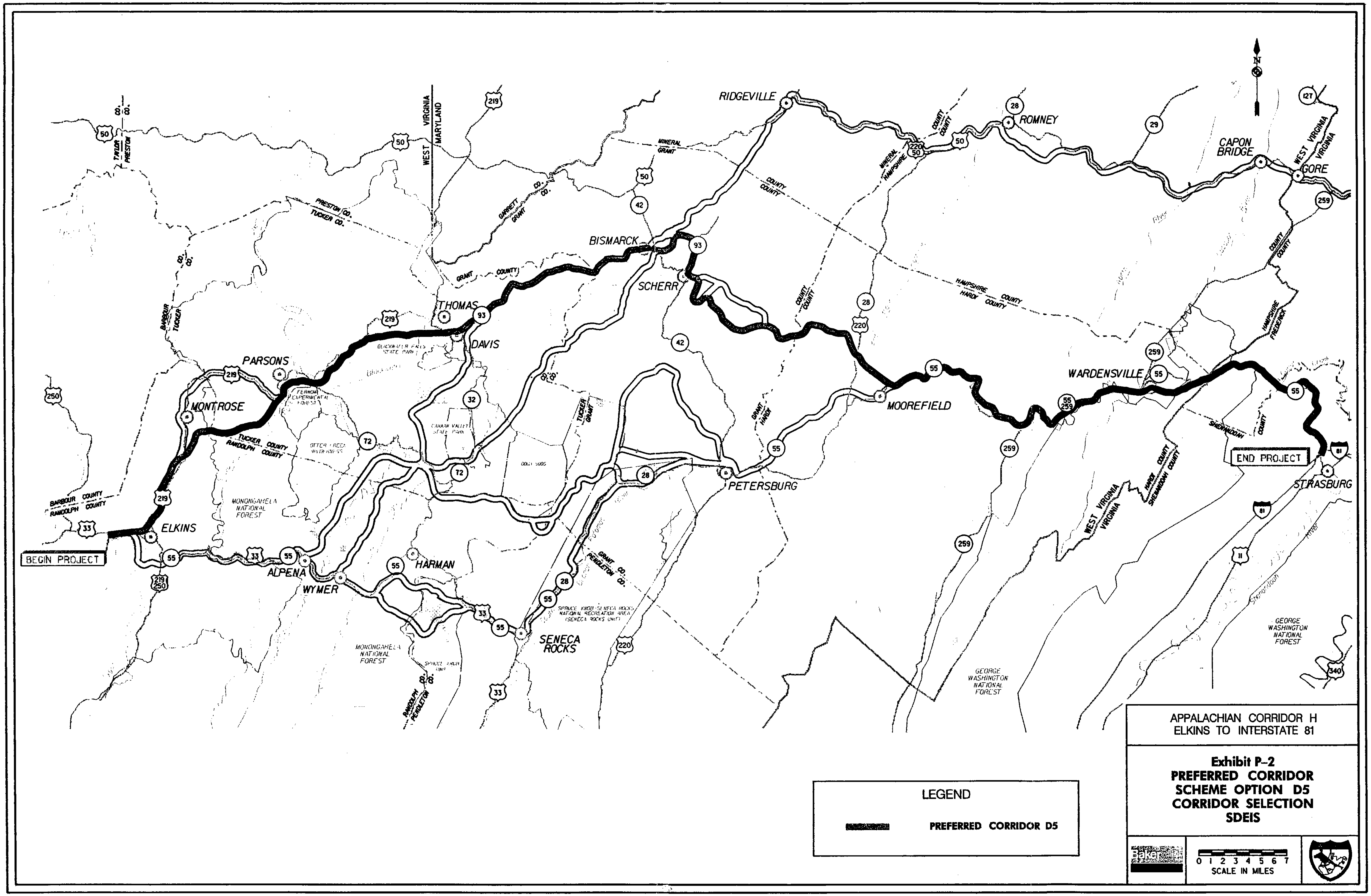

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- The documentation of the steps taken to develop possible alignments (the Build Alternative), as well as to develop other possible Corridor H alternatives (the Improved Roadway Alternative and the No-Build Alternative).

- The evaluation and comparison of detailed, site-specific and cumulative impacts that would result from the Build Alternative, the Improved Roadway Alternative, and the No-Build Alternative.

- The documentation of the public involvement processes and resource agency coordination throughout project development.

After the circulation of the *Alignment Selection SDEIS*, and after all required public meetings and hearings have been held, a Final EIS will be prepared to respond formally to comments on both the Corridor Selection SDEIS (Step 1) and the Alignment SDEIS (Step 2). Upon acceptance of the Final EIS, a Record of Decision will be prepared to document officially the decisions reached throughout the Corridor Selection SDEIS and the Alignment Selection SDEIS study process. Construction of Appalachian Corridor H between Elkins, West Virginia and Interstate 81 in Virginia cannot begin until the following are approved by FHWA: the *Alignment Selection SDEIS*, a Final EIS and a Record of Decision. In Virginia, construction would not begin unless approved by the Commonwealth Transportation Board.

FORMAT OF THE ALIGNMENT SELECTION SDEIS

CEQ regulations encourage agencies "to tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review." The regulations further state that, whenever a broad environmental impact statement has been prepared (i.e., the *Corridor Selection SDEIS*) and a subsequent statement follows (i.e., the *Alignment Selection SDEIS*), the subsequent environmental impact statement need only summarize the issues discussed in the broader statement by reference and shall concentrate on the issues specific to the subsequent action (40 CFR Parts 1502.20 and 1508.28). In accordance with these regulations, this *Alignment Selection SDEIS* will summarize previously discussed issues and provide references for further information. Information on how to review or obtain the Corridor H environmental impact statements and associated technical reports is available by contacting the WVDOT in Charleston, West Virginia or the Virginia Department of Transportation (VDOT) offices in Edinburg, Virginia.

SUMMARY

SUMMARY

A. PROPOSED ACTION

The West Virginia Department of Transportation - Division of Highways (WVDOT), in conjunction with the Virginia Department of Transportation (VDOT) and the Federal Highway Administration (FHWA), is proposing to construct an approximately 183 kilometer (114 mile) long highway from Elkins, West Virginia to I-81 in Strasburg, Virginia; completing the final section of Corridor H in the Appalachian Development Highway System. The proposed Corridor H facility would provide a divided, four-lane highway with partial control of access on new and existing location. The area through which the project traverses includes portions of the West Virginia Counties of Randolph, Tucker, Grant, and Hardy, as well as the Virginia Counties of Frederick and Shenandoah (Exhibit S-1).

Of the project's 183 kilometer (114 mile) length, approximately 161 kilometers (100 miles) would be located in West Virginia and 22 kilometers (14 miles) would be located in Virginia. In its entirety, Appalachian Corridor H would be approximately 233 kilometers (145 miles) in length, with the western terminus at I-79 in Weston, West Virginia and the eastern terminus at I-81 in Strasburg, Virginia. Appalachian Corridor H would serve as an east/west highway, connecting these two north/south Interstate facilities. Corridor H's eastern terminus at I-81 would also provide improved access to I-66, extending the Corridor System's east/west link with this Interstate facility (Exhibit S-2).

B. OTHER MAJOR GOVERNMENT ACTIONS

1. MOOREFIELD FLOODWALL PROJECT

A Moorefield Local Flood Protection Study was initiated in September of 1986 and completed in October of 1987. The second phase of the study, the feasibility phase, was conducted jointly by the US Army Corps of Engineers and the Interstate Commission on the Potomac River Basin. The objectives of the feasibility phase were to evaluate the specific engineering, environmental, and economic effects of the proposed construction solutions, to identify the best project for Moorefield, and to recommend a project for construction. The results of the study recommended construction of 6,400 linear meters (21,000 linear feet) of earthen levy and 381 linear meters (1,250 linear feet) of floodwall. Construction of these flood protection facilities would eliminate the dangers from flooding, such as those experienced by the Moorefield community in 1985. Total construction costs are estimated at $18.7 million.

2. STONY RUN WATERSHED WATER SUPPLY DAM

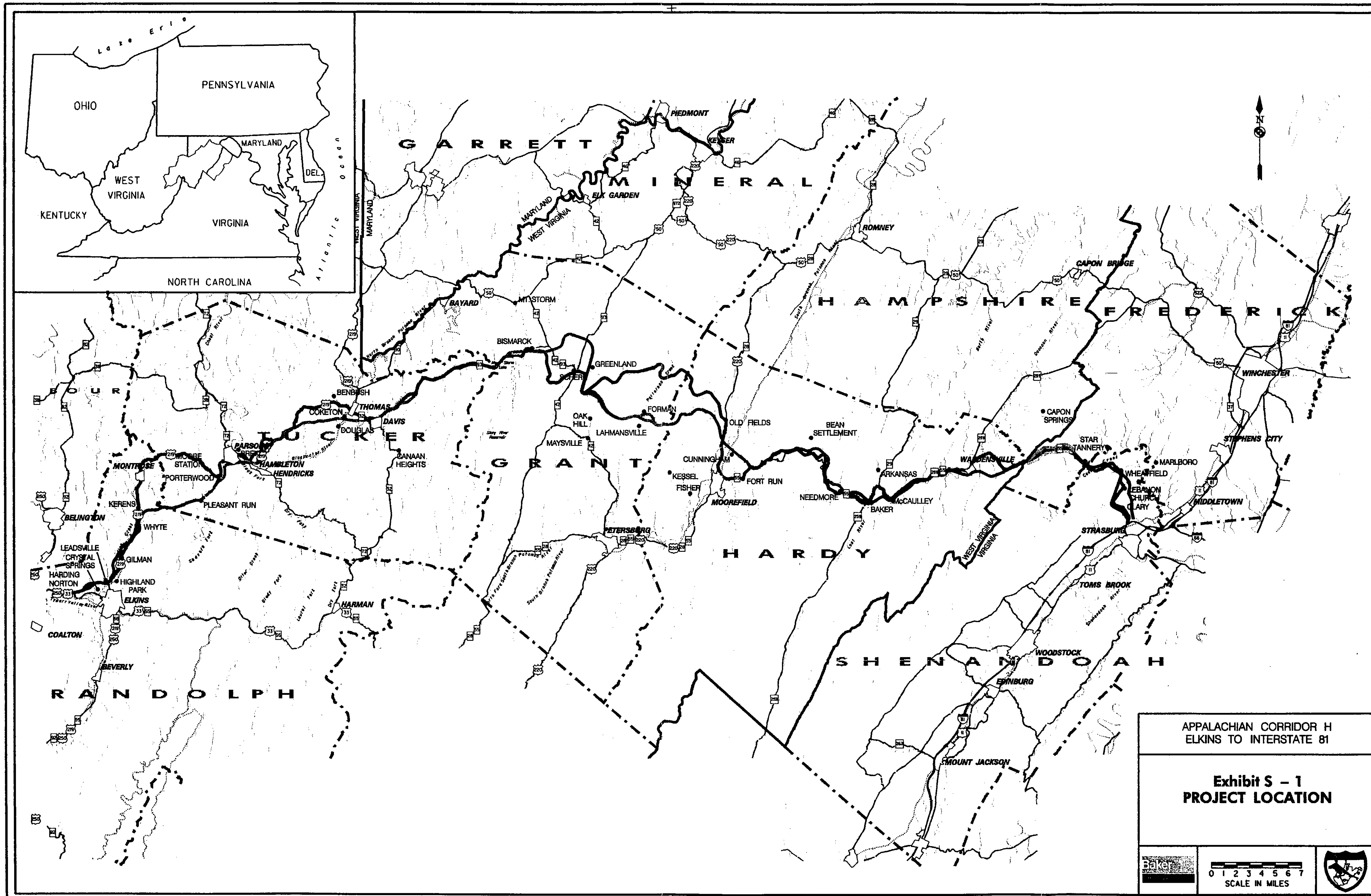
In 1994, a study was conducted to determine the feasibility of constructing a dam on Stony Run. The study was conducted by Hardy County, the Potomac Valley Soil Conservation District, and the West Virginia State Soil Conservation Committee with the assistance of the USDA's Soil Conservation Service. The purpose of the project is to provide additional public water supply capacity to Moorefield. Moorefield currently draws water from the South Fork River. The study concluded that the Stony Run Watershed has limitations for a water supply dam and reservoir but that "its proximity to the Moorefield water treatment plant and the relatively pristine condition of the watershed make the site worthy of consideration for water supply" (*Stony Run Watershed Feasibility Study*, 1994). Construction costs for this project would be approximately $13.5 million. Because the project is not eligible for assistance under USDA Soil Conservation Service programs, funding would have to be obtained from other Federal sources or through state and local sources.

3. CANAAN VALLEY NATIONAL WILDLIFE REFUGE

The Canaan Valley National Wildlife Refuge was officially dedicated by the US Fish and Wildlife Service in October of 1994. The Canaan refuge is the nation's 500th national wildlife refuge and the only such refuge to be located completely within West Virginia's boundaries. Located in Tucker County, the US Fish and Wildlife Service's *Final Environmental Impact Statement* indicates the refuge will eventually encompass 9,710 hectares (24,000 acres) of Canaan Valley's 12,545 hectares (31,000 acres). In November of 1993, Congress approved funds of $2 million towards the purchase of the refuge (1994 Interior Appropriations Bill). Canaan Valley is the largest wetland in the central and southern Appalachian Mountains. With an average altitude of 975 meters (3,200 feet), it is one of the highest valleys east of the Rocky Mountains and is home to more than 580 plant and 280 animal species.

4. MONONGAHELA NATIONAL FOREST MANAGEMENT PLAN

The Monongahela National Forest (MNF) is currently managed under the guidelines, goals, and objectives in the Forest Service's adopted 1986 *Land and Resource Management Plan and Final Environmental Impact Statement, Monongahela National Forest*. This plan was developed with a high level of public involvement and input. As a result, the MNF management direction specifically designates that 75 percent of MNF lands emphasize remote wildlife habitat and semi-primitive, non-motorized recreation in a natural setting. This forest plan guides all natural resource management activities on the MNF until 1995, at which time the plan will be revised.

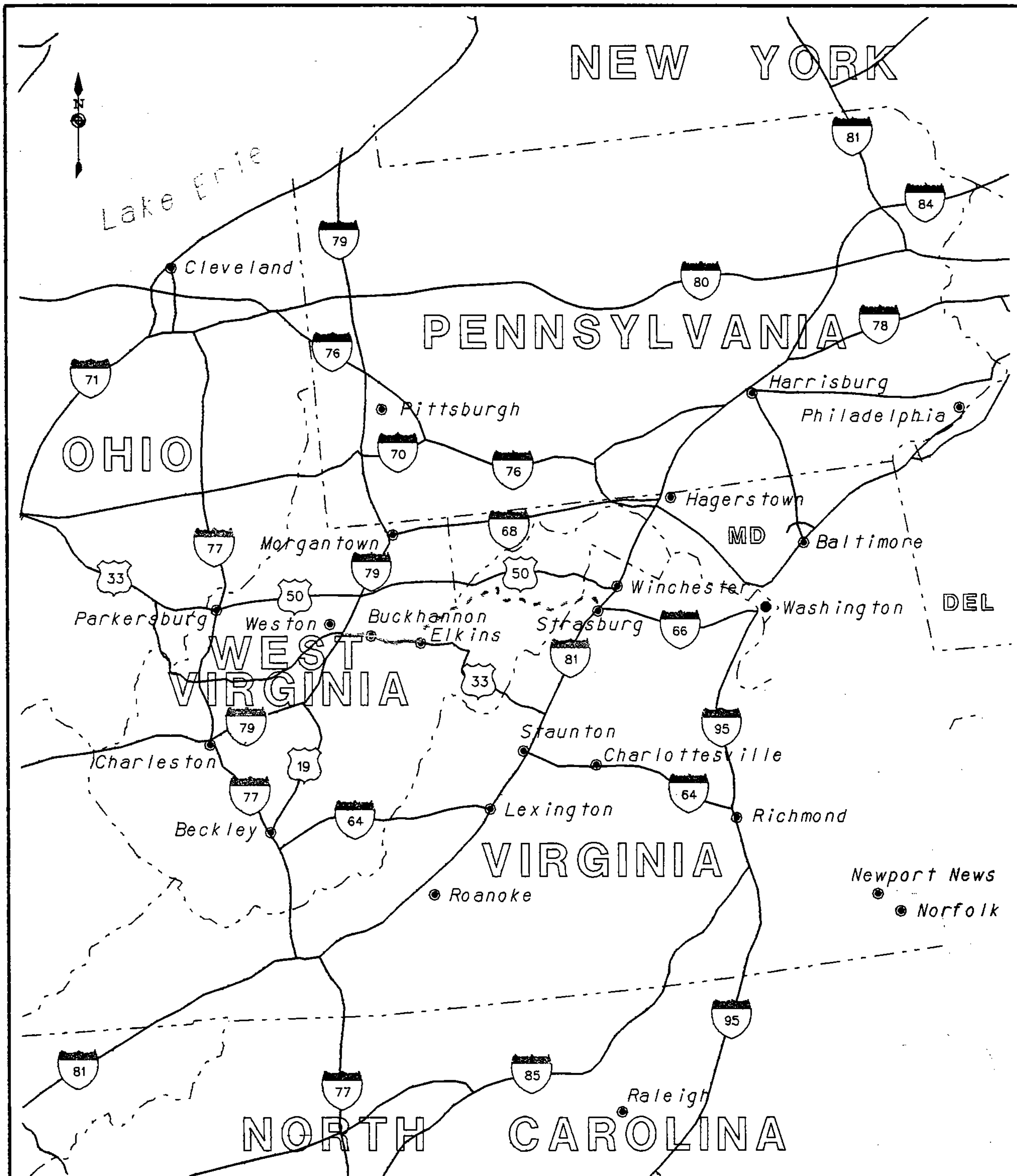


APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit S – 1
PROJECT LOCATION

0 1 2 3 4 5 6 7
SCALE IN MILES

PROLOC. DGN



LEGEND

- INTERSTATE HIGHWAY
- U.S. ROUTE
- COMPLETED CORRIDOR H
- PROPOSED CORRIDOR H

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit S–2
REGIONAL PROJECT LOCATION

0 75
SCALE IN MILES

5. GEORGE WASHINGTON NATIONAL FOREST MANAGEMENT PLAN

The USDA Forest Service completed and received approval of the *Final Revised Land and Resource Management Plan* for the George Washington National Forest in January of 1993. In May of 1993, a coalition of environmental groups filed an appeal, seeking that the entire plan be reevaluated. Representatives of the environmental coalition claim that the currently approved plan contradicts the Clinton Administration's plan to phase out uneconomic timber sales. At the same time, a logging industry coalition has filed an appeal to the plan, claiming it does not allow for enough timber harvesting. The plan covers 1.1 million acres across 13 counties in western Virginia, including Frederick and Shenandoah, and four Counties in eastern West Virginia, including Hardy and Hampshire.

6. PROPOSED ELKINS BYPASS

WVDOT and FHWA are in the early stages of studying the possibility of constructing a bypass around the town of Elkins. The purpose of the study is to identify and correct transportation deficiencies (traffic congestion and roadway design deficiencies) in the Elkins area in Randolph County. The western limit of the proposed project is approximately 4.5 kilometers (2.8 miles) west of Elkins, in the vicinity of Aggregates. The eastern limit of the project is located in the vicinity of the four-lane section of US 33, near Canfield. Four alternatives will be evaluated as part of the study: the No-Build Alternative, the Transportation Systems Management Alternative, the Improved Roadway Alternative, and the New Alignment Alternative.

WVDOT held an agency Scoping Meeting to kick off the project in September of 1994. The "Project Overview" prepared for the Scoping Meeting states that "The purpose and need for the project will be investigated during the initial phases of the project. The existing transportation system, existing and future capacity of the roadway network, social demands of the area, existing roadway deficiencies, and safety concerns will be among the topics investigated". This project would have socioeconomic, cultural, and environmental impacts. However, due to the very early stage of project development, it is not possible to determine the combined impact of Corridor H and the proposed Elkins Bypass.

7. BLACKWATER RIVER WATERSHED STUDY

In March of 1994, West Virginia Congressman Allen B. Mollohan and Tucker County Commission president Dewey Rice announced the start of a $500,000 study to improve the wetlands and water quality within the already damaged Blackwater River watershed. This study would involve a portion of an original proposal presented to the Environmental Protection Agency by the West Virginia University and Wheeling Jesuit College. The exact scope of the study has not yet been determined. The goal of the original study, at a cost of approximately $1.5 million, was to show how Tucker County's Blackwater River watershed could be restored during the construction of Corridor H. Mollohan stated the study will show how such improvements incorporated during the Corridor H construction process can be a highly cost-effective way to perform environmental remediation.

8. WATERSHED MANAGEMENT PROGRAM

In August of 1993, federal and state funding was approved for the creation of a comprehensive watershed management and protection program in West Virginia. The program received $98,000 in a US Environmental Protection Agency grant and $24,000 in funds from the WV Division of Natural Resources. West Virginia Governor Gaston Caperton stated that the goal of the program is to build public consensus for the conservation, management, and wise use of West Virginia's rivers and wetlands, and to put into effect a comprehensive plan to care for the state's aquatic resources. During the project's first year, a team of representatives from the Divisions of Natural Resources, Parks, Tourism, and Environmental Protection, as well as individuals and groups, will begin developing ten-year strategic management and conservation plans and projects for the state's rivers and wetlands. The program is based at the DNR operations center near Elkins.

9. AMERICAN DISCOVERY TRAIL

The American Discovery Trail is the only east/west transcontinental hiking trail in the nation. Approximately 482 (300 miles) of the ADTs 8,000+ kilometers (5,000+ miles) are in West Virginia. From the west, the ADT enters West Virginia at Parkersburg and winds across the state to Harper's Ferry. Along the way, it passes through various state parks, national forests, wilderness areas, and nature conservancies, among which include the Dolly Sods, Blackwater Falls, and Greenland Gap.

The National Park Service is currently conducting a feasibility study for this trail in regard to its designation as a National Scenic Trail. A decision on its designation is expected in 1995. Alternative corridors for the trail through the Monongahela National Forest have been proposed but a final corridor has not yet been selected by the National Trail Coordinator and the Park Service.

C. ALTERNATIVES CONSIDERED

The Alignment Selection process focused on the development of the No-Build, Improved Roadway, and Build Alternatives. In accordance with 40 CFR 1502.14, these three alternatives were developed to a comparable level of detail to evaluate their merits and impacts.

During the Corridor Selection process, the Improved Roadway Alternative was eliminated from further consideration because it did not meet the project purpose and need. However, the improvement of local roads as a method of reducing potential environmental impacts was the subject of considerable discussion throughout the Corridor Selection public involvement process. Interest in the improvement of local two-lane roads prompted WVDOT to determine that the Improved Roadway Alternative would be equally developed and evaluated throughout the Alignment Selection process, even though it does not meet the project purpose and need. Additionally, the resolution of the Virginia Commonwealth Transportation Board required the consideration of an alternative that would upgrade or improve the existing roadways in the Virginia portion of Corridor H.

Of the three alternatives considered for this project, only the Build Alternative fully meets the established project purpose and need. While the No-Build Alternative does not meet the needs of the project, it has been retained for consideration as a benchmark for comparison, enabling decision-makers to compare the magnitude of the environmental effects of the Build and Improved Roadway Alternatives. The No-Build Alternative remains a viable alternative of the Appalachian Corridor H project. Table S-1 provides a comparison of the alternatives under study relative to the purpose and need of the proposed project.

1. THE NO-BUILD ALTERNATIVE

The No-Build Alternative consists of a continuation of the existing routes between Elkins and I-81. This alternative includes such short-term, minor restoration activities as safety and maintenance improvements, resurfacing, bridge repairs, minor widenings, and intersection improvements. These improvements are already a part of both WVDOTs and VDOTs ongoing plan for the continued safe operation of the existing roadway system.

2. THE IMPROVED ROADWAY ALTERNATIVE

The Improved Roadway Alternative (IRA) consists of improving the existing route within Scheme Option D5 which best connects Elkins, West Virginia to I-81 in Strasburg, Virginia. The design objective of the IRA is to reconstruct existing roads, or construct relocated sections, so that the resulting facility meets current established design criteria. Reconstruction consists of adding climbing lanes, widening roadways and shoulders, reducing grades, flattening curves, and realigning to improve sight distance. The IRA is approximately 206 kilometers (128 miles) in length and would cost approximately $416 million to construct. Mitigation costs and right-of-way acquisition costs are estimated at $6,080,000 and $29,926,300, respectively, for the IRA.

TABLE S-1
PURPOSE AND NEED COMPARATIVE SUMMARY

PURPOSE AND NEED	OBJECTIVES	MEASURES OF EFFECTIVENESS	NO-BUILD	IRA			BUILD ALTERNATIVE: Line A		
				WV	VA	TOTAL	WV	VA	TOTAL
Legislation	Creation of Appalachian Development Highway System	Completion of Appalachian Corridor H	No	No	No	No	Yes	Yes	Yes
Improve System Linkage of Existing Transportation Network	Improve Access (System Linkage)	Improve Transportation Access at Regional Level	No	No	No	No	Yes	Yes	Yes
		Improve Transportation Access at Local Level	No	Partially	Yes	—	Yes	Yes	Yes
		Improve Access to Other Forms of Transportation	No	Partially	Partially	Partially	Yes	Yes	Yes
	Improve Efficiency of Transportation Network	Number of lanes provided yields LOS C or better	N/A	No	No	No	Yes	Yes	Yes
		Design Speed in 2013 (mph)	N/A	50	50	50	60	60	60
Improve Safety of Transportation Network	Minimize Accidents	Improve Access Control	N/A	No	No	No	Yes	Yes	Yes
		Passing Zone Opportunity	Limited	Restricted	Restricted	Restricted	Unlimited	Unlimited	Unlimited
Improve Existing Roadway Facilities	Reduce Roadway Deficiencies by Improving Vertical Alignment	• Maximum Grade • Total Length Grade > 6%	7% to 10%	7.4 % 45.8km (28.5mi)	7.0 % 5.9km (3.7mi)	7.4 % 51.7km (32.2mi)	6.5 % 3.9km (2.4mi)	6.0% 0km (0mi)	6.5 % 3.9km (2.4mi)
	Reduce Roadway Deficiencies by Improving Horizontal Alignment	• Maximum Degree Curve • # Curves > 7°30' • # Curves > 4°45' • # Curves > 3°00'	N/A	16° 30' 8 78 120	7°30' 1 12 16	16°30' 9 90 136	4°45' 0 0 7	4°00' 0 0 1	4°45' 0 0 8
Improve Socioeconomic Development Opportunities	Economic Growth	Temporary Jobs Created (#): • On-Site Construction Jobs • Off-Site Jobs Total # Temporary Jobs Created	 0 0 0	 3,700 5,000 8,700	 300 300 600	 4,000 5,300 9,300	 9,300 12,050 21,350	 1,200 1,600 2,800	 10,500 13,650 24,150
		Permanent Jobs Predicted (#):	0	984	273	1,257	8,100	9,723	17,823
		Predicted Tax Benefit	0	$626,700	$341,300	$968,000	$5,435,800	$13,868,600	$19,304,400
	Minimize Disruption to Existing Neighborhoods and Relocations	Number of Communities with cohesion impacts	0	0	0	0	4	1	5
		Number of businesses that are relocated	0	9	2	11	3	0	3
		Number of residences that are relocated	0	60	23	83	52	13	65

3. THE BUILD ALTERNATIVE

The Build Alternative consists of a divided, four-lane highway with partial control of access on primarily new location. Detailed alignments were developed within the preferred corridor (Scheme Option D5) identified in the 1993 *Decision Document: Corridor Selection SDEIS*. Development of these alignments took into consideration resources previously identified in the Corridor Selection process. Of the 52 possible alignments developed, a single alignment (Line A) and eight possible Option Areas (six in West Virginia and two in Virginia) were retained for further evaluation. Through a series of coordination meetings, the participating resource agencies provided concurrence on the alignment and option areas carried forward under the Build Alternative. The Build Alternative ranges in length from 181 kilometers (112 miles) to 183 kilometers (114 miles), depending on the option area(s) under consideration. Construction costs range from a low of $1,025,337,000 to a high of $1,075,163,000. Mitigation costs and right-of-way acquisition costs are estimated at $51,952,500 and $30,132,000, respectively, for the Build Alternative.

D. PREFERRED ALTERNATIVE

WVDOT has identified Line A of the Build Alternative as the preferred alternative in the West Virginia portion of the project. Through the alignment development process (discussed in Section II) and corresponding assessment of impacts, Line A is considered the least environmentally damaging alternative that meets the purpose and need of the project. The identification of a preferred alternative in a Draft EIS is consistent with the July 23, 1992 Interagency Consensus Agreement signed by the Federal Highway Administration, the Environmental Protection Agency (EPA), the US Fish and Wildlife Service (USFWS), the US Army Corps of Engineers (COE), and the National Marine Fisheries Service (NMFS). The goal of this interagency task force was to develop "a cooperative process that merges elements of the NEPA and Section 404 processes and builds consensus by all agencies involved. The overall goal is to assure timely, cost-effective development of needed, environmentally sensitive transportation projects..." The process contained in the interagency agreement is collectively referred to as the Integrated NEPA/404 Process. Accordingly, a Section 404 permit application has been filed with the COE - Pittsburgh District for the West Virginia portion of this project and is contained in Appendix G of this SDEIS.

VDOT has determined that its development of this project will not follow all aspects of the Integrated NEPA/404 Process. Accordingly, VDOT has not identified a preferred alternative in this document, and a Section 404 permit has not been applied for in that state. References to Line A in Virginia do not indicate a preference for that alignment in Virginia.

E. MAJOR ENVIRONMENTAL IMPACTS

A summary of the major environmental impacts, both beneficial and adverse, is presented in Tables S-2 through S-4. Table S-2 presents a summary of the potential impacts associated with Corridor D5 (the preferred corridor identified in the 1993 *Decision Document: Corridor Selection SDEIS*) and compares the results with the impacts associated with the No-Build, Improved Roadway, and Build Alternatives. Table S-3 presents a comparison of the social and environmental impacts for the No-Build, Improved Roadway, and Build Alternatives in West Virginia and Virginia. A summary of the social and environmental impacts by Option Area is provided in Table S-4. Detailed discussions on methodologies and impact assessment results are contained in Section III of this SDEIS.

1. BENEFICIAL IMPACTS

a. No-Build Alternative

The primary beneficial impact of the No-Build Alternative is that no cost, beyond that of normal, programmed maintenance and improvements, is associated with this alternative. This alternative would involve no impacts to the natural, social, or cultural environment.

b. Improved Roadway Alternative

The IRA provides for a continuous, two-lane roadway system with an 80 kph (50 mph) design speed. This alternative would reduce high accident rates common on the existing roads and would improve the level of service by adding climbing lanes and turning lanes, where possible. Based on the methodologies contained herein, this alternative could provide 9,300 temporary jobs associated with construction and 1,257 permanent jobs due to induced development, for a total predicted annual tax benefit of $968,000.

c. Build Alternative

The Build Alternative addresses all factors of the established need by completing a regional system of four-lane roads and providing the transportation infrastructure for economic development. The construction of this alternative would improve the safety and efficiency of the highway network. Truck traffic would be diverted to the proposed highway, thus allowing use of the existing roads for local and tourist travel. The existing roadway network would remain intact, except for a few short reaches that must be relocated for safe access to the proposed facility. Based on the methodologies contained herein, the Build Alternative could provide 24,150 temporary jobs associated with construction and over 17,800 permanent jobs due to induced development. The total annual tax benefit of the Build Alternative is predicted to be approximately $19,304,400.

TABLE S-2
IMPACT SUMMARY: CORRIDOR D5 COMPARISON WITH ALIGNMENT SELECTION ALTERNATIVES

	CORRIDOR D5 COMPARISON WITH ALTERNATIVES			
ISSUE	CORRIDOR D5* (Potential)	NO-BUILD	IRA	BUILD - LINE A
LENGTH	182 km (113 mi)	182 km (113 mi)	206 km (128 mi)	183 km (114 mi)
# Total Potential Relocations (residences & businesses)	561	0	94	68
CULTURAL RESOURCES:	891			
No Effect		0	338	398
Effected		0	213	148
Adversely Effected - buildings and structures / sites		0/0	16 / 26	12 / 11
PREHISTORIC SETTLEMENT PATTERN PROBABILITY ZONES:				
High	13%	N/A	11%	11%
Medium	25%	N/A	17%	15%
Low	62%	N/A	72%	74%
RECREATION RESOURCES:				
# National Forests & Degree of Impact	2 - Minor	2 - None	2 - Minor	2 - Minor
# Trail Involvements & Degree of Impact	N/A	None	10 - Minor 3 - Major	7 - Minor 3 - Major
# Local Parks & Degree of Impact	0 - None	None	2 - Minor	None
SENSITIVE VISUAL RESOURCES:				
# No Impact	3	31	6	10
# Impacted, Not Adverse	1	0	21	17
# Adverse Impact	0	0	4	4
HAZARDOUS MATERIALS:				
# RCRA Sites	3	0	0	0
# CERCLA Sites	0	0	0	0
# Leaking UST Sites	0	0	0	0
# Landfills	0	0	0	0
FARMLANDS: ha (ac)	2,071 ha (5,117 ac)	0 ha (0 ac)	118 ha (291 ac)	220 ha (543 ac)
WETLANDS: Total Area - ha (ac)	300 ha (741 ac)	0	8.7 ha (21.4 ac)	15.2 ha (37.7 ac)
FLOOD ZONE ENCROACHMENT: Total Area of Encroachment: ha (ac)	1,021 ha (2,528 ac)	0 ha (0 ac)	23 ha (57 ac)	22 ha (54 ac)
THREATENED & ENDANGERED SPECIES: # Federally Listed T & E Species	2	0	0	0
WILD & SCENIC RIVERS:				
# NRI - Wild Status Affected	0	0	0	0
# NRI - Scenic Status Affected	1	0	0	1
# NRI - Recreation Status Affected	1	0	0	0

**Corridor D5 is the preferred corridor in the 1992 Corridor Selection SDEIS. Data presented for Corridor D5 are the sum of the resources within the 2,000' corridor width.*

TABLE S-3
IMPACT SUMMARY: ALTERNATIVE COMPARISON

ISSUE	NO-BUILD	IRA			BUILD - LINE A		
		WV	VA	TOTAL	WV	VA	TOTAL
LENGTH	182 km (113 mi)	184 km (114 mi)	22 km (14 mi)	206 km (128 mi)	161 km (100 mi)	22 km (14 mi)	183 km (114 mi)
COST: Construction ($)	$0	$387,778,000	$28,019,000	$415,797,000	$951,164,000	$122,583,000	$1,073,747,000
COST: ROW Acquisition ($)	$0	$24,021,000	$5,905,300	$29,926,300	$26,198,000	$3,934,000	$30,132,000
COST: Mitigation ($)	$0	$5,640,000	$440,000	$6,080,000	$39,729,000	$12,223,500	$51,952,500
Total Costs ($)	$0	$417,439,000	$34,364,300	$451,803,300	$1,017,091,000	$138,740,500	$1,155,831,500
RELOCATIONS: # Residences Potentially Relocated	0	60	23	83	52	13	65
# Businesses Potentially Relocated	0	9	2	11	3	0	3
# Poultry Houses	0	1	0	1	4	0	4
# Total Potential Relocations	0	70	25	95	59	13	72
LAND USE CONVERSIONS: Total Area Converted	0 ha (0 ac)	473 ha (1,170 ac)	66 ha (162 ac)	539 ha (1,332 ac)	1,394 ha (3,444 ac)	171 ha (424 ac)	1,564 ha (3,868 ac)
% Forested	0%	76%	53%	73%	75%	82%	76%
% Agricultural	0%	12%	21%	13%	16%	13%	16%
% Rangeland	0%	4%	3%	4%	5%	3%	5%
% Urban/Build-Up	0%	5%	21%	7%	1%	2%	1%
% Other	0%	3%	2%	3%	3%	0%	2%
WATER SUPPLY: # Private Wells Impacted	0	1	0	1	6	0	6
# Private Wells within 152 m (500 ft)	0	24	0	24	17	0	17
# Public Water Sources Potentially Impacted	0	1 (Construction)	0	1 (Construction)	1 (Aquifer) 1 (Construction)	0	1 (Aquifer) 1 (Construction)
AIR: Year 2013 Worst Case 1-Hour CO (ppm)	7.9 in WV 3.0 in VA	6.1	4.8	N/A	5.5	4.4	N/A
NOISE: # FHWA NAC Exceedances - Year 2013	218	286	52	338	60	8	68
# Substantial Increase Exceedances	0	27	5	32	84	49	133
CULTURAL RESOURCES: No Effect	0	297	41	338	332	66	398
Effect	0	161	52	213	122	26	148
Adverse Effect - buildings & structures / sites	0	13 / 21	3 / 5	16 / 26	12 / 10	0 / 1	12 / 11

TABLE S-3 (CONT.)
IMPACT SUMMARY: ALTERNATIVE COMPARISON

ISSUE	NO-BUILD	IRA			BUILD - LINE A		
		WV	VA	TOTAL	WV	VA	TOTAL
PREHISTORIC SETTLEMENT PATTERN PROBABILITY ZONES: % Probability = High	N/A	12%	9%	11%	12%	7%	11%
% Probability = Medium	N/A	15%	41%	17%	14%	26%	15%
% Probability = Low	N/A	73%	50%	72%	74%	67%	74%
RECREATION RESOURCES: # National Forests & Degree of Impact	2 - None	2 - Minor	1 - Minor	2 - Minor	2 - Minor	1 - Minor	2 - Minor
# Trail Involvements & Degree of Impact	None	10 - Minor 2 - Major	0 - Minor 1 - Major	10 - Minor 3 - Major	7 - Minor 2 - Major	0 - Minor 1 - Major	7 - Minor 3 - Major
# Local Parks & Degree of Impact	None	2 - Minor	None	2 - Minor	None	None	None
SENSITIVE VISUAL RESOURCES: # No Impact	31	5	1	6	9	1	10
# Impacted, Not Adverse	0	16	5	21	12	5	17
# Adverse Impact	0	4	0	4	4	0	4
HAZARDOUS MATERIALS: # RCRA Sites	0	0	0	0	0	0	0
# CERCLA Sites	0	0	0	0	0	0	0
# UST Sites	0	1	0	1	0	0	0
# Leaking UST Sites	0	0	0	0	0	0	0
# Landfills	0	0	0	0	0	0	0
FARMLANDS: ha (ac)	0 ha (0 ac)	101 ha (250 ac)	17 ha (41 ac)	118 ha (291 ac)	193 ha (477 ac)	27 ha (67 ac)	220 ha (543 ac)
WETLANDS: Total Area - ha (ac)	0	8.2 ha (20.3 ac)	0.5 ha (1.1 ac)	8.7 ha (21.4 ac)	14.9 ha (36.9 ac)	0.3 ha (0.8 ac)	15.2 ha (37.7 ac)
FLOOD ZONE ENCROACHMENT: Total Area of Encroachment: ha (ac)	0 ha (0 ac)	20 ha (49 ac)	3 ha (8 ac)	23 ha (57 ac)	19 ha (48 ac)	2 ha (6 ac)	22 ha (54 ac)
THREATENED & ENDANGERED SPECIES: # Federally Listed T & E Species	0	0	0	0	0	0	0
HABITAT UNIT NET LOSS: # Habitat Units	0	3,035	164	3,199	6,318	827	7,145
WILD & SCENIC RIVERS: # NRI - Wild Status Affected	0	0	0	0	0	0	0
# NRI - Scenic Status Affected	0	0	0	0	1	0	1
# NRI - Recreation Status Affected	0	0	0	0	0	0	0

TABLE S-3 (CONT.)
IMPACT SUMMARY: ALTERNATIVE COMPARISON

ISSUE	NO-BUILD	IRA			BUILD - LINE A		
		WV	VA	TOTAL	WV	VA	TOTAL
STREAM ENCLOSURES Pipe	0	3,957 m (12,980 ft)	271 m (890 ft)	4,228 m (13,870 ft)	4,811 m (15,760 ft)	268 m (880 ft)	5,079 m (16,640 ft)
Box and Open Bottom Box Culverts	0	398 m (1,305 ft)	0 m (0 ft)	398 m (1,305 ft)	3,071 m (10,075 ft)	326 m (1,070 ft)	3,397 m (11,145 ft)
Total	0	4,355 m (14,285 ft)	271 m (890 ft)	4,626 m (15,175 ft)	7,882 m (25,835 ft)	594 m (1,950 ft)	8,476 m (27,785 ft)
STREAM RELOCATIONS	0	889 m (2,915 ft)	38 m (125 ft)	927 m (3,040 ft)	3,115 m (10,220 ft)	30 m (100 ft)	3,145 m (10,320 ft)
SECONDARY IMPACTS *Riparian Buffer Zones* Parallel Construction w/in 23 m (75 ft) of stream	0	8,662 m (28,418 ft)	801 m (2,627 ft)	9,463 m (31,045 ft)	3,645 m (11,778 ft)	0 m (0 ft)	3,645 m (11,778 ft)
Forest Fragmentation # Parcels created less than 150 ha (370 ac)	N/A	N/A	N/A	133	N/A	N/A	206
# Parcels created less than 1 ha (2.5 ac)	N/A	N/A	N/A	91	N/A	N/A	110
Stormwater Runoff	N/A	minimal	minimal	minimal	minimal	minimal	minimal
Cultural Resources # potentially impacted by commercial development	N/A	0	1	1	5	2	7
# existing roads experiencing minor or moderate noise impacts	N/A	6	0	6	0	0	0
Habitat Units # lost due to predicted development	N/A	65	16	81	5,339	4,519	9,858

d. Comparison of Economic Benefits under the IRA and the Build Alternative

Economic benefits relative to induced development were evaluated for the IRA and the Build Alternative. Economic development that could be induced by the proposed project was divided into three types: industrial, commercial, and service-oriented. Of these three types of induced development, the Build Alternative would be expected to generate growth in all categories whereas the IRA would only be expected to generate growth in the commercial sector.

Based on employment generated from industrial, commercial, and service-oriented induced growth, the Build Alternative would be expected to create over 17,800 additional jobs and generate an additional $19,304,400 in predicted tax benefits. The IRA would be expected to create approximately 1,250 additional jobs and generate an additional $968,000 in predicted tax benefits. Overall, the Build Alternative could provide 14 times as many permanent jobs and twenty times the amount of predicted tax benefits as would the IRA.

2. ADVERSE IMPACTS

a. No-Build Alternative

Selection of this alternative would involve adverse economic impacts, in that there would be a continuation of the negative trends in population, employment, and income in most communities and counties. This alternative would allow for the continuation of the high accident rates and level of service problems associated with the existing roadways. This alternative cannot accommodate the 2013 predicted traffic volumes on Routes 33 and 219 near Elkins.

b. Improved Roadway Alternative

By upgrading existing roads, there is no ability to control access. An AASHTO study of rural roads related the number of accidents to the number of access points. Under the IRA, future travelers would encounter the same number of access points (driveways, intersections) but at a higher travel speed. The resultant roadway system could be less safe than the existing roads. Further, the traffic analysis shows that a two-lane road cannot accommodate the future traffic, resulting in poor levels of service. The IRA would not provide for transportation access at the regional level (system linkage), one of the primary factors of need for the proposed project.

The IRA would cost approximately $452,000,000 to construct (including right-of-way and mitigation costs) and would relocate 83 residences and 11 businesses. This alternative would impact cultural resources: 16 historic buildings or structures and 26 known archaeological sites would be adversely affected. Effects on wetlands and water resources include the filling of 8.7 hectares (21.4 acres) of wetlands and relocating 927 meters (3,040 feet) of streams. Stream enclosures under the IRA total over 4,600 meters

(15,000 feet). Secondary impacts to streams and wildlife habitat include encroaching on nearly 9,500 meters (31,000 feet) of stream habitat corridors and creating 133 forest parcels considered too small for certain species to breed. Land cover conversion would involve 539 hectares (1,332 acres) of which 73% is forested, and the loss of 3,199 habitat units.

The IRA would not impact communities as a whole in terms of cohesion. However, certain neighborhoods such as Porterwood would experience substantial relocations. Further, future traffic on the IRA could result in impacts to the communities through which it passes.

c. Build Alternative

The Build Alternative would range in cost from $1,107,421,500 to $1,157,247,500, which includes right-of-way acquisition and mitigation costs, depending on the Option Area alignment selected. The Build Alternative (Line A) would relocate 65 residences and 3 businesses. The Build Alternative would not physically impact cultural resources in the form of historic buildings or structures but would adversely affect 12 such resources. Eleven (11) known archaeological sites would also be impacted by this alternative. Effects on wetlands and water resources include the filling of 15.2 hectares (37.7 acres) of wetlands and relocating 3,145 meters (10,320 feet) of streams. Stream enclosures under the Build Alternative total over 8,400 meters (27,800 feet).

Secondary impacts to streams and wildlife habitat include encroaching on approximately 3,600 meters (11,800 feet) of stream habitat corridors and creating 206 forest parcels considered too small for the breeding needs of certain species. Land cover conversion would involve 1,565 hectares (3,868 acres), of which 76% is forested, and the loss of 7,145 habitat units.

d. Comparison of the IRA and the Build Alternative

In many cases, the impacts expected under the IRA or the Build Alternative are similar. This would be the case for impacts associated with sensitive visual resources, hazardous materials, Threatened and Endangered Species, Wild and Scenic Rivers, and secondary impacts such as stormwater runoff. The similarity exists even though the Build Alternative would be almost entirely on new alignment while the IRA would remain largely on existing alignment. This reflects the dedicated level of effort taken during the alignment development process to avoid and minimize involvements with sensitive resources. Where considerable differences exist between the IRA and the Build Alternative, the differences are summarized below.

TABLE S-4
IMPACT SUMMARY: OPTION AREA COMPARISON

	OPTION AREA COMPARISON																
	INTERCHANGE		SHAVERS FORK		PATTERSON CR.		FORMAN		BAKER		HANGING ROCK		DUCK RUN			LEBANON CH.	
ISSUE	Line I	Line A	Line S	Line A	Line P	Line A	Line F	Line A	Line B	Line A	Line R	Line A	Line D1	Line D2	Line A	Line L	Line A
LENGTH: kilometers (miles)	2.4 (1.5)	2.4 (1.5)	4.3 (2.7)	4.2 (2.6)	6.8 (4.2)	6.5 (4.0)	5.1 (3.2)	5.0 (3.1)	5.3 (3.3)	5.5 (3.4)	3.4 (2.1)	3.7 (2.3)	9.0 (5.6)	8.4 (5.2)	8.7 (5.4)	7.3 (4.5)	8.5 (5.3)
CONSTRUCTION COST: $ millions	15,790	17,545	14,733	33,119	43,813	44,510	27,906	40,417	35,402	35,532	26,863	33,348	62,329	68,497	70,775	33,663	32,247
POTENTIAL RELOCATIONS:																	
# Residences Potentially Relocated	1	2	0	1	3	0	1	2	4	2	0	0	8	4	6	4	3
# Businesses Potentially Relocated	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0
# Total Potential Relocations	2	2	0	1	4	0	1	2	5	2	0	1	8	4	6	4	3
WATER SUPPLY:																	
# Private Wells Impacted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# Private Wells within 152 m (500 ft)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# Public Water Sources Potentially Impacted	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
NOISE: # FHWA NAC Exceedances-Year 2013	7	2	0	0	0	0	1	0	2	2	0	2	1	0	1	6	1
# Substantial Increase Exceedances	24	3	0	0	2	0	1	0	2	2	2	0	15	12	12	54	8
CULTURAL RESOURCES:																	
No Effect	0	0	9	7	2	1	0	1	4	3	1	1	1	1	1	58	52
Effect	3	3	1	4	2	3	4	3	6	7	3	3	2	2	2	19	25
Adverse Effect	0	0	0	1	1	1	0	0	1	0	0	0	1	1	1	1	1
PREHISTORIC SETTLEMENT PATTERN PROBABILITY ZONES																	
% Probability = High	3%	9%	11%	21%	21%	15%	27%	53%	26%	26%	4%	4%	0%	0%	0%	12%	19%
% Probability = Medium	59%	67%	7%	6%	24%	24%	22%	12%	5%	5%	2%	6%	7%	4%	7%	60%	60%
% Probability = Low	38%	24%	82%	73%	55%	61%	51%	35%	69%	69%	94%	90%	93%	96%	93%	28%	21%
RECREATION RESOURCES: # National Forests & Degree of Impact	0	0	1 Minor	1 Minor	0	0	0	0	0	0	0	0	1 Minor	1 Minor	1 Minor	0	0
# Trail Involvements & Degree of Impact	0	0	1 Major	1 Major	0	0	0	0	0	0	0	0	1 Major	1 Major	1 Major	0	0
# Local Parks & Degree of Impact	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SENSITIVE VISUAL RESOURCES: # No Impact	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
# Impacted, Not Adverse	0	0	1	1	0	0	0	0	1	1	1	0	3	3	3	1	2
# Adverse Impact (sites)	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0

TABLE S-4 (CONTINUED)
IMPACT SUMMARY: OPTION AREA COMPARISON

ISSUE	OPTION AREA COMPARISON																
	INTERCHANGE		SHAVERS FORK		PATTERSON CR.		FORMAN		BAKER		HANGING ROCK		DUCK RUN			LEBANON CH.	
	Line I	Line A	Line S	Line A	Line P	Line A	Line F	Line A	Line B	Line A	Line R	Line A	Line D1	Line D2	Line A	Line L	Line A
HAZARDOUS MATERIALS: # RCRA Sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CERCLA Sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# UST Sites/Leaking UST Sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# Leaking UST Sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# Landfills	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FARMLANDS: ha (ac)	2.5 (6.0)	9.1 (22.5)	5.1 (12.5)	8.1 (20.1)	5.5 (13.7)	2.7 (6.7)	11.1 (27.2)	22.2 (54.9)	6.2 (15.4)	2.8 (7.0)	0.2 (1.2)	0.2 (1.2)	0.1 (0.2)	1.4 (3.5)	1.2 (2.9)	23.2 (57.3)	21.3 (52.4)
WETLANDS: Total Area - ha (ac)	0.05 (0.13)	0.11 (0.27)	0.02 (0.04)	0.03 (0.08)	1.03 (2.56)	0.66 (1.62)	1.46 (3.62)	1.36 (3.37)	0.20 (0.51)	0.03 (0.07)	0.00 (0.00)	0.00 (0.00)	0.15 (0.36)	0.11 (0.28)	0.21 (0.52)	0.35 (0.87)	0.11 (0.27)
FLOOD ZONE ENCROACHMENT: Total Area of Encroachment: ha (ac)	3.4 (8.3)	2.0 (5.0)	0.0 (0.0)	3.4 (8.5)	0.0 (0.0)	0.0 (0.0)	1.3 (3.3)	1.1 (2.6)	0.6 (1.4)	0.2 (0.5)	0.0 (0.0)	0.0 (0.0)	0.8 (2.1)	0.0 (0.0)	0.8 (2.0)	0.0 (0.0)	0.5 (1.2)
THREATENED & ENDANGERED: # Federally Listed T & E Species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HABITAT UNIT NET LOSS: # Units	91	71	279	213	292	259	171	174	198	149	140	149	414	481	449	133	165
WILD & SCENIC RIVERS: # NRI - Wild Status Affected	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# NRI - Scenic Status Affected	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
# NRI - Recreation Status Affected	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STREAM ENCLOSURES: Length of Pipe - m (ft)	335 (1,110)	351 (1,150)	0 (0)	0 (0)	632 (2,075)	183 (600)	381 (1,250)	360 (1,180)	0 (0)	94 (310)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	107 (350)	189 (620)
Length of Box & Open Bottom Box Culverts - m (ft)	0 (0)	0 (0)	0 (0)	0 (0)	351 (1,150)	137 (450)	152 (500)	152 (500)	198 (650)	0 (0)	0 (0)	0 (0)	0 (0)	137 (450)	137 (450)	0 (0)	158 (520)
Total Length - m (ft)	335 (1,100)	351 (1,150)	0 (0)	0 (0)	983 (3,225)	320 (1,050)	533 (1,750)	512 (1,680)	198 (650)	94 (310)	0 (0)	0 (0)	0 (0)	137 (450)	137 (450)	107 (357)	347 (1,140)
STREAM RELOCATIONS - m (ft)	305 (1,000)	305 (1,000)	183 (600)	183 (600)	116 (380)	116 (380)	625 (2,050)	351 (1,150)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	30 (100)

(1) Social Impacts

In general, relocations under the IRA would be greater than under the Build Alternative. The IRA would require more business relocations than would the Build Alternative (83 versus 65 residences and 11 versus 3 businesses, respectively). Exceedances of the FHWA Noise Abatement Criteria would be greater under the IRA compared to the Build Alternative (338 versus 68, respectively). However, the Build Alternative would have more substantial increase exceedances than would the IRA (133 versus 32, respectively). The IRA would impact a greater number of recreation resources compared to the Build Alternative: ten minor trail impacts compared to the Build Alternative's seven minor impacts; and two minor involvements with local parks compared to none under the Build Alternative.

Based on the above, the IRA would generally have a greater magnitude of impact on these social resources than would the Build Alternative. As is typical with social resources, they tend to be located in close proximity to the existing roadway network. The primary reason that the IRA would have a greater magnitude of impact on the above resources is that, by remaining on the existing roadway, such sensitive resources cannot be avoided. Furthermore, the IRA impacts are still greater than the Build Alternative even though the IRA involves no construction through Wardensville or Parsons. Conversely, because the Build Alternative is on new alignment, it was possible to avoid or minimize the level of involvement with or impact to social resources.

(2) Cultural Resource Impacts

The IRA would have an adverse effect on considerably more cultural resource buildings and structures/sites than would the Build Alternative (16/26 versus 12/11 respectively). With regard to the prehistoric settlement pattern probability zones, the relative percentage proportions of high, medium, and low probability zones are quite similiar between the Build Alternative and the IRA. However, in terms of the acreage impacts among the zones, the Build Alternative would impact more acreage than would the IRA simply because of its greater area of construction.

(3) Environmental Impacts

Farmland impacts would be greater under the Build Alternative compared to the IRA (220 hectares versus 118 hectares, respectively). Wetland impacts would also be greater under the Build Alternative compared to the IRA (15.2 hectares versus 8.7 hectares, respectively). Over twice as many wildlife Habitat Units would be lost under the Build Alternative compared to the IRA (7,145 versus 3,199, respectively). The Build Alternative would have nearly twice as many stream enclosures as would the IRA (8,476 meters versus 4,626 meters, respectively) and would have more length of stream relocations as would the IRA (3,146 meters versus 927 meters). Many impact areas are nearly double under the Build Alternative as compared to the IRA due to the greater width required to construct a four-lane highway.

3. SUMMARY OF PROPOSED MITIGATION MEASURES

Mitigation measures for the IRA and the Build Alternatives are proposed throughout Section III of this document. Table S-5 presents a summary of the proposed mitigation measures by alternative. Mitigation of an impact area may not apply in both West Virginia and Virginia. Specific mitigation measures would be outlined in detail in the Final EIS, based on the selected alternative. Cost estimates for mitigation are provided in Section II.

F. AREAS OF CONTROVERSY

1. VIRGINIA OPPOSITION

Prior to the release of this document, the Virginia Advisory Committee issued a statement opposing Corridor H as presented. The group is calling for another detailed study to investigate improvements to VA 55. The committee structure and a summary of meetings held is discussed in detail in Section VII.

2. CHANGES TO THE RURAL CHARACTER OF THE AREA

In October of 1993, Scenic America, a non-profit group based in Washington, D.C., selected certain routes between Elkins and I-81, as one of the nation's ten most endangered scenic byways. The route includes WV 55 and VA 55, along with other two-lane roads "whose panoramas may be diminished by Appalachian Corridor H." The group stated that the list is developed annually to increase interest and appreciation of scenic byways and their potential for conservation, economic development, and tourism. Section III-B: *Land Use* and Section III-K: *Visual Resources* address this issue.

3. PUBLIC INTEREST GROUPS

Several groups have formed to express various positions on the proposed project, including groups in favor and in opposition. The most prominent and active group is Corridor H Alternatives, which was formed from a few smaller groups spread geographically across the area. The main area of controversy for the group was the need to reevaluate an alternative that would consider improvements to local roads. The Improved Roadway Alternative addresses their concern.

4. LANDS PREVIOUSLY ACQUIRED FOR CORRIDOR H

In the 1970s, the WVDOT acquired approximately 77 hectares (190 acres) of land along US 33, from Bowden to the top of Middle Mountain, for what was to be rights-of-way for the construction of Corridor H east of Elkins. Since then, the preferred route of Corridor H has shifted to the north, along the selected Scheme Option D5 corridor. Some of the original landowners along US 33 are now interested in regaining ownership of their property.

TABLE S-5
SUMMARY OF MITIGATION MEASURES

AREA OF IMPACT	IRA	BUILD
Wetlands	Replace on-site, in-kind	Replace on-site, in-kind
Aquatic and Terrestrial Habitat	N/A	Purchase property in Canaan Valley Wildlife Refuge Restore stripped areas adjacent to right-of-way
Groundwater	Construct filters at known sinkholes	Construct filters at known sinkholes
Wardensville Wellhead Protection Area	N/A	Construct monitoring wells in advance of construction and conduct additional dye trace; construct impervious median and ditches; construct detention system
Recreation Resources	Construct shared roadway bicycle facility	Construct separate bicycle facility
Visual	N/A	Construct scenic overlooks and Welcome Centers Scenic design features
Noise	Construct noise walls	Construct noise walls
Surface Waters	Open bottom box culverts	Open bottom box culverts Stream channel enhancement Fencing streams Erosion and sedimentation control per WVDOT 1993 manual Fisherman's access
General Natural Resources	N/A	Provide environmental monitor at construction sites
Cultural Resources	To be determined as Section 106 process continues	To be determined as Section 106 process continues

G. OTHER GOVERNMENT ACTIONS REQUIRED

As previously discussed, a Section 404 permit would be required from the US Army Corps of Engineers for construction activities in waters of the United States. Associated with this is the need to obtain Section 401 Water Quality Certifications from West Virginia and Virginia. In addition, a Subaqueous Bed Permit would be required from Virginia for any work in, on, or over State waters.

Although there are no rivers presently listed as navigable in the study area, such designations may be made on a case by case basis. Therefore, a Section 10 permit from the US Army Corps of Engineers and/or a Section 9 permit from the US Coast Guard for construction activities in navigable waters may be required.

A more detailed discussion of the types of environmental permits which would be required for either the Build Alternative or the IRA is provided in Section III-U: *Permits*.

Right-of-way acquisition for either the Build Alternative or the IRA would be necessary from the Monongahela National Forest and the George Washington National Forest.

Depending on the results of the ongoing Section 106 process, it may be necessary to enter into agreements regarding future Section 106 efforts and mitigation measures for adversely affected cultural resources. Discussions with the Advisory Council on Historic Preservation and the West Virginia and Virginia State Historic Preservation Officers have indicated that a programmatic Section 106 agreement covering future project activities would be a logical course of action.

SECTION I:
PURPOSE OF AND NEED FOR ACTION

SECTION I: PURPOSE OF AND NEED FOR ACTION

A. PROJECT DESCRIPTION

The West Virginia Department of Transportation - Division of Highways (WVDOT), in conjunction with the Virginia Department of Transportation (VDOT) and the Federal Highway Administration (FHWA), is proposing to construct an approximately 183 kilometer (114 mile) long highway from Elkins, West Virginia to I-81 in Strasburg, Virginia; completing the final section of Corridor H in the Appalachian Development Highway System. The proposed Corridor H facility would provide a divided, four-lane highway with partial control of access on new and existing location. The area through which the project traverses includes portions of the West Virginia Counties of Randolph, Tucker, Grant, and Hardy, as well as the Virginia Counties of Frederick and Shenandoah (Exhibit S-1). The current construction status of Corridor H is also presented in Exhibit I-1.

Of the project's 183 kilometer (114 mile) length, approximately 161 kilometers (100 miles) would be located in West Virginia and 22 kilometers (14 miles) would be located in Virginia. In its entirety, Appalachian Corridor H would be approximately 233 kilometers (145 miles) in length, with the western terminus at I-79 in Weston, West Virginia and the eastern terminus at I-81 in Strasburg, Virginia. Appalachian Corridor H would serve as an east/west highway, connecting these two north/south Interstate facilities (Exhibit S-1).

B. PROJECT PURPOSE AND NEED

A *Transportation Needs Study* for the proposed project was prepared in accordance with the FHWA's Technical Advisory T 6640.8A, *Guidance for Preparing and Processing Environmental and Section 4(f) Documents*, and the FHWA's 1990 policy statement, *Purpose and Needs in Environmental Documents*. The results of the study are presented in both the 1992 *Corridor H Corridor Selection Supplemental Draft Environmental Impact Statement* (Section I, pages I-1 through I-29) and the 1993 *Corridor H Corridor Selection Decision Document* (Section V, page 21). (Copies of these documents are available from the WVDOT in Charleston, West Virginia and the VDOT offices in Edinburg, Virginia.)

The following is a summary of the findings of the *Transportation Needs Study*. The legislation that originally established Appalachian Corridor H recognized the need to provide a transportation system that would improve east/west access and thereby stimulate and support economic development within the rural, mountainous region of northeastern West Virginia. The Appalachian Regional Commission's (ARC) 1990 Annual Report states:

"The Appalachian Development Highway System remains the most dramatic symbol of commitment to and achievement of the Commission's objectives. The Appalachian states continued to place completion of the most critical sections of highway at the top of their program agendas. Development of an adequate transportation system is still given top priority among efforts to develop the Region's economy" (Appalachian Regional Commission, *1990 Annual Report*, p. 6).

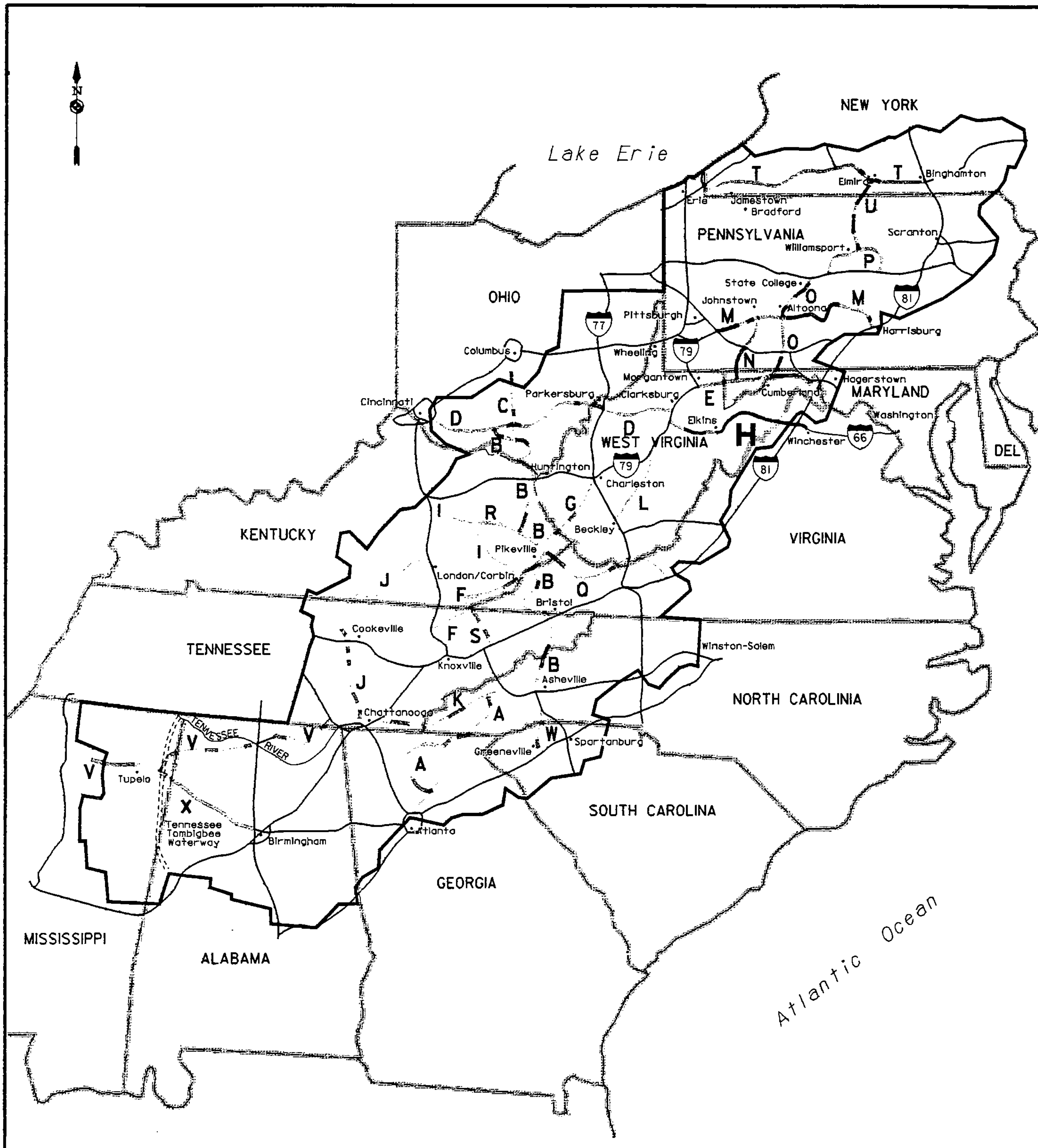
FHWA guidelines require the analysis of the following seven factors to establish project need for a transportation system such as Corridor H: social demand and economic development; system linkage; capacity and level of service; regional planning demands; safety considerations; and roadway deficiencies. The *Transportation Needs Study* for Corridor H analyzed these seven factors and showed that a transportation need exists in the proposed project area. In addition, the Resource Agency Workshops (May 5-6, 1992 and September 23-24, 1992) on the Preliminary *Corridor Selection* SDEIS, resulted in the overall recognition by resource agency representatives that a need for transportation improvements exists in the proposed project area. (Minutes from both Resource Agency Workshops are contained in Section VII of the 1992 *Corridor Selection SDEIS.*) With the need for the project established, the *Transportation Needs Study* evaluated several methods to meet the project need and determined that building a new highway (the Build Alternative) was the only alternative that fully met the established project need.

C. PROJECT HISTORY

Detailed descriptions of the project history are contained in the 1992 *Corridor Selection SDEIS* (Section I, pages I-3 through I-8) and the 1993 *Corridor Selection Decision Document* (*Abstract* and Section I, pages 1 through 7).

D. PROJECT STATUS

As noted in the Preface, the development of Corridor H is a two-step study process. The first step (Corridor Selection) was documented in the 1992 *Corridor Selection SDEIS* and culminated in the selection of a preferred corridor. Scheme Option D5 was selected as the preferred corridor on the basis that it best meets the established project purpose and need and has the least involvement with sensitive resources. The selection of Scheme Option D5 ends the Corridor Selection process and begins this Alignment Selection (Step 2) process. The *Alignment Selection SDEIS* began with the development of highway alignments at a scale of 1"=200'. It is based on the resource inventory developed and maintained for the *Corridor Selection SDEIS.*



S = Corridor Designation

Adequate or Complete - Sept. 30,1989

To Be Completed

Corridor H

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit I-1
APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM STATUS

0 125
Scale in Miles

SOURCE: Appalachian Regional Commission, September 30, 1992

ADHS61.DGN 091092

All resources within the selected corridor (Scheme Option D5) have been transferred from the GIS database onto current mapping prepared from 1992 aerial photography. This initial resource inventory was used to develop specific alignments that avoid known Section 4(f) lands, avoid or minimize impacts to other known sensitive social and environmental resources, as well as other resources identified through the photo interpretation of the 1992 aerial photography. This resource inventory was also used to document the existing condition (No-Build Alternative) and to develop the Improved Roadway Alternative.

Because of the increased level of detail required for the *Alignment Selection SDEIS*, field evaluations and studies were conducted throughout 1993 and early 1994 specifically to assess the potential impacts of various alternatives and alignments. In some instances, it became necessary to develop a specific alternative alignment outside, but in the general vicinity of, the selected corridor for the express purpose of avoiding important sensitive resources or meeting acceptable, safe design criteria. This situation occurred in response to additional information that only became available during the *Alignment Selection SDEIS* stage.

Specific activities of the project are shown on Exhibit I-2. Activities completed to date are in shaded boxes and activities yet to be completed are in unshaded boxes. The current schedule indicates that, following FHWA's approval of the *Alignment Selection SDEIS*, additional public meetings and hearings will be held to discuss the specific potential impacts of alternative alignments developed within the selected corridor. These meetings and hearings are expected to occur in the late 1994 and early 1995. Upon completion of the *Alignment Selection SDEIS* and the public involvement process, a Final EIS will be prepared addressing all of the comments on both the *Corridor Selection* and the *Alignment Selection SDEISs*.

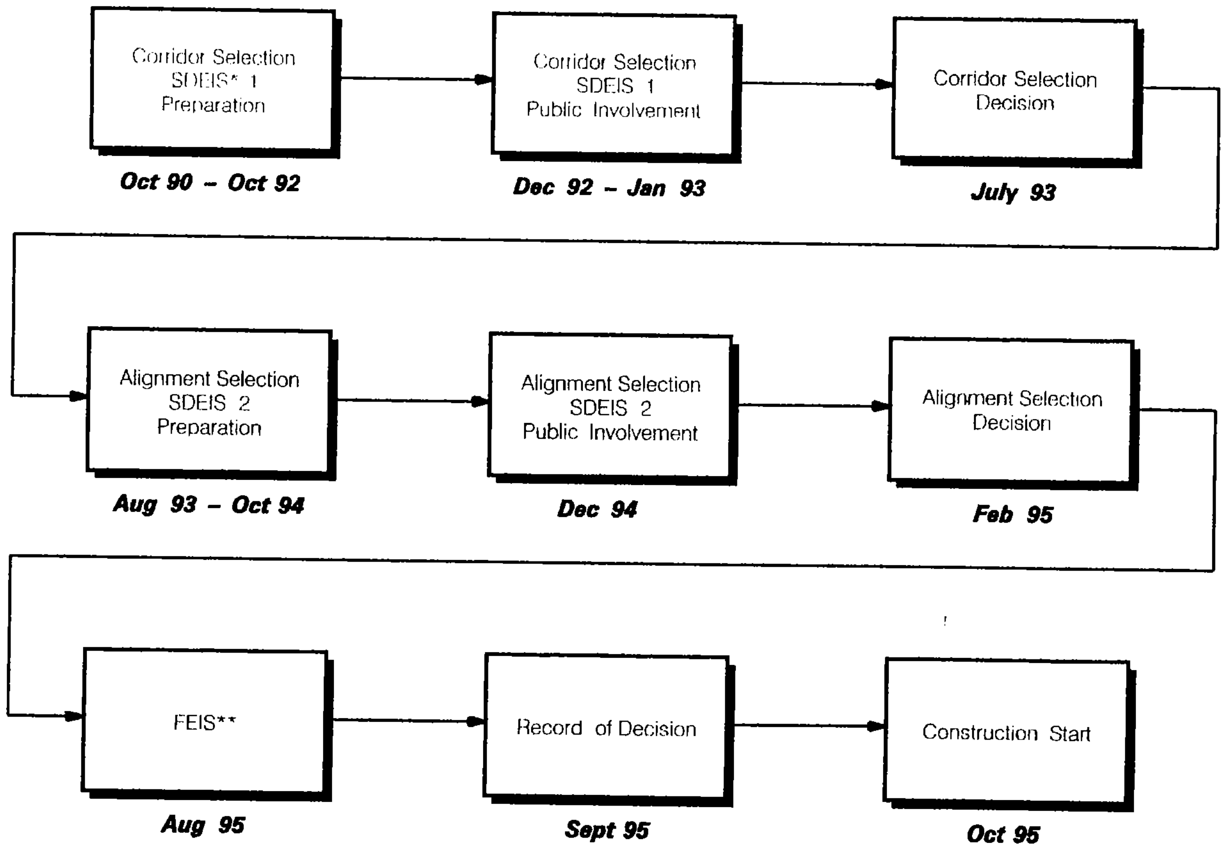
The Final EIS must be approved by FHWA and a Record of Decision (ROD) issued before WVDOT or VDOT can proceed with the construction of Appalachian Corridor H. Right-of-way acquisition could occur in early 1995, followed by construction starting in late 1995. The first construction section could be complete by 1997. It is likely that simultaneous construction of various sections will take place, allowing completion of Appalachian Corridor H by the year 2001.

Both the No-Build Alternative and the Improved Roadway Alternative are viable alternatives, should the negative impacts of the Build Alternative outweigh the advantages of constructing Corridor H.

E. FUNDING STATUS

The 1991 Federal Highway Bill, also known as "ISTEA", contained authorization for the entire Appalachian Regional Commission Corridor Highway System. In August 1994, Congress approved the Fiscal 1995 Energy and Water Appropriations Bill that included $75 million for the engineering, right-of-way acquisition, and start of construction for the remaining portion of Corridor H, from Elkins to I-81. In

September 1994, Congress also approved the Fiscal 1995 Transportation Appropriations Bill that included an additional $35 million for the construction of Corridor H. Moneys from both bills are to be used for construction of Corridor H in West Virginia. There are currently no funds appropriated for project construction in Virginia. Prior to 1994, Congress appropriated $160.5 million for Corridor H construction.



LEGEND

* SDEIS – Supplemental Draft Environmental Impact Statement

** FEIS – Final Environmental Impact Statement

☐ – Completed or In Progress

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit I–2
PROJECT DEVELOPMENT PROCESS

Baker

EV.DGN

REFERENCES

Appalachian Regional Commission. *1990 Annual Report*. Washington, D.C.: March 31, 1991.

Council on Environmental Quality, Executive Office of the President. *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act*. 40 CFR Parts 1500 - 1508. Reprint 43 FR 55978-56007: November 29, 1978.

US Department of Transportation, Federal Highway Administration. *Guidance for Preparing and Processing Environmental and Section 4(f) Documents*. FHWA Technical Advisory T 6640.8A. October 30, 1987.

West Virginia Department of Highways. *Draft Environmental Impact Statement: Appalachian Corridor H - Elkins, West Virginia to Interstate 81, Virginia*. Charleston, WV: March 13, 1981.

West Virginia Department of Transportation, Division of Highways. *Appalachian Corridor H Corridor Selection Decision Document*. Charleston, WV: May 28, 1993.

West Virginia Department of Transportation, Division of Highways. "Transportation Needs Study: Appalachian Highlands Region - Appalachian Corridor H". Technical Report prepared for 1992 *Appalachian Corridor H Corridor Selection SDEIS*. Charleston, WV.

SECTION II: ALTERNATIVES CONSIDERED

SECTION II: ALTERNATIVES CONSIDERED

A. DEVELOPMENT OF ALTERNATIVES

In accordance with 23 CFR 771.123 and FHWA Technical Advisory T 6640.8A, five broad-ranged alternatives were identified for consideration and development at the initiation of the 1992 *Corridor Selection SDEIS*. The five broad-ranged alternatives were:

1. A Transportation Systems Management Alternative (TSM);
2. A Mass Transit Alternative;
3. A No-Build Alternative of maintaining the existing roadway system;
4. An Improved Roadway Alternative; and
5. A Build Alternative involving the construction of Appalachian Corridor H.

The evaluation of these alternatives and their ability to meet the established project purpose and need are documented in the 1992 *Corridor Selection SDEIS*, Section II: Alternatives Considered (pages II-1 to II-23). The results of the evaluation indicate that neither the TSM, the Mass Transit, the Improved Roadway, nor the No-Build Alternative would adequately meet the project purpose and need: only the Build Alternative would do so. On the basis of information in the 1992 *Corridor Selection SDEIS* and supporting Technical Reports, as well as input received from the public involvement process, corridor Scheme Option D5 was selected as the Build Alternative corridor to be advanced to the Alignment Selection process.

The improvement of local roads as a method of reducing potential environmental impacts was the subject of considerable discussion throughout the Corridor Selection public involvement process. Originally, the Improved Roadway Alternative (IRA) was eliminated from further consideration because it did not meet the project purpose and need. However, interest in the improvement of local two-lane roads prompted WVDOT to determine that the IRA would be equally developed and evaluated throughout the Alignment Selection process, even though it does not meet the project purpose and need. In addition, the Virginia Commonwealth Transportation Board resolution required the consideration of the IRA in the Alignment Selection process.

Therefore, the Alignment Selection process focuses on the development of the No-Build, the Improved Roadway, and the Build Alternatives. In accordance with 40 CFR 1502.14, these three alternatives have been developed to a comparable level of detail to evaluate their merits and impacts.

At this time, WVDOT has identified the Build Alternative as the preferred alternative in West Virginia. In addition, WVDOT has identified Line A as the preferred alignment for the Build Alternative in West Virginia. VDOT has not identified a preferred alternative in Virginia nor have they identified a preferred alignment for the Build Alternative. Therefore, when references are made to Line A in Virginia, no preference is associated with this alignment over any other alignment or alternative. The final selection of an alternative and/or alignment in West Virginia or Virginia will not be made until comments on the *Alignment Selection SDEIS* and the associated public involvement process have been fully evaluated. In addition, the final selection of an alternative in Virginia must be approved by the Commonwealth Transportation Board.

B. DESIGN CRITERIA

The basic design criteria for the Appalachian Development Highway System are established within the framework of Section 201A-1 of the Appalachian Regional Commission Code. This Section states that "the design of the development highway system shall be 'comparable' with prevailing Federal-Aid highway standards, specifications, policies, and guides applicable to the projected type and volume of traffic". The recognized source for this information, as well as the basis upon which design criteria for Corridor H have been established, is the American Association of State Highway and Transportation Official's (AASHTO) *A Policy on Geometric Design of Highways and Streets* (1990). Elements of the design, such as number of lanes, grade, alignment, and access control, may be varied to achieve the ARC's objective of continuity and reasonable uniformity throughout the system.

Design criteria used to develop the Improved Roadway and the Build Alternatives are consistent with those used and accepted by FHWA, WVDOT, and VDOT. There are minor differences between West Virginia's and Virginia's roadway cross-section geometry. These differences include either wider or narrower shoulder and ditch widths, as well as minor differences in side slope ratios.

1. IMPROVED ROADWAY ALTERNATIVE

The IRA would consist of a two-lane highway with completely uncontrolled access. Construction of this alternative would involve improving the existing route within Scheme Option D5 which best connects Elkins, West Virginia to I-81 in Strasburg, Virginia. The design objective of the IRA is to reconstruct existing roads, or construct relocations, so that the resulting facility meets established design criteria. Reconstruction consists of adding climbing lanes, widening roadways and shoulders, reducing grades, flattening curves, and realigning to improve sight distance. The IRA would remain a two-lane road, with one travel lane in each direction.

The IRA would be classified as a two-lane, Rural Principal Arterial Highway with a design speed of 80 kph (50 mph). From a design standpoint, the roads which make up the IRA in West Virginia and the road which makes up the IRA in Virginia would be upgraded according to respective state design requirements for the roadway classification. The IRA design requirements would include such features as minimum paved roadway and shoulder widths and overall shoulder and ditch widths. A minimum design speed of 80 kilometers per hour (50 mph) would be required on all roads which make up the IRA. In both states, if an existing roadway grade or curve does not currently support an 80 kph (50 mph) design speed, the grade would be flattened, or the curve would be straightened. Table II-1 provides the desirable criteria for key design elements under the proposed IRA.

The IRA typical roadway and bridge sections are shown in Exhibits II-1 and II-2, respectively. Bridges would be required to cross major streams and rivers, valleys, and designated roadways. These structures would generally be two lanes (one travel lane in each direction), except where climbing lanes would be required. On the bridges, each travel lane would be 3.6 meters (12 feet) in width with 3 meter (10 feet) "shoulders" called water tables. Rainwater runoff would be piped off the bridge and handled in an appropriate manner. Bridge types and construction materials would be determined by factors including geometric constraints, maintenance, and cost. Whether an existing bridge would be rehabilitated or completely reconstructed would be determined by such factors as safety, required widths and hydraulic openings, and structural design considerations.

2. BUILD ALTERNATIVE

The Build Alternative would be classified as a four-lane, Rural Principal Arterial Highway with a design speed of 100 kph (60 mph). The Build Alternative would be a divided highway with partial control of access. The maximum gradient would be 7 percent (in rugged terrain), the maximum degree of curvature would be 4° 45', and median width would be 12 meters (40 feet). Access would be partially controlled, consisting of no more than two at-grade intersections per side per 1.6 kilometers (per mile). Table II-1 provides the desirable criteria for key design elements under the Build Alternative.

The proposed typical roadway and bridge sections for the Build Alternative are shown in Exhibits II-3 and II-4, respectively. In general, the typical section would consist of two 7.3 meter (24 foot) directional roadways separated by a median 12 meters (40 feet) in width. Shoulder width on the inside would be 1.8 meters (6 feet) and the outside shoulder width would be 3.7 meters (12 feet).

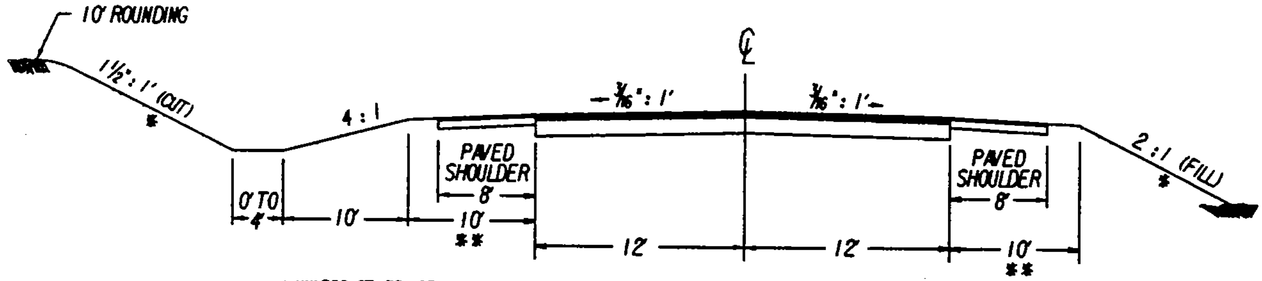
TABLE II-1
IRA AND BUILD ALTERNATIVE DESIGN CRITERIA

DESIGN ELEMENT	IRA		BUILD ALTERNATIVE	
	West Virginia	Virginia	West Virginia	Virginia
Design Speed	80 kph (50 mph)	80 kph (50 mph)	100 kph (60 mph)	100 kph (60 mph)
Maximum Degree of Curvature	7° 30'	7° 30'	4° 45'	4° 30'
Minimum Stopping Sight Distance	122 m (400')	122 m (400')	160 m (525')	160m (525')
Maximum Gradient (Rolling Terrain)	5%	5%	4%	4%
Maximum Gradient (Mountainous Terrain)	7%	7%	7%	7%
Control of Access	None	None	Partial[1]	Partial[1]
Traffic Lane Width (Each Lane)	3.6 m (12')	3.6 m (12')	3.6 m (12')[2]	3.6 m (12')[2]
Inside Shoulder Width (Paved)	N/A	N/A	0.9 m (3')	0.9 m (3')
Inside Shoulder Width (Unpaved)	N/A	N/A	0.9 m (3')	1.5 m (5')
Outside Shoulder Width (Paved)	2.4 m (8')	2.4 m (8')	3 m (10')	2.4 m (8')
Outside Shoulder Width (Unpaved)	0.6 m (2')	0.6 m (2') *Cut* 1.5 m (5') *Fill*	0.6 m (2')	0.6 m (2') *Cut* 1.5 m (5') *Fill*
Median Width	N/A	N/A	12.2 m (40')	12.2 m (40')
Fill Slope Ratio	2:1	2:1	2:1	2:1
Cut Slope Ratio	1½ :1	1½ :1	1½ :1	1½ :1

[1] Access: Generally limited to two (2) at-grade intersections per 1.6 kilometers (per mile) per side.

[2] Traffic Lanes: Four-lane divided roadway with climbing lanes, as warranted by AASHTO.

WEST VIRGINIA

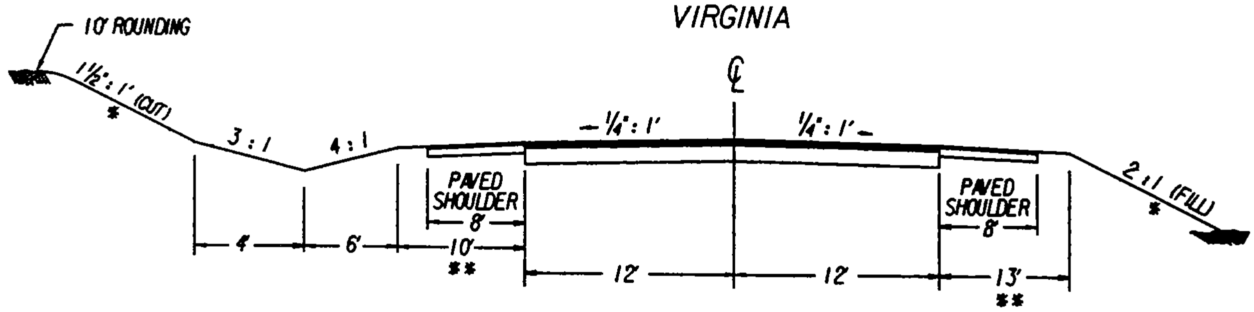


* UNLESS OTHERWISE NOTED ON PLANS.

** 4' MINIMUM SHOULDER WIDTH IN WIDENING AREAS; UNPAVED

TWO-LANE IMPROVED
ROADWAY ALTERNATIVE
(DESIGN SPEED= 50 M.P.H.)

VIRGINIA



* UNLESS OTHERWISE NOTED ON PLANS.

** WHEN ADJACENT TO TRUCK CLIMBING LANES, SHOULDER WIDTHS ARE 8'.

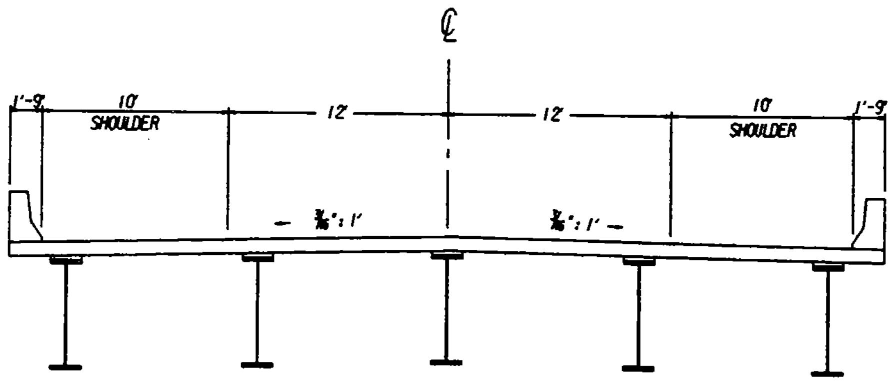
TWO-LANE IMPROVED
ROADWAY ALTERNATIVE
(DESIGN SPEED= 50 M.P.H.)

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-1
ROADWAY TYPICAL
SECTIONS: IRA

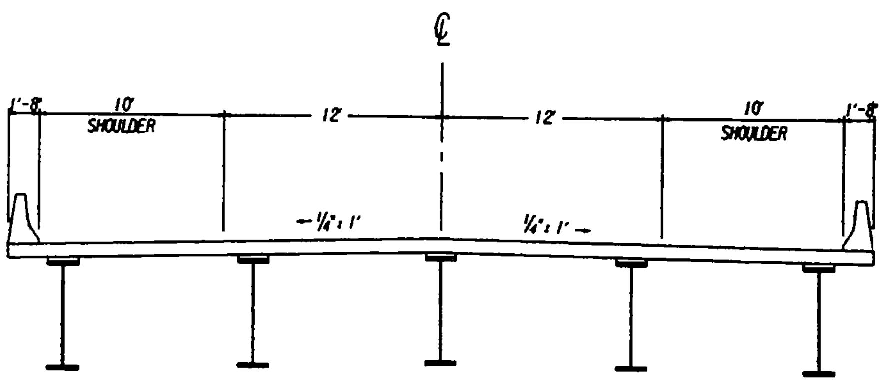
NOT TO SCALE

WEST VIRGINIA



TWO-LANE IMPROVED
ROADWAY ALTERNATIVE
(DESIGN SPEED= 50 M.P.H.)

VIRGINIA



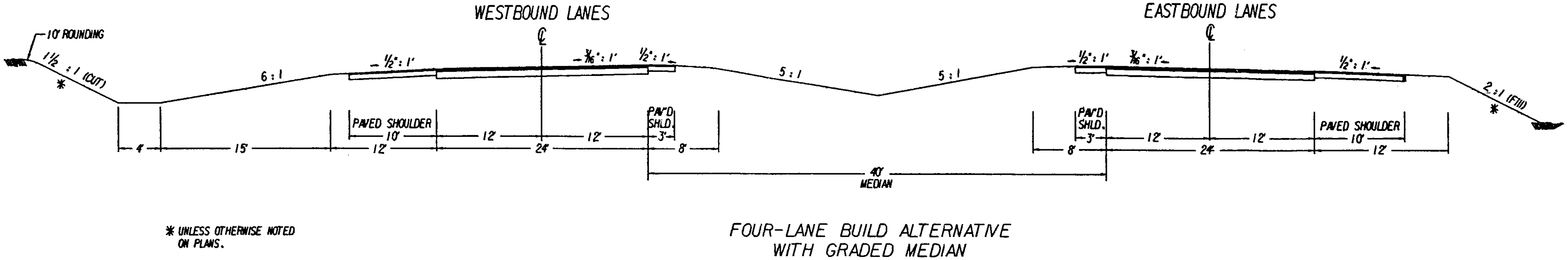
TWO-LANE IMPROVED
ROADWAY ALTERNATIVE
(DESIGN SPEED= 50 M.P.H.)

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-2
BRIDGE TYPICAL
SECTIONS: IRA

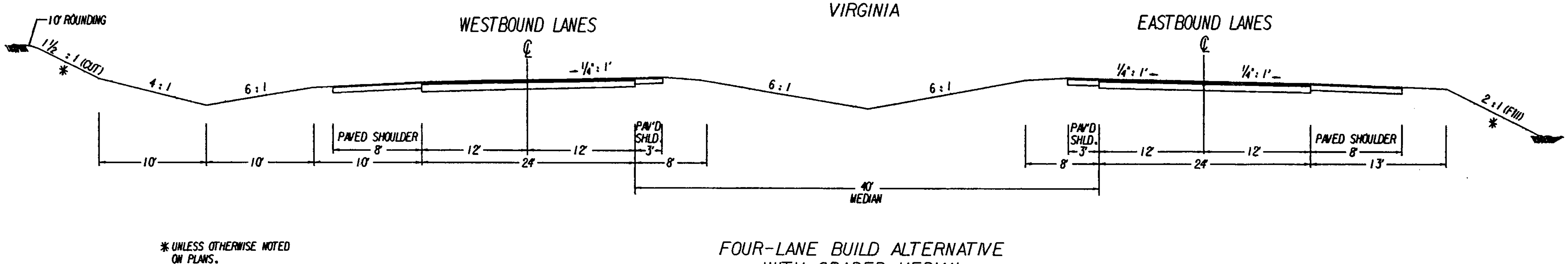
NOT TO SCALE

WEST VIRGINIA



FOUR-LANE BUILD ALTERNATIVE
WITH GRADED MEDIAN
DESIGN SPEED= 60 M.P.H.

VIRGINIA



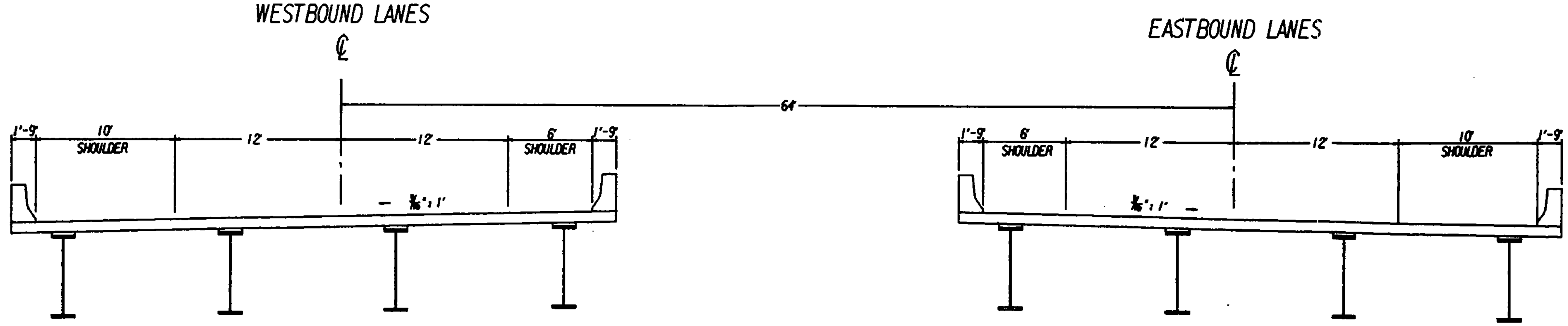
FOUR-LANE BUILD ALTERNATIVE
WITH GRADED MEDIAN
DESIGN SPEED= 60 M.P.H.

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-3
ROADWAY TYPICAL SECTIONS: BUILD ALTERNATIVE

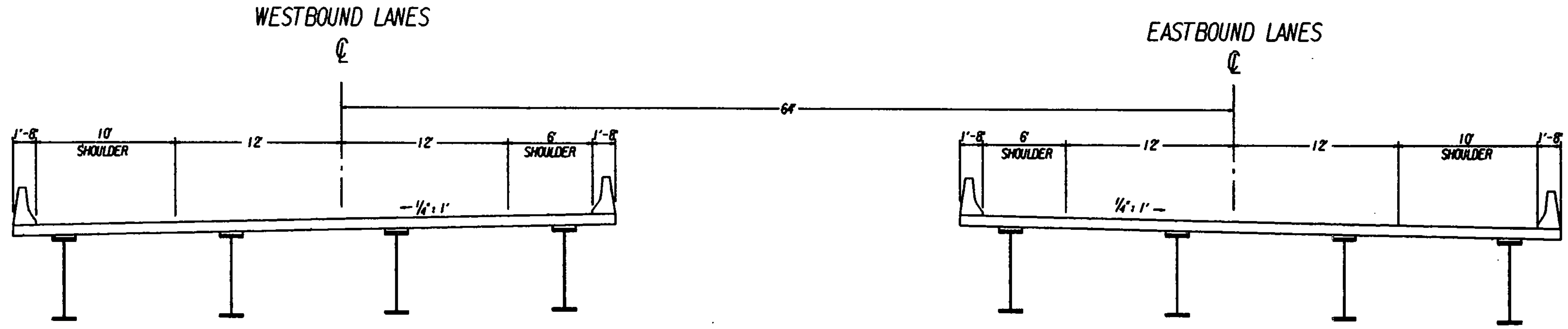
NOT TO SCALE

WEST VIRGINIA



FOUR-LANE DIVIDED
(DESIGN SPEED= 60 M.P.H.)

VIRGINIA



FOUR-LANE DIVIDED
(DESIGN SPEED= 60 M.P.H.)

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II–4
BRIDGE TYPICAL SECTIONS:
BUILD ALTERNATIVE

Baker

NOT TO SCALE

Bridges would be required to cross major streams, rivers, valleys, designated roadways, and interchanges. As with the proposed roadway typical section, the bridge typical section would consist of dual bridges, one for each direction of travel with a median shoulder or water table width of 1.8 meters (6 feet) and an outside water table width of 3.7 meters (12 feet).

The proposed bridges in Virginia and West Virginia would have the same lane and water table dimensions. These dimensions are consistent with the Rural Principal Arterial System classification. In Virginia, however, a slightly different cross slope ratio is preferred.

The determination of bridge types and construction materials (such as prestressed concrete or steel girders) would be based on factors such as geometric constraints, maintenance, and costs. These determinations would be made during the early stages of final design.

3. DESIGN CONSIDERATIONS

In addition to the design criteria and the environmental constraints previously discussed, the following considerations affected the location and characteristics of the alignments studied: access, climbing lanes, and maintenance of the existing roadway.

a. Access

Under the Improved Roadway Alternative, access to local roads and private property would be maintained in the same manner as currently exists. To improve safety and operation characteristics, left-turn lanes were provided at major crossroads. Entrances to private property would be reconstructed in their current location or, in certain cases, moved to improve sight distance.

Under the Build Alternative, access to and from Corridor H was an important principal factor in setting the route location. Proper access considerations are an essential element in establishing a network of basic transportation facilities. In general, access to the four-lane facility would be partially controlled by at-grade connections or interchanges, where required by traffic projections. Access points were generally limited to a maximum of two per side per 1.6 kilometers (per mile) of the proposed facility, with a limiting distance of approximately 3.2 kilometers (2 miles) between interchanges for safety purposes. A minimum distance of 610 meters (2,000 feet) would be maintained between access points, where possible. If warranted, the existing roads would be upgraded in the areas near access point, to insure proper sight distances.

Property access roads have been shown at locations where they appear warranted at this time, so as not to land lock property. Frontage roads or new at-grade connections to property could be provided where the proposed project would sever private roadways (entrances to private property); and acquisition of all property is not feasible or practicable. During final design, an economic analysis would be completed to determine appropriate connections.

b. Climbing Lanes

Climbing lanes would be provided where necessary for the Improved Roadway Alternative or the Build Alternative. Climbing lanes are typically provided where the grade, traffic volume, and heavy vehicle volume combine to degrade traffic operations from those on the approach to the grade. Climbing lanes were incorporated into the conceptual design of the proposed project for roadway segments with an uphill grade of 6 percent or greater. Exact locations and lengths of climbing lanes would be determined during final design.

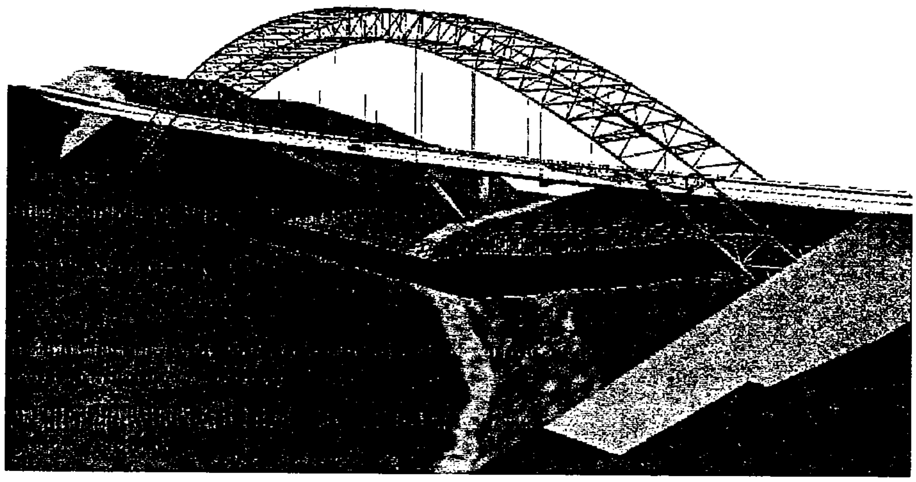
Climbing lane design requirements would be similar to the design requirements of either the Improved Roadway Alternative or the Build Alternative. Climbing lanes would be the same width as the mainline through-lanes. A usable, 1.2 meter (4 feet) shoulder would be provided; 0.9 meters (3 feet) of the shoulder would be paved. In addition, a 0.6 meter (2 feet) offset would be provided from the 1.2 meter (4 feet) usable shoulder to the face of the guardrail.

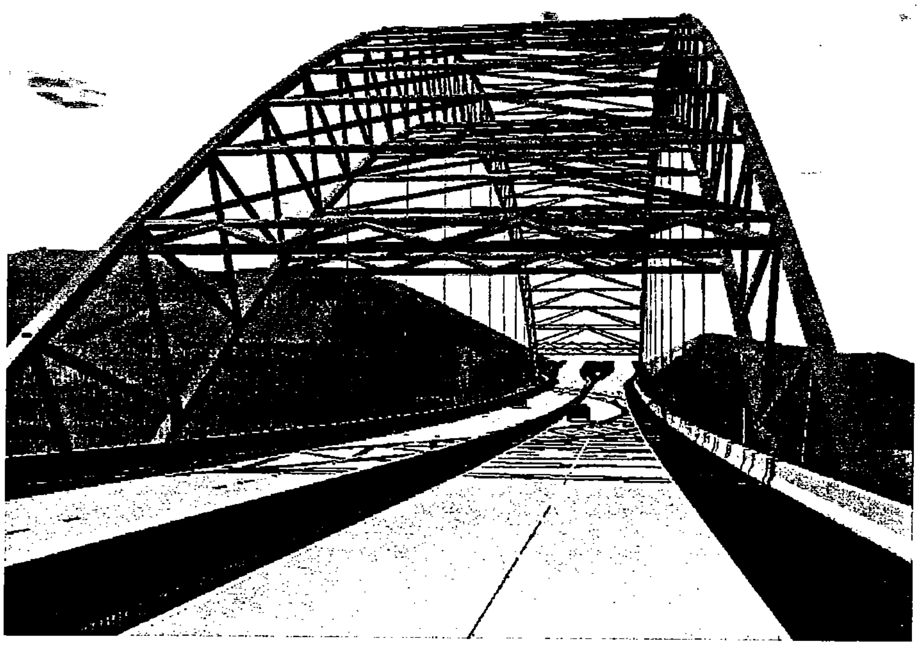
c. Continuity of Existing Roads

Maintaining the continuity of existing roadways would be achieved almost without exception. Because the Improved Roadway Alternative uses the existing road network, the continuity of the existing system would be preserved. The Build Alternative would not interrupt intra-community travel by residents. Conversely, residents would have the choice whether or not to use the proposed four-lane facility for more distant trips, or inter-community travel. School buses would likely use the existing local road network; a network made safer, in part, by the rerouting of a portion of the existing traffic volumes to the four-lane facility.

d. Special Bridge Structures - Build Alternative

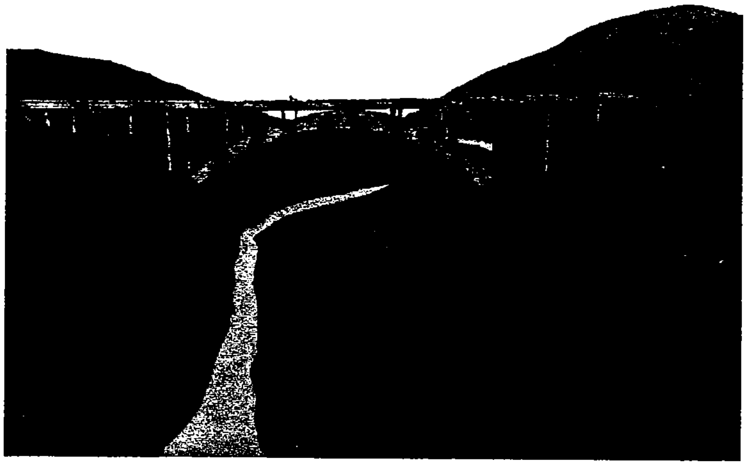
Of the approximate 52 bridges that would be required for the Build Alternative, most would be designed as shown in Exhibit II-4. Less than 10 bridges may require special bridge design considerations due to long spans, heights above existing ground, or both. In these situations, design engineers might use arch bridges, cable-stayed bridges, or suspension bridges. These bridges would most likely be single structures and not the typical dual bridge section. Exhibits II-5 and II-6 are renderings of bridge types that may be considered for long spans over steep valleys. Exhibit II-5 shows a side view and overhead view of a steel through-arch bridge in which the roadway is located midway through the arch. A unique concrete arch bridge, designed without vertical columns (spandrels), is shown in Exhibit II-6. This particular bridge type would be constructed using precast concrete segments.

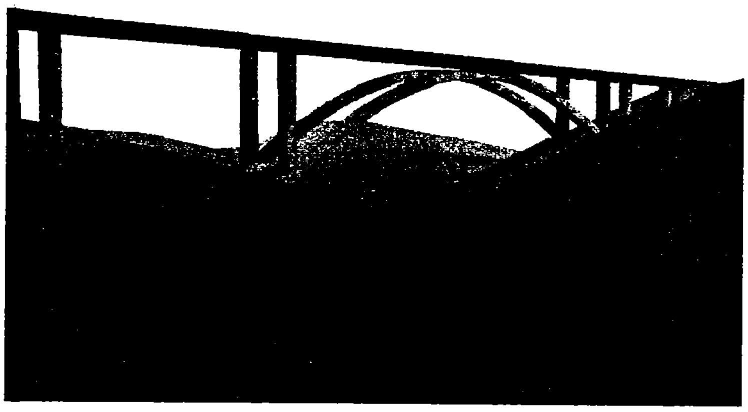




APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-5
SPECIAL STRUCTURES
STEEL THROUGH-ARCH
BRIDGE





APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-6
SPECIAL STRUCTURES
CONCRETE ARCH BRIDGE

For long spans that cross wide, flat valleys, designers might consider concrete box beams for the superstructure as shown in Exhibit II-7. Exhibit II-8 shows an application of a cable stayed bridge over a wide, flat valley. This bridge type might be considered if it is important to minimize the number of piers.

In all cases, the decision on the exact bridge type depends on the final location and elevation of the highway. Once determined, a number of conceptual bridge designs and costs would be developed prior to a final decision on bridge types. This would occur early in the final design process.

e. Scenic Design Features

It is the intent of WVDOT to incorporate scenic features in the design of Corridor H, given the natural beauty of the project area and the important role tourism plays in the economy of the region. In addition, the Corridor H resolution passed by Virginia's Commonwealth Transportation Board (May, 1993) included a statement in support of such design efforts. As part of the resolution, the Board directed that, "... the (alignment development) study seek to develop alternatives that could facilitate designs of the highway in keeping with the broad community goals to develop the region as a tourist and visitor attraction which highlights the unique historical and cultural attractions of the region ...". As a means to this end, the Board further resolved that "... in order to achieve such goals and accommodate desired traffic, the alignment and ultimate design of the highway should be more parkway in character in preference to traditional, four-lane interstate or arterial standard facility...".

As such, scenic design features have been incorporated into the design of the Build Alternative. The process by which scenic design features were incorporated was based on a literature search of parkway features, an evaluation of their application to Corridor H, and their implementation. The implementation of scenic design features would require specific approval from WVDOT or VDOT because such features are not among the designated design criteria and established standards of practice. In Virginia, scenic design feature implementation would also be based, in part, on guidance from the Virginia Advisory Committee.

(1) Literature Search

Numerous sources and examples were evaluated as part of the literature search. Applicable design guidance was obtained from publications by such sources as the Transportation Research Board, the Virginia Transportation Research Council, the American Association of State Highway Transportation Officials (AASHTO), FHWA, and the Virginia Department of Conservation and Recreation's Scenic Byway Program. Notable parkway facilities such as Skyline Drive, the Blue Ridge Parkway, and Vail Pass were also examined for design concepts that could be incorporated into Corridor H.

There are two basic types of scenic roadways: scenic byways and parkways. Scenic byways are typically low speed, low volume, two-lane roads that serve as an alternate route between or to points of interest. Parkways are typically arterial highways, often for non-commercial traffic only, generally operate at lower speeds, and are located within a park or a long, narrow, park-like area. Based on these definitions, the scenic design features used for Corridor H would be more parkway-like in character (AASHTO, 1970).

(2) Application to Corridor H

The literature search resulted in 13 possible design features evaluated for implementation in the design of Corridor H. Of the thirteen features evaluated, 11 were determined to be applicable. These features and their applicability are presented in Table II-2.

Design constraints for maximum gradient and degree of curvature eliminate the possibility of designing the roadway strictly to follow the terrain. In addition, because one of the primary purposes of the roadway is to be an economic development highway, it is not possible to restrict usage to non-commercial traffic.

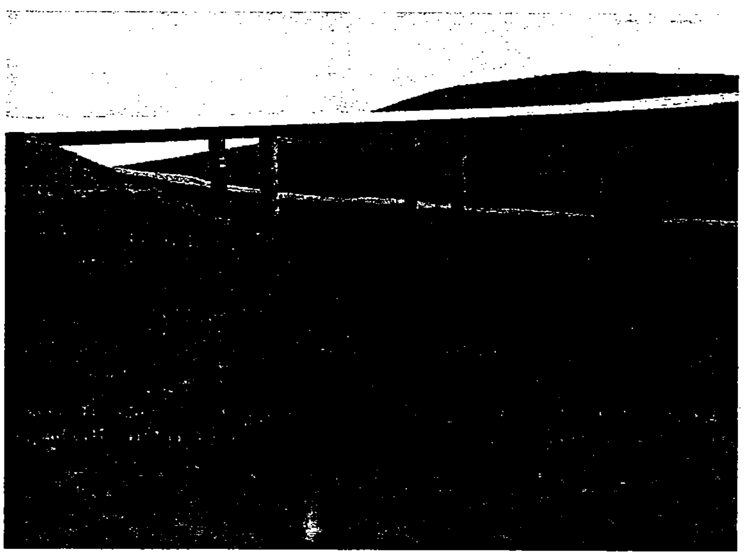
(3) Implementation of Scenic Design Features

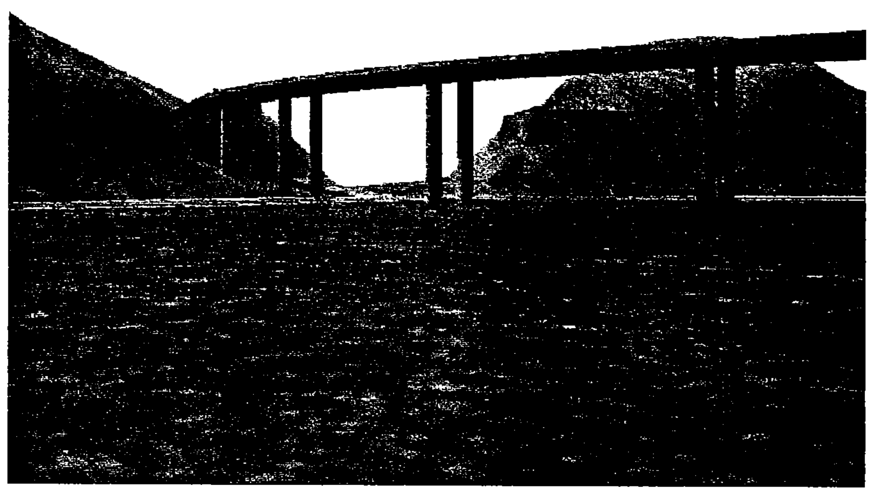
Where appropriate, the applicable scenic design features identified in Table II-2 would be incorporated into the final design of the Build Alternative. The location of possible bikeways is discussed below. The location of possible scenic overlooks and interpretive facilities are discussed in the Visual Analysis of Section III.

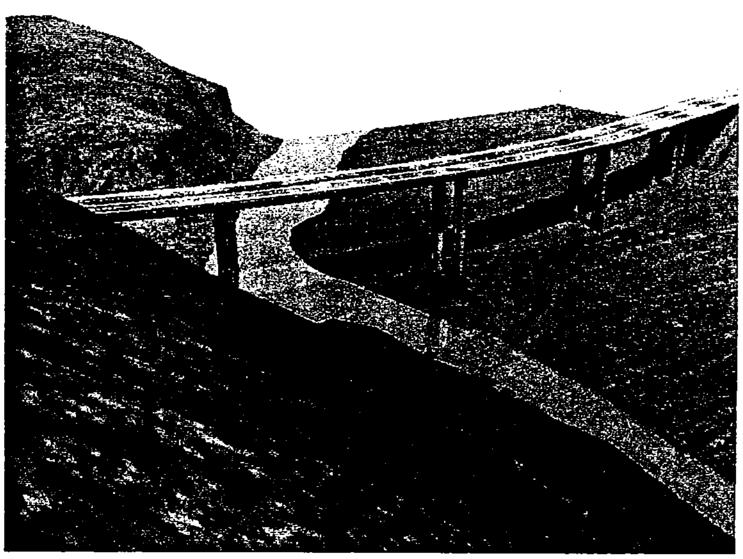
f. <u>Pedestrian and Bicycle Facilities</u>

WVDOT and VDOT have given full consideration to bicycle alternatives and the aspect of providing reasonable alternatives for the bicycling public. The provision of bicycling facilities has become an important consideration in many urban areas nationwide as a result of increased interest in bicycling for transportation and recreation. Even though the proposed project is located entirely in a rural area, such facilities were considered in the design process as a possible mitigation measure in the event the preferred alternative would impact visual or recreation resources.

WVDOT is committed to investigating the feasibility of incorporating bicycle and pedestrian facilities along state roadways. Guidelines established by the American Association of State Highway and Transportation Officials (AASHTO) are used by WVDOT for the evaluation and design of bicycle and pedestrian facilities. Similarly, VDOT is committed to constructing bicycle facilities along state roadways provided that the following conditions are met:

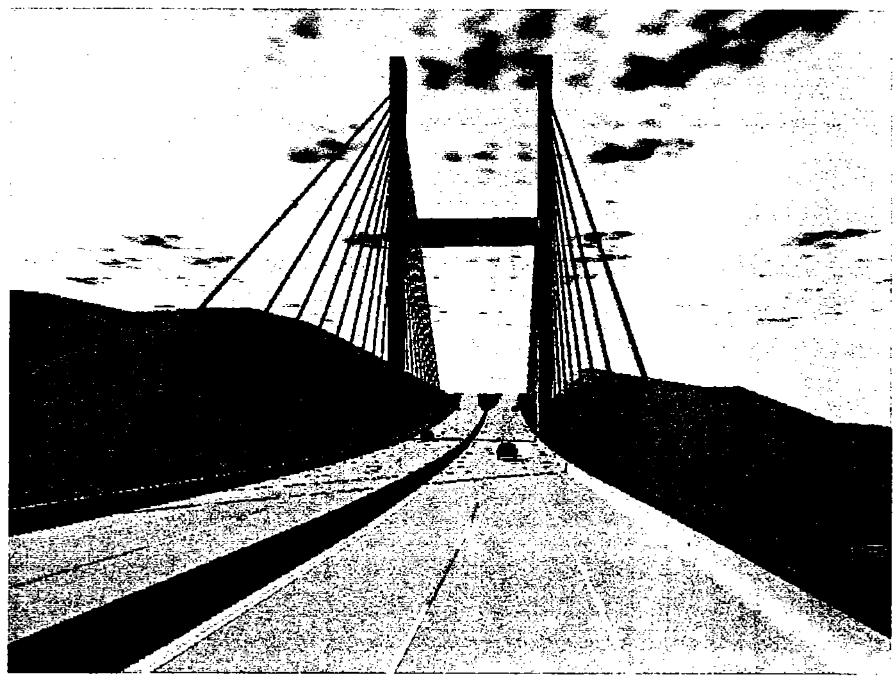


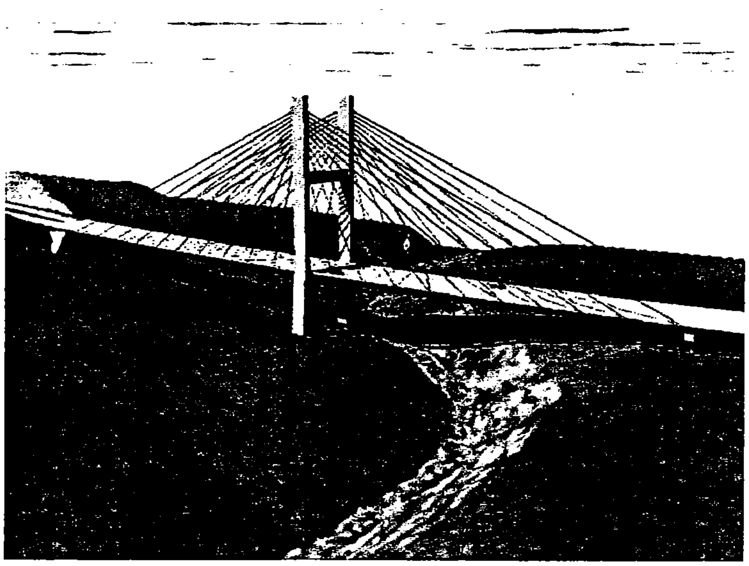




APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-7
SPECIAL STRUCTURES
CONCRETE BOX GIRDER
BRIDGE





APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-8
SPECIAL STRUCTURES
CABLE-STAYED BRIDGE

TABLE II-2

SCENIC DESIGN FEATURES AND THEIR APPLICABILITY TO CORRIDOR H

SCENIC DESIGN FEATURE	DESCRIPTION OF DESIGN FEATURE	APPLICABLE
Bifurcation	A bifurcated roadway is one in which the opposing lanes of travel are split vertically and/or horizontally into two separate roadways. Typically, existing trees and vegetation are left between the roadways, outside of the established clear-zone. Traveling on a bifurcated roadway gives the user a greater sense of intimacy with his or her surroundings. The overall effect is more one of traveling on a two lane road, rather than the four-lane facility it really is.	Yes
Fit to Terrain	Fitting the roadway to the existing terrain involves more closely following existing topographic conditions.	No
Scenic Overlooks	Scenic overlooks are roadside areas provided for motorists to pull-off the highway in a protected parking area for safely viewing the scenery. Picnic areas are often provided. Overlooks can be provided to allow for leisurely viewing while maintaining the smooth flow of highway traffic.	Yes
Wood Guardrails	Guardrails are protective devices intended to make highways safer by reducing accident severity. Typically, guardrails are metal, purely functional in design, and not aesthetically pleasing. Where appropriate, the use of wooden guardrails can soften the overall effect of the roadway, helping it to blend in with its surroundings.	Yes
Grass Shoulders	Where appropriate, grass shoulders can be used instead of stabilized (paved or gravel) shoulders to provide a more natural appearance and to help the roadway blend in with the surrounding landscape. For safety and maintenance purposes, grass shoulders do not extend to the roadway edge of pavement.	Yes
Rounded Cut Slopes	Slope rounding is the shaping or contouring of roadside slopes to provide a curvilinear transition between several planes; e.g., cut slopes can be rounded at the top to present a softer transition between constructed and existing slopes, thereby providing a more natural effect.	Yes
Wildflower Plantings	Wildflower plantings are used adjacent to roadway shoulders as well as in the grassed medians. Such plantings contribute to the scenic beauty of the travel way.	Yes
Landscaping	Enhancing the natural features of the land through the design and use of vegetation and other materials.	Yes
Bikeways	Where appropriate, bikeways could be provided adjacent to the outside travel lanes.	Yes
Restricted Usage	Restricted usage refers to limiting the use of the facility to non-commercial vehicles.	No
Rock Cut Sculpturing	Rock cut sculpturing is similar to slope rounding but is used in areas of deeper cut rock. Typical rock cuts leave sheer faces of exposed rock. Rock cut sculpturing involves rounding the rock cuts to provide a more natural appearance.	Yes
Interpretive Facilities	Interpretive facilities can be provided adjacent to the roadway in areas of special interest. The facilities can range from a simple diorama or plaque at a scenic overlook to a visitor center with exhibits.	Yes
Architectural Bridge Treatments	Incorporating architectural bridge treatments provides bridge crossings that blend in rather than detract from the surrounding landscape. Treatments include attention to the overall aesthetic beauty of the bridge and the use of indigenous materials in its construction.	Yes

- The bicycle facility will not impair the safety of the bicyclist, motorist, or pedestrian and is designed to meet current AASHTO Guidelines and/or VDOT guidelines.

- The bicycle facility will be accessible to users and will form a segment located and designed pursuant to a comprehensive plan that has been adopted by a local jurisdiction, or is part of the AASHTO-approved Interstate Bicycle Route System.

- The bicycle facility will have sufficient use to justify expenditure of public funding for construction and maintenance; or the bicycle facility is a significant link in a comprehensive bicycle system.

VDOT initiates bicycle facility construction only at the request of the affected local government, with the exception of the AASHTO-approved Interstate Bicycle Route System.

The existing roadway does not have continuous, separate facilities for pedestrians. It currently does not receive even moderate amounts of pedestrian traffic nor is it expected to in the future. Therefore, separate pedestrian facilities would not be provided under any of the proposed alternatives. However, any bicycle facility constructed or provided under any of the proposed alternatives may be available for pedestrian use. Project-related impacts to existing or proposed pedestrian and bicycle facilities are discussed in Section III under Recreation Resources.

(1) Bicycle Facility Types

The construction of several types of bikeway facilities within the construction limits of the proposed alignments was considered for this project. A bikeway is any road or path that, in some manner, is specifically designated as being open to bicycle travel; this is regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes. There are numerous methods to provide bicycle facilities. Two methods that best apply to this project are:

- **Bicycle Facilities Using a Shared Roadway**
  Bikeways could be provided on the same travel lanes as motor vehicles. On such shared roadways, bicyclists would legally use the same travel lanes as motorists. Shared lanes would typically feature 3.7 meter (12 foot) lane widths or less with no shoulders, allowing cars to safely pass bicyclists by crossing the center line or moving into another traffic lane.

- **Bicycle Paths**

  A bicycle path is a bikeway that is physically separated from a roadway by an open space or barrier. It would be located either within the highway right-of-way or within an independent right-of-way.

(2) Consideration of Bicycle Facility Types by Alternative

No additional project-related bicycle facilities would be provided under the No-Build Alternative. Bicycle facilities provided under the IRA could include shared roadway use and paved shoulder use. Bicycle facilities provided under the Build Alternative could include a separate facility or bicycle path.

Four screening criteria were used to identify suitable segments where bicycle facilities could be constructed under the IRA and Build Alternatives.

- Access - Beginning and endpoints of segments were established at locations where intersections or interchanges would permit cyclists and pedestrians to access the facility safely.

- Existing and Proposed Roadway Grade - Grades greater than 5 percent are undesirable. Above this, ascent is difficult and users may lose control during descent (AASHTO, 1991).

- Scenic Vistas - Access of connections to scenic vistas or existing or planned scenic overlooks

- Connections to existing or planned bicycle or pedestrian trails

Under the IRA, a separate bicycle facility could not be provided. The proximity of the IRA to existing structures would prohibit the taking of any additional right-of-way for the use of a separate bicycle path. Therefore, the IRA would need to be made as bicycle user-friendly as possible. The existing IRA travel lanes could be used as a shared roadway where the existing roadway would not be relocated. Where the IRA would be relocated, the 2.4 meter (8 foot) paved shoulders could be used to accommodate bicyclists. Should the IRA be carried forward, the ability to accommodate bicycle and pedestrian traffic along the IRA would be determined in the FEIS. The actual locations of such facilities would be determined during final design of the IRA.

Under the Build Alternative, a separate facility for bicycle and pedestrian traffic (a bike path) could be provided. Alignments under the Build Alternative were screened to identify potentially suitable locations for such facilities. Using the screening criteria, nine segments along Line A were identified as potential locations in which bikeway facilities could be incorporated. In addition, bicycle facilities could also be provided within the following Option Areas: Interchange (Line I), Forman (Line F), Baker (Line B), Hanging Rock (Line R), and Lebanon Church (Line L). Portions of these alignments were determined to have suitable grades and access for the inclusion of a bikeway facility. The potential location of these facilities is described in Table II-3 and presented in Exhibit II-9.

Each concept has its distinct advantages and disadvantages that should be weighed carefully in the selection of the type of facility. As previously noted, further detailed evaluation of several design issues should be completed to evaluate fully the feasibility of constructing a bikeway facility along any of the segments identified in Table II-3.

Should the Build Alternative be carried forward, its ability to accommodate bicycle and pedestrian traffic along the selected route would be determined in the FEIS. The actual locations of such facilities would be determined during final design of the Build Alternative. In addition, while it may be physically possible to construct a bikeway facility at the locations identified, provision of such facilities is not required, and the decision to fund and construct such a facility remains with WVDOT, VDOT, and/or other government agencies.

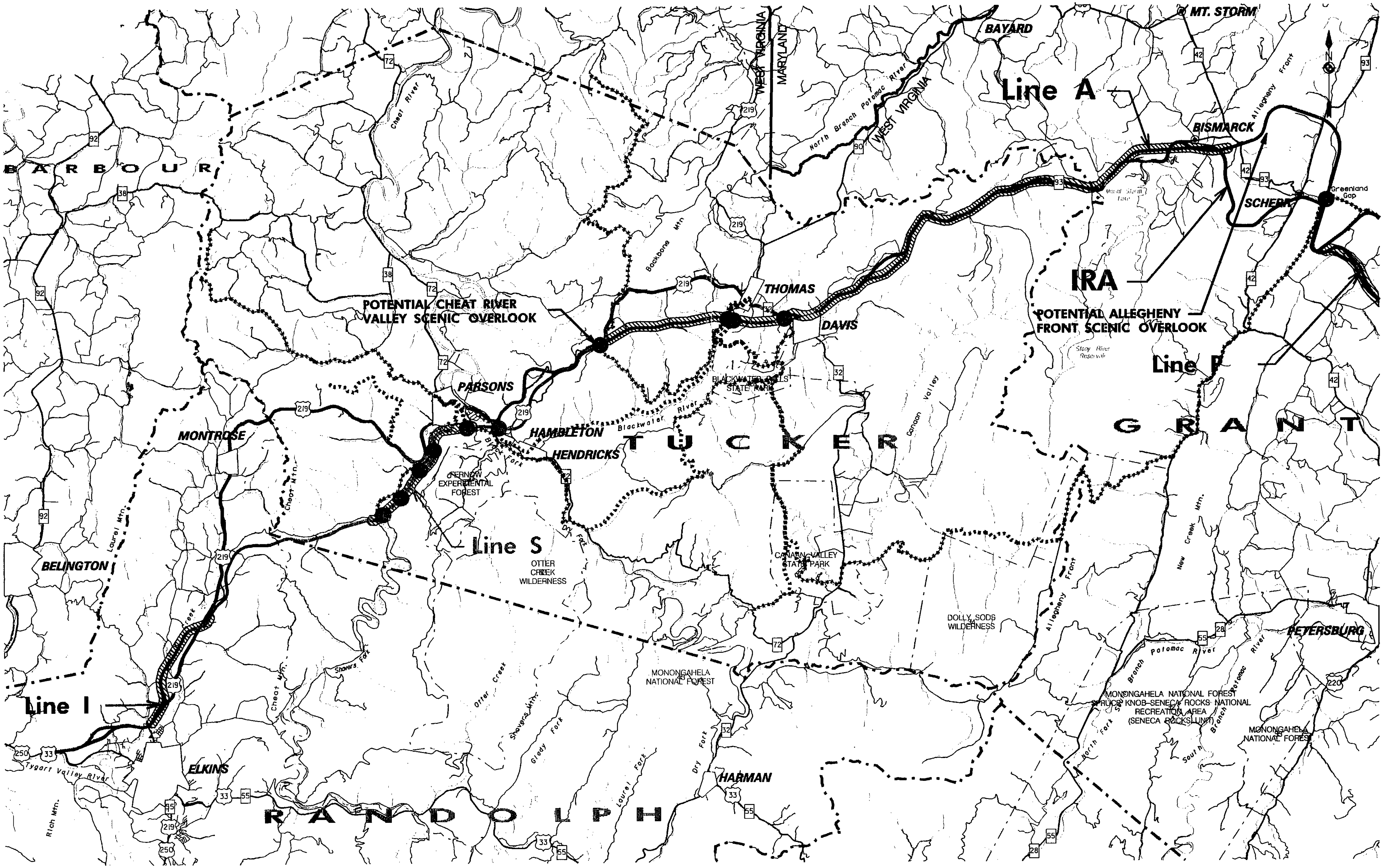
C. ALIGNMENT DEVELOPMENT

Various existing roadways and segments on new location were considered in the development of the IRA, as constrained by the current use and location of the existing roadway network. Alignments under the Build Alternative were developed within Scheme Option D5, as identified in the 1992 *Corridor Selection SDEIS*. Preliminary alignments were developed to avoid known wetlands (photo-interpreted from 1992 aerial photography); known historic and prehistoric sites; existing residential and commercial buildings; channelization or relocation of streams; churches, schools, and other public facilities. In addition, the alignments were developed to cross streams as close to perpendicular as possible and to avoid longitudinal stream impacts where possible. Alignments were also developed so that most existing roads remained in service and relocations of existing roads were minimal. The alignment development process focused on finding a single alignment that most avoided sensitive resources and environmental impacts.

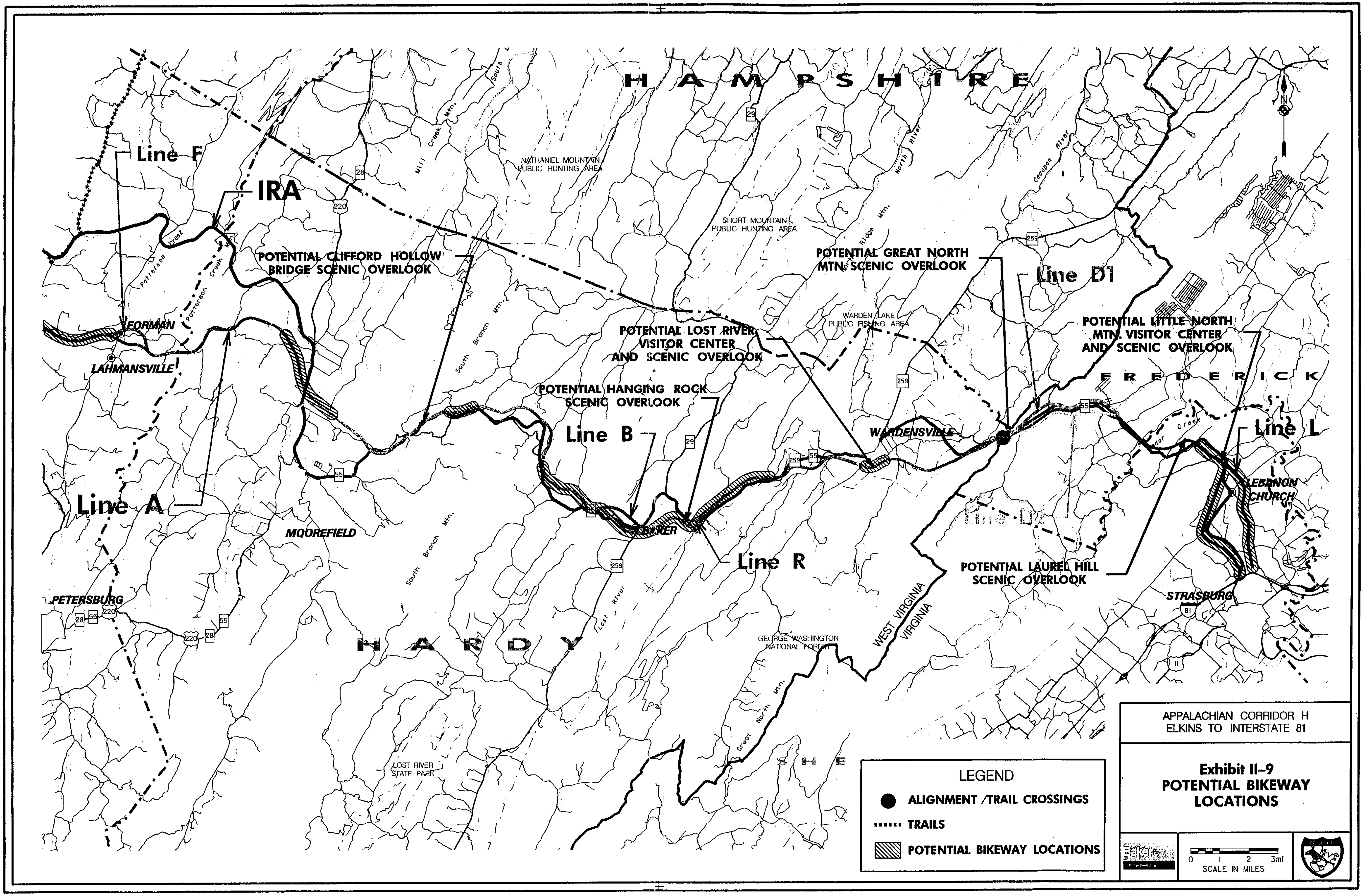
TABLE II-3
POTENTIAL LOCATIONS FOR BIKEWAY FACILITIES

LINE	POTENTIAL BIKEWAY FACILITY LOCATION	STATION*	LENGTH	OTHER FACTORS CONSIDERED
LINE A	From US 219 Interchange through CR 1 (Gilman Road) to US 219 at Kerens	Sta 490 to 660	5.1 km (3.2 miles)	CR 1 and US 219 at Kerens connect to the abandoned Western Maryland Railroad corridor rail trail connecting Kerens and Elkins.
	From CR 47 through CR 41 (Government Road), through US 219 connector at Porterwood to CR 219/7 connector (southeast of Parsons)	Sta 3300 to 3578	8.5 km (5.3 miles)	Would provide view of the Shavers Fork River Valley. Potential connection to the Allegheny and American Discovery Trails. Would provide view of the Black Fork River Valley.
	From US 219 connector (Backbone Mountain) through WV 32 Interchange at Davis through Brown Road (Grant CR/Tucker CR Line) to CR 42/1 near Bismarck	Sta 3904 to 5036	34.4 km (21.4 miles)	Would provide view of the North Fork of the Blackwater River. Potential connection to the AlleghenyTrail. Additional access points. Access to Mount Storm Lake.
	From CR 3 (Knobly Road) to CR 5 near Forman	Sta 5603 to 5790	5.6 km (3.5 miles)	Potential connection to the American Discovery Trail. Access to Greenland Gap Preserve area. Additional access at CR 5/4 (Thorn Run Road).
	From CR 220/8 (Fish Pond Road) through US 220/WV 28 Interchange to CR 6 (Trough Road) connector	Sta 6158 to 6283	3.9 km (2.4 miles)	Would provide view of the South Branch of the Potomac River.
	From CR 1 (North River Road) to CR 23/3	Sta 6629 to 6694	1.9 km (1.2 miles)	
	From WV 55 through WV 259 to WV 55	Sta 6849 to 7340	15 km (9.3 miles)	Would provide view of the Lost River Valley and Appalachian Mountains, George Washington National Forest, and Hanging Rock. Additional at-grade connections within segment.
	From CR 23/10 (Trout Run Road) to CR 5/1 (Waites Run Road)	Sta 7509 to 7579	2.1 km (1.3 miles)	Possible connection to J. Allen Hawkins Community Park in Wardensville.
	From VA 55 at Laurel Hill through VA 741 to I-81 Interchange	Sta 8220 to 8495	8.5 km (5.3 miles)	Additional at grade-connections within segment.
LINE I	From US 219 Interchange through CR 1 (Gilman Road) to CR 7	Sta 490 to 705	6.6 km (4.1 miles)	CR 1 connects to the abandoned Western Maryland Railroad corridor rail trail connecting Kerens and Elkins.
LINE F	From CR 3 (Knobly Road) to CR 5 near Forman	Sta 5603 to 5774	5.1 km (3.2 miles)	Potential connection to the American Discovery Trail. Access to Greenland Gap Preserve area.
LINE B	From WV 55 through WV 259 to WV 5	Sta 6849 to 7340	6.3 km (3.9 miles)	View of Lost River Valley and Appalachian Mountains. Near George Washington National Forest.
LINE R	From WV 259 to WV 55	Sta 7056 to 7340	8.7 km (5.4 miles)	View of Lost River Valley and Appalachian Mountains. Near George Washington National Forest.
LINE L	From VA 55 at Laurel Hill to I-81 Interchange	Sta 8216 to 8485	8.2 km (5.1 miles)	Two at-grade connections in segment.

*Stationing is shown on the *Alignment and Resource Location Plans*.


Line A
BISMARCK
MT. STORM
BAYARD
WEST VIRGINIA
MARYLAND
Greenland Gap
SCHERR
IRA
POTENTIAL ALLEGHENY FRONT SCENIC OVERLOOK
Line P
POTENTIAL CHEAT RIVER VALLEY SCENIC OVERLOOK
THOMAS
DAVIS
PARSONS
HAMBLETON
HENDRICKS
BLACKWATER FALLS STATE PARK
MONTROSE
BARBOUR
TUCKER
GRANT
RANDOLPH
FERNOW EXPERIMENTAL FOREST
Line S
OTTER CREEK WILDERNESS
CANAAN VALLEY STATE PARK
DOLLY SODS WILDERNESS
BELINGTON
Line I
ELKINS
HARMAN
PETERSBURG
MONONGAHELA NATIONAL FOREST
MONONGAHELA NATIONAL FOREST SPRUCE KNOB-SENECA ROCKS NATIONAL RECREATION AREA (SENECA ROCKS UNIT)
Cheat River
North Branch Potomac River
Blackwater River
Canaan Valley
Allegheny Front
Tygart Valley River
Stony River Reservoir

TLBIKE.DGN


HAMPSHIRE
HARDY
FREDERICK
Line F
IRA
Line A
Line B
Line R
Line D1
Line L
POTENTIAL CLIFFORD HOLLOW BRIDGE SCENIC OVERLOOK
POTENTIAL LOST RIVER VISITOR CENTER AND SCENIC OVERLOOK
POTENTIAL HANGING ROCK SCENIC OVERLOOK
POTENTIAL GREAT NORTH MTN SCENIC OVERLOOK
POTENTIAL LITTLE NORTH MTN. VISITOR CENTER AND SCENIC OVERLOOK
POTENTIAL LAUREL HILL SCENIC OVERLOOK
NATHANIEL MOUNTAIN PUBLIC HUNTING AREA
SHORT MOUNTAIN PUBLIC HUNTING AREA
WARDEN LAKE PUBLIC FISHING AREA
GEORGE WASHINGTON NATIONAL FOREST
LOST RIVER STATE PARK
FORMAN
LAHMANSVILLE
MOOREFIELD
PETERSBURG
WARDENSVILLE
LEBANON CHURCH
STRASBURG
WEST VIRGINIA
VIRGINIA
Patterson Creek
Mill Creek Mtn.
South Branch Mtn.
Lost River
North River
Cacapon River
Great North Mtn.
Cedar Creek
LEGEND
ALIGNMENT /TRAIL CROSSINGS
TRAILS
POTENTIAL BIKEWAY LOCATIONS
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81
Exhibit II-9
POTENTIAL BIKEWAY LOCATIONS
0 1 2 3mi
SCALE IN MILES

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The development of alignments for detailed study and evaluation required an 11-step process involving design engineers and transportation planning specialists; environmental, socioeconomic, and cultural resource specialists; state and federal resource agency representatives, and the public. The 11-step process is presented in Table II-4. As the table demonstrates, input from participating resource agencies was an on-going process. Their comments, concerns, and suggestions were considered in the development of alignments and options, and contributed to the decision-making process as to whether or not an alignment or option would be retained or eliminated from further consideration. Resource agency workshops were held in West Virginia and Virginia for the purpose of obtaining concurrence on the final alignments to be either eliminated or retained for further consideration. The concurrence workshop in West Virginia was held on March 9, 1994 and the Virginia workshop was held on April 19, 1994. The end result of the alignment development process was:

- An IRA made up of a single route on both new and existing location, and
- A Build Alternative made up of a single alignment and eight possible option areas (six in West Virginia and two in Virginia) to be carried forward in the remaining alignment selection process.

D. DESCRIPTION OF THE NO-BUILD ALTERNATIVE

The No-Build Alternative consists of a continuation of the existing routes between Elkins and I-81. This alternative includes such short-term, minor restoration activities as safety and maintenance improvements, resurfacing, bridge repairs, minor widening, and intersection improvements. Such improvements are already a part of both WVDOT's and VDOT's ongoing plan for the continued, safe operation of the existing roadway system.

E. DESCRIPTION OF THE IMPROVED ROADWAY ALTERNATIVE

The IRA is approximately 206 kilometers (128 miles) long. Approximately 184 kilometers (114 miles) would be in West Virginia and 23 kilometers (14 miles) would be in Virginia. Of the IRA's 206 kilometers, approximately 3 percent (6 kilometers or 4 miles) of the existing roadway would remain unchanged and 35 percent (72 kilometers or 45 miles) would require widening. Minor relocation would be required along approximately 38 percent (79 kilometers or 49 miles) of the IRA and would include such construction activities as straightening of curves and reducing grades. Roadway relocation would be required along approximately 24 percent (49 kilometers or 31 miles) of the proposed IRA. Table II-5 provides a breakdown of the required construction activities along the IRA.

An overview of the IRA alignment is presented in Exhibit II-10, with greater detail contained in the Alignment and Resource Location Plans. A descriptive overview of the IRA route is presented below.

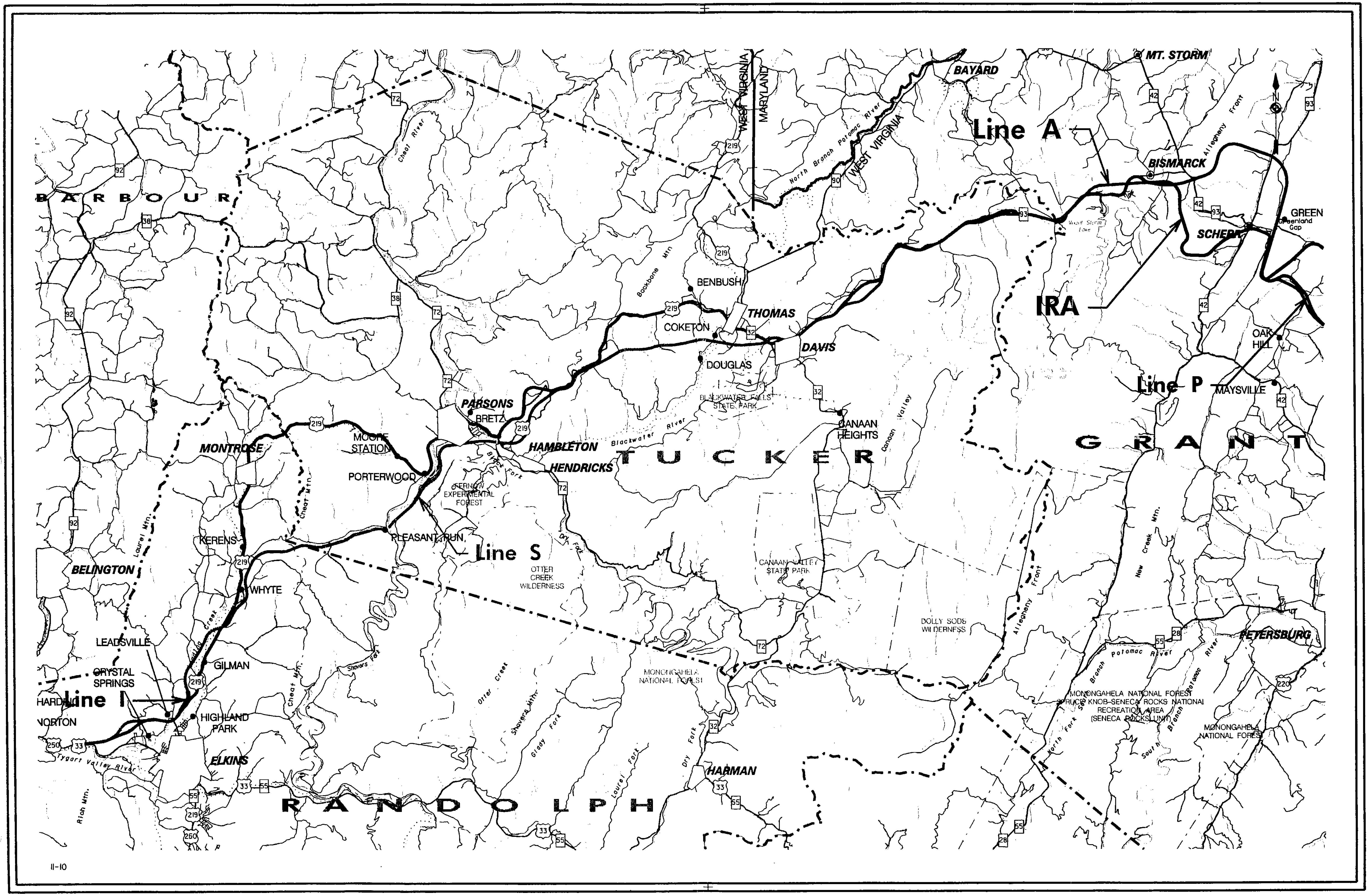
TABLE II-4

STEPS IN THE ALIGNMENT DEVELOPMENT PROCESS

STEP #	PROCESS DESCRIPTION
1	An initial resource inventory was established prior to alignment development. This inventory was based on: ◆ The previous resource inventory from the corridor selection process, and ◆ The wetland photo interpretation undertaken for the alignment selection process.
2	Under the Build Alternative, Scheme Option D5 was then divided into 16 sections for alignment development within each section. Initial alignments for the IRA and the Build Alternative were developed to avoid or minimize environmental impacts based on the data available from Step #1. (These sections were numbered from Strasburg to Elkins, with Strasburg being the Section 1 and Elkins being Section 16.)
3	Under the Build Alternative, the initial alignments were alpha-numerically labeled according to each section (e.g.: in Section 1, there was Line 1-A; in Section 2, there was Line 2-A; etc.). ◆ To specifically avoid a sensitive resource, often multiple lines were developed within each section for this reason. These options were also alpha-numerically designated by section (e.g.: options within Section 1 included Line 1-B, Line 1-C, Line 1-D, and Line 1-E).
4	Following the development of initial alignments and options in each section, site-specific field evaluations were undertaken. Initial field work investigations focused on the environmental, socio-economic, and cultural resource impacts associated with each initial alignment and option.
5	Based on the initial alignment field work investigation, alignments and options were either: ◆ Eliminated from further consideration on the basis of environmental impacts. ◆ Maintained for further consideration as viable alignments and options; or ◆ Re-routed to avoid or reduce impacts to sensitive resources. The revised alignments and options were then maintained for further consideration.
6	Under the Build Alternative, re-routed alignments and options were identified with a decimal prefix. For example, in Section 4, Line 4-A was re-routed, changing its designation to Line 4-A.1 to indicate it as such. Additional field work was conducted, where necessary.
7	Under the Build Alternative, Resource Agency Field Reviews were held in each section following the completion of alignment and option re-routes. Under the IRA in West Virginia, a single Resource Agency Field Review was held to review the alignment in its entirety.
8	In response to comments received through the Resource Agency Field Review process, alignments were further shifted or revised where possible.
9	All alignments were then presented to the public via a series of Public Involvement Workshops held in West Virginia and Virginia. The comments and data received during these meetings were added to the existing database and shared with the participating resource agencies.
10	As a result of public input, additional alignments were considered. The corresponding field work was completed for these alignments. Two of these alignments have been carried forward for further consideration in the alignment selection process.
11	Alignment concurrence meetings were held in West Virginia and Virginia for the purpose of obtaining participating resource agency concurrence on alignments and option areas to be either eliminated or retained for further consideration.

TABLE II-5
IRA: LENGTH AND TYPE OF CONSTRUCTION ACTIVITIES

CONSTRUCTION ACTIVITY	LENGTH OF IRA CONSTRUCTION ACTIVITY					
	West Virginia		Virginia		TOTAL	
	kilometers	miles	kilometers	miles	kilometers	miles
No Change	6.2	3.9	0	0	6.2	3.9
Widening	58.0	36.0	13.8	8.5	71.8	44.5
Minor Relocation	70.5	43.8	8.8	5.5	79.3	49.3
Relocation	49.0	30.5	0	0	49.0	30.5
Totals	**183.7**	**114.2**	**22.6**	**14.0**	**206.3**	**128.2**



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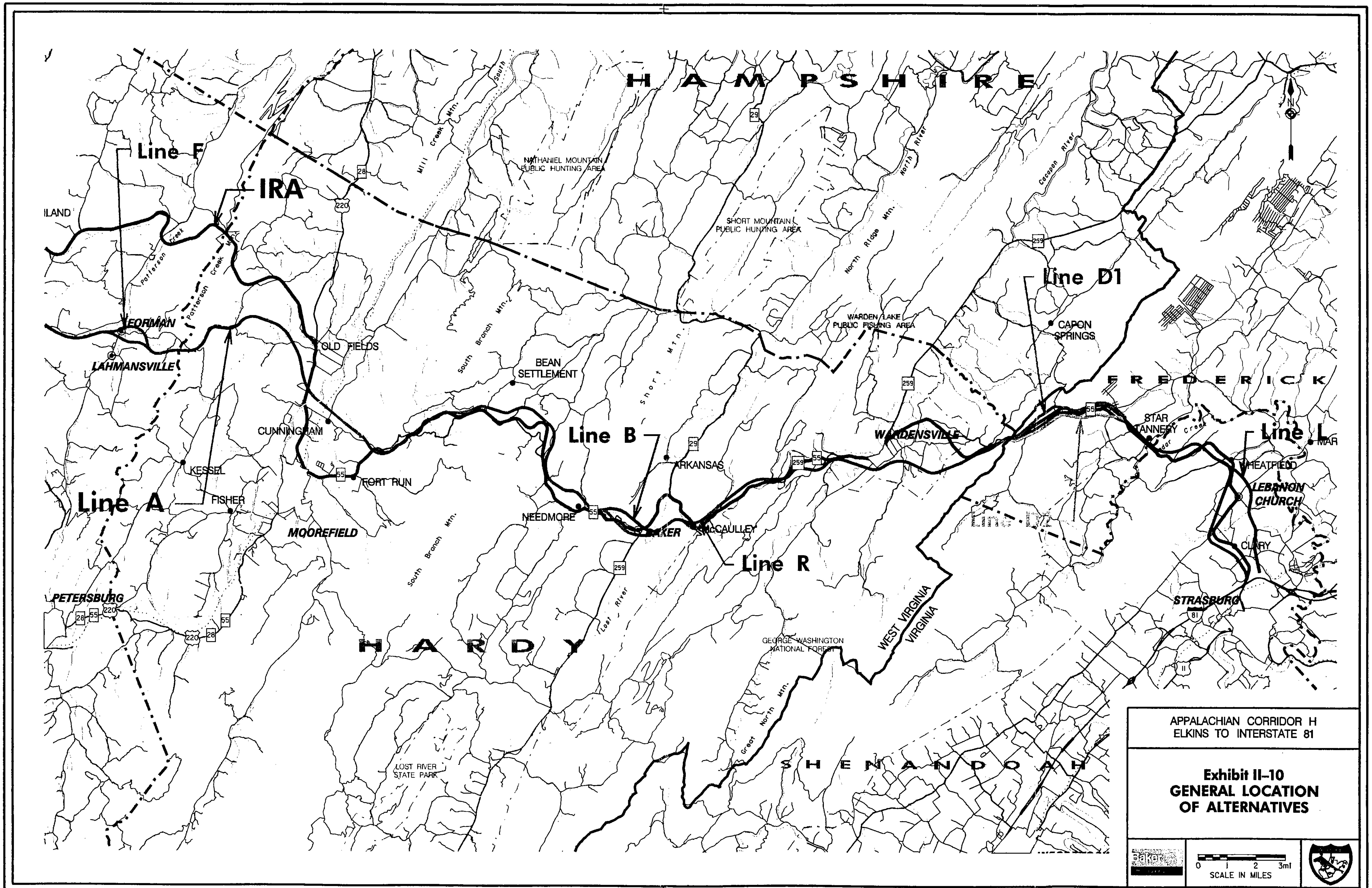


APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II–10
GENERAL LOCATION OF ALTERNATIVES

RTGENLOC.DGN

The western terminus of the IRA would tie in to WV 33/US 250 in Aggregates, WV. This tie-in would connect the IRA to the completed, four-lane Corridor H facility to the west. To maintain continuity of the existing Corridor H facility and due to projected traffic volumes near Elkins, the IRA would continue on four lanes to the interchange with US 219 and Laurel Mountain Road (County 11). This four-lane section of the IRA would be on new location. It would provide a northern bypass of Elkins, an at-grade crossing of Gum Road (County 14), and cross over Laurel Mountain Road (County 11). Following its diamond interchange with US 219, the IRA would begin its transition to a two-lane facility. The transition from four to two lanes would extend approximately 1,250 meters (4,100 feet) northeast of the US 219 interchange to a point where the IRA would tie in with existing US 219. The IRA would then continue as a two-lane facility.

The IRA would follow existing US 219 and provide at-grade connections at Israel Church Road (County 3), Gilman Road (County 1), Harpertown Road (County 1), County 219/1, and Stalnaker Road (County 9) via a connector road. The IRA would primarily follow US 219 to a point approximately 1,097 meters (3,600 feet) south of Kerens, WV. From this point south of Kerens, the IRA would be on new location, bridging the Western Maryland Railroad and Leading Creek, providing an at-grade intersection with Triplett Road (County 7), and tieing back in to US 219 north of Kerens.

North of Kerens, the IRA would primarily remain on existing US 219 to a point approximately 549 meters (1,800 feet) south of Cherry Fork. Here, the IRA would be on new alignment to cross Cherry Fork, then tie in to US 219 approximately 610 meters (2,000 feet) north of the crossing. With the exception of minor straightening of curves, the IRA would primarily remain on existing US 219 from this point to the eastern side of Parsons, WV. Existing at-grade connections would be maintained.

From the eastern side of Parsons, the IRA would primarily be on new alignment as it climbs Backbone Mountain to a point approximately 244 meters (800 feet) northeast of its crossing of Long Run. From this point to approximately 610 meters (2,000 feet) west of Thomas, WV, the IRA would alternate between new and existing alignment. The IRA would bypass Thomas to the south, tieing in to WV 32 just east of town. The IRA would primarily follow WV 32 on existing alignment to the intersection of WV 93. From this point, the IRA would turn to the northeast and follow WV 93, primarily on existing alignment, to a point approximately 732 meters (2,400 feet) west of the Bismarck Road (County 50/3) intersection. Existing at-grade connections would be maintained where the IRA remains on existing roadways. Where the IRA would be on new alignment, at-grade connections would be provided at intersections with Wolf Run Road (County 31) and Mackeyville Road (County 219/4), as well as at several points along existing US 219.

West of Bismarck Road, the IRA would turn to the southeast on new location. Following its crossing of Abrams Creek, County 42/1 and Little Creek, the IRA would turn due south to ascend the Allegheny Front. The IRA would then pass along the base of Fore Knobs, ultimately turning to the east and crossing WV 42, approximately 152 meters (500 feet) south of the intersection of WV 42 and 93 and Scherr, WV. The IRA would continue to the east on new alignment, paralleling the southern side of Greenland Road (County 1) and the North Fork of Patterson Creek. Through this area, at-grade intersections would be provided at County 42/1 and at the intersection with WV 42 and WV 93.

To avoid Greenland Gap, a National Natural Landmark, the IRA would cross then parallel County 42/3 in a southward direction, along the base of New Creek Mountain. Continuing to the south for approximately 1,219 meters (4,000 feet), the IRA would then turn to the east through a narrow pass in New Creek Mountain. On the eastern side of the mountain, the IRA would then turn to the north, continuing in this direction to its connection with Greenland Gap Road (County 3/3).

Once tied back to Greenland Gap Road, the IRA would turn east, generally following these existing routes: Greenland Gap Road to Knobly Road (County 3); Knobly Road to Belle Babb Lane (County 2); Belle Babb Lane to a point approximately 122 meters (400 feet) west of its intersection with Martin Road (County 3/2). While basically following these routes, the IRA would be on new alignment along much of them. At-grade connections would be provided for all of the above roads.

West of Martin Lane, the IRA would turn to the southeast, bridge the North Fork of Patterson Creek, and cross County 5 approximately 1,219 meters (4,000 feet) south of the intersection of Belle Babb Lane and County 5. An at-grade intersection would be provided at the IRA crossing of County 5. The IRA would then turn to the northeast, continuing towards Williamsport Twin Mountain Road (County 5/2) as it ascends Patterson Creek Mountain. As it begins its descent of the mountain, the IRA would turn to the south just after the at-grade intersection with Williamsport Twin Mountain Road and Old Fields Road. This portion of the IRA would be on new alignment.

Remaining on new alignment, the IRA would cross Patterson Creek Mountain in a southeast direction. Approximately 107 meters (350 feet) west of the intersection of Old Fields Road with Delta 4, the IRA would cross Old Fields Road with an at-grade intersection and then generally follow the road to its intersection with WV 28/US 220. Through this area, the IRA would alternate between new and existing roadway; providing at-grade intersections with Old Fields Road in locations where the IRA would be on new alignment and providing an at-grade intersection with Fish Pond Road (County 220/8) and WV 28/US 220.

Once tied-in to WV 28/US 220, the IRA would continue to the south, remaining on this existing roadway to a point approximately 1,067 meters (3,500 feet) north of the County 55/3 intersection in Moorefield, WV. From this point, the IRA would turn to the east on new location and connect with WV 55. From its connection with WV 55 to the intersection of WV 55 and Cunningham Lane (County 15), the IRA would alternate between using existing WV 55 to being on new location. At-grade intersections would be provided at Powder Spring Road (County 23/1), County 23/15, and Cunningham Lane.

Approximately 183 meters (600 feet) south of Cunningham Lane, the IRA would turn to the east on new location, paralleling the southern side of WV 55, then turn to the northeast to cross over WV 55 and pass the Lawn Knob to the north. The IRA would tie-back in to WV 55 to the east of Lawn Knob. Alternating between new location and existing WV 55, the IRA would provide at-grade intersections to WV 55 where it would be on new alignment and would maintain existing intersections where it remains on WV 55.

The IRA would be on new location from its intersection with Upper Skaggs Run Road (County 23/3) to a point approximately 183 meters (600 feet) west of the WV 55 intersection with Luxemberg Road (County 23/4). Here, the IRA would rejoin WV 55, and generally remain along the existing road to its eastern terminus in Strasburg, Virginia. The IRA would maintain existing access as it passes the West Virginia communities of Needmore, Baker, McCauley, and Wardensville and the Virginia communities of Star Tannery, Wheatfield, and Lebanon Church.

F. DESCRIPTION OF THE BUILD ALTERNATIVE

Various alignments and alignment options were considered in the development of the Build Alternative. The general location of the alignments developed for the Build Alternative is presented in Exhibit II-10. The Alignment and Resource Location Plans present more specific location details of the Build Alternative. (A discussion of the alignments considered but eliminated is presented later in this Section of the document.) A descriptive overview of the alignments retained for further consideration is presented below.

The alignment development process resulted in a single alignment (Line A), from Elkins, West Virginia to I-81 in Virginia, to be carried forward in the alignment development and selection process. In locations where a single alignment could not be easily determined, option areas were developed: six are in West Virginia and two are in Virginia. The West Virginia Option Areas include Interchange (Line I), Shavers Fork (Line S), Patterson Creek (Line P), Forman (Line F), Baker (Line B), and Hanging Rock (Line R). The Virginia Option Areas include Duck Run (Line D1 and Line D2) and Lebanon Church (Line L). An option area indicates that, within a specific area, there is more than one Build Alternative alignment from which to choose. Exhibits II-11 and II-12 show greater detail of the option areas in West Virginia. Exhibit II-13 shows greater detail of the option areas in Virginia. Table II-6 identifies the components of the Build Alternative and the Option Areas, as they appear in the *Alignment and Resource Location Plans.*

As previously stated, WVDOT has identified Line A of the Build Alternative as the preferred alternative in West Virginia. VDOT has not identified a preferred alternative nor have they identified a preferred alignment for the Build Alternative. Therefore, when references are made to Line A in Virginia, no preference is associated with this alignment over any other alignment or alternative. The final selection of an alternative and/or alignment will not be made until comments on the *Alignment Selection SDEIS* and the associated public involvement process have been fully evaluated.

1. LINE A IN WEST VIRGINIA

Line A is approximately 183 kilometers (114 miles) long. Approximately 161 kilometers (100 miles) are in West Virginia.

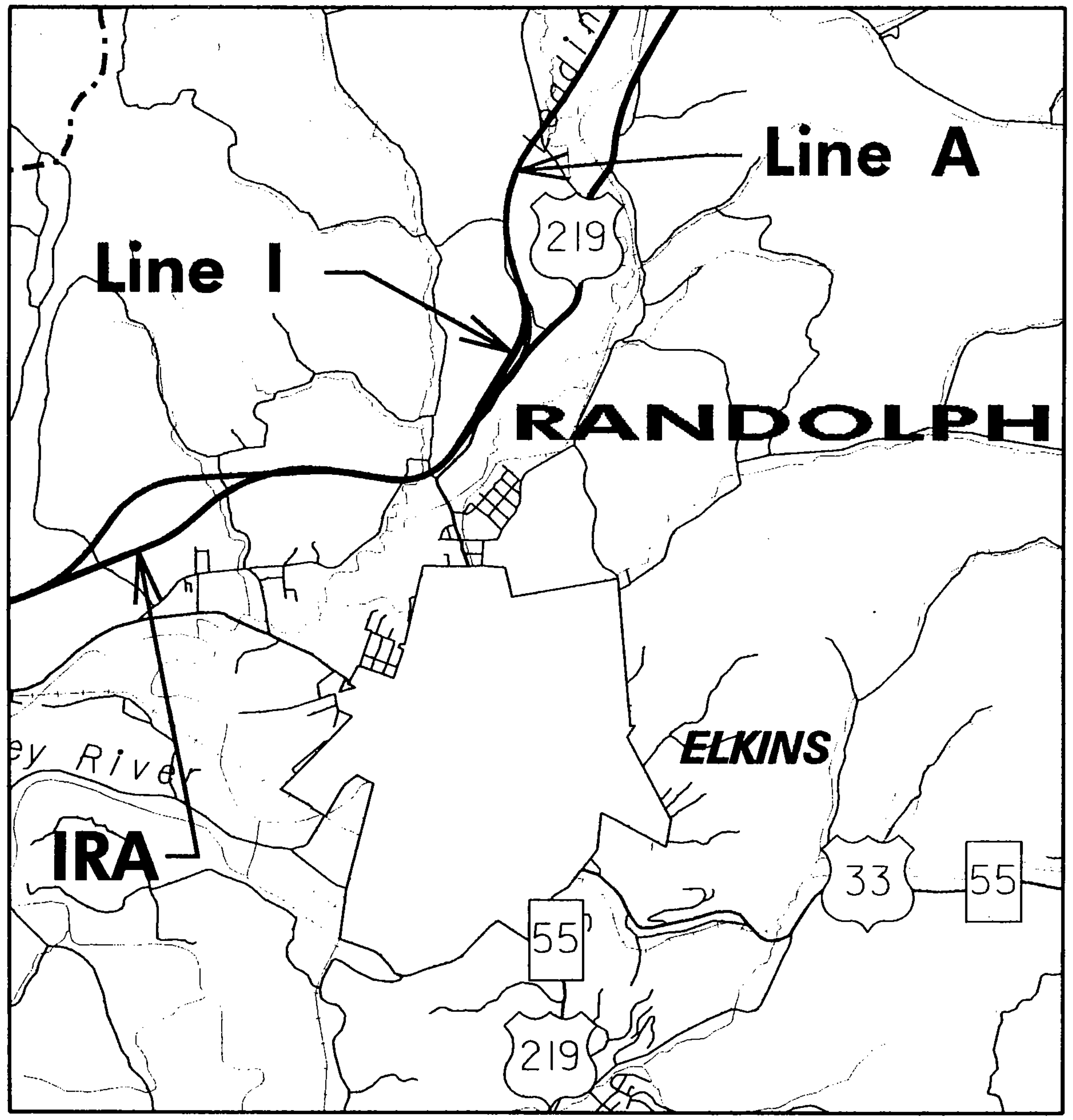
The western terminus of Line A would tie in to WV 33/US 250 in Aggregates, WV. This tie-in would connect Line A to the completed, four-lane Corridor H facility to the west. This connection would result in a reconfiguration of the existing roadway. Line A would directly connect to the completed four-lane facility to the west and existing WV 33/US 250 would be provided an at-grade connection to Line A approximately 244 meters (800 feet) to the east of the tie-in. A parking area for access to fishing in the Tygart Valley River would be built along the portion of the existing WV 33/US 250 roadway no longer in service.

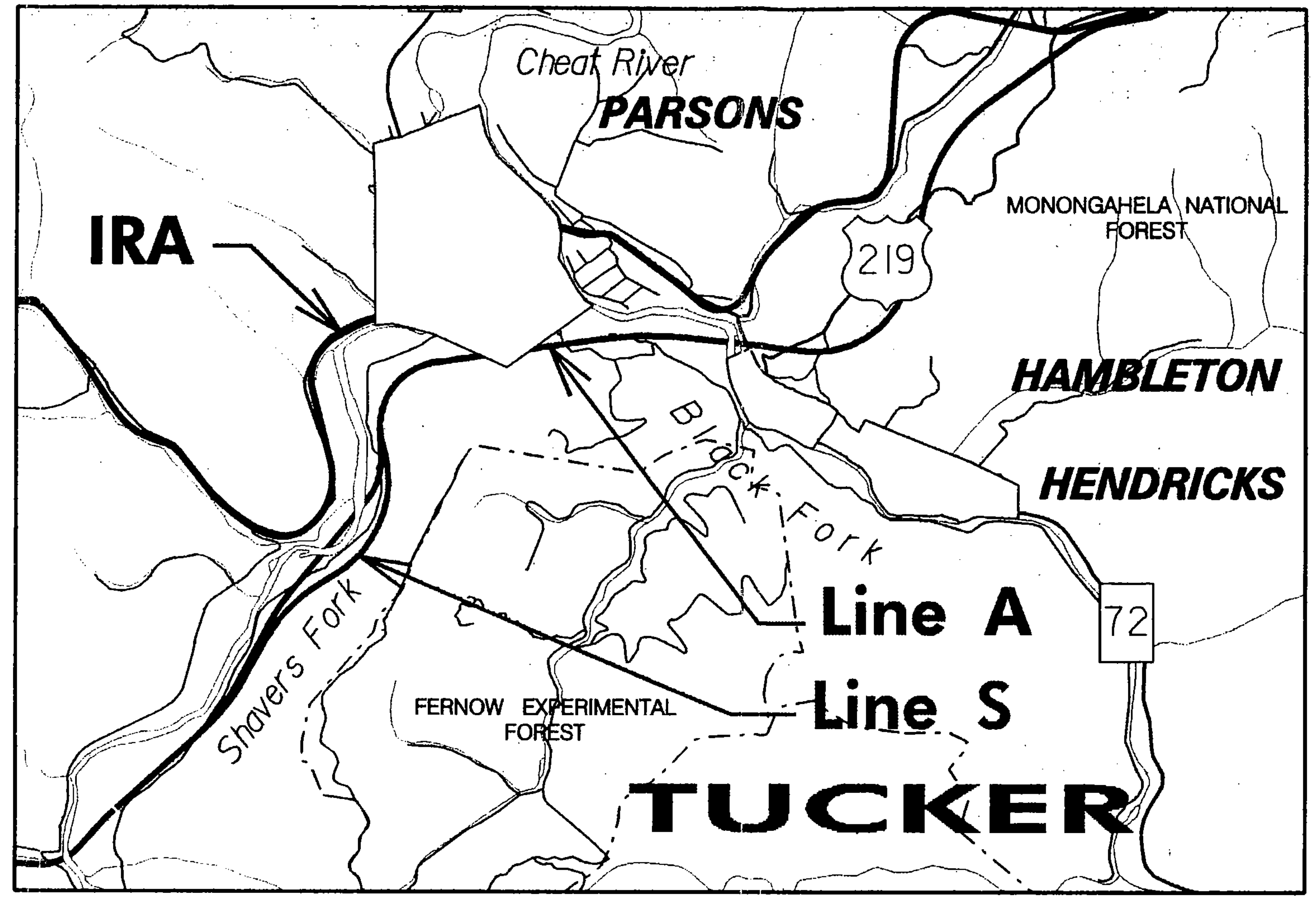
Line A would provide a northern bypass of Elkins. Continuing to the east, Line A would bridge Gum Road (County 14) north of Crystal Springs and would relocate and bridge Laurel Mountain Road and US 219 in the vicinity of Claylick Run. At this location, portions of both Laurel Mountain Road and US 219 would require minor relocations to improve the geometry of the proposed connection to Line A. To the east of Highland Park, Line A would provide an interchange with US 219. Turning to the northeast, Line A would then bridge Pearcy Run and Gilman Road (County 1) and provide an at-grade connection to Gilman Road. Line A would then bridge Leading Creek and the Western Maryland Railroad. An at-grade connection would be provided where Line A would cross US 219 west of Kerens.

Line A would bypass Kerens to the east, bridging Clifton Run Road (County 7). Continuing to the northeast, Line A would bridge County 3/4 and then turn to the east to enter the Monongahela National Forest. As it enters the Forest, Line A would be parallel to and south of Pleasant Run (also called Pheasant Run). It would bridge Slabcamp Run and County 47/1. Further to the east, Line A would bridge Shavers Fork near the confluence of Pleasant Run.

To the east of its crossing of Shavers Fork, Line A would turn to the northeast. Line A would then provide an at-grade connection to Government Road (County 41). In the vicinity of Porterwood, Line A would provide two additional at-grade connections with Government Road, bridge Shavers Fork twice, and provide an at-grade connection to US 219.

Interchange Option Area





Shavers Fork Option Area

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-11
OPTION AREA LOCATIONS
INTERCHANGE
AND SHAVERS FORK

Baker | NOT TO SCALE

TABLE II-6
COMPONENTS OF THE BUILD ALTERNATIVE

COMPONENTS OF WEST VIRGINIA LINE A		
SECTION	LINE DESIGNATIONS ON SDEIS PLANS	LINE DESIGNATIONS ON PREVIOUS PLANS (1)
16	Line A	Lines 16-A.1 to 16-E to 16-A.1 to 16-C to 16-A.1 to 16-F*
15	Line A	Lines 15-F* to 15-C.1 to 15-A.1
14	Line A	Line 14-A.1
13	Line A	Lines 13-A.1 to 13-D to 13-A.1
12	Line A	Lines 12-A.1 to 12-C to 12-B to 12-D to 12-A.1 to 12-E to 12-B
11	Line A	Lines 11-B.1 to 11-D
10	Line A	Lines 11-D to 10-A.1
9	Line A	Lines 9-A.1 to 9-A.2 to 9-A.1
8	Line A	Lines 8-A.1 to 8-D to 8-C to 8-A.1
7	Line A	Lines 7-A.1 to 7-B.1 to 7-A.1
6	Line A	Line 6-A.1 to 6-A.2 to 6-A.1
5	Line A	Lines 5-A.1
4	Line A	Lines 4-A.1 to 4-E to 4-A.1
3	Line A	Lines 3-A.1 to 3-A.2* to 3-A.1

WEST VIRGINIA OPTION AREAS		
OPTION AREA	LINE DESIGNATIONS ON SDEIS PLANS	LINE DESIGNATIONS ON PREVIOUS PLANS (1)
Interchange	Line I	Line 16-A.1
Shavers Fork	Line S	Line 14-D
Patterson Creek	Line P	Lines 9-B to 8-B to 8-A
Forman	Line F	Line 8-C
Baker	Line B	Line 5-E*
Hanging Rock	Line R	Line 4-A.1

COMPONENTS OF VIRGINIA LINE A		
SECTION	LINE DESIGNATIONS ON SDEIS PLANS	LINE DESIGNATIONS ON PREVIOUS PLANS (1)
2	Line A	Lines 2-B to 2-D to 2-A
1	Line A	Lines 1-A to 1-F to 1-A to 1-B to 1-A

VIRGINIA OPTION AREAS		
OPTION AREA	LINE DESIGNATIONS ON SDEIS PLANS	LINE DESIGNATIONS ON PREVIOUS PLANS (1)
Duck Run	Line D1	Line 2-A
	Line D2	Line 2-B
Lebanon Church	Line L	Line 1-E

(1) Previous plans include agency field review plans and those available after public meetings.
* Indicates lines developed after public meetings.

Line A would then proceed along the base of Fork Mountain, just south of Parsons. Through this area, Line A would bridge County 219/7 (part of the current route for the American Discovery Trail). Further to the east and north of Hambleton, Line A would bridge the Black Fork and then provide an interchange for access to US 219, WV 72, and Mackeyville Road (County 219/4). To improve the geometry of the connection between Mackeyville Road and Line A, a minor relocation of Mackeyville Road would be required. Just after the Mackeyville Road relocation, Line A would turn to the north as it begins its ascent of Backbone Mountain.

As Line A traverses Backbone Mountain, Mackeyville Road would be bridged twice and would have two additional at-grade connections to the line. Its last at-grade connection to Line A would include an at-grade connection to US 219 and would require a minor relocation of a portion of Mackeyville Road to improve the roadway geometry. Continuing to the northeast, Line A would cross and then follow Olsontown Road (Forest Road 717 and 18). This portion of Line A would require the relocation of approximately 2.8 kilometers (1.8 miles) of Forest Roads 717 and 18. Further to the east, the relocated road would have a new at-grade connection to US 219, as well as to Line A.

Atop Backbone Mountain and traveling east towards Coketon, Line A would bridge Big Run, cross over Long Run, and provide at-grade connections to three unnamed roads. Once in the Coketon area, Line A would bridge the North Fork of the Blackwater River, Douglas Road (County 27), and the eastern and western sides of the abandoned Western Maryland Railroad. This alignment of Line A allows for the avoidance of the Douglas Highwall Reclamation Project to the south and the town of Thomas to the north.

Continuing on its eastward path, Line A would provide an at-grade connection with an unnamed road and an interchange at its crossing of WV 32 and its connection to WV 93; just north of the town of Davis. Line A would exit the Monongahela National Forest in the vicinity of the proposed interchange. Line A would use or parallel existing WV 93 from its connection just west of Davis to a point just west of Bismarck. Along this route, Line A would bridge the Western Maryland Railroad just west of Mount Storm Lake; provide an interchange with WV 93 approximately 1,158 meters (3,800 feet) east of the lake; and provide several at-grade connections to WV 93, several unnamed access roads, and County 42/1.

Approximately 1.6 kilometers (1 mile) to the east, Line A would bridge WV 42/93 and begin its descent of the Allegheny Front. Line A would require the relocation of a portion of WV 42/93. Along its descent, Line A would provide frontage road access to several unnamed roads. Upon reaching New Creek Mountain, Line A would turn to the south, following the western side of the mountain's base for approximately 7.2 kilometers (4.5 miles). Along this area, Line A would bridge both Elklick Run and Greenland Road (County 1) and then provide a connection to Greenland Road and WV 93. Continuing in a southerly direction towards Greenland, Line A would bridge and connect with Greenland Road a second time.

Then Line A would bridge Greenland Road for a third time as well as bridge the North Fork of Patterson Creek. In this area, Line A would pass to the west of and avoid Greenland Gap.

Still following the western side of the base of New Creek Mountain, Line A would provide an at-grade connection with Cal Lyons-Tom Mason Road (County 42/3) and then remain in a southerly direction, parallel to Cal Lyons-Tom Mason Road. Line A would then turn to the east at a gap in New Creek Mountain. Bridging the Middle Fork of Patterson Creek, Line A would cross Knobly Mountain in the gap created by the creek. In a southeasterly direction, Line A would then cross the area between Knobly and Patterson Creek Mountains. Through this area, Line A would bridge then provide an at-grade connection to Knobly Road (County 3). Line A would provide an at-grade connection to an unnamed road and cross then parallel Thorn Run to a point approximately 457 meters (1,500 feet) west of the line's interchange with County 5 in the Forman area.

Continuing to the southeast, Line A would ascend Patterson Creek Mountain through a gap in the mountain. Once through the gap, Line A begins its descent, bridging Toombs Hollow and County 10/5. Line A would cross the valley between Patterson Creek Mountain and South Branch Mountain. Across this valley, Line A would turn to the south and bridge both Delta 4 and Walnut Bottom Run, and provide an at-grade connection with Fish Pond Road (County 220/8). South of Old Fields, Line A would provide an interchange at the crossing of US 220/WV 28. Turning to the southeast, Line A would then bridge the South Branch of the Potomac River and its floodplain, bridge the South Branch Valley Railroad, and then bridge and provide an at-grade connection to Trough Road (County 6), just north of Cunningham Lane.

Continuing to the east, Line A would somewhat parallel WV 55, providing an interchange at WV 55 approximately 518 meters (1,700 feet) east of the base of Potato Row. Cunningham Lane would have access to this interchange via an at-grade connection to WV 55. Ascending South Branch Mountain, Line A would then bridge Clifford Hollow to the west of Lawn Knob. Additional access to WV 55 would be provided via access to an at-grade connection to North River Road (County 1). As it descends South Branch Mountain, Line A would provide an at-grade intersection with Upper Skaggs Run Road (County 23/3). West of Needmore, Line A would turn to the south and would bridge Luxemberg Road (County 23/4) and provide an at-grade connection to WV 55.

North of Needmore, Line A would bridge Long Lick Run and Rock Oak Road (County 8). Line A would then parallel Baker Run along the base of Short Mountain. Continuing to the southeast, Line A would bridge Baker Run and WV 55 in the vicinity of the newly realigned section of WV 55. South of Baker, Line A would provide an interchange with WV 259 at the base of Little Ridge. Baker Run would again be bridged, as would the Lost River. Crossing over North River Mountain toward McCauley, Line A would again bridge the Lost River, WV 55, and McCauley Road (County 23/7).

Crossing Lost River, Line A would then follow the southeastern side of Hanging Rock Ridge and then bridge Sauerkraut Run. Continuing approximately 457 meters (1,500 feet) east, Line A would provide an at-grade connection with WV 55. Line A would then bridge the Lost River and WV 55 in the vicinity of river sinks and enter the George Washington National Forest. Line A would proceed to cross Sandy Ridge and then exit the forest. From Sandy Ridge to Wardensville, Line A would provide an at-grade connection to Squirrel Gap Road (Forest Road 344), and provide a bridge and at-grade connections to Trout Run Cut Off (County 23/12), and Trout Run Road (County 23/10). Line A would also bridge Trout Run to the southwest of Wardensville.

Line A would pass south of Wardensville, following the base of Anderson Ridge. Cutting across the toe of Anderson Ridge, Line A would provide an at-grade connection to Waites Run Road (County 5/1), then bridge Waites Run. The at-grade connection to Waites Run Road would require the relocation of a portion of this road to improve the geometry of this connection. Line A would remain to the south of the J. Allen Hawkins Community Park.

To the east of the park and Wardensville, Line A would begin its ascent of Great North Mountain and re-enter the George Washington National Forest. From this area to the Virginia State line, much of Line A would be located within the forest. Line A would also provide an at-grade connection with WV 55 approximately 213 meters (700 feet) west of the Virginia line.

2. LINE A IN VIRGINIA

Line A is approximately 183 kilometers (114 miles) long. Approximately 22 kilometers (14 miles) are in Virginia.

Entering Virginia, Line A would begin its descent of Great North Mountain. Line A would also cross the Big Blue Trail, requiring the relocation of a portion of the trail, as well as a portion of Forest Road 93. Line A would run parallel to and then bridge Duck Run, along the base of Paddy Mountain. Line A would bridge Duck Run, then follow the base of Short Mountain, paralleling the northern side of VA 55. Continuing to the southeast, Line A would bridge VA 608, VA 603, and VA 600. An at-grade connection to VA 55 would be provided approximately 488 meters (1,600 feet) east of the VA 55 intersection with VA 600.

Continuing to the southeast, Line A would exit the George Washington National Forest then bridge VA 604 and Cedar Creek north of Star Tannery. Further east, Line A would provide access to VA 55 via an at-grade connection just east of Laurel Hill. East of this connection, Line A would bridge Turkey Run and VA 714 then turn to the southwest just south of Wheatfield. From this area, Line A would follow the base of Little North Mountain then bridge VA 623; requiring the relocation of VA 623's at-grade connection to VA

55. Continuing in its southwesterly direction, Line A would avoid Lebanon Church by passing to the west of it. Approximately 229 meters (750 feet) south of Lebanon Church, Line A would provide an at-grade connection to VA 55 via a connector road and interchange. Continuing in its southwesterly direction, Line A would then bridge both VA 741 and VA 623. At its third bridging of VA 623, Line A would provide an at-grade connection to eastbound lanes.

Following its third bridging of VA 623, Line A would then turn to the southeast. Line A would bridge then provide an at-grade connection via a connector road to VA 622. From this point, Line A would turn towards the south and tie-in to VA 55 at the existing I-81 interchange.

3. OPTION AREAS IN WEST VIRGINIA

Within West Virginia, there are six possible option areas which provide alternate alignments to Line A: Interchange Option Area (Line I), Shavers Fork Option Area (Line S), Patterson Creek Option Area (Line P), Forman Option Area (Line F), Baker Option Area (Line B), and Hanging Rock Option Area (Line R). The following provides a summary of each option area in West Virginia.

a. Line I: Interchange Option Area

Line I would remain on the same alignment as Line A as it crosses the existing intersection of US 219 and Laurel Mountain Road (County 11). The difference between Line I and Line A at this location is that, where Line A would bridge this intersection, Line I would provide access to it via an interchange. The interchange along Line I would require the relocation of a portion of US 219 and Laurel Mountain Road. In addition, the interchange along Line I would eliminate the need for the Line A interchange approximately 823 meters (2,700 feet) to the northeast.

Within the Interchange Option Area, Line I is approximately 2.4 kilometers (1.5 miles) long; approximately the same length as Line A.

b. Line S: Shavers Fork Option Area

Line S would provide only one at-grade connection to Shavers Fork Road via a bridge over Shavers Fork. Line S would then diverge from Line A to the east of the at-grade connection. Line S would follow a more northeasterly route than would Line A, and would remain higher up the base of Fork Mountain. In the Porterwood area, Line S would not provide a connection to US 219 as would Line A. Line S would converge with Line A to the west of Parsons.

Within the Shavers Fork Option Area, Line S is approximately 4.4 kilometers (2.7 miles) long compared to Line A, which is approximately 4.2 kilometers (2.6 miles) long.

c. Line P: Patterson Creek Option Area

Line P would diverge from Line A west of the gap in New Creek Mountain, just south of Greenland and Scherr. Line P would follow a more northerly route than would Line A in the area between New Creek Mountain and Knobly Mountain. Once at the base of Knobly Mountain, Line P would parallel the northern side of the Middle Fork of Patterson Creek. Continuing to the southeast, Line P would bridge and then provide an at-grade connection to Knobly Road (County 3). Line P would converge with Line A just to the east of Thorn Run.

Within the Patterson Creek Option Area, Line P would be approximately 6.8 kilometers (4.2 miles) in length compared to Line A, which would be approximately 6.5 kilometers (4.0 miles) in length.

d. Line F: Forman Option Area

Line F would diverge from Line A approximately 823 meters (2,700 feet) west of Line A's interchange with County 5, just south of Forman. In this area, Line F would follow a more northeasterly route than Line A. Line F would provide an interchange with County 5 to the south of Thorn Run. Line F would then turn to the southeast, towards Patterson Creek Mountain, and bridge County 5/3 and County 5/5. Line F would converge with Line A as it begins its ascent of Patterson Creek Mountain, to the east of Forman.

Within the Forman Option Area, Line F is approximately 5.1 kilometers (3.2 miles) long compared to Line A, which is approximately 5.0 kilometers (3.1 miles) long.

e. Line B: Baker Option Area

Line B would diverge from Line A north of Needmore, in the vicinity of the bridging of Long Lick Run and Rock Oak Road (County 8). Here, following an easterly route, Line B would pass to the north of Baker. An at-grade connection would be provided at an unnamed road to the north of Baker Church. In its entirety, Line B would remain north of Baker Run and WV 55 to the point at which it would bridge and provide an interchange with WV 55/WV 259. Line B would converge with Line A to the east of Baker, following its bridging of the Lost River.

Within the Baker Option Area, Line B is approximately 5.3 kilometers (3.3 miles) long compared to Line A, which is approximately 4.1 kilometers (2.5 miles) long.

f. Line R: Hanging Rock Option Area

Line R would diverge from Line A at a point approximately 1,524 meters (5,000 feet) southwest of the crossing of the Lost River near Hanging Rock. Here, Line R would cross the Lost River west of Line A, passing approximately 61 meters (200 feet) to the west of the formation known as Hanging

Rock. Line R would continue to the northeast for approximately 1,067 meters (3,500 feet) to the point where the line converges with Line A.

Within the Hanging Rock Option Area, Line R is approximately 3.4 kilometers (2.1 miles) long compared to Line A, which is approximately 3.8 kilometers (2.3 miles) long.

4. OPTION AREAS IN VIRGINIA

Within Virginia, there are two possible option areas which provide alternate alignments to Line A: Duck Run Option Area (Line D1 and Line D2) and Lebanon Church Option Area (Line L). The following provides a summary of each option area in Virginia.

a. Line D1 and Line D2: Duck Run Option Area

Line D1 would diverge from Line A in the vicinity of the Virginia State line. Line D1 would require the relocation of a portion of VA 55 in the vicinity of where it would be bridged. Continuing to the east, Line D1 would run north of and parallel to VA 55 to its bridging of VA 609. At this point, Line D1 would exit the George Washington National Forest and turn to the southeast to bridge Duck Run and VA 55. Here, Line D1 would follow the base of Paddy Mountain, pass to the south of Cold Spring, and then turn to the east to bridge Duck Run and VA 55 again. At the base of Short Mountain, Line D1 would follow the same alignment as Line A to the eastern side of the bridging of VA 600.

Line D2 would follow the same alignment as Line A from the Virginia State line to a point approximately 457 meters (1,500 feet) west of Line A's first crossing of Duck Run. Line D2 would not cross Duck Run at this location. At the point where Line D2 diverges from Line A, Line D2 would turn to the southeast, following the base of Paddy Mountain and remaining on the southern side of and parallel to Duck Run. Continuing to the east, Line D2 would then exit the George Washington National Forest as it bridges VA 603. Approximately 183 meters (600 feet) to the east, Line D2 would then bridge VA 55. Line D2 would converge with the alignment of Line A after the bridging of VA 600.

Within the Duck Run Option Area, Line D1 is approximately 9.0 kilometers (5.6 miles) long, Line D2 is approximately 8.4 kilometers (5.2 miles) long, and Line A is approximately 8.7 kilometers (5.4 miles) long.

b. Line L: Lebanon Church Option Area

Line L would diverge from Line A just west of the bridging of Turkey Run and VA 714. Line L would then continue in a more easterly direction, passing to the south of Wheatfield then bridging VA 55 and crossing over Eishelman Run. From here, Line L would turn to the south and provide an interchange at

VA 628. At this interchange, Line L would turn to the south, passing to the east of Lebanon Church. Continuing in its southerly direction, Line L would terminate at a new interchange with I-81, to the north of Strasburg. Across this area, Line L would bridge Mulberry Run, the intersection of VA 629 and 631, provide an at-grade connection via a connector road to VA 631, bridge VA 622 and then provide an interchange at the I-81 terminus.

Within the Lebanon Church Option Area, Line L is approximately 7.3 kilometers (4.5 miles) long compared to Line A, which is approximately 8.5 kilometers (5.3 miles) long.

G. ALIGNMENTS CONSIDERED BUT ELIMINATED UNDER THE BUILD ALTERNATIVE

Alignments considered but eliminated can be divided into two categories: those lines developed only to a centerline and those lines that were more fully developed. Lines developed only to a centerline had horizontal alignments set but did not necessarily have vertical alignments. In some instances, an acceptable vertical grade was not possible. Lines fully developed had both horizontal and vertical alignments set, as well as the construction limits calculated.

Table II-7 presents the lines developed only to a centerline and the basis for eliminating them from further consideration. Fourteen alignment segments were eliminated at the centerline stage due to excessive impacts or undesirable design restrictions. Table II-8 presents the lines that were fully developed and identifies their basis for elimination. Approximately 42 segments of fully developed alignments were eliminated due to excessive impacts, undesirable design restrictions, or excessive costs. Both the centerline and fully developed alignments eliminated from further consideration are shown in black on the Alignment and Resource Location Plans. While sections are numbered from east to west, project-related impacts are reported from west to east. As a result, the Sections presented in Tables II-7 and II-8 are in descending order.

TABLE II-7

CENTERLINE ALIGNMENTS CONSIDERED BUT ELIMINATED

SECTION	LINE	BASIS FOR ELIMINATION
Section 15	15-B	◆ Requires additional bridge for crossing of Pleasant Run ◆ Requires skewed bridge crossing ◆ Excessive earthwork
Section 15	15-D	◆ Impacts Kerens Historic District ◆ Residential Impacts ◆ Impacts farms in floodplains
Section 14	14-C (USGS quad sheet study)	◆ Excessive earthwork ◆ Poor access to Parsons and Porterwood ◆ Numerous stream crossings ◆ Excessive length through Monongahela National Forest
Section 9	9-C	◆ Impacts to cultural resources ◆ Numerous residential and commercial displacements ◆ Impacts to Elklick Run ◆ Requires additional stream crossings
Section 7	6-B*	*This is a continuation of Section 6's Line 6-B which begins in Section 7 ◆ Excessive length in river floodplain ◆ Requires skewed river crossing
Section 6	6-B	◆ Impacts archaeological sites and historic structures
Section 5	5-B	◆ Poor access potential ◆ Excessive earthwork ◆ Numerous displacements ◆ Impacts three additional intermittent tributaries to Baker Run and an additional wetland
	5-C	◆ Requires additional crossing of tributary to Long Lick Run ◆ Considerable parallel impact to Long Lick Run ◆ Large wetland impact ◆ Excessive earthwork
Section 4	4-B	◆ Requires substantial roadway relocation of WV 55 ◆ Requires additional displacements ◆ Impacts Lost River ◆ Poor access potential
	4-C	◆ Construction parallel to Lost River channel too great and overall length too great ◆ Numerous impacts to wetlands ◆ Numerous impacts to historic structures and prehistoric sites ◆ Numerous residential relocations ◆ Excessive cut through Hanging Rock Ridge

TABLE II-7 *(CONT.)*
CENTERLINE ALIGNMENTS CONSIDERED BUT ELIMINATED

SECTION	LINE	BASIS FOR ELIMINATION
Section 3	3-B	◆ Numerous wetland impacts ◆ Proximity to cultural resources ◆ Proximity to Wardensville Spring ◆ Numerous roadway and residential relocations
Section 1	1-C	◆ Impacts potential cultural resources ◆ Impacts a forested wetland. ◆ Requires substantial realignment of secondary roads ◆ Creates awkward intersections
	1-D	◆ Crosses several additional drainage areas ◆ Poor access potential ◆ Numerous cultural resource sites prevent ability to continue west of Cedar Creek

TABLE II-8
DEVELOPED ALIGNMENTS CONSIDERED BUT ELIMINATED

SECTION	LINE	BASIS FOR ELIMINATION
Section 16	16-A	◆ Wetland impact
	16-A.1 (sta. 500 to 619)	◆ Excessive wetland impacts ◆ Requires additional displacement
	16-A.1 (sta. 620 to 735)	◆ Impacts possible slave graves on Isner Farm ◆ Impacts farms in Leading Creek floodplain ◆ Substantially more displacements and/or residential impacts
	16-B (sta. 500 to 619)	◆ Additional bridge cost ◆ Excessive floodplain impacts ◆ Closer proximity to residences, archaeological sites, and cemetery in Gilman
Section 15	15-A	◆ Wetland impact
	15-A.1 (sta. 734 to 3260)	◆ Excessive earthwork ◆ Impacts Wilmoth Run ◆ Requires relocation of CR 47 ◆ Alignment cuts off CR 47 access to 3 local roads to the south and 2 local roads to the north ◆ Impacts Leading Creek floodplain ◆ Wetland impacts ◆ Impacts Elkins Speedway
	15-C	◆ Excessive earthwork
Section 14	14-B (sta. 3412 to 3500)	◆ Requires channel relocation of Shavers Fork ◆ Within Shavers Fork floodplain ◆ Within Corrick's Ford Battlefield area
Section 13	13-A	◆ Wetland impacts
	13-A.1 (sta. 3880 to 3970)	◆ Excessive impacts to forested wetlands ◆ Impacts Tub Run
	13-B (sta. 3970 to 4123)	◆ Impacts Douglas and Albert Highwall reclamation projects ◆ Longer, more costly bridge over the North Fork of the Blackwater River ◆ Crosses tributaries to Long Run
	13-C (sta. 3970 to 4123)	◆ Impacts Douglas Historic District ◆ Impacts Long Run ◆ Impacts Albert and Douglas Highwall Reclamation projects
	13-E (sta. 3615 to 3700)	◆ Unable to provide connection to US 219 ◆ Involves additional residential displacements
Section 12	12-A	◆ Excessive wetland impacts ◆ Impacts potential historic structure
	12-A.1 (sta. 4170 to 4375 and sta. 4425 to 4515)	◆ Excessive wetland impacts ◆ Impacts additional upland habitat
	12-B (sta. 4338 to 4445)	◆ Excessive wetland impacts immediately adjacent to WV 93
	12-B (sta. 4186 to 4253)	◆ Impacts forested wetlands

TABLE II-8 *(CONT.)*
DEVELOPED ALIGNMENTS CONSIDERED BUT ELIMINATED

SECTION	LINE	BASIS FOR ELIMINATION
Section 11	11-A	◆ Excessive wetland impacts
	11-A.1 (sta. 4775 to 4900)	◆ Excessive wetland impacts ◆ Area is undermined
	11-A.1 (sta. 4515 to 4785)	◆ Impacts additional upland habitat
	11-B	◆ Excessive wetland impacts
	11-C (sta. 4775 to 4900)	◆ Excessive wetland impacts ◆ Area is undermined
Section 10	10-A (sta. 4995 to 5110)	◆ Stream impacts ◆ Excessive wetland impacts
Section 9	9-A	◆ Excessive wetland impacts
	9-A.1 (sta. 5475 to 5580)	◆ Long culvert on Middle Fork of Patterson Creek
Section 8	8-A	◆ Excessive wetland impacts
	8-A.1 (sta. 5760 to 5910)	◆ Additional displacement
Section 7	7-A	◆ Excessive wetland impacts ◆ Requires realignment of Delta 4
	7-A.1 (sta. 5998 to 6188)	◆ Greater wetland impacts ◆ Requires relocation of Walnut Bottom Run
	7-B	◆ Excessive wetland impacts
Section 6	6-A	◆ Excessive earthwork ◆ Impacts perennial stream ◆ Displacements ◆ Impacts wetlands and structures
	6-C.1 (sta. 6307 to 6438)	◆ Requires additional earthwork and waste ◆ Requires additional bridge over CR 15
Section 5	5-A	◆ Requires displacements ◆ Requires realignment of CR 23/4
	5-D (sta. 6810 to 6940)	◆ Impacts wetlands ◆ Impacts perennial stream

TABLE II-8 *(CONT.)*
DEVELOPED ALIGNMENTS CONSIDERED BUT ELIMINATED

SECTION	LINE	BASIS FOR ELIMINATION
Section 4	4-A	◆ Wetland impacts
	4-D (sta. 7090 to 7181)	◆ Access to WV 55 not necessarily desirable at this location due to scenic nature of area. ◆ Parallels WV 55 through the water gap ◆ Excessive floodplain encroachments and wetlands impacts ◆ Cuts out top of gap ◆ Excessive earthwork
Section 3	3-A	◆ Additional residential displacements ◆ Excessive earthwork
	3-C (sta. 7518 to 7674)	◆ Numerous residential relocations ◆ Numerous wetland impacts ◆ Requires relocation of CR 5 ◆ Impacts J. Allen Hawkins Community Park ◆ Greater visual intrusion
Section 1	1-A (sta. 8143 to 8215)	◆ Requires two additional residential displacements
	1-A (sta. 8340 to 8497)	◆ Greater visual impact to VA 55 ◆ Requires additional displacements ◆ Longer bridge crossing of Mulberry Run

H. TRAFFIC ANALYSIS

A traffic analysis was prepared for the three alternatives carried forward (the No-Build Alternative, the IRA, and the Build Alternative). The analysis identifies traffic volumes for a variety of development scenarios and identifies the facility improvements that would be necessary to provide an adequate level of service. Traffic volumes along the existing roadways within the study area were projected to present day 1993, opening year 2001, and design year 2013. These volumes represent the No-Build Alternative volumes. A traffic model was developed for each of these No-Build years that simulates the existing travel patterns within the roadway network. The roadway network represented in the models for years 2001 and 2013 was then adjusted to reflect transportation improvements associated with construction of the IRA or the Build Alternative. New traffic volumes for years 2001 and 2013 were developed based upon these improvements. These volumes are identified as IRA volumes or Build Alternative volumes.

The IRA involves upgrading existing roadways to provide an improved east-west routing through the study area. The Build Alternative involves the construction of a partially-controlled four-lane highway on new alignment. Existing crossroad connections to the IRA would be maintained and few new connections to the IRA would be required. The Build Alternative proposes new connections to state and county roads, where feasible. Each intersection was analyzed using the design year volumes predicted by the model and a decision was made regarding the type of connection that would be necessary to provide an adequate level of service.

The boundaries of the study area and corresponding network were developed by identifying the limits of a 30-minute commute from the proposed location of Corridor H. This 30-minute commute concept is discussed in detail in Section III-A, Economic Environment. The resulting study area extends east to I-81 and west to US 219 and WV 72, and includes all of Tucker, Grant, and Hardy Counties; parts of Preston, Mineral, Barbour, Hampshire, and Randolph Counties in West Virginia; part of Garrett County in Maryland; and parts of Frederick and Shenandoah Counties in Virginia.

1. BACKGROUND DATA AND METHODOLOGY

a. Traffic Data

Traffic volume growth rates were provided by WVDOT. The growth rates are specific to the county and roadway designation (i.e., interstate, state route, and county route). These growth rates were applied to the traffic volumes for the existing West Virginia roadways represented in the network. VDOT provided recent average daily traffic volumes (ADTs) and future 2010 daily traffic volumes. Annual growth rates were calculated and applied to the traffic volumes for the existing Virginia roadways represented in the network. The West Virginia growth rates were averaged according to roadway designation for the counties in the study area and applied to the roadways in Maryland. ADTs were projected to the present day 1993 and the design year 2013. The projected ADTs were used to verify the daily traffic volumes that are predicted by the traffic model for the No-Build Alternative.

An estimate of the number of trips that traveled completely through the study area was made to determine the percentage of existing trips in the network that would divert to an improved "through" route. The *Traffic and Transportation Technical Report* of the 1992 *Corridor Selection SDEIS*, estimated this number to be equal to 50% of the volume of the least traveled link along the two existing primary routes through the study area. The primary east-west traffic movements through the study area are served by two routes; a northern route which follows US 219, WV 93, and US 50 between Elkins, WV and Winchester, VA and a southern route which follows WV 55 and VA 55 between Elkins, WV and Strasburg, VA. It was estimated that there were approximately 1,400 vehicles per day making this east-west trip in 1993 (using one of the two routes). This volume was projected to reach 2,000 vehicles per day in 2013.

In addition to the trips that currently travel through the study area, it was necessary to estimate the number of vehicles that would divert to a new or improved roadway through the study area if one were made available for such use. An Origin and Destination (O/D) survey of the motorists who could use such a roadway was conducted. Survey stations were established at rest areas along Interstate 79 between Clarksburg, WV and Fairmont, WV and along Interstate 64, between Lewisburg, WV and Covington, VA. Information gathered at the rest areas included the number of motorists interviewed, the number of vehicles entering the rest area, the number of vehicles traveling the mainline interstate, the percentage of heavy vehicles entering the rest area, the percentage of heavy vehicles traveling the mainline interstate, and the surveyed motorist's origin and destination. Each survey response was reviewed and a determination, based upon travel time optimization, was made regarding the number of motorists who may use a new east-west roadway within the study area. This "latent" demand was calculated to be approximately 5,500 vehicles per day for 2013. These volumes represent the maximum number of vehicles that could be expected to divert to a new, four-lane facility.

It was also necessary to evaluate the latent demand for the IRA. While it is anticipated that an upgraded two-lane roadway may attract fewer vehicles than a new four-lane facility, there are no accepted criteria that would accurately represent this reduction. Both the Build Alternative and the IRA would offer a travel time savings when compared to the "round about" routing offered by Interstates 64 and 68. However, to account for what may be fewer volumes attracted to an improved two-lane facility, the latent demand volumes were reduced by 10% when applied to the IRA. Ten percent roughly corresponds to the percentage of heavy vehicles currently traveling Interstates 64 and 68 that would divert to a new four-lane facility but would not divert to an improved two-lane facility. The resulting latent demand volumes for the IRA in 2013 is 5,000 vehicles per day.

b. The Modeling Process

The study area was modeled using the Quick Response System (QRSII) computer program and involved a three-step process to forecast travel within a network. First, the entire study area was divided into the county Block Numbering Areas (BNA) identified by the US Census Bureau. Most of these areas were further divided into Traffic Analysis Zones (TAZs). Boundaries for the TAZs were developed by comparing the existing areas of development with the existing roadway network. The socioeconomic aspects of the TAZs and the roadway network can then be described in terms of nodes, links, and centroids: Nodes generally represent the intersection of two roadways; links connect one node to another representing the roadway segments between intersections; and centroids are connected to the links (or nodes) and represent the locations along the network where trips are generated from and are attracted to.

The roadways represented in the existing network included the principal through highways as noted on the official state map of West Virginia, and US and State highways as noted on the official state map of Virginia. These highways included multi-lane divided roads (controlled access and uncontrolled access) and two lane roads (uncontrolled access). In areas where principal through highways were not located, "important paved connecting road", as noted on the West Virginia map, and "two lane paved county highways", as noted on the Virginia map, were added to the network. Where important paved connecting roads were located close to each other, the roadway that connected more prominent communities was added as a link, and the other road's communities were represented with a centroid.

Input parameters that identify the number of people living and working in each TAZ, the number of households in each TAZ, along with the average auto ownership and the average income of the households in each TAZ were entered into the model. Each of the TAZs is represented in the network by a centroid connected to a network link. These TAZs can be seen in the exhibits prepared for the discussion of "Highway Capacity Analysis" (Exhibits II-14 through II-17). The program determines the number of trips that are generated from and attracted to all of the TAZs in the network.

The second step of the process is the distribution of trips. Once the network has been described and a TAZs capacity to generate or attract trips is determined, the model distributes these trips throughout the network. The trip distribution identifies how many trips are attracted from one TAZ (centroid) to another TAZ (centroid).

The third step converts the trip distributions identified in step two into route assignments. The trips (vehicle trips at this point) are assigned to the route which represents the shortest travel time through the network. As a result of the trip assignments, vehicle volumes can be generated for individual links and turning volumes can be generated for individual nodes.

The QRSII program has the capability to do an "all or nothing trip assignment" or a "capacity constrained trip assignment". With an all or nothing trip assignment, vehicle trips for individual origin-destination pairs are assigned to the shortest route based upon the travel times assigned to the links along the route. These link travel times will be maintained regardless of the capacity a particular link may have to carry the volumes assigned to it. With a capacity constrained trip assignment, the program assigns trips to the individual links along a route until a link begins to approach capacity. As a link approaches capacity, the program will recalculate the travel time along the link based upon the number of vehicles assigned to it. The program will then use the revised link travel time to recalculate the shortest route for the remaining origin-destination pairs.

The all or nothing assignment technique was used in this model. The all or nothing assignment identifies the raw trip demand. If a particular O/D pair is overloading a link, it would become evident in an all or nothing assignment. This same overload, if modeled with a capacity constrained trip assignment, could become buried in an alternate route to which the overload trips were assigned. The all or nothing assignment technique is best used to determine the need for improvements for a network based upon motorist demand, whereas the capacity constrained assignment technique is best used to determine an existing network's capability to handle a traffic generating improvement (i.e. a land development project).

The QRSII program was designed to forecast trips in an urban area. By stripping away aspects of the program that do not pertain to a rural area and by revising some of the program defaults for trip generation and trip attraction parameters, QRSII can be used as a rural forecasting model. The key to this process is a diligent effort in calibrating the model. Socioeconomic data for 1993 was entered into QRSII and the program was run with the program default values for trip productions and attractions. The link volumes predicted by the program were compared to the ADTs projected for the represented roadways in 1993, the base year. The production and attraction parameters for the program were then revised and the program re-run until the link volumes predicted by the program generally matched those that were projected for the represented roadway segments for the base year. In addition to revising the production and attraction parameters, adjustments were made in the percentage of the socioeconomic parameters of each BNA assigned to each zone. The trip production and attraction parameters developed for the base year were then used to generate trip assignments for the 2013 No-Build scenario.

The study area is unique in the fact that, while it is predominately rural, there are pockets of urban development scattered throughout it. Trip-making characteristics for an urban area are not the same as those for a rural area. To account for these differences, the model was established and calibrated as a rural area and additional trips were added to or detracted from some of the links in the areas that exhibited characteristics of an urban community. The results of the overall calibration process indicate that the model used for this study was able to predict 99.3% of the total vehicle volumes for the 1993 network. For the No-Build scenario in 2013, the model predicted 96.6% of the volumes projected for the traffic model.

c. The Analysis Scenarios

Four independent analysis scenarios were modeled based on the existing (1993) and future (2013) conditions.

1. 1993 Existing. A model was constructed to represent the existing highway network within the study area. Socioeconomic parameters representing conditions for 1993 were used as input. The model was calibrated by making adjustments to the trip attraction and trip production parameters so the link volumes predicted by the model generally agreed with those that were actually counted on the roadways.

2. 2013 No-Build. This model was constructed from the calibrated, 1993 base year, model. It reflects the 1993 highway network for the study area. Socioeconomic input parameters representing conditions anticipated for 2013 No-Build were calculated using a straight line growth factor from 1993. A comparison to the volumes projected in accordance with state growth rates for 2013 indicated that no further adjustment to trip attraction and trip production parameters was needed.

3. 2013 Improved Roadway Alternative. This model was constructed from the 2013 No-Build model. The highway network was revised to show a limited number of additional links that represented areas where the alignment of the IRA substantially departed from the existing roadways. Link travel times along roadway segments associated with the IRA were revised to show an improved travel time. Socioeconomic input parameters representing conditions anticipated for the 2013 IRA were similar to those used for 2013 No-Build. Existing volumes representing vehicles traveling through the study area (between Elkins and Strasburg) were reassigned from the existing roadway segments to the IRA. Vehicle volumes representing anticipated latent demand were also added.

4. 2013 Build. This model was constructed from the 2013 No-Build model. The highway network was revised to show the proposed Build Alternative. Socioeconomic input parameters representing conditions anticipated for 2013 Build were generated using the Corridor H Development Model which accounted for the secondary development that could occur due to the introduction of a four-lane facility into the study area. (See Section III-A, Economic Environment for details on the Corridor H Development Model.) Existing volumes representing vehicles traveling through the study area (between Elkins and Strasburg) were reassigned from the existing roadway segments to the Build Alternative. Vehicle volumes representing anticipated latent demand were also added.

d. Projected Traffic Volumes

The projected traffic volumes for the individual links representing the roadway segments within the study area are shown in Table II-9. These volumes include the estimates for the existing through volumes and the anticipated latent demand volumes as they apply to each of the four analysis scenarios. The predicted volumes for this network analysis are rounded to the nearest thousand vehicles per day.

2. ANALYSIS

a. Highway Capacity Analysis

The West Virginia Department of Highways Design Directive, DD-6-4, indicates that a new or reconstructed roadway requires four lanes if the traffic volumes projected for it equals or exceeds 6,000 vehicles per day (WVDOT DD, 1960). An existing two-lane roadway would not generally be considered for widening to a four-lane roadway until its Level of Service (LOS) drops to a LOS D. Level of Service is a qualitative measure describing the operational conditions within a traffic stream. Level of Service D represents high-density but stable flow where vehicle speed and freedom to maneuver are severely restricted.

The capacities of a typical four-lane divided rural highway and a typical two-lane rural roadway were calculated. The maximum ADT that corresponds to a Level of Service D for a limited access, four-lane facility is approximately 48,000 vehicles per day. The maximum ADT that corresponds to a Level of Service D for a high type, two-lane rural roadway is approximately 9,000 vehicles per day.

Exhibits II-14 through II-17 are schematic diagrams of the study area network for each of the four analysis scenarios. The links, representing individual roadway segments, are color coded to represent the number of lanes required to accommodate the projected traffic volumes. The width of the links represents the existing or projected traffic volumes for that link. Under the No-Build Alternative, some sections of the existing roadway network will require 4 lanes by the year 2013. Under the IRA, the entire length of the roadway from Elkins to Strasburg would require 4 lanes. Under the Build Alternative, the traffic volumes anticipated to use the facility in 2013 would justify the use of 4 lanes.

TABLE II-9
AVERAGE DAILY TRAFFIC VOLUMES

NETWORK LINK	1993 Existing	2013 No-Build	2013 IRA	2013 Build
CORRIDOR H: DAVIS TO 9653B (SR 93)				11,000
CORRIDOR H: H455 TO H565				14,000
CORRIDOR H: H455 TO 9659B				23,000
CORRIDOR H: H565 TO H3055				15,000
CORRIDOR H: H565 TO 9662A				1,000
CORRIDOR H: H3055 TO H3470				12,000
CORRIDOR H: H3470 TO 9654B				1,000
CORRIDOR H: H3470 TO PARSONS B				11,000
CORRIDOR H: H3900 TO DAVIS				10,000
CORRIDOR H: H3900 TO PARSONS B				12,000
CORRIDOR H: H3900 TO H3900A				2,000
CORRIDOR H: H4790 TO H4970				10,000
CORRIDOR H: H4790 TO 9653B (SR 93)				10,000
CORRIDOR H: H4970 TO BISMARCK				10,000
CORRIDOR H: H4970 TO H4970A				1,000
CORRIDOR H: H5300 TO BISMARCK				9,000
CORRIDOR H: H5300 TO H5405				9,000
CORRIDOR H: H5405 TO H5600				8,000
CORRIDOR H: H5600 TO H5790				9,000
CORRIDOR H: H5790 TO H6225				10,000
CORRIDOR H: H6225 TO H6400				11,000
CORRIDOR H: H6400 TO H6630				12,000
CORRIDOR H: H6630 TO BEAN				1,000
CORRIDOR H: H6630 TO H7055				11,000
CORRIDOR H: H7055 TO H7515				10,000
CORRIDOR H: H7515 TO H7805				8,000
CORRIDOR H: H7805 TO H8090				8,000
CORRIDOR H: H8090 TO H8215				13,000
CORRIDOR H: H8090 TO STAR				1,000
CORRIDOR H: H8215 TO LEBANON CHURCH				13,000
CORRIDOR H: H8215 TO H8215A				1,000
CORRIDOR H: H8430 TO STRASBURG B				15,000
CORRIDOR H: H8430 TO LEBANON CHURCH				15,000
CORRIDOR H: H8430 TO H8430A				1,000
County 1: BEAN TO 9701B	1,000	1,000	1,000	1,000
County 1: ROCK OAK TO 9701B	1,000	1,000	1,000	1,000
County 2: OLD FIELDS TO WILLIAMSPORT	1,000	1,000		1,000
County 2: OLD FIELDS TO R6225			8,000	
County 2: WILLIAMSPORT TO R6225			1,000	
County 3: H5600 TO 9694C				1,000
County 3: H5600 TO 9695B				1,000
County 3/3: FORMAN TO 9694C	1,000	1,000	1,000	2,000
County 3/3: SCHERR TO H5405				1,000

TABLE II-9 (CONT.)
AVERAGE DAILY TRAFFIC VOLUMES

NETWORK LINK	1993 Existing	2013 No-Build	2013 IRA	2013 Build
County 3/3: SCHERR TO 9694C	1,000	2,000	9,000	
County 3/3: H5405 TO 9694C				2,000
County 5: ARTHUR TO FORMAN	1,000	3,000	3,000	
County 5: ARTHUR TO H5790				3,000
County 5: BURLINGTON TO WILLIAMSPORT	1,000	3,000	3,000	3,000
County 5: FORMAN TO H5790				3,000
County 5: FORMAN TO 9694B	1,000	3,000	2,000	3,000
County 5: WILLIAMSPORT TO 9694B	2,000	4,000	3,000	4,000
County 7: AUGUSTA TO 9685A	1,000	3,000	3,000	3,000
County 7: BASS TO MOOREFIELD	1,000	1,000	1,000	1,000
County 7: BASS TO 9703B	1,000	1,000	1,000	1,000
County 7: ROCK OAK TO 9685A	1,000	1,000	1,000	2,000
County 12: BASS TO MATHIAS	1,000	1,000	1,000	1,000
County 14: CAPON BRIDGE TO 9686C	1,000	2,000	2,000	2,000
CR 14: YELLOW SPRING TO 9686C	1,000	1,000	1,000	1,000
County 16 & 23/10: LOST RIVER TO WARDENSVILLE	1,000	1,000	1,000	
County 16 & 23/10: LOST RIVER TO H7515				1,000
County 16 & 23/10: WARDENSVILLE TO H7515				3,000
County 28/7: COSNER GAP TO HOPEVILLE	1,000	1,000	1,000	1,000
County 45/4: CANAAN VALLEY TO DOLLY SODS	1,000	1,000	1,000	1,000
County 53: RIO TO ROCK OAK	1,000	1,000	1,000	1,000
I-81: GREENWOOD A TO 502C/511.98	32,000	51,000	52,000	55,000
I-81: GREENWOOD A TO GREENWOOD B	31,000	50,000	51,000	53,000
I-81: GREENWOOD B TO 509A	24,000	38,000	39,000	41,000
I-81: INWOOD TO 501/502B	28,000	47,000	47,000	47,000
I-81: STRASBURG A TO STRASBURG B	23,000	36,000	37,000	39,000
I-81: STRASBURG A TO 507	22,000	39,000	40,000	42,000
I-81: STRASBURG B TO 403	22,000	33,000	33,000	34,000
I-81: WOODSTOCK TO 403	23,000	35,000	35,000	35,000
I-81: WOODSTOCK TO 406A	23,000	36,000	36,000	36,000
I-81: 501/502B TO 502C/511.98	28,000	46,000	46,000	49,000
I-81: 506/508 TO 507	23,000	40,000	41,000	43,000
I-81: 506/508 TO 509A	26,000	42,000	43,000	45,000
IRA: SCHERR TO R5155			7,000	
IRA: R5255 TO 9702B			9,000	
IRA: R6225 TO 9694B			8,000	
IRA: 9659B TO 9662A			12,000	
IRA: 9694B TO 9694C			8,000	
LINK: A TO 9659B	11,000	23,000	28,000	28,000
LINK: B TO 9652D	1,000	2,000	2,000	2,000
LINK: C TO 9645	1,000	2,000	2,000	2,000
LINK: D TO 9642B	1,000	2,000	2,000	2,000
LINK: E TO OAKLAND	6,000	10,000	10,000	10,000

TABLE II-9 (CONT.)
AVERAGE DAILY TRAFFIC VOLUMES

NETWORK LINK	1993 Existing	2013 No-Build	2013 IRA	2013 Build
LINK: F TO 106	12,000	29,000	29,000	29,000
LINK: G TO 9684A	3,000	4,000	4,000	4,000
LINK: H TO PLEASANT DALE	2,000	3,000	3,000	3,000
LINK: I TO 503	5,000	8,000	8,000	8,000
LINK: J TO INWOOD	24,000	41,000	41,000	41,000
LINK: K TO STRASBURG A	14,000	32,000	32,000	33,000
LINK: L TO 406A	23,000	37,000	37,000	37,000
LINK: M TO 406B	1,000	1,000	1,000	1,000
LINK: N TO 9703C	2,000	3,000	3,000	3,000
LINK: O TO 9703B	1,000	1,000	1,000	1,000
LINK: P TO 9696A	3,000	4,000	4,000	4,000
LINK: Q TO 9704	2,000	3,000	3,000	3,000
LINK: R TO ALPENA	1,000	1,000	1,000	1,000
LINK: S TO MILL CREEK	3,000	6,000	6,000	6,000
LINK: T TO MILL CREEK	2,000	5,000	5,000	5,000
LINK: U TO 510.98	14,000	19,000	19,000	20,000
LINK: V TO 509B	9,000	15,000	15,000	15,000
LINK: W TO LOCK LYNN	5,000	8,000	8,000	7,000
LINK: X TO 509B	6,000	10,000	10,000	10,000
PR 19: DOLLY SODS TO HOPEVILLE	1,000	1,000	1,000	1,000
VA 7: GREENWOOD A TO 510.98	16,000	21,000	21,000	23,000
WV 28: HOPEVILLE TO SENECA ROCKS	2,000	4,000	3,000	3,000
WV 28: HOPEVILLE TO 9695A	2,000	4,000	3,000	3,000
WV 28: PETERSBURG A TO 9696B	8,000	12,000	11,000	13,000
WV 28: PETERSBURG A TO 9696C	15,000	25,000	24,000	26,000
WV 28: PETERSBURG B TO 9696C	14,000	23,000	22,000	23,000
WV 28: ROMNEY TO 9684A	5,000	8,000	8,000	8,000
WV 28: SENECA ROCKS TO 9704	2,000	3,000	3,000	3,000
WV 28: 9695A TO 9696B	3,000	6,000	5,000	5,000
WV 29: BAKER A TO RIO	1,000	1,000	1,000	1,000
WV 29: HANGING ROCK TO 9686B	3,000	5,000	5,000	5,000
WV 29: RIO TO 9686B	1,000	1,000	1,000	1,000
WV 32: CANAAN HEIGHTS TO CANAAN VALLEY	1,000	1,000	1,000	1,000
WV 32: CANAAN HEIGHTS TO DAVIS	2,000	3,000	3,000	4,000
WV 32: CANAAN VALLEY TO RED CREEK	1,000	1,000	1,000	1,000
WV 32: DAVIS TO THOMAS	5,000	7,000	13,000	5,000
WV 32: HARMON TO RED CREEK	1,000	1,000	1,000	1,000
VA 37: WINCHESTER A TO WINCHESTER B	12,000	21,000	20,000	25,000
VA 37: WINCHESTER A TO 502C/511.9	14,000	22,000	21,000	25,000
VA 37: WINCHESTER B TO 505D	8,000	13,000	12,000	16,000
VA 37: 505D TO 509A	12,000	19,000	19,000	23,000
WV 38: SAINT GEORGE TO 9652D	1,000	2,000	2,000	2,000
WV 42: ARTHUR TO 9695B	2,000	4,000	4,000	4,000

TABLE II-9 (CONT.)
AVERAGE DAILY TRAFFIC VOLUMES

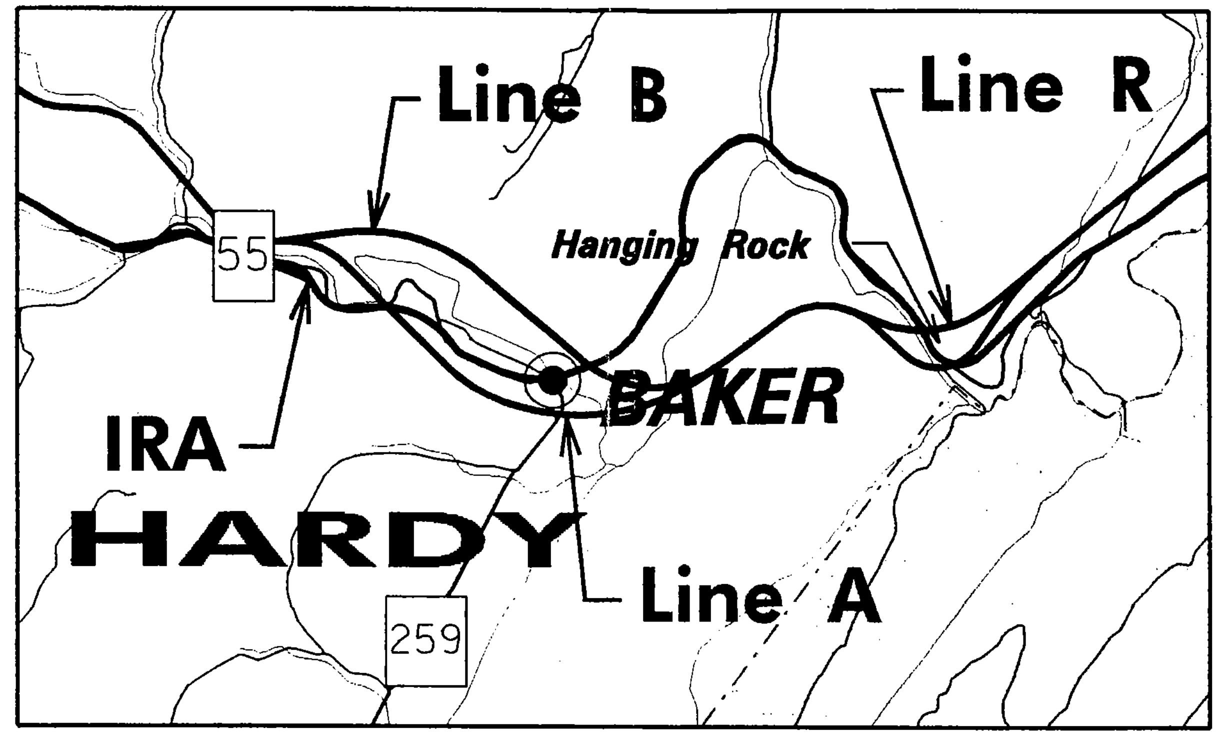
NETWORK LINK	1993 Existing	2013 No-Build	2013 IRA	2013 Build
WV 42: ARTHUR TO 9695C	3,000	6,000	6,000	7,000
WV 42: BISMARCK TO SCHERR	2,000	4,000	3,000	2,000
WV 42: BISMARCK TO 9694A	1,000	2,000	2,000	3,000
VA 42: COLUMBIA FURNANCE TO WOODSTOCK	6,000	9,000	9,000	9,000
VA 42: COLUMBIA FURNANCE TO 406B	1,000	1,000	1,000	1,000
WV 42: COSNER GAP TO SCHERR	1,000	3,000	3,000	3,000
WV 42: COSNER GAP TO 9695B	1,000	3,000	3,000	3,000
WV 42: MOUNT STORM TO 9694A	2,000	4,000	4,000	4,000
WV 42: PETERSBURG A TO 9695C	4,000	7,000	7,000	8,000
WV 55: BAKER A TO BAKER B	2,000	3,000	9,000	1,000
WV 55: BAKER A TO WARDENSVILLE	2,000	2,000	9,000	1,000
WV 55: BAKER B TO BEAN	1,000	2,000	8,000	1,000
WV 55: BEAN TO H6400				1,000
WV 55: BEAN TO 9702B	2,000	3,000	9,000	
VA 55: LEBANON CHURCH TO STAR	2,000	3,000	10,000	
VA 55: LEBANON CHURCH TO STRASBURG B	3,000	4,000	11,000	
VA 55: LEBANON CHURCH TO H8215A				1,000
VA 55: LEBANON CHURCH TO H8430A				1,000
WV 55: MOOREFIELD TO 9702B	4,000	6,000	4,000	5,000
WV 55: STAR TO WARDENSVILLE	2,000	3,000	10,000	1,000
VA 55: STAR TO H8215A				1,000
VA 55: STRASBURG B TO H8430A				1,000
WV 55: H6400 TO 9702B				6,000
WV 59: LOST CITY TO 402B	2,000	2,000	2,000	2,000
WV 72: MACOMBER TO 9642B	1,000	2,000	2,000	2,000
WV 72: MACOMBER TO 9652E	1,000	1,000	1,000	1,000
WV 72: PARSONS A TO 9654C	4,000	6,000	6,000	5,000
WV 72: PARSONS B TO 9653C	1,000	1,000	1,000	1,000
WV 72: RED CREEK TO 9653C	1,000	1,000	1,000	1,000
WV 72: SAINT GEORGE TO 9652C	1,000	1,000	1,000	1,000
WV 72: SAINT GEORGE TO 9652E	1,000	1,000	1,000	1,000
WV 72: 9652C TO 9654C	1,000	1,000	1,000	1,000
WV 90: GORMANIA TO PIERCE	1,000	1,000	1,000	1,000
WV 93: BISMARCK TO H4970A				1,000
WV 93: BISMARCK TO R5155			2,000	
WV 93: BISMARCK TO 9653B	1,000	2,000		
WV 93: CLAYSVILLE TO 9694D	2,000	5,000	4,000	4,000
WV 93: DAVIS TO 9653B	2,000	3,000	9,000	
WV 93: SCHERR TO 9694D	2,000	4,000	3,000	4,000
WV 93: H4790 TO H4970A				1,000
WV 93: R5155 TO 9653B			9,000	
WV 259: BAKER B TO LOST RIVER	1,000	2,000	2,000	
WV 259: BAKER B TO H7055				1,000

TABLE II-9 (CONT.)
AVERAGE DAILY TRAFFIC VOLUMES

NETWORK LINK	1993 Existing	2013 No-Build	2013 IRA	2013 Build
WV 259: GORE TO YELLOW SPRING	1,000	1,000	1,000	1,000
WV 259: LOST CITY TO LOST RIVER	2,000	3,000	3,000	3,000
WV 259: LOST CITY TO MATHIAS	2,000	2,000	2,000	2,000
WV 259: LOST RIVER TO H7055				4,000
WV 259: MATHIAS TO 9703C	2,000	3,000	3,000	3,000
WV 259: WARDENSVILLE TO YELLOW SPRINGS	1,000	1,000	1,000	2,000
MD 560: GORMANIA TO 7B/4A	4,000	5,000	5,000	6,000
MD 560: LOCH LYNN TO 7B/4A	5,000	8,000	8,000	7,000
VA 600: STAR TO 504B	1,000	1,000	1,000	1,000
VA 623: LEBANON CHURCH TO 402A	1,000	1,000	1,000	3,000
VA 628: LEBANON CHURCH TO 504C	1,000	1,000	1,000	3,000
VA 691: COLUMBIA FURNANCE TO 402B	2,000	2,000	2,000	2,000
US 17: GREENWOOD B TO 509 B	29,000	47,000	47,000	52,000
US 33: ALPENA TO BOWDEN	2,000	3,000	2,000	2,000
US 33: ALPENA TO 9663A	2,000	3,000	2,000	2,000
US 33: BOWDEN TO ELKINS B	6,000	11,000	10,000	10,000
US 33: ELKINS A TO 9660A	10,000	19,000	13,000	3,000
US 33: ELKINS A TO 9662B/9661	19,000	34,000	32,000	34,000
US 33: ELKINS B TO 9662B/9661	19,000	34,000	32,000	34,000
US 33: HARMAN TO SENECA ROCKS	2,000	3,000	2,000	2,000
US 33: HARMAN TO 9663A	2,000	4,000	3,000	2,000
US 33: 9659B TO 9660A	11,000	23,000	16,000	5,000
US 50: AUGUSTA TO PLEASANT DALE	7,000	12,000	11,000	12,000
US 50: AUGUSTA TO 9683B	7,000	11,000	10,000	11,000
US 50: BURLINGTON TO JUNCTION	3,000	9,000	8,000	7,000
US 50: BURLINGTON TO NEW CREEK	5,000	12,000	11,000	11,000
US 50: CAPON BRIDGE TO GORE	5,000	6,000	5,000	6,000
US 50: CAPON BRIDGE TO HANGING ROCK	5,000	7,000	6,000	7,000
US 50: CLAYSVILLE TO 105	5,000	9,000	7,000	8,000
US 50: CLAYSVILLE TO 107	3,000	4,000	4,000	4,000
US 50: GORE TO 504A	5,000	7,000	6,000	7,000
US 50: GORMANIA TO 7A	3,000	4,000	4,000	4,000
US 50: GORMANIA TO MOUNT STORM	2,000	4,000	4,000	4,000
US 50: HANGING ROCK TO 9686A	6,000	10,000	9,000	10,000
US 50: JUNCTION TO 9684B	6,000	10,000	9,000	8,000
US 50: MACOMBER TO 9642A	1,000	2,000	1,000	1,000
US 50: MACOMBER TO 9645	2,000	2,000	2,000	2,000
US 50: MOUNT STORM TO 107	2,000	3,000	3,000	3,000
US 50: NEW CREEK TO 105	5,000	12,000	11,000	12,000
US 50: PLEASANT DALE TO 9686A	7,000	10,000	9,000	10,000
US 50: RED HOUSE TO 7A	3,000	4,000	4,000	4,000
US 50: RED HOUSE TO 9642A	1,000	2,000	2,000	2,000
US 50: ROMNEY TO 9683A/9685B	12,000	22,000	21,000	21,000

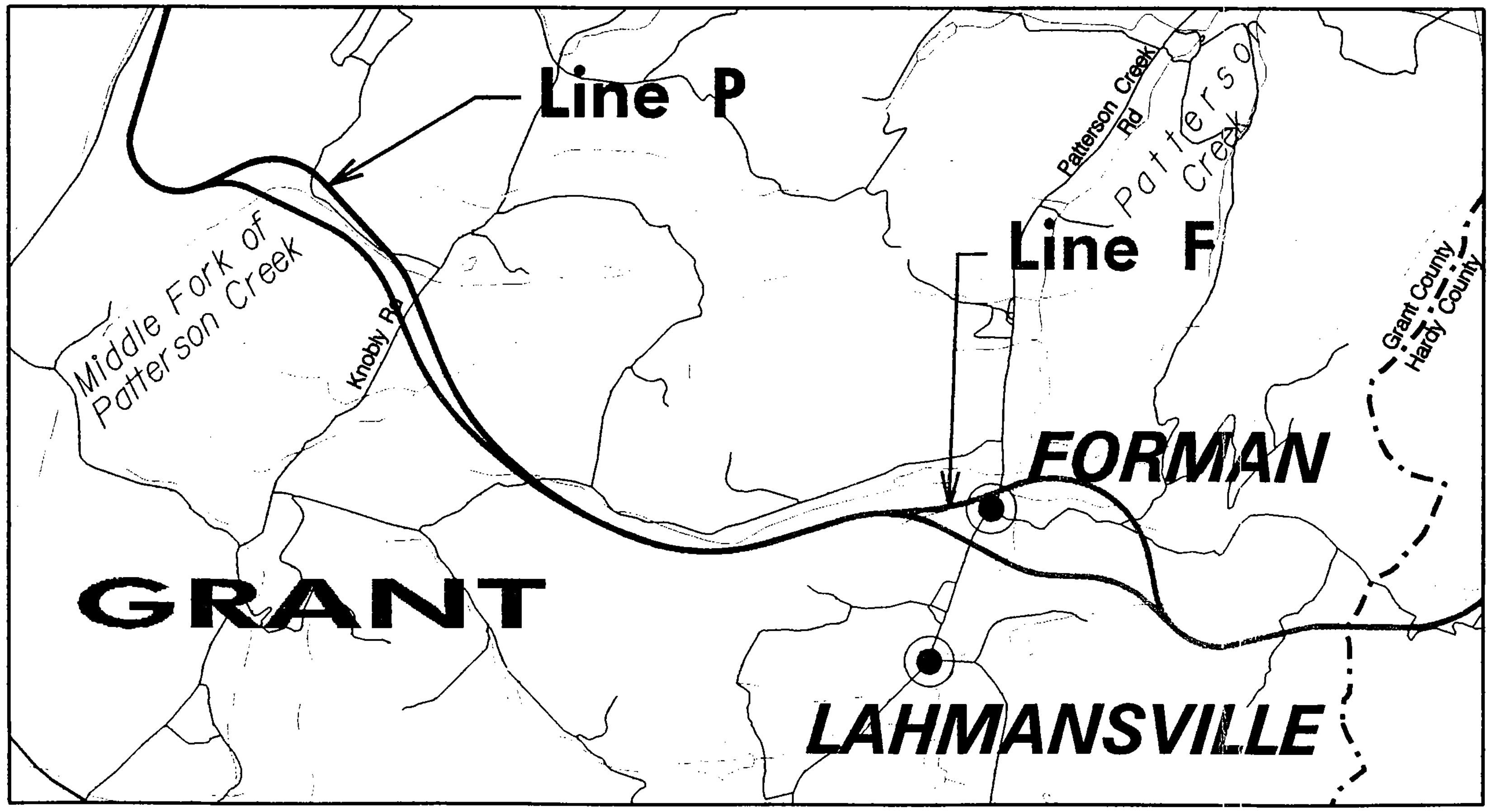
TABLE II-9 (CONT.)
AVERAGE DAILY TRAFFIC VOLUMES

NETWORK LINK	1993 Existing	2013 No-Build	2013 IRA	2013 Build
US 50: ROMNEY TO 9684B	12,000	19,000	18,000	18,000
US 50: WINCHESTER B TO 504A	11,000	17,000	15,000	24,000
US 50: 9683B TO 9685B/9683A	8,000	15,000	14,000	14,000
US 219: BACKBONE MOUNTAIN TO PARSONS B	2,000	3,000	10,000	
US 219: BACKBONE MOUNTAIN TO THOMAS	3,000	4,000	10,000	2,000
US 219: BACKBONE MOUNTAIN TO H3900A				2,000
US 219: ELKINS A TO H455				24,000
US 219: ELKINS A TO 9662A	10,000	17,000	12,000	
US 219: ELKINS B TO 9659A	18,000	31,000	31,000	33,000
US 219: MILLCREEK TO 9659A	7,000	10,000	10,000	11,000
US 219: MONTROSE TO H3055				2,000
US 219: MONTROSE TO 9654B	3,000	4,000	11,000	1,000
US 219: MONTROSE TO 9662A	3,000	6,000	13,000	
US 219: OAKLAND TO 7C	6,000	10,000	10,000	10,000
US 219: PARSONS A TO 9654A	4,000	6,000	13,000	3,000
US 219: PARSONS A TO 9654B	3,000	4,000	11,000	1,000
US 219: PARSONS B TO H3900A				1,000
US 219: PARSONS B TO 9654A	5,000	7,000	13,000	8,000
US 219: PIERCE TO THOMAS	4,000	5,000	5,000	6,000
US 219: PIERCE TO 9652A	2,000	2,000	2,000	3,000
US 219: RED HOUSE TO 6A	2,000	5,000	5,000	5,000
US 219: RED HOUSE TO 9652A	1,000	1,000	1,000	1,000
US 219: H455 TO 9662A				11,000
US 219: H3055 TO 9662A				1,000
US 219: 6A TO 7C	4,000	7,000	7,000	7,000
US 220: DURGAN TO PETERSBURG B	6,000	9,000	8,000	8,000
US 220: DURGAN TO 9703A	4,000	8,000	6,000	6,000
US 220: JUNCTION TO 9684C	2,000	3,000	3,000	4,000
US 220: MOOREFIELD TO OLD FIELDS	3,000	4,000		
US 220: MOOREFIELD TO H6225				3,000
US 220: MOOREFIELD TO R5255			3,000	
US 220: MOOREFIELD TO 9703A	8,000	11,000	11,000	11,000
US 220: NEW CREEK TO 106	10,000	24,000	24,000	24,000
US 220: OLD FIELDS TO H6225				5,000
US 220: OLD FIELDS TO R5255			12,000	
US 220: OLD FIELDS TO 9684C	2,000	3,000	3,000	4,000
US 220: PETERSBURG B TO 9696A	5,000	8,000	8,000	9,000
US 522: CROSS JUNCTION TO 502A/505A	8,000	12,000	12,000	13,000
US 522: WINCHESTER A TO 502A/505A	11,000	18,000	18,000	20,000



Baker and Hanging Rock Option Areas

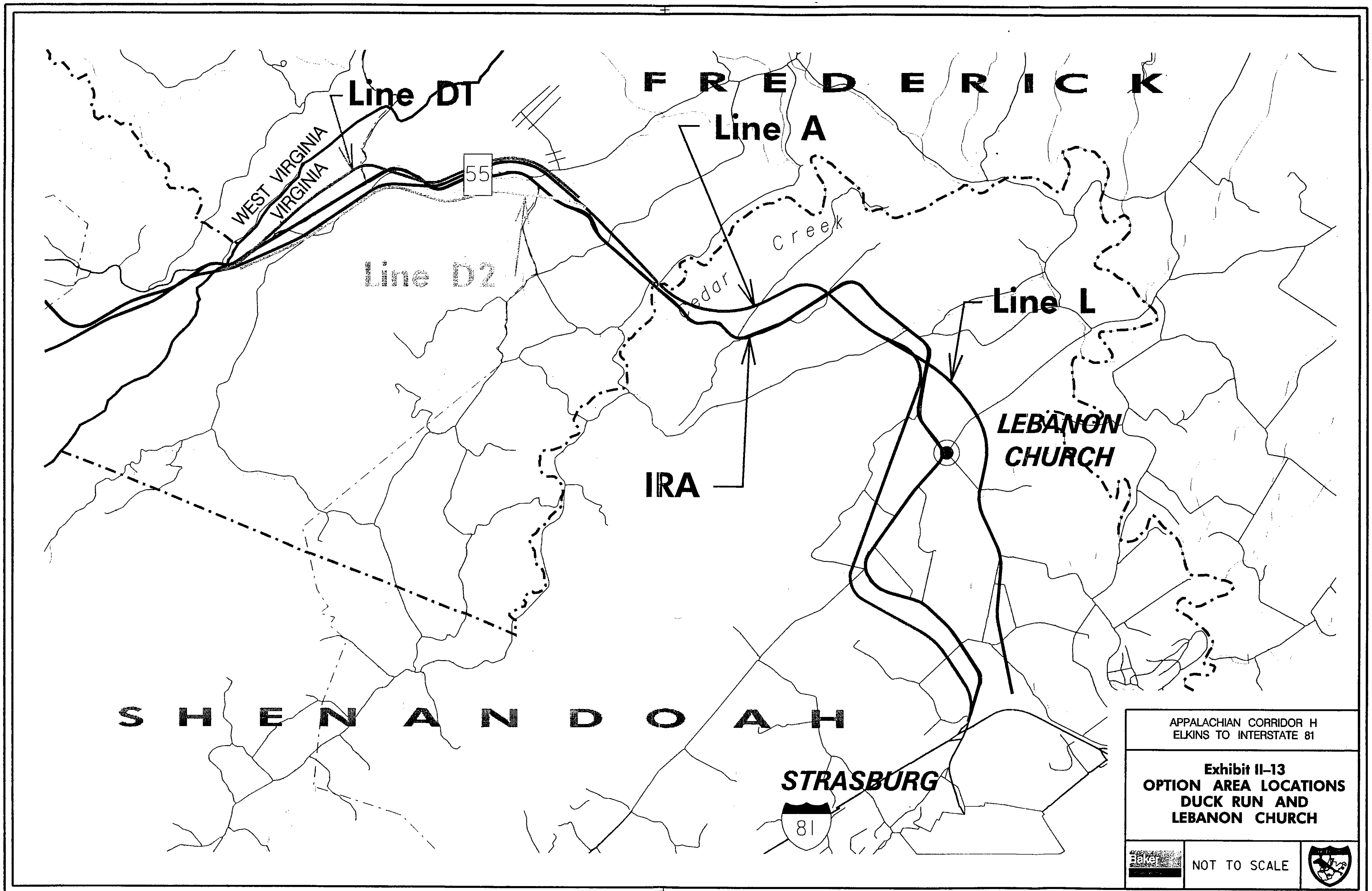
Patterson Creek and Forman Option Areas



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-12
OPTION AREA LOCATIONS
PATTERSON CREEK, FORMAN, BAKER, HANGING ROCK

NOT TO SCALE



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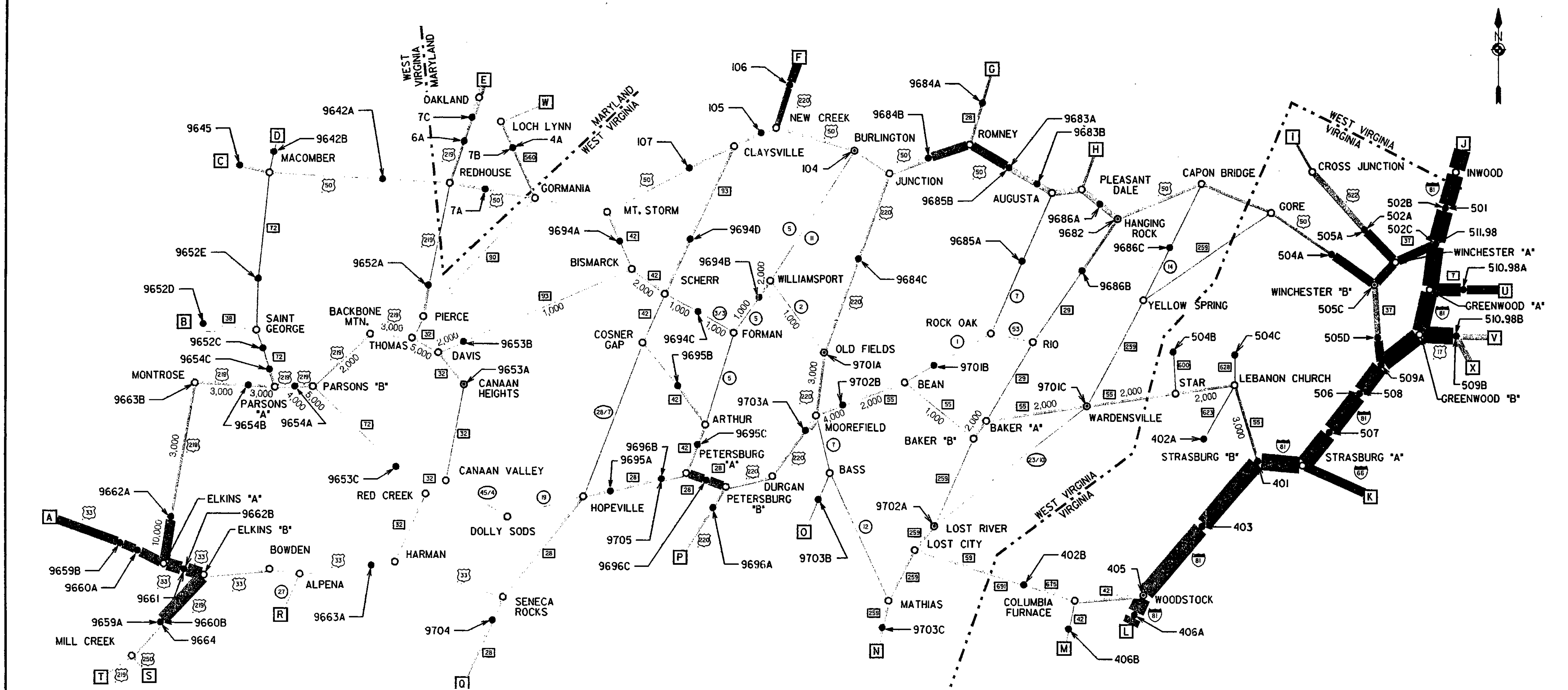

LEGEND	
* OF LANES REQUIRED	O NODE LOCATION
6 LANES	NODE & CENTROID LOCATION
4 LANES	N GATEWAY IDENTIFICATION
2 LANES	H BUILD ALTERNATIVE
81 INTERSTATE ROUTE	
33 UNITED STATES ROUTE	AVERAGE DAILY TRAFFIC
55 STATE ROUTE	1 2-5 6-10 11-15 16-20 21+
7 COUNTY ROUTE, PUBLIC ROUTE, OR DELTA ROUTE.	VEHICLES/DAY (1000'S)
● CENTROID LOCATION	

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-14
1993 EXISTING TRAFFIC MODEL

NOT TO SCALE

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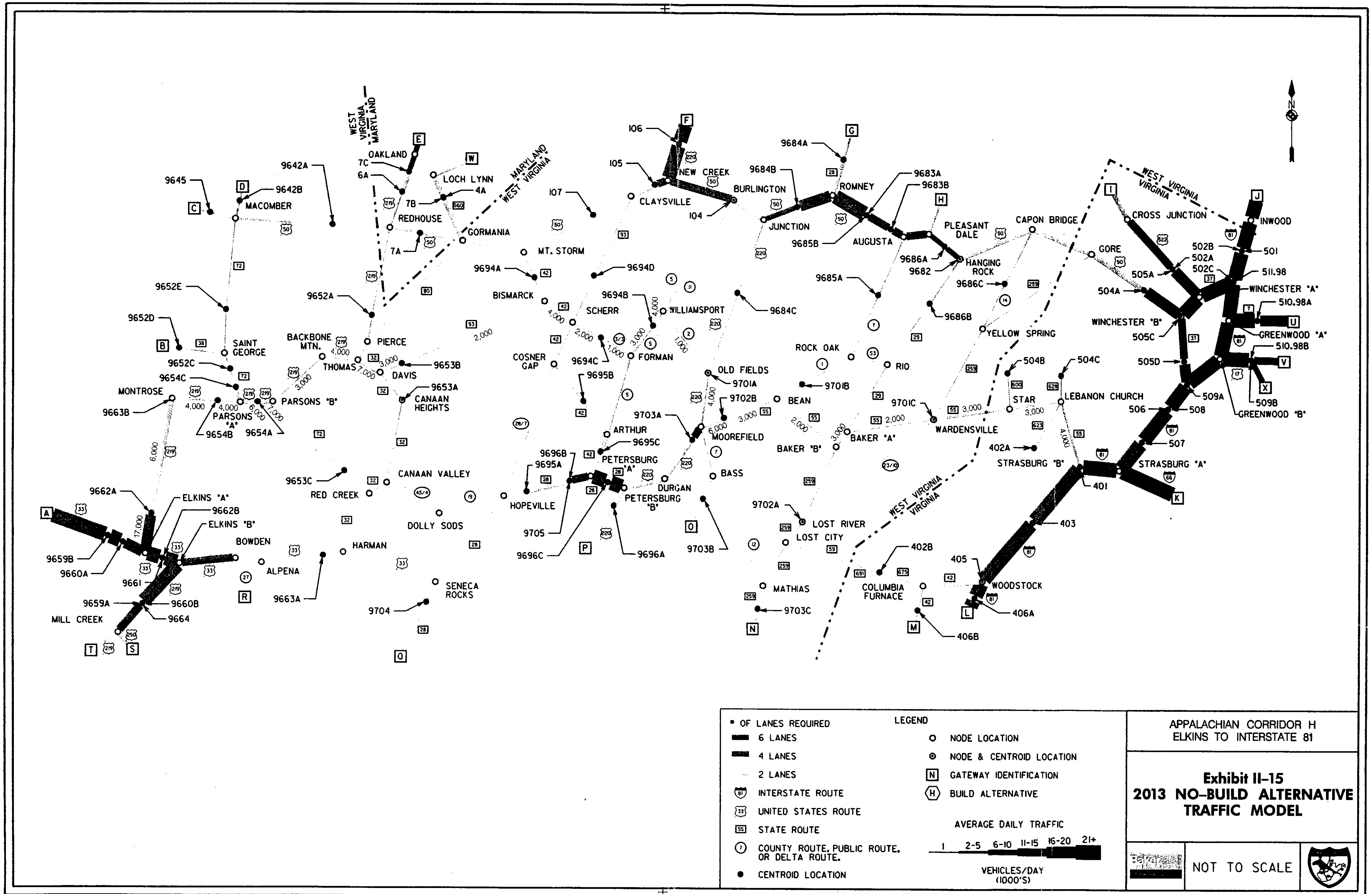
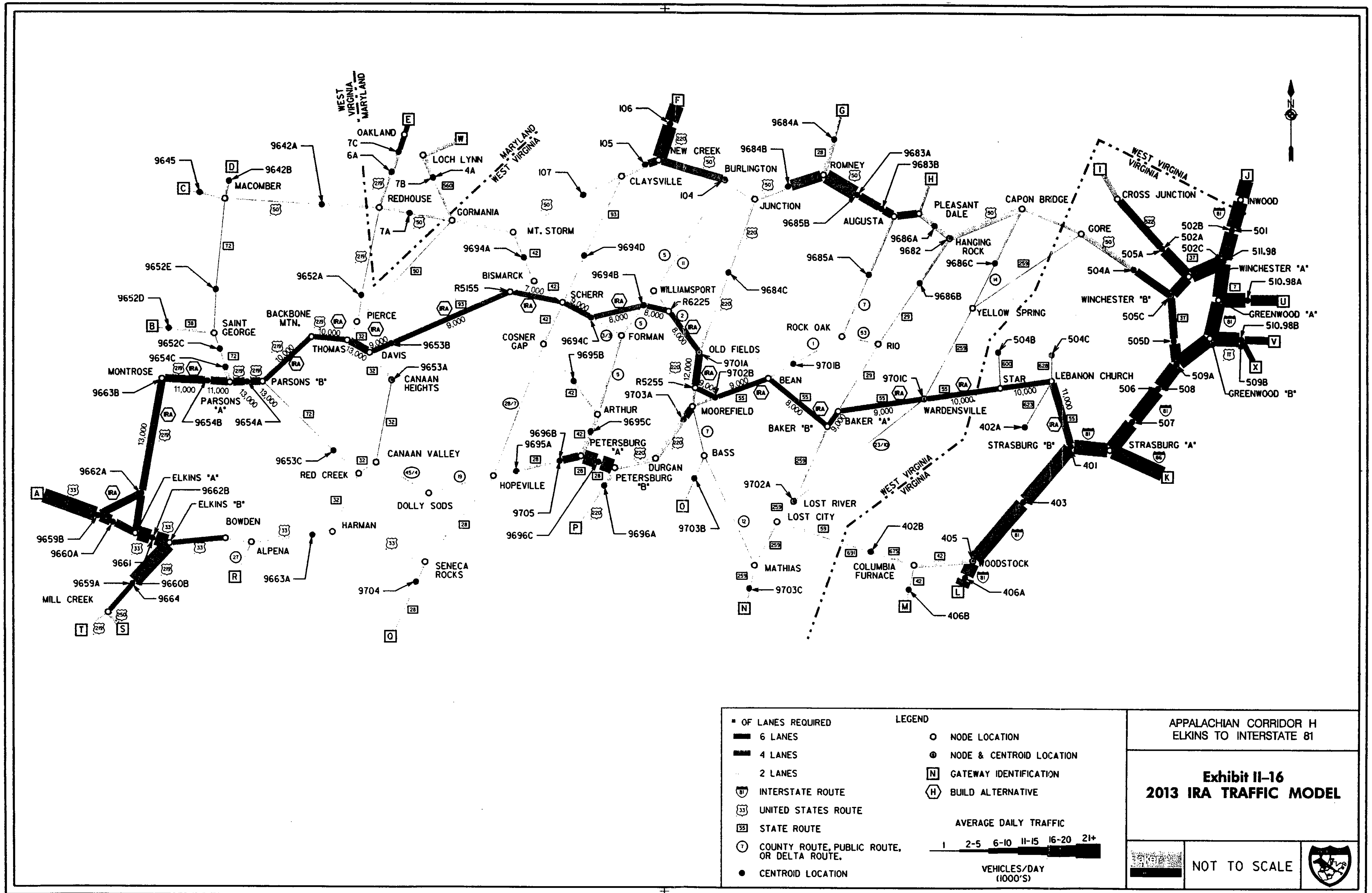


APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81
Exhibit II-15
2013 NO-BUILD ALTERNATIVE
TRAFFIC MODEL
NOT TO SCALE
LEGEND
OF LANES REQUIRED
6 LANES
4 LANES
2 LANES
INTERSTATE ROUTE
UNITED STATES ROUTE
STATE ROUTE
COUNTY ROUTE, PUBLIC ROUTE, OR DELTA ROUTE.
CENTROID LOCATION
NODE LOCATION
NODE & CENTROID LOCATION
GATEWAY IDENTIFICATION
BUILD ALTERNATIVE
AVERAGE DAILY TRAFFIC
1
2-5
6-10
11-15
16-20
21+
VEHICLES/DAY
(1000'S)
WEST VIRGINIA
MARYLAND
VIRGINIA
OAKLAND
LOCH LYNN
REDHOUSE
GORMANIA
MACOMBER
SAINT GEORGE
MONTROSE
PARSONS "A"
PARSONS "B"
BACKBONE MTN.
THOMAS
DAVIS
PIERCE
CANAAN HEIGHTS
CANAAN VALLEY
RED CREEK
DOLLY SODS
HARMAN
SENECA ROCKS
ELKINS "A"
ELKINS "B"
BOWDEN
ALPENA
MILL CREEK
MT. STORM
BISMARCK
SCHERR
COSNER GAP
FORMAN
ARTHUR
HOPEVILLE
PETERSBURG "A"
PETERSBURG "B"
DURGAN
NEW CREEK
CLAYSVILLE
BURLINGTON
WILLIAMSPORT
OLD FIELDS
MOOREFIELD
BASS
JUNCTION
ROMNEY
AUGUSTA
PLEASANT DALE
HANGING ROCK
CAPON BRIDGE
GORE
CROSS JUNCTION
INWOOD
WINCHESTER "A"
WINCHESTER "B"
GREENWOOD "A"
GREENWOOD "B"
YELLOW SPRING
ROCK OAK
RIO
BEAN
BAKER "A"
BAKER "B"
WARDENSVILLE
STAR
LEBANON CHURCH
STRASBURG "A"
STRASBURG "B"
LOST RIVER
LOST CITY
MATHIAS
COLUMBIA FURNACE
WOODSTOCK



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-16
2013 IRA TRAFFIC MODEL

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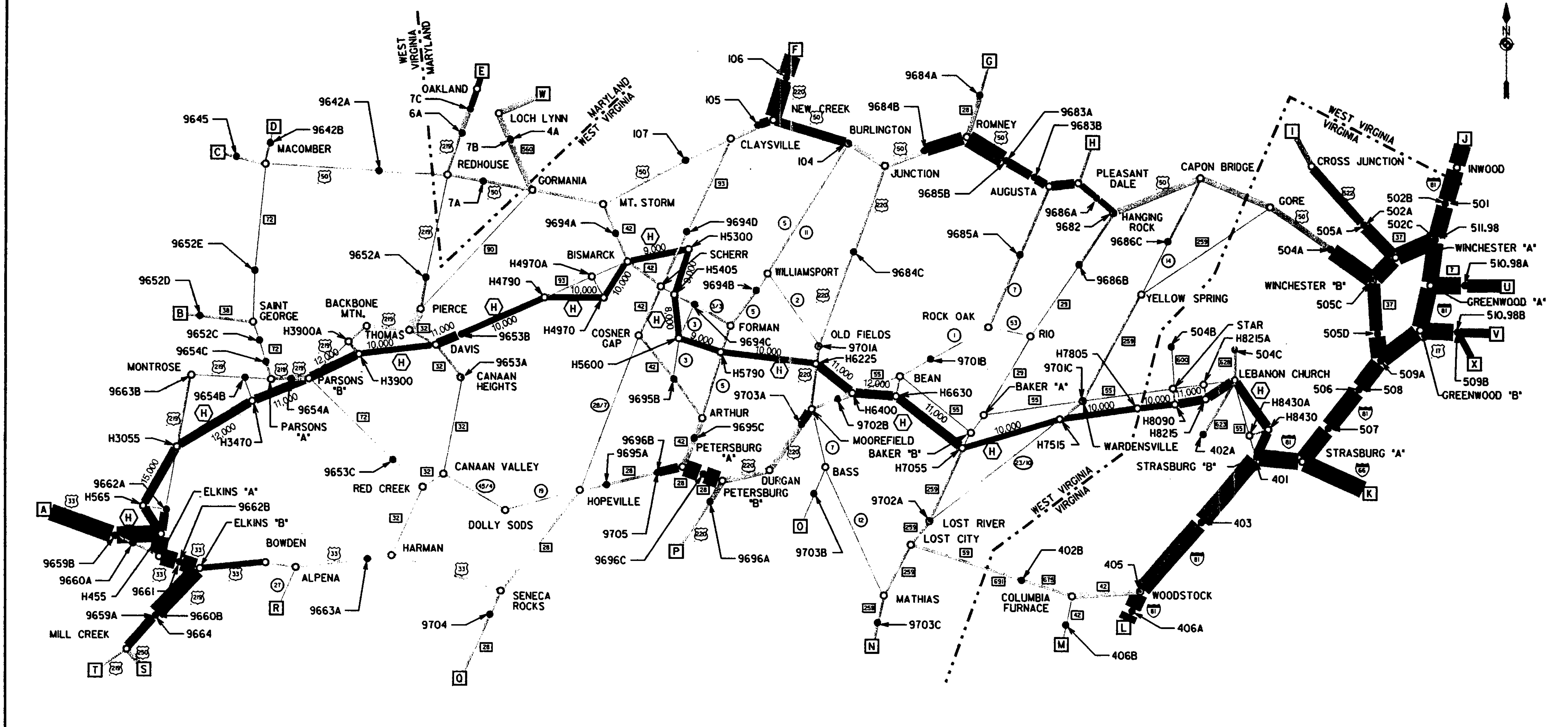

# OF LANES REQUIRED	LEGEND
6 LANES	NODE LOCATION
4 LANES	NODE & CENTROID LOCATION
2 LANES	GATEWAY IDENTIFICATION
INTERSTATE ROUTE	BUILD ALTERNATIVE
UNITED STATES ROUTE	
STATE ROUTE	
COUNTY ROUTE, PUBLIC ROUTE, OR DELTA ROUTE.	
CENTROID LOCATION	

AVERAGE DAILY TRAFFIC

1 | 2-5 | 6-10 | 11-15 | 16-20 | 21+

VEHICLES/DAY (1000'S)

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit II-17
2013 BUILD ALTERNATIVE TRAFFIC MODEL

NOT TO SCALE

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b. Corridor H Connection Analysis

The connections along Corridor H have been identified, and a determination has been made regarding the type of connection required to accommodate the traffic volumes predicted by the model for the design year. Average daily traffic volumes and Turning Movement Volumes (TMVs) were calculated for the design year.

Design criteria for Corridor H dictates that access to the proposed four-lane facility from crossroads be made from at-grade, stop-controlled approaches or from grade-separated interchanges. The Build Alternative is intended to provide a continuous and uninterrupted route for vehicles traveling the mainline. Consequently, signalized intersections along the Build Alternative have not been considered. The criteria used in this analysis to determine the need for grade separations are "signal warrants". Signal warrants test the design year ADTs. Warrant 1 tests the total volume of traffic entering an intersection and Warrant 2 tests the delay experienced on the minor streets (Bleyl, 1987).

The following procedure for determining the crossroad connection requirements was used. If the volumes on the mainline and crossroad did not exceed either warrant, an at-grade connection was considered adequate. If the conflicting traffic volumes at a proposed crossroad connection exceeded the volumes in either warrant, it was assumed that the roadways would require at least a grade-separated crossing with a single, at-grade connector roadway to accommodate the turning movements between the crossroad and the Build Alternative. If the traffic volumes at the intersection of the connector roadway and the Build Alternative met or exceeded either warrant, an interchange was provided at that location.

It is important to note that the above warrants served as a guide in determining the connection requirements. Other factors including the proximity of the connection to a town or developed area, the route designation of the crossroad, the type of terrain and geometry of the connection area, and the distance between interchanges, were also considered in determining the design requirements of the connection. Decision making in borderline cases generally would provide a facility with greater capacity rather than one with less capacity.

c. Vehicle Miles Traveled

The vehicle miles traveled and vehicle hours of travel for vehicles along the roadways of the study area network were calculated for each of the four analysis scenarios. The results are represented in Table II-10.

TABLE II-10
DAILY TRAVEL TIME AND DISTANCES

	TRAVEL TIME	TRAVEL DISTANCES	
SCENARIO	(HOURS)	Kilometers	Miles
1993 Existing	66,863	5,498,000	3,417,000
2013 No-Build	107,713	8,866,900	5,510,800
2013 IRA	120,361	9,919,500	6,165,000
2013 Build	127,715	10,679,400	6,637,300

d. User Benefit Analysis

Using the results of the traffic model, a user benefit analysis of the alternatives was calculated. The procedure was based on the methodology described in AASHTOs 1977 manual, *A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements*.

Traffic forecasts produced by the modeling process include two categories which influence the user benefits associated with each alternative. These categories are: 1) traffic generated by secondary development which is forecast to occur as a result of the Build Alternative; and 2) traffic that diverts to the Build Alternative or Improved Roadway Alternative and is expected to travel completely through the corridor.

To calculate the user benefits that are associated only with the existing users of the system, the additional traffic that is anticipated to be generated from the secondary development was removed from the 2013 Build Alternative network.

The link volumes calculated for the IRA and Build Alternative networks also include motorists attracted to the study area because both alternatives would result in a travel time savings between I-81 and I-79. It is estimated that approximately 5,500 vehicles per day will divert to the Build Alternative in 2013. The IRA is anticipated to attract slightly less at 5,000 vehicles per day in 2013.

User benefits occur when a transportation improvement results in a reduction in total user costs. Existing motorists (Internal Users) would experience a reduction in travel distance and travel time offered by the Build Alternative and the IRA. Travel benefits would also be realized by motorists from outside of the study area (External Users) who use the Build Alternative or the IRA. User Benefits for both the Internal and External Users were calculated.

The resulting user benefits (in 1993 dollars) for the IRA would be $49.5 million in 2013, whereas the user benefits for the Build Alternative would be $62.2 million in 2013. Amortizing these benefits over the design life of the project results in a total User Benefit as a result of a reduction in travel distance and travel time reduction. The total User Benefit would be $449.0 million for the IRA and $571.6 million for the Build Alternative.

3. SAFETY CONSIDERATIONS

a. Access

An access conflict is an accident that involves a vehicle turning onto or off of a side road and a vehicle traveling on the main road. In 1992, almost 20% of all West Virginia accidents were access conflicts and 21% were rear end collisions (Crash Data, p. 8). One of the most probable causes for rear end collisions is that the driver is unaware of an upcoming intersection, according to *The Manual on Identification, Analysis and Correction of High-Accident Location* (Missouri Highway and Transportation Department, second edition, 1990).

Under the Improved Roadway Alternative, the number and frequency of at-grade connections (accesses) cannot be limited or controlled to a minimum number or distance between. A study performed by J. Cirillo et al. showed that, on rural two-lane highways, the rate of accidents per vehicle miles traveled increased as the number of intersections per mile increased. At the time of the 1992 *Corridor H Transportation Needs Study*, the area was experiencing accident rates higher than those calculated in J. Cirillo's study. Another study entitled "Relationships of Rural Highway Geometry to Accident Rates in Louisiana" (O.K. Dart, Jr. and L. Mann Jr.) was referenced in the AASHTO's *A Policy on Geometric Design of Highways and Streets*. The study was sited because it demonstrated the direct relationship to an increase in accident rates with the increase in minor road intersections and principal access driveways per mile.

The Build Alternative would provide fully controlled access with interchanges located at US 219, US 219/WV 72, WV 32, WV 93, County 5, US 220/WV 28, WV 55, WV 259, VA 55, and I-81. Other access connections on the Build Alternative would partially control the access by providing direct at-grade connections with low volume roads and providing connector roads to higher volume roads. Also, all access points would be at least 610 meters (2,000 feet) apart and limited to two per side per 1.6 kilometers (1 mile) for safety reasons.

b. Clear Zones

Clear zone is the unobstructed area provided beyond the edge of the travel way for the recovery of errant vehicles (Green Book, p. 343). The width of this area is relative to the speed of the main road and the slope of the clear zone, but is generally considered to be 30 feet (Green Book, p. 112). In 1992, 25% of all accidents occurring in West Virginia were the result of the vehicle running off the road. The IRA could not always provide the appropriate amount of clear zones due to its proximity to existing potential hazards such as houses, walls, or other obstructions. Unlike the IRA, the Build Alternative would provide clear recovery zones to minimize the damage and hazard that would result from a vehicle leaving the road.

c. Passing Zones

The IRA would provide truck climbing lanes where determined to be warranted by grade and length of grade; however, passing zones would continue to be used in many areas. Even though the design speed would be 80 kph (50 mph), the opportunity to pass would still be limited by sight distance and opposing traffic volumes and could result in head-on collisions. In 1992, 4% of the accidents in West Virginia were head-on collisions (Crash Data, p. 8).

The Build Alternative would provide two lanes in each direction to enable faster vehicles to pass in the inside lane without opposing conflicts and, where warranted by grade and length of grade, truck climbing lanes would be provided for additional passing opportunities.

d. Pedestrian and Bicycle Traffic

Because the IRA would upgrade the existing roads where homes and business are located, pedestrian and bicycle traffic would be unrestricted. Conflicts between these modes of travel would increase with the increase in traffic resulting from the improved roadways. The Build Alternative would be restricted to motorized vehicles on the traveled way. Refer to Section II-B, *Design Criteria,* for discussion of pedestrian and bicycle facilities for this project.

e. Future Roadway Improvements

As illustrated by Exhibits II-15 and II-17, roadways within the 30-minute commute area do not show a need for the addition of traffic lanes to carry future traffic when comparing the 2013 No-Build Alternative to the 2013 Build Alternative. However, there are areas that would need improvements regardless of the alternative chosen. The construction of the Build Alternative would not initiate the need for extensive additional roadway improvements. Improvements at crossroads and connectors to improve the sight distances may be warranted.

4. CAPON SPRINGS

WVDOT was requested to investigate and analyze the potential traffic impacts that the Build Alternative and the Improved Roadway Alternative would have on Capon Springs and Farms. Specific concerns of Capon Springs and Farms relate to the potential for increased travel along County 16 through the resort area by motorists viewing County 16 as a short-cut between VA 55 and WV 259. The recent increase in residential development in Hampshire County is viewed by the resort managers as a contributing factor to these concerns.

Capon Springs and Farms is located along County 16 in Hampshire County, West Virginia, approximately 7 miles northeast of Wardensville. The two travel routes compared in this analysis include VA 55 to WV 55 to WV 259 and VA 609 to County 16 between the intersection of VA 609 and VA 55, southeast of Capon Springs and the intersection of County 16 and WV 259, west of Capon Springs. The VA 55 to WV 55 to WV 259 route is approximately 13 miles long and is posted with a 50 mph speed limit. The roadways along this route are constructed of bituminous concrete and are approximately 20 to 24 feet in width. The County 16 to VA 609 route is approximately 7 miles long and is posted with a 25 mph speed limit near Capon Springs and Farms but is unposted to the east of the resort. WV state law states that prudent speed of 35 mph should be used on unposted gravel roads. However, a field view of this roadway showed that it would be difficult to maintain a speed of 35 mph on County 16 to VA 609, east of the resort. County 16, west of the resort, is a bituminous concrete roadway approximately 16 to 18 feet in width. County 16 to VA 609 east of the resort is an earthen and gravel roadway approximately 12 to 15 feet wide.

While the travel distance along County 16 to VA 609 is approximately 6 miles shorter; the travel time along this route was measured to be nearly the same (one minute longer) than the travel time along VA 55 to WV 55 to WV 259. This demonstrates that there is currently no travel time advantage to utilizing County 16 as a shortcut between VA 55 and WV 259. The mountainous terrain and poor roadway conditions along County 16 and VA 609 east of the resort also indicates that there is no apparent advantage by way of comfort or convenience for traveling along this route as opposed to the VA 55 to WV 55 to WV 259 routing.

A previous study conducted by the WVDOT in December 1992, states that "Total traffic volumes along County Route 16 range from 360 ADT to the resort area to 110 ADT from the resort area to the Virginia State Line. The majority of these trips are assumed to be local trips to and from the Intermont, Yellow Springs and Capon Springs area." The relative magnitude of these volumes is supported by information contained on the West Virginia Traffic Volume Map. This source identifies an ADT of 550 vehicles per day along County 16 between WV 259 and the resort area for the year 1990. Neither the West Virginia Traffic Volume Map nor the Virginia Roadway Inventory identifies an ADT for County 16 to VA 609 east of the resort. Based upon the absence of ADT data, a recent field view of the roadway, and the traffic volumes documented in the December 1992 report, it can be concluded that the eastern segment of County 16 carries a very minimal amount of traffic. The substantial difference between the traffic volumes along County 16 west of the resort area and the traffic volumes along County 16 to VA 609 east of the resort area is an indication that most of the traffic along County 16 to VA 609 is local traffic, specifically destined for the Capon Springs Resort or the environs adjacent to it. This is the same conclusion drawn in the December 1992 report; "the majority of the traffic using County Route 16 is local traffic."

Construction of the Build Alternative or the IRA is not anticipated to alter the local nature of travel along County 16 to VA 609. The Build Alternative does not provide a direct connection with VA 609. Without improvements to County 16 to VA 609, there is no quantifiable reason to expect an increase in travel along this route from through traffic. Further, the Build Alternative would provide a third means of travel from VA 55 to the intersection of WV 259 and County 16. The travel time from Corridor H (Sta 8090) to WV 55 at Sta 7805 to WV 259 to County 16 would be shorter than either of the existing routes, from the same point on VA 55 (Sta 8090). Consequently, all traffic projected in 2013 would be allocated to this route.

I. CONSTRUCTION COSTS

Table II-11 presents a comparison of the preliminary construction cost estimates by alternative and option area. The No-Build Alternative would be the least expensive in that no project-related construction costs would be associated with it. In its entirety, the IRA would cost $415,797,000 with an average cost of $2,015,497 per kilometer ($3,243,346 per mile). Line A of the Build Alternative would cost $1,073,747,000 in its entirety, with an average cost of $5,873,889 per kilometer ($9,443,685) per mile.

Within the Option Areas, Line A would be more costly to construct than the Option Area alignments, with the exception of Line L in Lebanon Church, although in many cases the differential cost is small. Note that the construction cost of Line L does not include the cost of an interchange that would be developed in conjunction with I-81 improvements. Appendix A contains detailed roadway and bridge preliminary construction cost estimates.

J. OTHER COSTS

The total cost of each alternative involves the costs of right-of-way acquisition and mitigation, as well as the construction costs. Table II-12 identifies the right-of-way and mitigation costs associated with each alternative. Total costs by alternative are presented in the Summary (Table S-2).

1. RIGHT-OF-WAY ACQUISITION COSTS

Costs of right-of-way acquisition have been developed in accordance with methods used by the WVDOT and VDOT. For projects of this magnitude, estimates for the acquisition of property are developed on a unit cost basis (per hectare or acre for land; per kilometer or mile for utilities). Costs of residential and industrial/business property acquisition are developed based on the type of displacements and average cost for each property type. In West Virginia, unit costs were obtained from WVDOT. Right-of-way costs in Virginia were estimated and provided by VDOT.

Table II-12 provides a breakdown of right-of-way acquisition costs by alternative. Right-of-way costs estimates were not prepared by Option Area because the differences in land use/land cover and displacements were negligible. Depending on the alternative selected, these figures would be contained in the Final EIS.

2. MITIGATION COSTS

Various mitigation measures were provided in the Summary (Table S-5), and are discussed in the environmental analyses in Section III of this SDEIS. For those mitigation measures that are quantifiable at this time, an estimate of the cost of these measures has been provided by alternative and is included in Table II-12.

TABLE II-11
PRELIMINARY CONSTRUCTION COST ESTIMATES

ALTERNATIVES COMPARISON

ALTERNATIVES COMPARISON		TOTAL LENGTH kilometers	miles	AVERAGE COST PER: kilometer	mile	TOTAL COST*
No-Build Alternative		0.0	0.0	$0	$0	$0
Improved Roadway Alternative (IRA)	West Virginia	183.7	114.2	$2,110,931	$3,395,604	$387,778,000
	Virginia	22.6	14.0	$1,239,779	$2,001,357	$28,019,000
	TOTALS	**206.3**	**128.2**	**$2,015,497**	**$3,243,346**	**$415,797,000**
Build Alternative: Line A	West Virginia	160.8	100.0	$5,915,199	$9,511,640	$951,164,000
	Virginia	22.0	13.7	$5,571,955	$8,947,664	$122,583,000
	TOTALS	**182.8**	**113.7**	**$5,873,889**	**$9,443,685**	**$1,073,747,000**

*Total Costs rounded to the nearest $1000.

OPTION AREA COMPARISON

OPTION AREA COMPARISONS		TOTAL LENGTH kilometers	miles	AVERAGE COST PER: kilometer	mile	TOTAL COST*
Interchange	Line I	2.4	1.5	$6,579,167	$10,526,667	$15,790,000
	Line A	2.4	1.5	$7,310,417	$11,696,667	$17,545,000
Shavers Fork	Line S	4.3	2.7	$3,426,279	$5,456,667	$14,733,000
	Line A	4.2	2.6	$7,885,476	$12,738,077	$33,119,000
Patterson Creek	Line P	6.8	4.2	$6,443,088	$10,431,667	$43,813,000
	Line A	6.5	4.0	$6,847,692	$11,127,500	$44,510,000
Forman	Line F	5.1	3.2	$5,471,765	$8,720,625	$27,906,000
	Line A	5.0	3.1	$8,083,400	$13,037,742	$40,417,000
Baker	Line B	5.3	3.3	$6,679,623	$10,727,879	$35,402,000
	Line A	5.5	3.4	$6,460,364	$10,450,588	$35,532,000
Hanging Rock	Line R	3.4	2.1	$7,900,882	$12,791,905	$26,863,000
	Line A	3.7	2.3	$9,012,973	$14,499,130	$33,348,000
Duck Run	Line D1	9.0	5.6	$6,925,444	$11,130,179	$62,329,000
	Line D2	8.4	5.2	$8,154,405	$13,172,500	$68,497,000
	Line A	8.7	5.4	$8,135,057	$13,106,481	$70,775,000
Lebanon Church	Line L	7.3	4.5	$4,611,370	$7,480,667	$33,663,000
	Line A	8.5	5.3	$3,793,765	$6,084,340	$32,247,000

*Total Costs rounded to the nearest $1000.

TABLE II-12
RIGHT-OF-WAY ACQUISITION
AND MITIGATION COST ESTIMATES

		ALTERNATIVES						
		NO-BUILD	IRA			BUILD - LINE A		
CATEGORY	LINE ITEM		WV	VA	TOTAL	WV	VA	TOTAL
ROW ACQUISITION	Land	$0	$2,896,000	$1,044,000	$3,940,000	$12,798,000	$1,404,000	$14,202,000
	Residences	$0	$6,000,000	$1,846,500	$7,846,500	$5,200,000	$1,045,500	$6,245,500
	Businesses & Poultry Houses	$0	$1,175,000	$30,000	$1,205,000	$1,100,000	$0	$1,100,000
	Utilities and Other Relocations	$0	$8,550,000	$1,830,800	$10,380,800	$3,500,000	$475,500	$3,975,500
	Administrative and Indirect Costs	$0	$5,400,000	$1,154,000	$6,554,000	$3,600,000	$1,009,000	$4,609,000
	TOTAL	***$0***	***$24,021,000***	***$5,905,300***	***$29,926,300***	***$26,198,000***	***$3,934,000***	***$30,132,000***
MITIGATION	Wetland Replacement	$0	$1,200,000	$160,000	$1,360,000	$1,800,000	$160,000	$1,960,000
	Wildlife Refuge Property Acquisition	$0	$0	$0	$0	$1,800,000	$0	$1,800,000
	Habitat Restoration in Stripped ROW Areas	$0	$0	$0	$0	$500,000	$0	$500,000
	Wardensville Wellhead Protection	$0	$0	$0	$0	$1,675,000	$0	$1,675,000
	Groundwater Protection Systems	$0	$150,000	$0	$150,000	$150,000	$0	$150,000
	Bicycle Paths	$0	$500,000	$0	$500,000	$2,550,000	$450,500	$3,000,500
	Scenic Overlooks	$0	$0	$0	$0	$2,500,000	$1,500,000	$4,000,000
	Welcome Centers	$0	$0	$0	$0	$2,000,000	$2,000,000	$4,000,000
	Other Scenic Design Features	$0	$2,000,000	$280,000	$2,280,000	$5,000,000	$700,000	$5,700,000
	Noise Walls	$0	$1,760,000	$0	$1,760,000	$19,392,000	$7,328,000	$26,720,000
	Environmental Monitor @ Construction	$0	$0	$0	$0	$525,000	$75,000	$600,000
	Open Bottom Box Culverts	$0	$30,000	$0	$30,000	$440,000	$0	$440,000
	Stream Channel Enhancement	$0	$0	$0	$0	$1,022,000	$10,000	$1,032,000
	Fisherman's Access	$0	$0	$0	$0	$75,000	$0	$75,000
	Fencing Streams	$0	$0	$0	$0	$300,000	$0	$300,000
	TOTAL	***$0***	***$5,640,000***	***$440,000***	***$6,080,000***	***$39,729,000***	***$12,223,500***	***$51,952,500***

K. ADDITIONAL ANALYSES

The Intermodal Surface Transportation Efficiency Act (ISTEA) states that transportation projects that provide a "significant increase in a single occupancy vehicle (SOV) capacity in air quality nonattainment Transportation Management Areas (TMAs)" must undergo congestion management system (CMS) planning and analyses based on Section 1024 of ISTEA and the FHWA/Federal Transit Administration Interim Guidance for metropolitan planning issued on April 6, 1992. The requirements to conduct a CMS analysis do not apply to this project for the following reasons: the entire Corridor H project area is in attainment for carbon monoxide and ozone and, the project area does not meet the definition of a TMA (an urbanized area with population greater than 200,000).

In addition to the CMS requirements, ISTEA requires that a Major Investment Study (MIS) be performed for all major metropolitan transportation investments. Because there are no Metropolitan Planning Organizations (MPOs) within the project, and not having met the TMA definition, these new requirements are not applicable to Corridor H and, as such, were not carried out in the study efforts.

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SECTION III:
EXISTING ENVIRONMENT AND THE ENVIRONMENTAL IMPACTS

SECTION III: EXISTING ENVIRONMENT AND THE ENVIRONMENTAL IMPACTS

This section combines the description of the existing environment with the discussion of the environmental impacts of the proposed project. The purpose of this format is twofold. First, it serves to eliminate the repetition of information which is common when these sections are separate. Second, in describing the existing conditions of each issue and immediately following with a discussion of the associated impacts, a more comprehensive understanding of the project effects can be obtained. The general format for this section includes a description of the assessment methodology; a description of the existing environment; a discussion of impacts; and a description of measures to avoid, minimize, or mitigate the impacts that would result from project implementation.

Two technical approaches served as the foundation upon which the impact assessment process has been based. These approaches are: the use of a Geographic Information System (GIS) and the assessment of applicable secondary and cumulative impacts on a watershed basis. Because of the importance of these two approaches, brief descriptions are provided below.

- **Geographic Information System**
  Given the size of the project and the level of detail used in the evaluation of each issue, all project-related data were managed through a Geographic Information System (GIS). A GIS was used because of its ability to combine relational database management systems with high-performance computer graphics to manage geographically-referenced data. With geography as a common denominator, a GIS makes it possible to capture and integrate many types of data describing the locations, shapes, relationships, and descriptive facts and figures of objects or features into a single, logical data model. Software tools provided the data management, display, query, analysis, and output tools needed to maintain and understand the geography-based information.

- **Watersheds**
  A watershed approach has been taken to put the impacts of the proposed project in a broader ecological context. Two major river systems are crossed by the proposed project: the Monongahela River and the Potomac River. Each river system is composed of several major watersheds. Within West Virginia, the proposed project crosses five of these major watersheds: the Tygart Valley River and the Cheat River of the Monongahela River System; and the North Branch and South Branch of the Potomac River and the Cacapon River of the Potomac River System. Within Virginia, the proposed project crosses the Shenandoah River watershed of the Potomac River System. These major watersheds have been

subdivided into smaller subwatersheds that immediately "surround" the proposed project. In this fashion, direct impacts can be evaluated based on their effects to "local project watersheds" and secondary and cumulative impacts can be addressed in terms of the "regional project watersheds." A detailed definition, discussion, and presentation of all watersheds are included in Section III-M: Watershed Overview.

- **Secondary Impacts**

  Secondary impacts are defined as "those that are caused by an action and are later in time or farther removed in distance. . ." from the construction of the proposed project (Bank, 1992). To refine and present more easily the results of secondary impact analyses, the impacts are typically discussed in the following two categories, defined for this project.

  1. Those impacts that are related to the construction, operation, and maintenance of the proposed facility. This would be considered highway-related secondary impacts (sometimes called indirect impacts) and would include such impacts as stormwater runoff.
  2. Those impacts that are related to development that occur as the result of the highway. This would be considered development-related secondary impacts, such as the possible relocation of a perennial stream associated with the construction of an industrial park.

- **Cumulative Impacts**

  Cumulative impacts "result from the incremental consequences of an action when added to other past and reasonably foreseeable future actions . . . and are less defined than secondary effects" (Bank, 1992). To refine and present more easily the results of cumulative impact analyses, the impacts are typically discussed in the three categories below, also defined for this project.

  1. The sum of all direct impacts to a given resource, such as the total of all stream relocations within a watershed.
  2. The sum of direct and secondary impacts to a given resource, such as the total of direct and secondary impacts to streams in a watershed.
  3. The sum of all direct and secondary impacts to a given resource due to the proposed action, *plus* the potential impacts of reasonably foreseeable future Federal actions, such as the construction of the proposed highway, in addition to the construction of the Moorefield Floodwall project.

The cumulative impacts of the project with the following five foreseeable future Federal actions have been identified and evaluated in this study: the Moorefield Floodwall Project, Stony Run Dam, Canaan Valley Wildlife Refuge, the Monongahela National Forest Management Plan, and the George Washington National Forest Management Plan. For descriptions of these Federal actions, refer to Summary-B: *Other Major Government Actions*.

A. ECONOMIC ENVIRONMENT

Economic development is a primary factor of the need for the proposed project. This section covers the existing economic environment for the counties and communities through which the proposed project would pass. A summary of the economic environment for surrounding counties is also provided because these areas would also potentially experience positive economic impacts.

Direct economic impacts are addressed for the Improved Roadway and Build Alternatives relative not only to the economic impacts of relocated businesses, but also to the temporary jobs that would be created due to construction of the proposed project.

A rigorous assessment of induced development and corresponding secondary economic impacts has been conducted and is discussed in detail in the *Secondary and Cumulative Impacts Technical Report*. The results of this analysis are provided below.

1. EXISTING ENVIRONMENT

Economic information and statistical data were used to establish baseline economic conditions. Principal sources for this data included the US Bureau of Economic Analysis; the US Bureau of the Census; the West Virginia University, College of Business and Economics; the West Virginia Division of Employment Security; the Virginia Employment Commission; various economic planning and development authorities serving the area; and various other sources, such as transportation research studies and economic development studies. The economic development studies used include:

- Appalachian Maryland Development Plan, 1993
- Economic Adjustment Strategy for Grant County
- Economic Adjustment Strategy for Hampshire County, 1990
- Frederick County Comprehensive Plan 1990
- Region 7 Development Plan, 1991-1993
- Region 8 Development Plan, Fiscal Year 1991
- Shenandoah County Comprehensive Plan: 2010, 1991
- Tucker County Comprehensive Plan, 1992
- Draft Hardy County Comprehensive Plan, 1994

The economic analysis focused on three main areas important to the economy: population, employment, and income. The analysis of population, employment, and income examines West Virginia communities relative to the state of West Virginia, Virginia communities relative to the state of Virginia, and comparisons between the respective communities of West Virginia and Virginia. In preparing the employment analysis, information on all industrial classifications was prepared using Standard Industrial Classifications (SIC). Most of these categories are self explanatory. However, for this project it is important to note that the poultry industry falls into the manufacturing classification, timber falls into the agriculture classification, and tourism falls into the service classification.

Data and a summary discussion of Randolph, Tucker, Grant, and Hardy Counties in West Virginia and Frederick and Shenandoah Counties in Virginia is presented below. Data is also presented for Barbour, Mineral, Hampshire, and Preston counties in West Virginia and Garrett County in Maryland.

a. Randolph County

Figure III-1 presents the economic statistics for Randolph County. Statistics on population and employment were analyzed for the county and for the two communities within five miles of the alternatives; Elkins and Montrose.

Figure III-1 provides the employment statistics by economic sector for Randolph County, Elkins, and Montrose. For Randolph County, the economic sectors of agriculture; mining; manufacturing; finance, insurance and real-estate industries (FIRE); and public administration all decreased substantially from 1980 to 1990. Increases occurred in the construction, transportation, and services sectors. Elkins had decreases in all sectors of the economy, with the greatest occurring in agriculture. Montrose had such a small employment base that the increase and decrease of individual sectors offset each other.

Randolph County has lost both people and jobs from 1980 to 1990. The losses were even greater for the community of Elkins, which lost one out of every five employees. In terms of the impact of such losses, decreases in population and employment illustrate a corresponding decrease in the tax base in Randolph County at a time when the unemployment rate is over 10%.

b. Tucker County

Economic data on Tucker County and several specific incorporated municipalities within the county were prepared. The specific communities included: Davis, Hambleton, Hendricks, Parsons, and Thomas. The population and economic statistics for Tucker County are presented in Figure III-2.

FIGURE III-1
RANDOLPH COUNTY STATISTICS

JURISDICTION	1980 POPULATION	1990 POPULATION	PERCENT CHANGE	1980 EMPLOYMENT	1990 EMPLOYMENT	PERCENT CHANGE
Randolph County	28,734	27,803	-3%	11,861	9,861	-17%
Elkins	8,536	7,420	-13%	3,607	2,774	-23%
Montrose	129	140	9%	39	44	13%

JURISDICTION	1990 UNEMPLOYMENT	1990 % BELOW POVERTY	1990 PER CAPITA INCOME
Randolph County	13%	22%	$7,343
Elkins	12%	21%	$9,669
Montrose	24%	31%	$6,846

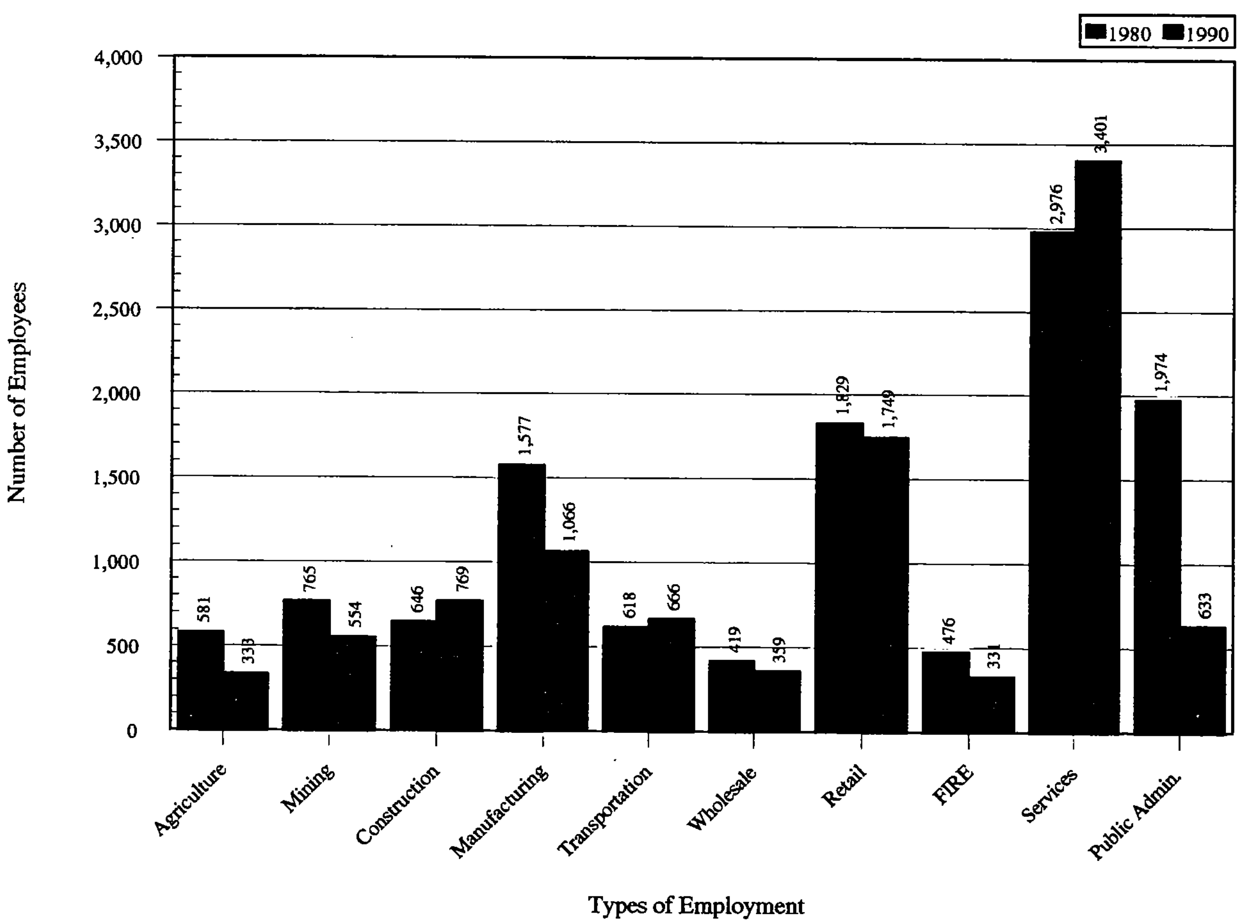
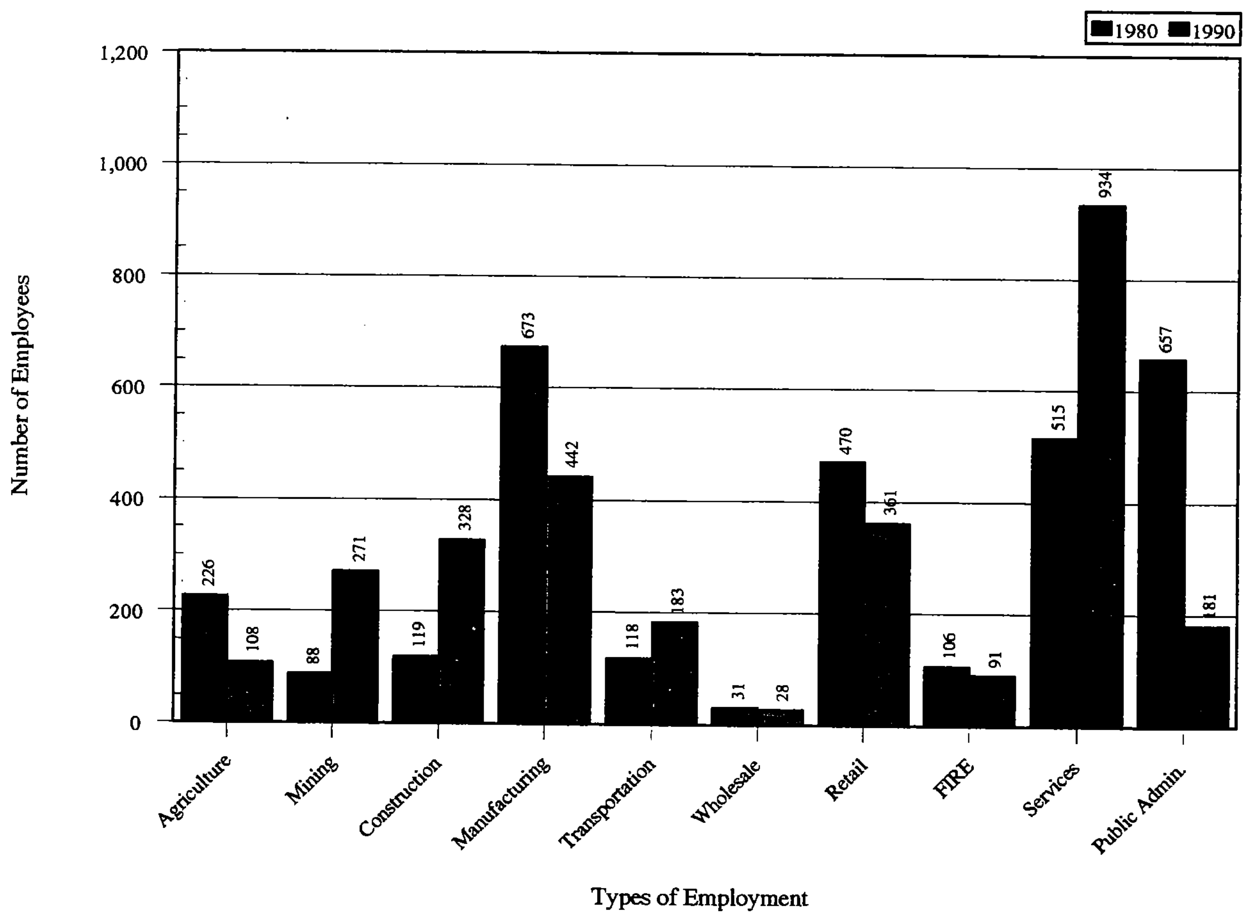


FIGURE III-2
TUCKER COUNTY STATISTICS

JURISDICTION	1980 POPULATION	1990 POPULATION	PERCENT CHANGE	1980 EMPLOYMENT	1990 EMPLOYMENT	PERCENT CHANGE
Tucker County	8,675	7,728	-11%	3,003	2,927	-3%
Davis	979	796	-19%	328	269	-18%
Hambleton	403	268	-33%	122	75	-39%
Hendricks	390	313	-20%	133	104	-22%
Parsons	1,937	1,440	-26%	764	589	-23%
Thomas	747	576	-23%	282	223	-21%

JURISDICTION	1990 UNEMPLOYMENT	1990 % BELOW POVERTY	1990 PER CAPITA INCOME
Tucker County	8.7%	17%	$8,978
Davis	12%	20%	$9,113
Hambleton	14%	20%	$6,059
Hendricks	11%	30%	$7,353
Parsons	8%	55%	$9,063
Thomas	6%	8%	$10,524



The employment statistics for the incorporated municipalities illustrate that the decline is greater in these communities than in Tucker County overall. Tucker County only decreased in employment by 3% and all of the incorporated municipalities within five miles of the proposed alignments had employment declines of over 18%. Growth and development is not continuing in areas where infrastructure is already in place in Tucker County. The lack of additional infrastructure has been identified as a development constraint in the comprehensive plan for Tucker County (Tucker, 1992).

Figure III-2 also shows the employment by sector for Tucker County. From 1980 to 1990, the greatest decline in employment was in the public administration and the agricultural sectors of the economy. Decreases also occurred in manufacturing, wholesale trade, retail trade, and FIRE. The greatest increase (208%) was in the mining sector. Employment in the service sector increased 81% over the decade and construction increased 176%. This trend in increased construction employment is consistent with the development of vacation homes in the Canaan Valley area of Tucker County (Tucker, 1992). Within the municipalities analyzed, the data show a reliance on service jobs as the primary source of employment. This finding is consistent with the development of Tucker County as a tourism destination due to the abundance of parks located in the county. In all municipalities, employment in agriculture decreased by at least 75%.

c. Grant County

The economic statistics for Grant County and Bayard are presented in Figure III-3. The data show different trends in the county as population remained stable from 1980 to 1990 with a 2% increase; however, employment experienced a 20% decrease. Bayard lost 23% in population and gained 9% in employment. The effects of these shifts are limited due to the small population and employment in Bayard.

Figure III-3 shows the rapid development of Grant County. This rapid growth is the result of the increase in the second home market in the eastern portions of the 30-Minute Contour. Shifts in employment by industry that occurred in Grant County support this assertion, as construction jobs increased by 49%. Other industries that increased were manufacturing (75%), retail trade (10%), FIRE (42%), and services (131%). The increases in service and retail jobs in Grant County were consistent with national trends, but were also a function of the increase in residents moving into the county. In Grant County, the industries that had decreases in employment between 1980 and 1990 included agriculture, mining, transportation, and utilities.

d. Hardy County

Figure III-4 presents data for Hardy County, Moorefield, and Wardensville. Hardy County increased in population by 9% from 1980 to 1990, whereas population losses were experienced in Moorefield (5%) and Wardensville (50%). These losses were from a very small population base. Hardy County experienced an increase in employment (7%), whereas Moorefield remained relatively stable with a small reduction (2%) and Wardensville experienced a considerable reduction (43%).

Employment by industry showed increases in Hardy County for almost all categories. Only agriculture and public administration decreased between 1980 to 1990. An important component of the economy in Hardy County is the poultry industry, with employment increases occurring in Moorefield where Wampler Longacre and Hester Industries are based, the largest employers in the county. The increase in the poultry industry is represented by the 18% increase in manufacturing jobs in Hardy County and a 13% increase in Moorefield. Other substantial increases in employment occurred in the construction sector, transportation and utilities sector, and the services sector.

e. Frederick County

The proposed Corridor H alternatives would not directly effect any of the incorporated municipalities in Frederick County, and would only impact a small section of the southwest quadrant of the county. However, since the eastern logical terminus of the proposed facility is close to Winchester, statistics for this incorporated municipality have been included in Figure III-5.

Population in Frederick County and Winchester increased by 34% and 9% respectively. Frederick County lost about 20% in employment, but that was offset by a 22% increase in Winchester. The decrease mainly resulted from a loss of almost 2,000 jobs in agriculture and public administration employment in the county. The strongest increases were in construction. From 1980 to 1990, with the exception of the manufacturing sector, Winchester did not experience declines in employment in any industry. The greatest increase in employment was in construction, FIRE, and retail trade.

f. Shenandoah County

Figure III-6 shows the economic data gathered for Shenandoah County and Strasburg, just east of the project's eastern terminus. Shenandoah County and Strasburg both experienced population growth from 1980 to 1990. Shenandoah County gained 15% in population and 22% in employment and Strasburg gained 63% in population and 84% in employment. The 1990 unemployment rates were very low: Shenandoah County was under 4% and Strasburg was 5%. Per capita incomes for both were over $11,000.

FIGURE III-3
GRANT COUNTY STATISTICS

JURISDICTION	1980 POPULATION	1990 POPULATION	PERCENT CHANGE	1980 EMPLOYMENT	1990 EMPLOYMENT	PERCENT CHANGE
Grant County	10,210	10,428	2%	5,594	4,486	-20%
Bayard	540	414	-23%	161	175	9%

JURISDICTION	1990 UNEMPLOYMENT	1990 % BELOW POVERTY	1990 PER CAPITA INCOME
Grant County	6%	15%	$10,394
Bayard	9%	10%	$10,675

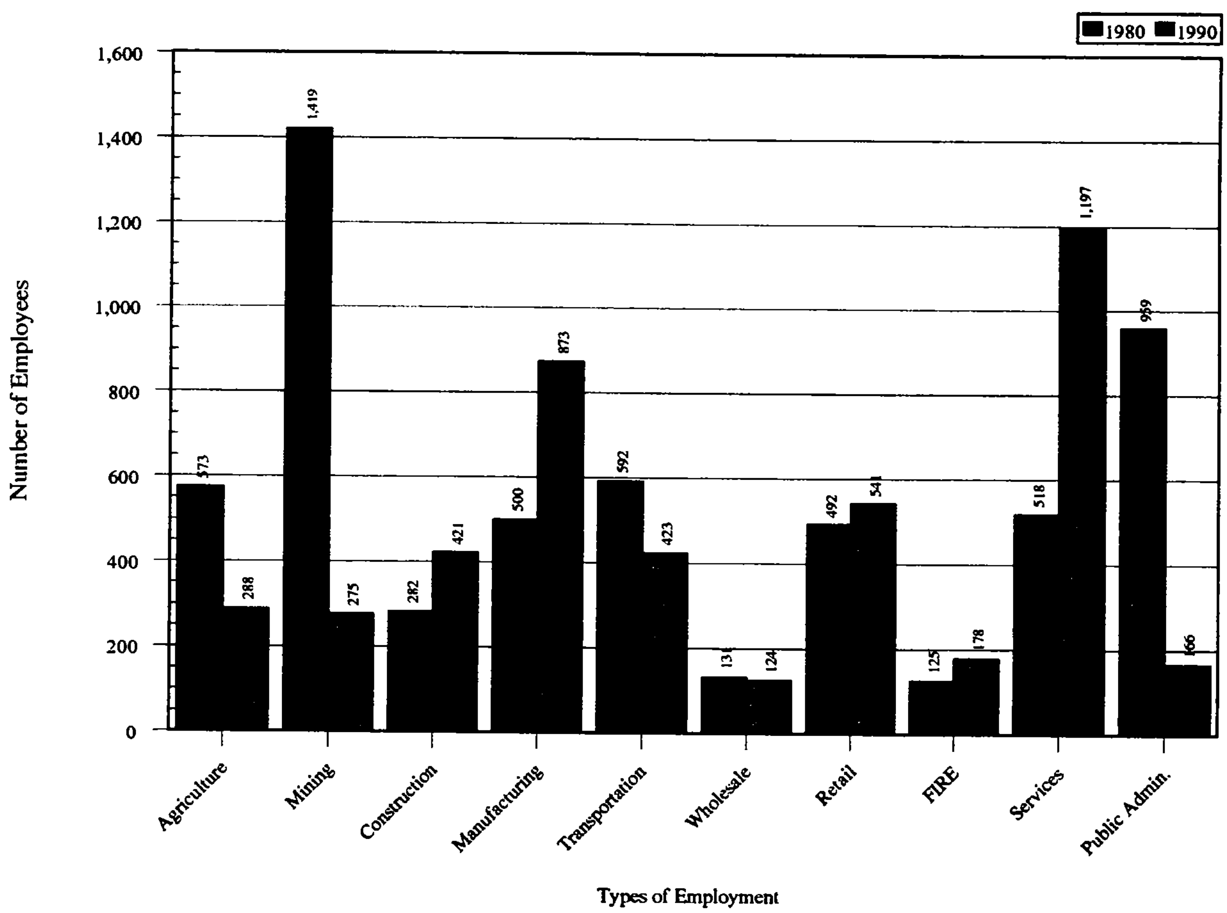


FIGURE III-4
HARDY COUNTY STATISTICS

JURISDICTION	1980 POPULATION	1990 POPULATION	PERCENT CHANGE	1980 EMPLOYMENT	1990 EMPLOYMENT	PERCENT CHANGE
Hardy County	10,030	10,977	9%	4,526	4,861	7%
Moorefield	2,257	2,148	-5%	1,019	999	-2%
Wardensville	241	121	-50%	70	40	-43%

JURISDICTION	1990 UNEMPLOYMENT	1990 % BELOW POVERTY	1990 PER CAPITA INCOME
Hardy County	5%	15%	$10,696
Moorefield	5%	19%	$11,780
Wardensville	9%	26%	$8,455

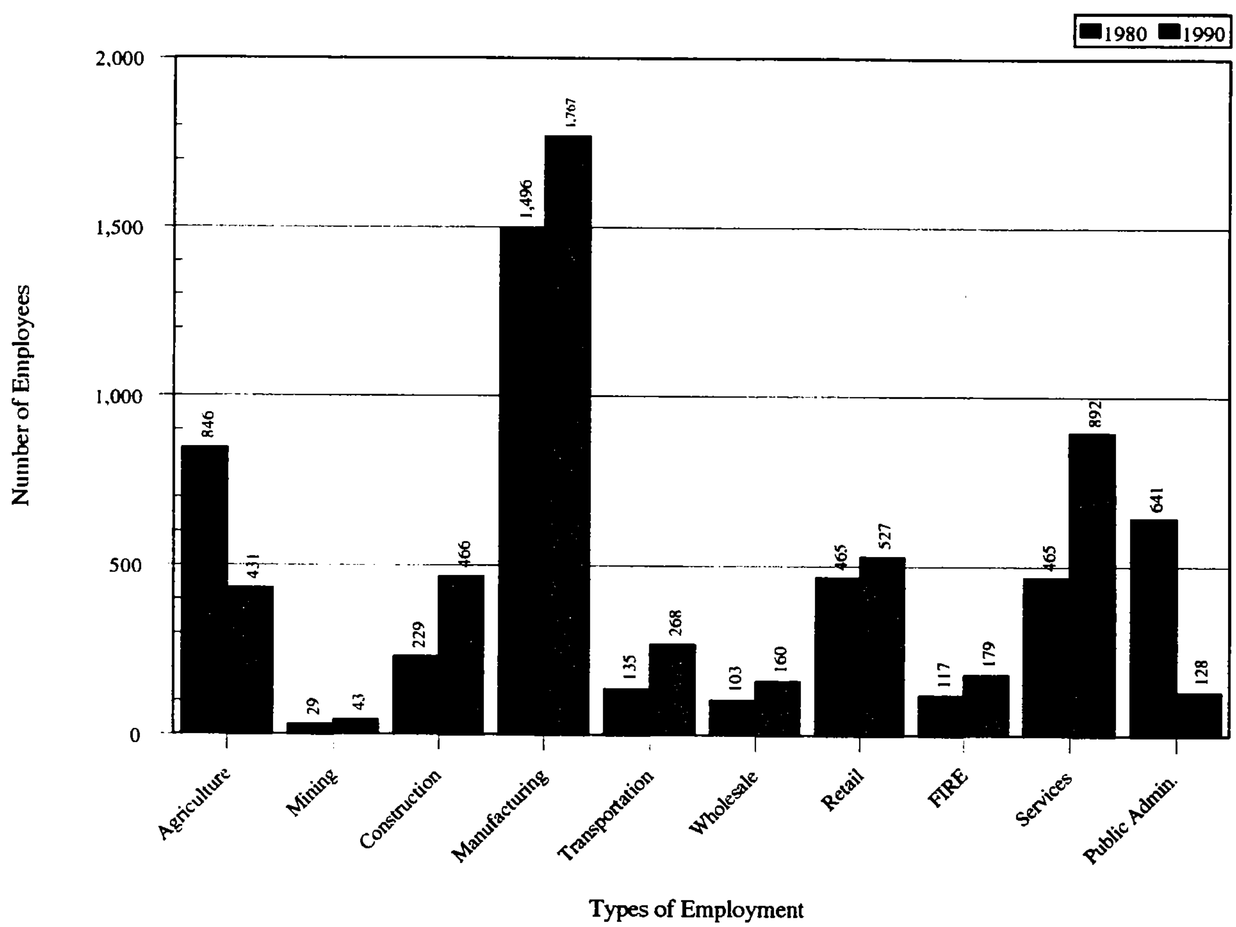


FIGURE III-5
FREDERICK COUNTY STATISTICS

JURISDICTION	1980 POPULATION	1990 POPULATION	PERCENT CHANGE	1980 EMPLOYMENT	1990 EMPLOYMENT	PERCENT CHANGE
Frederick County	34,150	45,723	34%	29,950	43,056	44%
Winchester	20,217	21,947	9%	9,326	11,399	22%

JURISDICTION	1990 UNEMPLOYMENT	1990 % BELOW POVERTY	1990 PER CAPITA INCOME
Frederick County	4.3%	7%	$13,671
Winchester	5%	11%	$14,214

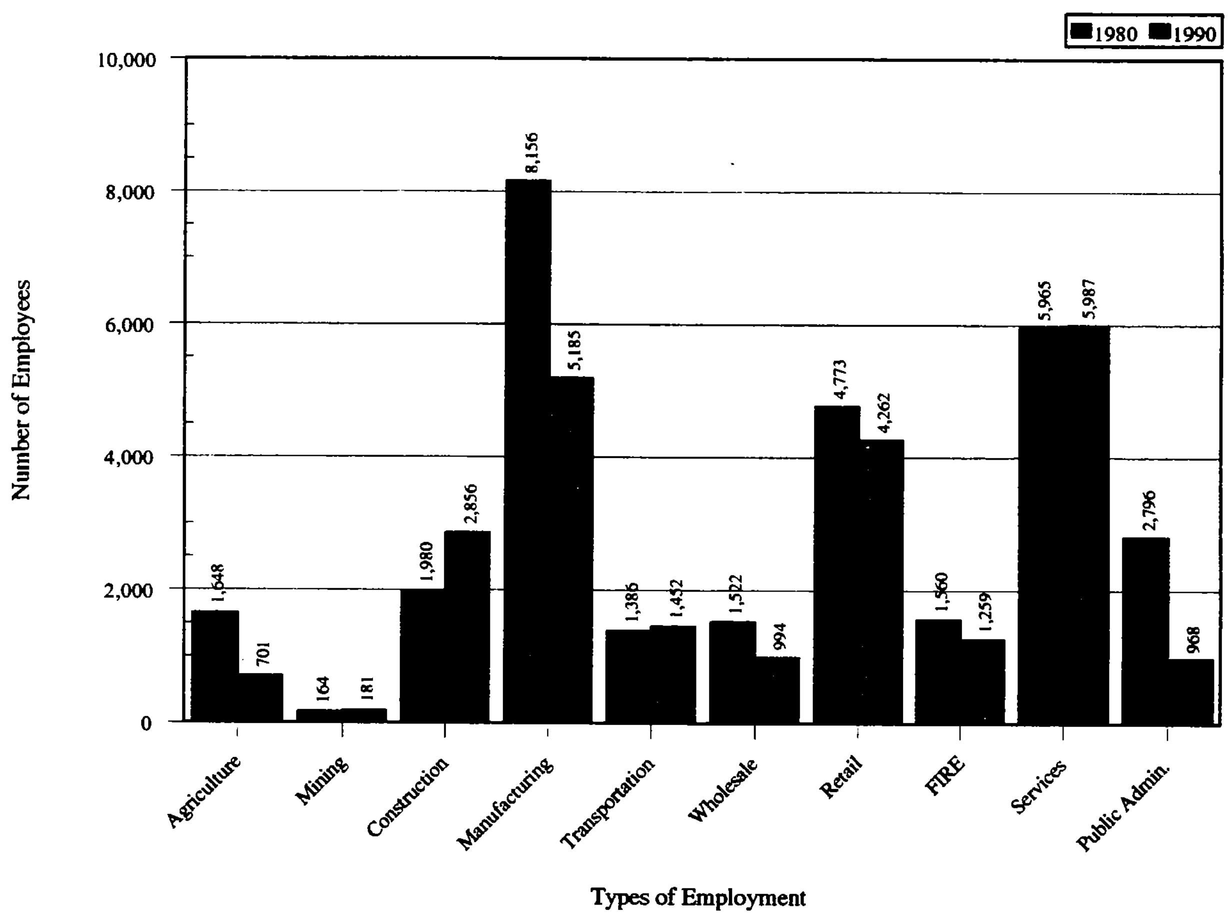
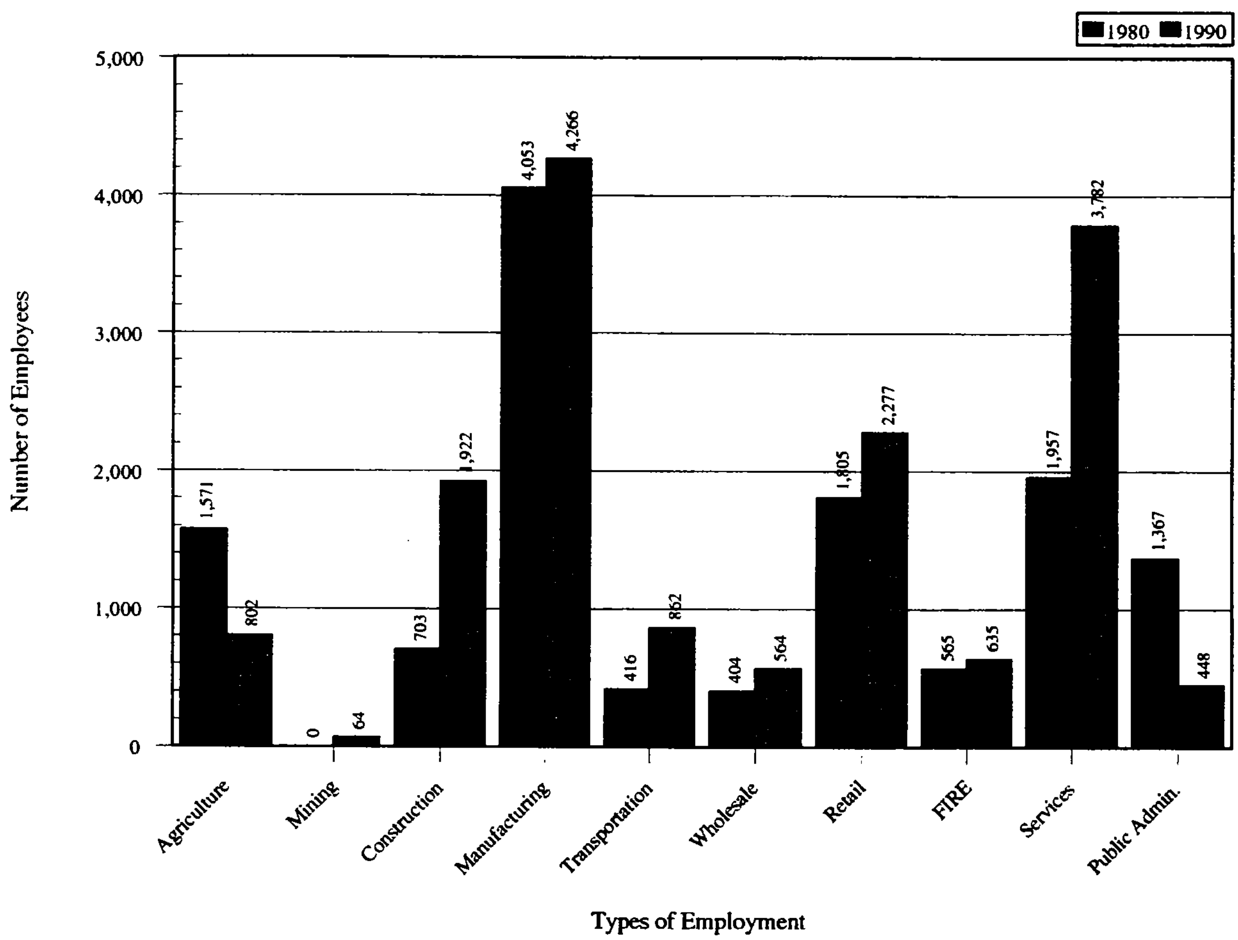


FIGURE III-6
SHENANDOAH COUNTY STATISTICS

JURISDICTION	1980 POPULATION	1990 POPULATION	PERCENT CHANGE	1980 EMPLOYMENT	1990 EMPLOYMENT	PERCENT CHANGE
Shenandoah County	27,559	31,636	15%	12,575	15,622	24%
Strasburg	2,311	3,762	63%	994	1,824	84%

JURISDICTION	1990 UNEMPLOYMENT	1990 % BELOW POVERTY	1990 PER CAPITA INCOME
Shenandoah County	3.8%	11%	$12,686
Strasburg	5%	14%	$11,286



The data on employment by industry shows that growth occurred in all sectors of the economy except for agriculture and public administration. Shenandoah County had strong increases in construction, services, FIRE, transportation, and utilities. During the decade, Strasburg became more of an activity center with an employment growth of over 100% in construction, retail trade, FIRE, and public administration. The rapid increase in employment in most sectors of the economy indicates a clustering of jobs and services in the municipalities.

g. Summary of the Economic Environment

Tables III-1 through III-4 summarize the population, employment, and income statistics for all counties analyzed. For comparison purposes, data on state totals for West Virginia and Virginia are also provided.

(1) Population

The population trends vary widely from 1980 to 1990 within the West Virginia portion of the project (Table III-1). Hampshire and Hardy Counties experienced a population growth of about 10% while Tucker County suffered an 11% population loss over the same time frame. Between 1980 and 1990, these three West Virginia counties lost fewer than 1% of their population (about 1,600 persons) compared to a total state population of 8%. In Virginia, both Frederick and Shenandoah Counties experienced population growth (15% and 34%, respectively). The combined population growth of Frederick and Shenandoah Counties is much higher than the growth experienced by the West Virginia Counties, as well as 16% higher than Virginia's overall population growth rate.

The data indicate trends in population growth within the study area. First, the population growth that occurred in the past decade is not evenly dispersed. Thus, some counties (Hardy, Frederick, and Shenandoah) grew while others declined (Tucker and Randolph). The growth that did occur was not in the established small communities within close proximity of the alternatives.

(2) Employment

The county statistics in Tables III-2 and III-3 demonstrate that there is diversity in employment trends and that overall employment section changes have occurred in the counties analyzed. Over the decade, the fringe counties (Hampshire, Mineral, and Preston) had employment gains compared to employment decreases experienced by all West Virginia counties (in particular those directly along the alignments). The greatest decrease was experienced in Grant County where 20% of the jobs were lost. The rapid growth in employment on the fringes of the study area caused the West Virginia county employment total to increase by 6%. Employment growth in the Virginia counties (38%) was higher than the overall employment growth rate for Virginia (34%).

TABLE III-1
POPULATION STATISTICS FOR COUNTIES ANALYZED

COUNTY	1980 POPULATION	1990 POPULATION	PERCENT CHANGE
Barbour, WV	16,700	15,699	-6%
Hardy, WV	10,030	10,977	9%
Hampshire, WV	14,867	16,498	11%
Grant, WV	10,210	10,428	2%
Tucker, WV	8,675	7,728	-11%
Randolph, WV	28,300	27,803	-2%
Mineral, WV	27,234	26,697	-2%
Preston, WV	30,460	29,037	-5%
WV Study Area Total	**146,476**	**144,867**	**-1%**
State of West Virginia	**1,949,644**	**1,793,477**	**-8%**
Shenandoah, VA	27,559	31,636	15%
Frederick, VA	34,150	45,723	34%
VA Study Area Total	**61,709**	**77,359**	**25%**
Virginia	**5,346,818**	**6,187,358**	**16%**
Garrett, MD	26,490	28,138	6%

Sources: Center For Economic Research, WVU (1993), and US. Census Bureau 1990 Census

TABLE III-2
EMPLOYMENT STATISTICS FOR COUNTIES ANALYZED

COUNTY	1980 EMPLOYMENT	1990 EMPLOYMENT	PERCENT CHANGE
Barbour, WV	5,939	5,170	-13%
Hardy, WV	4,526	4,861	7%
Hampshire, WV	4,937	6,536	32%
Grant, WV	5,594	4,486	-20%
Tucker, WV	3,003	2,927	-3%
Randolph, WV	11,861	9,861	-17%
Mineral, WV	7,732	10,987	42%
Preston, WV	8,813	10,525	19%
WV Study Area Total	**52,405**	**55,353**	**6%**
West Virginia	**716,000**	**671,085**	**-6%**
Shenandoah, VA	12,575	15,622	24%
Frederick, VA	29,950	43,056	44%
VA Study Area Total	**42,525**	**58,678**	**38%**
Virginia	**2,788,796**	**3,727,549**	**34%**
Garrett, MD	10,104	11,748	16%

Sources: Center For Economic Research, WVU (1993), US. County Business Patterns, and Virginia Employment Commission

TABLE III-3
EMPLOYMENT BY SECTOR

COUNTY	YEAR	EMPLOYMENT BY SECTOR (FULL AND PART TIME)									
		Agriculture	Mining	Construction	Manufacturing	Transportation	Wholesale	Retail	FIRE	Services	Public Admin.
Barbour, WV	1980	640	1732	242	251	133	112	604	169	1158	894
	1990	569	385	143	206	187	90	744	206	1807	774
		-11%	**-78%**	**-41%**	**-18%**	**41%**	**-20%**	**23%**	**22%**	**56%**	**-13%**
Hardy, WV	1980	846	29	229	1496	135	103	465	117	465	641
	1990	710	9	242	2165	164	113	566	189	652	579
		-16%	**-69%**	**6%**	**45%**	**21%**	**10%**	**22%**	**62%**	**40%**	**-10%**
Hampshire, WV	1980	1112	16	239	745	267	163	485	167	702	1041
	1990	907	26	360	523	294	132	704	225	1003	1456
		-18%	**63%**	**51%**	**-30%**	**10%**	**-19%**	**45%**	**35%**	**43%**	**40%**
Grant, WV	1980	573	1419	282	500	592	131	492	125	518	959
	1990	490	1039	998	728	423	151	655	208	855	969
		-14%	**-27%**	**254%**	**46%**	**-29%**	**15%**	**33%**	**66%**	**65%**	**1%**
Tucker, WV	1980	226	88	119	673	118	31	470	106	515	657
	1990	203	73	249	585	195	43	438	146	926	579
		-10%	**-17%**	**109%**	**-13%**	**65%**	**39%**	**-7%**	**38%**	**80%**	**-12%**
Randolph, WV	1980	581	765	646	1577	618	419	1829	476	2976	1974
	1990	580	384	794	1257	626	479	2143	577	3337	1982
		-0%	**-50%**	**23%**	**-20%**	**1%**	**14%**	**17%**	**21%**	**12%**	**0%**
Mineral, WV	1980	408	96	763	1945	411	186	1139	242	1173	1365
	1990	361	154	651	1801	615	261	1430	332	1610	1592
		-12%	**60%**	**-15%**	**-7%**	**50%**	**40%**	**26%**	**37%**	**37%**	**17%**
Preston, WV	1980	1066	1037	357	1140	721	233	1106	345	925	1883
	1990	849	848	462	818	916	256	1344	423	1659	1745
		-20%	**-18%**	**29%**	**-28%**	**27%**	**10%**	**22%**	**23%**	**79%**	**-7%**
West Virginia	**1980**	**28,177**	**67,602**	**46,117**	**122,006**	**46,992**	**33,728**	**120,129**	**37,195**	**140,162**	**136,033**
	1990	**27,396**	**37,152**	**39,644**	**90,825**	**42,670**	**31,984**	**140,578**	**38,780**	**184,371**	**136,782**
		-3%	**-45%**	**-14%**	**-26%**	**-9%**	**-5%**	**17%**	**4%**	**32%**	**1%**
Shenandoah, VA	1980	1571	0	703	4053	416	404	1805	565	1957	1367
	1990	1272	14	1188	5457	644	474	2335	859	3278	1564
		-19%	**n/a**	**69%**	**35%**	**55%**	**17%**	**29%**	**52%**	**68%**	**14%**
Frederick, VA	1980	1648	164	1980	8156	1386	1522	4773	1560	5965	2796
& Winchester	1990	1295	180	3512	9186	1620	2553	8786	2227	9699	3998
		-21%	**10%**	**77%**	**13%**	**17%**	**68%**	**84%**	**43%**	**63%**	**43%**
Virginia	**1980**	**101,692**	**24,730**	**161,049**	**421,733**	**127,377**	**110,471**	**400,588**	**202,890**	**563,480**	**674,786**
	1990	**92,009**	**17,327**	**246,275**	**436,831**	**168,487**	**139,728**	**597,755**	**280,745**	**968,178**	**780,214**
		-10%	**-30%**	**53%**	**4%**	**32%**	**26%**	**49%**	**38%**	**72%**	**16%**

Source: West Virginia University, Bureau of Economic Analysis, Virginia Employment Commission

TABLE III-4
UNEMPLOYMENT AND INCOME STATISTICS FOR COUNTIES ANALYZED

COUNTY	1990 UNEMPLOYMENT	1990% BELOW POVERTY	1990 PER CAPITA INCOME
Barbour, WV	13%	29%	8,036
Hardy, WV	5%	15%	10,696
Hampshire, WV	8%	18%	9,996
Grant, WV	6%	15%	10,394
Tucker, WV	9%	17%	8,974
Randolph, WV	13%	22%	9,009
Mineral, WV	7%	15%	10,398
Preston, WV	10%	19%	9,158
WV Study Area Average	**8%**	**19%**	**9,583**
West Virginia	**10%**	**20%**	**10,520**
Shenandoah, VA	4%	11%	12,686
Frederick, VA	4%	7%	13,671
VA Study Area Average	**4%**	**9%**	**13,179**
Virginia	**4%**	**10%**	**15,713**
Garrett, MD	7%	15%	10,124

Sources: US Census Bureau 1990 Census

In general, the bulk of employment within each county is concentrated in the manufacturing, retail, and services sectors. A number of the West Virginia communities continue to rely on the natural resource sectors of agriculture, forestry & fisheries, and the mining sectors. All West Virginia counties analyzed showed increases in services and retail. The totals for West Virginia show decreases in most economic sectors, especially for the mining industry which declined by 45%. These decreases were, in some sense, offset by the increasing rate of employment in retail and services. However, service and retail jobs do not have wage levels nearly as high as the jobs that they have replaced. In Virginia, all sectors of the economy experienced growth with the exception of agriculture and mining. The decrease in agricultural employment is considerable, since both counties had overall employment increases of over 20%.

There has been a movement in the economic base of the study area away from goods-producing activities such as agriculture, mining, and manufacturing (in some counties), to a heavier reliance on service and retail jobs. This trend is true throughout the study area in West Virginia and Virginia.

(3) Income

Table III-4 shows 1990 unemployment rates, percent of population below the US poverty level, and per capita incomes for the counties analyzed. Double digit unemployment was experienced in Barbour, Randolph, and Preston Counties in the western portion of the study area. In 1990, the West Virginia counties analyzed had an overall unemployment rate of 8.3%, which was slightly lower than that of West Virginia (9.6%). Within the West Virginia counties studied, the lowest unemployment rates were in Grant and Hardy Counties. In Virginia the unemployment rates for Frederick and Shenandoah Counties were below the state average for 1990.

The percent of the population with incomes below the US poverty level in the West Virginia counties analyzed ranges from 29% in Barbour County to 15% in Hardy, Mineral, and Grant Counties. Randolph County is experiencing the second highest percentage (22%) of its population below the poverty level. In Frederick and Shenandoah Counties, the percentage of the population below the poverty level are 7% and 11%, respectively. Shenandoah County is at a higher percentage than the Commonwealth of Virginia (9%). Overall poverty levels in the counties analyzed are higher in West Virginia (19%) than in Virginia (9%).

The average per capita income ($9,583) in the analyzed West Virginia counties was below the overall West Virginia per capita income ($10,520), with the exception of Hardy County, which was slightly higher. In Virginia, Frederick and Shenandoah Counties also had lower per capita incomes than the entire state. However, the Virginia counties' per capita income is nearly $3,600 higher than per capita incomes of neighboring counties in West Virginia.

Table III-4 shows that although unemployment and the percentage of the population below the poverty level in 1990 in the West Virginia counties are slightly lower than West Virginia, the per capita incomes are lower. Although there are less people overall that are without jobs as compared to the state, the jobs that do exist pay less than the average for the state. The data also shows that the counties in West Virginia are consistently worse economically than the counties in Virginia. All of the counties in the West Virginia section of the project have higher rates of unemployment, higher percentages of persons living below the poverty level, and lower per capita incomes than the Virginia counties.

2. DIRECT ECONOMIC IMPACTS

a. No-Build Alternative

There would be no direct economic impacts associated with the No-Build Alternative. However, there would be economic effects of this alternative in that the downward trends in population, employment, and income in some counties would continue.

b. Improved Roadway Alternative

The direct impacts that would result from the IRA would be the impacts to those businesses displaced or impacted by its construction. The proposed plans show that there are eleven (11) businesses directly displaced. This number of displacements would not likely have long-term consequences on the economy.

Other direct economic impacts would occur during the construction period. Construction impacts would include an increase in employment due to the use of local labor and the impacts of construction on business traffic in the construction zone. Research shows that for every million dollars spent on construction, there are 9.75 on-site jobs and 12.7 off-site jobs created (TRB, 1985). At a preliminary cost of approximately $416 million for the IRA, there could be 9,300 jobs created. However, at the same time there could be economic impacts to those businesses located along the IRA that might not be accessible during the construction period. Research shows that business sales drop between 4% and 12% during the construction period for upgrading an existing highway facility, based on projects across the United States (Buffington, 1990). A drop in business sales could be expected in the municipalities impacted by the IRA such as Montrose, Moorefield, Petersburg, and Wardensville.

c. Build Alternative

The Build Alternative would impact either 3 or 4 businesses, depending on the alignment selected. None of these businesses are major employers. Therefore, no direct adverse economic impacts on the local economy would be expected due to loss of jobs or relocation of businesses.

Economic impacts resulting from construction activities would involve an increase in employment due to the use of local labor, and the impact on business traffic in the construction zone. The economic impacts of the Build Alternative would include the 9.75 on-site jobs and 12.7 off-site jobs per million dollars spent on construction. At an estimated cost of approximately $1,075 million for the Build Alternative, there would be 10,500 on-site jobs and 13,650 off-site jobs. In addition, there would be minimal adverse traffic impacts during the construction phase of the Build Alternative because construction would generally not be conducted on the existing highway system.

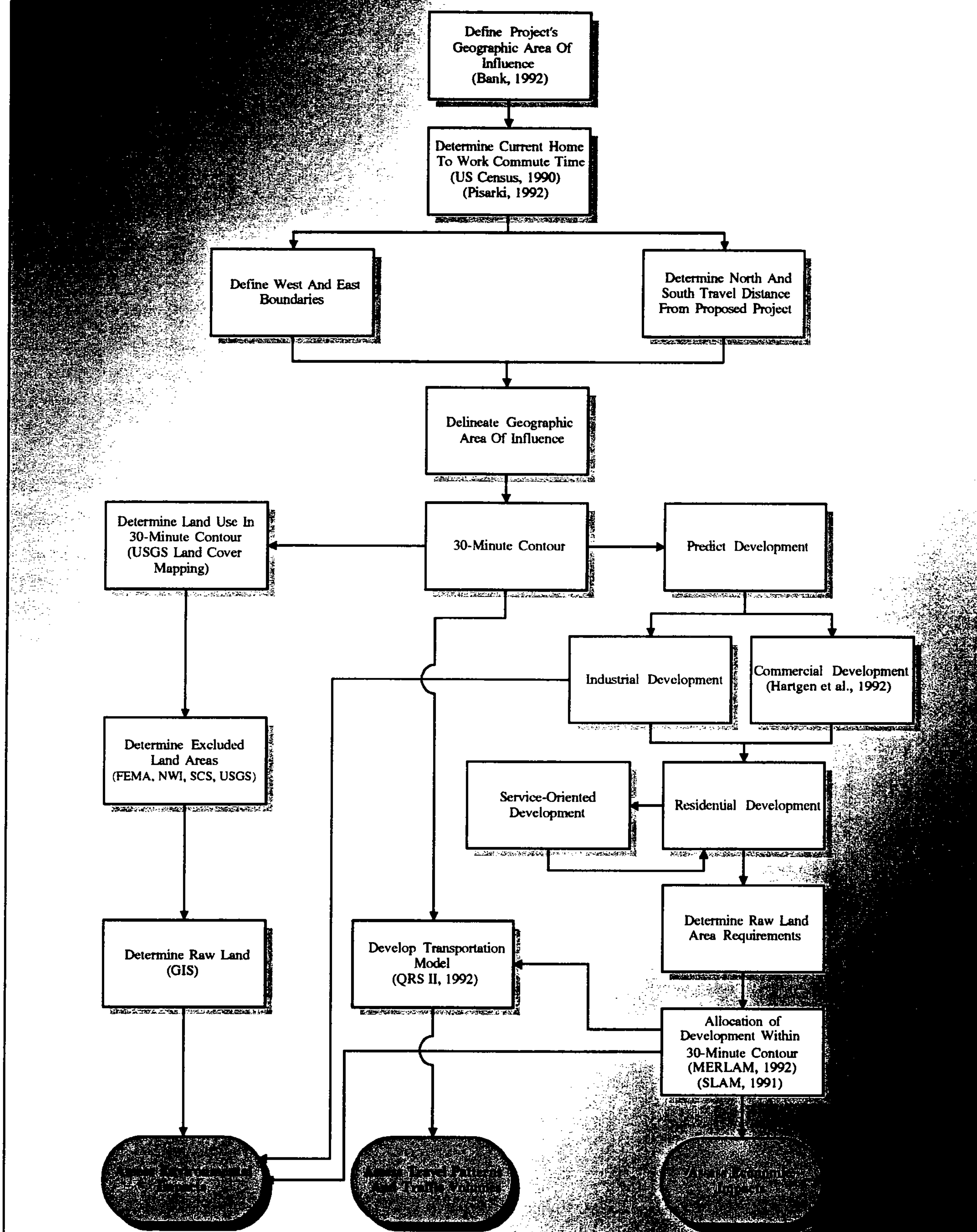
3. INDUCED DEVELOPMENT IMPACTS: BUILD ALTERNATIVE

a. Methodology

Economic development that could be induced by the proposed project has been divided into three types: industrial, commercial, and service-oriented. Industrial development is analyzed with respect to industrial parks based on reasonable projections. Commercial development is predicted by various models for growth at interchanges or intersections of new rural highways. Based on job growth predictions, an estimate was made of new residential development required. This is followed by growth in the service areas to support residential needs.

The process used to predict development for the Build Alternative is presented in Exhibit III-1. The aggregate of all models and processes included in the flow chart is termed collectively as the Corridor H Development Model, designed for this project. The development predictions that follow apply to the Build Alternative, regardless of the particular alignment selected. The process begins with the determination of an area of influence for the project, in accordance with guidance provided in FHWA's position paper entitled, "Secondary and Cumulative Impact Assessment in the Highway Development Process" (Bank, 1992). The area of influence is defined as the area within which the proposed project would affect development patterns or alter travel behavior. This area was determined by analyzing commute times in the project area and calculating the distance and location from the proposed project for a 30-minute commute. Data taken from the 1990 US Census for West Virginia indicates that currently 90% of all commute trips within the Corridor H census area require no more than 30 minutes. By plotting all 30-minute trips along existing roadways and connecting these points, a "commute contour" was defined in this study as the 30-Minute Contour. The area within this contour represents the area of influence for this study. Exhibit III-2 presents the 30-Minute Contour.

Exhibit III-1
Corridor H Development Model



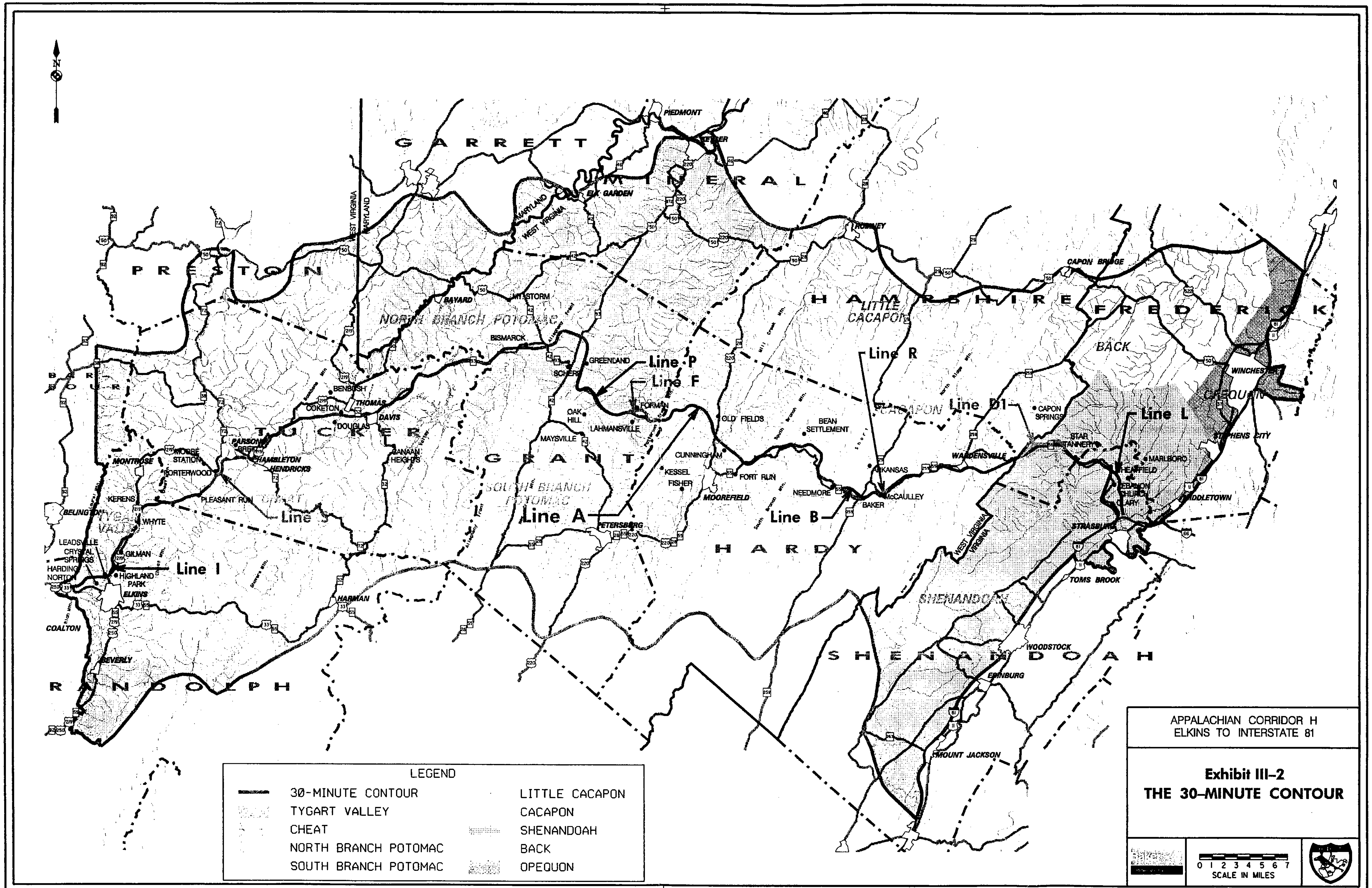


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Exhibit III-2
THE 30-MINUTE CONTOUR

The 30-Minute Contour encompasses an area of over 7,000 sq. km. (2,800 square miles). This area includes all or part of the following counties: Barbour, Randolph, Tucker, Preston, Grant, Hardy, Mineral, and Hampshire in West Virginia; Frederick and Shenandoah in Virginia; and Garrett in Maryland. The 30-Minute Contour spans large parts of six watersheds defined as regional project watersheds (See Section III-M: *Watersheds*), as well as portions of the Back Creek and Opequon Creek watersheds in Virginia. In accordance with Bank (1992), the 30-Minute Contour also forms the limits of the transportation model. That is, all principal through highways located within the 30-Minute Contour and noted on official state maps were included in the highway network. A complete discussion of the transportation model and results are included in Section II.

b. Development Predictions

A complete discussion of the methodology and results of the development projections is contained in the *Secondary and Cumulative Impacts Technical Report.* The following is a summary of the procedures and the results for each development type.

(1) Industrial Development

Industrial development was assumed to take place at existing industrial parks or those that are planned. As shown in Exhibit III-3, thirteen (13) industrial parks were identified within the 30-Minute Contour, occupying a total land area of 753 hectares (1,860 acres). Currently, the aggregate occupancy rate is 36% providing work for over 6,000 employees. The current level of development of each industrial park was identified and a calculation of current employees per built-out hectare (acre) was made.

Build-out scenarios were discussed with regional and local planners to confirm the reasonableness of the assumptions. A build-out scenario based on a 100% occupancy rate or full build-out of each industrial park was assumed by the year 2013. Employee projections were made by extrapolating to the full build-out scenario. The results show that approximately 10,000 additional jobs would be generated by the year 2013. Table III-5 provides the existing and future jobs by industrial park and state.

The growth in industrial parks would be expected to be related to existing businesses and industries in the area. Data from economic development plans show continued expansion of the following industries: poultry, agriculture, timber, and back-office production. Back-office production includes business, accounting and auditing firms, and branch offices of larger corporations.

The poultry industry is expected to remain one of the main components of growth in the Corridor H area. This industry is one of the primary employers in the counties analyzed, with the following major facilities located in Moorefield and Baker: Wampler-Longacre, Hester Industries, and Perdue.

Interviews and discussions with Wampler, Hester, and Perdue indicated that the addition of the four-lane Build Alternative would benefit their operations. Officials at Wampler indicated that the facility would increase the safety and efficiency of transporting products from the Moorefield plant (Price, 1994). At this time, however, no expansions have been announced by these businesses due to the construction of Corridor H.

Agriculture in Hardy, Frederick, and Shenandoah Counties is projected to remain strong and includes products such as rabbits, apples, and fish-farming (aqua-culture). Growth in aqua-culture is also expected in Tucker County (Bonner, 1994).

The timber industry may grow as a result of the Build Alternative. Existing lumber and wood products industries are involved in the cutting and processing of timber into chips, poles, pilings, lumber, and processed wood products such as paneling. The primary market for these products is the construction sector. Growth is projected for this industry well into the future (Wise, 1992). The following plans include timber as part of their future economic expansions and marketing:

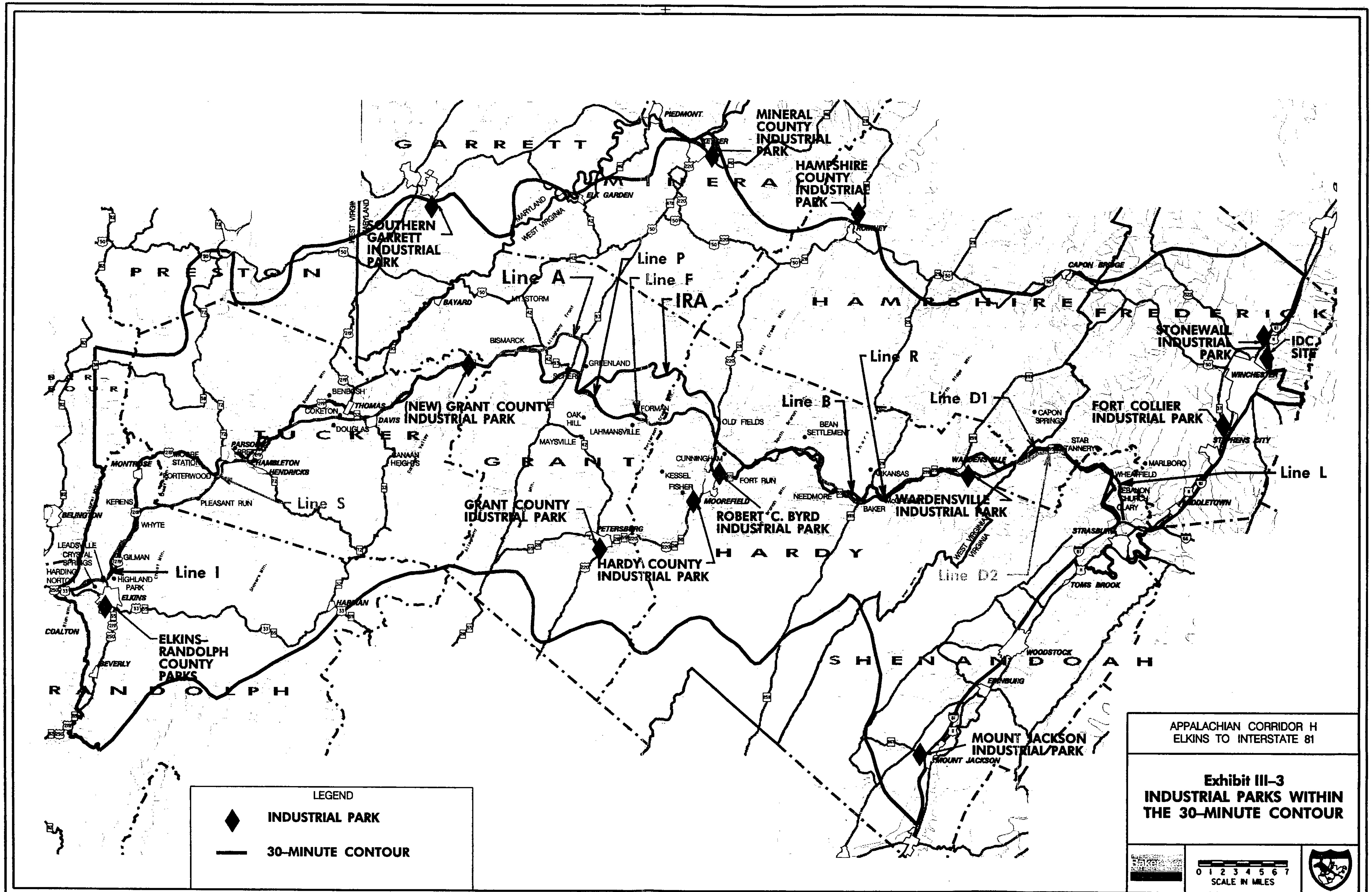
- Tucker County Comprehensive Plan
- Regional Development Plan, Region 8
- Regional Development Plan, Region 7
- Economic Adjustment Strategy for Hampshire County.

The economic plans of Tucker County, Regions 7 and 8, Hampshire County, and Frederick County target growth in such services as back-office operations, accounting, and auditing. A portion of this growth is expected to occur in the industrial parks.

(2) Commercial Development

To predict commercial development around intersections and interchanges, a model (Hartgen et al., 1992) was employed that was developed to predict such growth on sections of Interstate 40 (I-40) in rural North Carolina. This model predicts the level of development, if any, that could occur in an area surrounding intersections and interchanges of new, rural multi-lane highways and is based on the following variables:

- volume of traffic on the existing cross route;
- visibility of the land surrounding the proposed intersection;
- distances to nearby communities or other intersections; and
- availability or potential availability of infrastructure such as water and sewer services.



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-3
INDUSTRIAL PARKS WITHIN THE 30-MINUTE CONTOUR

TABLE III-5
EMPLOYMENT BY INDUSTRIAL PARK

NAME	EXISTING EMPLOYEES	ADDITIONAL EMPLOYEES
Grant County Industrial Park	275	675
Hampshire County Industrial Park	100	312
Hardy County Industrial Park	714	42
Wardensville Industrial Park	12	194
Mineral County Industrial Park	600	253
Elkins-Randolph County Parks	65	338
Robert C. Byrd Industrial Park	0	599
(New) Grant County Industrial Park	0	1,435
Southern Garrett Industrial Park*	1,022	422
WV TOTAL	***2,788***	***4,270***
Mount Jackson Industrial Park	437	1,072
Stonewall Industrial Park	1,600	2,954
IDC Site	0	338
Fort Collier Industrial Park	1,390	1,435
VA TOTAL	***3,427***	***5,799***
GRAND TOTAL	***6,215***	***10,069***

* Garrett County has been included in the West Virginia totals.

The model was employed for all intersections and interchanges proposed for the Build Alternative. Thirteen were predicted to undergo development. Employment projections at each intersection were calculated using the average employment rates at similar businesses (e.g., gas stations, motels, restaurants). These employment rates were provided by the University of West Virginia's Regional Research Center. The total growth in employment due to predicted intersection and interchange commercial development would be approximately 1,250. This job growth would be in the form of services geared almost entirely to tourism and recreation in the Corridor H area. The potential of linking the many recreation areas (discussed in Section III-J: Recreation Resources) by a four-lane facility represents access to new markets. The above job growth predictions focus on commercial enterprises at intersections and interchanges.

The positive economic impact of the proposed highway on the ski industry cannot be overlooked. A four-lane highway would expand the market area served by the existing ski facilities, making them more competitive with facilities in other parts of West Virginia and neighboring states. Officials at ski facilities in the Corridor H area did not have specific projections on potential growth of their businesses and corresponding new job potential, so that such growth would be in addition to the 1,250 commercial jobs predicted above.

The economic benefits of Corridor H in terms of a scenic byway were also studied. The *1990 Scenic Byways Study* describes the aesthetic values associated with byways as: vegetation such as forests and shrub land, agricultural patterns, panoramas, rock outcrops, and water bodies such as lakes, rivers, and wetlands (FHWA, 1990). These are all characteristics of Corridor H, regardless of the alternative selected. However, since most scenic byways are new or newly designated, exact figures on the economic impacts are not yet available. Further, future job growth and sales and wage tax benefits would vary across the project, depending on the scenic and historic potential of a specific area. These types of initiatives must be advanced by local parties and guided by local and regional plans.

(3) Residential and Service-Oriented Development

Residential and service-oriented development occur as the result of job growth in the industrial sector. Based on data obtained from the US Census Bureau, as many as 15,637 new homes could be required due to this growth. Service-oriented development includes banking facilities, doctors' offices, real estate offices, and other professional services that offer support to people.

A combination of two predictive models (discussed in the *Secondary and Cumulative Impacts Technical Report*) was used to predict the types and numbers of service-oriented facilities that could develop. Based on West Virginia figures for the average employment within such facilities, approximately 6,500 jobs could be created by the predicted service-oriented development.

(4) Total Job Growth

A summary of the job growth results are provided by county in Table III-6.

c. Land Use Allocation

In order to predict land areas that could be developed for residential and service uses, it was necessary to make a determination of the total land area that is feasible and practicable to develop. The GIS was utilized to overlay several layers of geographic data within the 30-Minute Contour and queried to identify tracts of land that were free of the following features:

- 100-year floodplains
- slopes greater than 25%
- wetlands
- existing development
- public parks, other public facilities, or National Forests.

The resulting areas were designated as *raw land* (Lapping, 1992) available for development, and are shown in Exhibit III-4. The total raw land area is approximately 212,300 hectares (525,000 acres). Through GIS queries, the existing land cover of the raw land areas was determined to be 67% forested and 33% agricultural. Further models were employed to locate the residential development by census tract or Block Numbering Area (BNA). The GIS was then used to categorize these locations by watershed for ecological impact assessment.

4. INDUCED DEVELOPMENT IMPACTS: IRA

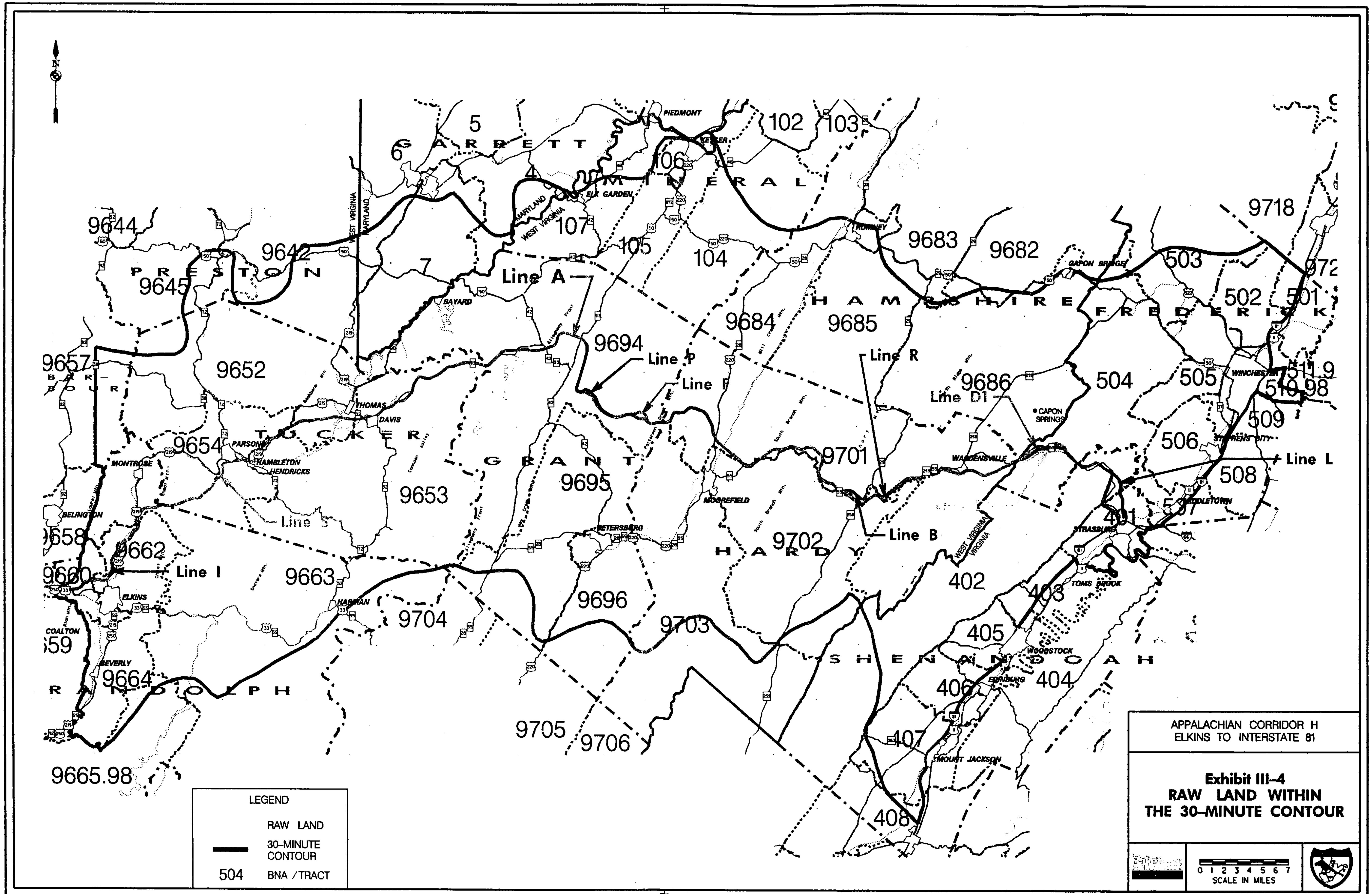
a. Industrial Development

Recent research indicates that limited growth could be expected due to the construction of the Improved Roadway Alternative, as a result of some improved access to areas surrounding the corridor. A research study conducted in Indiana compared economic growth that occurred following construction of new multi-lane facilities to new two-lane facilities (Lombard, 1992). The study analyzed economic growth in both urban and rural counties throughout the state over a 10-year period (1980 to 1990).

TABLE III-6
TOTAL PREDICTED JOB GROWTH: BUILD ALTERNATIVE

County	Industrial	Commercial	Service-Oriented	County/State Totals
Garrett, MD*	422	0	297	719
Hardy	835	116	247	1,198
Hampshire	312	0	69	381
Grant	2,110	0	1,369	3,479
Tucker	0	301	158	459
Randolph	338	567	541	1,446
Mineral	253	0	165	418
WV Total	***4,270***	***984***	***2,846***	***8,100***
Frederick	4,727	0	3,080	7,807
Shenandoah	1,072	273	571	1,916
VA Total	***5,799***	***273***	***3,651***	***9,723***
Grand Total	***10,069***	***1,257***	***6,497***	***17,823***

* Garrett County has been included in the West Virginia totals.



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-4
RAW LAND WITHIN THE 30-MINUTE CONTOUR

In all cases, in the Indiana study, the economic development that occurred following the addition of new two-lane facilities was a fraction of the development that occurred following the construction of new multi-lane facilities. In the case of total employment, the growth estimate associated with a new two-lane road was one-sixth that of the growth associated with a new multi-lane facility. Because the IRA involves improvements to an existing two-lane road, rather than a new two-lane road, it is reasonable to predict that less than one-sixth of the Build Alternative growth could be induced by the IRA. Several calculations were made based on one-sixth to one-tenth of the 10,069 jobs projected for the Build Alternative. The results range from 1,678 to 1,007 jobs. These figures were compared to recent growth trends and found to be lower or comparable. Therefore, no additional industrial jobs are predicted based on the construction of the IRA.

b. Commercial Development

Commercial development in the form of restaurants and service stations would reasonably occur due to the construction of the IRA. The jobs associated with this development fall into the tourism category discussed for the Build Alternative, and would be predicted at nearly the same level, approximately 1,250. Included in this total would be the jobs created due to the possible re-opening of presently closed service stations and restaurants along the IRA. The summary of job growth by county is presented in Table III-7.

c. Residential Development

The increase in commercial development alone would not be expected to induce additional residential development. The 1,250 jobs predicted are assumed to be taken by existing unemployed residents. Further, jobs associated with tourism are not of a wage level that would induce movement of people into the area. The average weekly wage of such a job is $200 less than that of an industrial job (Virginia Employment Commission, 1993).

5. SECONDARY ECONOMIC IMPACTS

The predicted earnings potential due to job growth for the Build Alternative and the IRA is presented by county in Table III-8. To determine the economic impact of predicted development, projections were made relative to real estate and income tax gains and losses. The real estate tax gains and losses were determined using the average tax rate assessed for each land cover type. Income taxes were calculated by assuming an average wage rate for employees in industrial, commercial, and service-oriented businesses within the 30-Minute Contour. These rates were then applied to the employment increases for each type of employment to determine income tax gains. Predicted tax losses and gains for the Build and Improved Roadway Alternatives are presented in Table III-9.

TABLE III-7
TOTAL PREDICTED JOB GROWTH: IRA

County	Commercial
Randolph	567
Tucker	301
Hardy	116
WV Total	***984***
Shenandoah	273
VA Total	***273***
Grand Total	***1,257***

TABLE III-6 (Repeated for Comparison)
TOTAL PREDICTED JOB GROWTH: BUILD ALTERNATIVE

County	Industrial	Commercial	Service-Oriented	County/State Totals
Garrett, MD*	422	0	297	719
Hardy	835	116	247	1,198
Hampshire	312	0	69	381
Grant	2,110	0	1,369	3,479
Tucker	0	301	158	459
Randolph	338	567	541	1,446
Mineral	253	0	165	418
WV Total	***4,270***	***984***	***2,846***	***8,100***
Frederick	4,727	0	3,080	7,807
Shenandoah	1,072	273	571	1,916
VA Total	***5,799***	***273***	***3,651***	***9,723***
Grand Total	***10,069***	***1,257***	***6,497***	***17,823***

* Garrett County has been included in the West Virginia totals.

TABLE III-8
TOTAL PREDICTED (2013) ANNUAL WAGE EARNINGS DUE TO INDUCED DEVELOPMENT

County	IRA	Build
Randolph	$10,363,626	$23,194,782
Tucker	5,402,649	7,233,447
Grant	0	63,856,996
Hardy	2,406,420	21,802,995
Hampshire	0	6,952,255
Mineral	0	8,087,212
Garrett, MD*	0	14,344,523
WV Total	***$18,172,695***	***$145,472,210***
Frederick	0	$224,655,488
Shenandoah	7,241,871	44,591,887
VA Total	***$7,241,871***	***$269,247,375***
Grand Total	***$25,414,566***	***$414,719,585***

* Garrett County has been included in the West Virginia totals.

TABLE III-9
PREDICTED TAX BENEFITS

IMPROVED ROADWAY ALTERNATIVE

County	Annual Land Tax Loss 1996-2013	Real Estate Tax Gain Residential 2001-2013	Real Estate Tax Gain Service/Retail 2001-2013	Net Annual Land Tax Gain/(Loss) 2001-2013	State Income Tax Gain 2001-2013	Total Tax Benefit 2001-2013
Randolph	$500	N/A	$800	$300	$357,900	$358,200
Tucker	800	N/A	600	(200)	186,000	185,800
Grant	800	N/A	0	(800)	0	(800)
Hardy	1,400	N/A	200	(1,200)	84,700	83,500
Hampshire		N/A	0	0	0	0
Mineral		N/A	0	0	0	0
Garrett, MD*		N/A	0	0	0	0
WV Total	***$3,500***		***$1,600***	***($1,900)***	***$628,600***	***$626,700***
Frederick	$4,000	N/A	$0	($4,000)	$0	($4,000)
Shenandoah	2,700	N/A	1,900	(800)	346,100	345,300
VA Total	***$6,700***		***$1,900***	***($4,800)***	***$346,100***	***$341,300***
Grand Total	***$10,200***		***$3,500***	***($6,700)***	***$974,700***	***$968,000***

BUILD ALTERNATIVE

County	Annual Land Tax Loss 1996-2013	Real Estate Tax Gain Residential 2001-2013	Real Estate Tax Gain Service/Retail 2001-2013	Net Annual Land Tax Gain/(Loss) 2001-2013	State Income Tax Gain 2001-2013	Total Tax Benefit 2001-2013
Randolph	$1,000	$10,000	$1,200	$10,200	$801,000	$811,200
Tucker	2,600	3,800	800	2,000	249,000	251,000
Grant	3,600	50,600	2,300	49,300	2,249,000	2,298,300
Hardy	3,700	10,200	500	7,000	767,000	774,000
Hampshire		2,900	100	3,000	244,500	247,500
Mineral		17,800	800	18,600	287,000	305,600
Garrett, MD*		30,000	700	30,700	717,500	748,200
WV Total	***$10,900***	***$125,300***	***$6,400***	***$120,800***	***$5,315,000***	***$5,435,800***
Frederick	$11,300	$478,400	$16,000	$483,100	$11,154,500	$11,637,600
Shenandoah	6,300	102,700	3,600	100,000	2,131,000	2,231,000
VA Total	***$17,600***	***$581,100***	***$19,600***	***$583,100***	***$13,285,500***	***$13,868,600***
Grand Total	***$28,500***	***$706,400***	***$26,000***	***$703,900***	***$18,600,500***	***$19,304,400***

* Garrett County has been included in the West Virginia totals.

B. LAND USE

FHWA Technical Advisory T 6640.8A recommends that land use impacts should be discussed relative to current development trends within the area that might be affected by the proposed project and the consistency of the proposed project with plans and policies that "are normally reflected in the area's comprehensive development plan." Additionally, FHWA advises that "the secondary social, economic and environmental impacts of any substantial foreseeable, induced development should be presented" when preparing land use impact analyses.

The discussion below focuses on the consistency of the proposed project with the comprehensive and economic development plans of those regions through which it passes, as well as the project's direct impacts to land use and land cover. The impact of the proposed project on current development trends and secondary impacts relative to community and regional development is analyzed and presented in Section III-A: *Economic Environment* of this document. Details concerning Land Use are contained in the *Socioeconomics Technical Report.*

1. METHODOLOGY

Comprehensive plans, development plans, and subdivision ordinances were requested from regional planning agencies, counties, and local governments. These documents were analyzed to assess the consistency of the proposed project with them. Additionally, meetings were held with local and regional planning officials and local elected officials to confirm the analyses and to assess the consistency of the proposed project with community and agency development goals.

The GIS was used to determine direct impacts to land cover and land use compartment types. Anderson Level II (Anderson et al., 1973) land use/land cover mapping was prepared by photointerpretation of aerial photography. Photo-interpreted land use/land cover compartments were entered into the GIS. Mapping was then prepared, ground-truthed in the field, and adjustments were made to the land use/land cover compartments as necessary. Construction limits of the Build and Improved Roadway Alternatives were superimposed on the completed land use/land cover mapping. The GIS then calculated the areal extent of direct impacts of the proposed project to each land use/land cover compartment.

2. CONSISTENCY WITH REGIONAL DEVELOPMENT PLANS

The West Virginia portion of the project is within State Planning Regions VII (Randolph and Tucker Counties) and VIII (Hardy and Grant Counties). The Planning and Development Councils for each of these regions have developed and published overall economic development plans that outline goals and strategies for regional development. In each of these plans, specific communities and areas are designated as desirable growth centers. The communities or areas identified include: Elkins; Davis and the Canaan Valley area; Moorefield; and Petersburg. The Build Alternative and the IRA would provide additional and more efficient access to each of these designated growth centers. As shown in Section II-H: Traffic Analysis, the Build Alternative would provide the highest level of service and would attract the largest volume of traffic.

The Lord Fairfax Planning District Commission in Virginia serves much the same function as the Planning and Development Councils in West Virginia. Corridor H is not mentioned in the Lord Fairfax Planning District Commission's plans.

3. CONSISTENCY WITH COUNTY COMPREHENSIVE PLANS

Tucker and Hardy Counties in West Virginia and Shenandoah and Frederick Counties in Virginia are in the process of developing or have developed comprehensive plans. Additionally, in 1991, Grant County, West Virginia adopted an "Economic Adjustment Strategy."

The *Tucker County Comprehensive Plan* states that the construction of Corridor H would "greatly enlarge the number of potential industrial sites and enhance their development"(Chapter 5: Proposed Major Highway Improvements, 1992). Additionally, Tucker County has based its *Land Use and Development Plan* on construction of Corridor H. The *Tucker County Comprehensive Plan* makes no mention of the Improved Roadway Alternative but does present an optional or contingency land development plan under a No-Build scenario.

Hardy County's *Draft Comprehensive Plan* (1993) states that one of its goals is to "advocate the maintenance and improvement of the transportation system so that people and goods can move safely and efficiently throughout the County." Construction of either the Build Alternative or the IRA would be consistent with this goal. The *Hardy County Comprehensive Plan* recognizes the Corridor H project in "Section XIV: Existing Roads Systems" and discusses its proposed route throughout the County. The plan stresses the importance that agriculture plays in the economic and cultural facets of development in the county and that agricultural use be allowed in all parts of the county (Hardy, 1993). The plan also calls for orderly development and the protection of agricultural land from "scattered residential development." Commercial development is to be concentrated near the main existing retail centers (Hardy, 1994). Because of the importance of agricultural land use in Hardy County, conversion of agricultural land for the alternatives under study is of concern. As stated in Section III-E: *Farmlands,* 120,868 hectares (298,672 acres) in Grant and Hardy Counties are currently being used for crops and pastures. The Improved Roadway Alternative would impact 32 hectares (80 acres) and the Build Alternative would impact 167 hectares (413 acres).

Grant County's "Economic Adjustment Strategy" (1991) assesses the county's economic strengths and weaknesses and presents a strategy for economic revitalization. The proposed Corridor H project is noted in this strategy as a planning element.

Frederick County adopted a comprehensive plan in May of 1990 which identifies Corridor H as a planning element. Corridor H would be located in the southwest corner of Frederick County, near existing VA 55. There are two components of the land use designation in this area according to the comprehensive plan: recreation and agriculture. The recreation use is associated with the George Washington National Forest. The agricultural use is to be protected from scattered residential development, industrial development, or commercial development (Comprehensive, 1990).

The *Shenandoah County Comprehensive Plan: 2010* (1991) does not refer to the proposed project.

4. CONSISTENCY WITH LOCAL PLANS

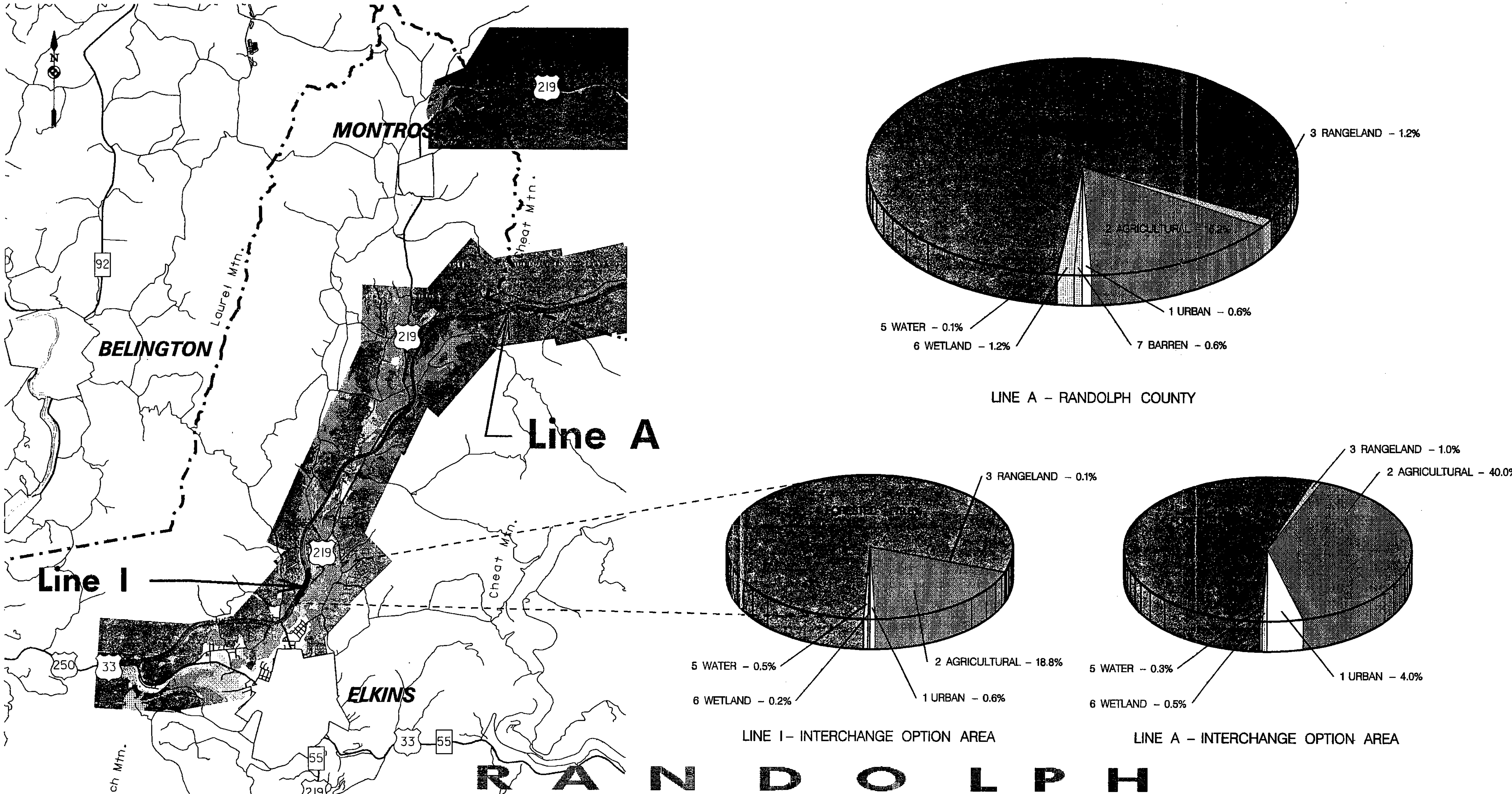
None of the municipalities in West Virginia that are directly impacted by the proposed project have comprehensive plans or land use ordinances. Hardy County's Planning Commission has adopted and sent to the County Commissioners a subdivision plan but, as of this writing, it has not been acted upon. An analysis of the ordinance revealed that, should it be adopted, it would not conflict with either the Build Alternative or the IRA.. Communities in Virginia rely on the county plans discussed above and zoning ordinances for land use control.

5. LAND USE/LAND COVER IMPACTS

Data on land use and land cover compartment impacts by the proposed Build Alternative, Option Areas, and IRA are presented in Table III-10A. Detailed analyses of the socioeconomic and ecological importance of these impacts are presented in the following sections of this document and in the *Socioeconomics Technical Report*. While all land cover types would be affected, both the Build Alternative and the Improved Roadway Alternative would impact over four times more forest land cover than the next highest land cover category; agricultural. Exhibits III-5 through III-10 show graphical representations of land use and land cover impacts by county.

6. DEVELOPMENT-RELATED SECONDARY IMPACTS

Secondary land use/land cover impacts were determined by the GIS. The percentage of each land cover type was calculated for each BNA predicted to experience residential or service-oriented growth. These percentages were then applied to the total amount of land required for the specific form of development (e.g., commercial, residential, service-oriented) to determine the amount of each land cover type that would be impacted. Because the locations of industrial parks are known, land use impacts associated with them were analyzed specifically. The total amount of each land cover type predicted to be converted for the Build and Improved Roadway Alternatives is presented in Table III-10B. The ecological impacts associated with the conversion are discussed in the following subsections as they relate to that particular category of impact analysis (i.e., Vegetation and Wildlife, Wetlands and Streams).



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-5
RANDOLPH COUNTY
LAND USE / LAND COVER
IMPACTS

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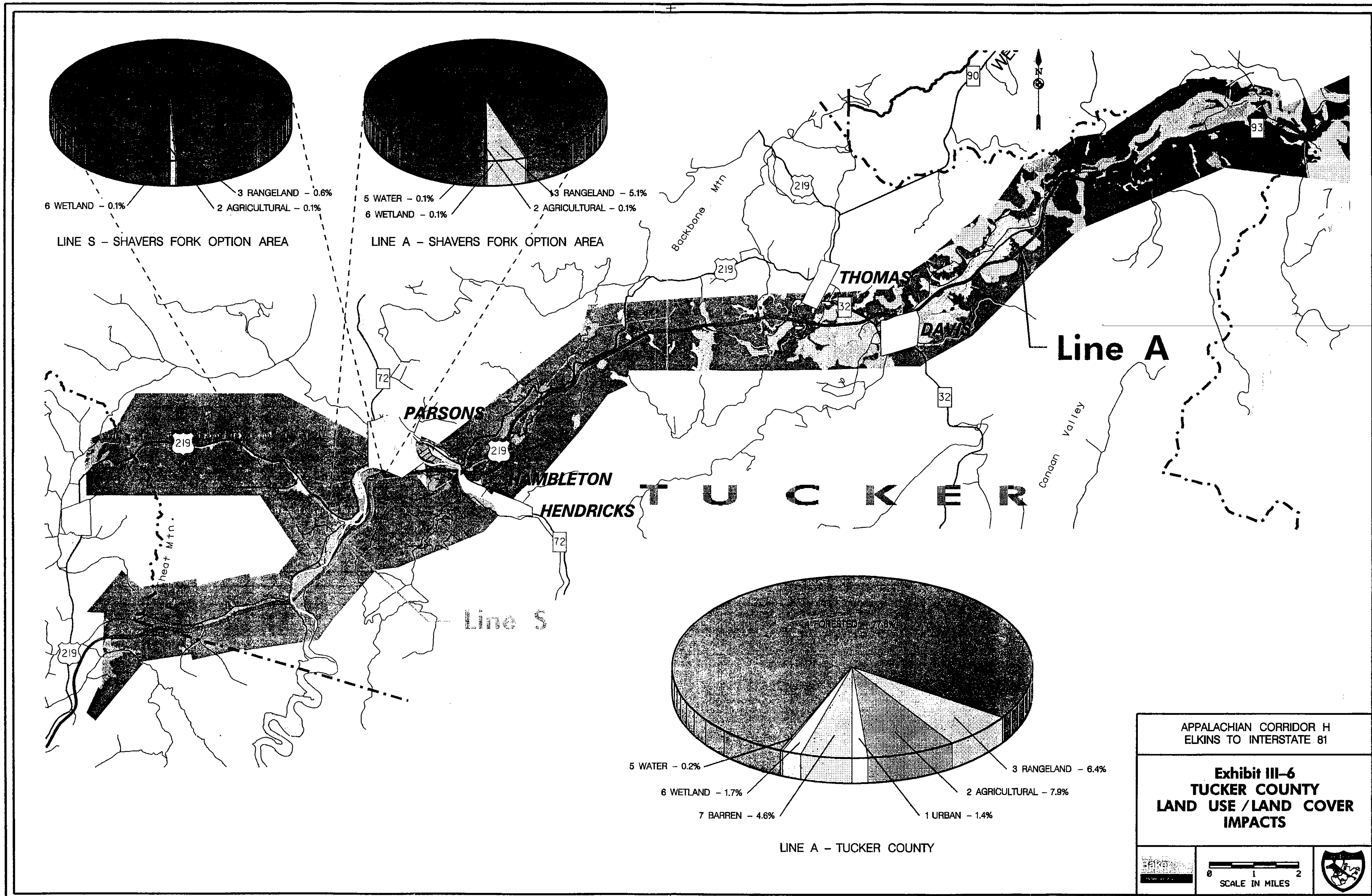
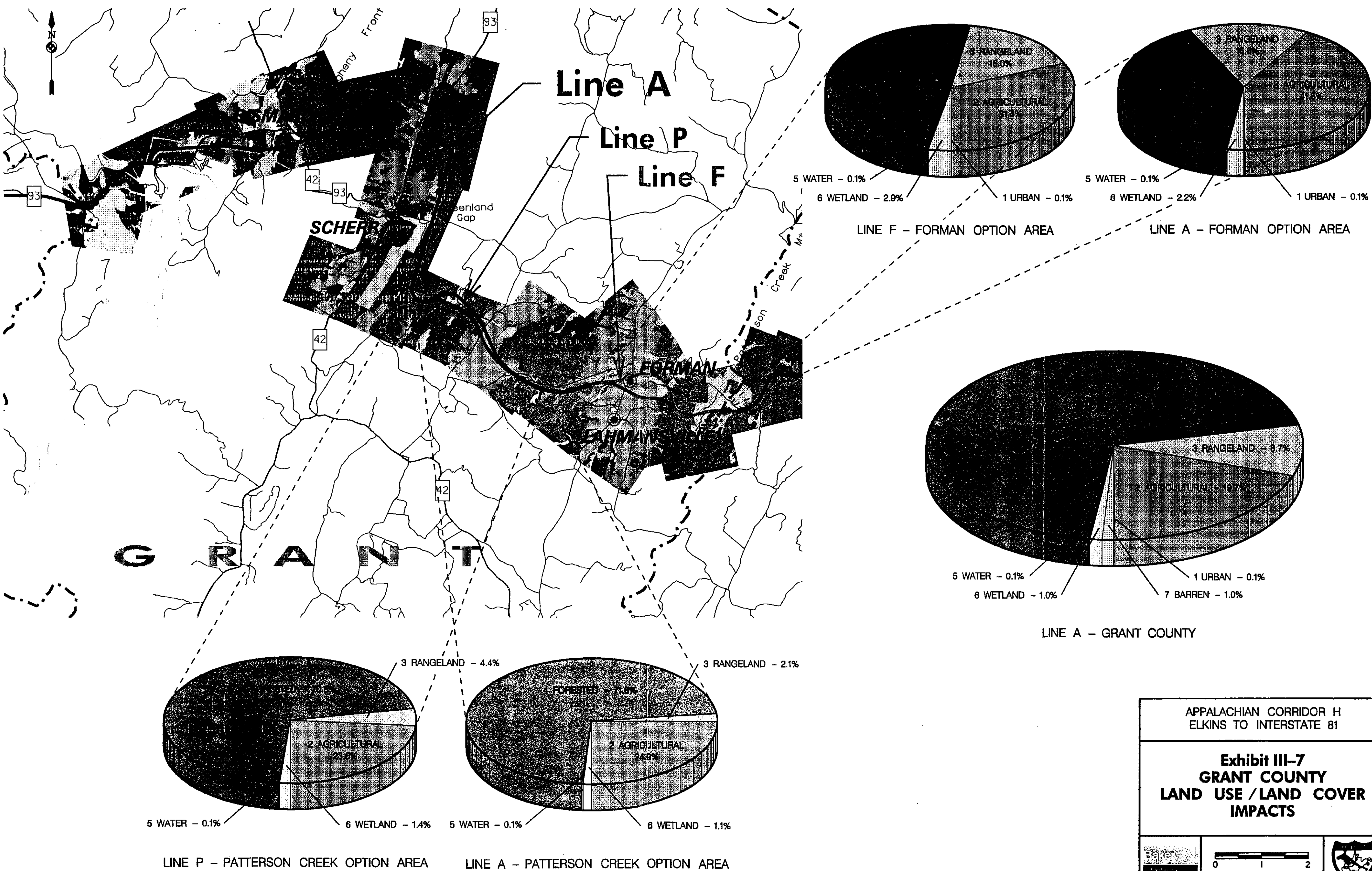
SCALE IN MILES



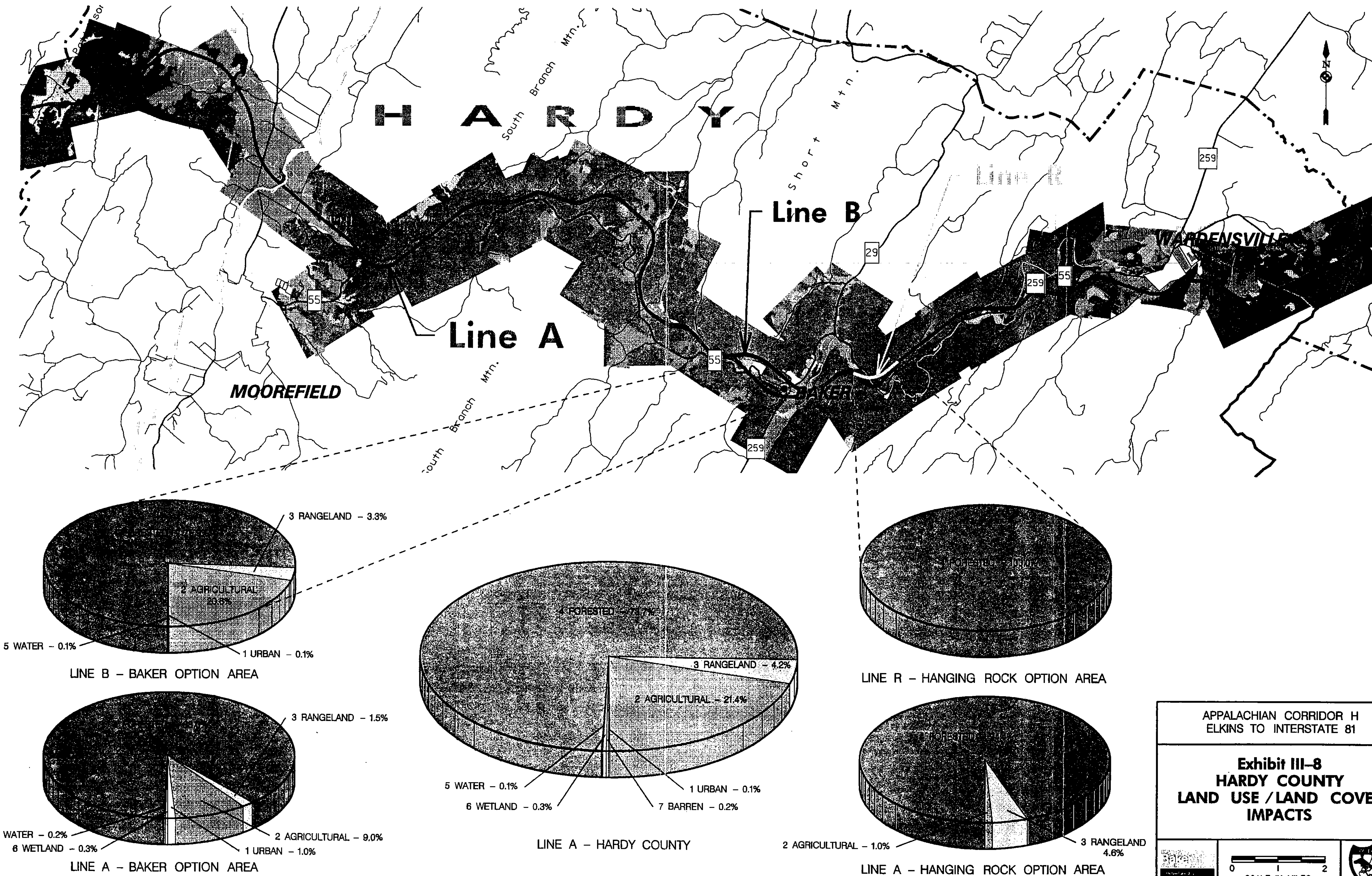
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-6
TUCKER COUNTY
LAND USE / LAND COVER
IMPACTS



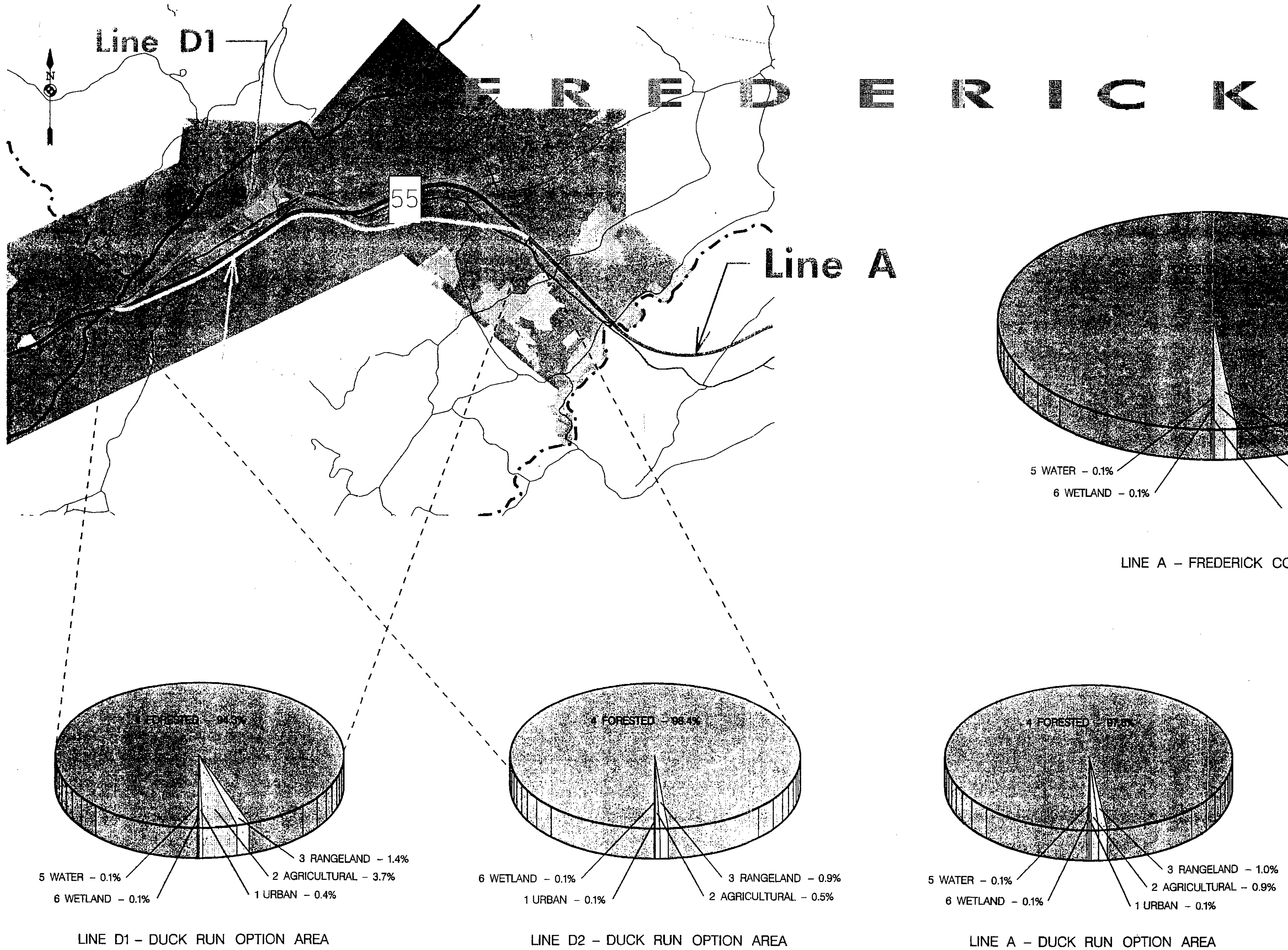
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-7
GRANT COUNTY
LAND USE / LAND COVER
IMPACTS



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-8
HARDY COUNTY
LAND USE / LAND COVER
IMPACTS



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-9
FREDERICK COUNTY
LAND USE / LAND COVER IMPACTS

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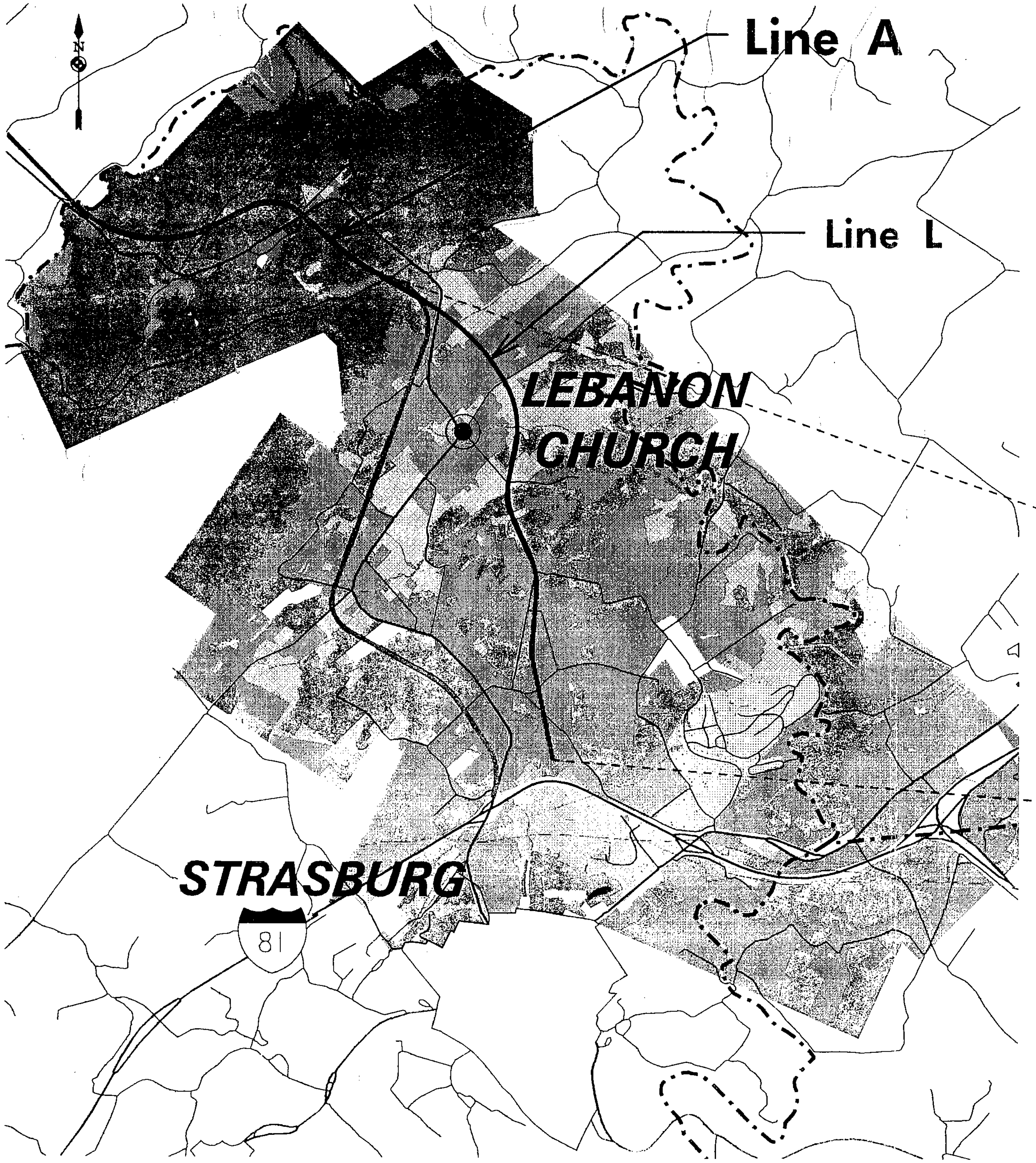
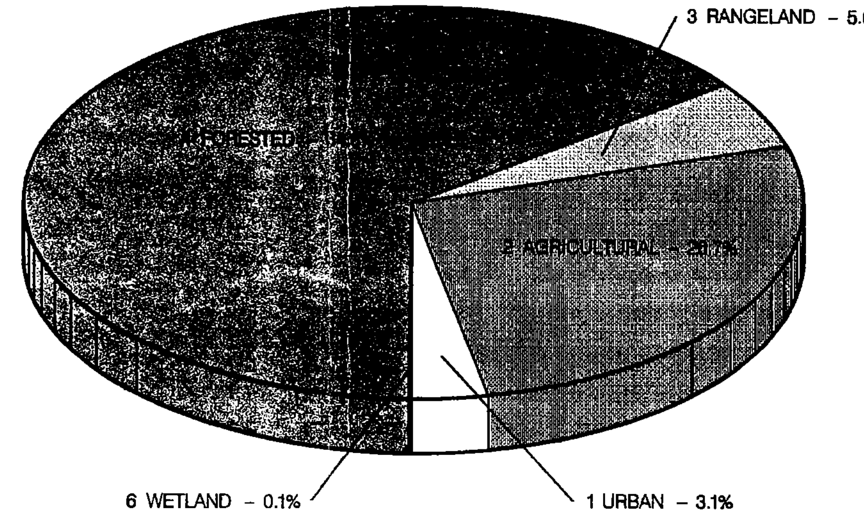
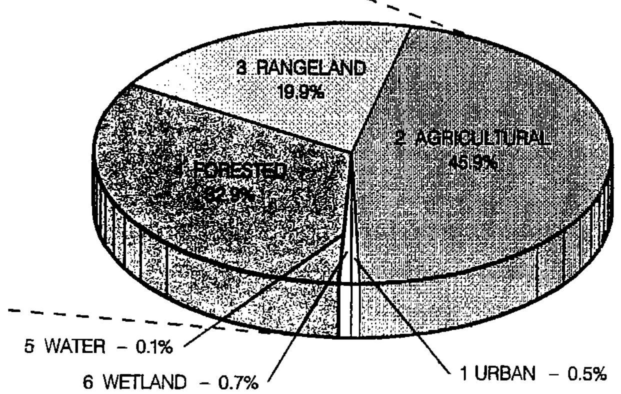
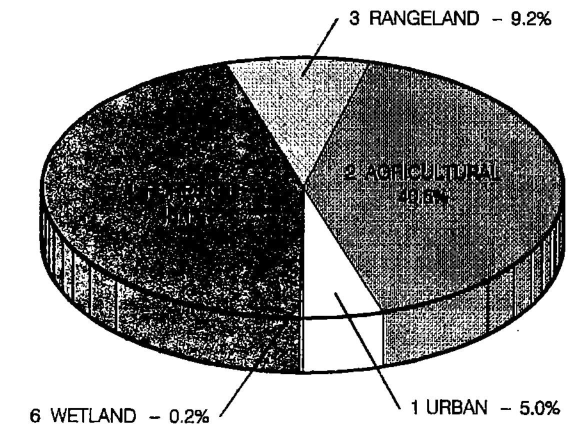




LINE A – SHENANDOAH COUNTY



LINE L – LEBANON CHURCH OPTION AREA



LINE A – LEBANON CHURCH OPTION AREA

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-10
SHENANDOAH COUNTY
LAND USE / LAND COVER
IMPACTS

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SCALE IN MILES

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TABLE III-10A
DIRECT LANDUSE IMPACTS - BUILD ALTERNATIVE

Land Use Type	West Virginia				Option Area Comparisons in WV											
					Interchange				Shavers Fork				Patterson Creek			
	IRA		Line A		Line I		Line A		Line S		Line A		Line P		Line A	
	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres
Urban / Built	22.0	54.3	7.5	18.6	0.1	0.3	0.8	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agriculture	56.2	139.0	226.4	559.5	3.8	9.4	8.4	20.7	0.0	0.1	0.0	0.1	16.4	40.4	14.7	36.4
Rangeland	21.2	52.5	76.1	188.1	0.0	0.1	0.2	0.5	0.3	0.8	2.1	5.3	3.1	7.6	1.2	3.0
Forest	360.9	891.8	1044.6	2581.3	16.1	39.8	11.4	28.1	50.1	123.9	39.6	97.9	49.0	121.0	42.5	104.9
Water	0.2	0.6	1.4	3.4	0.1	0.3	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
Wetlands	8.1	20.0	13.4	33.1	0.0	0.1	0.1	0.3	0.0	0.0	0.0	0.1	1.0	2.5	0.7	1.6
Barren	4.7	11.7	24.3	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	***473.3***	***1169.9***	***1393.7***	***3444.0***	***20.1***	***50.0***	***21.0***	***51.8***	***50.4***	***124.8***	***41.8***	***103.5***	***69.5***	***171.6***	***59.1***	***145.9***

Land Use Type	Option Area Comparisons in WV											
	Forman				Baker				Hanging Rock			
	Line F		Line A		Line B		Line A		Line R		Line A	
	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres
Urban / Built	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.2	0.0	0.0	0.0	0.0
Agriculture	15.7	38.9	24.5	60.5	9.0	22.2	4.2	10.4	0.0	0.0	0.3	0.7
Rangeland	8.1	19.9	9.3	22.9	1.4	3.6	0.7	1.7	0.0	0.0	1.3	3.2
Forest	25.1	62.0	24.2	59.7	32.9	81.4	40.9	101.0	25.7	63.5	27.2	67.2
Water	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0
Wetlands	1.5	3.6	1.3	3.2	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0
Barren	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	***50.4***	***124.4***	***59.3***	***146.4***	***43.3***	***107.3***	***46.5***	***114.8***	***25.7***	***63.5***	***28.8***	***71.1***

Land Use Type	Virginia				Option Area Comparisons in VA									
					Duck Run						Lebanon Church			
	IRA		Line A		Line D1		Line D2		Line A		Line L		Line A	
	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres
Urban / Built	13.9	34.3	2.7	6.6	0.3	0.7	0.1	0.2	0.1	0.2	0.2	0.6	2.5	6.3
Agriculture	14.3	35.3	23.0	56.7	2.9	7.2	0.5	1.2	0.7	1.8	21.4	52.9	20.5	50.6
Rangeland	2.2	5.3	5.4	13.4	1.1	2.8	0.8	2.0	0.8	2.0	9.3	22.9	4.6	11.5
Forest	34.9	86.3	140.0	346.1	74.4	183.7	87.4	215.9	81.2	200.8	15.4	38.0	22.8	56.3
Water	0.0	0.0	0.1	0.2	0.1	0.2	0.0	0.0	0.1	0.2	0.0	0.1	0.0	0.0
Wetlands	0.5	1.2	0.2	0.6	0.1	0.1	0.1	0.3	0.1	0.3	0.3	0.8	0.1	0.3
Total	***65.8***	***162.4***	***171.4***	***423.6***	***78.9***	***194.7***	***88.9***	***219.6***	***83.0***	***205.3***	***46.6***	***115.3***	***50.5***	***125.0***

TABLE III-10B
SUMMARY OF LAND COVER IMPACT
BY DEVELOPMENT TYPE

BUILD ALTERNATIVE

Development Type	Land/Cover Type	Watershed															
		Tygart Valley		Cheat		North Branch Potomac		South Branch Potomac		Cacapon		Shenandoah		Back		Opequon	
		Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres
Commercial	Forest	27	68	19	46	0	0	0	0	2	4	10	25	0	0	0	0
	Farmland	13	32	8	20	0	0	0	0	6	14	14	35	0	0	0	0
	Developed	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
Residential	Forest	750	1,853	477	1,179	211	521	1,674	4,137	713	1,761	1,350	3,336	1,569	3,876	244	603
	Farmland	277	685	360	889	86	213	942	2,327	263	651	1,523	3,762	276	684	120	297
Service	Forest	16	39	11	26	4	11	37	91	8	20	32	79	47	117	16	39
	Farmland	6	15	8	20	2	5	20	51	3	7	36	90	9	21	7	19
Total	Forest	793	1,960	506	1,251	215	533	1,711	4,228	722	1,784	1,392	3,440	1,617	3,993	260	642
	Farmland	296	732	376	929	88	218	962	2,378	272	673	1,573	3,887	285	705	127	316
	Developed	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0

IMPROVED ROADWAY ALTERNATIVE

Development Type	Land/Cover Type	Watershed															
		Tygart Valley		Cheat		North Branch Potomac		South Branch Potomac		Cacapon		Shenandoah		Back		Opequon	
		Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres
Commercial	Forest	27	68	19	46	0	0	0	0	2	4	10	25	0	0	0	0
	Farmland	13	32	8	20	0	0	0	0	6	14	14	35	0	0	0	0
	Developed	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
Total	Forest	27	68	19	46	0	0	0	0	2	4	10	25	0	0	0	0
	Farmland	13	32	8	20	0	0	0	0	6	14	14	35	0	0	0	0
	Developed	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0

C. SOCIAL ENVIRONMENT

1. METHODOLOGY

Social impacts include changes in community cohesion, accessibility, travel patterns, and community resources. The data necessary for this analysis was obtained from the US Census Bureau and organized by Census Tract and Block Numbering Areas (BNAs). The statistics included data on racial composition, age characteristics, ethnicities, and automobile ownership. Data was also gathered from regional planning authorities, local economic development plans, and comprehensive plans. In addition, meetings were held with planning officials in the counties through which the alignments would pass.

The effects of the Improved Roadway Alternative on community cohesion were not analyzed since disruptions to existing communities would not occur where the IRA would follow existing roadways. In addition, where the IRA would not follow existing alignments, it would not pass through existing communities. However, communities through which the IRA passes could experience secondary impacts due to increased traffic.

The effects of the Build Alternative alignments on community cohesion were analyzed. Community characteristics were identified using the Gutman Graph Technique which is an economic development tool specifically designed to analyze data on small communities. The Gutman graphs identify the services available to each community in a given area. Information needed to complete this analysis was obtained through research and field verification. Social impacts may also result from the displacement of community facilities and businesses; those impacts are also addressed in this analysis. Information on the impacts of displacements is presented under Section III-D: *Relocations*.

2. EXISTING ENVIRONMENT AND IMPACTS

a. Changes in Neighborhoods and Community Cohesion

Community cohesion is defined as a community's level of commitment to itself, as shown by the extent of interaction among individuals, groups, and institutions within the community. The cohesive qualities of a community are often based on ethnic, social, and family ties; school enrollment; residential stability and longevity; population, employment, income, and the mix of local residents; community activities; use of public facilities and services; and cultural sites and events (FHWA 1991).

Fifty communities were studied and are listed in Table III-11 and shown in Exhibit III-11. These communities were analyzed because they are located within five miles of the Build Alternative and would be the most likely to experience social changes due to their proximity to the alignments. Gutman graphs were developed to identify the economic facilities, social services, and municipal services present within each of the 50 communities. These graphs are included in the *Socioeconomic Technical Report.*

The analysis showed that Elkins, Parsons, Thomas, Davis, Moorefield, Strasburg, and Winchester serve as the social and economic centers and provide most of the services available in each county through which the Build Alternative would pass. The majority of the communities analyzed are service interdependent; that is, the residents rely on other communities for many services that are not available within their community. Five of the 50 communities analyzed as part of the Community Cohesion Analysis would be affected by the Build Alternative.

The five communities that would be directly impacted by the Build Alternative are: Greenland, Forman, Baker, Wardensville, and Clary. The presence of a new four-lane highway where one does not currently exist may create a barrier that would separate some residents from their communities. The effect of the Build Alternative on the five communities is summarized below.

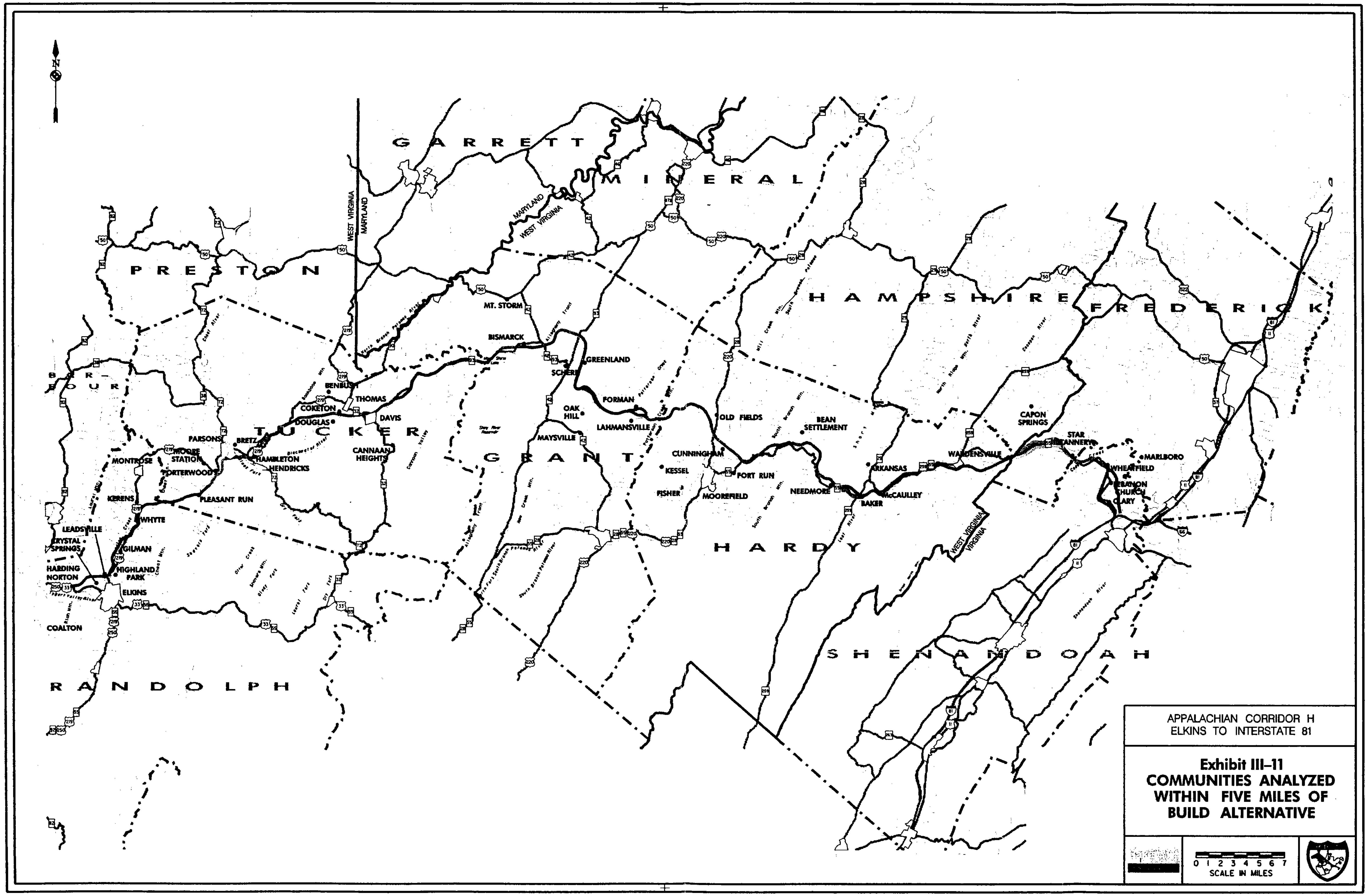
Line A would pass through the small community of Greenland by passing to the south of the intersection of Greenland Road (County 1) and Greenland Gap Road (County 3/3) and then crossing over Greenland Road to the west of that intersection. Several houses located at the intersection would be isolated by Line A because it would cross Greenland Road twice. The barrier would be social in nature in that it would place a four-lane highway between these residents and Greenland Road in both directions. Vehicular and pedestrian access would be maintained.

Forman is not a densely developed community, but there are would be residents along Patterson Creek Road (County 5) that may be impacted by either of the two alignments proposed by the Build Alternative in the Forman Option Area. Line A would pass to the south of Forman whereas Line F would pass to the north of Forman. In both cases, County 5 would be bridged and an interchange is proposed. In both cases, residents who live on either side of Line A or Line F would have a physical barrier created. The Forman Community Center is located between Lines A and F, and the selection of either would separate a portion of the residents from the center. In addition, Line A would displace the local post office. Line F would separate residents on County 5 and those who live on Thorn Run Road from the Forman Community Center, which is to the south of Line F. Since access for pedestrians and vehicles would be maintained, the barrier would be social in nature.

TABLE III-11
COMMUNITY COHESION IMPACT ASSESSMENT

RANDOLPH	IMPACTED
Crystal Springs	No
Coalton	No
Elkins	No
Gilman	No
Harding	No
Highland Park	No
Kerens	No
Leadsville	No
Montrose	No
Norton	No
Whyte	No
TUCKER	
Bretz	No
Benbush	No
Canaan Heights	No
Coketon	No
Davis	No
Douglas	No
Hambleton	No
Hendricks	No
Moore Station	No
Parsons	No
Pleasant Run	No
Porterwood	No
Thomas	No

GRANT	IMPACTED
Bismarck	No
Forman	Yes
Greenland	Yes
Lahmansville	No
Maysville	No
Mt. Storm	No
Oak Hill	No
Scherr	No
HARDY	
Arkansas	No
Baker	Yes
Bean Settlement	No
Cunningham	No
Fisher	No
Fort Run	No
Kessel	No
McCauley	No
Moorefield	No
Needmore	No
Old Fields	No
Wardensville	Yes
HAMPSHIRE	
Capon Springs	No
FREDERICK	
Marlboro	No
Star Tannery	No
SHENANDOAH	
Clary	Yes
Lebanon Church	No
Wheatfield	No



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-11
COMMUNITIES ANALYZED WITHIN FIVE MILES OF BUILD ALTERNATIVE

Near the community of Baker, the Build Alternative has two proposed lines for the Baker Option Area. Line A would pass to the south of Baker and cross WV 55 between Baker Church and East Hardy High School. Line A would pass above the community and bridge over WV 55 at this point. Thus, no physical barriers would be created by Line A. Line B would pass directly through the community of Baker and bisect the community to the east of WV 259, near the Loudon Heights Fuel Company. Although access would be maintained by an interchange in this location and WV 55 would be bridged, a physical barrier could be created since there are community facilities located on both sides of Line B. The E. A. Hawse Continuing Care Center, the Baker Fire Department, and the Perdue Egg Processing Plant, as well as a Jehovah's Witness Church would be located to the east of Line B, and the East Hardy High School and Middle School, the Hardy Library, and the Baker Church would be located to the west. Since access for pedestrians and vehicles would be maintained, the barrier would be social in nature.

The Build Alternative would pass south of the municipality of Wardensville and bisect Waites Run Road (County 5/1), Trout Run Road (County 23/10), and Trout Run Cut Off Road (County 23/12). The residents who live to the south of the alignment would be isolated from Wardensville and the resources that have developed around WV 55, including the J. Allen Hawkins Community Park, grocery stores, gas stations, the Veterans Memorial Community Center, restaurants, and other services. There are no services south of Line A that would be isolated from the rest of Wardensville. However, access would be maintained for all vehicular and pedestrian traffic via a proposed at-grade connection at Waites Run Road. Trout Run Road would be bridged and a connector road would be provided so that access to the community is maintained.

The small community of Clary is located near the intersection of VA 55 and VA 622. In Clary, Line A would intersect County 622 south of VA 55, isolating some of the residents who live along that road from the remaining community. The Shiloh United Methodist Church, a local grocery, and a gas station would be separated from Clary by Line A; however, vehicular and pedestrian access would be maintained since Line A would pass under VA 622.

b. Changes in Accessibility

All of the Build Alternative alignments would help to promote regional accessibility by providing better access between the 50 communities analyzed. As previously mentioned, many of the communities are service interdependent and lack many services such as banks, gas stations, retail outlets, stores, and health care facilities. Improving the transportation linkage between these communities would improve the ability to access these services. The Build Alternative would provide new and improved access between the communities in the study area and these service centers. The No-Build Alternative would not provide any increase in access to community facilities. The IRA would provide improved access to the area, but would not open-up access to new areas for development.

The Build Alternative would provide new access to employers and industrial parks that the IRA would not. Because of the new access to industrial parks, industrial type jobs are expected to result from the construction of the Build Alternative. Since service jobs traditionally follow industrial jobs, communities would have the opportunity to reduce the service interdependency they now experience. These benefits have been addressed in Section III-A: *Economic Environment.*

The No-Build Alternative would not provide new access to undeveloped land. The IRA would provide slightly more efficient access, but not new access to employers and industrial parks.

c. Impacts to Community Resources

No schools, churches, police stations, fire stations, hospitals, or community centers would be directly impacted or taken by any of the alternatives currently under study. There is a small postal facility, (roughly 100 square feet) in Forman that would be impacted by Line A, but this facility could be easily relocated because of its small size and available land. Impacts to recreation areas have been analyzed in Section III-J: *Recreation Resources.*

The displacement of businesses and residents within the project area would not have any impacts on these community facilities and services. As shown in the relocations analysis (Section III-D), the business displacements would be few (3 or 4 for the Build Alternative, and 11 for the IRA) and would not have long term negative ramifications on the economy. In addition, the relocations analysis shows that the vacancy rates in the project area would be high enough to provide relocation housing within the same geographic location. Therefore, indirect social impacts such as changes in school populations or increased unemployment rates due to the relocation or displacement of residents in the study area would not be anticipated.

d. Impacts on Safety

Safety considerations have been addressed in Section II. As stated in that section, over 40% of the accidents that occur in West Virginia are attributed to access points. Although the IRA would provide safety improvements, it would follow existing roadways and not limit the access points to two per side per mile, except at points of significant relocations, such as between Bismarck and Greenland.

Safety features that are incorporated into the design of a partially controlled access, four-lane highway could also result in improvements to the social services that would use the highway network. These services include police, fire and ambulance services, government vehicles, trash collection, military vehicles, road maintenance vehicles, postal services, package delivery services, and school buses. Specifically, the

Build Alternative would result in a reduction in travel times, meaning a reduction in response time. Any reduction in response time for emergency services would be a beneficial impact.

e. Impacts on Social Groups

The demographic statistics for the project area show that in the BNAs and Census Tracts where potential displacements are located, there would be no concentrations of minority social groups that might be negatively impacted by the Alternatives.

Minority employment opportunities, as with all employment opportunities, could be increased by the IRA and Build Alternative. Job opportunities resulting from the IRA would be limited to service job increases associated with increased traffic resulting from the latent demand. The job opportunities would not be as widespread as those anticipated to be created under the Build Alternative. The analysis of social characteristics showed that no particular social group would be disproportionately impacted, either positively or negatively, by the No-Build, Improved Roadway, or Build Alternatives.

3. AVOIDANCE, MINIMIZATION, AND MITIGATION

For the Build Alternative, consideration has been given to the placement of intersections, the re-configuration of intersections, and the relocation of severed roadways to maintain existing vehicular and pedestrian access.

D. RELOCATIONS

1. METHODOLOGY

The IRA and the Build Alternative would require right-of-way acquisition which may result in the displacement of residential, commercial, and industrial structures. Relocations were identified from the *Alignment and Resource Location Plans* and were field verified. The data necessary for this analysis was obtained from the US Census Bureau and was organized by Census Tract or Block Numbering Areas (BNAs), as defined by the 1990 Census. In addition, relocated businesses were reviewed based on size and type of facility, relocation requirements, and possible impact on the local community's social and economic structure.

2. EXISTING ENVIRONMENT AND IMPACTS

The Uniform Relocation Assistance and Real Property Act of 1970 (as amended, 1987) prescribes the procedures and provisions required for persons displaced as a result of federally assisted programs. Anyone displaced by a federally assisted project must be compensated or provided a comparable replacement dwelling. Relocation resources would be made available to residential, commercial, and industrial relocatees without discrimination. The procedures established by the Uniform Relocation Act would be followed by WVDOT and VDOT if either the IRA or the Build Alternative is selected and the right-of-way acquisition process is initiated.

a. Residential Relocations

Table III-12 shows the statistics for residential relocations. No residential relocations are expected from the No-Build Alternative. The IRA would have the greatest number of residential relocations at 83. Line A of the Build Alternative would have 65 residential relocations. Within the Option Areas, the number of residential relocations varies. The maximum number of residential relocations would involve the selection of Option Area Lines P, B, D1 and L for a total of 73.

All residential relocations would be single family unit structures. No substantial concentrations of ethnic conclaves, minority populations, or elderly populations would be impacted by any lines under the Build Alternative or the IRA. The vacancy rates in all of the zones are at a level at which housing should be available within the same Census Tract or BNA for all those displaced, as determined by the US Census Bureau data on social characteristics. Since there is vacant housing available within each of the zones, housing would be of the same type and quality of the residences displaced. Although it does not appear necessary for this project, WVDOT and VDOT are committed to last resort housing, if needed.

TABLE III-12
RESIDENTIAL AND BUSINESS RELOCATIONS

ALTERNATIVES COMPARISON

ALTERNATIVE	STATE	# RESIDENTIAL RELOCATIONS	# BUSINESS RELOCATIONS	# POULTRY HOUSE RELOCATIONS	TOTAL RELOCATIONS
No-Build Alternative	West Virginia & Virginia	0	0	0	0
Improved Roadway	West Virginia	60	9	1	70
Alternative (IRA)	Virginia	23	2	0	25
	TOTALS	***83***	***11***	***1***	***95***
Build Alternative:	West Virginia	52	3	4	59
Line A	Virginia	13	0	0	13
	TOTALS	***65***	***3***	***4***	***72***

OPTION AREA COMPARISON

OPTION AREA	LINE	COUNTY	# RESIDENTIAL RELOCATIONS	# BUSINESS RELOCATIONS	# POULTRY HOUSE RELOCATIONS	TOTAL RELOCATIONS
Interchange	Line I	Randolph	1	1	0	2
	Line A	Randolph	2	1	0	3
Shavers Fork	Line S	Tucker	0	0	0	0
	Line A	Tucker	1	0	0	1
Patterson Creek	Line P	Grant	3	0	4	7
	Line A	Grant	0	0	0	0
Forman	Line F	Grant	1	0	0	1
	Line A	Grant	2	0	0	2
Baker	Line B	Hardy	4	1	0	5
	Line A	Hardy	2	0	0	2
Hanging Rock	Line R	Hardy	0	0	0	0
	Line A	Hardy	0	1	0	1
Duck Run	Line D1	Frederick	8	0	0	8
	Line D2	Frederick	4	0	0	4
	Line A	Frederick	6	0	0	6
Lebanon Church	Line L	Shenandoah	4	0	0	4
	Line A	Shenandoah	3	0	0	3

b. Business Relocations

The No-Build Alternative would not require any business relocations. The IRA would have the most business relocations (11) as well as the relocation of one poultry house (Table III-12). The relocations would all be small commercial operations including two stores, an ice cream store, two gift shops, two gas stations, an automotive repair shop, two restaurants, and a garage.

Line A of the Build Alternative would have three business relocations as well as the relocation of four poultry houses. The businesses displaced are: an automotive repair shop, a turnkey chicken production facility and one ice cream store. The selection of Line P in the Patterson Creek Option area would relocate four additional poultry houses. The selection of Line B in the Baker Option Area would increase the number of business relocations by one wood fuel industrial operation (by taking four industrial buildings).

There is adequate commercial space available within the region for the relatively small number of business relocations under the Build or Improved Roadway Alternatives. The nature of the displaced business entities makes it likely that they would stay in the region rather than relocating outside the region.

c. Other Relocations

All of the proposed alignments would potentially impact several farms and outbuildings. (Impacts to farmlands are discussed in the Section III-E: *Farmlands*.) However, Line A would impact 110 outbuildings and the IRA would impact 74 outbuildings.

A small postal facility (roughly 120 square feet) would be displaced by Line A in Forman. However, this facility could be relocated without causing any undue social or economic hardship. There would be no other community facilities such as schools, churches, community centers, or health care facilities displaced by the Build Alternative. The IRA would impact a cemetery located on VA 55, relocating 19 graves, and would potentially impact a nursing home and school building located on US 219 outside of Thomas.

E. FARMLANDS

The Farmland Protection Policy Act (FPPA) of 1984 requires a farmland impact evaluation for applicable, federally funded projects. Because the Corridor H proposed project area is considered to be rural and is not a categorically excluded project, coordination with the United States Department of Agriculture, Soil Conservation Service is required through completion of a Farmland Conversion Impact Rating Form (Form AD-1006) for each county impacted.

The purpose of the Farmland Protection Policy Act is "to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses . . ." Should the Soil Conservation Service (SCS) determine that the proposed action would adversely affect farmland, the agency funding the proposed action is required to consider alternatives to lessen them.

The Farmland Conversion Impact Rating Form is a tool used by the SCS to evaluate the impact to soils the SCS has designated as either prime, unique, statewide, or locally important. In accordance with the FPPA, the SCS criteria for determining prime, unique, statewide, and locally important farmlands are based on soil type and slope, regardless of whether or not the land in question is currently used for agricultural purposes. Within each State, the SCS District Conservationists are responsible for determining which soils are classified as such and are, therefore, afforded protection under the Farmland Protection Policy Act.

1. METHODOLOGY

The locations of soils determined to be either prime, unique, statewide, or locally important were taken from the SCS *Soil Surveys* for the West Virginia Counties of Randolph, Tucker, Grant, and Hardy, and the Virginia Counties of Frederick and Shenandoah. The locations of these soils were entered into the Geographic Information System (GIS). Following the identification of alignments to be carried forward, the farmland conversions were determined on a county-by-county basis to facilitate completion of Form AD-1006. The applicable sections of Form AD-1006 were completed for each county involvement and then submitted to the appropriate SCS State and District Conservationists for their review.

2. EXISTING ENVIRONMENT

In general, the steep terrain of the proposed project area reduces the occurrence of soils considered to be prime, unique, statewide, or locally important farmland soils.

Crops and pasture account for approximately 44 percent (120,868 hectares or 298,672 acres) of the area in Grant and Hardy Counties. Approximately 25 percent (27,303 hectares or 67,467 acres) of the area in Tucker County is in crops or pasture. In Randolph County, approximately 22 percent of the county's total area is in crops or pasture. In Frederick County, farmland makes up 44 percent (49,867 hectares or 123,220 acres) of the county's total area. In Shenandoah County, cropland and pasture make up 38 percent (50,426 hectares or 124,600 acres) of the total area.

3. FARMLAND IMPACTS

Farmland Conversion Impact Ratings (Form AD-1006) for this project were submitted to the appropriate West Virginia and Virginia SCS offices. In order for the SCS offices to complete their impact rating forms, each would need to have the acreage of individual soil units impacted by the project. However, neither SCS office has this information, given that the project covers such a large area. Therefore, neither the West Virginia nor the Virginia SCS were able to complete Form AD-1006 for this project. The Virginia SCS office provided a letter indicating that this was the case (Appendix C, SCS letter dated July 22, 1994).

While the SCS was unable to complete the farmlands conversion impact rating, a farmlands impact assessment was still completed based on the conversion of prime, unique, statewide important, and locally important soils. Table III-13 provides a breakdown of impacts by alternative. Table III-14 provides a breakdown of farmland conversions by county.

a. No-Build Alternative

There would be no project-related farmland conversions under the No-Build Alternative in either West Virginia or Virginia.

b. Improved Roadway Alternative

Construction of the IRA would result in the direct conversion of farmlands. In its entirety, the IRA would convert approximately 118 hectares (291 acres) of farmlands: of the total farmland converted, approximately 4 percent is classified as locally important, 34 percent is prime, and 62 percent is statewide important.

(1) West Virginia

Approximately 32 percent of the total area within the West Virginia Counties of Randolph, Tucker, Grant, and Hardy is considered farmable. The IRA would convert approximately 0.05 percent (101 hectares or 250 acres) of farmlands within the West Virginia counties: of this, approximately 5 percent is classified as locally important, 30 percent is prime, and 65 percent is statewide important. The IRA would convert the greatest area of farmlands in Hardy County and the least in Randolph County.

TABLE III-13
FARMLAND CONVERSIONS BY ALTERNATIVE AND OPTION AREA

COMPARISON BY ALTERNATIVE

FARMLAND TYPE	NO-BUILD		IMPROVED ROADWAY (IRA)						BUILD ALTERNATIVE - LINE A					
			WV		VA		TOTAL		WV		VA		TOTAL	
	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac
Locally Important	0.0	0.0	5.2	12.8	0.0	0.0	5.2	12.8	7.7	19.0	0.0	0.0	7.7	19.0
Prime	0.0	0.0	30.0	73.9	10.2	25.2	40.2	99.1	59.5	147.0	16.7	41.2	76.2	188.2
Statewide Important	0.0	0.0	66.0	163.0	6.4	16.0	72.4	179.0	125.7	310.5	10.3	25.5	136.1	336.0
Total	*0.0*	*0.0*	*101.2*	*249.7*	*16.6*	*41.2*	*117.8*	*290.9*	*192.8*	*476.5*	*27.0*	*66.7*	*220.0*	*543.2*

COMPARISON BY OPTION AREA: West Virginia

FARMLAND TYPE	WV TOTAL		Interchange				Shavers Fork				Patterson Creek				Forman				Baker				Hanging Rock			
			Line I		Line A		Line S		Line A		Line P		Line A		Line F		Line A		Line B		Line A		Line R		Line A	
	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac
Locally Important	7.7	19.0	0.1	0.1	2.4	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prime	59.5	147.0	1.8	4.5	1.5	3.7	0.0	0.0	1.7	4.3	4.9	12.2	2.2	5.5	2.8	6.8	6.4	15.9	4.7	11.7	2.2	5.5	0.2	0.6	0.2	0.6
Statewide Important	125.7	310.5	0.6	1.4	5.2	12.9	5.1	12.5	6.4	15.8	0.6	1.5	0.5	1.2	8.3	20.4	15.8	39.0	1.5	3.7	0.6	1.5	0.0	0.6	0.0	0.6
Total	*192.8*	*476.5*	*2.5*	*6.0*	*9.1*	*22.5*	*5.1*	*12.5*	*8.1*	*20.1*	*5.5*	*13.7*	*2.7*	*6.7*	*11.1*	*27.2*	*22.2*	*54.9*	*6.2*	*15.4*	*2.8*	*7.0*	*0.2*	*1.2*	*0.2*	*1.2*

COMPARISON BY OPTION AREA: Virginia

FARMLAND TYPE	VA TOTAL		DUCK RUN						LEBANON CHURCH			
			Line D1		Line D2		Line A		Line L		Line A	
	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac
Locally Important	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prime	16.7	41.2	0.1	0.2	0.3	0.8	0.1	0.2	7.6	18.7	11.9	29.3
Statewide Important	10.3	25.5	0.0	0.0	1.1	2.7	1.1	2.7	15.6	38.6	9.4	23.1
Total	*27.0*	*66.7*	*0.1*	*0.2*	*1.4*	*3.5*	*1.2*	*2.9*	*23.2*	*57.3*	*21.3*	*52.4*

TABLE III-14
FARMLAND CONVERSIONS BY COUNTY

IRA FARMLAND CONVERSIONS

FARMLAND CLASSIFICATION	WEST VIRGINIA COUNTIES								VIRGINIA COUNTIES				IRA TOTALS					
	Grant		Hardy		Randolph		Tucker		Frederick		Shenandoah		WV		VA		BOTH	
	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre
Locally Important	0.0	0.0	0.0	0.0	5.2	12.8	0.0	0.0	0.0	0.0	0.0	0.0	5.2	12.8	0.0	0.0	5.2	12.8
Prime	3.8	9.4	17.8	43.9	4.9	12.0	3.5	8.6	1.1	2.7	9.1	22.5	30.0	73.9	10.2	25.2	40.2	99.1
Statewide Important	24.6	60.7	15.2	37.6	4.0	9.9	22.2	54.8	0.1	0.4	6.3	15.6	66.0	163.0	6.4	16.0	72.4	179.0
TOTAL	28.4	70.1	33.0	81.4	14.1	34.7	25.7	63.4	1.2	3.1	15.4	38.1	101.2	249.7	16.6	41.2	117.8	290.9

LINE A FARMLAND CONVERSIONS

FARMLAND CLASSIFICATION	WEST VIRGINIA COUNTIES								VIRGINIA COUNTIES				LINE A TOTALS					
	Grant		Hardy		Randolph		Tucker		Frederick		Shenandoah		WV		VA		BOTH	
	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre	hectare	acre
Locally Important	0.0	0.0	0.0	0.0	7.7	19.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	19.0	0.0	0.0	7.7	19.0
Prime	15.4	38.1	33.3	82.2	4.8	11.9	6.0	14.8	0.1	0.2	16.6	41.0	59.5	147.0	16.7	41.2	76.2	188.2
Statewide Important	18.7	46.1	44.4	109.7	14.6	36.0	48.1	118.7	1.1	2.7	9.2	22.8	125.8	310.5	10.3	25.5	136.1	336.0
TOTAL	34.1	84.2	77.7	191.9	27.1	66.9	54.1	133.5	1.2	2.9	25.8	63.8	193.0	476.5	27.0	66.7	220.0	543.2

(2) Virginia

The IRA would convert approximately 0.01 percent (17 hectares or 41 acres) of the total farmable land in Frederick and Shenandoah Counties. Much of the farmland conversion would be within Shenandoah County and would involve prime and statewide important soils.

c. Build Alternative

Construction of the Build Alternative would result in a greater conversion of farmlands than would the IRA. In its entirety, Line A would convert approximately 220 hectares (543 acres) of farmlands compared to 118 hectares (291 acres) under the IRA. Of the total farmland converted under Line A, approximately 4 percent is classified as locally important, 35 percent is prime, and 61 percent is statewide important.

(1) West Virginia

Line A would convert approximately 0.10 percent (193 hectares or 477 acres) of the total farmable land within the West Virginia Counties of Randolph, Tucker, Grant, and Hardy. Of the total farmable lands within each county, Line A would covert approximately 0.03 percent in Randolph, 0.09 percent in Tucker, 0.04 percent in Grant and 0.06 percent Hardy. In West Virginia, the majority (65 percent) of the converted farmland is classified as statewide important.

Within the Patterson Creek and Baker Option Areas, Lines P and B, respectively, would have a greater conversion of farmlands than would Line A. Within the Interchange, Shavers Fork, and Forman Option Areas, Line A would have a greater conversion than would Lines I, S, and F, respectively. Within the Hanging Rock Option Area, farmland conversions under Line R would be comparable to Line A.

(2) Virginia

Line A would convert approximately 0.03 percent (27 hectares or 67 acres) of the total farmable land within Frederick and Shenandoah Counties. The majority (62 percent) of this existing area is classified as prime farmland.

Within both the Duck Run and Lebanon Church Option Areas, Line A would convert fewer farmlands than would Line D2 and L, respectively. Within the Duck Run Option Area, Line D1 would convert fewer farmlands than would Line A.

Concern has recently been expressed over the rapid loss of farmlands to development in Virginia's Northern Shenandoah Valley (which includes both Frederick and Shenandoah Counties). The American Farmland Trust (AFT), a national farming interest group, recently ranked the Shenandoah Valley as the 11th most endangered agricultural region in America. The AFT created their list by evaluating agricultural production, population growth, production per acre, and farmland loss. The Trust is noted as saying that population growth during the 1980s and urban edge sprawl from Northern Virginia are putting increasing developmental pressure on agricultural land in these two counties. As previously stated, construction of either the IRA or the Build Alternative would have a minimal effect (0.01 and 0.1 percent, respectively) on the total farmable lands within either Frederick or Shenandoah County.

4. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

The alignment development process incorporated measures to avoid and minimize farmlands identified as prime, unique, statewide important, and locally important. Based on the ratings provided by the SCS, the project's minimal effect on farmland conversions would not require mitigation measures.

F. PUBLIC WATER SUPPLY

1. METHODOLOGY

Impacts to sole-source aquifers have been evaluated in accordance with 40 CFR 149. The municipalities served by, and the sources of, public drinking water supplies were identified based on published *River Basin Plans* for the Potomac and Monongahela Rivers, as well as on communications with county and local officials. Public water supply systems were identified for the West Virginia towns of Wardensville, Moorefield, Mt. Top, Davis, Thomas, Hambleton, Hendricks, Parsons, and Elkins. No public water systems were identified in the Virginia portion of the proposed project. For each public water supply identified, the approximate location of the source or system intake was identified on project mapping. The distance between the proposed alignments and each water source or intake was then determined.

Identification and protection of sole source aquifers and wellhead protection areas are required by the Safe Drinking Water Act of 1986. Wellhead protection areas are defined in the Act 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 or reach such well or wellfield" (EPA, 1987). The West Virginia Department of Health and Human Resources and the Lord Fairfax Planning District in Virginia were contacted to identify any sole source aquifers or wellhead protection areas crossed by the proposed alignments. There are no sole source aquifer designations in the vicinity of the proposed project. There is one wellhead protection area within the project area, a discussion of which is provided below.

2. EXISTING ENVIRONMENT AND IMPACTS

Nine communities are serviced by public water supplies. Seven of the nine obtain their water supply from surface water sources and two (Wardensville and Mt. Top) from springs. Daily demand among these nine public water supplies ranges from 5.5 l/sec (1,250 gal/min.) in Elkins to 0.21 l/sec (50 gal/min.) in the Hamrick Public Service District (Towns of Hambleton and Hendricks) intake.

Public water supplies and geographical relationships to the proposed alignments are discussed below and presented in Table III-15. Of the nine public water supplies identified, the following seven would not be impacted by any proposed alignment: Moorefield, Mt. Top, Hambleton and Hendricks, Thomas, Davis, Douglas, and Elkins. These seven public water supplies would not be impacted because all of the proposed alignments are either located outside the water supply's watershed or are located downstream of the water supply's intake. Parsons water supply is discussed on the following pages. Because the water supply to Wardensville originates from groundwater, that discussion is contained in Section III-G: *Groundwater Resources*.

TABLE III-15
PUBLIC WATER SUPPLY IMPACTS

COMMUNITY NAME	PUBLIC WATER SOURCE	LINE	LOCATION OF PROPOSED ALTERNATIVES	IMPACT TYPE
Wardensville	Spring	IRA	Not located in wellhead protection area	None
		Line A	Wellhead protection area encroachment	Possible Impact on the Aquifer*
Moorefield	South Branch of Potomac River	IRA & Line A	+6 km (+3 mi.) South of spring and outside of watershed	None
Mt. Top	Spring	IRA & Line A	+3.2 km (+2 mi.) Downstream of spring	None
Hambleton and Hendricks (Hamrick PSD)	Dry Fork River	IRA & Line A	+2.5 km (+1.5 mi.) Downstream of intake	None
Thomas	Reservoir on unnamed creek 4.8 km (3 mi.) north of Thomas	IRA & Line A	Alignments not in reservoir watershed	None
Davis	Blackwater River	IRA & Line A	No crossing of Blackwater River	None
Douglas	Reservoir on tributary to Long Run	IRA & Line A	+1.5 km (+1 mi.) north of reservoir	None
Parsons	Shavers Fork	IRA	Parallel construction on same side of river as intake	Possible Construction Impacts
		Line A	Bridging +2 km (+1 mi.) upstream of intake. Some parallel construction opposite intake	Possible Construction Impacts
		Line S	Parallel construction opposite intake	Possible Construction Impacts
Elkins	Tygart Valley River	IRA & Line A	+3 km (+ 2 mi.) downstream	None

* Refer to Section III- G: *Groundwater Resources*

Parsons' water supply is drawn from Shavers Fork. The intake for this water supply is located on the west bank of Shavers Fork, just north of its confluence with Sugarcamp Run. Line A would require two bridge crossings upstream of the water intake; the closest crossing being 2.1 kilometers (1.3 miles) and the farthest being 5.6 kilometers (4.3 miles). In the Shavers Fork Option Area, Line S would require no bridging but, like Line A, would require construction parallel to Shavers Fork on the east bank. The proposed construction activities and final highway construction limits for either Line A or Line S would not encroach into Shavers Fork.

The IRA would require construction parallel to Shavers Fork on its western side but, like Line A or Line S, would not encroach into the river. The IRA, Line A, or Line S could cause minor and temporary construction-related impacts to the water supply related to possible erosion. No direct or permanent impacts would be expected from construction, operation, or maintenance of either the Build or Improved Roadway Alternatives. The No-Build Alternative would not impact Parsons' water supply at Shavers Fork.

3. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

The alignment development process for both the IRA and the Build Alternative included efforts to avoid public water supplies. At this time, there would be no impacts to public water supplies by any alternative . Construction activities in the Parsons area would be carried out using the practices described in WVDOT's *Erosion and Sediment Control Handbook for Developing Areas in West Virginia.* Application of these policies and practices would assure that erosion and sedimentation impacts would be controlled.

G. GROUNDWATER RESOURCES

Groundwater resources have been evaluated in accordance with FHWA Technical Advisory T 6640.8A. This discussion focuses on three groundwater topic areas: private wells, springs, and karst/sandstone recharge areas. Methodologies, existing environment, impacts, and mitigation measures are discussed by topic area in the sections below. Sources for information in this assessment include the West Virginia Geologic and Economic Survey, the Virginia Division of Minerals and Mines, and the US Geological Survey.

Most people in the project area obtain their drinking water from either private wells or springs. Wells are typically installed in the first water bearing rock formation encountered during well drilling. These wells, depending on the local geology, range in depth from a few to several hundreds of feet. Groundwater can be obtained from sedimentary rocks such as sandstones, siltstones, shales, and limestones. The water quality associated with these rocks varies as discussed below.

Groundwater quality is a function of the amount of time water is in the groundwater system and the rock type from which it is derived. Wells located on ridges composed of sandstone and limestone tap relatively "young" and pure groundwater. This is because the "young" groundwater has not had sufficient time in the goundwater flow system to accumulate dissolved mineral matter. Wells penetrating valleys formed by shales will obtain "older", less pure groundwater. This is because the groundwater has had sufficient time in the system to accumulate dissolved mineral matter. Groundwater obtained within shales or coal contains greater amounts of iron and sulfate, indicating reduced water quality.

Groundwater within the Appalachian Plateau physiographic province is obtained from sandstones, shales, siltstones, or limestones. The chemical character of the groundwater in these watersheds is variable, ranging from acidic to basic, and contains low to high concentrations of iron and chloride. East of the Allegheny Front, the proposed alignments enter the Valley and Ridge physiographic province. Most of the ridges are composed of limestones and sandstones that serve as recharge areas for groundwater. Valleys in this province are typically formed of shale. The groundwater quality in this province ranges from very poor to excellent depending on the aquifer.

1. PRIVATE WELLS

a. Methodology

Well locations and additional data regarding well construction and bedrock units in West Virginia were obtained from the USGS National Water Information System. The location of private water wells in Virginia was obtained from the EPA STORET groundwater database. Water quality data concerning private wells is described according to the geologic formation or rock units into which the wells were installed. When the available secondary data sources made no specific reference to water quality data for a formation or rock unit, the known water quality typical for that kind of sedimentary rock unit (i.e., sandstone, shale, siltstone, or limestone) was used.

All water wells within 152 meters (500 feet) of the proposed construction limits of the IRA and the Build Alternative were identified as being within the potential impact zone. The potential zone of impact was based on the best professional judgment of a certified hydrogeologist. In addition, well impacts were assumed to occur when residential relocations were required and were not currently served by a known public water supply.

b. Impacts

The No-Build Alternative would not impact existing wells. The IRA would directly impact 1 well, with an additional 24 wells within 152 meters (500 feet) of the IRA. All of these wells are located in West Virginia. There would be no impact to known wells in Virginia under the IRA. Six wells would be directly impacted by Line A in West Virginia. These wells are all associated with residential relocations. Seventeen additional wells were determined to be within 152 meters (500 feet) of Line A, all in West Virginia. There are no known wells within any of the Option Areas, or in Virginia that would be impacted.

c. Avoidance, Minimization, and Mitigation

The alignment development process for both the IRA and the Build Alternative included efforts to avoid or minimize impacts to groundwater resources. The following mitigation measures could be used during final design and construction of the proposed alignments to monitor impacts to existing wells, based on the final design of the project:

- Any wells that would be lost due to construction activities would be replaced, as necessary, through WVDOT's or VDOT's right-of-way acquisition process. Wells would be properly abandoned and sealed in accordance with standards set by current regulations.

- Wells that are within 152 meters (500 feet) of the Build Alternative and the IRA would be monitored before, during, and after construction to identify any changes in water quality during construction activities. If substantial changes in water quality or quantity occur, these wells would be replaced.

2. SPRINGS

This section discusses spring assessment methodologies, impacts and mitigation for springs associated with a public water supply, an important site, or farm or business operation. Other springs identified or brought to the attention of WVDOT are also discussed. The following discussion of methodologies covers the methods used in all or some of the springs discussed. Following the methodology discussion, each spring is discussed as a stand-alone topic due to the uniqueness of each situation.

a. Methodology

The locations of springs were identified based on three sources: publications from the West Virginia Geological and Economic Survey; springs encountered during field work; and information obtained from public meetings or public involvement. The location of each spring was assessed relative to its proximity to the alignments, its use, and the type of geologic unit involved. Dye tracer studies were conducted and are described later in this section.

Dye tracing technology involves the injection of nontoxic dyes into the groundwater system by various means. Sampling is conducted through the use of charcoal filter packets, placed at pre-designed areas downstream of the injection point. Highly sensitive detection equipment is used to measure the parts per million of the dye recovered. Background sampling is generally conducted two weeks prior to the injection of dye and normally for a six week period following injection. Ozark Underground Laboratories (OUL) conducted these studies for the proposed project. Results of the dye tracer studies can provide valuable information on groundwater flow patterns and time of travel. Tracer studies were conducted at Wardensville Spring and the springs associated with the Lost River, the Capon Springs and Farms Resort, and Greenland Gap. Reports prepared by OUL are included in Appendix B of this SDEIS.

b. Wardensville Spring

(1) Existing Environment

The Wardensville Spring is located at the nose of Anderson Ridge, approximately 61 meters (200 feet) east of Waites Run Road (County 5/1) and within the boundaries of the J. Allen Hawkins Community Park. The spring discharges from Oriskany Sandstone at a rate of 4.1 liters per second (65 gallons per minute) (McCulloch, 1986). Wardensville's water plant is located at the discharge point of the spring and consists of a pump house, clear well, two high volume pumps, a spring water storage tank, an overflow pipe, and a chlorinator (SCS, 1985). Wardensville's daily water demand on this spring is approximately 190,000 liters (50,000 gallons).

In February 1994, the West Virginia Department of Health and Human Resources initiated a Wellhead Protection Program for the Wardensville Spring. One of the major elements of the Wellhead Protection Program was the determination of the preliminary boundaries of a wellhead protection area for the Wardensville Spring. The preliminary boundaries encompass an irregularly shaped area approximately 192 hectares (500 acres) in size. The preliminary boundaries extend 305 meters (1,000 feet) north of the discharge point of the spring and 2,286 meters (7,500 feet) southwest of its discharge point.

These boundaries were determined based on a procedure described by EPA entitled, *Guidelines for Delineation of Wellhead Protection Areas* (EPA, 1987). As shown in Exhibit III-12, Line A would cross Anderson Ridge 606 meters (2,000 feet) southwest of the spring discharge point, with a depth of fill of 3 meters (10 ft) just west of Waites Run and a cut of 47 meters (154 feet) at the highest point on the ridge.

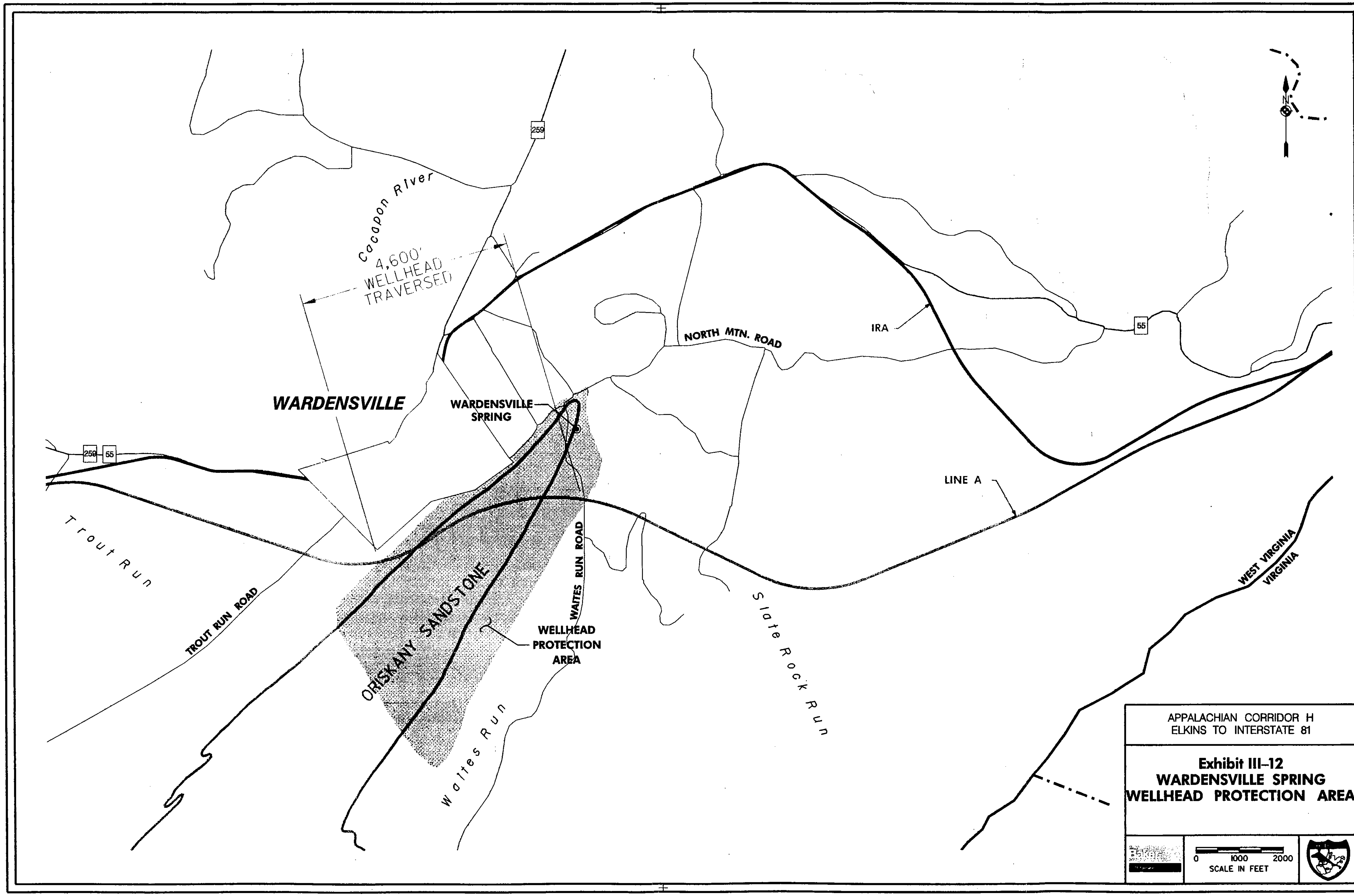
(2) Dye Tracing Results and Impact Assessment

Ozark Underground Laboratories provided a preliminary assessment of the potential project-related impacts to the Wardensville Spring. The assessment was based on the preliminary wellhead protection area boundaries for the Wardensville Spring, information gained from field observations and other hydrogeological, geographic, and topographic information from secondary sources (McColloch, 1986; Hobba et al., 1972; Hobba, 1985). This preliminary assessment concluded that, even though the Build Alternative would cross the Wardensville Spring wellhead protection area, the quantity of flow would most likely not be affected. The finished grade of Line A would be located 23 meters (77 feet) to 47 meters (154 feet) above the sandstone unit identified as one portion of the aquifer supplying groundwater to the spring. In order to obtain as much information as possible, and because this area is a sensitive recharge unit (see below), a dye tracer study was conducted by Ozark Underground Laboratories. The purpose of these additional studies was to:

- More precisely determine the recharge area for the Wardensville Spring;
- More confidently predict project-related impacts;
- Better understand the nature of groundwater flow to the spring; and
- Prescribe measures to mitigate predicted or possible impacts.

The dye trace involved the injection of one pound of rhodamine WT dye immediately adjacent to the Wardensville water tank on Anderson Ridge. As shown in Exhibit III-13, eight monitoring stations were established to detect dye from this injection. This location was selected to test the "worst case" scenario that water could move rapidly into the groundwater flow system and discharge from Wardensville Spring within a few hours or days.

After six weeks of sampling, no dye was recovered in any samples. The sampling was extended to 14 weeks with still no dye recovery. The results indicate that water infiltrating Anderson Ridge, located within the recharge area for the spring, do not rapidly contribute waters to the Wardensville Spring at the dye injection site and by inference, similar sites on Anderson Ridge (Ozark Underground Laboratory, 1994). Because the dye is biodegradable after a period of time, it cannot and has not been concluded that surface waters recharging Anderson Ridge do not reach the Wardensville Spring.

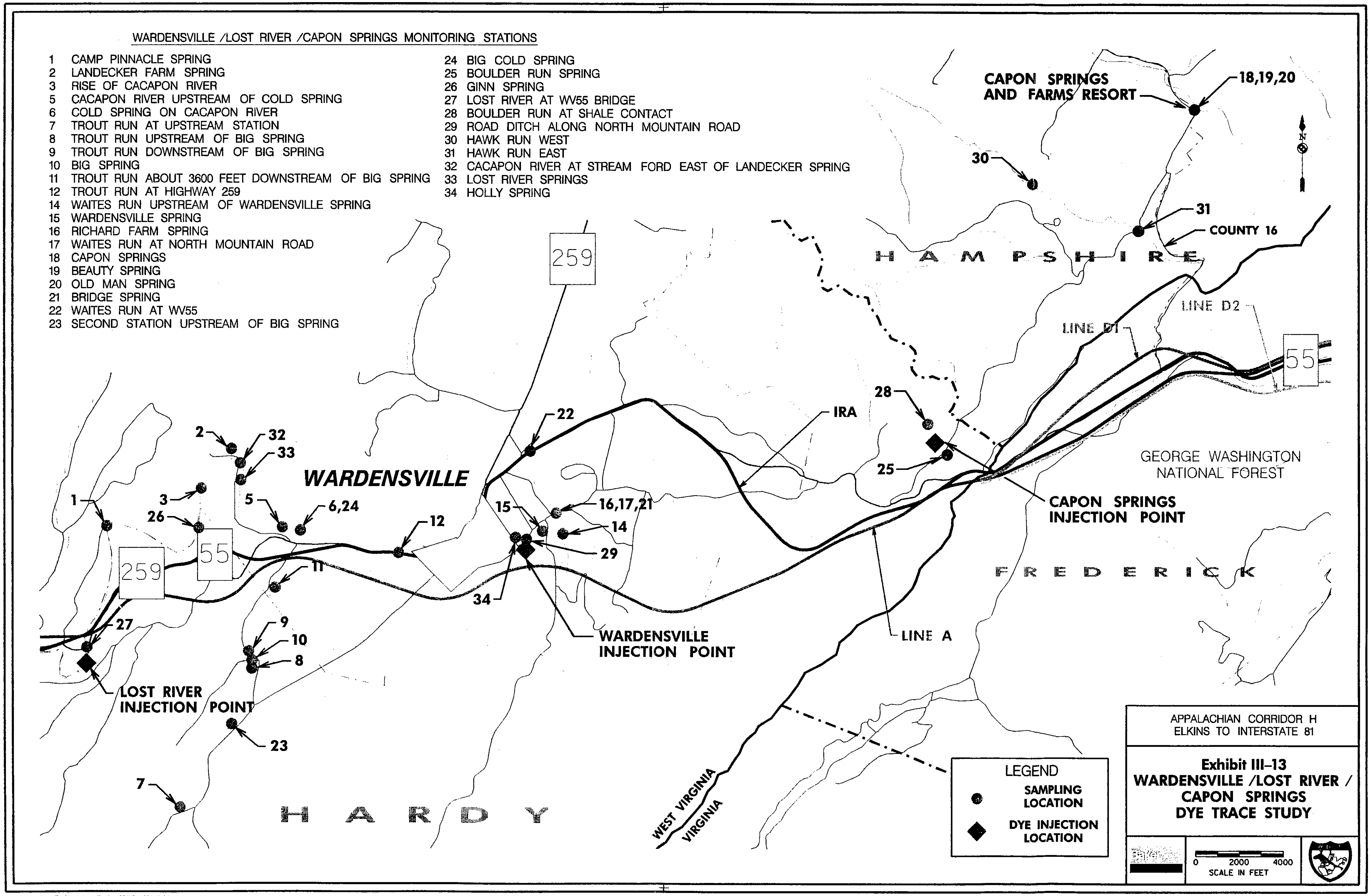


APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-12
WARDENSVILLE SPRING
WELLHEAD PROTECTION AREA

0 1000 2000
SCALE IN FEET

/corh/shtplot/final/geo/iiime5.dgn 08-OCT-1994 14:46


WARDENSVILLE /LOST RIVER /CAPON SPRINGS MONITORING STATIONS
1 CAMP PINNACLE SPRING
2 LANDECKER FARM SPRING
3 RISE OF CACAPON RIVER
5 CACAPON RIVER UPSTREAM OF COLD SPRING
6 COLD SPRING ON CACAPON RIVER
7 TROUT RUN AT UPSTREAM STATION
8 TROUT RUN UPSTREAM OF BIG SPRING
9 TROUT RUN DOWNSTREAM OF BIG SPRING
10 BIG SPRING
11 TROUT RUN ABOUT 3600 FEET DOWNSTREAM OF BIG SPRING
12 TROUT RUN AT HIGHWAY 259
14 WAITES RUN UPSTREAM OF WARDENSVILLE SPRING
15 WARDENSVILLE SPRING
16 RICHARD FARM SPRING
17 WAITES RUN AT NORTH MOUNTAIN ROAD
18 CAPON SPRINGS
19 BEAUTY SPRING
20 OLD MAN SPRING
21 BRIDGE SPRING
22 WAITES RUN AT WV55
23 SECOND STATION UPSTREAM OF BIG SPRING
24 BIG COLD SPRING
25 BOULDER RUN SPRING
26 GINN SPRING
27 LOST RIVER AT WV55 BRIDGE
28 BOULDER RUN AT SHALE CONTACT
29 ROAD DITCH ALONG NORTH MOUNTAIN ROAD
30 HAWK RUN WEST
31 HAWK RUN EAST
32 CACAPON RIVER AT STREAM FORD EAST OF LANDECKER SPRING
33 LOST RIVER SPRINGS
34 HOLLY SPRING
CAPON SPRINGS AND FARMS RESORT
18,19,20
30
31
COUNTY 16
N
HAMPSHIRE
259
LINE D1
LINE D2
55
IRA
28
25
22
GEORGE WASHINGTON NATIONAL FOREST
CAPON SPRINGS INJECTION POINT
WARDENSVILLE
2
32
33
1
3
26
5
6,24
12
15
16,17,21
14
29
34
FREDERICK
259
55
11
27
9
10
8
WARDENSVILLE INJECTION POINT
LINE A
LOST RIVER INJECTION POINT
23
7
HARDY
WEST VIRGINIA
VIRGINIA
LEGEND
SAMPLING LOCATION
DYE INJECTION LOCATION
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81
Exhibit III-13
WARDENSVILLE /LOST RIVER / CAPON SPRINGS DYE TRACE STUDY
0 2000 4000
SCALE IN FEET

A second dye trace was conducted at a sinking point on the Lost River located about 213 meters (700 feet) upstream of the WV 55 crossing of the Lost River. Four pounds of eosine dye powder were injected into a point were the river was flowing into the limestone on the east bank of the river. Sixteen monitoring stations were established to detect dye from this injection site as shown in Exhibit III-13. Dye tracing results indicate that dye from this injection point discharged into the Cacapon River in a segment between monitoring stations 3 and 5. This indicated that there is little storage in the portion of the karst aquifer traversed by dye used in this tracing study (Ozark Underground Laboratory, 1994). Furthermore, any contaminants entering this sinking portion of the Lost River have the potential to enter the groundwater flow system throughout the year with rapid travel rates to a segment of the Cacapon River about 2,530 meters (8,300 feet) downstream. Eosine dye was not recovered from the Wardensville Spring which demonstrates that a hydrologic connection between the sinks in the Lost River and the Wardensville Spring does not exist.

Neither the No-Build Alternative nor the IRA would impact the Wardensville Spring or its associated wellhead protection area.

(3) Avoidance, Minimization, and Mitigation

Mitigation measures would be required to protect the Wardensville water supply from contamination due to construction activities associated with the Build Alternative.

In advance of construction, a series of groundwater monitoring wells would be constructed on Anderson Ridge at the proposed location of Line A to obtain information on the elevation of the saturated zone of the aquifer. Well installation and monitoring would begin as soon as practical. Further, one monitoring well would be used as an injection point to introduce dye directly into the aquifer supplying the spring. This dye trace would provide important information for impact mitigation.

During construction, storage and use of fuels and other similar materials would not be permitted within the recharge area or across Anderson Ridge. Construction vehicles and equipment would be stored away from the wellhead protection area. Blasting programs would be designed so that excavation across the ridge would use the smallest effective charge and so that cuts would be made in the smallest incremental heights possible. Monitoring for short term turbidity would be conducted. Plans for the short term use of alternate water supplies would be developed and in place in advance of construction.

Measures would be taken to prevent contamination of the water supply due to operation of the highway, such as stormwater runoff, and accidental spills. Such measures would include the design and construction of impervious ditches and medians across Anderson Ridge, and a collection and retention system outside of the wellhead protection area. Impervious ditches could be constructed using traditional pavement materials such as asphalt or concrete, or could be designed using an impervious geotextile material that would be placed beneath a gravel layer. This would allow for a median and ditch that could be seeded as in typical highway construction. This arrangement would be more aesthetically pleasing, but would still function in the event of an accidental spill.

c. Capon Warm Springs Complex

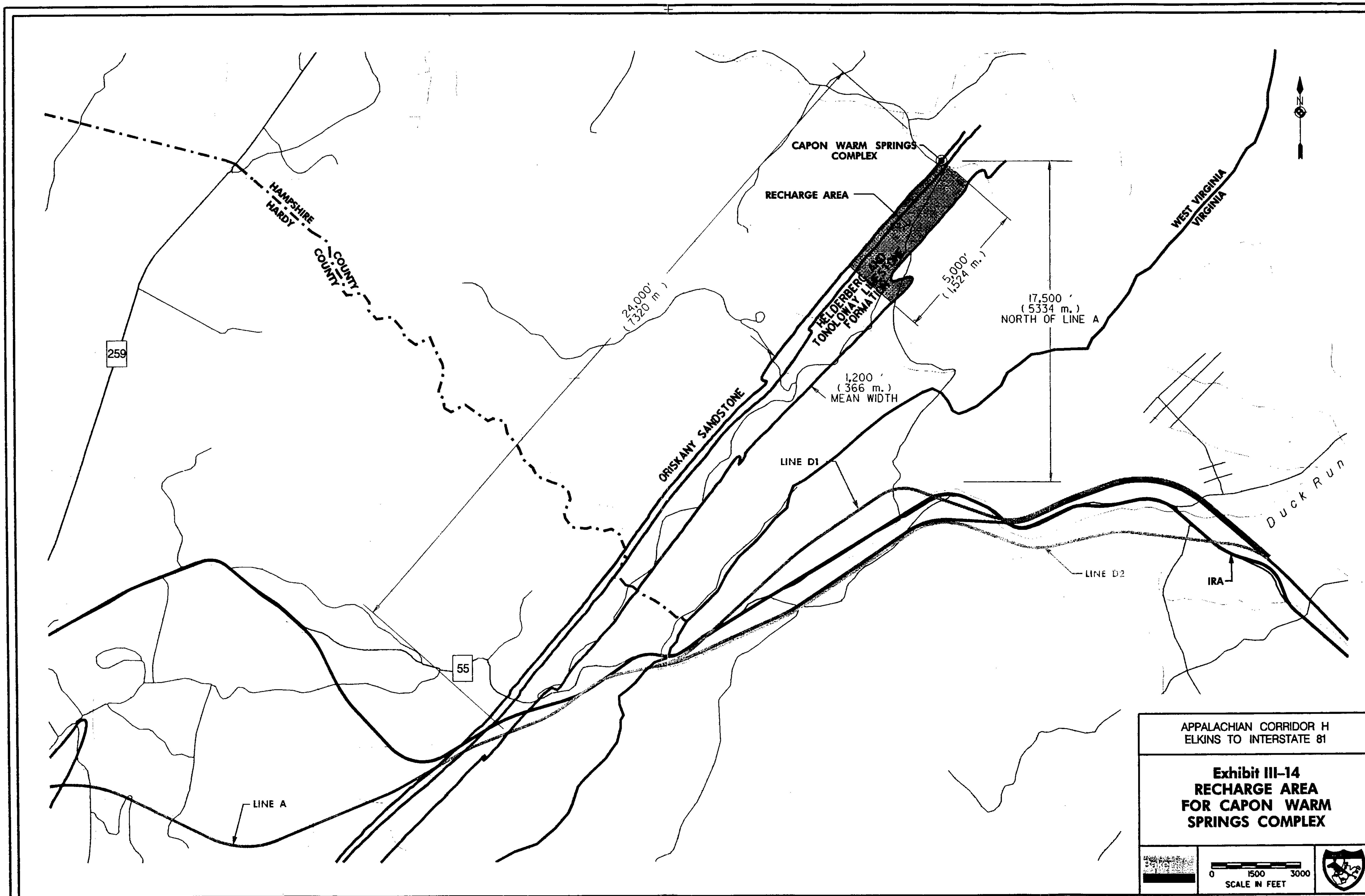
(1) Existing Environment

Capon Springs is a complex of several warm springs, including Old Man Spring and Beauty Spring. The spring complex is located 12 kilometers (7.5 miles) northeast of Wardensville, approximately 5.3 km (3.3 miles) north of the proposed alignments. Capon Springs and Farm Resort, which is listed on the National Register of Historic Places, was developed around these warm springs. The principal spring used at the resort discharges from a nearly vertical outcrop of the Oriskany Sandstone at a gap along the northwestern limb of the Great North Mountain Anticlinorium. This gap is located along Bear Ridge.

(2) Dye Tracing Results and Impact Assessment

As a part of the groundwater impact assessment, Ozark Underground Laboratories performed an independent assessment to define further the recharge area for the Capon Warm Springs Complex. It was determined that the Oriskany Sandstone, Tonoloway Limestone, and the Helderberg Group provide groundwater recharge to the springs. The results place the proposed alignments approximately 5.8 kilometers (3.6 miles) south of the newly defined southern boundary of the recharge area, removing the springs even further from a potential impact. The probable extent of the recharge area for this spring complex is presented on Exhibit III-14.

A dye trace was conducted between the Build Alternative and the Capon Warm Springs Complex along the sinking portion of an unnamed stream. (Refer to Exhibit III-13 for dye injection location and monitoring stations.) This stream is located approximately 6.1 kilometers (3.8 miles) southwest of the Capon Warm Springs Complex just off Forest Road 502 that continues to the Hawk Campground. Three pounds of fluorescein dye powder were injected into the sinking portion of this stream which flows across the entire extent of the groundwater recharge units for the Capon Warm Springs Complex. Six monitoring stations were established to detect dye from this trace study.



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-14
RECHARGE AREA FOR CAPON WARM SPRINGS COMPLEX

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Results from the dye trace indicate that little, if any, water from the sinking portion of the stream recharged groundwater supplies in the Oriskany Sandstone and the associated Helderberg and Tonoloway limestones. This conclusion was based on the very large amount of dye recovered at a monitoring station (Station 28) located down the topographic valley from the dye injection site. Furthermore, no dye was recovered at any stations located between the dye injection site and the Capon Warm Springs Complex. No dye was recovered at the Capon Warm Springs Complex. Neither this data nor any other hydrogeologic data indicate or suggest that waters entering the groundwater system along the Build Alternative would ultimately reach any of the springs in the Capon Warm Springs Complex (Ozark Underground Laboratory, 1994).

(3) Avoidance, Minimization, and Mitigation

About 457 meters (1,500 feet) of the Build Alternative would be located on the outcrop area of recharge units which are associated with the Capon Warm Springs Complex. Even though it has been demonstrated that the Build Alternative would be located beyond the recharge area for the springs, special care would be taken when crossing these recharge units to prevent contaminants from entering the groundwater system. Stormwater runoff would be diverted away from recharge units in this segment of the highway.

d. Greenland Gap

(1) Existing Environment

Greenland Gap is located at New Creek Mountain (Wills Mountain Anticline) where the North Fork of Patterson Creek cuts through the resistant beds of the anticline. Limestone units comprise the eastern and western flanks of the anticline. The Build Alternative would pass upgradient of these limestone units on the western flank of New Creek Mountain to the east of County 1. This valley, located between Walker Ridge and New Creek Mountain, contains numerous sinkholes and "lost" streams. Two sinkholes along County 1 serve as groundwater recharge points and would be located about 150 meters (500 feet) down gradient from Line A.

Another karst area on top of Walker Ridge contains a very large depressional sinkhole. A spring located 640 meters (2,100 feet) east provides a perennial supply of water into this sinkhole.

(2) Dye Tracing Results and Impact Assessment

Three dye injection sites formed the basis of this study. Two dye injections were located along County 1 (Southern Greenland Gap Trace [120] and Middle Greenland Gap Trace [121]) and another on top of Walkers Ridge (Northern Greenland Gap Trace [122]). Refer to Exhibit III-15 for dye injection locations and monitoring stations. Eosine dye (0.33 pounds) was injected into a sinkhole named the Southern

Greenland Gap Trace site. This site is located about 1006 meters (3,300 feet) north of the intersection of County 1 and Greenland Road, on the eastern side of County 1. One pound of rhodamine WT dye was injected into a second sinkhole located about 978 meters (3,210 feet) north of the Southern Greenland Gap Trace site on the western side of County 1. The third dye injection, the Northern Greenland Gap Trace site, was located in a sinkhole on top of Walkers Ridge. One pound of fluorescein dye was injected into this sinkhole.

Dye trace studies were conducted in this karst area to determine if these sinkholes contribute recharge waters to springs located in the surface valley occupied by County 1. It was also important to determine which springs in the Patterson Creek watershed receive recharge waters from the selected dye injection sites.

Results from the three groundwater traces demonstrate that waters originating from the Build Alternative would enter the groundwater system and discharge from two locations. The primary discharge point is Muntzing Spring (Station 113), an important cold water tributary to Patterson Creek. A secondary discharge point is a spring or springs in, or tributary to Patterson Creek between monitoring stations 118 and 119. All three tracer dyes reached Muntzing Spring within seven days of dye injection. Rapid groundwater travel rates and the appreciable concentration of the dyes recovered indicate that the groundwater system is highly permeable and that it provides ineffective natural cleansing (Ozark Underground Laboratory, 1994). Any event which yields contaminants at Muntzing Spring would directly yield contaminants to Patterson Creek.

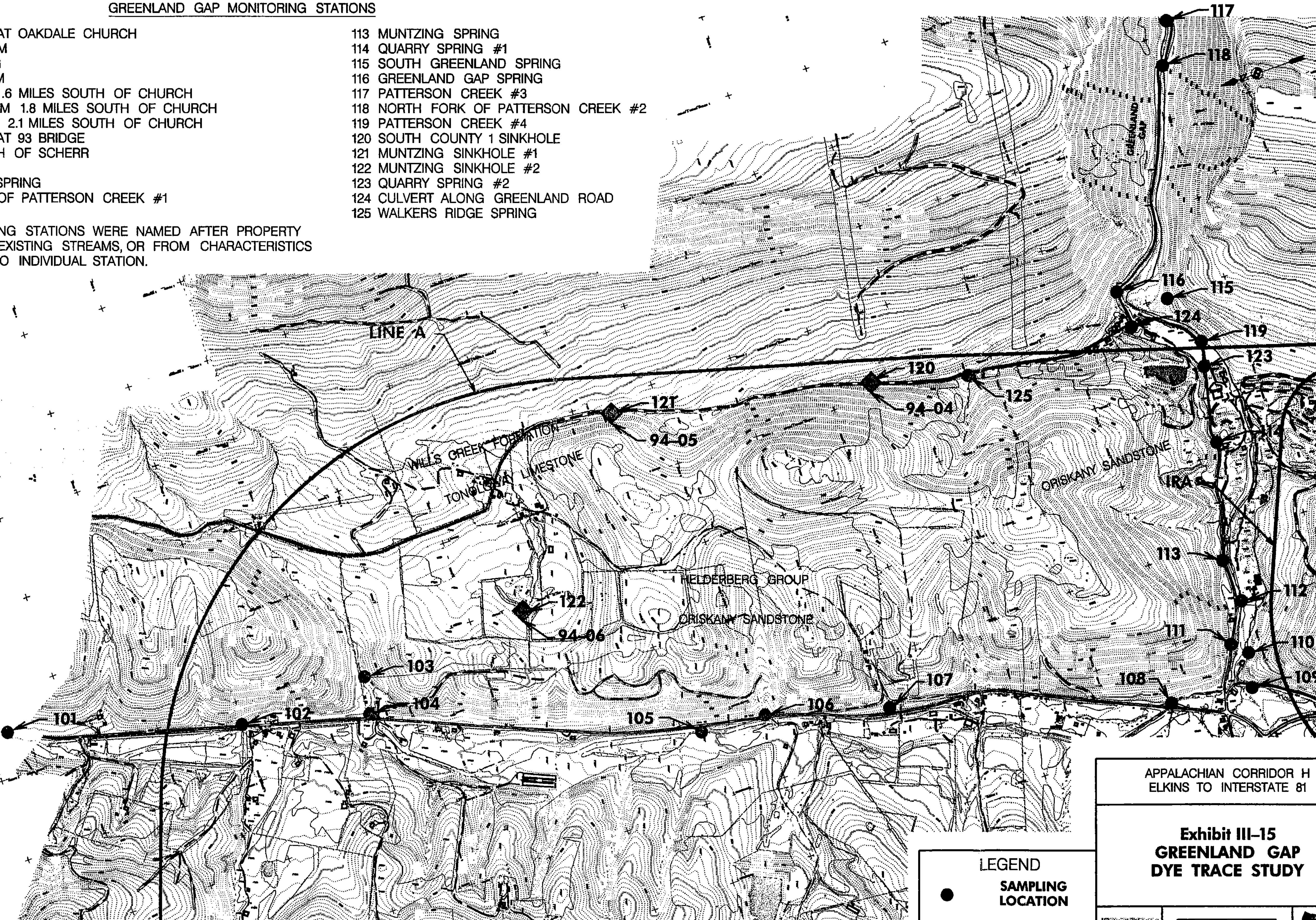
Residents along County 1 obtain their drinking water from wells and springs. Portions of this valley downstream of the dye injection points are drained by sinking streams. It was not possible to obtain water samples from all private water sources during the course of the study. However, it is likely that some water sinking in this valley downstream of the dye injection sites subsequently discharges at these drinking water springs (Ozark Underground Laboratory, 1994).

Inasmuch as existing roadways cross most of the same zones of sensitivity, contamination of groundwater due to accidental spills could occur due to the selection of the No-Build, Improved Roadway, or Build Alternatives.

GREENLAND GAP MONITORING STATIONS

101 ELKLICK RUN AT OAKDALE CHURCH
102 CATTAIL STREAM
103 WINGO SPRING
104 WINGO STREAM
105 ELKLICK RUN 1.6 MILES SOUTH OF CHURCH
106 POSTED STREAM 1.8 MILES SOUTH OF CHURCH
107 ROCKY SPRING 2.1 MILES SOUTH OF CHURCH
108 ELKLICK RUN AT 93 BRIDGE
109 STREAM SOUTH OF SCHERR
110 CABIN SPRING
111 HELDERBERG SPRING
112 NORTH FORK OF PATTERSON CREEK #1
113 MUNTZING SPRING
114 QUARRY SPRING #1
115 SOUTH GREENLAND SPRING
116 GREENLAND GAP SPRING
117 PATTERSON CREEK #3
118 NORTH FORK OF PATTERSON CREEK #2
119 PATTERSON CREEK #4
120 SOUTH COUNTY 1 SINKHOLE
121 MUNTZING SINKHOLE #1
122 MUNTZING SINKHOLE #2
123 QUARRY SPRING #2
124 CULVERT ALONG GREENLAND ROAD
125 WALKERS RIDGE SPRING

NOTE: MONITORING STATIONS WERE NAMED AFTER PROPERTY OWNERS, EXISTING STREAMS, OR FROM CHARACTERISTICS UNIQUE TO INDIVIDUAL STATION.



LEGEND
- SAMPLING LOCATION
- DYE INJECTION LOCATION

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-15
GREENLAND GAP DYE TRACE STUDY

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SCALE IN FEET

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(3) **Avoidance, Minimization, and Mitigation**

Dye tracing results have demonstrated that stormwater runoff and accidental spills in relation to the construction and use of the Build or Improved Roadway Alternatives would enter the Greenland Gap karst groundwater system. Due to the rapid travel time of groundwater in this area, detention ponds would be constructed to contain spills. Additionally, peat sand filters would be constructed upgradient of the sinkholes to intercept and treat the highway runoff before entering the groundwater system. Peat sand filters have been successfully used by the Indiana Department of Transportation. The filters consist of layered sand and peat approximately three feet in depth, underlain by a drainage tile system to remove the filtered runoff. Highway runoff is diverted over the filter and allowed to percolate through, providing for the cation exchange of heavy metals and removal of suspended sediment. Planting the filter surface can further increase the filter's effectiveness.

e. Knobly Road Spring

Knobly Road Spring is located along the Middle Fork of Patterson Creek within the Patterson Creek Option Area, approximately 400 meters (1,310 feet) upstream from the point at which the Build Alternative would cross Knobly Road. A small structure is built around the spring which is located on the southern bank of Patterson Creek. This spring was located during field work and was further identified by a local resident. According to local residents, this spring provides water for five or six farms, two homes, livestock, and chickens. Based on geologic mapping (Reger et al., 1923), this spring discharges near a contact of the Oriskany Sandstone and the Helderberg Limestone. There are no published data available to verify the reported flow or chemical characteristics of this spring.

The No-Build and the Improved Roadway Alternatives would have no impact on this spring.

Under the Build Alternative, both Line A and Line P would impact the Knobly Road Spring. Line A, located upgradient of the spring, could reduce the flow of groundwater to the spring. Line P would less likely impact the flow of groundwater to the spring due to its position on the opposite side of Patterson Creek and away from the limits of cut. However, because a recharge area for Knobly Road Spring has not been defined, groundwater may also be recharging the spring from the northern side of Patterson Creek. The extent of impact on groundwater flow to the spring would depend on the elevation of the top of the saturated zone relative to the elevation of the finished grade of the proposed highway.

f. Cold Spring

Cold Spring is located 10.6 kilometers (6.6 miles) east of Wardensville in a gap between Paddy Mountain and Short Mountain. The spring is approximately 38 meters (125 feet) south of VA 55, on the opposite side of the road from Duck Run. This spring is frequented by local residents and used as a discretionary source of drinking water. According to the Department of Health in Frederick County, Cold Spring is not a sole water source. Springs like Cold Spring are commonly used by local residents as a discretionary source of perceived clear, clean mountain water.

Cold Spring appears to be a contact spring where groundwater flowing through a permeable sandstone layer (the Oswego Formation) encounters the less permeable Martinsburg Shale (Butts, 1963). In the area of this encounter, the groundwater is forced to the surface at a fracture point to create a spring. Cold Spring does not function as a major water source to Duck Run, a native trout stream located approximately 100 meters (300 feet) to the north.

A recharge area for Cold Spring has not been calculated according to the US Geological Survey. However, it has been suggested that the recharge area would likely be located upgradient from the spring, along Paddy Mountain and to the west. The proposed alignments adjacent to Cold Spring are in the Duck Run Option Area. Both the IRA and the Build Alternative within the Duck Run Option Area would require construction within the spring's probable recharge area along Paddy Mountain.

The IRA would require the realignment of VA 55 along this section. As such, it would require construction within 16 meters (50 feet) of the spring, as well as within a portion of the assumed recharge area. The spring may still be used as a local potable water supply after construction, but would probably be inaccessible during construction. Because of the potential impact to Duck Run, it would not be possible to shift the IRA to the north of VA 55 to avoid Cold Spring.

Under the Build Alternative and within the Duck Run Option Area, the construction limits of Line D1 would extend within 53 meters (175 feet) of the spring. While Line D1 would be the closest of the Build Alternative alignments to the spring, it would require the least amount of construction within the probable recharge area. Line D2 would be the farthest Build Alternative from the spring and would require construction limits extending within 122 meters (400 feet) of the spring. Line D2 would require the greatest amount of construction within the probable recharge area. Line A would require construction limits extending within 91 meters (300 feet) of the spring with construction limits also extending within the probable recharge area.

g. Other Springs

There are a number of springs located throughout the project area that were identified during field work and public meetings. None of these springs are known to be used as a drinking water supply.

In the Cheat River Watershed a spring is located west of Mackeyville Road at the head of a small drainage way to Roaring Run. Line A would impact this spring while the IRA would avoid this spring.

In the North Branch of the Potomac River Watershed, there is an area of karst with sinkholes and springs along the western flank of New Creek Mountain. Three springs were identified on the eastern flank of New Creek Mountain ranging from 183 meters (600 feet) to 33 meters (100 feet) from the proposed alignments Line A and the IRA).

There is a spring along the western bank of the Potomac River, 61 meters (100 feet) south of Line A. Line A and the IRA would avoid impacts to this spring.

The Cacapon River Watershed contains a number of springs due to the geology of the area. Line A would impact a spring located along an unnamed tributary to the Lost River. This spring would be avoided by the IRA. Big Spring is a large spring located along Trout Run, upstream of the proposed crossing by Line A and the IRA. Neither the Build Alternative nor the IRA would impact Big Spring.

3. KARST/SANDSTONE RECHARGE UNITS

a. Methodology

While karst is defined in the Geology section as areas involving only limestone, limestones and sandstones in the proposed project area typically serve as source areas for groundwater recharge. Being the most permeable rock units, they are also more susceptible to contamination. Areas underlain by a combination of limestone and sandstone were considered in this assessment for potential impacts to groundwater. The location and extent of nine limestone and two sandstone units were identified from secondary data sources (West Virginia Geologic and Economic Survey, 1924, 1926; and the Virginia Division of Mineral Resources, 1963). These units include Oriskany Sandstone, Williamsport Sandstone, Helderberg Group, Tonoloway Limestone, Greenbriar Limestone, Wills Creek Formation, McKenzie Formation, Beekmantown Group, Conococheague Formation, and the Elbrook Formation. The orientation and extent of each unit was superimposed over alignment mapping. This combined mapping was used to define the limits of areas termed *zones of sensitivity*. Three such zones were defined:

- Zone 1: Areas that provide groundwater recharge for a public water supply; areas that contain sinkholes and which provide recharge to a National Resource Water, a West Virginia High Quality Stream, a Virginia Outstanding State Resource Water; or any other important site. Zone 1 is of high sensitivity.

- Zone 2: Areas that contain sinkholes and provide groundwater supplies for private drinking water in moderately populated areas. Zone 2 is of moderate sensitivity.

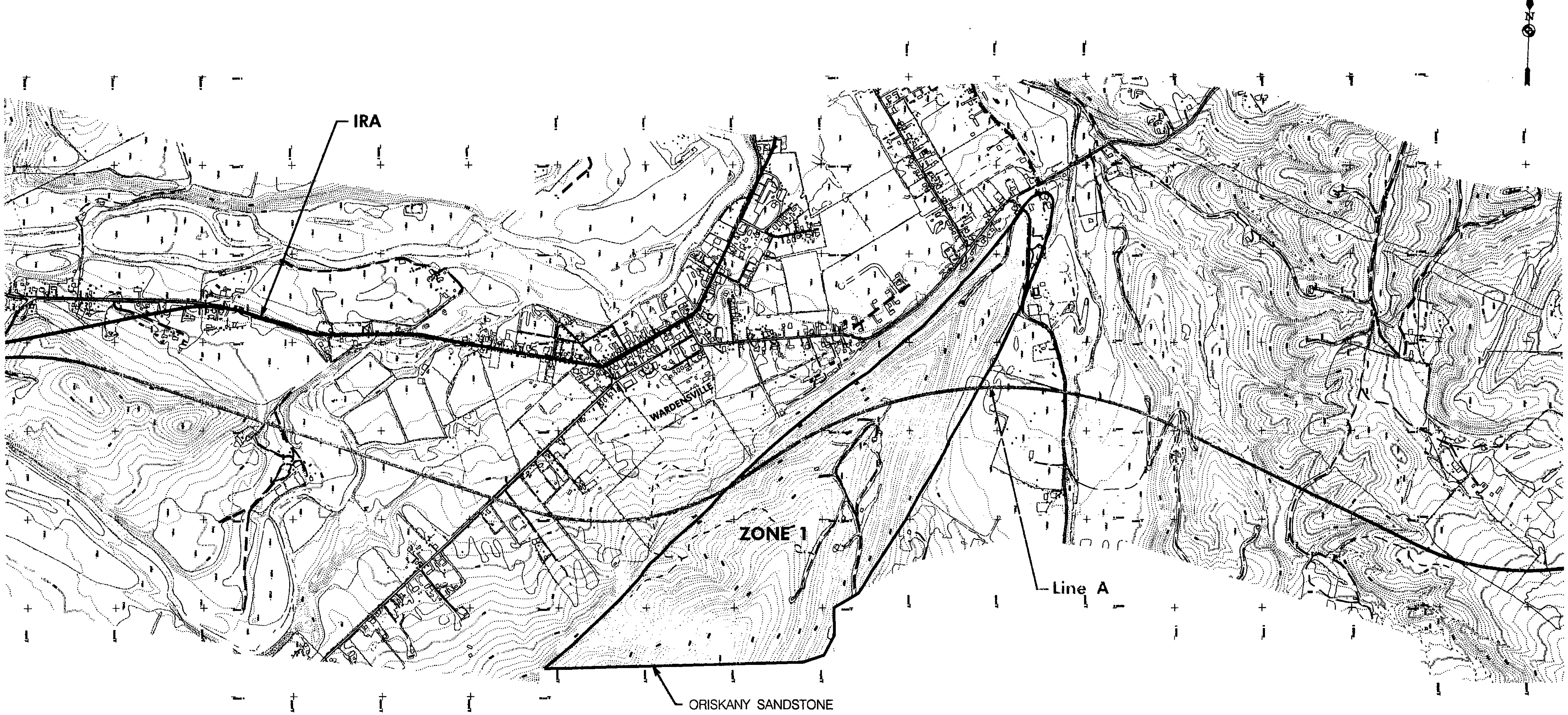
- Zone 3: Areas that contain no sinkholes and provide groundwater supplies for private drinking water in less populated areas. Zone 3 is of low sensitivity.

b. Existing Environment and Impacts

Zone 1 areas include the Wardensville Spring, Capon Warm Springs Complex, and the Greenland Gap Karst area (Exhibits III-16 through III-18). Dye tracing studies were utilized to assess impacts for each of these areas. These areas are primarily underlain by the Oriskany Sandstone, Tonoloway Limestone, and the Helderberg Group. Anticlinal ridges underlain by the Oriskany Sandstone serve as recharge areas within the Potomac River Basin. Springs commonly discharge from the Oriskany at water gaps, noses of plunging anticlines, at the base of the ridges, or on upper slopes of the ridges. The Tonoloway Limestone and the limestones of the Helderberg Group are significant host units for caves and karst aquifers (Davies, 1958). As part of the karst system, caves often provide preferential flow routes for groundwater. Any introduction of contaminants into the groundwater system through these units can impact the quality of groundwater resources.

Zone 2 includes areas east of Little North Mountain underlain by limestone near the towns of Lebanon Church and Clary (Exhibit III-19). These limestone formations include the Elbrook Formation, the Beekmantown Group, and the Conococheague Formation. This zone is located within the Valley and Ridge Province of Virginia. This valley traversed by the Build Alternative commonly displays surface expression of groundwater recharge due to the presence of sinkholes. Disruption of surface hydrology from highway construction may result in an associated impact to the quality of groundwater resources. Any changes made to the groundwater flow routes during highway construction can result in the formation of new sinkholes.

Zone 3 areas include Laurel Mountain west of Elkins, Backbone Mountain, Allegheny Front, Patterson Creek Mountain, Hanging Rock, and Duck Run (Exhibits III-20 through III-25). Zones within the Appalachian Plateau Province are underlain by the Greenbriar Limestone. Zones in the Valley and Ridge Province are primarily underlain by the Oriskany Sandstone, Helderberg Group, Tonoloway Limestone, and the Wills Creek Formation. These zones currently exhibit no surface expressions of karst. Highway construction may or may not cause impacts to groundwater resources in these areas.



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-16
ZONES OF SENSITIVITY: WARDENSVILLE

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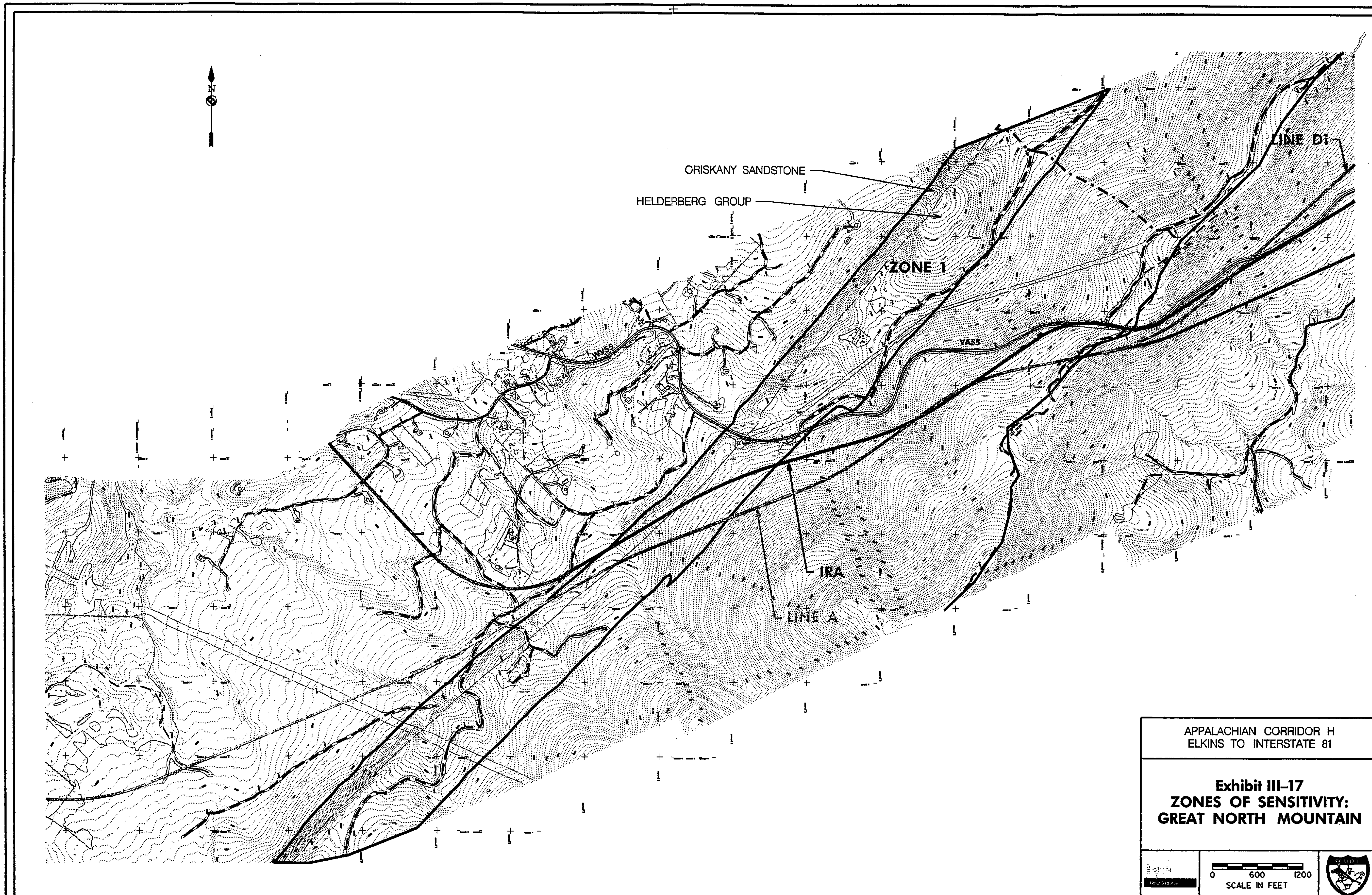

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Exhibit III–17
ZONES OF SENSITIVITY:
GREAT NORTH MOUNTAIN

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APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-18
ZONES OF SENSITIVITY:
GREENLAND GAP

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APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-19
ZONES OF SENSITIVITY:
LEBANON CHURCH

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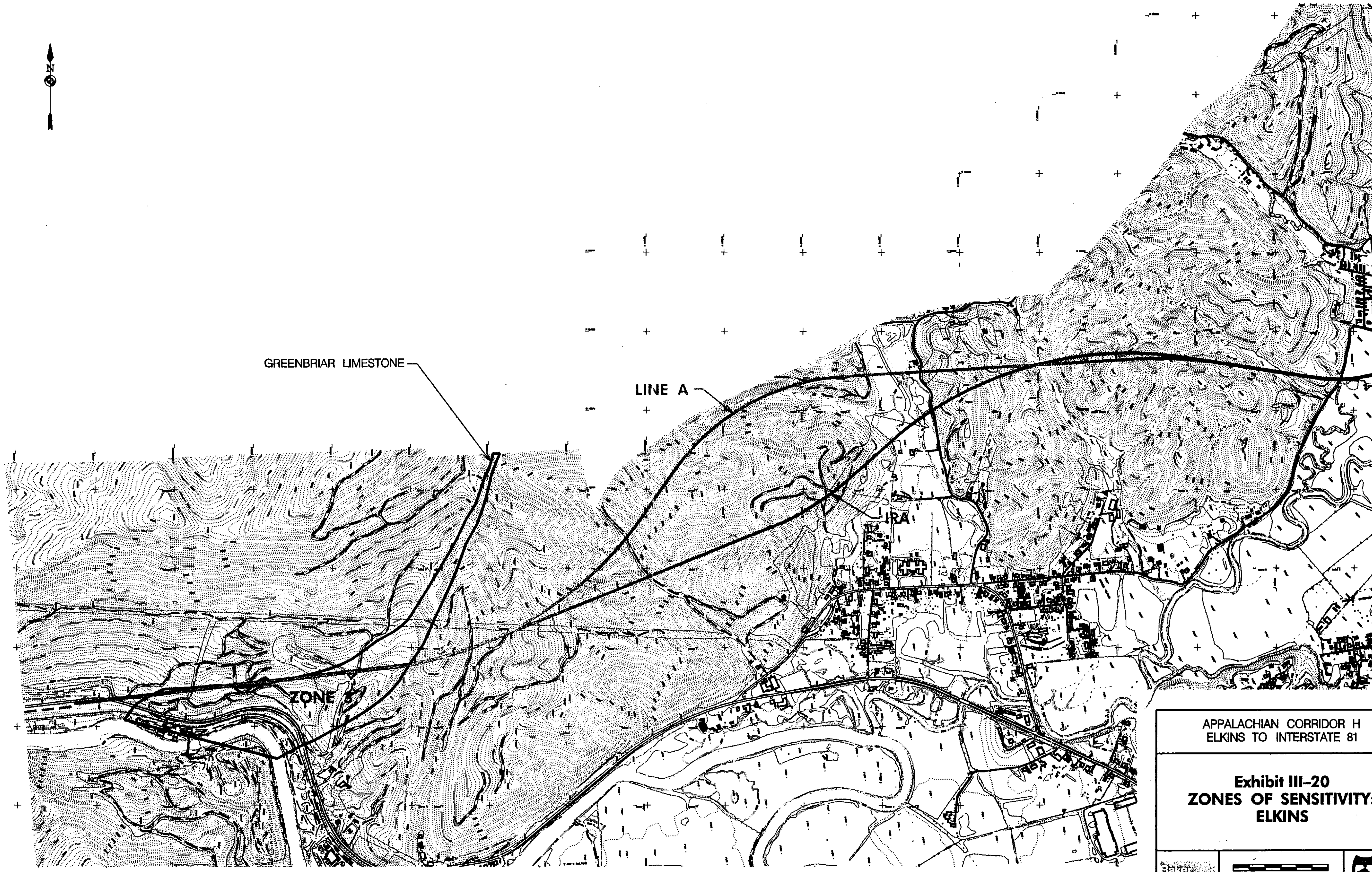

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-20
ZONES OF SENSITIVITY:
ELKINS

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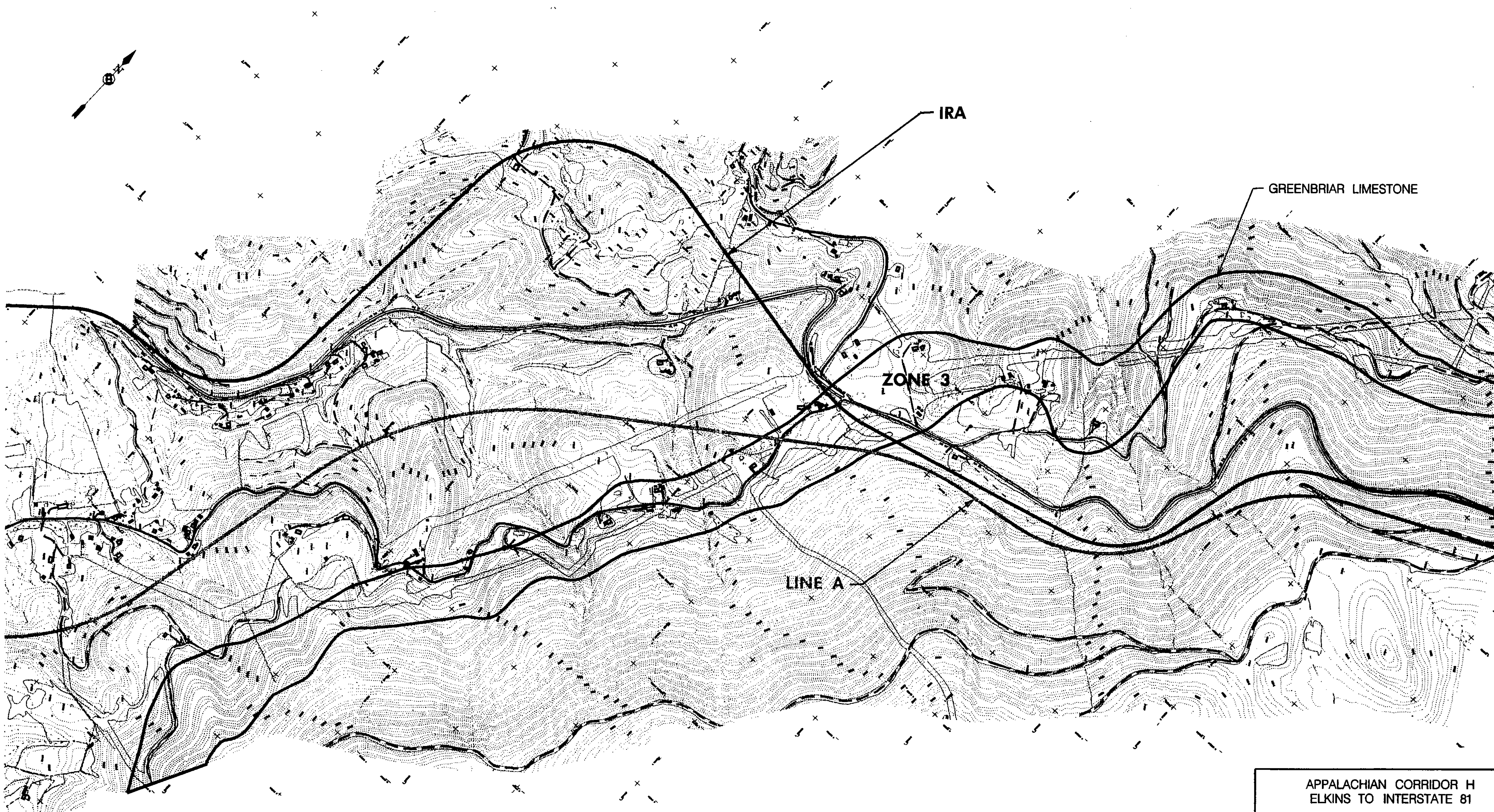

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-21
ZONES OF SENSITIVITY: BACKBONE MOUNTAIN

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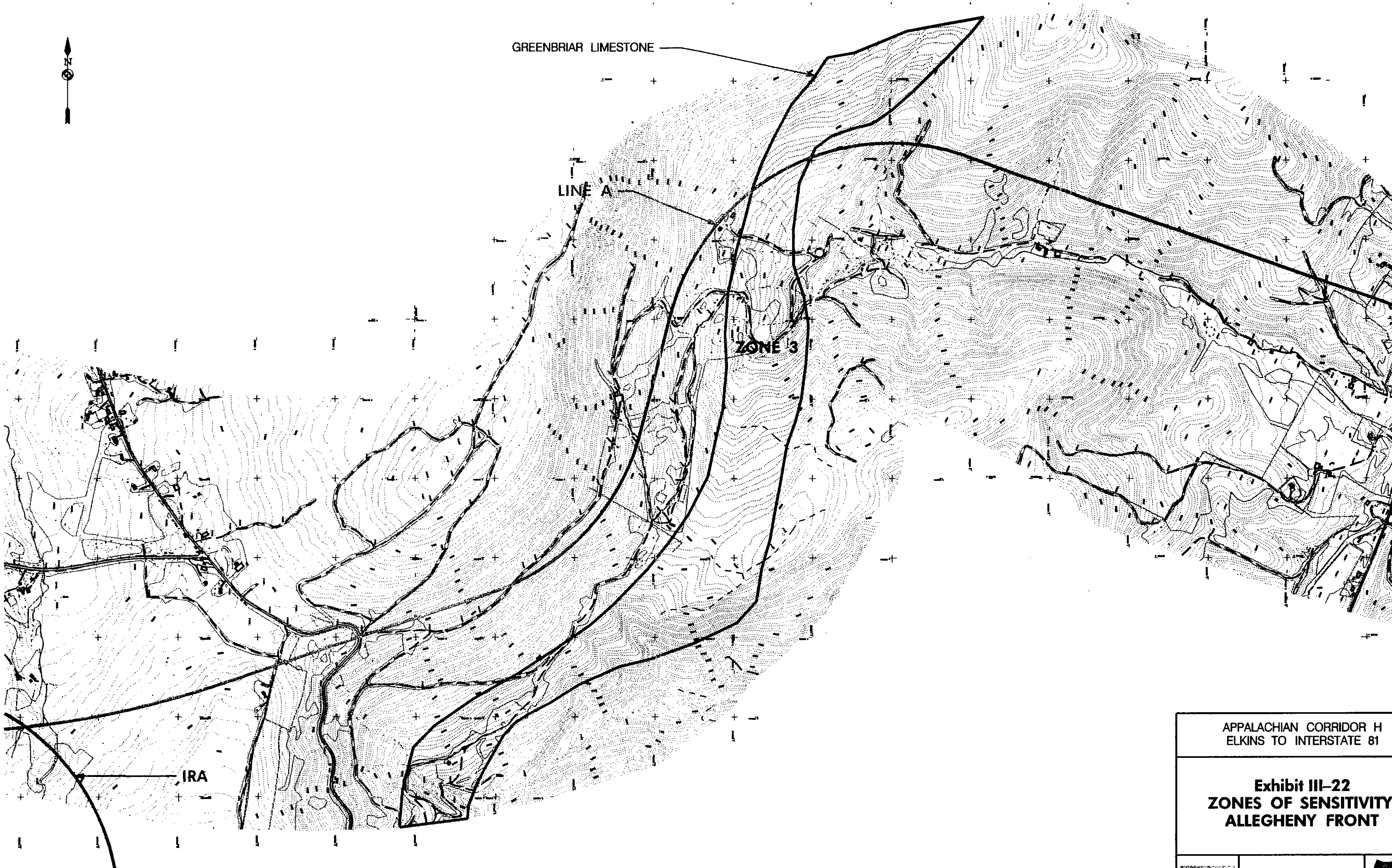

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III–22
ZONES OF SENSITIVITY:
ALLEGHENY FRONT

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SCALE IN FEET

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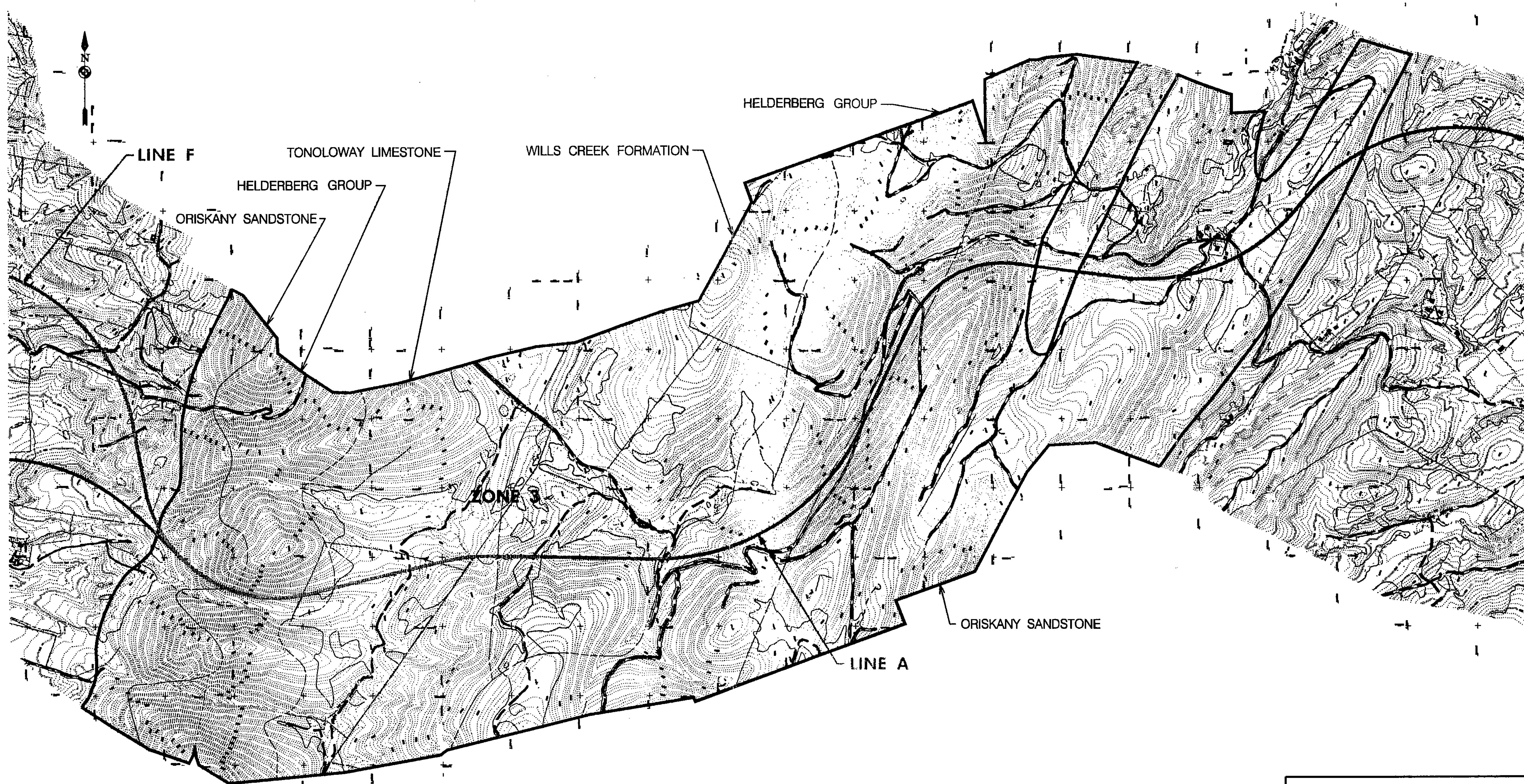

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-23
ZONES OF SENSITIVITY: PATTERSON CREEK MOUNTAIN

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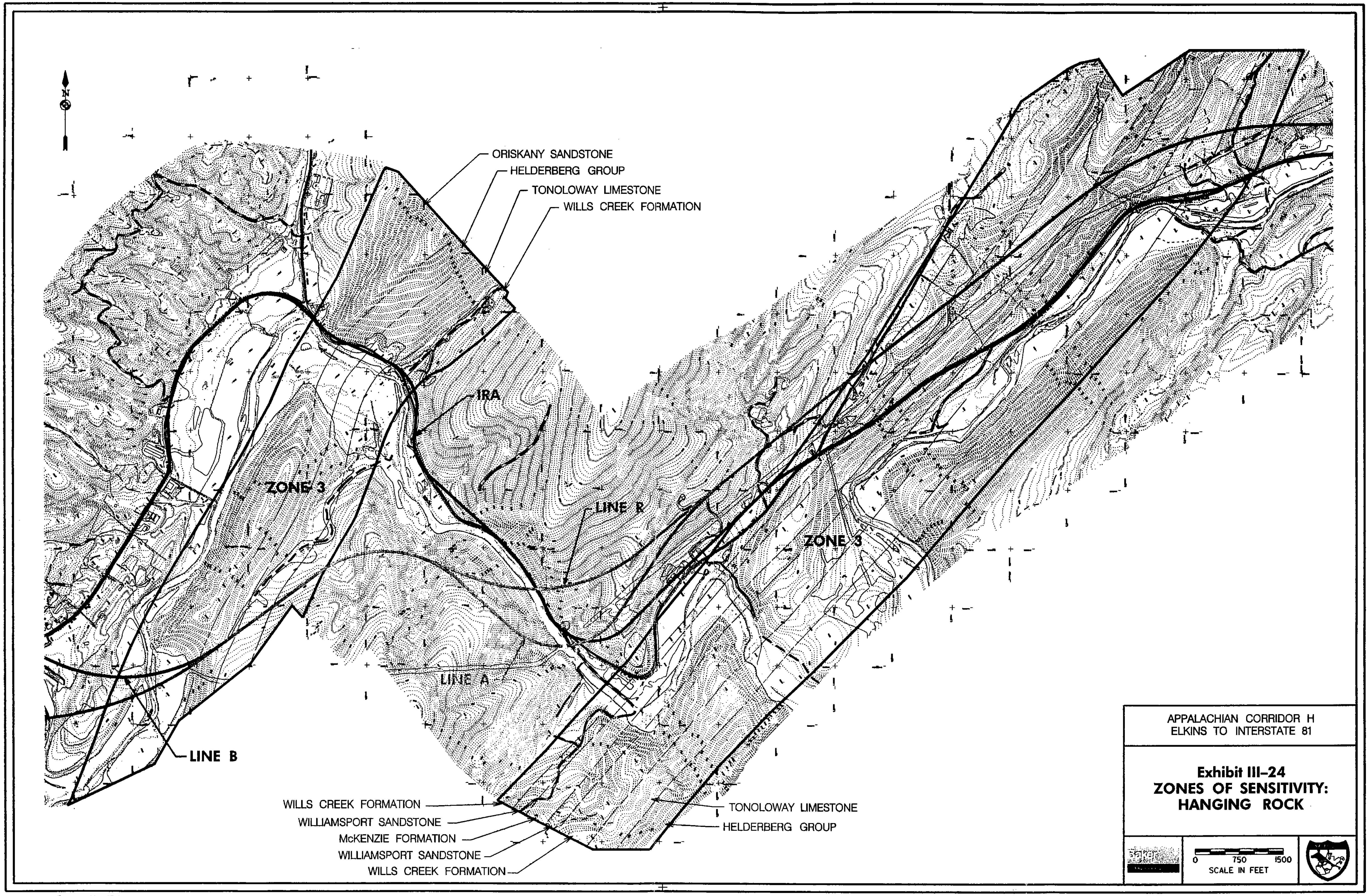

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c. Avoidance, Minimization, and Mitigation

(1) Zone 1 Areas

Mitigation measures for impacts to Zone 1 sensitivity areas (Wardensville, Capon Springs, and Greenland Gap) have been discussed under each of these topics.

(2) Zone 2 Areas

One area, Lebanon Church, has been designated Zone 2 for sensitivity to groundwater resources and would be subject to Virginia's Stormwater Management Regulations (1993). Mitigation measures in Lebanon Church could also involve monitoring a private well every 1,000 meters (1,600 feet) along the selected alignment (Build or IRA) during construction. Information obtained from such monitoring or from other additional studies could determine time of groundwater travel and would assist in the preparation of an Emergency Response Program should an accidental spill occur. This measure should be considered regardless of the alternative selected since spills can occur on the existing roadway system.

(3) Zone 3 Areas

Several areas discussed previously have been designated as Zone 3 or low sensitivity to groundwater resources. The Duck Run Zone 3 area in Virginia would be subject to Virginia's Stormwater Management Regulations (1993). Because this zone contains no surface expression of karst, impacts are not anticipated. However, in this and all other Zone 3 areas, special care would be taken during construction activities to prevent the introduction of contaminants through these recharge units into the groundwater system.

4. SECONDARY IMPACTS

a. Highway-Related Impacts

In actuality, all impacts discussed in this section are highway-related secondary impacts. In addition to stormwater runoff and groundwater contamination due to accidental spills, additional roadway construction would increase the amount of impervious cover in each of the watersheds. While this would increase stormwater runoff volumes and peak discharges, no long-term impact to the quantity of groundwater would be expected. The area covered by the highway pavement would be small in comparison to the overall land available for recharge.

b. Development-Related Impacts

(1) Improved Roadway Alternative

Because there are no housing unit increases predicted under the IRA, there would be no impact to groundwater resources due to private water wells.

(2) Build Alternative

Predicted residential and service-oriented development would generally occur in areas not supplied by a public water supply system. These homes and businesses would, therefore, have to rely upon wells for their water supply. Demand was calculated by multiplying the number of predicted housing units by an average daily usage of 567 liters (150 gallons). This figure was supplied by the West Virginia Department of Health. Utilizing a housing unit density of 125 single family units per square kilometer (1 unit per 0.80 hectare (2 acres)), water demand would equal approximately 70,000 liters per square kilometer per day.

Aquifer capacity (yield) data available for the 30-Minute Contour was available for the Counties of Mineral, Grant, Hardy and Hampshire (Ward and Wilmoth, 1968; Hobba et al., 1972). Based on published information, it is reasonable to conclude that aquifers located in the other counties within the 30-Minute Contour would have a potential yield at least equivalent to those for which data are available. Yields in liters per day per square kilometer for those counties for which data are available range from 150,000 to 300,000. Based on these data, the additional housing units predicted to occur as the result of development would not adversely impact groundwater resources within the 30-Minute Contour.

5. CUMULATIVE IMPACTS

There are no anticipated cumulative impacts to groundwater resources from either the additive effects of secondary impacts or from the foreseeable future actions under consideration.

H. AIR QUALITY

Under the Clean Air Act of 1970, the Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for the protection of public health and welfare. The NAAQS addresses six major pollutants: Carbon Monoxide (CO), Ozone (O_3), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Particulate Matter (PM_{10}) and lead (Pb). Of these six pollutants, FHWA requires a detailed evaluation of Carbon Monoxide (CO).

The primary source of air pollution emissions associated with the proposed project are those caused by motor vehicles using the roadway system. An air quality assessment was performed following the guidelines and recommendations received from the West Virginia Department of Transportation, the West Virginia Division of Environmental Protection, the Virginia Department of Environmental Quality - Division of Air Quality, the Virginia Department of Transportation, and the Environmental Protection Agency - Region 3 in Philadelphia.

This section discusses the assessment methodology, the existing mobile source (traffic-related) air quality in the proposed project area, and the predicted impacts to the local air quality from implementation of the Improved Roadway or the Build Alternative. Construction mitigation measures and other mitigation measures, if any, are also addressed. Details of the air quality analysis are contained in the *Air, Noise, and Energy Technical Report.*

1. METHODOLOGY

A microscale analysis was performed to predict the effects of CO changes to local air quality from the construction of either the IRA or the Build Alternative. The microscale analysis predicts the generation and transportation of CO in the immediate project area. The years 2001 (proposed opening year) and 2013 (proposed design year) were analyzed and compared to the NAAQS.

Motor vehicle emission rates were computed using EPA's MOBILE 5.0a emissions model (March, 1993). The emission factors were developed with conservative model inputs. Credits for a "Basic" Inspection/Maintenance Plan (I & M) were not taken to provide a worst-case scenario. In addition, refueling emissions were not included in any of the scenarios. Carbon monoxide concentrations from highway vehicles were calculated by using CAL3QHC, a Gaussian dispersion model and hybrid of the CALINE 3 model.

A worst-case approach was taken for nearly all meteorological conditions. Three-hundred and sixty wind directions were analyzed at 1 degree intervals to determine the maximum CO concentrations. Other factors included a wind speed of one meter per second, a neutral atmospheric condition (D), a mixing height of 1,000 meters (3,280 feet), and a worst case ambient temperature of -7°C (20°F).

Modeling was done for the peak 1-hour condition. A background concentration of 2.0 parts per million (ppm) for the 1-hour concentration was used to account for CO sources outside the proposed project area. Speeds for the roadways and the proposed highway were based on the functional type and location of the particular road.

Receptor sites along the roadway were chosen at locations where the highest CO concentrations could be expected and where the general public would have access during the analysis periods. These were placed at various representative points on adjoining property right-of-way lines where human activity may occur. The CO concentrations were compiled to include the project roadway, cross-street, and background concentrations.

A mesoscale or "regional" analysis was not performed for the project because the proposed project area is in attainment for both CO and O_3.

2. EXISTING ENVIRONMENT

The proposed project area (the West Virginia Counties of Randolph, Tucker, Grant, and Hardy, and the Virginia Counties of Frederick and Shenandoah) is located within Region 3 of the EPA's jurisdiction. The agencies normally involved with air quality in this region are the EPA, the West Virginia Division of Environmental Protection, WVDOT, the Virginia Department of Environmental Quality - Air Division, and VDOT.

The Clean Air Act directed the Environmental Protection Agency to establish standards for clean air via the NAAQS. The NAAQS are shown in Table III-16 and represent levels of these pollutants and exposure periods that pose no significant threat to human health or welfare. West Virginia and Virginia adhere to the same standards.

Currently, air monitoring is conducted for these pollutants at various locations throughout the State of West Virginia and the Commonwealth of Virginia by the National Air Monitoring System (NAMS) and the State and Local Air Monitoring System (SLAMS) program. As a result of the Clean Air Act Amendments, and based on historical monitoring data, all of the counties in the study area are designated as being in attainment for Carbon Monoxide (CO) and Ozone (O_3); pollutants most normally associated with mobile source (motor vehicle) emissions.

TABLE III-16
NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	TIME OF AVERAGE	PRIMARY STANDARD	SECONDARY STANDARD
PM_{10}	Ann. Geo. Mean	75 ug/m^3	None
	24-Hour	260 ug/m^3	150 ug/m^3
SO_2	Ann. Arith. Mean	80 ug/m^3	None
	24-Hour	365 ug/m^3	None
	3-Hour	none	1300 ug/m^3
NO_2	Ann. Arith. Mean	100 ug/m^3	100 ug/m^3
CO	8-Hour	10 mg/m^3 9 ppm	None
	1-Hour	40 mg/m^3 35 ppm	None
O_3	1-Hour	0.12 ppm 235 ug/m^3	0.12 ppm 235 ug/m^3
Pb	Quarterly Arith. Mean	1.5 ppm	1.5 ppm

Source: United States Environmental Protection Agency

Note: All standards with averaging times of 24 hours or less are not to be exceeded more than once per year.

ug/m^3 = micrograms per cubic meter of air mg/m^3 = milligrams per cubic meter of air ppm = parts per million

Ann. Geo. Mean = Annual Geometric Mean Ann. Arith. Mean = Annual Arithmetic Mean

The term 'attainment' refers to the status of the various pollutants described in the above NAAQS table. If a pollutant does not exceed the standard more than once per year, then it is considered in attainment of the standard. If the pollutant exceeds the standard two or more times during the year, then it is considered in non-attainment of the standard. When a project is designated as non-attainment, it must be on an approved Transportation Improvement Plan (TIP) or meet a series of requirements in order for the project to be approved. As mentioned, the project is located in areas designated as being in attainment of the standard for both CO and O_3.

3. IMPACTS

The predicted impacts of the microscale analysis were imperceptible among the No-Build Alternative, the IRA, and the Build Alternative.

a. Microscale Analysis

Numerous CO sites were investigated for the microscale analysis. None of the predicted 1-hour analysis sites would exceed the 1-hour criteria of 35 ppm, as identified in the NAAQS. These predicted concentrations also did not exceed the 8-hour concentration criteria of 9 ppm. As a result, an 8-hour analysis was not performed because 8-hour concentrations are always less than 1-hour concentrations. Table III-17 shows the predicted highest 1-hour CO receptor concentrations for the alternatives in the interim year 2001 and the design year 2013. These concentrations would be located in areas where the greatest traffic volumes would be at their closest to a property line, typical of where human activity may occur. These predicted concentrations include a conservative 1-hour background level of 2.0 ppm.

(1) West Virginia

The highest concentrations in West Virginia are predicted to occur near US 33 and US 219 near Elkins. These concentrations are the highest because the predicted traffic volumes would be the highest at this location.

Under the No-Build Alternative, the highest predicted 1-hour CO concentration for the years 2001 and 2013 would be 7.0 ppm and 7.9 ppm, respectively. Based on these results, no exceedance of either the 1 or 8-hour criteria is predicted to occur at any receptor for the No-Build Alternative.

Under the IRA, the highest predicted 1-hour CO concentration for the years 2001 and 2013 would be 5.4 ppm and 6.1 ppm, respectively. Based on these results, no exceedance of either the 1 or 8-hour criteria is predicted to occur at any receptor for the IRA.

TABLE III-17

1-HOUR PREDICTED HIGHEST CO CONCENTRATIONS FOR YEARS 2001 & 2013

STATE	RECEPTOR	INTERIM YEAR 2001			DESIGN YEAR 2013		
		No-Build	IRA	Build Alt.	No-Build	IRA	Build Alt.
West Virginia	A	7.0 ppm	5.4 ppm	3.4 ppm	7.9 ppm	6.1 ppm	4.0 ppm
West Virginia	B	N/A	3.7 ppm	5.2 ppm	N/A	3.8 ppm	5.5 ppm
West Virginia	C	N/A	3.7 ppm	5.2 ppm	N/A	3.8 ppm	5.5 ppm
Virginia	D	3.6 ppm	5.1 ppm	2.8 ppm	3.0 ppm	4.8 ppm	2.3 ppm
Virginia	E	3.6 ppm	5.1 ppm	2.8 ppm	3.0 ppm	4.8 ppm	2.3 ppm
Virginia	F	N/A	N/A	4.1 ppm	N/A	N/A	4.4 ppm

Where:

NAAQS: 1-HOUR = 35 ppm
NAAQS: 8-HOUR = 9 ppm
N/A = Not Applicable
The predicted concentrations include a background CO level of 2.0 ppm.

Under the Build Alternative, the highest predicted 1-hour CO concentration for the years 2001 and 2013 would be 5.2 ppm and 5.5 ppm, respectively. Based on these results, no exceedances of either the 1 or 8-hour criteria is predicted to occur at any receptor for any alignment under the Build Alternative.

(2) Virginia

The highest concentrations in Virginia are predicted to occur along VA 55, between Wheatfield and I-81. These concentrations are the highest because the predicted traffic volumes would be the highest at this location.

Under the No-Build Alternative, the highest predicted 1-hour CO concentration for the years 2001 and 2013 would be 3.0 ppm and 3.6 ppm. Based on these results, no exceedances of either the 1 or 8-hour criteria is predicted to occur at any receptor for the No-Build Alternative.

Under the IRA, the highest predicted 1-hour CO concentration for the years 2001 and 2013 would be 4.8 ppm and 5.1 ppm, respectively. Based on these results, no exceedances of either the 1 or 8-hour criteria is predicted to occur at any receptor for the IRA.

Under the Build Alternative, the highest predicted 1-hour CO concentration for the years 2001 and 2013 would be 4.1 ppm and 4.4 ppm, respectively. Based on these results, no exceedances of either the 1 or 8-hour criteria is predicted to occur at any receptor for any Build Alternative Alignment.

b. Mesoscale Analysis

A mesoscale analysis was performed to analyze the proposed project's effect on the precursors of ozone, volatile organic compounds (VOCs) and Nitrogen Oxides (NOx). The NAAQS has an established standard of 0.12 ppm for ozone that is not to be exceeded more than once in any one year. Historical monitoring information was received from the EPA's National Dry Deposition Network (NDDN) for all these sites through the Northeastern Forest Experiment Station in Parsons. The last full year of monitored and summarized data was available through 1992.

The predicted VOC level for the design year 2013 IRA is 12.0% greater than the predicted design year 2013 No-Build Alternative level, and the predicted design year 2013 Build Alternative is 15.5% greater than the predicted design year 2013 No-Build Alternative level. The predicted NOx level for the design year 2013 IRA is 15.0% greater than the predicted design year 2013 No-Build Alternative level., and the predicted design year 2013 Build Alternative is 17.4% greater than the predicted design year 2013 No-Build Alternative level.

4. AVOIDANCE, MINIMIZATION, AND MITIGATION

The proposed project is in an attainment area for CO. Based on the predicted results, the construction of the Build Alternative or IRA would not cause an exceedance of the NAAQS for CO in any of the analysis years. The predicted CO concentrations are below both the 1-hour and 8-hour criteria for all conditions. Therefore, no mitigation measures are required as a result of the microscale analysis. The proposed project is in an attainment area for O_3. It is also in an area where the SIP does not contain any transportation control measures. Therefore, the conformity procedures of 23 CFR, Part 770 do not apply.

I. NOISE

This noise analysis was prepared in accordance with the *Federal-Aid Highway Program Manual*, Volume 7, Chapter 7, Section 3 (FHPM 7-7-3), "Procedures for Abatement of Highway Traffic Noise and Construction Noise," that establishes a requirement for a noise study for any proposed Federal or Federal-aid project. This section presents a description of the methods used for analysis, applicable noise standards and criteria, an assessment of the existing noise environment, the predicted impact assessment of future levels, and a discussion of mitigation measures. Construction mitigation measures are also discussed. Details of the noise analysis are contained in the *Air, Noise, and Energy Technical Report.*

1. METHODOLOGY

Traffic noise calculations were performed using the FHWA approved STAMINA 2.0; a computer model derived from the FHWA Highway Traffic Noise Prediction Model, FHWA-RD 77-108, December 1978. The modeling accounted for soft/hard sites, traffic speed and design hour volumes for autos, medium trucks (2-axle, 6-tire) and heavy trucks (3 or more axles).

Noise prediction analyses were performed for the No-Build Alternative, the IRA, and the Build Alternative for the year 2013. Traffic volumes for the study were derived from WVDOT and from traffic reports prepared by Michael Baker Jr., Inc. The design directional hourly volumes (DHV) were used in the analysis, representing the loudest period of the day. Design speeds were used for the roadways. Traffic assumptions included a DHV of 10%. Recent traffic surveys indicate that the vehicle mix for the proposed highway would consist of 90% automobiles (including pickup trucks, vans, etc.), 3% medium trucks (2-axle/6-tires) and 7% heavy trucks (3 or more axles). Local roadways were predicted to consist of the same percentage vehicle mixes.

Sound intensity is normally presented as a sound level using the unit "decibel" (dB). The decibel is used to measure either sound power or sound pressure levels. These sound pressure levels are shown as dBA $L_{eq}(h)$. The term dBA refers to decibels on the A-weighted scale that represents the way the human ear perceives sound. The term $L_{eq}(h)$ refers to a representative of an average sound level over an hour's time period.

Table III-18 shows the Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC) for various land use Activity Categories. Activity Category B, representative of residences, schools, churches, parks, etc., was used as the criteria for sensitive receptors identified in the proposed project area. In situations where the NAC is approached or exceeded at any receptor location, noise abatement must be considered for that site. The Approach Criteria is defined as 1 dBA less than the NAC for any Activity Category.

TABLE III-18
NOISE ABATEMENT CRITERIA (NAC):
HOURLY A-WEIGHTED SOUND LEVEL- DECIBELS (DBA)

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.

Source: *Federal-Aid Highway Program Manual Transmittal 348*, August 9, 1982; Vol. 7, Ch. 7; Sec 3, Attachment.

The State of West Virginia also has a substantial increase criteria, based on one of the recommended standards established by FHWA: the predicted noise level increase over the existing condition. Abatement must be considered if, as a result of the proposed action, the existing noise level at a particular site increases by more than 15 decibels. The Commonwealth of Virginia has a substantial increase criteria based on 10 or more decibels.

Forty-two short-term measurements, approximately 10-20 minutes in length, were taken using a Metrosonics dB-308 Precision I integrating sound level meter during the peak traffic periods. Simultaneous traffic counts were recorded for nearby roadways, as applicable. The data was then extrapolated to one-hour volumes for calibration purposes. There were 35 measured sites in West Virginia and 7 measured sites in Virginia. More than 2000 locations were modeled to account for areas most likely affected as a result of the proposed action. The locations of the modeled and monitored sites are presented in the *Air, Noise, and Energy Technical Report.* Vehicle classification counts were taken during the measurement periods to determine the percentage of heavy trucks (3 or more axles), medium trucks (2-axle/6-tires) and passenger vehicles (including vans, pickup trucks and motorcycles).

2. EXISTING ENVIRONMENT

Noise is often defined as unwanted sound. It is emitted from many sources including highway vehicles, airplanes, factories, railroad cars and power plants. Highway vehicle noise is a composite of engine exhaust, drive train, and tire-roadway interaction.

Sound is a very subjective concept. Degrees of sound disturbance depend on several things; the amount and nature of the intruding noise, the relationship between the background noise and intruding noise and the type of activity occurring where the noise is heard. Time also enters into an individual's noise judgment. For example, a car horn is much more annoying at 2 AM than at 2 PM, even though the car horn has the same decibel level at both times. This is because the nighttime background levels (approximately 45 dBA) are lower than the daytime levels (approximately 55 dBA); consequently, the person notices the greater difference at night.

Activity interference can also occur depending on what the person is doing. For certain sound levels, normal conversation may be possible but sleep may be difficult. Work that involves a high degree of concentration may be affected by noise while manual labor may not be interrupted to the same level by the same sound. As mentioned, sound is a subjective concept. It is so subjective that a person may not consider a particular noise source to be intrusive if that person is subjected to the same or similar noise over a long period of time.

a. Noise Sensitive Areas

Land use determines the sensitivity of an area to noise. Residential areas are the most sensitive to noise, particularly single family homes. Land uses which are less sensitive to noise include open land, wooded areas, commercial properties, and agricultural areas. Land use within the study area can be characterized as predominantly woodland and agricultural areas, occupying approximately 90% of the proposed project area. The remainder of the proposed project area is characterized as residential, commercial, industrial, other urban land, areas of mines/quarries/pits, transportation/commercial/utilities, other agricultural land, and water resources. Residential, commercial, and industrial areas are located mainly on the primary travel routes.

b. Measured Noise Levels

Tables III-19 and III-20 show existing noise levels, land uses, the measurement period and the dominant noise source(s) at each site. This was validated in the field for the 42 noise monitoring sites. Tables III-21 and III-22 show the existing noise levels, the hourly vehicle volumes, the distances from existing roadways and the estimated travel speeds on these roads, as applicable. In each table, sites have been numbered. The location of each site can be viewed in the *Air, Noise, and Energy Technical Report.*

3. IMPACTS

Noise prediction analyses were performed for the existing (1993) and the design year (2013) scenarios. Table III-18 identified the FHWA Noise Abatement Criteria for various land use Activity Categories. The criteria used for the previously identified sensitive receptors was Activity Category B; representative of residences, schools, churches, and parks.

Noise impacts are determined based on the degree to which the projected noise levels approach or exceed the established noise level criteria or threshold of a given Activity Category. Noise abatement must be considered for sites when the NAC is approached or exceeded at any receptor location. In both West Virginia and Virginia, the approach criteria is 66 dBA for Category B receptors. In West Virginia, a substantial increase criteria of greater than 15 dBA over the existing condition is applied. In Virginia, a substantial increase criteria of 10 or more dBA is applied.

After a review of maps, preliminary plans, and field investigations, 42 noise locations were measured in the study area. These noise locations were representative of the various land uses and vehicle type and volume characteristics. Nearly 2,300 receptor locations were modeled to account for sensitive receptor locations most likely impacted by the proposed project.

TABLE III-19
MEASURED NOISE LEVELS: WEST VIRGINIA

SITE #	LAND USE	DATE	MEASUREMENT PERIOD	L_{eq} (dBA)	DOMINANT NOISE SOURCE
8	Residential	10-18-93	11:35-11:43	42	Local Activities
9	School	10-18-93	17:41-17:49	57	WV 55
10	Residential	10-18-93	17:30-17:38	43	Local Activities
11	Recreational	10-18-93	13:10-13:18	57	WV 55
12	Residential	10-18-93	13:30-13:38	43	Local Activities
13	Health Care	10-18-93	17:07-17:15	57	WV 55
14	School	10-18-93	14:10-14:18	53	WV 55
15	Church	10-18-93	16:45-16:53	59	WV 55
16	Residential	10-18-93	14:40-14:48	43	Local Activities
17	Res/Agricul.	10-18-93	15:03-15:11	43	Local Activities
18	Residential	10-18-93	15:25-15:33	43	Local Activities
19	Church	10-18-93	15:50-15:58	62	WV 55
20	Res/Agricul.	10-19-93	16:15-16:23	43	Local Activities
21	Res/Agricul.	10-19-93	08:45-08:53	64	US 220/WV 28
22	Agricultural	10-19-93	09:30-09:38	42	Local Activities
23	Residential	10-19-93	11:00-11:08	42	Local Activities
24	Residential	10-19-93	11:30-11:38	42	Local Activities
25	Industrial	10-19-93	12:00-12:08	62	Local Activities
26	Church	10-19-93	13:20-13:28	46	Local Activities
27	Recreational	10-19-93	14:00-14:10	43	Local Activities
28	Residential	10-20-93	15:30-15:47	69	US 219
29	Residential	10-20-93	16:00-16:08	64	US 219
30	Church	10-20-93	16:23-16:31	54	US 219
31	Res/Agricul.	10-21-93	15:45-15:55	45	Local Activities
32	Residential	10-21-93	15:30-15:40	45	Local Activities
33	Church	10-21-93	16:15-16:25	53	Local Activities
34	Res/Com	10-21-93	16:48-16:58	71	US 219
35	Res/Agricul.	10-21-93	17:06-17:26	51	Local Activities
36	Res/Institut.	10-21-93	17:22-17:32	64	US 219
37	Residential	10-21-93	17:40-17:50	55	Local Activities
38	Res/Agricul.	10-21-93	17:50-18:00	61	US 219
39	Res/Agricul.	10-22-93	07:50-08:00	49	Local Activities
40	Commercial	10-22-93	08:10-08:20	68	WV 92
41	Industrial	10-22-93	08:30-08:40	69	WV 92
42	Church	10-22-93	08:52-09:02	50	Local Activities

TABLE III-20
MEASURED NOISE LEVELS: VIRGINIA

SITE #	LAND USE	DATE	MEASUREMENT PERIOD	Leq (dBA)	DOMINANT NOISE SOURCE
1	Church	10-18-93	08:35-08:44	56	VA 55
2	Residential	10-18-93	09:20-09:28	45	Local Activities
3	Residential	10-18-93	09:50-09:58	55	VA 55
4	Church	10-18-93	10:15-10:23	49	VA 55
5	Commercial	10-18-93	18:05-18:13	58	VA 55
6	Residential	10-18-93	10:50-10:58	45	Local Activities
7	Recreational	10-18-93	11:08-11:16	44	Local Activities

TABLE III-21
MEASURED SITE CHARACTERISTICS: WEST VIRGINIA

SITE #	NAME & GENERAL LOCATION	HOURLY VEHICLE VOLUMES						DISTANCE FROM TRAVEL LANE C/L	ESTIMATED SPEED
		NEAR LANE			FAR LANE				
		A	MT	HT	A	MT	HT		
8	Residential, on CR 5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
9	Wardensville School	173	0	0	158	0	0	15m (50 ft)	60km (35mph)
10	Residential, Trout Run Road, CR 23/12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	Lost River Park	180	8	0	38	8	0	15m (50 ft)	75km (45mph)
12	Residential, CR 23/8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
13	E.A. Hawse Contiguous Health Care Center	105	8	8	75	15	8	30m (100 ft)	83km (50 mph)
14	East Hardy High School	105	0	8	173	0	23	90m (300 ft)	83km (50 mph)
15	Baker United Methodist Church	68	0	15	83	8	15	45m (150 ft)	92km (55 mph)
16	Residential, William Hawse House, CR 8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
17	Res/Agricultural,CR 23/4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
18	Residential, CR 23/3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
19	God's Way United Pentacost Church	128	8	0	75	15	23	15m (50 ft)	92km (55 mph)
20	Res/Agricultural,CR 15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
21	Res/Agricultural, US 220/WV 28	98	8	8	30	23	0	14m (40 ft)	92km (55 mph)
22	Agricultural, CR 220/8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
23	Residential, CR 3/2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
24	Residential, CR 42/1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
25	Industrial, near Power Plant, WV 93	15	0	15	15	0	38	15m (50 ft)	100km (60mph)

Where:

A = Automobile (including vans, pickup trucks and motorcycles)
MT = Medium Truck (2-axle/6-tires)
HT = Heavy Truck (3 or more axles)
n/a = Not applicable (no traffic visible at the receptor site)
C/L = Centerline

TABLE III-21 *(CONT.)*
MEASURED SITE CHARACTERISTICS: WEST VIRGINIA

SITE #	NAME & GENERAL LOCATION	HOURLY VEHICLE VOLUMES						DISTANCE FROM TRAVEL LANE C/L	ESTIMATED SPEED
		NEAR LANE			FAR LANE				
		A	MT	HT	A	MT	HT		
26	St. John's Lutheran Church, 3rd Street	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
27	Monongahela National Forest	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
28	Residential, US 219	64	0	26	143	11	23	14m (40 ft)	A-92km (55mph) T-50km (30mph)
29	Residential, US 219 near WVDOT building	270	8	8	113	15	15	15m (50 ft)	A-92km (55mph) T-58km (35mph)
30	Riverview Chapel, CR 39, near US 219	113	0	8	158	0	23	30m (100 ft)	83km (50mph)
31	Res/Agricultural, CR 3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
32	Residential, CR 3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
33	Hambleton United Methodist Church	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
34	Res/Commercial, US 219 and CR 3	126	0	12	60	6	24	15m (50 ft)	92km (55mph)
35	Res/Agricultural, CR 7 and CR 3/3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
36	Res/Cemetery, US 219	138	0	6	132	12	6	15m (50 ft)	92km (55mph)
37	Residential, CR 1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
38	Res/Agricultural, US 219	114	6	6	126	6	6	15m (50 ft)	66km (40mph)
39	Res/Agricultural, CR 14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
40	Commercial, WV 93/CR 11	336	12	18	156	12	36	15m (50 ft)	75 km (45mph)
41	Industrial (Quarry), WV 93	366	78	24	138	0	18	14m (40 ft)	83km (50mph)
42	Leadsville Church	n/a	n/a	n/a	n/a4	n/a	n/a	n/a	n/a

Where:

A = Automobile (including vans, pickup trucks and motorcycles)
MT = Medium Truck (2-axle/6-tires)
HT = Heavy Truck (3 or more axles)
n/a = Not applicable (no traffic visible at the receptor site)
C/L = Centerline

TABLE III-22
MEASURED SITE CHARACTERISTICS: VIRGINIA

SITE #	NAME & GENERAL LOCATION	HOURLY VEHICLE VOLUMES						DISTANCE FROM TRAVEL LANE C/L	ESTIMATED SPEED
		NEAR LANE			FAR LANE				
		A	MT	HT	A	MT	HT		
1	Shiloh United Methodist Church	75	15	0	113	15	0	30m (100 ft)	92km (55mph)
2	Residential, corner of VA 629 and VA 631	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	Residential, corner of VA 55 and VA 623	113	15	0	75	15	0	15m (50 ft)	92km (55mph)
4	Laurel Hill Christian Church	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5	Four Corners Restaurant	83	0	0	38	0	0	n/a	n/a
6	Residential, VA 608	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7	George Washington National Forest	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Where:

A = Automobile (including vans, pickup trucks and motorcycles)
MT = Medium Truck (2-axle/6-tires)
HT = Heavy Truck (3 or more axles)
n/a = Not applicable (no traffic visible at the receptor site)
C/L = Centerline

a. FHWA Criteria Exceeded in West Virginia

In West Virginia, there are 118 receptors that currently approach or exceed the FHWA Noise Abatement Criteria for the existing 1993 condition. In the year 2013, the predicted NAC would be exceeded at 200 receptors under the No-Build Alternative, at 286 receptors under the IRA, and at 60 receptors under the Build Alternative (Line A).

In the Interchange Option Area, the NAC would be exceeded at five more receptors under Line I than would the comparable portion of Line A (7 vs. 2). In both the Shavers Fork and Patterson Creek Option Areas, the NAC would not be exceeded under Line S, Line P, or the respective Line A counterparts. In the Forman Option Area, Line F would have one more predicted exceedance than would Line A (1 vs. 0). In the Baker Option Area, Line B would have no more predicted exceedances than would Line A (2 vs. 2). In the Hanging Rock Option Area, Line R would have two fewer predicted exceedances than would Line A (0 vs. 2).

b. FHWA Criteria Exceeded in Virginia

In Virginia, there are currently five receptors which approach or exceed the FHWA Noise Abatement Criteria for the existing 1993 condition. In the year 2013, the predicted NAC would be exceeded at 18 receptors under the No-Build Alternative, at 52 receptors under the IRA, and at 8 receptors under the Build Alternative (Line A).

In the Duck Run Option Area, Line D1 would have no more predicted exceedances than would Line A (1 vs. 1), whereas Line D2 would have one less predicted exceedance (0 vs. 1). In the Lebanon Church Option Area, Line L would have five more predicted exceedances than would Line A (6 vs. 1).

Table III-23 summarizes the receptors by FHWA noise Activity Category B for each alternative for both West Virginia and Virginia.

c. Exceedance of the Substantial Increase Criteria in West Virginia

In West Virginia, the Substantial Increase Criteria does not apply for the existing condition. In the year 2013, the number of predicted exceedances would be zero under the No-Build Alternative, 24 under the IRA, and 84 under the Build Alternative (Line A).

TABLE III-23
PREDICTED FHWA NOISE ACTIVITY CATEGORY EXCEEDANCES

WEST VIRGINIA

		# PREDICTED EXCEEDENCES															
		1993 WV	2013 WV	2013 WV	2013 WV	Option Area Comparisons in WV - 2013											
						Interchange		Shavers Fork		Patterson Creek		Forman		Baker		Hanging Rock	
FHWA ACTIVITY CATEGORY	NAC APPROACH CRITERIA	Existing	No-Build	IRA	Line A	Line I	Line A	Line S	Line A	Line P	Line A	Line F	Line A	Line B	Line A	Line R	Line A
Category B	66 dBA	118	200	286	60	7	2	0	0	0	0	1	0	2	2	0	2

VIRGINIA

		# PREDICTED INCREASES								
		1993 VA	2013 VA	2013 VA	2013 VA	Option Area Comparisons in VA - 2013				
						Duck Run			Lebanon Church	
FHWA ACTIVITY CATEGORY	NAC APPROACH CRITERIA	Existing	No-Build	IRA	Line A	Line D1	Line D2	Line A	Line L	Line A
Category B	66 dBA	5	18	52	8	1	0	1	6	1

In the Interchange Option Area, Line I would have 21 more predicted exceedances than would Line A (24 vs. 3). In the Shavers Fork Option Area, neither Line S nor Line A would have a predicted exceedance (0 vs. 0). In the Patterson Creek Option Area, Line P would have 2 more predicted exceedances than would Line A (2 vs. 0). In the Forman Option Area, Line F would have one more predicted exceedance than would Line A (1 vs. 0). In the Baker Option Area, Line B and Line A would have the same number of predicted exceedances (2 vs. 2). In the Hanging Rock Option Area, Line R would have 2 more predicted exceedances than would Line A (2 vs. 0).

d. Exceedance of the Substantial Increase Criteria in Virginia

In Virginia, the Substantial Increase Criteria does not apply for the existing condition. In the year 2013, the number of predicted receptor exceedances would be zero under the No-Build Alternative, 5 under the IRA, and 49 under the Build Alternative (Line A). In the Duck Run Option Area, Line D1 would have three more predicted exceedances than would Line A (15 vs. 12), whereas the number of predicted exceedances would be the same under Line D2 or Line A (12 vs. 12). In the Lebanon Church Option Area, Line L would have 46 more predicted exceedances than would Line A (54 vs. 8).

Table III-24 summarizes the receptors by substantial increase criteria for each alternative in West Virginia and Virginia.

e. Natural Areas of Concern

In addition to the residences, schools, churches and parks that were modeled, other sensitive receptor locations were identified including Big Run Bog in the Monongahela National Forest, Great North Mountain in the George Washington National Forest and the Greenland Gap Conservancy. The areas in both National Forests have current measured dBA levels in the mid 40's. These levels are primarily generated from the local activites in the forests and from vehicle usage on State Route 55 (George Washington National Forest) and US Route 219 (Monongahela National Forest). The Greenland Gap Conservancy had measured dBA levels in the mid 50's because of the traffic sound echo on Greenland Gap Road (County 3/3).

For the proposed No-Build Alternative in the year 2013, the predicted levels for the Monongahela and Washington Forest sites increase by 1 dBA due to future minor traffic volume increases. The Conservancy site increases by 3 dBA to 59 dBA since the local traffic is predicted to double on Greenland Gap Road.

TABLE III-24
PREDICTED 2013 SUBSTANTIAL INCREASE EXCEEDANCES

WEST VIRGINIA

LEVEL OF PREDICTED INCREASE	WV IMPACT CRITERIA*	# PREDICTED INCREASES															
		2013 WV No-Build	2013 WV IRA	2013 WV Line A	Option Area Comparisons in WV - 2013												
					Interchange		Shavers Fork		Patterson Creek		Forman		Baker		Hanging Rock	
					Line I	Line A	Line S	Line A	Line P	Line A	Line F	Line A	Line B	Line A	Line R	Line A
< 0-5dBA	None	1,879	1,362	1,344	59	91	35	32	5	4	8	9	36	33	9	3
6-10 dBA	Minimal	0	416	288	10	16	4	7	3	3	1	3	12	13	1	8
11-15 dBA	Moderate	0	74	163	21	4	0	0	3	6	3	1	3	5	4	5
>15 dBA	Substantial	0	27	84	24	3	0	0	2	0	1	0	2	2	2	0

VIRGINIA

LEVEL OF PREDICTED INCREASE	VA IMPACT CRITERIA*	# PREDICTED INCREASES							
		2013 VA No-Build	2013 VA IRA	2013 VA Line A	Option Area Comparisons in VA - 2013				
					Duck Run			Lebanon Church	
					Line D1	Line D2	Line A	Line L	Line A
< 0-5dBA	—	334	198	244	11	13	15	44	116
6-9 dBA	—	0	131	41	12	13	11	31	5
= or >10 dBA	Substantial	0	5	49	15	12	12	54	8

* *Note:* West Virginia defines a substantial increase as an increase greater than 15 dBA.
Virginia defines substantial increase as an increase greater than or equal to 10 dBA.

For the proposed Improved Roadway Alternative in the year 2013, the predicted levels for the Monongahela and George Washington National Forest sites increase by 3-4 dBA because of the predicted doubling of future traffic volumes on the nearby routes. The Conservancy site stays at a predicted level of 59 dBA because Greenland Gap Road remains the dominant sound generator at the Conservancy's closest point to the Improved Roadway Alternative roadway centerline (approximately 457 meters or 1500 feet) and the proposed alternative does not add to the total sound level at that distance.

For the proposed Build Alterantive in the year 2013 , the George Washington National Forest site increases by 7 dBA over the existing condition to 51 dBA. The Monongahela National Forest site increases by 5 over the existing condition to 48 dBA. Similar to the IRA, the Conservancy site stays at a predicted level of 59 dBA because Greenland Gap Road remains the dominant sound generator at the Conservancy's closest point to the Build Alternative roadway centerline (approximately 305 meters or 1000 feet) and the proposed alternative does not add to the total sound level at that distance.

4. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

Avoidance, minimization, and mitigation measures would not be necessary under the No-Build Alternative. The alignment development process for both the IRA and the Build Alternative included efforts to avoid or minimize noise impacts to sensitive receptors through alignment shifts. However, avoidance and minimization measures under the IRA were not as effective as they were under the Build Alternative. Efforts to shift the IRA alignment away from sensitive receptors were constrained by the fact that most sensitive receptors are in close proximity to the existing roadway.

a. General Noise Reduction Measures

There are four general types of noise reduction measures used to mitigate noise impacts: highway plantings, structures (buildings), earth berms, and barrier walls. Existing dense highway vegetation can, under certain conditions, reduce traffic sound levels up to 5 dBA: to do so requires a vegetative cover of a minimum 30 meters (100 feet) in depth, 4.5 meters (14 feet) in height, and of sufficient density that no visual path through it exists between the highway and the adjacent land use area. A narrow width of vegetation would not provide any degree of effective sound level reduction. The use of highway plantings and existing vegetation alone would not be an effective solution for substantial noise reduction. However, where desirable vegetation exists between the proposed highway and the adjacent land use areas, every effort would be made to preserve and encourage its propagation.

Intervening buildings themselves may be used as noise barriers, providing up to 15 dBA of sound level attenuation. This amount would only occur when the buildings are continuous and there is no direct line-of-sight between the source and the observer. A row of houses, depending on their spacing, can typically reduce sound levels by 3 to 5 dBA. This shielding is most prevalent in the more populated areas where residential, neighborhood, institutional, commercial, and/or industrial buildings exist. Given the rural nature of the area, the use of structures would not be an effective means of noise attenuation.

Noise reduction measures such as earth berms and barrier walls would provide the greatest degree of noise attenuation. A graded, vegetated earth berm that blends with the surrounding topography is one of the more aesthetically pleasing noise barriers. The feasibility of berm construction would be considered as part of the overall grading plan for the proposed project. There may be instances where an effective earth berm can be constructed within normal right-of-way or with a minimal additional right-of-way purchase. If right-of-way is insufficient to accommodate a full height earth berm, a lower earth berm could be constructed in combination with a wall to achieve the necessary height and attenuation. An earth berm may also provide slightly more attenuation (up to 3 dBA more) than a vertical barrier wall of the same height because of the better absorptive quality of the earth.

A solid, acoustically opaque barrier (barrier wall) can theoretically reduce noise exposure of a property by as much as 15 to 20 dBA (one-third to one-fourth a reduction in noise level), although a typical reduction is 10 dBA (about one-half). The barriers can be constructed from common building materials such as concrete, wood, plastic, and recycled products. The design can range from relatively simple, straight-line walls to complex designs that blend in with local features such as terrain and neighborhood characteristics. The materials should be rigid and sufficient dense to provide adequate mitigation and drainage, while at the same time be attractive, durable, and relatively maintenance-free. Both the on-site cost and the degree of noise attenuation must be considered when selecting barrier wall materials. In addition, it is unlikely that any one barrier wall type or material would be applicable in every situation. Consideration must also be made for the on-site cost of the foundations, fabrication, erection, and maintenance of the wall, as well as for any additional drainage costs that may be associated with the construction of the barrier.

For maximum effectiveness, barriers should be as close as possible to either the source or the receiver and should be high and long enough to mitigate adequately the site. Space limitations and public involvement often determine the type of barrier used. A combination of earth mound topped by a wall can be visually pleasing as well as functional. In some cases, the wall may serve to control access and eliminate the need for and cost of right-of-way fencing. Barrier walls are typically not provided in areas where access to adjacent development is necessary. The walls become ineffective at noise attenuation when opened up to provide access on an uncontrolled access facility.

b. Conditions for Implementing Mitigation Measures

Mitigation measures (noise abatement) would be considered when one or more of the following conditions are met under the IRA or the Build Alternative.

- The design year sound levels exceed or approach the FHWA Noise Abatement Criteria. The approach criteria for West Virginia and Virginia is 66 dBA for Category B receptors (representative of exterior sound levels for residences, schools, churches, parks and other institutional activities) or;

- The predicted design year level substantially increases over the existing sound level at the same site. In West Virginia, a substantial increase is defined as an increase greater than 15 dBA over the existing condition. In Virginia, it is defined as an increase of 10 or more dBA over the existing condition.

Mitigation considerations are comprised of two components: feasibility and reasonableness. The feasibility of mitigating noise impacts deals primarily with quantitative elements such as topography, access points, drainage, safety, maintenance requirements, other noise sources, and whether the proposed insertion of a barrier could reduce the sound levels by a minimum of at least 5 dBA. The reasonableness of mitigating noise impacts is a more subjective criteria. Reasonableness is based on such factors as the cost effectiveness of protecting an isolated or small number of receptors, exposed wall heights, distances to receptors from the mitigated source, a minimum decibel change of at least 3 dBA over the existing levels (when people can first notice a minor change in the sound environment), residential support or desires for noise abatement features, and concerns for physical and visual access to commercial establishments. Where noise abatement considerations are warranted, every reasonable effort would be made to achieve adequate noise level reductions for locations where the levels exceed the noise abatement criteria or where the projected noise levels exceed the substantial increase criteria.

A preliminary analysis addressed the receptors that required noise mitigation consideration. Some receptors were eliminated from further noise abatement consideration (sound barriers) because of the justifiable warrants identified below:

- Safety issues, including line-of-sight requirements, particularly where the proposed roadway and the local roads and driveways intersected at-grade.

- Isolated or single receptor locations that would not typically warrant further consideration because of the potential cost of protecting one site;

- Areas with only a few homes which did not have acceptable cost per receptor ratios;
- Areas where the predicted noise contributions coming from other streets would have predicted an insufficient Insertion Loss (IL) from any proposed solid wall structure;
- Overriding direct access requirements to the roadways, particularly along most of the IRA; and
- Other considerations, such as business visibility and access to the general public.

c. Preliminary Identification of Sound Barrier Locations

Noise mitigation via sound barriers was evaluated for those receptors that were not eliminated from further study as a result of the justifiable warrants listed above. A preliminary location analysis identified the noise mitigation areas to be studied. The proposed sites would be studied in greater detail depending on the alternative and associated alignment selected. Detailed sound barrier justifications that deal with specific lengths, heights, materials, costs, distances from the roadway, community desires, and visual impacts would be analyzed in final design, in conjunction with the final alignment development.

Tables III-25 through III-27 show the proposed preliminary sound barrier locations and construction costs for the IRA, Line A, and the option area comparisons. Noise abatement considerations were not warranted on the portion of the IRA in Virginia, as well as in the Option Areas of Shavers Fork and Forman. The preliminary areas presented in Tables III-25 through III-27 are very conservative in length and location and would typically be the maximum extent of solid wall sound barrier proposals. The cost estimates assume an average structure height of 6.1 meters (20 feet) and a cost of $16 per square foot in both West Virginia and Virginia. However, these estimates may be slightly higher where sections of proposed sound barriers cross bridges (due to the need for additional support requirements).

During final design (depending on the alternative and alignment carried forward through the FEIS) some of the areas identified may be eliminated from further consideration for the same reasons or warrants as were the others. In addition to these warrants, these areas may be eliminated from further consideration because of proposed cut slopes and how the receptors may be shielded from the roadway by the natural terrain. The final length, height, and cost of sites to be mitigated will be addressed in the FEIS.

TABLE III-25
PROPOSED PRELIMINARY SOUND BARRIER LOCATIONS: IRA

ALTERNATIVE	STATE	STATIONS	LENGTH	COST
IRA	West Virginia	393+00LT to 407+00LT	426 m (1,400 ft)	$448,000
		2285+00LT to 2295+00LT	305 m (1,000 ft)	$320,000
		5167+00LT to 5183+00LT	488 m (1,600 ft)	$512,000
		6610+00LT to 6625+00LT	457 m (1,500 ft)	$480,000
			West Virginia Total	***$1,760,000***
	Virginia	*none*	—	$0
			Virginia Total	***$0***
			Total Cost of Noise Barriers: IRA (WV and VA)	***$1,760,000***

TABLE III-26
PROPOSED PRELIMINARY SOUND BARRIER LOCATIONS: LINE A

ALTERNATIVE	STATE	STATIONS	LENGTH	COST
Line A	West Virginia	387+00LT to 410+00LT	701 m (2,300 ft)	$736,000
		634+00LT to 645+00LT	335 m (1,100 ft)	$352,000
		557+00RT to 570+00RT	396 m (1,300 ft)	$416,000
		570+00LT to 585+00LT	457 m (1,500 ft)	$480,000
		727+00LT to 750+00LT	701 m (2,300 ft)	$736,000
		741+00RT to 761+00RT	610 m (2,000 ft)	$640,000
		3210+00LT to 3267+00LT	1,737 m (5,700 ft)	$1,824,000
		3380+00LT to 3343+00LT	1,067 m (3,500 ft)	$1,120,000
		3331+00RT to 3354+00RT	701 m (2,300 ft)	$736,000
		3571+00LT to 3600+00LT	884 m (2,900 ft)	$928,000
		3635+00LT to 3655+00LT	610 m (2,000 ft)	$640,000
		3686+00LT to 3700+00LT	426 m (1,400 ft)	$448,000
		4093+00LT to 5014+00LT	640 m (2,100 ft)	$672,000
		5667+00LT to 5704+00LT	823 m (2,700 ft)	$864,000
		5983+00LT to 5991+00LT	244 m (800 ft)	$256,000
		6026+00LT to 6035+00LT	274 m (900 ft)	$288,000
		6275+00LT to 6300+00LT	762 m (2,500 ft)	$800,000
		7165+00LT to 7175+00LT	30 m (100 ft)	$32,000
		7216+00LT to 7232+00LT	488 m (1,600 ft)	$512,000
		7515+00LT to 7530+00LT	457 m (1,500 ft)	$480,000
		7548+00RT to 7564+00RT	488 m (1,600 ft)	$512,000
		7548+00LT to 7568+00LT	610 m (2,000 ft)	$640,000
			West Virginia Total	***$19,392,000***
	Virginia	8025+00LT to 8055+00LT	914 m (3000 ft)	$960,000
		8021+00RT to 8041+00RT	610 m (2000 ft)	$640,000
		8061+00LT to 8095+00LT	1036 m (3400 ft)	$1,088,000
		8065+00RT to 8073+00RT	244 m (800 ft)	$256,000
		8155+00RT to 8190+00RT	1067 m (3500 ft)	$1,120,000
		8055+00LT to 8282+00LT	823 m (2700 ft)	$864,000
		8311+00LT to 8324+00LT	396 m (1300 ft)	$416,000
		8450+00LT to 8457+00LT	213 m (700 ft)	$224,000
		8459+00LT to 8464+00LT	152 m (500 ft)	$160,000
		8462+00RT to 8472+00RT	305 m (1000 ft)	$320,000
		A 610 linear meter (2,000 linear foot) area along the west side of I-81 and south of Line A (no station # in area next to the proposed interchange)	610 m (2000 ft)	$640,000
			Virginia Total	***$7,328,000***
			Total Cost of Noise Barriers: Line A (WV and VA)	***$26,630,000***

TABLE III-27
PROPOSED PRELIMINARY SOUND BARRIER LOCATIONS: OPTION AREA COMPARISONS

INTERCHANGE OPTION AREA

LINE I			LINE A		
STATIONS	LENGTH	COST	STATIONS	LENGTH	COST
638+00LT to 648+00LT	305 m (,1000 ft)	$320,000	387+00LT to 410+00LT	701 m (2,300 ft)	$736,000
638+00RT to 648+00RT	305 m (1,000 ft)	$320,000	634+00LT to 645+00LT	335 m (1,100 ft)	$352,000
2966+00RT to 3005+00RT	1188 m (3,900 ft)	$1,248,000	557+00RT to 570+00RT	396 m (1,300 ft)	$416,000
2991+00LT to 3003+00LT	366 m (1,200 ft)	$384,000	570+00LT to 585+00LT	457 m (1,500 ft)	$480,000
3056+00LT to 3085+00LT	884 m (2,900 ft)	$928,000	727+00LT to 750+00LT	701 m (2,300 ft)	$736,000
3013+00LT to 3041+00LT	853 m (2,800 ft)	$896,000	741+00RT to 761+00RT	610 m (2,000 ft)	$640,000
	Total Cost	***$4,096,000***		***Total Cost***	***$3,360,000***

PATTERSON CREEK OPTION AREA

LINE P			LINE A		
STATIONS	LENGTH	COST	STATIONS	LENGTH	COST
5547+00RT to 5557+00RT	305 m (1,000 ft)	$320,000	(none proposed)		
	Total Cost	***$320,000***		***Total Cost***	***$0***

BAKER OPTION AREA

LINE B			LINE A		
STATIONS	LENGTH	COST	STATIONS	LENGTH	COST
7040+00RT to 7058+00RT	549 m (1,800 ft)	$576,000	(none proposed)		
	Total Cost	***$576,000***		***Total Cost***	***$0***

TABLE III-27 *(CONT.)*
PROPOSED PRELIMINARY SOUND BARRIER LOCATIONS: OPTION AREA COMPARISONS

HANGING ROCK OPTION AREA

LINE R			LINE A		
STATIONS	LENGTH	COST	STATIONS	LENGTH	COST
(none proposed)			7165+00LT to 7175+00LT	305m (1,000 ft)	$320,000
	Total Cost	***$0***		***Total Cost***	***$320,000***

DUCK RUN OPTION AREA (LINE D1)

LINE D1			LINE A		
STATIONS	LENGTH	COST	STATIONS	LENGTH	COST
8025+00LT to 8055+00LT	914 m (3000 ft)	$960,000	8025+00LT to 8055+00LT	914 m (3000 ft)	$960,000
8021+00RT to 8041+00RT	610 m (2000 ft)	$640,000	8021+00RT to 8041+00RT	610 m (2000 ft)	$640,000
	Total Cost	***$1,600,000***		***Total Cost***	***$1,600,000***

DUCK RUN OPTION AREA (LINE D2)

LINE D2			LINE A		
STATIONS	LENGTH	COST	STATIONS	LENGTH	COST
8006+00LT to 8024+00LT	549 m (1,800 ft)	$560,000	8025+00LT to 8055+00LT	914 m (3,000 ft)	$960,000
—	—	—	8021+00RT to 8041+00RT	610 m (2,000 ft)	$640,000
	Total Cost	***$560,000***		***Total Cost***	***$1,600,000***

TABLE III-27 *(CONT.)*
PROPOSED PRELIMINARY SOUND BARRIER LOCATIONS: OPTION AREA COMPARISONS

LEBANON CHURCH OPTION AREA

LINE L			LINE A		
STATIONS	LENGTH	COST	STATIONS	LENGTH	COST
8055+00LT to 8284+00LT	884 m (2900 ft)	$928,000	8055+00LT to 8282+00LT	823 m (2700 ft)	$864,000
8422+00RT to 8480+00RT	1768 m (5800 ft)	$1,856,000	8311+00LT to 8324+00LT	396 m (1300 ft)	$416,000
8420+00RT to 8436+00RT	488 m (1600 ft)	$512,000	8450+00LT to 8457+00LT	213 m (700 ft)	$224,000
8459+00RT to 8473+00RT	426 m (1400 ft)	$448,000	8459+00LT to 8464+00LT	152 m (500 ft)	$160,000
—	—	—	8462+00RT to 8472+00RT	305 m (1000 ft)	$320,000
—	—	—	610 linear meter (2,000 linear foot) area west of I-81 and south of Line A (no station # in area next to proposed interchange)		$640,000
	Total Cost	***$3,744,000***		*Total Cost*	***$3,264,000***

J. RECREATION RESOURCES

The proposed project's impact on recreation resources has been assessed. Details of the analysis are included in the *Socioeconomics Technical Report.*

1. METHODOLOGY

Recreational resources within a 30-minute drive of the proposed project area were inventoried through review of available mapping and coordination with Federal, state, and local government agencies, private organizations, and persons with knowledge of existing and proposed recreational facilities.

Mapping of the proposed alignments was reviewed to identify direct impacts with known recreational resources within the preliminary construction limits for the IRA and the Build Alternative. Impacts to recreation resources were rated on the following basis:

- No Impact: The facility or recreational function of the facility would not be directly affected by construction and/or operation of the proposed project.

- Minor Impact: A recreational resource could be directly affected by a specific alignment, but its function would not be affected. Impacts were also considered minor when construction activities could temporarily, but not permanently, affect the recreational function of a specific resource.

- Major Impact: The primary function of a specific recreation resource would be directly affected by construction and operation of a specific alignment, potentially resulting in the loss of the recreational opportunity.

2. EXISTING ENVIRONMENT AND IMPACTS

Recreational opportunities offered throughout West Virginia and Virginia are diverse in nature and include: water activities such as white water rafting, boating, and water skiing; fishing and hunting; hiking; bicycling; rock climbing and rappelling; spelunking; cross-country and downhill skiing; golfing and court sports; historical and environmental interpretive (educational) activities; jogging and walking; and scenic driving. Recreation resources within a 30-minute drive from the proposed project are identified on Table III-28. These resources are discussed in detail in the *Socioeconomics Technical Report.*

TABLE III-28
RECREATION RESOURCES WITHIN 30 MINUTE DRIVE OF PROJECT AREA

RECREATION RESOURCE	Approximate Distance from Alignments in kilometers (miles)	Public/ Private	RECREATION ACTIVITY														
			Camping	Hunting/Fishing	Rock Climbing	Hiking/Biking	Horseback Riding	Spelunking	Swimming	Boating	Downhill Skiing	X-Country Skiing	Picnic	Baseball/Softball	Court Sports	Other	Interpretive/Educational
Allegheny Trail - WV	◆	Public*				✓										✓	
Alpena Gap NRA	24 (15)	Public		✓									✓				
American Discovery Trail (proposed) - WV	◆	Public*				✓										✓	
Big Bend NRA - WV	35 (22)	Public											✓				
Big Blue Trail - WV/VA	◆	Public*				✓						✓					
Black Fork - WV	◆	Public								✓							
Blackwater Falls SP - WV	2.4 (1.5)	Public	✓			✓				✓			✓				
Canaan Valley Resort SP - WV	17 (11.5)	Public	✓		✓	✓						✓	✓		✓	✓	
Canaan Valley NWR - WV	17 (10.5)	Public		✓													✓
Cedar Creek - VA	◆	Public			✓										✓	✓	✓
Dolly Sods Wilderness - WV	46.7 (29)	Public		✓	✓	✓											✓
Duck Run - VA	◆	Public		✓													
Elklick Run - WV	◆	Public		✓													
Edwards Run PHFA - WV	45(28)	Public		✓													
Fairfax Stone SP - WV	11.2 (7)	Public											✓				✓
Fernow Exp. Forest - WV	◆	Public															✓
Geo. Washington NF - WV/VA	◆	Public	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	
Greenland Gap Nature Preserve - WV	◆	Public		✓		✓											✓
Hawk PHFA - WV	4.8 (3)	Public		✓													
Hawthorne Valley GC - WV	◆	Private														✓	
J. Allen Hawkins Park - WV	◆	Public											✓	✓	✓		
Kimsey Run Dam & Lake (proposed) - WV	◆	Public		✓													
Leading Creek - WV	◆	Public		✓													
Lost River - WV	◆	Public		✓									✓				
Lost River SP - WV	20.9 (13)	Public	✓			✓	✓		✓				✓	✓	✓		✓
Mill Race Park - WV	◆	Public											✓	✓	✓	✓	
Monongahela NF - WV	◆	Public	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓				
Moorefield City Park - WV	◆	Public							✓				✓	✓	✓		
Nathanial Mountain PHFA - WV	27 (17)	Public		✓													

◆ = Resource crosses or is adjacent to alignment(s)

* = Trail is located on both public and private land, open to the public, and administered by private organizations.

Where:

NF = National Forest
NRA = National Recreation Area
NWR = National Wildlife Refuge
PHFA = Public Hunting and Fishing Area
SP = State Park
GC = Golf Course

TABLE III-28 (CONT.)
RECREATION RESOURCES WITHIN 30 MINUTE DRIVE PROJECT AREA

RECREATION RESOURCE	Approximate Distance from Alignments in kilometers (miles)	Public/ Private	RECREATION ACTIVITY: Camping	Hunting/Fishing	Rock Climbing	Hiking/Biking	Horseback Riding	Spelunking	Swimming	Boating	Downhill Skiing	X-Country Skiing	Picnic	Baseball/Softball	Court Sports	Other	Interpretive/Educational
N. Fork Blackwater River - WV	◆	Public		✓					✓								
N. Fork Patterson Creek - WV	◆	Public		✓													
Pleasant Creek - WV	◆	Public		✓													
River City Park - WV	◆	Public											✓	✓	✓		
Roaring Run - WV	◆	Public		✓													
Shavers Fork - WV	◆	Public		✓					✓								
Shingle Tree Run Trail - WV	◆	Public				✓											
Short Mountain PHFA - WV	16 (10)	Public	✓	✓													
Trout Pond Rec. Area - WV	24 (15)	Public	✓	✓					✓	✓							
Trout Run - WV	◆	Public		✓													
Valley View GC - WV	11.6 (7.2)	Public											✓		✓	✓	
VA Route 600 - VA	◆	Public														✓	
Waites Run - WV	◆	Public		✓													
Warden Lake - WV	9 (6)	Public		✓													
Wardensville PHFA - WV	9 (6)	Public		✓													
Wheatlands Lake - VA	22.5 (14)	Public		✓													
Wolf Gap PHFA - WV	19 (12)	Public		✓													

◆ = Resource crosses or is adjacent to alignment(s)

* = Trail is located on both public and private land, open to the public, and administered by private organizations.

Where:

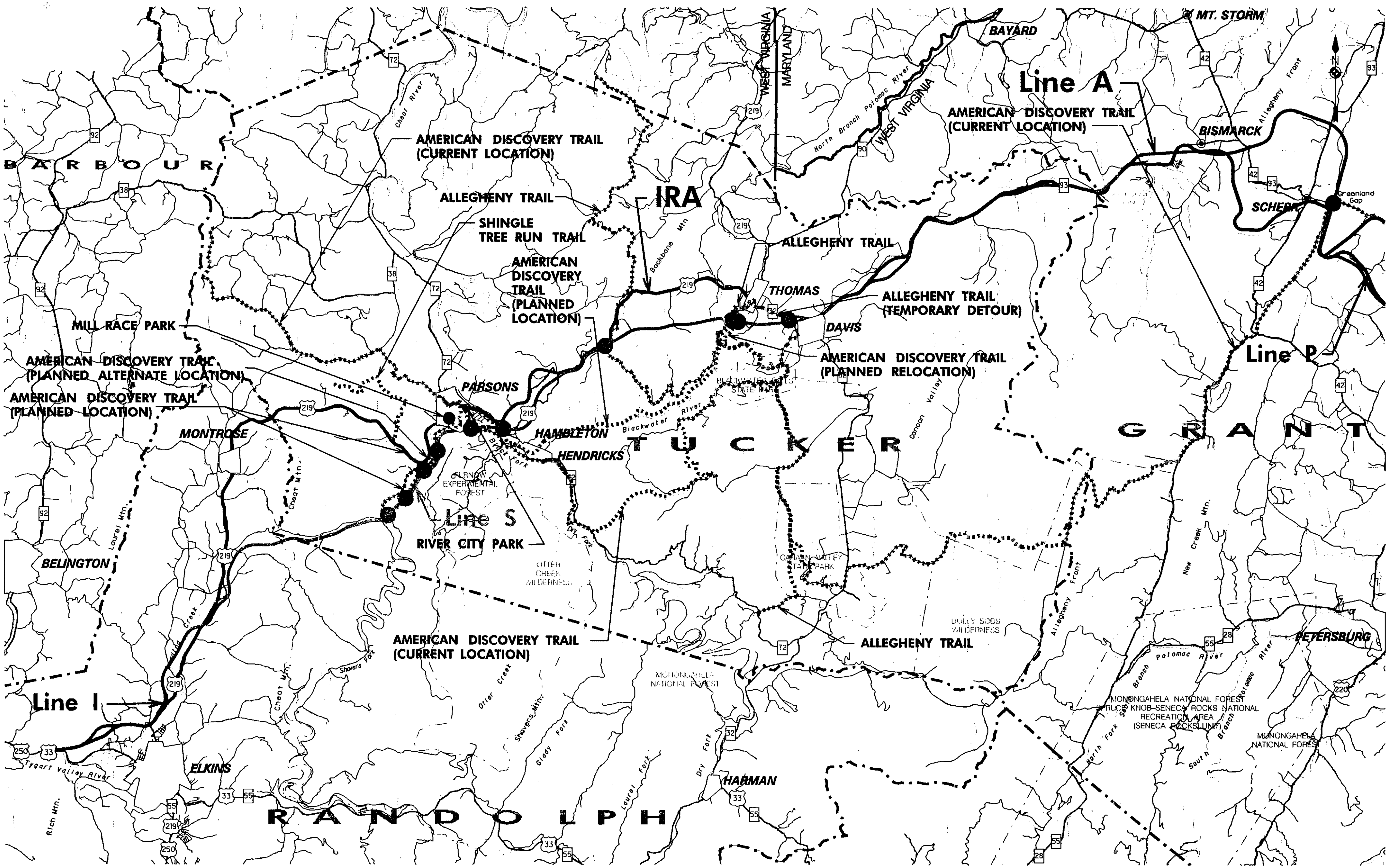
NF = National Forest
NRA = National Recreation Area
NWR = National Wildlife Refuge
PHFA = Public Hunting and Fishing Area
SP = State Park
GC = Golf Course

Under any alternative, there would be no direct impacts to publicly owned parks, recreation areas, or wildlife or waterfowl refuges. Recreation resources within the proposed project area are presented on Exhibit III-26. These are described below for the No-Build, Improved Roadway and Build Alternatives. Tables III-29 and III-30 summarize the impact by alternative and option area. An overview of each alternative's impact on recreation resources is provided below, followed by a discussion of specific resource impacts.

The No-Build Alternative would not result in any direct impacts to recreation resources located in close proximity to the proposed project area. Without regional access improvements, travel times to and from recreation sites will increase as traffic volumes on major arterials increase. As access becomes more and more difficult, potential recreationists may opt to find other, more easily accessible recreation areas that provide the same type of activities. Such access problems could result in a loss of patronage and associated local, regional, and state revenues. Furthermore, the provision of safe access heavily influences use at those sites providing winter sports activities. Given the mountainous terrain of the area, heavy snows create problems for drivers traveling the winding, steep roadways of West Virginia. Such travel conditions may encourage potential users to seek out other facilities that provide similar recreation opportunities.

Under either the IRA or the Build Alternative, access to recreation resources would be an improvement over the No-Build Alternative; and the Build Alternative more than the IRA. As noted in the 1992 *Corridor Selection SDEIS*, the determination of adverse or beneficial effects resulting from access improvements to developed and undeveloped recreation resources varies, depending upon the views of the recreation user and the recreation provider. One point of view would be that improved access would result in a reduction of recreational enjoyment as resource visitation increases in volume and frequency. This would likely be the case for those individuals who come to the area seeking a more remote and primitive recreation experience. However, to others, improved access would be positive, providing recreation opportunities that they might otherwise not have visited. To the recreation provider, improved access might place user demands on resources which the provider may be unable to meet. On the other hand, increased visitation could provide an opportunity for growth and development of natural and developed recreation resources within the area.

Specific impacts to recreation resources under either the IRA or the Build Alternative are identified. For discussion purposes, these resources have been grouped into five categories: national forest land supporting dispersed recreation activities, hiking and bicycling trails, streams, local parks, and scenic driving.



AMERICAN DISCOVERY TRAIL (CURRENT LOCATION)
ALLEGHENY TRAIL
SHINGLE TREE RUN TRAIL
AMERICAN DISCOVERY TRAIL (PLANNED LOCATION)
IRA
ALLEGHENY TRAIL
THOMAS
ALLEGHENY TRAIL (TEMPORARY DETOUR)
DAVIS
AMERICAN DISCOVERY TRAIL (PLANNED RELOCATION)
MILL RACE PARK
AMERICAN DISCOVERY TRAIL (PLANNED ALTERNATE LOCATION)
AMERICAN DISCOVERY TRAIL (PLANNED LOCATION)
PARSONS
HAMBLETON
HENDRICKS
MONTROSE
BELINGTON
Line S
RIVER CITY PARK
AMERICAN DISCOVERY TRAIL (CURRENT LOCATION)
ALLEGHENY TRAIL
Line I
ELKINS
HARMAN
Line A
AMERICAN DISCOVERY TRAIL (CURRENT LOCATION)
BISMARCK
SCHERR
Greenland Gap
MT. STORM
BAYARD
Line P
WEST VIRGINIA
MARYLAND
BARBOUR
TUCKER
GRANT
RANDOLPH
PETERSBURG
MONONGAHELA NATIONAL FOREST
SPRUCE KNOB-SENECA ROCKS NATIONAL RECREATION AREA (SENECA ROCKS UNIT)
MONONGAHELA NATIONAL FOREST
DOLLY SODS WILDERNESS
OTTER CREEK WILDERNESS
FERNOW EXPERIMENTAL FOREST
CANAAN VALLEY STATE PARK
BLACKWATER FALLS STATE PARK

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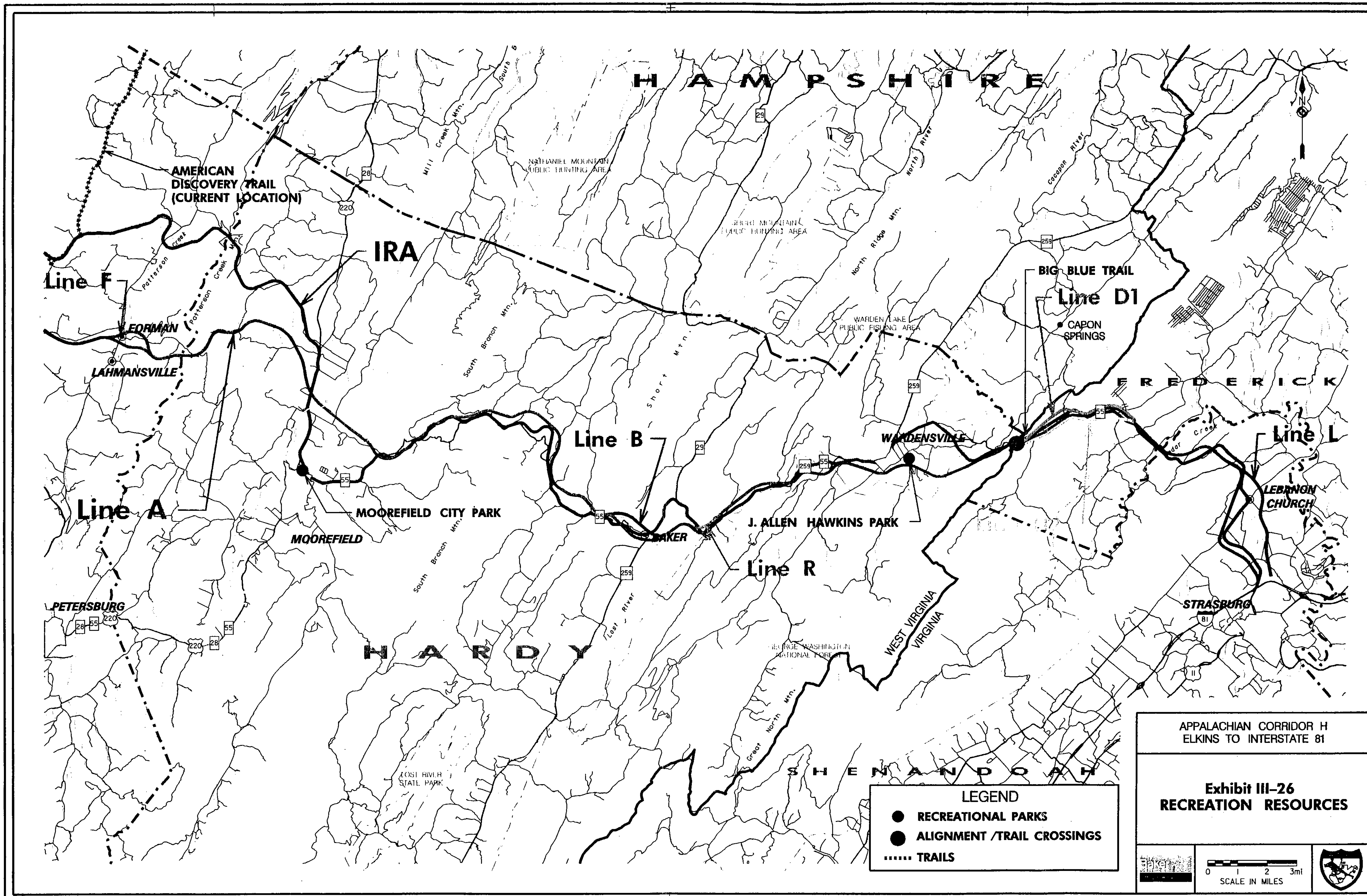

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Exhibit III-26
RECREATION RESOURCES

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TABLE III-29
RECREATION RESOURCE IMPACTS COMPARISON OF ALTERNATIVES

RECREATION RESOURCE AND AREA OF IMPACT		ALTERNATIVE: NO-BUILD	IRA		BUILD-LINE A	
			WV	VA	WV	VA
LOCAL PARKS	J. Allen Hawkins Park	None	None		None	
	Mill Race Park	None	Minor		None	
	River City Park	None	None		None	
	Moorefield City Park	None	Minor		None	
ALLEGHENY TRAIL	WV 32, Davis	None	Minor		Minor	
	CR 27, Coketon	None	None		Minor	
	W. Maryland Railroad, Coketon	None	None		Minor	
	FSR 18/717	None	None		Major	
	CR 27, Thomas	None	Minor		None	
	WV 32, Thomas	None	Minor		None	
	FSR 18/ US 219	None	Major		None	
AMERICAN DISCOVERY TRAIL	CR 41, Parsons to Porterwood	None	None		Major	
	CR 219/7, Parsons	None	Minor		Minor	
	WV 72, Hambleton	None	None		Minor	
	W. Maryland Railroad, Coketon	None	Minor		Minor	
	US 219, Moore to Porterwood	None	Minor		None	
	US 219, Parsons	None	Minor		None	
	Thomas	None	Minor		None	
	CR 1 & 42, Greenland Gap	None	None		Minor	
	CR 42/3, Greenland Gap	None	Minor		None	
	CR 3 & 3/3, Greenland Gap	None	Major		None	
BIG BLUE TRAIL	WV/VA State Line	None		Major		Major
SHINGLE TREE RUN TRAIL	Shingle Tree Run	None	Minor		None	
RIVERS & STREAMS	Black Fork	None	Minor		Minor	
	Cedar Creek	None		Minor		Minor
	Duck Run	None		Minor		Minor
	Elklick Run	None	Minor		Minor	
	Leading Creek	None	Minor		Minor	
	Lost River	None	Minor		Minor	
	North Fork of Blackwater Creek	None	Minor		Minor	
	North Fork of Patterson Creek	None	Minor		Minor	
	Pleasant Run	None	Minor		Minor	
	Roaring Run	None	Minor		Minor	
	Shavers Fork	None	Minor		Minor	
	South Branch of Potomac River	None	Minor		Minor	
	Trout Run	None	Minor		Minor	
OTHER	Monongahela NF	None	Minor		Minor	
	George Washington NF	None	Minor	Minor	Minor	Minor
	Greenland Gap Nature Preserve	None	Minor		Minor	
	VA 600	None		Minor		Minor
	VA 55	None		Minor		Minor
TOTALS:	*# Resources with Impact = None*	*41*	*8*	*0*	*13*	*0*
	# Resources with Impact = Minor	*0*	*26*	*5*	*21*	*5*
	# Resources with Impact = Major	*0*	*2*	*1*	*2*	*1*

TABLE III-30
OPTION AREA COMPARISON OF RECREATION RESOURCE IMPACTS

	WEST VIRGINIA												VIRGINIA				
	INTERCHANGE		SHAVERS FORK		PATTERSON CREEK		FORMAN		BAKER		HANGING ROCK		DUCK RUN			LEBANON CHURCH	
RECREATION RESOURCE	LINE I	LINE A	LINE S	LINE A	LINE P	LINE A	LINE F	LINE A	LINE B	LINE A	LINE R	LINE A	LINE D1	LINE D2	LINE A	LINE L	LINE A
American Discovery Trail: CR 41, Parsons to Porterwood			Major	Major													
Big Blue Trail													Major	Major	Major		
Duck Run													Minor	None	Minor		
George Washington NF													Minor	Minor	Minor		
Leading Creek	Minor	Minor															
Lost River									Minor	Minor	Minor	Minor					
Shavers Fork			Minor	Minor													
Monongahela NF			Minor	Minor													
# Resources w/ Impact = None	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*
# Resources w/ Impact = Minor	*1*	*1*	*2*	*2*	*0*	*0*	*0*	*0*	*1*	*1*	*1*	*1*	*2*	*1*	*2*	*0*	*0*
# Resources w/ Impact = Major	*0*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*	*1*	*0*	*0*

a. National Forest Lands

Roads within the Monongahela and George Washington National Forests that would be located within the construction limits of either the IRA or the Build Alternative would be affected by construction and operation of the proposed facility. Relocation of forest roads and intersections with these roads would be reconstructed to the standards of the Forest Service. However, no additional access roads would be reconstructed and therefore, impacts associated with changes in access (i.e. loss of a recreational opportunity as a result of access denial, or increased demand on areas preserved for remote experiences associated with additional access) would not occur in conjunction with either the IRA or any of the alignments under the Build Alternative.

(1) Monongahela National Forest

The IRA would traverse the Monongahela National Forest. Other than the involvements with the Allegheny, American Discovery, and Shingle Tree Run Trails, no developed recreation resources would be directly impacted by the IRA.

The Build Alternative would also traverse land within the Monongahela National Forest. Other than involvements with the Allegheny and American Discovery Trails, no developed recreation resources would be directly impacted by any of the alignments under the Build Alternative.

(2) George Washington National Forest

The IRA would traverse portions of the George Washington National Forest. Through the Lost River area of Hardy County, the IRA would follow WV 55 on existing location, skirting the northern boundary of the Forest Service lands. The Big Blue Trail would be the only designated recreation resource located within the boundaries of the George Washington National Forest that would be affected by the IRA. The IRA would have a minor impact on this trail.

The Build Alternative would also traverse portions of the George Washington National Forest. Through the western portion of Frederick County, the Duck Run Option Area of the Build Alternative (Lines A, D1, and D2) would pass through the northern end of the Forest Service lands. Lines A and D2 may affect land associated with the Johnnies Knob Management Area (Management Area 9). Land contained in this Management Area are "managed to provide older vegetation in remote and isolated areas where recreationists can obtain a degree of solitude and environment can be managed in a near natural state with minimum intervention." The impact would be limited to the perimeter of the area and within the same general vicinity as WV/VA 55. Therefore, the impact is considered to be minor.

The Big Blue Trail is the only recreation resource located within the boundaries of the George Washington National Forest that would be affected by the Build Alternative. In general, the construction of Line A, Line D1, or Line D2 would require the relocation of the Big Blue Trail. This impact would be considered to be major. A more detailed discussion of the impacts to the Big Blue Trail is presented under the discussion of trails.

b. Pedestrian and Bicycling Trails

The development of pedestrian and bicycle trails throughout West Virginia has gained momentum. Advocates note that there is a strong potential for the Tucker County region to become a major trail hub in the national trails area where hikers and cyclists may head onto major trails in the north, east, south, and west. Several designated trails cross the proposed alignments. Within the Monongahela National Forest, these trails include the Allegheny Trail, the American Discovery Trail, and the Shingle Tree Run Trail. The Big Blue Trail is the only such trail within the George Washington National Forest.

Under the IRA, most trails would be spanned and impacts would be limited to temporary loss of use during construction. In a few cases, the trails now share right-of-way with existing roadways which would be upgraded under the IRA. Expansion of the right-of-way on current location is considered to be a minor impact since vehicular and non-motorized traffic is now mixed under the current configuration.

Under either the IRA or the Build Alternative, major impacts to trails would occur where trails either follow existing roadways which are to be relocated or where trails would cross the proposed alignments via an at-grade crossing. While such impacts are considered major, they would be temporary in nature because they are construction-related. Following construction activities, trail use would continue as before, regardless of whether or not the trail required relocation.

(1) Allegheny Trail

The IRA would impact the Allegheny Trail where the trail passes through the Monongahela National Forest: FR 18/US 219, on Backbone Mountain; County 27, in Thomas; and WV 32, in Thomas and Davis. At the first location, the Allegheny Trail follows FR 18/US 219 to Sugarlands Road (County 25). Under the IRA, a 9,700 foot section of trail would be directly affected by the realignment of US 219, between FR 18 and County 25. At the other locations, no impacts to the function of the trail would occur. Where the Allegheny Trail follows County 27 into Thomas, the IRA would span the North Fork of the Blackwater River and CR 27. The Allegheny Trail now follows WV 32 through Davis. Under the IRA, this road would be widened, affecting a 7,500 foot section of the trail. Impacts at both locations would be limited to a temporary loss of use during construction.

Under the Build Alternative, there would be four involvements with the Allegheny Trail where the trail passes through the Monongahela National Forest: County 27 in Coketon; Western Maryland Railroad in Coketon; WV 32 in Davis; and FR 18 and 717 on Backbone Mountain. Both crossings of the Allegheny Trail near Coketon by the Build Alternative would be on structure over the trail. Therefore, impacts to the trail would be limited to the loss of use during construction. Where the Build Alternative would span WV 32 and hence the trail, a proposed diamond interchange at this location may affect the safety of trail users. The placement of bridge piers could reduce sight distance of trail users and motorists in the interchange area. The Build Alternative would also require the relocation of Forest Service Routes 18/717, affecting the function of a 3,270-foot section of the Allegheny Trail. The trail would be directly affected by the highway and the relocation of FR 18/717. The forest service roads would be relocated on new location to the south and east of their present location and tie into US 219 approximately 3,000 feet northeast of the existing intersection. This would require the relocation of the trail in this area.

(2) American Discovery Trail

The National Park Service is currently conducting a Feasibility Study for the American Discovery Trail in regard to its designation as a National Scenic Trail. A decision on its designation is expected in 1995. Alternative corridors for the trail through the Monongahela National Forest have been proposed and a final corridor has not yet been selected by the national trail coordinators and the National Park Service. Consequently, this analysis considers impacts to both the original corridor and the proposed relocations through the Monongahela National Forest.

The IRA would cross or parallel the American Discovery Trail at the following locations:

- US 219, Moore to Porterwood (proposed relocation)
- US 219, Parsons (original location)
- County 219/7, Parsons (original location)
- Western Maryland Railroad, Coketon
- Thomas (proposed relocation)
- County 42/3, Greenland Gap
- County 3, Greenland Gap

Of these nine involvements, only those at Greenland Gap would likely result in major impacts to the trail. At most other locations, the IRA would span the trail corridors and impacts would be limited to loss of use during construction. Where widening of existing roadways is proposed for the IRA, impacts to the American Discovery Trail would also be limited to loss of use during construction.

Through Grant County, the American Discovery Trail follows County 42/3 to County 3/3 and then north on County 3 to points north of the proposed project area. An at-grade intersection connecting the Improved Roadway Alternative with 42/3 would be constructed approximately 1,200 feet south of the existing intersection of County 1 and County 42/3 intersection. Trail users would cross this alignment via an at-grade crossing. Impacts would occur in conjunction with the reconstruction of County 3/3 and 3 east of the Greenland Gap Nature Preserve Area, requiring the relocation of a 10,000 foot section of the trail.

Under the Build Alternative, involvements with the American Discovery Trail would occur at the following locations:

- County 41, Porterwood to Parsons (proposed relocation)
- County 219/7, Parsons (original location)
- WV 72, Hambleton (proposed relocation)
- Western Maryland Railroad, Coketon (proposed relocation)
- County 1, Greenland Gap

Direct impacts to the function of the American Discovery Trail would be limited to the segment following County 41, between Parsons and Porterwood. Under Line A, County 41 in this location would be severed by the highway. Consequently, a 40,000 foot section of the proposed American Discovery Trail could not be used for hiking or biking activities and would require relocation of the trail. For all other involvements identified above, the Build Alternative would span the trail at these locations. No additional impacts to the trail or its function, other than temporary loss of use during construction, were identified.

(3) Shingle Tree Run Trail

The trail head at US 219 west of Moore, West Virginia would be affected by roadway improvements proposed under the IRA. The improvements would not impact the function of the trail. None of the alignments under the Build Alternative would impact this trail.

(4) Big Blue Trail

Under the IRA, VA 55 would be widened where the Big Blue Trail now crosses the roadway. No changes to the crossing or function of the trail would occur as a result of construction of the IRA. Representatives of the George Washington National Forest have expressed concern that the existing crossing is not readily visible to motorists and the potential for a serious or fatal accident exists at this crossing. The retention of the existing crossing configuration is considered to be a major impact, due to increased traffic volumes predicted for the IRA

Under the Build Alternative and within the Duck Run Option Area, the section of the Big Blue Trail which parallels the crest of the Great North Mountain near the West Virginia/Virginia state line would be directly impacted. This section of trail is located on private property and is maintained through a cooperative agreement between the George Washington National Forest and the Potomac Appalachian Trail Club. The Big Blue Trail would be impacted by Line A, Line D1, and Line D2 in the vicinity of the crossing of VA 55, near the West Virginia/Virginia state line. Line A, D1, and D2 would cross the trail approximately 600 feet southwest of the trail's existing crossing of VA 55. Concerns over the safety of the existing crossing were expressed by representatives of the George Washington National Forest during early coordination activities for this project. An improved crossing and development of a parking area for trail users were noted as potential benefits that the project could provide with respect to the Big Blue Trail. Potential relocation routes for the trail were developed with the assistance of representatives from George Washington National Forest and are presented in the discussion of possible mitigation measures. In addition to the permanent impacts described above, construction activities would result in a temporary loss of use of the trail.

c. Streams

Hunting and fishing are major recreational activities within West Virginia and Virginia. While there are several designated public hunting and fishing areas within the 30-minute drive area, none would be located near the proposed alignments. Outside of these designated areas, hunting and fishing are popular activities associated with the Monongahela and George Washington National Forest, as well as with most other public recreation areas.

The IRA and the alignments under the Build Alternative would cross a number of streams that provide fishing and/or boating opportunities. Access to these streams would be improved under either alternative. Neither alternative would have a major impact on the recreational opportunities currently afforded by these streams.

d. Local Parks

Local parks primarily serve residents of the surrounding community; only a small percentage of total attendance comes from outside of the community. Therefore impacts to local parks have been considered for only those parks that are located adjacent to the proposed alignments or adjacent to a connecting roadway. Four local parks, River City Park (Parsons), Mill Race Park (Parsons), Moorefield City Park, and J. Allen Hawkins Park (Wardensville) are located near the proposed alignments.

Three local parks, Mill Race Park and River City Parks (both located in Parsons) and the Moorefield City Park are located in close proximity to the IRA. No right-of-way would be required from parcels associated with these parks. The IRA would improve access to these facilities. The current function of these local parks would not be affected by the IRA.

Under the Build Alternative, there would be no impact to any of the four local parks previously identified, nor would there be any impairment of park functions. In Wardensville, Line A would avoid the J. Allen Hawkins Park.

e. Scenic Driving

Given the natural beauty and diverse viewsheds across West Virginia and Virginia, scenic driving is considered to be an important major recreation activity in West Virginia and Virginia. There are currently no state designated scenic byways in West Virginia or Virginia that would cross or would be adjacent to any of the proposed alignments. In Virginia, preliminary information provided for the *1993 Outdoor Recreation Plan* indicates that VA 55 and VA 600 may be eligible for inclusion in the Virginia Scenic Byways Program. Both of these routes would be adjacent to or crossed by the proposed project.

In Virginia, much of the IRA would consist of upgrading existing VA 55. Scenic driving conditions on VA 55 under the IRA would likely improve as the safety of the facility is improved. The IRA's impact to scenic driving opportunities on VA 600 would likely be minor because VA 55 currently intersects VA 600 at-grade.

Construction of the Build Alternative would provide additional scenic driving opportunities within West Virginia and Virginia.

3. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

Direct impacts to recreational resources resulting from construction and/or operation of the alignments now under consideration were reviewed. Reasonable measures that could be implemented to reduce or eliminate the identified impacts have been developed and are discussed below.

a. Pedestrian and Bikeway Facilities

Although there are no impacts to existing pedestrian and bicycle facilities, other than hiking trails, bikeway facilities would be provided as mitigation for recreation resource impacts in general. Under the Build Alternative, a separate bikeway facility would be provided as discussed in Section II. Exact locations would be provided in the Final EIS. Under the IRA, shared roadway type bicycle facilities would be provided, and discussed in detail in the Final EIS.

b. Trails

Final design of the IRA or the Build Alternative should include signing alerting motorists of trail crossings or shared right-of-way, where appropriate. Similarly, in those areas where trails would cross or parallel the IRA or the Build Alternative, design should be sensitive to sight distance requirements to minimize the potential for vehicle-pedestrian conflicts. Finally, in those areas where trails and the IRA or the Build Alternative would share right-of-way, adequate shoulder width should be provided to accommodate bicyclists and pedestrians.

c. National Forest Land

Under either the IRA or the Build Alternative, mitigation other than fair compensation for property purchased is not required. Representatives of the Monongahela National Forest and the George Washington National Forest should be updated with regard to construction scheduling and activities in a timely manner so that users are aware of construction zones and detours.

Overall construction impacts to trails under either the IRA or the Build Alternative could be mitigated through coordination with the West Virginia Scenic Trails Association, Inc. (Allegheny Trail), Monongahela National Forest (Allegheny American Discovery and Shingle Tree Trails), West Virginia Rails-to-Trails, Inc. (American Discovery Trail), George Washington National Forest (Big Blue Trail) and the Potomac Appalachian Trail Club (Big Blue Trail). This should ensure the development of suitable temporary and permanent relocation routes where required, as well as the installation of trail markers so that the trails can remain open during construction.

Under the IRA, impacts to the Allegheny Trail at Backbone Mountain could be mitigated by relocating the trail onto relocated US 219, resulting in a minor change in distance. Impacts to the American Discovery Trail near Greenland Gap could be mitigated by relocating trail onto relocated County 3/3 and 3, resulting in a minor change in distance.

Under the Build Alternative, impacts to the function of the Allegheny Trail where it follows FR 18 and US 219 could be mitigated by rerouting the Allegheny Trail onto new FR 18. The length of the trail would be increased by approximately 1,550 feet between Olsontown Road and the proposed intersection of FR 18 and US 219. Impacts to the American Discovery Trail between Porterwood and Parsons associated with Line A could be mitigated by relocating the trail to the corridor originally proposed by the West Virginia Rails to Trails group. However, users would lose the visual experience of the Shavers Fork canyon. Under Line S, the trail could be rerouted on relocated County 41 to the connection to County 39 and onto US 219.

Under the Build Alternative, potential relocation routes for the Big Blue Trail were developed with the assistance of personnel from the George Washington National Forest. One trail relocation route was developed for Line A and Line D2. A 2,200 foot section of the Big Blue Trail would be rerouted to the east, adding approximately 4,500 feet to the trail. The relocation would provide users with a spectacular view of the wooded slopes of Paddy Mountain to the southeast, greatly enhancing the aesthetic experience of users. The trail would cross Line A or Line D2 via an underpass, ensuring minimal conflict between trail and highway users.

Two relocation routes for the Big Blue Trail were developed in conjunction with Line D1. The first possibility would be to reroute a 2,200-foot section of the trail to the east, adding approximately 5,575 feet to the trail. The relocation would provide users with a spectacular view of the wooded slopes of Paddy Mountain to the southeast of the trail. The trail would cross Line D1 via an underpass, ensuring minimal conflict between trail and highway users. The second possibility would be to reroute a 2,200 foot section of the trail to the southeast, adding 13,500 feet to overall length of the Big Blue Trail. A portion of the relocation would use a 5,125 foot segment of FR 93. The trail would then parallel VA 55 and cross beneath Line D1 before reconnecting to the trail's original alignment.

d. Local Parks

Under either the IRA or the Build Alternative, coordination with the West Virginia Development Office, Community Development Division; Tucker and Hardy Counties, as well as Parsons and Moorefield should be maintained through final design and pre-construction activities.

e. Scenic Routes

The intersection of VA Route 55 and VA Route 600 should be designed in accordance with design standards of the Virginia Scenic Byways Program to ensure that VA 600 and VA 55 remain eligible for designation as Virginia Scenic Byways. Such efforts would require roadway design coordination between VDOT and the Virginia Department of Conservation and Recreation.

K. VISUAL

The visual impact assessment has been prepared in accordance with NEPA requirements and 23 USC 109 (h). The assessment is based on guidelines provided in FHWA's *Visual Impact Assessment for Highway Projects* and includes a description of the methodology, an inventory of visual characteristics of sensitive resources, a description of the affected viewers, impact determinations, and a discussion of possible avoidance, minimization, and mitigation measures.

1. METHODOLOGY

The visual assessment is based on the visual resource management (VRM) system used by several Federal agencies. The existing visual environment was inventoried via field visits, and determinations of existing visual quality were made for visually sensitive resources. Impact determinations were based on comparisons of existing conditions to the proposed condition, taking into account the nature of the sensitive resources.

a. Identification of Sensitive Resources

Visually sensitive resources are resources whose surrounding views are either integral components or the primary function of the site and the viewer's activity or experience. The following types of resources were identified as visually sensitive: cultural resources, recreation resources, unique physical features, and designated scenic areas. Visually sensitive cultural resources were selected if they were either eligible for listing or listed in the National Register of Historic Places (NRHP). Thirty-one resources were identified based on their visual sensitivity and proximity to the IRA or the Build Alternative.

b. Viewshed Inventory

The viewshed inventory established the existing or baseline visual condition from which the impact assessment was made. Viewshed inventories were based on a 360 degree view from the resource. The inventory required documenting the percentage of visual space each visual unit occupies within the viewshed of the observer; the primary viewers of the resource and the proposed alternatives; and the overall visual quality of the existing viewshed.

c. Impact Assessment

Visual impacts were assessed for two viewer groups: those with a view from the proposed project and those with a view of the proposed project. A rating scale was used to qualify the relative degree of visual impact. The proposed project's visual involvement with a sensitive resource could fall into one of four categories: No Involvement; No Impact; Impact, but Not Adverse; or Adverse Impact.

- NO INVOLVEMENT:

  A determination of "No Involvement" indicated that there would be no change to the existing visual environment: i.e., the No-Build Alternative would not alter the existing viewshed and either the IRA or the Build Alternative would be so far removed from the site that there would be no concern over visual involvement.

- NO IMPACT:

  A determination of "No Impact" indicated that there would be 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:

  A determination of "Impact - Not Adverse" indicated one of the following: 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:

  A determination of "Adverse Impact" indicated that 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.

2. EXISTING ENVIRONMENT

The existing visual environment is the baseline condition of the visual assessment and was the framework upon which impact determinations were made. The existing visual environment is a combination of the existing natural and man-made physical characteristics of the proposed project area, the principal viewers, and the visually sensitive resources within the proposed project area.

a. Visual Characteristics of the Proposed Project Area

The proposed project area has unique visual qualities due to the mountainous terrain, vast forested areas, and rural and natural scenic beauty. The land within the proposed project area is primarily forested, approximately 75 percent of the total land area. Twenty percent of this forest land is contained within the Monongahela and the George Washington National Forests. In their entirety, these Forests provide scenic tourism and outdoor recreation activities to thousands of visitors daily. Within the project area, the project involves only the northern most portion of each of these Forests. Much of the land within the Forests remains natural in appearance. The existing modifications in the Forests include roadways, utility corridors, timber harvests, and pockets of residential and commercial development.

The dominant visual features are the mountainous topography and the variety of vegetation. Occasional rock outcrops and formations and numerous streams and rivers add to the overall visual quality of the forested areas. On the West Virginia side of the project, over 70 percent of the project is in forested, mountainous terrain. This is the case for about 50 percent of the project within Virginia.

Cropland and pasture occupy about 25 percent of the land. On the Virginia side of the project, the Shenandoah Valley is well known for its quaint, pastoral landscape. The visual quality of the Valley is a major factor in its popularity as a tourist destination, making the economic benefits of tourism in the Shenandoah Valley comparable to the area's agriculture and industry sector (Draft, *The 1994 Virginia Outdoors Plan*, December 1993.) In West Virginia, the Old Fields, Forman, and Lahmansville areas provide similar quaint, pastoral settings. However, tourism is not a major contributor to the economy of these areas. On the West Virginia side of the project, approximately 18 percent of the land area is in an agricultural or pastoral setting, primarily in the Old Fields, Forman, and Lahmansville areas, as well as the area between Elkins and Kerens. On the Virginia side, from Wheatfield to Strasburg, approximately 50 percent is in an agricultural or pastoral setting.

The remaining five percent of the total project area is in residential, commercial, industrial, and mining use. Within the project area, the few developed areas have maintained either rural or small town characteristics.

b. Principal Viewers of the Proposed Project Area

Resource viewers are divided into two groups: those viewing from the proposed project (tourist, local, and through traffic) and those with a view of the proposed project (residential, recreational, community, educational, commercial, and industrial). The function and location of the resource determines the viewers affected.

c. Sensitive Visual Resources

The 31 visually sensitive resources identified are listed on Table III-31. The table also identifies the resource type (cultural, recreation, etc.), the factors that contribute to the resource's visual sensitivity, and the resource's overall visual quality.

TABLE III-31
SELECTED VISUALLY SENSITIVE RESOURCES

SENSITIVE VISUAL RESOURCE	RESOURCE TYPE	RESOURCE IMPORTANCE	EXISTING VISUAL QUALITY
Kerens Historic District	Cultural Resource	NRHP - Eligible: Architecture and Industry	Common
Monongahela National Forest (MNF)	Recreation Resource	National Forest: Recreation and Scenic Resources	Distinctive
River City Park	Recreation Resource	Community Park	Minimal
Tucker County Courthouse & Jail	Cultural Resource	NRHP - Listed: Architecture	Common
Mill Race Park	Recreation Resource	Community Park	Common
Allegheny Trail	Recreation Resource	Trail	Common
American Discovery Trail (ADT)	Recreation Resource	Trail: Only Trans-Continental Trail in US.	Common
Cottrill Opera House	Cultural Resource	NRHP - Listed: Theater and Local History	Common
Coketon Coke Works Historic District	Cultural Resource	NRHP - Eligible: Industry	Common
Greenland Gap	Unique Physical Feature	National Natural Landmark: Unique Geologic Feature	Distinctive
Fort Pleasant	Cultural Resource	NRHP - Listed: Architecture and Military	Distinctive
Buena Vista Farms	Cultural Resource	NRHP - Listed: Architecture and Association	Distinctive
Willow Wall	Cultural Resource	NRHP - Listed: Architecture and Art	Distinctive
The Meadows	Cultural Resource	NRHP - Listed: Architecture, Agriculture, and Association	Distinctive
Moorefield City Park	Recreation Resource	Community Park	Common
P. W. Inskeep House	Cultural Resource	NRHP - Listed: Architecture and Agriculture	Common
Hawse House	Cultural Resource	NRHP - Eligible: Architecture	Common
John Bott House	Cultural Resource	NRHP - Eligible: Architecture	Common
Hanging Rock	Unique Physical Feature	Unique Geologic/Man-Made Feature	Distinctive
Baughman House	Cultural Resource	NRHP - Eligible: Architecture	Common
Cacapon/Lost River @ sinks	Unique Physical Feature	Unique Geologic/Hydrologic Feature	Minimal
Francis Godlove House	Cultural Resource	NRHP - Eligible: Architecture	Common
Nicholas Switzer House	Cultural Resource	NRHP - Eligible: Architecture	Common
Valentine Switzer House	Cultural Resource	NRHP - Eligible: History, Association, and Architecture	Common
J. Allen Hawkins Community Park	Recreation Resource	Community Park	Common
Big Blue Trail	Recreation Resource	Trail	Distinctive
VA 600	Scenic Resource	Potential Virginia Scenic Byway	Minimal
George Washington National Forest (GWNF)	Recreation Resource	National Forest: Recreation and Scenic Resources	Distinctive
Boehm/Coffelt House	Cultural Resource	NRHP - Eligible: Architecture	Distinctive
Vesper Hall and Tenant House	Cultural Resource	NRHP - Eligible: Architecture	Common
VA 55	Scenic Resource	Potential Virginia Scenic Byway	Distinctive

Where:

NRHP - Listed = Site listed in the National Register of Historic Places.
NRHP - Eligible = Site eligible for listing in the National Register of Historic Places.

A resource's overall visual quality is based on the combination of and dominating features within its viewshed. Determining a resource's overall visual quality is subjective. However, visual quality determinations were made based on the assumption that the quality of a resource's visual environment can be classified as either distinctive, common, or minimal. A distinctive visual environment most clearly exhibits the natural processes or characteristics of a region. A common visual environment is characteristically typical within a region. A minimal visual environment is low in visual diversity and is often not visually pleasing due to intrusions such as trash and manmade alterations to the surrounding landscape.

(1) Cultural Resources

Of the 31 sites evaluated, 17 are cultural resources. The types of cultural resources assessed include 7 houses, 6 house and farm sites, 2 historic districts, 1 opera house, and 1 county courthouse and jail. Site specific descriptions of these resources are located in Section III-L: *Cultural Resources*. The most visually sensitive of the cultural resources evaluated were those whose setting is a contributing factor in their importance. The resources evaluated that fall in this category include Fort Pleasant, Buena Vista Farms, Willow Wall, The Meadows, and the P.W. Inskeep House. With the exception of the P.W. Inskeep House, the above sites are situated in rural, agricultural, and pastoral settings of distinctive scenic quality. The Boehm/Coffelt House is also situated in a similar setting of distinctive scenic quality. The remaining cultural resource sites, including the P.W. Inskeep House, are situated in areas with more common scenic qualities.

(2) Recreation Resources

Of the nine recreation resources evaluated, two are National Forests, three are trails, and four are community parks. Site-specific descriptions of these resources are presented in Section III-J: *Recreation Resources*. The visual settings of the National Forests vary, but are primarily dominated by densely forested vegetation in a mountainous setting. Both the Monongahela and the George Washington National Forests offer unique and scenic viewing opportunities and, overall, are considered to possess distinctive scenic qualities.

Within the proposed project area, both the Allegheny Trail and the American Discovery Trail are primarily located within the Monongahela National Forest. The visual setting for both trails is diverse within the mountainous and forested terrain. In part, the routes of both trails follow US, State, County, Local, and Forest roads, as well as abandoned railroad beds and established foot trails. In addition to the typical visual trail experience of forests, meadows, pastures, streams, and rivers, the trail routes also pass through several small communities and an abandoned industrial site (i.e., Coketon Historic District). The visual quality of both trails is considered to be common in the areas where the trails would be involved with the proposed project.

The Big Blue Trail is located in the George Washington National Forest within the proposed project area. The visual experience along this trail primarily consists of an undisturbed, mountainous, forested setting. The trail currently crosses VA 55 at-grade, in a visual setting typical of the area. The visual quality of the trail is considered to be distinctive due to the generally undisturbed setting and scenic vistas along the trail.

The four parks in the proposed project area include River City and Mill Race Parks in Parsons, Moorefield City Park in Moorefield, and the J. Allen Hawkins Community Park in Wardensville. Visually, River City Park is surrounded by development associated with Parsons. Located in a narrow floodplain, the park is bounded to the northwest by US 219 and a mix of residential and commercial development border the remaining sides of the park. Forested mountains provide the background view from the park. The visual quality of the area surrounding the park is considered to be minimal due to trash and debris surrounding the park's foreground views.

Mill Race Park is located within a large floodplain on the eastern side of Parsons. It is bounded by US 219/72 and a mix of residential and commercial development to the north and northeast, Shavers Fork and an open valley to the east and southeast, and mountains and light residential development to the west. Densely wooded mountains provide the visual backdrop for the park. The visual setting is that of a rural community park in a mountainous setting. The overall visual quality of the park is considered to be typical or common for the region.

Located within a long valley, the Moorefield Community park is surrounded on three sides by a mix of commercial, industrial, and residential development associated with Moorefield. From the park, the remaining view to the west is that of a long and narrow valley in agricultural use. Mountains provide the visual backdrop for the park. The J. Allen Hawkins Park is situated in a small floodplain in the rural community of Wardensville. To the west, it is bounded by a few older homes (including the Valentine Switzer House) and the foot of Anderson Ridge. To the east, it is bounded by woods, Waites Run, and the foot of an unnamed ridge. The overall visual quality of both parks is considered to be typical or common for their respective regions.

(3) Unique Physical Features

The three unique physical features of the area that are visually sensitive include Greenland Gap, a National Natural Landmark; Hanging Rock over WV 55; and River Sinks on the Lost River. Greenland Gap is a unique water gap formed by the cutting down of Patterson Creek Mountain by the North Fork of Patterson Creek. Visually, the Gap is flanked by massive cliffs of Tuscarora sandstone that rise 244 meters (800 feet) above the creek. Below the sheer cliffs are talus slopes and a variety of vegetation dominating the view. The Gap was acquired by the Nature Conservancy in 1974 for the express purpose of protecting its natural beauty, as well as its unique and diverse vegetation and wildlife. The visual quality of the Gap is considered to be distinctive.

Hanging Rock is a unique rock formation that appears to hang approximately 42 meters (136 feet) above WV 55. The view surrounding Hanging Rock includes the narrow, winding route of WV 55 running parallel to the Lost River and a relatively undisturbed mountainous backdrop. This unique visual setting where the Lost River flows past Hanging Rock accounts, in part, for its popularity as a local fishing spot. The visual quality of Hanging Rock is considered to be distinctive.

River Sinks is a classic example of karst topography (caverns, sinkholes, and solution cavities) in which the river disappears into a sinkhole in the calcareous rocks of the riverbed. Below the riverbed, the water follows solution cavities until it reappears as a surface seep approximately 76 meters (250 feet) down the riverbed. A roadside picnic area is located in the vicinity of the sinks, along the northern side of WV 55. The overall visual quality of the Sinks area is considered to be minimal.

(4) Designated Scenic Areas

The project has no involvement with designated scenic areas. However, the Virginia Department of Conservation and Recreation is considering designating the portion of VA 600 in Frederick County and the portion of VA 55 in Shenandoah County as State Scenic Byways. In the proposed project area, VA 600 is a two-lane, winding secondary road located at the bottom of a narrow valley, between two steep ridges. VA 600 intersects VA 55 at-grade. Within the proposed project area, this portion of VA 600 is not especially scenic: either side of the road is strewn with trash and, on the eastern side of VA 600, a small quarry is also strewn with trash and debris. For this reason, the visual quality of VA 600 at this location is considered minimal. In Shenandoah County, VA 55 is a two-lane highway that traverses the pastoral scenery of the Shenandoah Valley. The surrounding scenery along VA 55 is considered to be distinctive.

3. VISUAL IMPACTS

Understanding approximately how the proposed project would look and its proximity to the existing resource is important in understanding the associated visual impacts. Section II provides cross-section illustrations of both the IRA and the Build Alternative. Computer models simulating the proposed project's visual involvement have been prepared for those sites determined to be adversely impacted, as well as for those sites with a high degree of public use. The reporting of impact determinations is separated into two categories: the project's impact on the view from the proposed project and the project's impact on the view of the proposed project. Numerous exhibits and tables are included in the discussion of the visual impacts. For ease of reading, the exhibits and tables within the visual impacts subsection have been placed at the end the subsection text.

a. View from the Proposed Project

In the project area, roadways are the main transportation link: they are vital to the area's economy and way of life. Roadways are also considered public places which provide an important sense of community identity. Often, the clearest and most lasting impression of a community or an area is formed by what is seen from vehicle windows. Roadway users are not limited to motorists alone: cyclists, hikers, pedestrians, and others can be expected to use and appreciate views from the road (Dutchess Roadside Council, 1989). Given the natural beauty of the area, any roadway, be it the existing roadway network, the IRA, or the Build Alternative, would offer the roadway user scenic mountain vistas and pastoral views of the rural area. The following summarizes the visual impacts of each alternative, as seen from the proposed project.

(1) No-Build Alternative

The No-Build Alternative would not alter the existing roadway user's views.

(2) Improved Roadway Alternative

The IRA would not substantially detract from the visual experience of and from the existing roadway. The addition of truck climbing lanes, straightening of sharp curves, and widening of shoulders would not adversely alter a viewshed that already includes a well-traveled roadway. Approximately half of the IRA would be on new alignment, most of which would be in close proximity to the existing facility. However, in areas where the IRA would be on new alignment away from existing roads, such as the area between Bismarck and Forman, scenic vistas would likely be opened up where none previously existed. It is also possible that the roadway user's enjoyment of the view from the road would be improved under the IRA since traffic conditions would be improved. However, it is also possible that improved roadway conditions could increase traffic volumes. Depending on a resource's proximity to the IRA, increased traffic volumes could also lessen the resource's surrounding visual quality.

(3) Build Alternative

The Build Alternative would constitute a substantial change in the existing viewshed. Being on new alignment, the Build Alternative would make available vistas and vantage points of the area's natural beauty that were previously unavailable by vehicle. In areas of major cuts, the Build Alternative would offer textbook views of the spectacular geologic processes of the area. While the Build Alternative would offer expanded views of the area's natural beauty, it would not provide as intimate a visual experience as would the No-Build Alternative and the IRA. In addition, the Build Alternative would avoid passing directly through existing communities. As a result, the feeling of local communities that is typically experienced driving from one small town to the other would not be as evident as it would be under the No-Build Alternative and the IRA.

b. View of the Proposed Project

From the perspective of the view of the road, the assessment of potential visual involvements was based on two factors: (1) The visual components of the facility itself and the facility's relationship to the surrounding environment, and (2) The potential impact the facility would have on the sensitive viewers of the resource.

Table III-32 summarizes both the resource's visual involvement with proposed alternatives and the primary viewers affected. Distance reported is the approximate distance from the closest construction limits of an alignment to a primary vantage point of the resource. The table also indicates whether or not the proposed alignment would be visible from the resource and, if visible, the approximate perspective (e.g.: the view of the alignment would be in the foreground and the proposed roadway alignment would be at-grade). Table III-33 summarizes the visual impact determinations for each resource. Table III-34 summarizes the basis for the impact determinations.

(1) No-Build Alternative

The No-Build Alternative would not impact the existing viewshed within the project area.

(2) Improved Roadway Alternative

Overall, the IRA would not have as substantial a visual intrusion as would the Build Alternative. Approximately half of the IRA would remain on existing alignment with minor modifications. With the exception of the portion of the IRA between Bismarck and Forman, the remaining half of the IRA, while on new alignment, would remain in close proximity to the existing roadway. Such changes would not substantially alter the overall existing visual environment. The IRA between Bismarck and Forman would primarily be on new alignment, crossing the Allegheny Front and Patterson Creek Mountain. The IRA through this area would traverse relatively undisturbed mountainous terrain. While construction of the IRA through this area would alter the visual character of the immediate area, the area is so sparsely populated that the intrusion would not be considered adverse.

TABLE III-32
VIEWS OF AND FROM THE PROPOSED PROJECT

SENSITIVE VISUAL RESOURCES	LINE	VIEWER'S PERSPECTIVE	DISTANCE FROM SITE TO ALIGNMENT	PRIMARY VIEWERS OF ROAD FROM SITE: Residential	Recreational	Community	Educational	Commercial	Industrial	VIEW FROM ROAD OF SITE: Tourist Traffic	Local Traffic	Through Traffic
Kerens Historic District	IRA	AF	76m (250')	✓		✓				✓	✓	✓
	Line A	AF	76m (250')	✓		✓				✓	✓	✓
Monongahela National Forest	IRA	Varies	Varies	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Line A	Varies	Varies	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Line S	Varies	Varies	✓	✓	✓	✓	✓	✓	✓	✓	✓
River City Park	IRA	GF	23m (75')		✓	✓				✓	✓	✓
	Line A	AB	580m (1900')		✓	✓				✓	✓	✓
Tucker County Courthouse & Jail	IRA	GF	15m (50')			✓	✓	✓		✓	✓	✓
	Line A	AB	1311m (4300')			✓						
Mill Race Park	IRA	GF	30m (100')		✓	✓				✓	✓	✓
	Line A	Not Visible	Not Visible									
Allegheny Trail	IRA	Varies	Varies		✓							
	Line A	Varies	Varies		✓							
American Discovery Trail	IRA	Varies	Varies		✓							
	Line A	Varies	Varies		✓							
Cottrill Opera House	IRA	AB	549m (1800')			✓						
	Line A	Not Visible	Not Visible									
Coketon Coke Works Historic District	IRA	AF	61m (200')		✓	✓	✓			✓	✓	✓
	Line A	AF	0m (0')		✓	✓	✓			✓	✓	✓
Greenland Gap	IRA	Not Visible	Not Visible									
	Line A	Not Visible	Not Visible									
Fort Pleasant	IRA	GM	335m (1100')	✓						✓	✓	✓
	Line A	Not Visible	Not Visible									
Buena Vista Farms	IRA	BF	91m (300')	✓						✓	✓	✓
	Line A	Not Visible	Not Visible									
Willow Wall	IRA	GF	6m (20')	✓						✓	✓	✓
	Line A	AB	488m (1600')									
The Meadows	IRA	AB	549m (1800')	✓						✓	✓	✓
	Line A	Not Visible	Not Visible									
Moorefield City Park	IRA	AF	37m (120')		✓	✓				✓	✓	✓
	Line A	Not Visible	Not Visible									
P. W. Inskeep House	IRA	GF	6m (20')	✓						✓	✓	✓
	Line A	Not Visible	Not Visible									

Visual Perspective:

Foreground (F) = 0m to 183m (0' to 600')

Midground (M) = 183.1m to 366m (601' to 1200')

Background (B) = 366.1m & up (1201' & up)

VERTICAL GRADE	VISUAL PERSPECTIVE: Foreground	Midground	Background
At-Grade Road (G)	GF	GM	GB
Above-Grade Road (A)	AF	AM	AB
Below-Grade Road (B)	BF	BM	BB

TABLE III-32 (CONT.)
VIEWS OF AND FROM THE PROPOSED PROJECT

SENSITIVE VISUAL RESOURCES	LINE	VIEWER'S PERSPECTIVE	DISTANCE FROM SITE TO ALIGNMENT	PRIMARY VIEWERS OF ROAD FROM SITE						VIEW FROM ROAD OF SITE		
				Residential	Recreational	Community	Educational	Commercial	Industrial	Tourist Traffic	Local Traffic	Through Traffic
Hawse House	IRA	Not Visible	Not Visible									
	Line A	AF	64m (210')		✓					✓	✓	✓
John Bott House	IRA	GF	6m (20')	✓						✓	✓	✓
	Line A	AF	160m (525')	✓						✓	✓	✓
	Line B	AF	160m (525')	✓						✓	✓	✓
Hanging Rock	IRA	GF	0m (0')		✓	✓				✓	✓	✓
	Line A	AF	168m (550')		✓	✓				✓	✓	✓
	Line R	AF	61m (200')		✓	✓				✓	✓	✓
Baughman House	IRA	AF	3m (10')	✓						✓	✓	✓
	Line A	AF	91m (300')	✓						✓	✓	✓
	Line R	AF	76m (250')	✓						✓	✓	✓
Cacapon/Lost River @ river sinks	IRA	AF	0m (0')		✓					✓	✓	✓
	Line A	AF	0m (0')		✓					✓	✓	✓
Francis Godlove House	IRA	GM	259m (850')	✓						✓	✓	✓
	Line A	AM	213m (700')	✓						✓	✓	✓
Nicholas Switzer House	IRA	Not Visible	Not Visible									
	Line A	Not Visible	Not Visible									
Valentine Switzer House	IRA	Not Visible	Not Visible									
	Line A	AB	373m (1225')	✓								
J. Allen Hawkins Park	IRA	Not Visible	Not Visible									
	Line A	AF	30m (100')		✓	✓				✓	✓	✓
Big Blue Trail	IRA	GF	0m (0')		✓					✓	✓	✓
	Line A	AF	0m (0')		✓					✓	✓	✓
	Line D1	AF	0m (0')		✓					✓	✓	✓
	Line D2	AF	0m (0')		✓					✓	✓	✓
VA 600	IRA	GF	0m (0')	✓	✓	✓		✓		✓	✓	✓
	Line A	AF	0m (0')	✓	✓	✓		✓		✓	✓	✓
	Line D1	AF	0m (0')	✓	✓	✓		✓		✓	✓	✓
	Line D2	AF	0m (0')	✓	✓	✓		✓		✓	✓	✓

Visual Perspective:

Foreground (F) = 0m to 183m (0' to 600')

Midground (M) = 183.1m to 366m (601' to 1200')

Background (B) = 366.1m & up (1201' & up)

	VISUAL PERSPECTIVE		
VERTICAL GRADE	Foreground	Midground	Background
At-Grade Road (G)	GF	GM	GB
Above-Grade Road (A)	AF	AM	AB
Below-Grade Road (B)	BF	BM	BB

TABLE III-32 (CONT.)
VIEWS OF AND FROM THE PROPOSED PROJECT

SENSITIVE VISUAL RESOURCES	LINE	VIEWER'S PERSPECTIVE	DISTANCE FROM SITE TO ALIGNMENT	PRIMARY VIEWERS OF ROAD FROM SITE						VIEW FROM ROAD OF SITE		
				Residential	Recreational	Community	Educational	Commercial	Industrial	Tourist Traffic	Local Traffic	Through Traffic
George Washington National Forest	IRA	Varies	Varies	✓	✓	✓	✓	✓		✓	✓	✓
	Line A	Varies	Varies	✓	✓	✓	✓	✓		✓	✓	✓
	Line D1	Varies	Varies	✓	✓	✓	✓	✓		✓	✓	✓
	Line D2	Varies	Varies	✓	✓	✓	✓	✓		✓	✓	✓
Boehm/Coffelt House	IRA	AF	30m (100')			✓				✓	✓	✓
	Line A	AM	229m (750')			✓				✓	✓	✓
	Line L	Not Visible	Not Visible									
Vesper Hall & Tenant House	IRA	Not Visible	Not Visible									
	Line A	Not Visible	Not Visible									
	Line L	Not Visible	Not Visible									
VA 55	IRA	Varies	Varies	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Line A	Varies	Varies	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Line L	Varies	Varies	✓	✓	✓	✓	✓	✓	✓	✓	✓

Visual Perspective:

Foreground (F) = 0m to 183m (0' to 600')

Midground (M) = 183.1m to 366m (601' to 1200')

Background (B) = 366.1m & up (1201' & up)

VERTICAL GRADE	VISUAL PERSPECTIVE		
	Foreground	Midground	Background
At-Grade Road (G)	GF	GM	GB
Above-Grade Road (A)	AF	AM	AB
Below-Grade Road (B)	BF	BM	BB

TABLE III-33
VISUAL IMPACT BY ALTERNATIVE

VISUAL RESOURCE NAME	EXISTING VISUAL QUALITY	VISUAL IMPACT Adverse (A), Impact, Not Adverse (INA), No Impact (N), or No Involvement (Blank)											
		NO-BUILD	IRA	BUILD ALTERNATIVE									
				Line A	Line I	LineS	Line P	Line F	Line B	Line R	Line D1	Line D2	Line L
Kerens Historic District	Common	N	A	A									
Monongahela N.F.	Distinctive	N	INA	INA		INA							
River City Park	Minimal	N	INA	INA									
Courthouse & Jail	Common	N	INA	INA									
Mill Race Park	Common	N	INA	N									
Allegheny Trail	Common	N	INA	INA									
A.D.T.	Common	N	INA	INA									
Cottrill Opera House	Common	N	INA	N									
Coketon H.D.	Common	N	INA	INA									
Greenland Gap	Distinctive	N	N	N									
Fort Pleasant	Distinctive	N	INA	N									
Buena Vista Farms	Distinctive	N	INA	N									
Willow Wall	Distinctive	N	INA	INA									
The Meadows	Distinctive	N	INA	N									
Moorefield City Park	Common	N	A	N									
. W. Inskeep House	Common	N	A	N									
Hawse House	Common	N	N	A									
John Bott House	Common	N	INA	INA					INA				
Hanging Rock	Distinctive	N	INA	A						A			
Baughman House	Common	N	A	A						INA			
Cacapon/Lost River	Minimal	N	INA	INA									
F. Godlove House	Common	N	INA	INA									
N. Switzer House	Common	N	N	N									
V. Switzer House	Common	N	N	INA									
J. Allen Hawkins Park	Common	N	N	INA									
Big Blue Trail	Distinctive	N	INA	INA							INA	INA	
VA 600	Minimal	N	INA	INA							INA	INA	
G. Washington N.F.	Distinctive	N	INA	INA							INA	INA	
Boehm/Coffelt House	Distinctive	N	INA	INA									N
Vesper Hall	Common	N	N	N									N
VA 55	Distinctive	N	INA	INA									INA
TOTAL "NO INVOLVEMENT"		0	0	0	31	30	31	31	30	29	28	28	28
TOTAL "NO IMPACT"		31	6	10	0	0	0	0	0	0	0	0	2
TOTAL "IMPACT, NOT ADVERSE"		0	21	17	0	1	0	0	1	1	3	3	1
TOTAL "ADVERSE IMPACT"		0	4	4	0	0	0	0	0	1	0	0	0

TABLE III-34
VISUAL IMPACT DETERMINATION

SENSITIVE VISUAL RESOURCES	ALT.	IMPACT	BASIS FOR IMPACT DETERMINATION
Kerens Historic District	IRA	A	Visibility and proximity of IRA on new alignment would be inconsistent with the existing visual qualities of this Historic District. In addition, the IRA on new alignment across the floodplain would be in strong contrast with the existing landscape of the District.
	Line A	A	Visibility and proximity of Line A would be inconsistent with the existing visual qualities of this Historic District.
Monongahela National Forest	IRA	INA	The MNF is a multiple use area with existing roadways within the forest limits. Improvements to the existing road would not adversely impact visually sensitive resources within the MNF.
	Line A	INA	The MNF is a multiple use area with existing roadways within the forest limits. Dominating visual intrusions such as topography, vegetation, and distance would reduce the visual intrusion of Line A on visually sensitive resources within the MNF. Therefore, Line A would not have an adverse impact on the visual resources within the MNF.
	Line S	INA	The MNF is a multiple use area with existing roadways within the forest limits. Dominating visual intrusions such as topography, vegetation, and distance would reduce the visual intrusion of Line S on visually sensitive resources within the MNF. Therefore, Line S would not have an adverse impact on the visual resources within the MNF.
River City Park	IRA	INA	The IRA would remain on existing US 219 as it passes the park. The IRA would not change the existing visual environment associated with the park.
	Line A	INA	Topography, vegetation, and distance would reduce the visual intrusion of Line A into the viewshed of the park. Given that the park is in a relatively developed setting, the addition of Line A into the background viewshed would not adversely impact the visual integrity of the park.
Tucker County Courthouse & Jail	IRA	INA	The IRA would remain on existing US 219/72 as it passes the courthouse and jail. The IRA would not change the existing visual environment associated with the courthouse and associated jail.
	Line A	INA	Topography, vegetation, and distance would reduce the visual intrusion of Line A into the viewshed of the courthouse. Because the courthouse and jail are in a relatively developed setting, the addition of Line A into the background viewshed would not adversely impact the site's visual integrity.
Mill Race Park	IRA	INA	The IRA would remain on existing US 219/72 as it passes the park. The IRA would not change the existing visual environment associated with the park.
	Line A	N	Line A would not be visible from the park.
Allegheny Trail	IRA	INA	The Allegheny Trail would have several involvements with the IRA as the trail passes through the area. The IRA would not adversely impact the visual experience associated with the trail given that the trail already passes through small towns and encounters a variety of visual experiences. Visual experiences associated with the IRA would not be inconsistent with experiences along the rest of the trail within the area.
	Line A	INA	The Allegheny Trail would have several involvements with Line A as the trail passes through the area. Line A would not adversely impact the visual experience associated with the trail given that the trail already passes through small towns and encounters a variety of visual experiences. Visual experiences associated with Line A would not be inconsistent with experiences along the rest of the trail within the area.

Where:

N = No Impact INA = Impact, Not Adverse A = Adverse Impact

TABLE III-34 (CONT.)
VISUAL IMPACT DETERMINATION

SENSITIVE VISUAL RESOURCES	ALT.	IMPACT	BASIS FOR IMPACT DETERMINATION
American Discovery Trail	IRA	INA	The American Discovery Trail would have several involvements with the IRA as the trail passes through the area. The IRA would not adversely impact the visual experience associated with the trail given that the trail already passes through small towns and encounters a variety of visual experiences. Visual experiences associated with the IRA would not be inconsistent with experiences along the rest of the trail.
	Line A	INA	The American Discovery Trail would have several involvements with Line A as the trail passes through the area. Line A would not adversely impact the visual experience associated with the trail given that the trail already passes through small towns and encounters a variety of visual experiences. Visual experiences associated with Line A would not be inconsistent with experiences along the rest of the trail.
Cottrill Opera House	IRA	INA	The IRA would cross the background view from the opera house. Given the existing development surrounding the opera house and the distance removed from the IRA, the proposed line would not have an adverse visual impact.
	Line A	N	Line A would not be visible from the Cottrill Opera House.
Coketon Coke Works Historic District	IRA	INA	The viewshed of this Historic District is of limited importance with regard to the value of the site. While the IRA would be in close proximity to the District, its associated intrusion into the viewshed of the District would not be considered adverse.
	Line A	INA	The viewshed of this Historic District is of limited importance with regard to the value of the site. In addition, the original visual condition associated with the District has been considerably altered due to the Douglas Highwall Reclamation Project in the vicinity of the Line A crossing. While Line A would bridge the middle of the District, its associated intrusion into the viewshed of the District would not be considered adverse.
Greenland Gap	IRA	N	The IRA would not be visible within Greenland Gap.
	Line A	N	Line A would not be visible within Greenland Gap.
Fort Pleasant	IRA	INA	Topography, distance, and existing visual intrusions (houses that block the view of the IRA) would reduce the visual impact of the IRA. In addition, there would be a weak visual contrast between the proposed facility and the existing landscape for the portions of the IRA that would be visible. The IRA would not have an adverse impact on the visual quality of Fort Pleasant.
	Line A	N	Line A would not be visible from Fort Pleasant.
Buena Vista Farms	IRA	INA	Topography, distance, and existing visual intrusions would reduce the visual impact of the IRA. In addition, there would be a weak visual contrast between proposed facility and the existing landscape for the portions of the IRA that would be visible. The IRA would not have an adverse impact on the visual quality of Buena Vista Farms.
	Line A	N	Line A would not be visible from Buena Vista Farms.
Willow Wall	IRA	INA	The IRA would be located along existing WV 28 as it passes Willow Wall. Modifications to the existing roadway under the IRA would be minimal. Therefore, the IRA would not adversely impact the existing visual quality of Willow Wall.
	Line A	INA	Topography, vegetation, and distance would reduce the visual impact of Line A within the viewshed of Willow Wall. Therefore, Line A would not adversely impact the visual quality of Willow Wall.

Where:

N = No Impact   INA = Impact, Not Adverse   A = Adverse Impact

TABLE III-34 (CONT.)
VISUAL IMPACT DETERMINATION

SENSITIVE VISUAL RESOURCES	ALT.	IMPACT	BASIS FOR IMPACT DETERMINATION
The Meadows	IRA	INA	The IRA would be located along existing WV 28 as it passes The Meadows. Modifications to the existing roadway under the IRA would be minimal. Therefore, the IRA would not adversely impact the visual quality of Willow Wall.
	Line A	N	Line A would not be visible from The Meadows.
Moorefield City Park	IRA	A	The IRA would be on new alignment and in close proximity to the park. The park is currently bounded on three sides by development associated with Moorefield. The remaining side offers the only undisturbed view of the mountain and valley setting. The ballfield bleachers are situated such that the ballfield is in the foreground and the undisturbed mountain and valley view is in the mid and background. The IRA would pass directly in front of and in close proximity to the ballfield. The close proximity of the IRA, its obstruction of the primary view from the park, and the intrusion of vehicular traffic into the foreground of the primary view would result in an adverse visual impact.
	Line A	N	Line A would not be visible from Moorefield City Park.
P. W. Inskeep House	IRA	A	The extremely close proximity of the IRA to the P.W. Inskeep house would substantially alter the existing visual quality of the house. The proximity of the IRA would be in strong contrast with the existing landscape. Therefore, the IRA would have an adverse impact on the P.W. Inskeep House.
	Line A	N	Line A would not be visible from the P.W. Inskeep House.
Hawse House	IRA	N	The IRA would not be visible from the Hawse House.
	Line A	A	The visibility and close proximity of Line A within the viewshed of the Hawse House would be inconsistent with the existing visual qualities of the site. Therefore, Line A would adversely impact the Hawse House.
John Bott House	IRA	INA	The John Bott House is located along the southern side of WV 55. The IRA would end its relocation of WV 55 in front of the Bott House. Proposed changes to WV 55 under the IRA would not be inconsistent with the existing viewshed associated with the Bott House. Therefore, the IRA would not have an adverse impact on this site.
	Line A	INA	Because the Bott house is already situated along WV 55, the introduction of an additional road in this area would not be inconsistent with the existing viewshed. Topography and vegetation would reduce the visibility of Line A in the vicinity of the Bott House. Therefore, Line A would not have an adverse impact on this site.
	Line B	INA	Because the Bott house is already situated along WV 55, the introduction of an additional road in this area would not be inconsistent with the existing viewshed. Topography and vegetation would reduce the visibility of Line B in the vicinity of the Bott House. Therefore, Line B would not have an adverse impact on this site.
Hanging Rock *(Continues on next page)*	IRA	INA	The IRA would avoid the unique "hanging" feature. However, it is possible the blasting and construction activities in the vicinity of Hanging Rock could disturb the feature. Therefore, the IRA would have an impact, but not adverse, on the visual quality of Hanging Rock.
	Line A	A	The bridge associated with Line A would pass directly behind the currently undisturbed view of Hanging Rock. The visibility and close proximity of Line A to Hanging Rock, and the inconsistency of Line A within the Hanging Rock viewshed, would render Line A's visual involvement as an adverse impact.
	Line R	A	The bridge associated with Line R would pass directly in front of the currently undisturbed view of Hanging Rock. The visibility and close proximity of Line R to Hanging Rock, and the inconsistency of Line R within the Hanging Rock viewshed, would render Line R's visual involvement as an adverse impact..

Where:

N = No Impact INA = Impact, Not Adverse A = Adverse Impact

TABLE III-34 (CONT.)
VISUAL IMPACT DETERMINATION

SENSITIVE VISUAL RESOURCES	ALT.	IMPACT	BASIS FOR IMPACT DETERMINATION
Hanging Rock *(Continued)*	Line A	A	The extremely close proximity of Line A to the Baughman House would substantially alter the existing visual integrity of the house. The visibility and proximity of Line A would be in strong contrast to the existing visual environment. Therefore, Line A would have an adverse impact on the visual quality of the Baughman House.
	Line R	INA	Line R would pass behind the principal viewshed of the Baughman House. Therefore, it would not have an adverse impact on the visual quality of the site.
Baughman House	IRA	A	The extremely close proximity of the IRA to the Baughman House would substantially alter the existing visual integrity of the house. The visibility and proximity of the IRA would be in strong contrast to the existing visual environment, given the IRA earthwork required within the viewshed of the Baughman House. Therefore, the IRA would have an adverse impact on the visual quality of the Baughman House.
Cacapon/Lost River @ River Sinks	IRA	INA	Given the minimal existing visual quality of the sinks area, it can be inferred that the viewshed of this resource is limited in importance. The introduction of the IRA on new alignment through this area would not substantially interfere with the site's existing visual quality. The IRA would not adversely impact the existing visual quality of this site.
	Line A	INA	Given the minimal existing visual quality of the sinks area, it can be inferred that the viewshed of this resource is limited in importance. Therefore, the introduction of Line A through this area would not adversely impact the site's existing visual quality.
Francis Godlove House	IRA	INA	Intervening topography, vegetation, and distance would reduce the visual intrusion of the IRA into the viewshed of the Francis Godlove House. In addition, the IRA would remain on existing WV 55 through the Wardensville area. Therefore, the IRA would not adversely impact this site.
	Line A	INA	Intervening topography, vegetation, and distance would reduce the visual intrusion of Line A into the viewshed of the Francis Godlove House. Therefore, Line A would not adversely impact this site.
Nicholas Switzer House	IRA	N	The IRA would not be visible from the Nicholas Switzer House.
	Line A	N	Line A would not be visible from the Nicholas Switzer House.
Valentine Switzer House	IRA	N	The IRA would not be visible from the Valentine Switzer House.
	Line A	INA	Intervening topography, vegetation, and distance would reduce the visual intrusion of Line A into the viewshed of the Valentine Switzer House. Therefore, Line A would not adversely impact this site.
J. Allen Hawkins Community Park	IRA	N	The IRA would not be visible from the Hawkins Community Park.
	Line A	INA	Intervening topography, vegetation, and distance from the park's formal activities reduce the visual intrusion of Line A into the park's existing viewshed. Views of Line A would not interfere with current park activities. Picnicking, a visually sensitive activity, takes place in the park at the furthest point from Line A. Therefore, Line A would not have an adverse visual impact on the J. Allen Hawkins Community Park.
Big Blue Trail *(Continues on next page)*	IRA	INA	The Big Blue Trail currently crosses VA 55 at-grade. Changes made to VA 55 under the IRA would not substantially alter the existing visual quality of the trail. Therefore, the IRA would not have an adverse impact on the visual quality of this site.
	Line A	INA	Line A would require the relocation of the Big Blue Trail. The introduction of an additional roadway facility would not be inconsistent given that the trail currently crosses VA 55 at-grade. The relocated trail would likely provide additional scenic vistas not currently available along the existing trail. Line A would not adversely impact the visual quality of the trail.

Where:

N = No Impact   INA = Impact, Not Adverse   A = Adverse Impact

TABLE III-34 (CONT)
VISUAL IMPACT DETERMINATION

SENSITIVE VISUAL RESOURCES	ALT.	IMPACT	BASIS FOR IMPACT DETERMINATION
Big Blue Trail *(Continued)*	Line D1	INA	Line D1 would require the relocation of the Big Blue Trail. The introduction of an additional roadway facility would not be inconsistent given that the trail currently crosses VA 55 at-grade. The relocated trail would likely provide additional scenic vistas not currently available along the existing trail. Line D1 would not adversely impact the visual quality of the trail.
	Line D2	INA	Line D2 would require the relocation of the Big Blue Trail. The introduction of an additional roadway facility would not be inconsistent given that the trail currently crosses VA 55 at-grade. The relocated trail would likely provide additional scenic vistas not currently available along the existing trail. Line D2 would not adversely impact the visual quality of the trail.
VA 600	IRA	INA	Changes made to VA 55, including the reconstruction of the existing VA 600 intersection, would not adversely impact the visual qualities of this site. The IRA would not adversely impact VA 600.
	Line A	INA	In the vicinity of Line A, VA 600 is considered to have a minimal level of visual quality. Given the existing visual conditions, it can be inferred that this area is of limited visual importance. Therefore, the introduction of Line A in this area would not have an adverse impact on the site.
	Line D1	INA	In the vicinity of Line D1, VA 600 is considered to have a minimal level of visual quality. Given the existing visual conditions, it can be inferred that this area is of limited visual importance. Therefore, the introduction of Line D1 in this area would not have an adverse impact on the site.
	Line D2	INA	In the vicinity of the Line D2 location, VA 600 is considered to have a minimal level of visual quality. Given the existing visual conditions, it can be inferred that this area is of limited visual importance. Therefore, the introduction of Line D2 in this area would not have an adverse impact on the site.
George Washington National Forest (GWNF)	IRA	INA	The GWNF is a multiple use area with existing roadways within the forest limits. Improvements to the existing road would not adversely impact visually sensitive resources within the GWNF.
	Line A	INA	The GWNF is a multiple use area with existing roadways within the forest limits. Dominating visual intrusions such as topography, vegetation, and distance would reduce the visual intrusion of Line A on visually sensitive resources within the GWNF. Therefore, Line A would not have an adverse impact on the visual resources within the GWNF.
	Line D1	INA	The GWNF is a multiple use area with existing roadways within the forest limits. Dominating visual intrusions such as topography, vegetation, and distance would reduce the visual intrusion of Line D1 on visually sensitive resources within the GWNF. Therefore, Line D1 would not have an adverse impact on the visual resources within the GWNF.
	Line D2	INA	The GWNF is a multiple use area and there are existing roadways within the forest limits. Dominating visual intrusions such as topography, vegetation, and distance would reduce the visual intrusion of Line D2 on visually sensitive resources within the GWNF. Therefore, Line D2 would not have an adverse impact on the visual resources within the GWNF.
Boehm/Coffelt House	IRA	INA	The Boehm/Coffelt House is located along the southern side of VA 55. The IRA would slightly shift to the north of VA 55, away from the Boehm/Coffelt House. Proposed changes to VA 55 under the IRA would not be inconsistent with the existing viewshed associated with the Boehm/Coffelt House. Therefore, the IRA would not have an adverse impact on this site.
	Line A	INA	Intervening distance, topography, and vegetation would substantially reduce the visual intrusion associated with Line A Therefore, Line A would not have an adverse impact on the visual quality of the Boehm/Coffelt House.
	Line L	N	Line L would not be visible from the Boehm/Coffelt House.

Where:

N = No Impact   INA = Impact, Not Adverse   A = Adverse Impact

TABLE III-34 (CONT.)
VISUAL IMPACT DETERMINATION

SENSITIVE VISUAL RESOURCES	ALT.	IMPACT	BASIS FOR IMPACT DETERMINATION
Vesper Hall & Tenant House	IRA	N	The IRA would not be visible from Vesper Hall and Tenant House.
	Line A	N	Line A would not be visible from Vesper Hall and Tenant House.
	Line L	N	Line L would not be visible from Vesper Hall and Tenant House.
VA 55	IRA	INA	Minor improvements to VA 55 under the IRA would not alter the existing scenic qualities associated with the area's surrounding viewshed. The IRA would not adversely impact the scenic nature of VA 55.
	Line A	INA	Approximately half of Line A would be visible from VA 55 within Shenandoah County. Intervening topography, vegetation, distance, and structures would reduce the degree of visual intrusion along the remaining visible half. While Line A would be a visual intrusion into the existing viewshed associated with VA 55, this intrusion would be lessened by the above factors. Therefore, Line A would not adversely impact this site.
	Line L	INA	Much of Line L would not be visible from VA 55. Therefore, Line L would not adversely impact the scenic qualities associated with the VA 55 viewshed.

Where:

N = No Impact   INA = Impact, Not Adverse   A = Adverse Impact

Of the 31 visually sensitive resources evaluated, most are located along or in close proximity to existing roadways that are part of the IRA. Therefore, the associated impacts for existing sensitive resources under the IRA is higher than it is under the Build Alternative. Of the 31 sites evaluated, 4 resources would be adversely impacted and 21 resources would be impacted, but not adversely (compared with Line A, in which 4 sites would be adversely impacted and 17 sites would be impacted, but not adversely). The IRA would adversely impact the visual quality of Kerens Historic District, Moorefield City Park, the P.W. Inskeep House, and the Baughman House. Computer models depicting the IRA's approximate visual involvement have been developed for those sites adversely impacted by the IRA. While the IRA would not adversely impact the scenic viewshed of the Allegheny Trail, a computer model has been prepared because of the interest in this resource. These models are presented on Exhibits III-27 to III-31. (Because there are so many visual impact exhibits, they have been placed at the end of the visual resources discussion to make text reading easier.)

(3) Build Alternative

Determining the visual impact of the Build Alternative as a whole would generate as many opinions as there are affected parties. The introduction of four-lane, divided highway on new alignment through mountainous and relatively undeveloped areas would affect the surrounding viewshed. How individuals interpret the addition of the facility within the existing viewshed varies. To some, a bridge or road that has been carefully designed to blend with the natural surroundings would be aesthetically pleasing to view and may even contribute to their visual experience. To some, roads and bridges are a sign of progress and development and are looked upon with favor. To some, the introduction of a bridge or road within their viewshed would not affect their visual experience one way or the other. However, to others, the same bridge or highway would represent an unfortunate imprint of human activity upon nature and would strongly detract from their visual experience, regardless of how carefully the proposed project has been designed.

In general, the four-lane visual intrusion of the Build Alternative would be greater than that of the two-lane IRA simply due to the size of the facility. In an area where the existing transportation network is made up of winding, two-lane paved and unpaved roads, the addition of a four-lane facility would alter the context of the surrounding visual environment.

While the Build Alternative could be considered to be a greater visual intrusion to the existing visual environment, the fact that it would be on new alignment makes it more possible to easily avoid visually sensitive resources. Under Line A, 4 visually sensitive resources would be adversely impacted and 17 would be impacted, but not adversely. The sites adversely impacted by Line A would be the Kerens Historic District, the Hawse House, Hanging Rock, and the Baughman House. Line R would also adversely impact Hanging Rock. Computer models depicting approximate visual involvements have been developed for those sites adversely impacted by Line A and the Option Areas (Exhibits III-32 to III-37).

While the Build Alternative would not adversely impact the scenic viewsheds of the Allegheny Trail, the American Discovery Trail, and the J. Allen Hawkins Park, computer models have been prepared because of interest in these resources. The computer models are presented on Exhibits III-38 to III-40. In addition, the Big Blue Trail would not be adversely impacted by the Build Alternative. However, it was not possible to accurately depict the Build Alternative's involvement with the Big Blue Trail through a computer model. Therefore, the Build Alternative's involvement with the Big Blue Trail can be seen on Sheet 65 of 108 on the *Alignment and Resource Location Plans*.

The following Option Areas would have no visual involvement with the 31 sites evaluated: Interchange (Line I), Patterson Creek (Line P), and Forman (Line F). The impacts of Option Areas that would be in the proximity of sensitive visual resources are identified below.

- Shavers Fork Option Area: Line S, as Line A, would alter the visual environment of the portion of the Monongahela National Forest through which it traverses. However, the visual impact under either line would not be considered adverse.

- Baker Option Area: Line B, as Line A, would alter the visual environment of the John Bott House. However, the visual impact under either line would not be considered adverse.

- Hanging Rock Option Area: Line R, as Line A, would adversely impact the visual environment surrounding Hanging Rock. For those viewing Hanging Rock from the scenic pull-offs along WV 55 or from the Lost River, Line R would be a greater visual intrusion than would Line A. The bridge over the Lost River associated with Line R would obstruct the view of Hanging Rock. The same bridge associated with Line A would be immediately behind Hanging Rock, substantially altering the undisturbed visual context of this unique physical feature.

- The Baughman House would be impacted, but not adversely, by Line R (compared to an adverse impact under Line A). Line R would be to the west of or behind the principal viewshed associated with the Baughman House. Line A would be in the immediate foreground of the site's viewshed.

- Duck Run Option Area: Lines D1 and D2, as Line A, would not have an adverse visual impact on the following sites: the Big Blue Trail, VA 600, and the George Washington National Forest. There would be little visual difference between these three lines and their relative visual impact.

- Lebanon Church Option Area: Line L, as Line A, would not have an adverse impact to VA 55 nor would it be visible to Vesper Hall and Tenant House. Unlike Line A, Line L would not be visible from the Boehm/Coffelt House.

(4) Comparison of Impacts between WV and VA

Of the 31 sensitive visual resources evaluated, 25 are located in West Virginia and 6 are located in Virginia. In West Virginia, the IRA would adversely impact 4 sites and Line A would adversely impact 4 sites. Neither the IRA nor any lines under the Build Alternative would adversely impact visually sensitive resources within Virginia.

4. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

The quality of the view from the road and of the road are important considerations for this project because the highway would serve as one of the principal means of entry into West Virginia and Virginia, and because it would serve as the gateway to the area's vast forested, rural, and natural scenic beauty. As such, an objective of the design of Corridor H would be to construct a facility that is visually compatible with the mountainous and rural environment. Possible minimization and mitigation measures are divided into three categories: general measures based on design, construction, and landscaping techniques; scenic overlooks to enhance the visual experience associated with the proposed project; and site-specific measures to mitigate the adverse impacts previously identified.

a. General Measures

General mitigation measures could include the following:

- Bifurcate the road where possible. This provides a much more intimate driving experience; like that of driving on a two-lane roadway, only safer. Where possible, earthwork and vegetation would remain in the median between the bifurcated roadways to help block the view of the opposing roadway.

- Design the highway as a modified parkway by providing a generous right-of-way, wide medians with island plantings, rounded slopes, and heavy plantings along the highway. This design concept could result in additional right-of-way acquisition costs and displacements. However, it would be visually effective and would improve the scenic quality of the viewshed from the roadway and of the roadway by returning the landscape to a more natural looking state; it would improve the chances for faster and more successful revegetation of the right-of-way; and it would reduce the chances for slope stability and erosion problems. Strategic gaps in plantings could also be used to frame scenic views. Roadside plantings could be used to help hide views of unattractive features such as power lines (FHWA, 1990).

- Landscape the median with trees, shrubs, and flowers. Where such plantings pose safety hazards, provide guardrails to prevent vehicles from running into the plantings. Provide plantings that match the surrounding vegetation. In areas where the road traverses open valleys, provide mass plantings of wildflowers in the median. This would be effective in areas such as Forman, Lahmansville, Old Fields, and the Shenandoah Valley

- Enhance the visual quality of the area by laying the roadside cuts back and planting them with indigenous vegetation. This would eliminate the barren, unnatural appearance of the roadside.

- Provide pulloffs with information plaques describing geologic processes in areas where geologic features are unique or outstanding. Areas of note include Hanging Rock, the Allegheny Front, Lost River at River Sinks, and the Shenandoah Valley. Use native materials to construct pedestrian barriers or safety walls at these pulloffs.

b. Scenic Overlooks

Potential locations for scenic overlooks associated with the Build Alternative are provided below. Detailed locations are provided in the *Alignment and Resource Location Plans*.

- **Cheat River Valley Scenic Overlook**

  Northeast of Hambleton, the plan sheets indicate a possible scenic overlook of the Cheat River Valley. A nice view of the Cheat River Valley could be provided on Line A, between stations 3855 and 3870. The overlook could use what would be the abandoned portion of Olsontown Road (FR 717). Vegetation currently blocks the view and would have to be selectively cut to open it up. (It may also be necessary to cut vegetation selectively on the north side of US 219 below.) This spot would seem to provide easy access for west-bound travelers to pulloff and get back on.

- **Allegheny Front Scenic Overlook**
  A sweeping, scenic overlook from the Allegheny Front could be provided on Line A, near station 5125 to 5130.

- **Clifford Hollow Bridge Scenic Overlook**
  A scenic overlook of Clifford Hollow and the bridge could be provided on Line A, near stations 6505 to 6525. The Clifford Hollow Bridge could be a central part of the scenic pull-off. Displays showing the stages of bridge construction could be provided.

- **Hanging Rock Scenic Overlook**
  A scenic overlook of Hanging Rock, Hanging Rock Ridge, and the Lost River could be provided for either Line A or Line R, near station 7160. Viewers would look back across the Lost River to view the Hanging Rock formation. Displays could be provided, indicating the geologic processes at work.

- **West Virginia Welcome Center - Lost River Valley Scenic Overlook**
  A West Virginia Welcome Center and a scenic overlook of the Lost River's unique geologic formations to the north of the river could be provided on Line A, near station 7425.

- **Great North Mountain Scenic Overlook**
  A scenic overlook on Great North Mountain across the valley to Paddy Mountain could be provided for either Line A, Line D1, or Line D2 near station 7810 to 7820.

- **Laurel Hill Scenic Overlook**
  A scenic view from Laurel Hill into the valley below could be provided on Line A, near station 8185 to 8190.

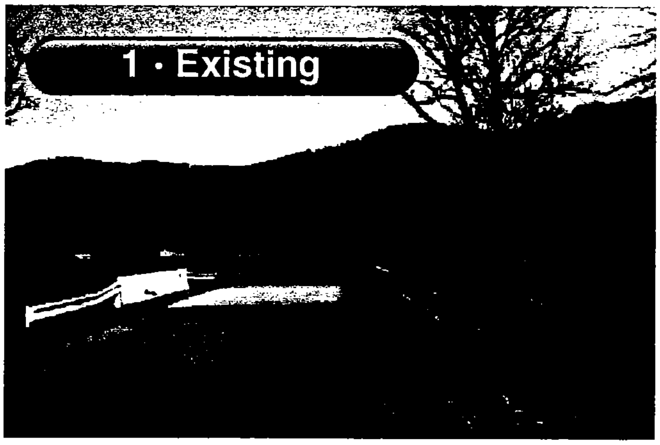
- **Virginia Welcome Center - Little North Mountain Scenic Overlook**
  In the vicinity of the project area, the nicest vista of the valley would come from a vantage point on top of Little North Mountain. A visitor's center could be provided at the top of Little North Mountain, providing a scenic vista of the Shenandoah Valley. An access road to such a vista would be necessary.

c. Site-Specific Measures for Adverse Impacts

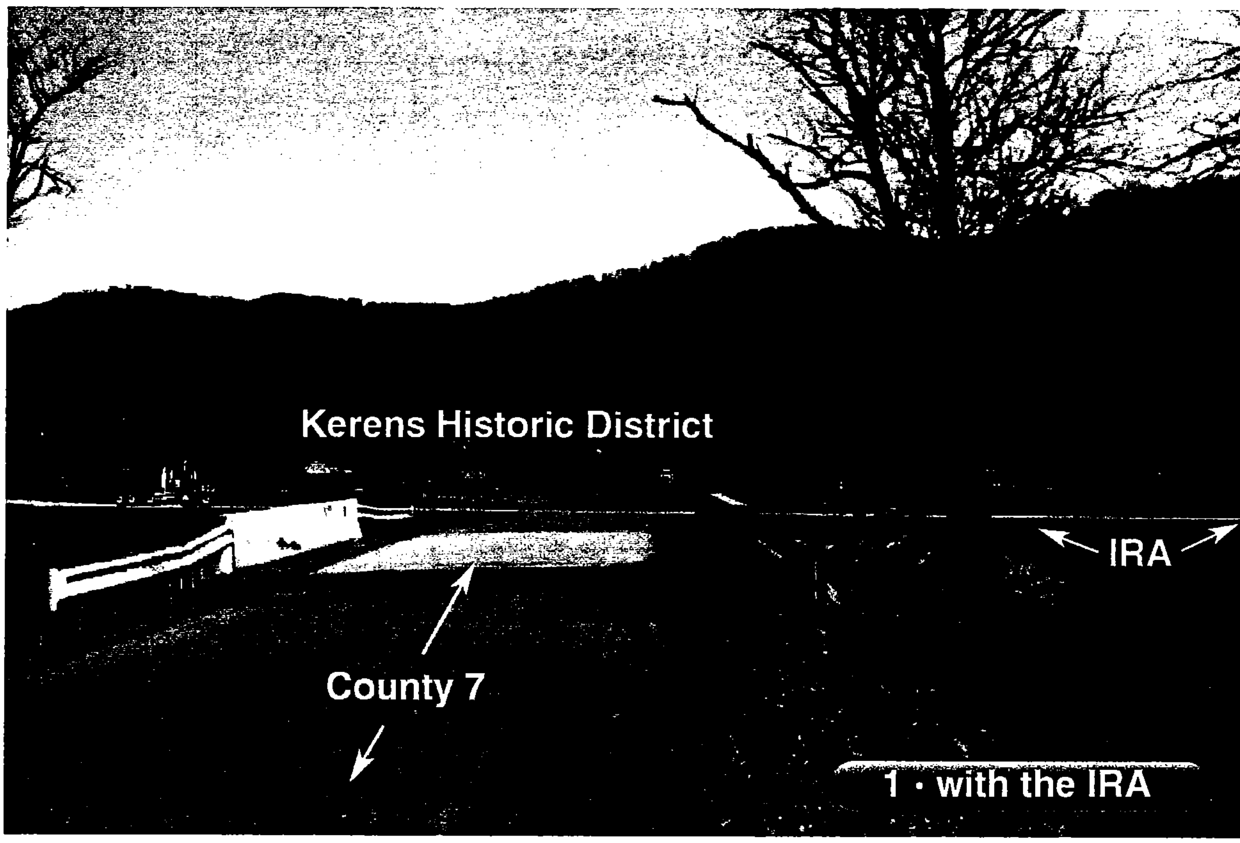
Under the proposed project, four resources under the IRA and four resources under the Build Alternative would be adversely impacted. The No-Build Alternative is the only alternative that would avoid adversely impacting the Kerens Historic District, Hanging Rock, and the Baughman House. Both the No-Build Alternative and Line A would avoid adversely impacting Moorefield City Park and the P.W. Inskeep House. Table III-35 identifies possible measures to mitigate adverse impacts to these sites.

TABLE III-35
POSSIBLE MITIGATION MEASURES FOR ADVERSELY IMPACTED SITES

ADVERSELY IMPACTED SITE	ALT.	POSSIBLE MITIGATION MEASURES
Kerens Historic District	IRA	Plantings may be partially effective in screening the IRA's visual intrusion. However, the IRA would be located in an open floodplain, in clear view of the District, making it difficult to screen.
	Line A	Plantings alone would not be effective in screening Line A due to its close proximity to the District and the fact that it would be on fill and structure through the area. The visual impact could be somewhat reduced by landscaping the cut and fill slopes to blend in with the existing scenery.
Moorefield City Park	IRA	Shift the IRA away from the park. Provide dense plantings to screen the at-grade view of the road and traffic.
P. W. Inskeep House	IRA	Plantings alone would not be effective in screening the IRA due to its close proximity to the house. The visual impact could be reduced by shifting the IRA away from the house, closer to the existing roadway and providing plantings to screen the view.
Hawse House	Line A	Shift Line A away from the house. Provide dense plantings to screen the view of the road and traffic. Depress the roadway to reduce the visual intrusion. Landscape the cut and fill slopes to blend in with existing scenery. Gently round the cut and fill slopes to blend in with surrounding topography, reduce erosion and slope stability problems, and allow for a greater success rate for revegetation.
Hanging Rock	IRA	Given the close proximity of the IRA to Hanging Rock, and the potential for construction activities to disturb the feature, no mitigation measures would be effective.
	Line A	Given the location of Line A in relation to Hanging Rock, no mitigation measures would be effective in reducing the line's intrusion into the site's currently undisturbed view.
	Line R	Given the location of Line R in relation to Hanging Rock, no mitigation measures would be effective in reducing the line's intrusion into the site's currently undisturbed view.
Baughman House	IRA	Given the close proximity of the IRA to the house, landscaping of cut and fill slopes would only be moderately effective in reducing the visual intrusion.
	Line A	Given that Line A would bridge the Baughman House, landscaping would not be effective in reducing the visual intrusion. It is not likely that any mitigation measures would be effective.



Before and after view of the IRA, looking to the east, as seen from Triplett Road (County 7) where it bridges Leading Creek. The view is looking towards the Kerens Historic District with the IRA in the foreground.



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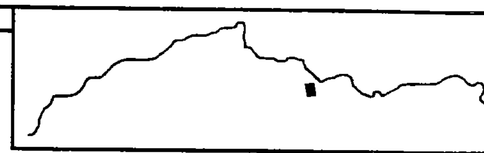
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

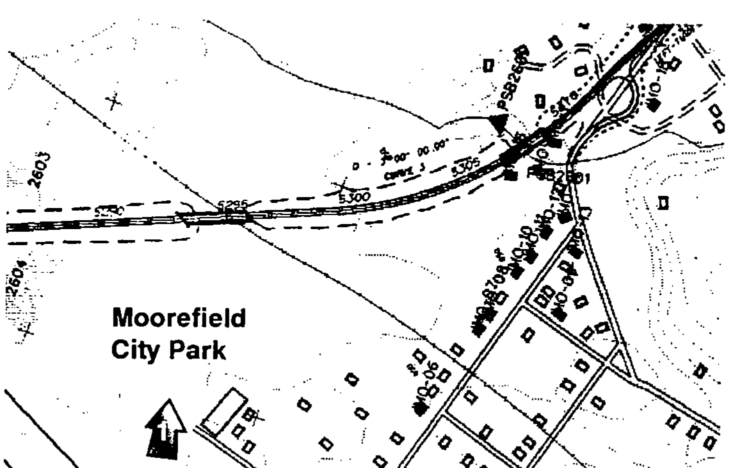
Exhibit III-27
VISUAL IMPACT ASSESSMENT: KERENS HISTORIC DISTRICT WITH THE IRA

Baker



1 • Existing

Before and after view of the IRA, looking to the east, as seen from the bleachers of the park ballfield. The foreground view from this point would be of the vegetated fill slope, embankments and bridging of the South Branch Valley Railroad. The IRA would block the existing view of the valley beyond.



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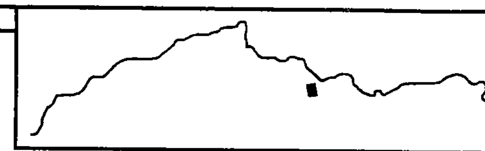
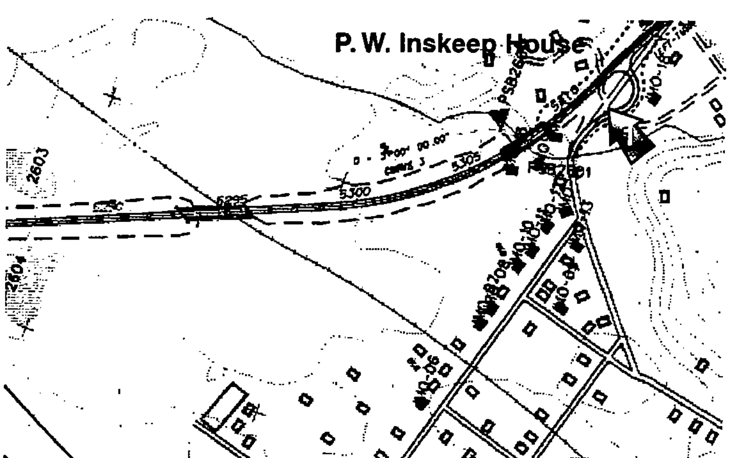
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-28
VISUAL IMPACT ASSESSMENT: MOOREFIELD CITY PARK WITH THE IRA



Before and after view of the IRA in front of the Inskeep House, looking to the northeast, as seen from the southern side of WV 55. Foreground view shows that the IRA would remain at the same elevation but would be much closer to the house



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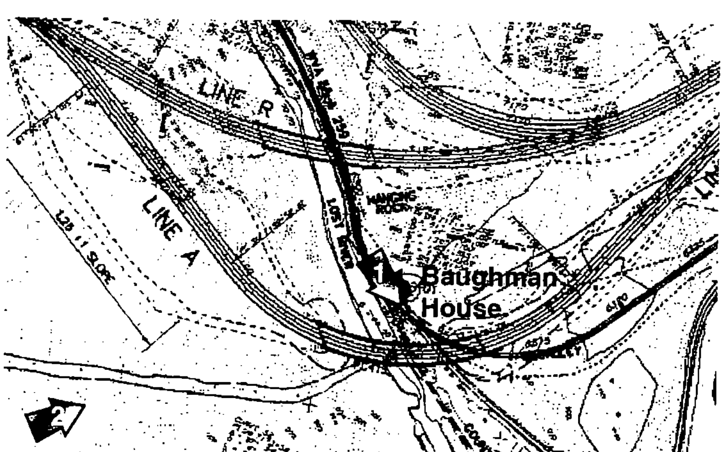
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-29
VISUAL IMPACT ASSESSMENT:
P.W. INSKEEP HOUSE
WITH THE IRA

Before and after view of the IRA, looking to the southeast, as seen from the driveway of the Baughman House, along the northern side of WV 55. Foreground view shows that the grade of the IRA along WV 55 would be raised. View of the IRA would be of fill slope and a widened WV 55.



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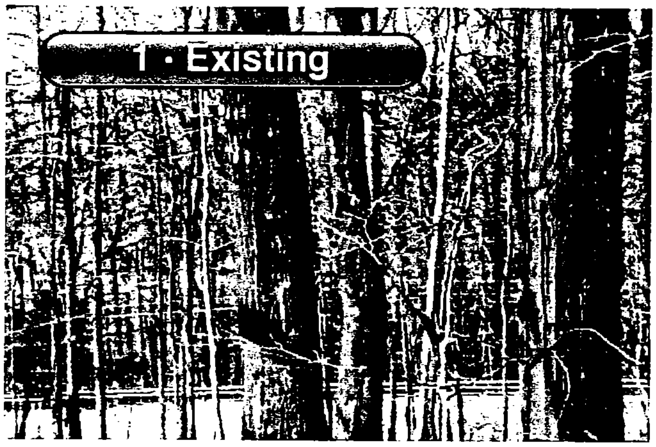
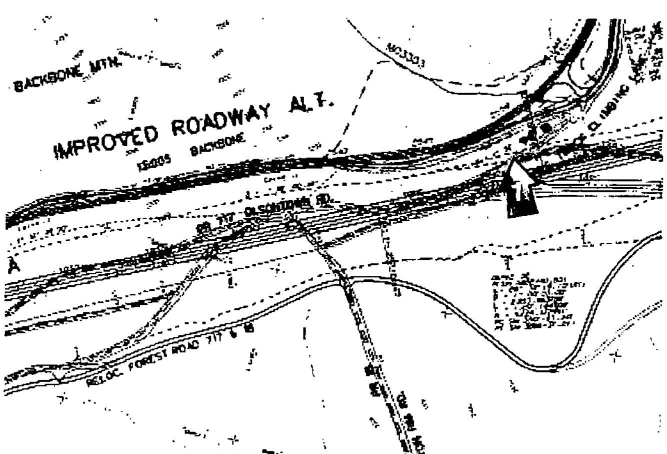
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-30
VISUAL IMPACT ASSESSMENT:
BAUGHMAN HOUSE
WITH THE IRA

Baker



Before and after view of the IRA, looking to the northwest, as seen from the Allegheny Trail along Canyon Rim Road (FR 18) near US 219. Roadway shown in existing photo is US 219. Foreground view would be of the IRA on new alignment. The IRA would be on fill within this view.



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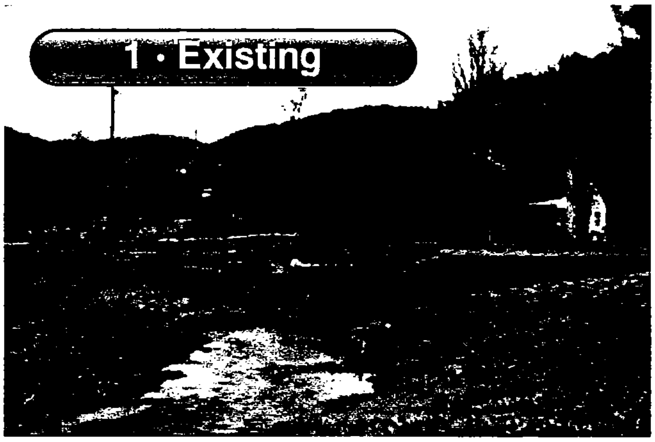
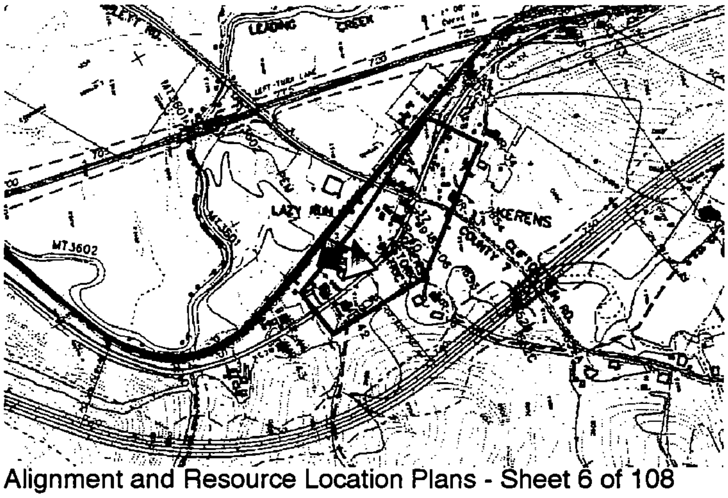
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-31
VISUAL IMPACT ASSESSMENT:
ALLEGHENY TRAIL
WITH THE IRA

Baker



Before and after view of Line A, looking to the east, as seen from US 219 and the US Post Office, in the middle of the Kerens Historic District. View from this point would be of the vegetated fill slope in the foreground.



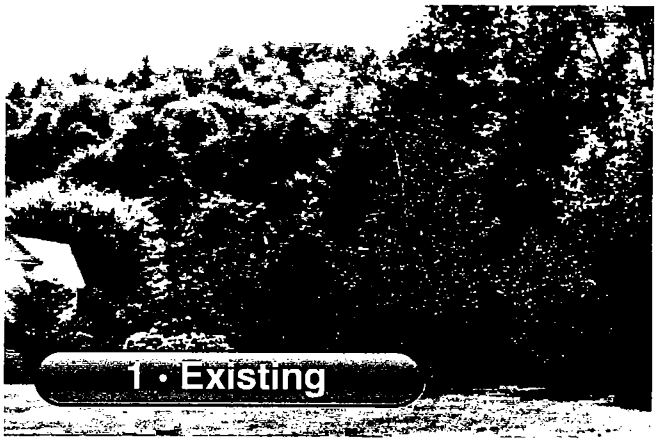
Alignment and Resource Location Plans - Sheet 6 of 108

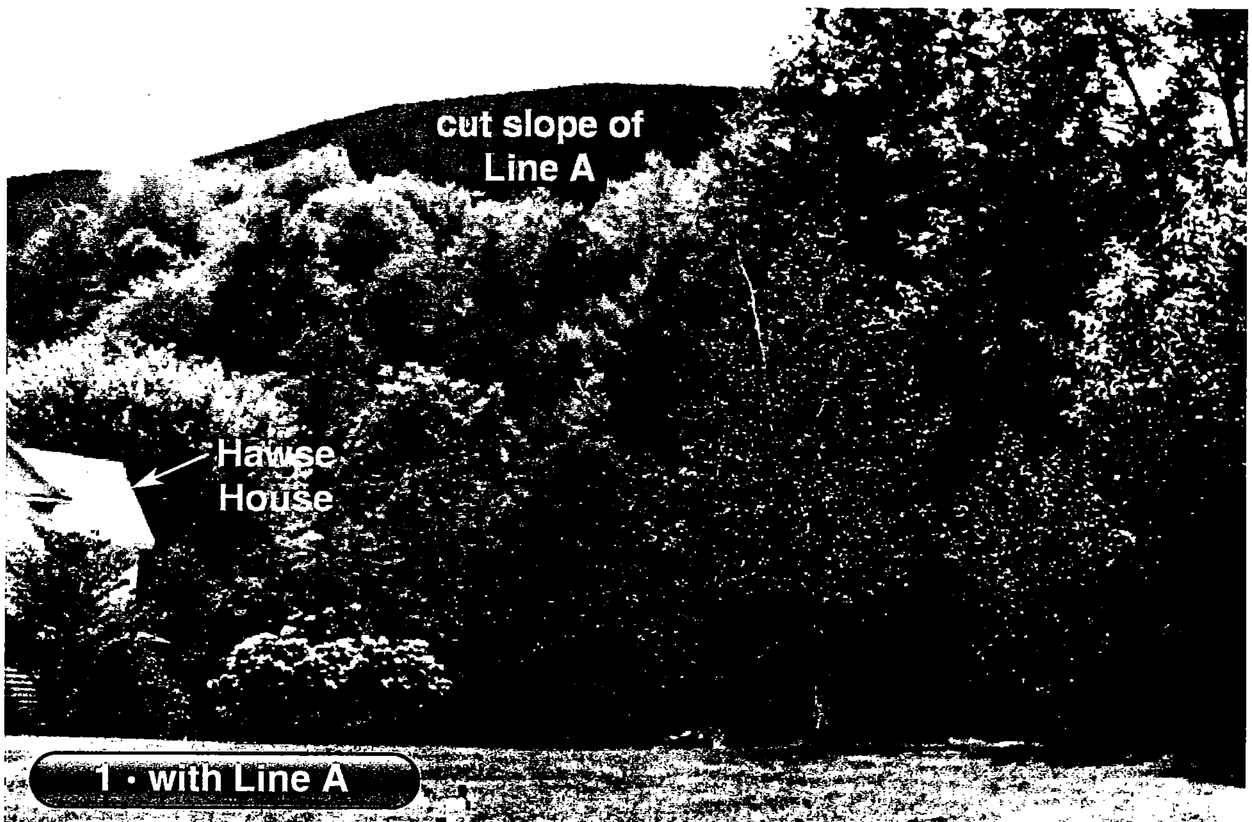
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-32
VISUAL IMPACT ASSESSMENT: KERENS HISTORIC DISTRICT WITH LINE A

Baker

Before and after view of Line A, looking to the southwest, as seen from the side yard of the Hawse house. Part of the house is shown in the left side of the photo. Foreground view from this point would be of Line A's cut slope on the ridge behind the house.





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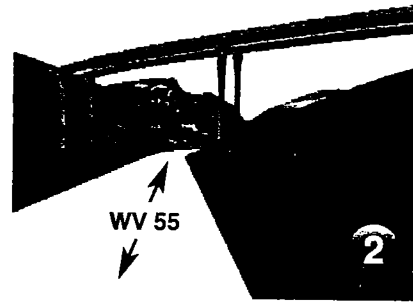
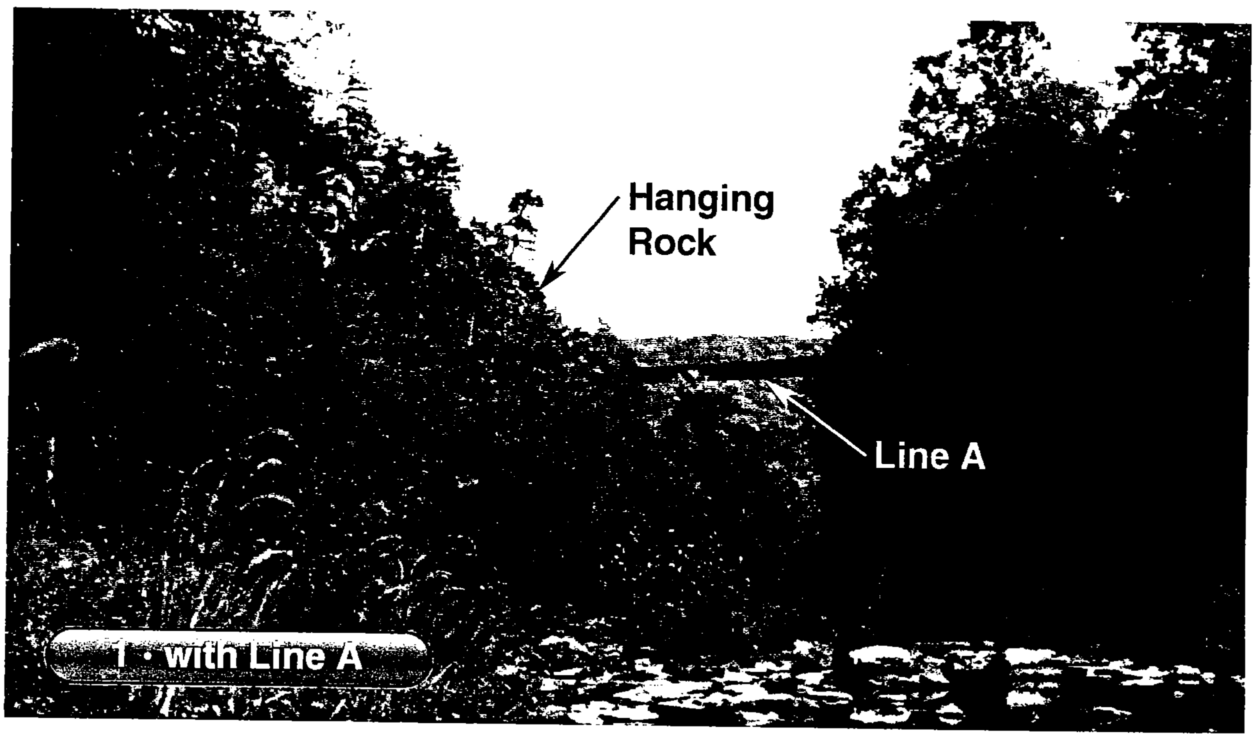
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

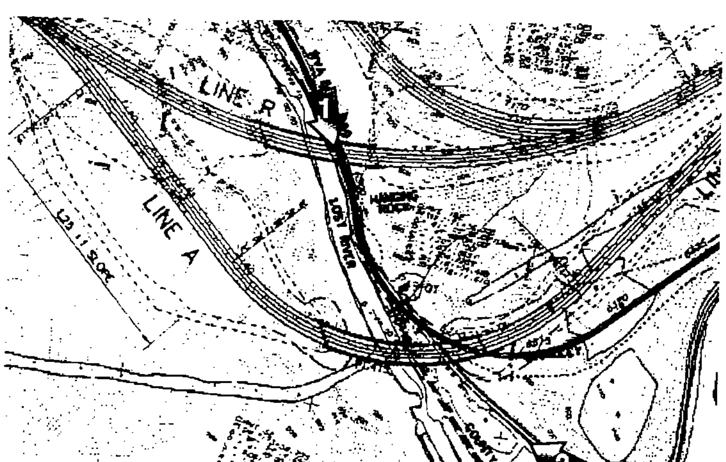
Exhibit III-33
VISUAL IMPACT ASSESSMENT:
HAWSE HOUSE
WITH LINE A

Baker





Photos are before and after views of Line A, looking to the east towards Hanging Rock, from the middle of the Lost River. Foreground view shows that the bridging of the Lost River would be behind Hanging Rock. Rendering shows view of Line A from the other direction, looking to the west towards Hanging Rock, as seen from existing WV 55. Hanging Rock would not be visible from this point.



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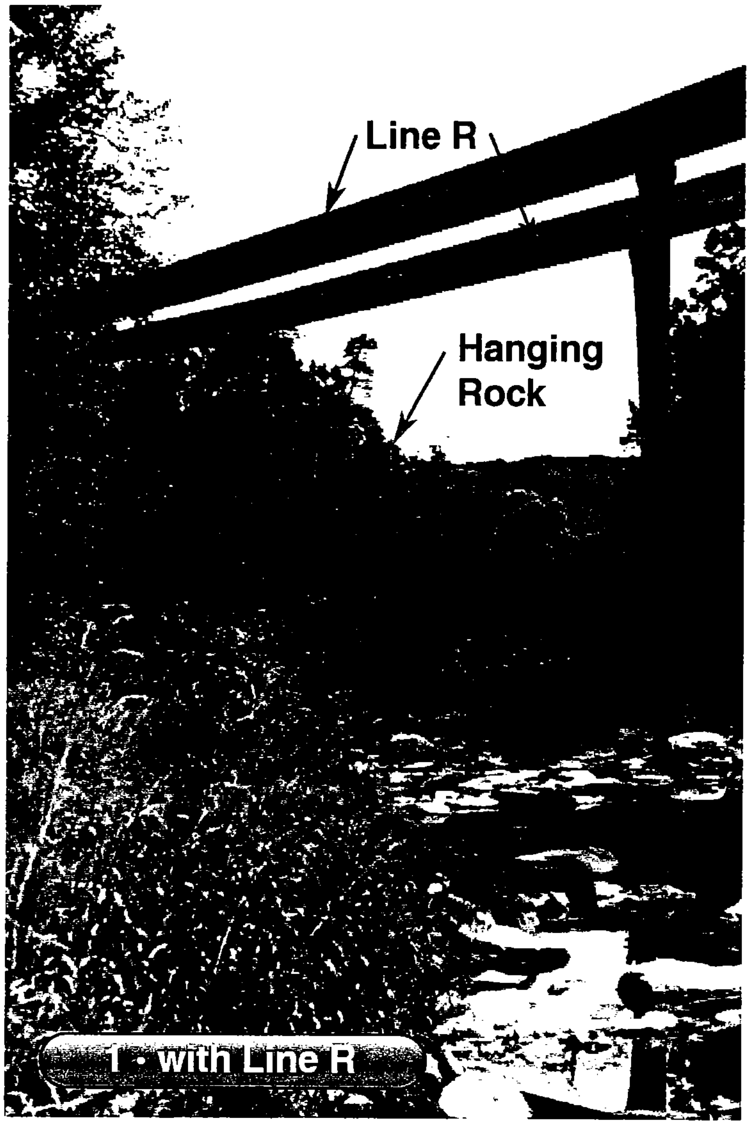
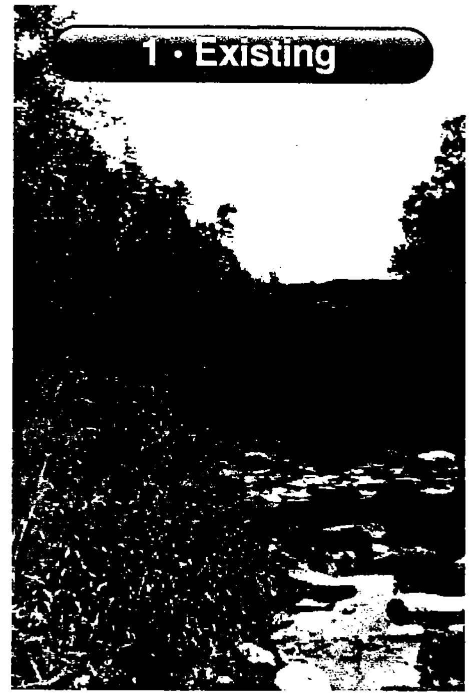
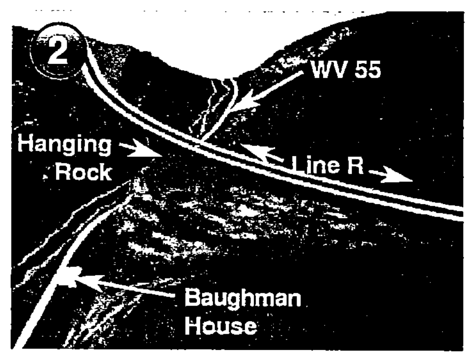
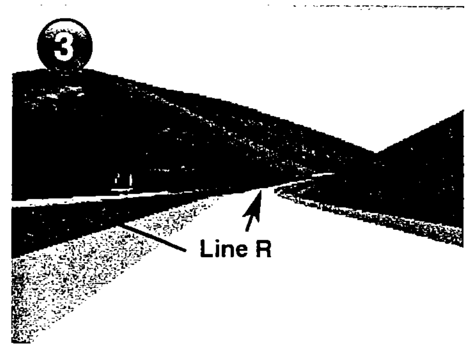
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-34
VISUAL IMPACT ASSESSMENT: HANGING ROCK WITH LINE A

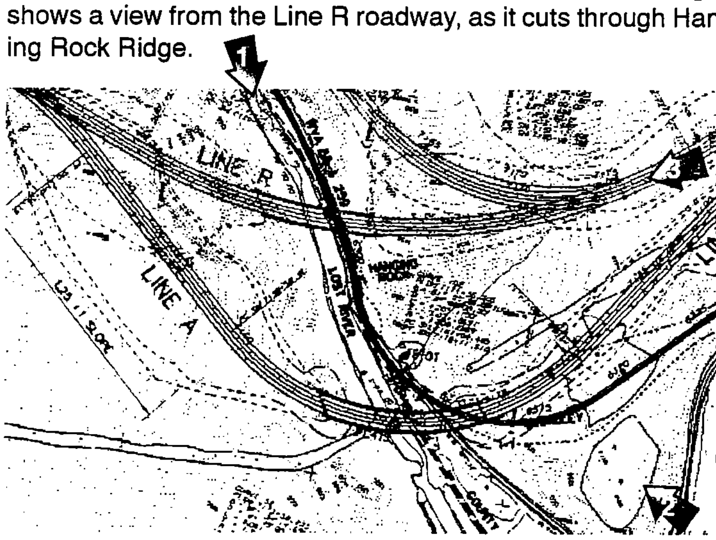








Photos are before and after views of Line R, looking to the east towards Hanging Rock, from the middle of the Lost River. Foreground view shows that the bridging of the Lost River would be in front of Hanging Rock. Rendering #2 shows an aerial view of Line R as it crosses WV 55 and the Lost River. Rendering #3 shows a view from the Line R roadway, as it cuts through Hanging Rock Ridge.



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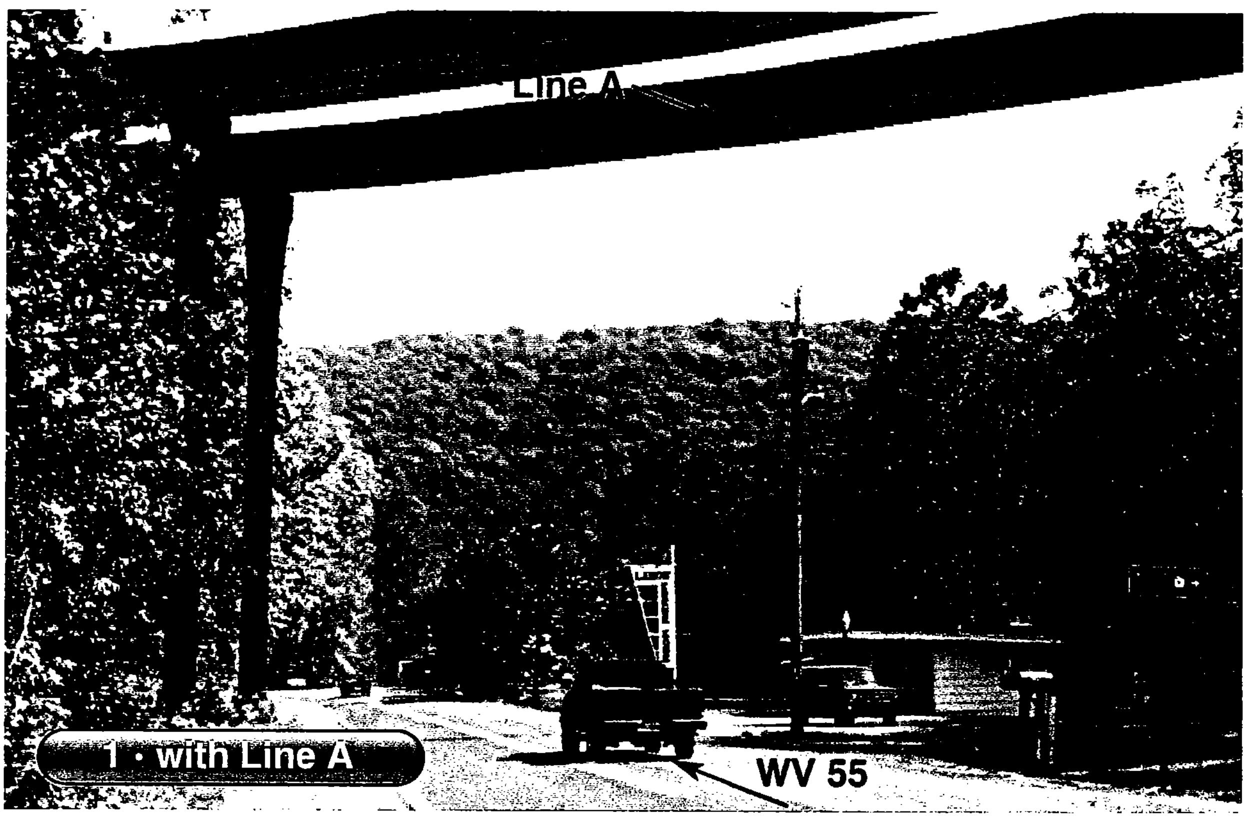
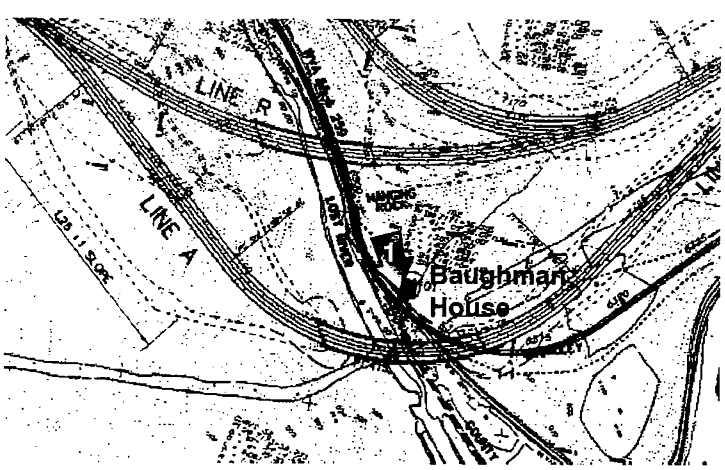
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-35
VISUAL IMPACT ASSESSMENT:
HANGING ROCK
WITH LINE R

Baker

Before and after view of Line A, looking to the southeast, as seen from the driveway of the Baughman House, along the northern side of WV 55. Foreground view shows Line A bridge crossing overhead.





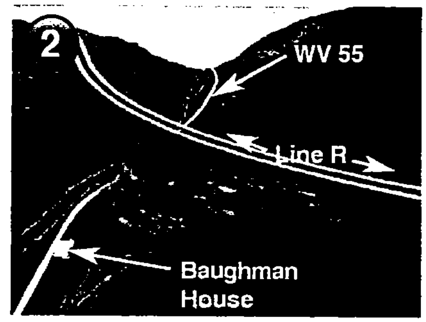
Alignment and Resource Location Plans - Sheet 58 of 108

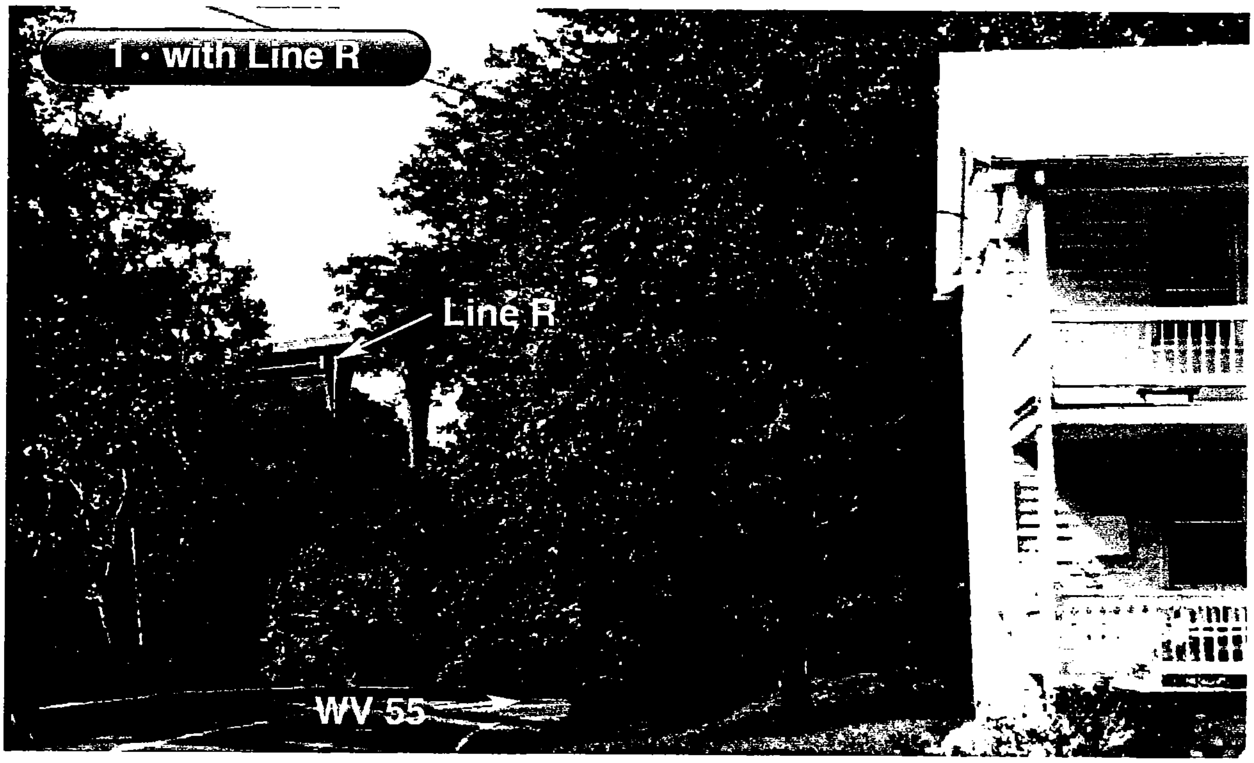
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-36
VISUAL IMPACT ASSESSMENT: BAUGHMAN HOUSE WITH LINE A

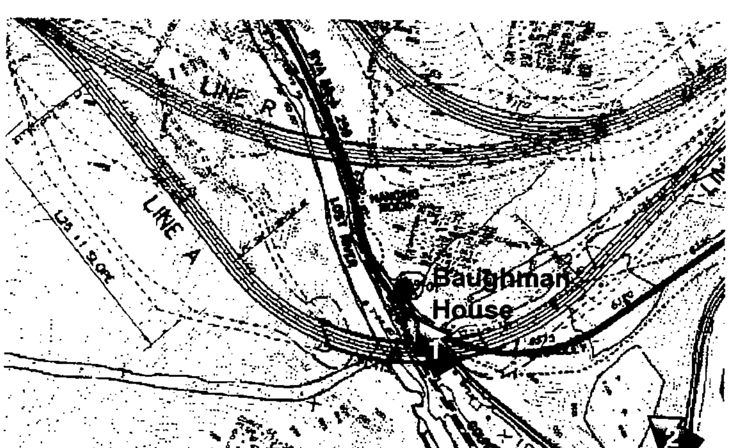
Baker

WVDOT





Photos are before and after views of Line R, looking to the west, as seen from the driveway of the Baughman House, along the northern side of WV 55. Foreground view shows Line R bridge crossing behind the Baughman House and its primary viewshed. Rendering shows an aerial view of Line R and its proximity to the house as it crosses WV 55 and the Lost River.

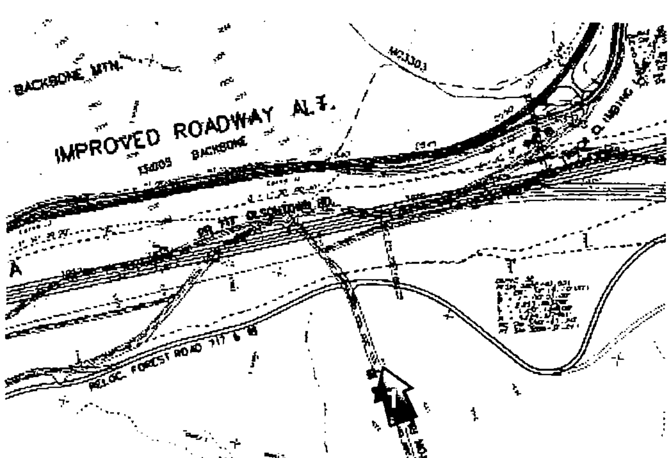


Alignment and Resource Location Plans - Sheet 58 of 108

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-37
VISUAL IMPACT ASSESSMENT: BAUGHMAN HOUSE WITH LINE R

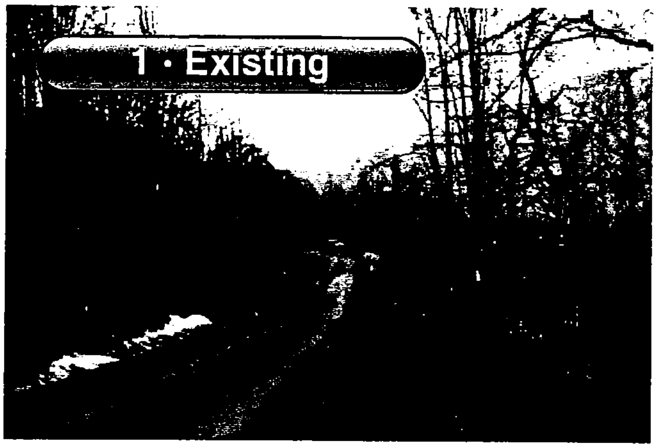
Before and after view of Line A, looking to the northwest, as seen from the Allegheny Trail along Canyon Rim Road (FR 18). Line A would not be visible from this point along the trail, only the removal of vegetation to accommodate the cut slope on the other side of the ridge. Plans call for rerouting the trail to follow re-routed FR 18. If so, Line A would not be visible from the Allegheny Trail in this general area.

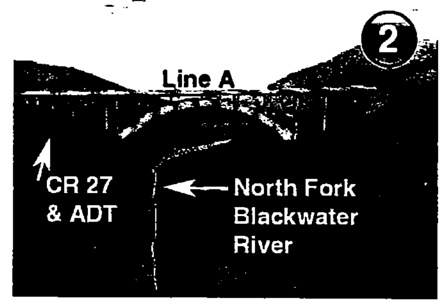


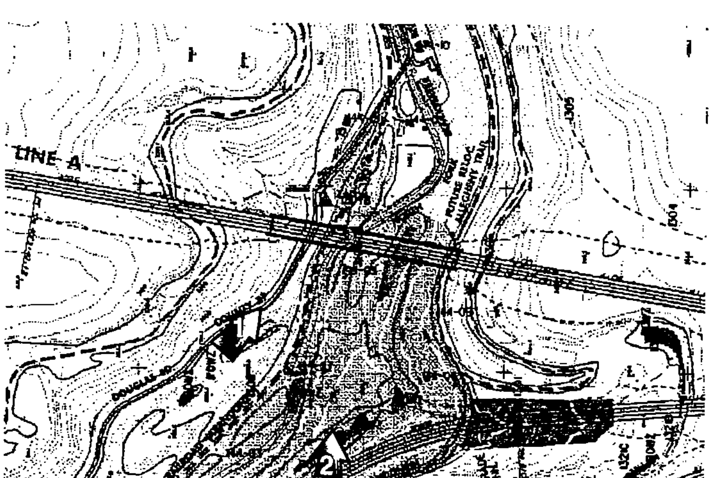
Alignment and Resource Location Plans - Sheet 17 of 108

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-38
VISUAL IMPACT ASSESSMENT:
ALLEGHENY TRAIL
WITH LINE A







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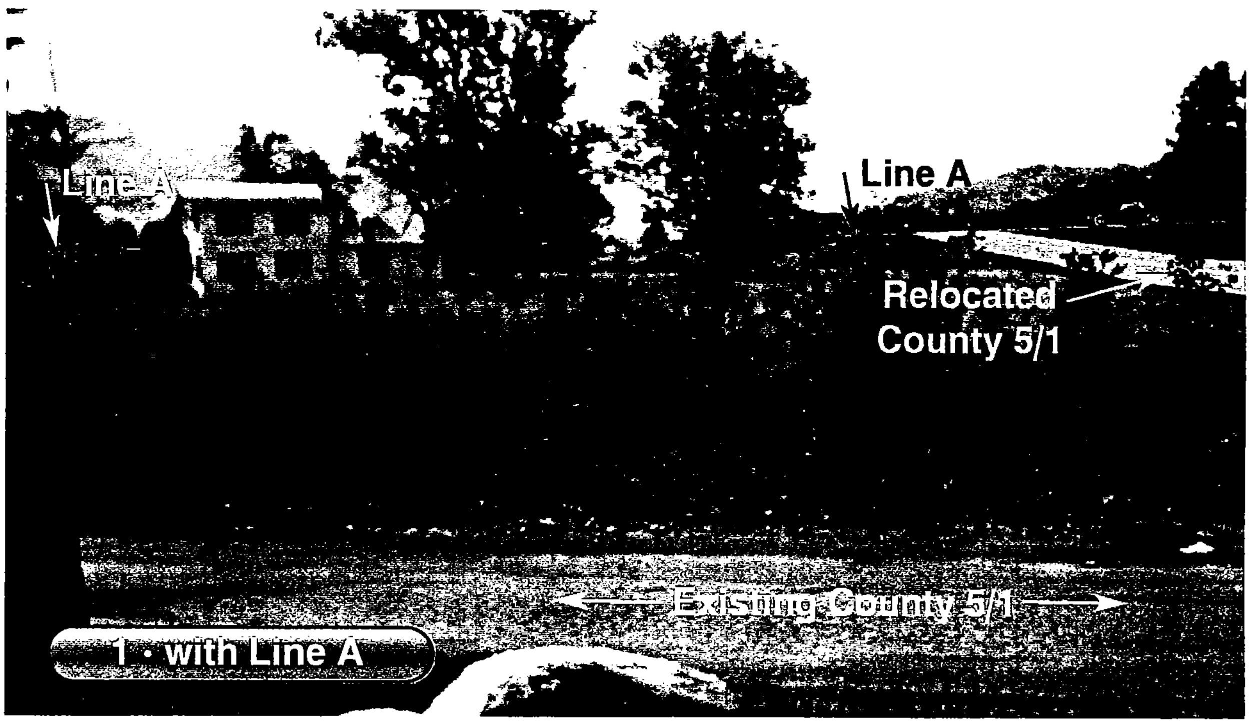
Photos are before and after view of Line A, looking to the northeast, as seen from Douglas Road (County 27) and the American Discovery Trail. Foreground view shows the bridging of the N. Fork of Blackwater River. Rendering shows overall view of Line A bridging the valley, in relation to the trail.

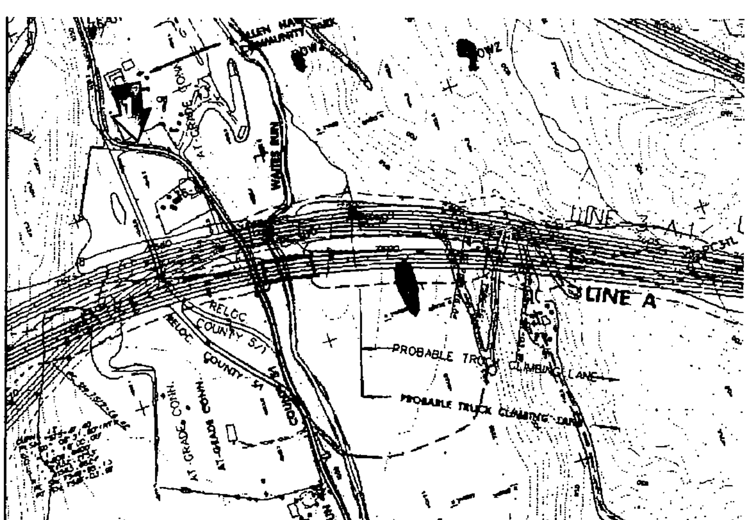
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-39
VISUAL IMPACT ASSESSMENT: AMERICAN DISCOVERY TRAIL WITH LINE A

Baker

WVDOT





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Before and after view of Line A, looking to the south, as seen from Waites Run Road (County 5/1) near the park's tennis courts. Foreground view of relocated County 5/1 and its intersection with Line A. Vegetation, topography, and structures would limit the view of Line A's fill slope and bridge over Waites Run, in the left side of the photo.

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-40
VISUAL IMPACT ASSESSMENT:
J. ALLEN HAWKIN'S PARK
WITH LINE A

L. CULTURAL RESOURCES

"Cultural Resources" are the potentially significant, patterned physical remains of human activity distributed about the landscape over time. They include, for example, historically or architecturally notable structures, the locations of important events, early industrial resources, battlefields, historic roads or railroad right-of-ways, Native American archaeological sites, and so on. They may range in size and complexity from an entire district containing dozens of majestic high-style buildings to the scattered, millennia-old remnants of a prehistoric camp site.

This section summarizes the studies taken to determine the effect of the proposed project on cultural resources. This study is undertaken towards compliance with the Antiquities Act of 1906; the National Historic Sites Act of 1935; Section 106 of the Historic Preservation Act of 1966, as amended; the Department of Transportation Act of 1966; the National Environmental Policy Act of 1969; Executive Order 11593: "Protection and Enhancement of the Cultural Environment" (1971); the Archaeological and Historic Preservation Act of 1974; the regulations of the Advisory Council on Historic Preservation (36 CFR 800); 36 CFR 63; the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation; West Virginia Code 29-1-6b; the Virginia Antiquities Act; Code of Virginia Title 10.1-2305; and current research guidelines provided by the West Virginia Division of Culture and History (WVDCH) and the Virginia Department of Historic Resources (VDHR).

Following a discussion of the methodology, this section discusses the identified cultural resources and then provides an assessment of project effects and adverse effects for each alternative under consideration. All study results for the West Virginia portion of the project have been reviewed by the West Virginia Division of Culture and History (WVDCH) and their comments are reflected herein. This advance review was considered necessary because WVDOT has identified a preferred alternative in this SDEIS. Coordination has been ongoing with the Virginia Department of Historic Resources (VDHR) and their review of this study will provide important information relative to alternative selection in that state. Detailed information on the cultural resource landscape of the project area is presented in the *Cultural Resources Technical Report,* available for review at the WVDOT, VDOT, WVDCH, VDHR and the Monongahela National Forest Service office in Elkins, West Virginia.

1. METHODOLOGY

a. Background Research

An examination of cultural resource maps, site forms, cultural resource reports, and other available records was conducted at the West Virginia Division of Culture and History (WVDCH) and the Virginia Department of Historic Resources (VDHR). USGS quadrangle maps and county files containing location data for archaeological sites and historic structures in or near the project area were examined and the locations and agency designations of all recorded resources were transferred to project maps. Site and structure registration forms, National Register nomination forms, and other available data were photostatically copied for all identified resources, and are attached to the cultural resource data forms prepared for this project.

Additionally, cultural resource reports and other secondary archaeological and historic studies were examined for information specific to the project area. Relevant geological, hydrological, pedological, climatological, floral, faunal, and similar environmental background information was reviewed.

b. Development of Prehistoric and Historic Contexts

Prehistoric and historic contextual information for the project area was assembled at a level sufficient to develop determinations of significance, in accordance with National Register Bulletin 15, Section V (1991: 7-10), National Register Bulletin 16, and the Virginia Department of Historic Resources (February 1991). National Register Bulletin 15 notes:

"Historic Contexts are those patterns, themes, or trends in history by which a specific occurrence, property, or site is understood and its meaning [and ultimately its significance] within prehistory or history is made clear . . . Its core premise is that resources, properties, or happenings in history do not occur in a vacuum but rather are part of larger trends or patterns . . ." and that these patterns can be ". . . identified through consideration of the history of the surrounding area" (1991: 7).

"Contexts" may be broad in scope (e.g., "Social development" or "Military History"), while "themes" provide a means of spatially and temporally organizing properties into coherent patterns within contexts (e.g., Military Campaigns in the Northern Shenandoah Valley -1863-1864).

c. Field Reconnaissance

The primary operational goal of this study was to assemble a detailed cultural resource inventory for the project area suitable for alignment planning purposes. This inventory consisted of the identification and listing on project maps of the following:

- All known archaeological resources (registered prehistoric and historic sites);

- All known or registered historic buildings, districts, structures, or objects; and

- All previously undocumented historic buildings, districts, structures, or objects with a construction date preceding ca. 1945 (or, in the case of districts, that a significant number of historically or functionally related properties evidenced a construction date preceding ca. 1945), and located within approximately 305 meters (1,000 feet) of any of the proposed alternatives or alignments.

The project field reconnaissance consisted of a vehicular and pedestrian examination of the entire preferred corridor area, approximately 183 kilometers (114 miles) long by 610 meters (2,000 feet) wide. Where proposed alignments were located near the margins of the original corridor, the reconnaissance was expanded on an *ad hoc* basis to preserve the 305 meters (1,000 feet) zone of effect to the "outside" of the proposed line.

Known prehistoric and historic resources were located and their condition and degree of preservation determined. Surficial observation of high-visibility areas such as plowed fields, road cuts, stream cuts and banks, tree falls, construction zones, etc. was undertaken. Informant interviews were conducted with local residents in an attempt to locate additional undocumented archaeological and historic resources. All historic buildings, structures, or objects within the zone of assessment which appeared to be greater than 50 years of age and which were physically and legally accessible to the crews were documented. All resources were recorded on standardized cultural resource data forms and were photo documented. Each identified resource was assigned a unique Resource Number.

No shovel probe testing or deep testing was conducted during this reconnaissance, except for that performed in association with the prehistoric settlement pattern model testing (see below). A Phase I subsurface test program would be conducted for the selected alternative.

(1) Cultural Resources Data Forms

In order to provide uniformity and continuity to the data collection process, a 14-page standardized Cultural Resources Data Form was developed specifically for the Corridor H Project. This form was used throughout the reconnaissance. This form was derived from the current archaeological site and historic structure recording forms of both West Virginia and Virginia and uses all of the information categories contained within these forms. The form is divided into 13 sections including: (I) survey information; (II) recorder identification and date; (III) property location; (IV) environmental information; (V) archaeological resource data; (VI) historic building/structure data; (VII) artifact data; (VIII) informants/collections; (IX) information sources; (X) National Register status; (XI) impacts; (XII) recommendations and additional comments; and (XIII) a plan view sketch map of the resource.

(2) Architectural References

In order to provide typological and terminological continuity in the recording of building descriptions, a single reference, McAlester and McAlester (1992), was used as a guide in assigning building style categories and in organizing form and structure descriptions. A building typology based on McAlester and McAlester and an extended form discussing the methodology and terminology were used to document architectural resources.

d. Assessments of Significance

Preliminary assessments of significance in terms of eligibility for nomination to the National Register of Historic Places (Register) have been made for all cultural properties identified during the course of the background research and field reconnaissance. These eligibility assessments are subject to change pending the receipt of additional information which may be acquired during the course of future Phase I or Phase II-level research efforts. These preliminary eligibility assessments are intended to:

- Maximize avoidance of potentially significant properties during the planning process, and
- Provide a level of information to regulatory agencies sufficient for them to recommend a preferred alternative from among the various project options.

As per National Register Bulletin 15 (1991: 2): The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- That are associated with events that have made a significant contribution to the broad patterns of our history; or
- That are associated with the lives of persons significant in our past; or
- That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- That have yielded, or may be likely to yield, information important in prehistory or history.

These four "Criteria" are normally referred to as Criteria A, B, C, and D, respectively. Based on these criteria, all documented properties have been assigned to one of six significance categories: Listed, Eligible, Potentially Eligible, Considered Eligible, Not Eligible, and Eligibility Undetermined.

- **Listed:**
  Listed Properties are those which are currently listed on the National Register or on State historic registers.

- **Eligible:**
  Eligible properties have been determined by state agencies or other authority to be eligible for the National Register but have not, as yet, been nominated or listed.

- **Potentially Eligible:**
  Potentially Eligible properties were determined by the consultant to be potentially eligible for nomination to the National Register based on application of the National Register criteria. Historic properties (buildings, districts, structures, objects) greater than 50 years of age and possessing integrity in location, design, setting, materials, workmanship, feeling, and association, and which, normally, were associated with a defined historic context, were considered to be potentially eligible under Criterion C. All archaeological sites were considered potentially eligible under Criterion D pending additional testing. Also, various properties associated with historic events or personages (e.g., the Civil War in West Virginia and Virginia) were deemed potentially eligible under Criteria A and B. Resources originally categorized as such for planning purposes in West Virginia have now been revised to "Considered Eligible" discussed below. Resources in Virginia would be revised accordingly upon review by VDHR.

- **Considered Eligible:**
  Considered Eligible properties are those resources in West Virginia identified as outlined above which were reviewed and determined eligible by WVDCH.

- **Not Eligible:**
  A designation of Not Eligible was reserved for properties that, in the opinion of the investigators, could be safely removed from further consideration. Only archaeological sites consisting of "isolated finds," or those which had been tested at the Phase II level with negative results, have been so assessed. For historic properties, those structures which were determined to be clearly ineligible based on extensive major addition, alteration, deterioration, or substantial loss of feeling and context, have been assigned to

this category. In West Virginia, the WVDCH has provided concurrence on properties designated as Not Eligible, and has down-graded certain other properties from Potentially Eligible to Not Eligible.

- **Eligibility Undetermined:**
  A determination of Eligibility Undetermined was employed for those sites/historic properties for which insufficient information was available to make an assessment of eligibility. This normally involved posted or gated properties or properties which were otherwise inaccessible to field crews. In West Virginia, these resources were later categorically upgraded to Considered Eligible. Undetermined properties in Virginia would be reassessed if they fall within the impact area of the selected alternative.

In addition to the above categories, for those resources located in West Virginia, equivalent West Virginia Survey Evaluation Categories have been assigned to appropriate properties. This rating system, which is used by the staff of the West Virginia Division of Culture and History, divides properties into five categories as follows:

1. National Register listed or eligible-State Register listed or eligible;
2. Contributing or potentially contributing structure in an historic district;
3. Vernacular Resource - eligible as contributing structures in rural areas;
4. Potential Resource - lacks sufficient information to determine eligibility;
5. Unrated.

e. Assessments of Effect

The Criteria of Effect and Adverse Effect have been applied to all properties determined as Listed, Eligible, Considered Eligible, Potentially Eligible, or Eligibility Undetermined in accordance with 36 CFR part 800.5.

The Criteria of Effect states that:

A. An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property for inclusion in the National Register. For the purpose of determining effect, alteration to features of a property's location, setting, or use may be relevant depending on a property's significant characteristics and should be considered. Properties determined to be Not Eligible were not assessed for project effect or adverse effect.

The Criteria of Adverse Effect states that:

B. An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, material, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:

1. Physical destruction, damage or alteration of all or part of the property;
2. Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register;
3. Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;
4. Neglect of a property resulting in its deterioration or destruction; and
5. Transfer, lease or sale of the property.

To assess effect objectively, all appropriate properties were appraised for physical, visual, auditory, and secondary/cumulative impact, based generally on the proximity of the property to the various alternative and alignment options as measured by the GIS. Each impact category was coded as: None,. Minimal, Moderate, or Major, based on these considerations:

- **Physical** impact indicates that the property is within or is physically touching the mapped "cut-and-fill" limits of a proposed option, or that the property may be reasonably expected to be destroyed, damaged, or altered by project activities, or that access to the property may be restricted.

- **Visual** impact suggests that the visual atmosphere and historic feeling of a visually-sensitive property may be compromised by a proposed option. Using the GIS, the distance from a property to each option was measured. Properties within 91 meters (300 feet) of an option were assessed as potentially suffering major visual impact. Properties 91 to 83 meters (300 to 600 feet) from an option were assessed as suffering moderate visual impact. Properties 183 to 305 meters (600 to 1,000 feet) from an option were assumed to suffer only minimal impact. Finally, beyond 305 meters (1,000 feet), visual impact was normally assumed to be negligible. Normally, archaeological sites were not coded for visual impact.

- **Auditory** impact suggests that the auditory atmosphere and historic feeling of a property may be compromised by the traffic noise level generated by a project option. Properties 305 meters (1,000 feet) or further from a proposed option were generally determined to suffer minimal to no auditory impact. Properties 305-152 meters (1,000-500 feet) from a proposed option were coded moderate impact, while properties 152 meters (500 feet) or less from a proposed option were coded as potentially suffering major impact. Normally, archaeological sites were not coded for auditory impact.

- **Secondary** impacts are those impacts which, while not immediately and directly affecting a property, may occur later in time and/or further in distance from a proposed option.

- **Cumulative** impacts are those incremental consequences which, when added together, or added to the consequences of other foreseeable projects or actions, may have a greater impact. For the purposes of this assessment, secondary and cumulative impacts have been collapsed into a single category.

In assessing Adverse Effect, it was generally assumed that only a physical impact would constitute an Adverse Effect. Visual, auditory or potential secondary impacts to a resource were generally not considered to constitute an Adverse Effect. All assessments of effect in West Virginia were reviewed by WVDCH whose determination generally agreed. In some cases, WVDCH has determined visual or auditory impacts as Adverse and these have been reflected accordingly in the results contained herein.

f. Secondary and Cumulative Impacts

Secondary impacts are those impacts which may be expected to occur later in time and further in distance from the project area as the result of project construction or operation. Cumulative impacts are incremental consequences that added together, or added to the impacts of other projects, may negatively affect cultural resources.

Development-related secondary impacts to cultural resources have been assessed in three ways:

- Identification of any significant resources that are within 305 meters (1,000 feet) of the alternatives and falling within raw land areas predicted for residential and service-oriented development;

- Identification of resources falling within intersection areas predicted for commercial development;

- Identification of existing roads that are predicted to experience substantial increases in average daily traffic and associated noise impacts to any cultural resources; and

- Archaeological sites identified by WVDCH as potentially experiencing secondary impacts due to proximity to the construction area or that may experience other secondary effects.

g. Settlement Pattern Modeling

As part of the cultural resource investigations associated with this SDEIS, a prehistoric settlement pattern model was developed and field tested for the project area. The model prioritizes the project area into differential zones of high, moderate, and low probability for the preservation of prehistoric resources. Because relatively little is known of the project area archaeology, the model is based on a variety of geographic and environmental variables derived from analog studies in contiguous or nearby environmentally similar regions.

Field testing of this model was conducted over the summer of 1994 in nine discrete Test Areas, seven in West Virginia and two in Virginia. The test program resulted in the shovel testing of 414, 50-meter square Test Units placed within the various probability zones, and the machine-assisted excavation of six deep test trenches. Ninety of the Test Units (22%) revealed the presence of prehistoric artifacts. From these positive Test Units, 38 prehistoric sites and 11 isolated find locales were identified. Statistical analysis of the test results suggest that the model is supported at a 99% confidence level in both the Allegheny Mountain Section of the Appalachian Plateaus Physiographic Province and the Appalachian Mountain Section of the Ridge and Valley Physiographic Province. The model is supported at a 90% confidence level in the Great Valley Section of the Ridge and Valley Physiographic Province. To summarize, field testing of the model has strongly confirmed its predictive ability. Accordingly, the model provides a powerful research tool for assessing the prehistoric resource sensitivity of the project area.

The total acreage for each probability zone has been computed for each proposed alternative and for alignments within the various option areas using GIS. This permitted an assessment of the relative potential for encountering prehistoric sites in each of the proposed alternatives.

2. EXISTING ENVIRONMENT

a. Prehistoric Context

The Corridor H project area has been more-or-less continuously occupied by Native American peoples for at least 12,000 years. Previous prehistoric culture reconstructions associated with the project area (Cunningham and Barse, 1979) echo the paleo-environmental scheme and culture history sequence set forth in the mid-1970s by William M. Gardner (1984). Following more recent studies (e.g., Watts, 1979, 1983;

Gardner, 1986; Anderson et al., 1992), a revised culture chronology is proposed for the project area. The Prehistoric Culture History written for the project follows this scheme and the chronology has also been used in the development of the project prehistoric settlement pattern predictive model. This chronology is presented below in brief outline form.

1. Early Man and PaleoIndian Periods (15,000 - 8500 BC)
2. Early Archaic Period (8500 - 6000 BC)
3. Middle Archaic Period (6000 - 4000 BC)
4. Late Archaic Period (4000 - 2000/1900 BC)
5. Terminal Archaic Period (1800 - 1200 BC)
6. Early Woodland Period - Ridge and Valley Province (1200 - 500 BC)
7. Early Woodland Period - Appalachian Plateaus Province (1000 BC - AD 1)
8. Middle Woodland Period - Ridge and Valley Province (500 BC - AD 900)
9. Middle Woodland Period - Appalachian Plateaus Province (AD 1 - 500)
10. Late Woodland Period - Appalachian Plateaus Province (AD 500 - 1200)
11. Late Woodland Period - Ridge and Valley Province (AD 900 - 1580)
12. Late Prehistoric Period - Appalachian Plateaus Province (AD 1200 - 1580)
13. Protohistoric Period - Ridge and Valley Province (AD 1580 - 1630)

b. Historic Context

Beginning with the post-contact settlement of the area by native peoples, the Historic Period traces the dominant historic trends within the region, from the earliest European exploration of the interior of Virginia (including present-day West Virginia) in the seventeenth century to the present day.

Chronological, geographical, and thematic elements define the field of the historic context. Chronological themes proceed from the onset of the first Euro-American explorations in the project area, beginning about 1670, to approximately 1944, an arbitrary cut-off point defined by the 50-year age criterion prescribed for the listing of a cultural resource in the National Register. Purely chronological themes within the historical context statement therefore emphasize broader, often regional, trends and the diachronic relationships between events. They offer a temporal framework or structure for the discussion and comprehension of culture-historical themes. The text of the historic context is therefore organized first along broadly chronological lines. As the vector of historical development within the project area generally proceeds from east to west, the historic context narrative is also organized to reflect this geographic progression.

Within this chronological and geographical hierarchy, six broad culture-historical themes are interwoven that further define the major historical "boundaries" of the project area. These themes are conceptual in nature and establish reference points for evaluating the significance of specific cultural resources identified in the project. This approach facilitates evaluation of the historical significance of diverse resource types within a holistic historical framework that is directly related to the intent of the underlying legal mandates. As with the Prehistoric Context discussion, a brief outline of the historic period overview is presented below.

1. Historic Period Native Americans
   - The major Native American language families and "tribes" who lived in or passed through the project area in the seventeenth and eighteenth centuries.
   - Native American trails in the project area
   - Native American uses of land in the project area during the historic period and relationships between the archaeology of the Protohistoric period and the sporadic early historic record.
   - The role of trade between Native Americans and early Euro-Americans and the effects of culture contact on native health and cultural institutions.

2. Exploration and Early Settlement, 1670-1755
   - The record of the first European explorations to and beyond the Blue Ridge, the Great Valley and the Appalachian Mountains during the seventeenth and eighteenth centuries.
   - The role of land speculation in initial settlement of the project area prior to the French and Indian War: Virginia land grants and the Fairfax proprietary in the Northern Neck of Virginia.
   - Origins and motivations of the first settlers from Europe, Virginia, Pennsylvania, and elsewhere.
   - Size and location or early land grants.
   - Effects of settlement on the development of towns in the lower and upper Shenandoah Valley (e.g., Winchester and Staunton), in the South Branch Valley, the Patterson Creek Valley, and the Tygart Valley.

3. Socioeconomic Development
   - Ethnic background of major population groups in the project area - Virginians, Scots-Irish, eastern Europeans, African-Americans, Pennsylvania-Germans, English, Welsh, and others.

- Religious affiliations of early settlers and later immigrants and the effect of religion on the culture of the project area during the eighteenth, nineteenth, and twentieth centuries.
- Educational developments in the project area: subscription schools, public schools, private academies, etc.
- Subsistence -- the roles of farming and cattle raising and their importance to the economic development of the project area.
- Industry and Commerce -- timbering, iron manufacturing, milling, the growth of commerce and the establishment of commercial centers and trade networks in the project area.
- Recreation and the arts.

4. Transportation and Communication
    - Construction of early roads in the project area and the relationship of these roads to the development of early settlements and markets.
    - Attempts to develop inland navigation.
    - Railroads and their relationship to the settlement, commercial development, and military history of the project area.

5. Political Development
    - Chronology and course of Virginia county formation and the relationship to early settlement in the project area.
    - Establishment of county and state boundary lines.
    - The emergence of new counties in the new state of West Virginia.

6. Military History
    - The French and Indian War, 1754-1763, and its effect on the first settlements in the project area.
    - Frontier forts in the project area.
    - Pontiac's Conspiracy, 1763-1764: continued hostility with Native Americans and its effect on further settlement.
    - Lord Dunmore's War, 1774.
    - The project area during the American Revolution, 1775-1783.
    - The post-Revolutionary resettlement of the project area and an end to Indian hostility.
    - The Civil War in the project area, 1861-1865.

c. Summary of Identified Cultural Resources

Using the background research and field efforts a master cultural resource data base was generated. The resources identified are divided into 7 categories:

Prehistoric archaeological sites are the material culture remains of pre-European contact, indigenous native peoples. Since previous field investigations have rarely been conducted at a level sufficient to assess significance, the majority of Native American sites located in the project area are, pending additional testing, considered to be at least Potentially Eligible for nomination to the Register under Criterion D. Only those sites consisting of "isolated finds" or which have been tested at the Phase II level with negative results have been recorded as "Not Eligible." No prehistoric sites are currently listed on or determined to be eligible for listing in the Register within or near the boundaries of the Project Area.

Historic Archaeological Sites refer to those archaeological sites of post-contact, normally Euro-American origin, usually consisting of the surficial and subsurface remnants of former buildings/structures with their associated features (e.g., wells, privies, outbuildings, dependencies, etc.) and artifacts.

Multi-component archaeological sites are those sites which contain two or more separate cultural or temporal assemblages, for example, a site containing both prehistoric and Civil War relics.

Single Historic Buildings, as per National Register Bulletin 15 (1991: 4), are "...created principally to shelter any form of human activity". Building" may also be used to refer to historically and functionally related units, such as a house and barn.

Historic Structures are distinguished from buildings in that their function is usually for purposes other than habitation (National Register Bulletin 15 1991: 4). Bridges, tunnels, and coal tipples are examples of structures.

Historic Districts and Multiple Resource Areas are a related group of buildings/structures which possess a ". . . significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development" (National Register Bulletin 15 1991: 5). It should stressed that at this level of documentation, the boundaries illustrated for potential historic districts in the Alignment and Resource location Plans are strictly to indicate the geographic location and general cohesiveness of the resource and should not be construed as formally proposed National Register boundaries. For those resources initially identified by Commonwealth Associates, Inc. (1979) (i.e., Lebanon Church, Kerens, Scherr), Commonwealth's suggested boundaries have been used for illustration purposes without modification. A single Multiple Resource Area, the Old Fields Multiple Resource Area, was identified in West Virginia.

Historic Cemeteries are collections of graves that are marked by stones or other means, or are otherwise recognizable through features such as fencing or depressions, or are indicated on maps.

The basic information on all cultural resources identified in the project area includes the Corridor H resource number - a unique alphanumeric designation applied to each resource; the known name, if any, of the resource; the agency or other designation, if any; a description of the resource; the site type or building style; the cultural period or date(s) of the property, if known; an assessment of eligibility for nomination to the National Register of Historic Places; and locational information including county, USGS 7.5' Quadrangle map, and the map number on which the location of the resource is illustrated in the Alignment and Resource Location Plans.

A total of 1,154 cultural resources have been identified in all alternatives of Corridor H. Of those, 891 were individually documented and filed with WVDCH and VDHR. These 891 resources are summarized by type, eligibility and state in Table III-36. The remaining 263 resources are potentially contributing structures in three historic districts and were not fully documented. In all cases, no construction would occur in these districts. One hundred and sixty two (162) make up the Thomas Historic District, 71 are located in or near the Parsons Historic District and 30 (of a total of 77) are located in the Wardensville Historic District.

Note that any "Considered Eligible" determinations for prehistoric and historic archaeological resources are preliminary, due to the fact that these resources have not been examined at a level necessary to formally determine eligibility. Since few prehistoric or historic sites located within the project area have undergone testing at a level necessary to determine significance, it was conservatively assumed that <u>any</u> identified and untested archaeological site was at least potentially eligible under Criterion D pending additional testing. This merely indicates that with the present information, the possibility cannot be ruled out that it might be eligible. Normally, eligibility for any given archaeological resource can only be determined through an appropriate regime of Phase II testing. Since project planners were developing alignments during the cultural resources field effort, conservative standards of assessment were employed by researchers in an attempt to maximize avoidance of potentially significant resources. It was assumed that it would be far better to err on the side of eligibility than to expose a presumably non-eligible structure to project impact, only to have that assessment reversed at a later date when mitigation alternatives would be far less flexible.

TABLE III-36
SUMMARY OF IDENTIFIED CULTURAL RESOURCES

	NATIONAL REGISTER OF HISTORIC PLACES SITE STATUS										
	# Sites in West Virginia					# Sites in Virginia					
CULTURAL RESOURCE TYPE	Listed	Eligible	Considered Eligible	Not Eligible	Eligibility Undetermined	Listed	Eligible	Potentially Eligible	Not Eligible	Eligibility Undetermined	TOTALS
Prehistoric Archaeological Sites	0	0	71	0	0	0	0	2	0	0	**73**
Historic Archaeological Sites	0	8	49	1	0	0	0	16	0	0	**74**
Multi-Component Sites	0	0	5	0	0	0	0	0	0	0	**5**
Single Historic Buildings	7	11	266	276	0	0	2	76	39	6	**683**
Single Historic Structures	0	0	8	0	0	0	0	1	0	0	**9**
Historic Districts	1	1	11	0	0	0	0	1	0	0	**14**
Historic Cemeteries	0	1	13	12	0	0	0	0	7	0	**33**
Totals	**8**	**21**	**423**	**289**	**0**	**0**	**2**	**96**	**46**	**6**	**891**

3. IMPACTS

a. Summary of Project Effects By Alternative

A summary of the Effects and Adverse Effects is provided in Table III-37. This table indicates that Line A of the Build Alternative would have somewhat less effect on significant cultural resources than the IRA in West Virginia and markedly less effect in Virginia. This assessment is based on simple proximity to the alternative and does not consider quantitative or qualitative differences in the nature and severity of the impact between the two alternatives (e.g. it assumes that the auditory impact and visual intrusiveness of the two alternatives will be approximately the same). Note also that at this level of evaluation, visual and auditory impacts have generally not been assessed as "Adverse". It is suggested that after the selection of an alignment, all eligible resources within that alignment that have received a potentially major impact assessment for visual or auditory impact be reevaluated for Adverse Effect.

b. Summary of Project Effects By Option Area

Table III-37 summarizes the impacts in each Option Area for Line A and the optional lines, and summarizes the potential Effect and Adverse Effect.

In assessing the relative effect on cultural resources of the various alignments within the Option Areas of the Build Alternative, impacts vary slightly from area to area, producing no substantial differences except for the Lebanon Church Option Area. In this Option Area, Line L provides some advantage from a cultural resources standpoint with 19 Effects and 1 Adverse Effect, as opposed to 25 Effects and 1 Adverse Effect for Line A.

c. Archaeological Sites

One hundred fifty-two prehistoric and historic archaeological sites have been identified in the project area through a combination of known site assessment, informant interview, and surficial examination. No Phase I-level sub-surface testing has been performed within the current project area, except for that accomplished in connection with the testing of the prehistoric settlement pattern model (see *Cultural Resources Model Test Report*). During that testing, 38 additional prehistoric sites were identified during the examination of approximately 17.7 linear kilometers (11 linear miles) of project area.

TABLE III-37
SUMMARY OF EFFECT AND ADVERSE EFFECT BY ALTERNATIVE AND OPTION AREA

ALTERNATIVES COMPARISON				
D5 Corridor	IRA		Build - Line A	
Potential - 891	WV	VA	WV	VA
No Effect	297	41	332	66
Effect	161	52	122	26
Adverse Effect (Buildings and Structures / Sites)	13 / 21	3 / 5	12 / 10	0 / 1

	OPTION AREA COMPARISONS IN WEST VIRGINIA												OPTION AREA COMPARISONS IN VIRGINIA				
	INTERCHANGE		SHAVERS FORK		PATTERSON CREEK		FORMAN		BAKER		HANGING ROCK		DUCK RUN			LEBANON CHURCH	
	Line I	Line A	Line S	Line A	Line P	Line A	Line F	Line A	Line B	Line A	Line R	Line A	Line D1	Line D2	Line A	Line L	Line A
No Effect	0	0	9	7	2	1	0	1	4	3	1	1	1	1	1	58	52
Effect	3	3	1	4	2	3	4	3	6	7	3	3	2	2	2	19	25
Adverse Effect	0	0	0	1	1	1	0	0	1	0	0	0	1	1	1	1	1

These sites range in complexity from isolated finds and small, nondiagnostic lithic scatters to the multi-component Mathias Farm Site/site complex on the floodplain of the South Branch of the Potomac River. Since statistical analysis of the model has confirmed its predictive ability, it is recommended that future Phase I sub-surface testing within the selected alignment be restricted to areas of high and moderate potential, as defined by the model. Areas of predicted low probability should be traversed and assessed for the presence of historic resources or rockshelters, but not otherwise tested. If the Mathias Farm Site cannot be avoided, given its artifact yield and potential complexity, it is suggested that Phase II-level testing be initiated as soon as possible to assess site dimensions, stratigraphy, feature survival, and potential significance.

d. Historic Buildings

Seven individual historic buildings listed on the Register were identified in the West Virginia portion of the project area within the general effect zone of the project, including the Tucker County Court House and Jail and the several high-style late 18th-early 19th century mansions in the South Branch Valley (e.g. Willow Wall and Fort Pleasant). Thirteen historic buildings were identified for which previous determinations of eligibility had been made, 11 in West Virginia and 2 in Virginia. Finally, 266 Considered Eligible buildings were identified in West Virginia, and 76 Potentially Eligible buildings were identified in Virginia, for a total of 342 buildings Considered or Potentially Eligible for nomination to the Register. These range from simple rural vernacular structures, through 19th and early 20th century company housing, to high-style residences and commercial buildings.

The majority of buildings documented within the project area are rural vernacular residences, primarily in the following styles (in descending order of occurrence with approximate number) National I-Houses (200); National Gable Front and Wing (60); National Hall and Parlor (50); National Pyramidal (45); National Gable Front (40); Craftsman (35); Colonial Revival (30); Queen Anne (20); Gothic Revival (15); Pre-Railroad Tidewater I-House (10); and Pre-Railroad Midland Double Pen (10). Numerous other minor classifications are represented including Georgian Side Gabled (2); Greek Revival (4); Italianate (3); Folk Victorian (8); Early Classical Revival (2); Second Empire (1); Transitional Adam/Italianate (1); and Neo-Midland (1). The inventory also includes a variety of vernacular commercial buildings (21); churches (14); schools (3); barns (8); and miscellaneous categories including a jail, a garage, a springhouse, and a mill.

At this level of investigation, historic property boundaries have not been established for Potentially Eligible and Considered Eligible resources. Accordingly, listed Adverse Effects to buildings are generally in the form of direct impact to the structure of the building only. It is recommended that during the Phase I survey, historic boundaries be established for Listed, Eligible, Considered, and Potentially Eligible properties within reasonable proximity to the cut and fill lines of the selected alignment.

e. Historic Districts

Fourteen existing and proposed historic districts have been identified in the project area, 13 in West Virginia and one in Virginia. In West Virginia, the Scherr and Kerens historic districts were defined in the previous investigations conducted by Commonwealth Associates, Inc. (1979) in connection with the 1981 DEIS. Kerens has been determined to be eligible for the Register by WVDCH. However, fires and demolition have destroyed approximately half of the contributing buildings originally deemed eligible, thus diminishing its future significance. A single historic district, Capon Springs, has been recently listed on the Register and is discussed below. Of the remaining proposed districts, Thomas and Wardensville, West Virginia, and Lebanon Church, Virginia, are particularly atmospheric and well-preserved reminders of both the region's rural village past and, in the case of Thomas, the dynamic, if short-lived, era of the coal and coke industry "boom". Although not considered specifically under beneficial economic impacts, a sensitively-handled restoration of the commercial core of Thomas, combined with the integration of the North Fork of the Blackwater River Valley environmental restoration with preservation of industrial remnants, and the increased access afforded by the project, could create a focus for tourism and reinvigorate the local economy. Other proposed historic districts in West Virginia include Douglas, Hambleton, Benbush, Fort Run, Old Fields, Shady Run, Parsons, and Davis. The proposed historic district of Shady Run is of particular interest as a purported former African-American community, an ethnic group whose lifeways are not well documented in the project area.

Finally, consideration was given to the potential adverse impacts to which the historic district of Capon Springs might be exposed through project activity. While the authors appreciate the concerns of the Capon Springs management and owners, no objective evidence in the form of traffic models or other studies have come to their attention which would suggest that the project, in its various forms, would have a demonstrable Effect or Adverse Effect upon the Capon Springs National Register property. Factors mitigating against a finding of Effect or Adverse Effect include the lack of proximity of the property to the project area, and the "buffer zone" of approximately 5,000 acres owned by Capon Springs that surround the core property.

f. Secondary Impacts

The assessment of secondary impacts to cultural resources due to predicted commercial development is identical under both the Build and Improved Roadway Alternatives. Eight resources (Table III-38) were identified that meet the constraints discussed above. Additionally, the WVDCH identified 46 resources (Table III-38) that may be subject to secondary impacts from construction (borrow sites or work areas) or other development: 23 for the Build Alternative and 23 for the Improved Roadway Alternative. However, sufficient area exists for induced development that could avoid secondary impacts to significant cultural resources. Accordingly, secondary impacts, where projected, while constituting an Effect have not been deemed to be an Adverse Effect within the meaning of 36 CFR Part 800.5.

Investigation of substantial increases in average daily traffic showed that the IRA, when compared to the No-Build Alternative, resulted in differences of up to 7,000 vehicles/day (County 3/3) quadrupling the existing volumes. In most cases, the same route under the Build Alternative would experience a slight increase or a reduction in average daily traffic (ADT). Increases equal to or greater than 3,000 vehicles per day between the No-Build and the IRA and between the No-Build and Build Alternatives are presented in Table III-39. Based on noise analysis investigations, six of the roads under the IRA (County 3/3, WV 55 Baker, WV 55 State Line, WV 93, US 219 Parsons, and US 219 Montrose) would experience noticeable increases in noise levels when compared to the No-Build Alternative. Of these, County 3/3 and WV 55 State Line would be considered moderate noise impacts. Under the Build Alternative, there would be no noticeable noise increases, with two of the roads experiencing a noticeable decrease in decibel level from existing conditions. While all cultural resources within the 30-Minute Contour have not been identified, it can be concluded that resources along the roads noted above could experience an Effect, possibly Adverse, under the Improved Roadway Alternative.

g. Cumulative Effect

The additive effects of direct impacts on cultural resources have been quantified in the *Cultural Resources Technical Report*. The evaluation system used in order to make a Determination of Effect on a given resource consisted of the "addition" of physical, visual and auditory effects. Inasmuch as this system also evaluated secondary impacts, this technique has also considered the additive effects of direct and secondary impacts to cultural resources.

TABLE III-38
PREDICTED SECONDARY IMPACTS TO CULTURAL RESOURCES

BUILD AND IMPROVED ROADWAY ALTERNATIVES: SITES PROXIMAL TO PREDICTED COMMERCIAL DEVELOPMENT	
RESOURCE NO.	RESOURCE TYPE & ELIGIBILITY
01-01	Prehistoric Site (PE)
01-03	National Gable Front & Wing Residence (PE)
02-04	National I-House (PE)
80-01	Queen Anne Residence (CE);
80-02	Pre-Railroad Tidewater Residence (CE);
142-01	Craftsman Side Gabled Residence (CE)
191-01	National Gable Front & Wing Residence (CE)
IBK-01	Historic Domestic Site (CE)

SITES IDENTIFIED BY WEST VIRGINIA DIVISION OF CULTURE AND HISTORY			
BUILD ALTERNATIVE		IMPROVED ROADWAY ALTERNATIVE	
RESOURCE NO.	RESOURCE TYPE & ELIGIBILITY	RESOURCE NO.	RESOURCE TYPE & ELIGIBILITY
35-03	Historic Domestic Site (CE)	29-01	Open Air Lithic Scatter (CE)
40-02	Historic Domestic Site (CE)	38-13	Prehistoric Civil War (CE)
42-02	Historic Domestic Site (CE)	44-01	Prehistoric Open Site (CE)
43-01	Quarry/Reduction Site (CE)	44-02	Historic Domestic Site (CE)
44-01	Base Camp (CE)	48-01	Prehistoric Open Site (CE)
44-02	Historic Domestic Site (CE)	163-01	Porterwood Mill (CE)
44-03	Historic Domestic Site (CE)	188-01	Prehistoric Open Site (CE)
44-04	Open Air/Lithic Surface (CE)	188-02	Prehistoric Open Site (CE)
58-03	Base Camp/Hunting Station (CE)	188-03	Prehistoric Open Site (CE)
108-03	Base Camp (CE)	189-01	Prehistoric Open Site (CE)
108-04	Base Camp (CE)	189-02	Prehistoric/Revolutionary War (CE)
109-01	Camp (CE)	IBK-04	Prehistoric/French and Indian War (CE)
117-01	Historic Domestic Site (CE)	IBK-08	Historic Farm Site (CE)
157-05	Prehistoric Site (CE)	IGG-02	Surveyor's Camp Site (CE)
164-02	Prehistoric Site (CE)	IMO-65	Prehistoric Open Site (CE)
164-03	Prehistoric Site (CE)	IMO-66	Prehistoric Open Site (CE)
182-02	Historic Domestic Site (CE)	IMO-72	Prehistoric Open Site (CE)
182-03	Historic Domestic Site (CE)	IWD-60	Historic Commercial Site (CE)
182-05	Camp (CE)	IWD-62	Prehistoric Open Site (CE)
182-06	Camp (CE)	IWD-64	Prehistoric Open Site (CE)
189-01	Transient Camp (CE)	IWD-67	Prehistoric Open Site (CE)
IBK-08	Historic Farmstead Remains (CE)	IWD-68	Prehistoric Open Site (CE)
IBK-11	Prehistoric Base Camp (CE)	IWD-69	Prehistoric Open Site (CE)

TABLE III-39

2013 AVERAGE DAILY TRAFFIC VOLUMES FOR ROADWAYS PROJECTED TO EXPERIENCE AN INCREASE OF OVER 3000 VEHICLES

ROUTE	NUMBER OF LANES	ALTERNATIVES		
		NO-BUILD	IMPROVED ROADWAY	BUILD
Grant County 3/3	2	2,000	9,000	2,000
I-81	4	51,000	52,000	55,000
WV 32	2	7,000	13,000	5,000
VA 37	4	21,000	20,000	25,000
WV 55 @ Baker	2	3,000	9,000	1,000
WV 55 @ State Line	2	3,000	10,000	1,000
WV 93	2	3,000	9,000	4,000
US 17	4	47,000	47,000	52,000
US 50	4	17,000	15,000	24,000
US 219 Parsons	2	4,000	10,000	2,000
US 219 Montrose	2	4,000	11,000	1,000

Relative to the cumulative impact on cultural resources based on the five foreseeable future actions, all such actions are subject to the same scrutiny as the proposed project in accordance with Section 106 of the National Historic Preservation Act. Further, the Canaan Valley Wildlife Refuge is in itself a preservation measure and would not impact cultural resources. The Stony Run Dam is located such that potentially affected resources would not constitute additional effects to those identified by the proposed action. Site identification, determinations of eligibility, and mitigation measures for potential effects on cultural resources relative to the Moorefield Floodwall Project are currently underway. Further, the results of these efforts served as background information and basis for the predictive settlement pattern model discussed in the *Cultural Resources Model Test Report*. The management plans for the Monongahela and the George Washington National Forests would primarily involve potential effects to archaeological resources on federal lands. It is not possible at this time to determine whether or not Forest Service activities would affect, in some cumulative fashion, the resources also affected by the proposed action.

h. Probability Zone Distributions

Table III-40 shows the distribution of prehistoric probability zones within the project area, as defined by the Corridor H prehistoric settlement pattern model. Each cell within the table indicates the total area in acres for each probability zone as measured by the GIS within the construction limits of a particular alignment. Percentage distributions are provided permitting comparisons of the impact to undocumented prehistoric sites for each of the project options.

An examination of the probability zone distributions, as shown in Table III-40, suggests that the relative percentage proportions of high, medium, and low probability zones in West Virginia for the IRA and the Build Alternative (Line A) are quite similar. This might be expected since the two alternatives cross similar topographic and environmental zones. In absolute terms, Line A impacts approximately twice as much acreage as the IRA due to the inherent differences in these alternatives. In Virginia, the IRA demonstrates a somewhat higher percentage of medium probability zones (41% vs. 26%) and high probability zones (9% vs. 7%) compared to the Build Alternative, although again, in absolute terms, the IRA affects less acreage. It should be stressed that the probability zones are based on predictions and the actual effects could change based on the Phase I survey results.

Comparison of the lines within the Options Areas in West Virginia and Virginia reveals differential impacts. In the Interchange, Shavers Fork, Forman, Hanging Rock, and Lebanon Church Option Areas, Line A has more high probability acreage than the respective optional lines. In Patterson Creek and Baker, the opposite situation exists, with Lines P and B showing more high probability acreage than Line A. There is little difference among the three Duck Run options, D1, D2, and Line A.

TABLE III-40
TOTAL AREA AND PROPORTIONS OF PREHISTORIC SETTLEMENT PATTERN PROBABILITY ZONES BY ALTERNATIVE AND OPTION AREA

	ALTERNATIVES												
	D5 Corridor	IRA						Build - Line A					
		WV			VA			WV			VA		
	ACRES (RATIO)	HECTARES	ACRES	RATIO	HECTARES	ACRES	RATIO	HECTARES	ACRES	RATIO	HECTARES	ACRES	RATIO
High	3,448 (13%)	82.0	202.6	12%	6.2	15.4	9%	169.5	418.9	12%	11.7	28.9	7%
Medium	6,671 (25%)	102.9	254.3	15%	28.1	69.4	41%	198.5	490.5	14%	46.3	114.5	26%
Low	16,814 (62%)	518.3	1,280.7	73%	33.6	83.0	50%	1,063.5	2,627.9	74%	119.1	294.2	67%
Total	26,933 (100%)	703.2	1,737.6	100%	67.9	167.8	100%	1,431.5	3,537.3	100%	177.1	437.6	100%

TABLE III-40 (CONTINUED)
TOTAL AREA AND PROPORTIONS OF PREHISTORIC SETTLEMENT PATTERN PROBABILITY ZONES BY ALTERNATIVE AND OPTION AREA

	OPTION AREAS IN WEST VIRGINIA																	
	Interchange						Shavers Fork						Patterson Creek					
	Line I			Line A			Line S			Line A			Line P			Line A		
	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO
High	0.6	1.5	3%	2.1	5.1	9%	5.5	13.5	11%	9.1	22.4	21%	14.3	35.4	21%	9.2	22.8	15%
Medium	12.1	29.8	59%	15.4	38.0	67%	3.4	8.4	7%	2.6	6.5	6%	17.1	42.2	24%	14.3	35.4	24%
Low	7.7	19.1	38%	5.3	13.2	24%	41.8	103.3	82%	31.2	77.0	73%	38.2	94.3	55%	36.7	90.8	61%
Total	20.4	50.4	100%	22.8	56.3	100%	50.7	125.2	100%	42.9	105.9	100%	69.6	171.9	100%	60.2	149.0	100%

	OPTION AREAS IN WEST VIRGINIA																	
	Forman						Baker						Hanging Rock					
	Line F			Line A			Line B			Line A			Line R			Line A		
	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO
High	12.7	31.4	27%	30.6	75.6	53%	13.2	32.6	26%	12.2	30.2	26%	1.1	2.7	4%	1.3	3.1	4%
Medium	10.7	26.4	22%	6.8	16.9	12%	2.7	6.6	5%	2.4	6.0	5%	0.4	1.1	2%	1.7	4.1	6%
Low	24.2	59.8	51%	20.0	49.4	35%	34.2	84.6	69%	31.5	77.8	69%	25.2	62.2	94%	26.9	66.4	90%
Total	47.6	117.6	100%	57.4	141.9	100%	50.1	123.8	100%	46.1	114.0	100%	26.7	66.0	100%	29.9	73.6	100%

	OPTION AREAS IN VIRGINIA														
	Duck Run									Lebanon Church					
	Line D1			Line D2			Line A			Line L			Line A		
	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO	ha	ac	RATIO
High	0.0	0.0	0%	0.0	0.0	0%	0.0	0.0	0%	5.9	14.5	12%	10.3	25.5	19%
Medium	5.4	13.4	7%	3.6	9.0	4%	6.0	14.9	7%	29.9	73.8	60%	33.0	81.5	60%
Low	75.2	185.8	93%	85.5	211.2	96%	77.7	192.1	93%	14.1	34.8	28%	11.8	29.1	21%
Total	80.6	199.2	100%	89.1	220.2	100%	83.7	207.0	100%	49.9	123.1	100%	55.1	136.1	100%

4. AVOIDANCE, MINIMIZATION, AND MITIGATION

A variety of mitigation options are available to planners subsequent to a final determination of Adverse Effect for significant cultural resources. Mitigation of Adverse Effect to archaeological sites (both historic and prehistoric) through avoidance is always the preferred option. If additional data demonstrates that a resource merits preservation in place, that resource must be avoided. For sites that do not merit preservation in place, and if it is neither prudent nor feasible to minimize impact through avoidance, a Phase III data recovery program would be developed in cooperation with the appropriate State Historic Preservation Office.

If Adverse Effect to significant historic structures cannot be avoided, various mitigation options are available to reduce visual and auditory impact, depending on the nature and severity of the impact. These include:

1. Minor alignments shifts
2. Grassed embankments, earthworks, or other landscaping
3. Vegetative screening in the form of trees, bushes, or hedgerows
4. Artificial barriers such as fences, walls and noise barriers
5. Relocation of the resource
6. HABS-HAER recordation prior to destruction
7. Other interpretive documentation.

M. WATERSHED OVERVIEW

1. INTRODUCTION

Except for a few areas of impact assessment (e.g., air quality, noise), the analysis of the environmental impacts of a proposed highway project has traditionally focused on the direct impacts on the resources lying within a relatively narrow corridor. Recently, increased emphasis has been placed on the analysis of secondary and cumulative impacts (Bank, 1992). These impacts may occur well outside of the narrow corridor. This increased emphasis on secondary and cumulative impact analysis recognizes a need to understand impacts in a broader perspective than direct impact measurement. Southerland, in his report to the EPA entitled *Evaluation of Ecological Impacts from Highway Development* (1993), recognizes the need to put impacts in a broader and more meaningful ecological context when he states, "Although in some cases the ecological impacts may be limited to the highway corridor (e.g., 300 feet in width), impacts will often extend to the watershed or ecological region."

To put the impacts of this proposed project in a broader ecological context, a watershed approach has been taken. The proposed project crosses two river systems: the Monongahela River and the Potomac River. Each river system is composed of several watersheds (Exhibit III-41). Within West Virginia, the proposed project crosses five of these watersheds: the Tygart Valley and Cheat Rivers in the Monongahela River system; the North and South Branches of the Potomac River, the Cacapon River and the Shenandoah River in the Potomac River system. In Virginia, the proposed project crosses the Shenandoah River watershed.

These six watersheds cover a very large geographical area in comparison to the proposed project. Because of the size disparity between the geographic coverage of the watershed and the geographic coverage of the proposed project within that watershed, utilizing the total resource base of each of these watersheds to determine ecological impacts would likely underrepresent the scale of magnitude or ecological importance of the project's environmental impacts. To adjust for this scale of magnitude effect and to produce a broader and more representative ecological impact analysis, each of the six major project watersheds was divided into smaller subwatersheds that are more directly related in a geographic and ecological sense to the proposed project. These subwatersheds are termed *local project watersheds.* In terms of location, these are the subwatersheds of the major watershed that "surround" the proposed project. A graphical representation of these is presented in Exhibit III-42. In the following *Existing Environment and the Environmental Impacts* Sections, these local project watersheds are referenced by the major watersheds that "surround" them. For example, collectively the Stony River and Patterson Creek subwatersheds are referenced as the North Branch of the Potomac River watershed.

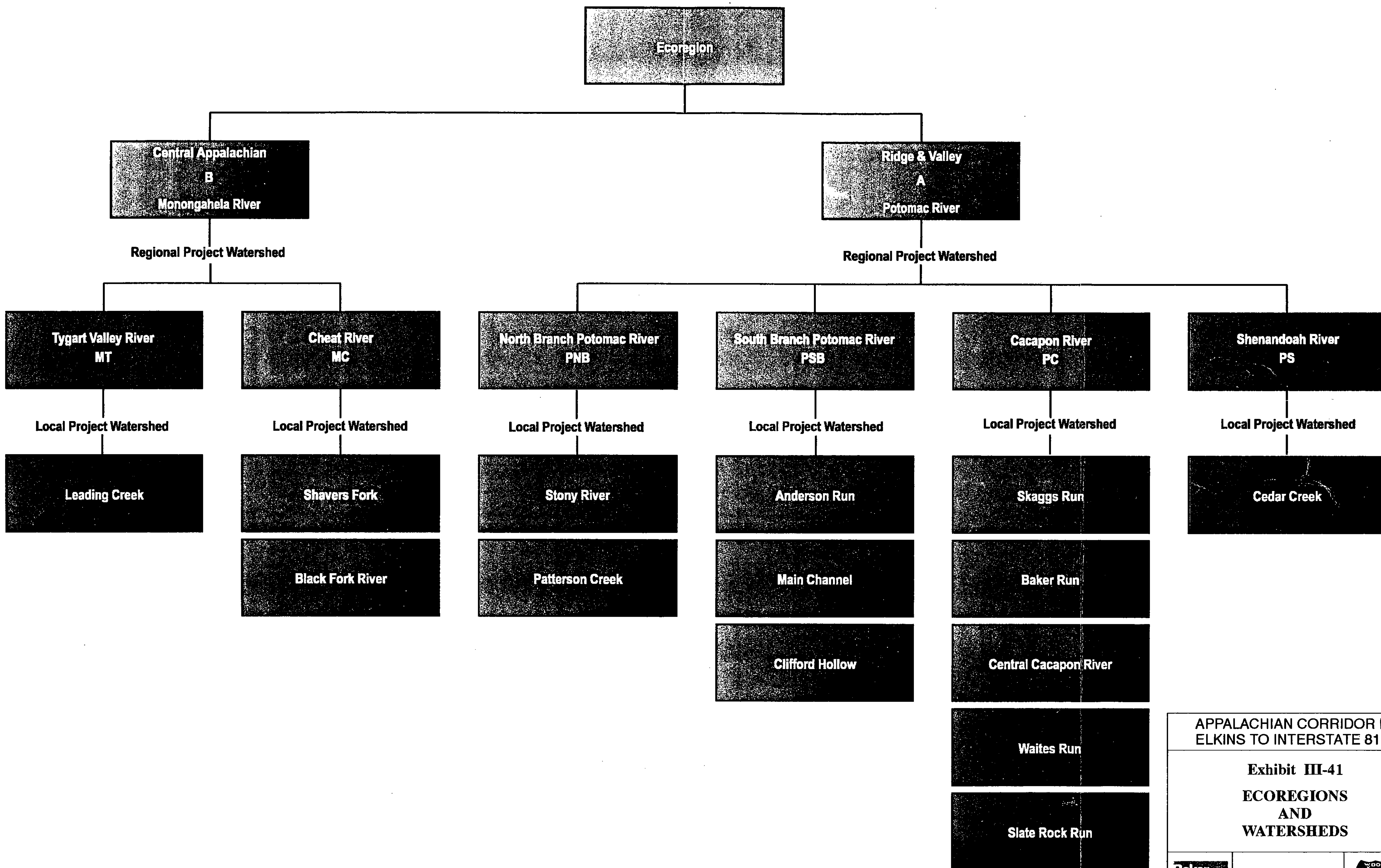
While the use of the total watershed area could underrepresent the ecological importance of certain impact types, the use of the local project watersheds could overestimate and consequently misrepresent the ecological importance of other impacts (i.e., impacts that occur beyond the boundaries of the local project watersheds). To adjust for the possible overestimate of impacts and to be certain that the ecological importance of impacts outside the local project watersheds was not missed, *regional project watersheds* were defined and utilized for the analysis of the ecological importance of secondary and cumulative effects. Regional project watersheds cover the portion of the major watershed that is bounded by the 30-Minute Contour defined for this project.

In summary, local project watersheds are utilized for the analysis of direct ecological impacts of the proposed project, while regional project watersheds are utilized for the analysis of secondary and cumulative ecological impacts presented in the *Secondary and Cumulative Impacts Technical Report,* and summarized herein.

2. RIVER SYSTEMS

a. Monongahela River System

The Monongahela River System drains portions of West Virginia, Pennsylvania, and Maryland toward the Mississippi River. The West Virginia portion of the Monongahela River System stretches from Pocahontas County to the Pennsylvania state line, comprising a total area of 10,826 square kilometers (4,180 sq. miles). The river system is located in the Appalachian Mountain Section of the Appalachian Plateau Province, which is typified by mountains and high plateaus with steep slopes and long, narrow valleys and well developed dendritic drainage patterns. Near the Allegheny Front, elevations range from 900 to 1,400 meters (3,000-4,600 feet), while near Elkins, the elevations range from 500 to 750 meters (1640 to 2460 feet). This river system is part of the Mixed Mesophytic Forest Biome, which consists of a variety of hardwood and evergreen forests. During the half century between 1870 and 1920, the upland forests of West Virginia were subjected to such intensive logging that by the end of this period the original forests had been essentially eliminated (Clarkson, 1968). Extensive forest fires, fueled by large amounts of logging slash, also destroyed large areas of virgin timber. As a result of the extensive logging and frequent fires that occurred throughout the upland forest region during this period, the present day forest vegetation is mostly a mosaic of second and third-growth forest communities (Stephenson, 1993).

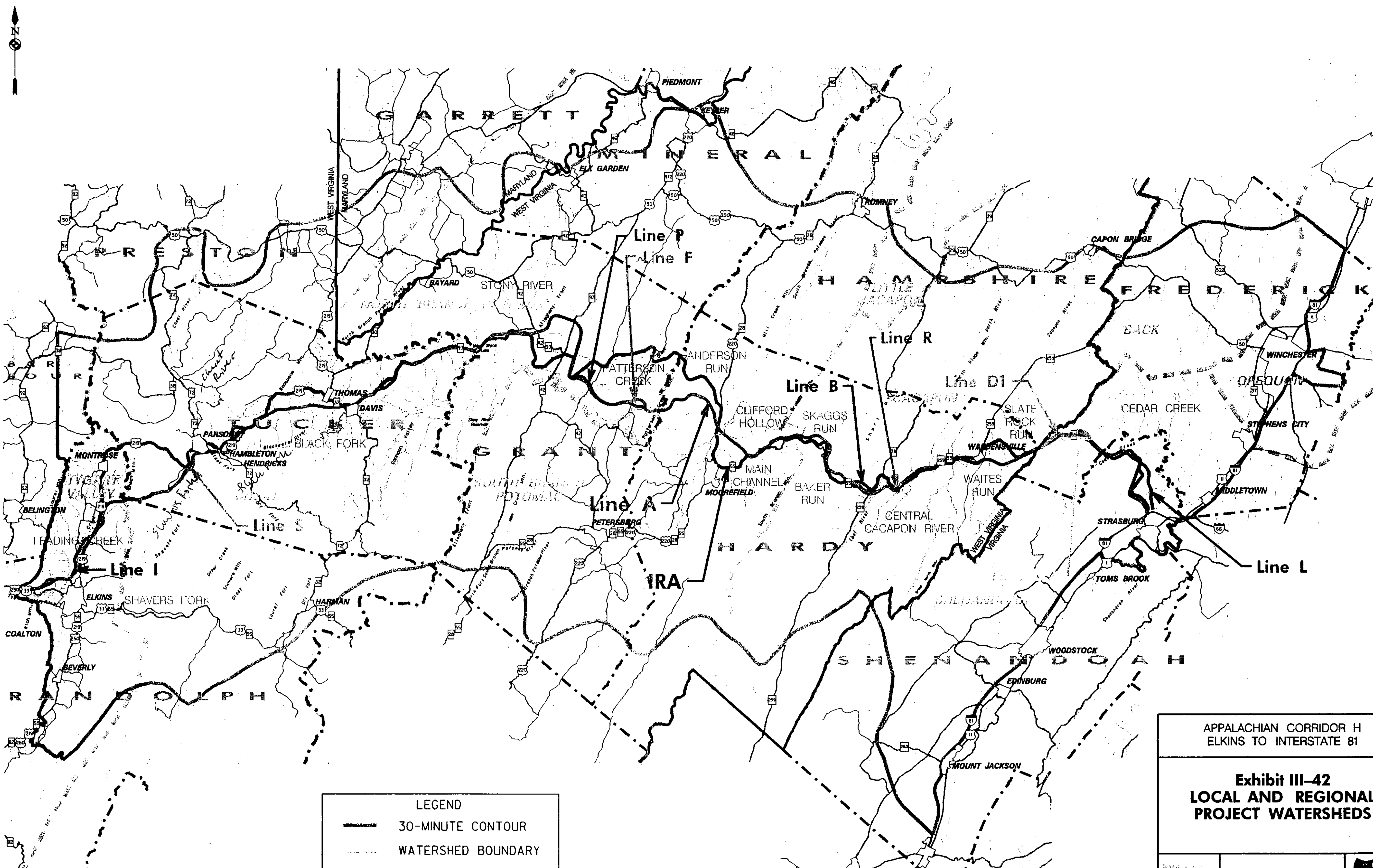


APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-41

ECOREGIONS AND WATERSHEDS

Baker



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-42
LOCAL AND REGIONAL PROJECT WATERSHEDS

LITSHED.DGN

A wide range of wildlife is present within this river system due to the abundance and variety of upland forest, pasture and cropland, and riverine habitats. A number of game, non-game, and furbearing mammals as well as upland game birds, waterfowl, non-game birds, and raptors use these habitats for feeding and breeding. One federally listed Threatened (Cheat Mountain Salamander, *Plethodon nettingi*) and three federally listed Endangered (Virginia Northern Flying Squirrel, *Glaucomys sabrinus fuscus;* Indiana bat, *Myotis sodalis;* and the Virginia Big-eared Bat, *Plecotus townsendii virginianus*) wildlife species, as well as one federally listed Endangered plant species (Running Buffalo Clover, *Trifolium stoloniferum*) occur within the upland habitat of this river system.

Annual precipitation in this portion of the Monongahela River basin ranges from 102 to 178 cm (40 to 70 inches) per year depending upon elevation, terrain and exposure. In the high elevations, wetlands are typically bogs and fens dominated by mosses, sedges and shrubs, reflecting the higher precipitation and cooler temperatures. Along the larger rivers and streams in lower elevation valleys, man-made ponds and floodplain wetlands are the dominant wetland types. The Monongahela River System is composed of the Tygart Valley River Watershed and the Cheat River Watershed.

(1) Tygart Valley River Watershed

The Tygart Valley River rises near Spruce, West Virginia in Pocahontas County and flows northward toward the Monongahela River. The entire watershed drains 3,564 square kilometers (1,376 sq. miles) including portions of Randolph, Upshur, Barbour, and Taylor Counties. The Tygart Valley River watershed is dominated by deciduous forest (72%) with cropland and pasture comprising 22% of the existing land use. The Tygart Valley River regional project watershed drains approximately 396 square kilometers (153 square miles) north of Elkins, West Virginia.

The proposed project lies within the drainage area of Leading Creek, which is characterized by wide stream valleys with meandering stream channels, silty substrates, and wide floodplains. The elevations and topography of this watershed are not as high or as steep as found in surrounding watersheds. Leading Creek and a number of its tributaries have been degraded by agricultural nonpoint source pollution. Within the Leading Creek subwatershed, there are no native or stocked trout streams, Nationwide Rivers Inventory listed rivers, or streams impacted by acid mine drainage.

Major municipalities in the Leading Creek watershed include Elkins and Montrose. Major employment sectors include retail trade, manufacturing, and services. This watershed has one industrial park located in Elkins (Elkins-Randolph County Park).

(2) Cheat River Watershed

The Cheat River is formed near Parsons, West Virginia at the confluence of the Black Fork and Shavers Fork and flows north to its confluence with the Monongahela River at Point Marion, Pennsylvania. The Cheat River watershed, including all its tributaries, is comprised of parts of Pocahontas, Randolph, Tucker, Preston, and Monongahela Counties in West Virginia. The Cheat River regional project watershed drains 1,750 square kilometers (675 square miles).

Much of the Cheat River watershed is composed of undeveloped rural land. This watershed is dominated by deciduous and mixed forests (84%) with cropland and pasture comprising 12% of the existing land use. Part of the Monongahela National Forest (MNF), including the Congressionally designated Otter Creek and Dolly Sods Wilderness areas, lie within the Cheat River regional project watershed. These wilderness areas are not impacted by the proposed alignments. Several areas of historic interest including the Corrick's Ford Battlefield and the Douglas Coke Ovens are also present.

Historically, the Cheat River watershed has been an area dominated by coal mining, especially in the northern portion of the watershed, and particularly in the drainage area of the Black Fork and Beaver Creek. Active mines continue to operate within this watershed. As a result, many abandoned deep and surface mines in the area discharge untreated mine drainage, the major water quality problem in the watershed. Within portions of the watershed which have not been subjected to mining, high quality streams and rivers exist, including Shavers Fork and several trout streams.

Several restoration and reclamation projects are currently being undertaken along the Blackwater River and portions of the Black Fork, Long Run and Middle Run. WVDEP is constructing a limestone treatment station along the Blackwater River, approximately one mile upstream from Davis, above the confluence with Beaver Creek. The goal is to reduce the acidity of a five mile segment of the river sufficiently to sustain a year-round trout population. Completion of this project is anticipated for late 1994. Portions of the drainage areas of Middle Run, Long Run and the North Fork of the Blackwater River have been recently modified as part of the Albert Highwall and Douglas Highwall Reclamation projects. These projects included grading, covering and planting highwall areas and treatment of acid mine drainage.

Major municipalities in this watershed include Parsons, Hambleton, Hendricks, Thomas, and Davis, West Virginia. Major employment sectors include manufacturing, services, and mining. This watershed currently has no industrial park development.

b. Potomac River System

The Potomac River System drains 37,992 square kilometers (14,669 square miles) of portions of West Virginia, Virginia, Maryland, Pennsylvania, and the District of Columbia toward the Chesapeake Bay and the Atlantic Ocean. The Potomac River System lies in the Valley and Ridge Province which is typified by long, narrow and level valleys between steep parallel slopes and a trellised drainage pattern. Elevations range from 220 meters (725 feet) in the Shenandoah Valley to nearly 880 meters (2,900 feet) in Grant County. Within West Virginia, the Potomac River System drains 9,039 square kilometers (3,490 square miles).

This river system is part of the Oak-Chestnut Forest Biome, which consists of mixed hardwood forests. The original forests were essentially eliminated by intensive logging and extensive forest fires near the turn of the century. This has resulted in a present day vegetative community of second and third-growth forests. Large portions of the present deciduous forest (primarily oaks) have been defoliated by gypsy moth outbreaks in the eastern portion of this system, including parts of the George Washington National Forest (GWNF). By the summer of 1992, reproducing populations of gypsy moths were found on approximately half of GWNF and since the original outbreak (1986), 40% of the forest has experienced at least one defoliation (USDA, FEIS George Washington National Forest, 1993). Repeated defoliations can result in severe tree mortality, thereby initiating a change in forest species composition where oaks are replaced by species less susceptible to gypsy moth damage. Currently, there is no cost-effective or environmentally acceptable way of achieving wide-spread control of gypsy moth populations in heavily infested areas.

Wetlands within this system are mostly small man-made ponds and floodplain wetlands formed along the wider river valleys. A wide range of wildlife is present within this river system due to the abundance and variety of upland forest, pasture and cropland, and riverine habitats. A number of game, non-game, and furbearing mammals as well as upland game birds, waterfowl, non-game birds, and raptors use these habitats for feeding and breeding. Five federally listed Endangered wildlife species (Virginia Northern Flying Squirrel, Indiana bat, Virginia Big-eared Bat, Peregrine Falcon, *Falco peregrinus*, Bald Eagle, *Haliaeetus leucocephalus*) occur within the upland and riverine habitats of this river system. Average annual precipitation is lower than found west of the Allegheny Front (97 cm (38 inches) per year). The watersheds which the proposed project cross include the North Branch of the Potomac River, the South Branch of the Potomac River, the Cacapon River, and the Shenandoah River.

(1) North Branch of the Potomac River Watershed

The North Branch of the Potomac River watershed drains portions of Grant and Hampshire Counties and all of Mineral County, West Virginia. The North Branch of the Potomac River watershed is dominated by deciduous and mixed forests (79%) with cropland and pasture comprising 17% of the existing land use. The river itself runs generally northeastward along a basin between the Allegheny Front and Backbone Mountain. The North Branch of the Potomac regional project watershed drains approximately 1,200 square kilometers (460 square miles).

Suspected sources of pollution in the North Branch of the Potomac River include sediment runoff from agriculture, timbering, oil and gas exploration, and coal refuse piles. Acid mine drainage, mainly from abandoned mines, also poses a major problem, generally limited to the drainage's of Stony River and Abrams Creek.

A portion of Seneca Rocks National Recreation Area lies in the southwest portion of this watershed. Greenland Gap, located near the town of Scherr, West Virginia, is a unique topographic feature within this watershed. The gap is considered to be the least disturbed and most distinctive water gap in West Virginia, with towering sandstone cliffs that arch upward over 244 meters (800 feet) (Scott, 1991). The above two areas are not impacted by the proposed alignments. In the Patterson Creek drainage, there are native and stocked trout streams.

The major municipality in this watershed is Bayard in Grant County, West Virginia. This watershed has one industrial park near Bayard that is not yet constructed.

(2) South Branch of the Potomac River Watershed

The South Branch of the Potomac River is the larger of the two major branches of the Potomac River. The South Branch rises in Highland County, Virginia and flows in a general northeast direction into West Virginia to its confluence with the North Branch. The South Branch of the Potomac River drains portions of Pendleton, Grant, Hardy, and Hampshire Counties. The South Branch of the Potomac River watershed is dominated by deciduous and mixed forests (72%) with cropland and pasture comprising 26% of the existing land use. The portion of this watershed within the 30-Minute Contour drains 1,338 square kilometers (510 square miles) within Grant, Hardy and Hampshire counties.

The water quality of the South Branch is considered excellent. However, some pollution associated with agriculture, poultry production, and forestry is present. The extensive stream channel work conducted as a result of the November 1985 flood has modified a number of the streams in the watershed. Within the South Branch watershed, there are no native or stocked trout streams or streams impacted by acid mine drainage, but the tributaries to Anderson Run exhibit impacts from agricultural activities. The South Branch of the Potomac River is listed on the Nationwide Rivers Inventory.

Moorefield and Petersburg, West Virginia are the major municipalities in this watershed. This watershed has two industrial parks in Moorefield, which is predicted to be a major growth center for the South Branch of the Potomac area by local and regional planners, and two industrial parks in Petersburg, which is experiencing economic growth due to the expanding poultry industry and other industrial development.

(3) Cacapon River Watershed

The Cacapon River originates in the southeastern portion of Hardy County on West Mountain. This watershed encompasses 1,792 square kilometers (692 square miles) in Hardy, Hampshire, and Morgan Counties. The Cacapon River watershed is dominated by deciduous and mixed forests (82%) with cropland and pasture comprising 17% of the existing land use. The Cacapon River regional project watershed drains approximately 1,190 square kilometers (460 square miles). The eastern end of this watershed lies within the George Washington National Forest. This watershed contains the Lost River, so-named because the upper reaches of the Cacapon River goes completely underground into cavernous limestone during periods of low flow. Approximately 6.4 kilometers (4 miles) west of Wardensville, the river cuts an underground passage in the existing limestone and remains underground for 3.2 kilometers (2 miles) until it emerges west of Wardensville. (See Section III-G, *Groundwater* for additional information on this feature.)

Water quality within the watershed is excellent, with limited pollution associated with agricultural and timber harvesting activity. There has been no substantial mining activity in this watershed. Wardensville is the major municipality in this watershed. The Wardensville Industrial Park is located on the east side of Wardensville, but has had limited development.

(4) Shenandoah River Watershed

The Shenandoah River watershed drains portions of Augusta, Rockingham, Page, Frederick, Shenandoah, Warren, and Clarke Counties in Virginia and Jefferson and Hardy Counties in West Virginia. The Hardy/Frederick County line and the axis of Great North Mountain mark the division between the Shenandoah River watershed and the Cacapon River watershed to the west. The Shenandoah River watershed existing land use is composed of deciduous and mixed forests (52%), and cropland and pasture (40%). The Shenandoah River regional project watershed drains approximately 875 square kilometers (340 square miles) in Frederick and Shenandoah Counties in Virginia.

The western portion of this watershed lies within the George Washington National Forest. This watershed includes the municipalities of Strasburg and Winchester, Virginia. Interstate 81 is a major north-south transportation corridor located within this watershed. Major employment sectors include tourism and associated retail trade, the apple industry, and manufacturing. This watershed has one industrial park located in Mt. Jackson, Virginia and three in Winchester. Because the Shenandoah Valley has played a significant role in the nation's history, historic structures and sites are prevalent within the watershed.

N. FLOODPLAINS

The protection of floodplains and floodways is required by Executive Order 11988, *Floodplain Management*; US DOT Order 5640.2, *Floodplain Management and Protection*; FHPM 6-7-3-2; and 23 CFR 650. The intent of these regulations is to avoid or minimize highway encroachments within the 100 year (base) floodplains, where practicable, and to avoid supporting land use development which is incompatible with floodplains values. Where encroachment is unavoidable, the regulations require taking appropriate measures to minimize impacts.

Floodplains occur along streams and rivers, but not all floodplains represent a risk of flood damage. Officially designated floodplains are established by the Federal Emergency Management Agency (FEMA) where substantial flooding occurs near development. Floodplains are classified by FEMA based on the accuracy of the analysis used to calculate the extent of the floodplain and the regulations restricting development within the floodplain. A 100-year floodplain is the area that would be inundated by a 100-year flood (i.e. a flood which has the probability of occurring once every 100-years). The extent and elevation of the 100-year flood is determined through a detailed hydraulic study. A flood hazard zone is the area flooded during a 100-year storm; the area is determined by an engineer's professional judgment with respect to historical stream data and topography. A regulatory floodway is a portion of the 100-year floodplain within which the majority of the flood waters are carried and where flooding hazards are highest. Encroachment within a floodway could result in increased flood elevations and, possibly, additional property damages during a flood event. As a result, federal, state, and local agencies regulate development in floodways. The minimum federal standards set by FEMA limit such flood elevation increases to one foot, provided that hazardous velocities are not produced.

1. METHODOLOGY

The assessment methodology is based on the requirements provided in Executive Order 11988, *Floodplain Management*; 23 CFR Part 650; FHPM 6-7-3-2, *Location and Hydraulic Design of Encroachments on Floodplains*, and US DOT 5650.2, *Floodplain Management and Protection*. Floodplain regulations require that a Location Hydraulics Study be performed pursuant to 23 CFR Part 650. The study evaluates the following items for each of the alternatives under consideration:

- The risk of flooding associated with the implementation of the highway facility;
- The impacts on natural and beneficial floodplain values;
- The support of development within the floodplain; and
- Measures to minimize floodplain encroachments.

Floodplain regulations also require the use of National Flood Insurance Program (NFIP) maps to identify the limits of the 100-year floodplain. The NFIP was established by FEMA and is administered and enforced through communities affected by floodplain encroachments. Under the authority of the NFIP, some communities have established permit requirements for all development within the base floodplain zone. As a result, a community's participation status in the NFIP dictates what type of mapping is available for estimating floodplain encroachments. A community's participation and status in the NFIP is based on the Regular Program and the Emergency Program.

Communities participating in NFIP's Regular Program generally have quantitative flood hydraulic studies performed on each floodway. In these communities the NFIP map is a Flood Insurance Rate Map (FIRM) and, in the majority of cases, a regulatory floodway is in effect. Communities participating in NFIP's Emergency Program generally possess qualitative flood hydraulic data for the floodway. In the Emergency Program, the community's NFIP map is a Flood Hazard Boundary Map (FHBM) showing only approximate base floodplain boundaries.

As defined by FEMA, the three types of NFIP maps include Flood Hazard Boundary Maps (FHBM), Flood Boundary and Floodway Maps (FBFM), and Flood Insurance Rate Maps (FIRM). The FHBM are usually not based on detailed hydraulic studies of a floodway and present only approximate base floodplain boundaries. According to FEMA, approximate analyses were used to study those areas having low development potential or minimal flood hazards. The FBFM accurately delineate floodplains and floodways because they are derived from detailed hydraulic studies of the floodway in question. Conversely, detailed hydraulic studies are performed on major rivers and streams, resulting in greater accuracy for estimating floodplain and floodway boundaries for such waterbodies. Boundaries for floodplain and floodway zones of smaller streams and tributaries are qualitatively estimated because no detailed hydraulic studies have been performed on them. FIRM's are usually created concurrently with the FBFM, are based on the same hydraulic analyses, detail flood rate zones, and provide elevations for base flooding. The FIRM's estimate 100 and 500 year floodplain boundaries for major rivers and streams and approximate floodplain boundaries for small streams and tributaries.

a. Data Collection

Flood Insurance Rate Maps (FIRM) and Flood Boundary and Floodway Maps (FBFM) were obtained for the project area to determine the limits of the 100-year floodplains and regulatory floodways within the study area.

A literature search was conducted to compile historical flooding information. This information was used to assess the flooding risks associated with the implementation of a highway facility within the study area. The primary sources of historical flooding information included the US ACOE, Pittsburgh and Baltimore Districts; the US DOI; FEMA; and the State of West Virginia, Office of Emergency Services.

Additional floodplain data were obtained by field views of each prospective stream crossing that was identified as an encroachment. For some streams, supplementary flooding history was obtained by contacting local residents.

b. Data Analysis

The base floodplains, regulatory floodways, and the alternatives under consideration were digitized and superimposed on the GIS mapping of the project area. The area of encroachment on flood hazard zones, 100-year floodplains, and floodways was calculated within the construction limits of each alignment. Each floodplain encroachment was identified as one of the following six categories:

- 100-Year Floodplain - Longitudinal Encroachment
- 100-Year Floodplain - Transverse Encroachment
- 100-Year Floodplain - Complex Encroachments
- Regulatory Floodway - Longitudinal Encroachment
- Regulatory Floodway - Transverse Encroachment
- Regulatory Floodway - Complex Encroachments

Impacts parallel to the floodplain are considered longitudinal encroachments. Impacts perpendicular to the floodplain are considered transverse encroachments. A complex encroachment would occur when there are both longitudinal and transverse encroachments or in situations where an impacted floodplain from one stream converges with an impacted floodplain from another stream.

An alternatives analysis of floodplain avoidance was conducted for a comparison of the No-Build Alternative, the IRA, and the Build Alternative.

c. HEC-2 Analyses

In situations where stream crossings would involve encroachments on designated floodways and floodplains, the US ACOE's HEC-2 Water Surface Profile Computer model was used to determine the flood elevations both before and after construction for a 100-year flood event. In cases where the initial hydraulic structure would result in an increase in the 100-year flood elevations of more than one foot, the structure was redesigned to accommodate a greater floodflow. The three types of hydraulic structures to be used for the proposed project are pipes, concrete box culverts, and bridges.

2. EXISTING ENVIRONMENT

Floodplains serve to moderate the flow of floods, provide water quality maintenance, act as areas for ground water recharge, and serve as habitat for plants and animals. Most floodplains in the project area lie on rural, undeveloped land and tend to be narrow because they are confined by steep valleys. Shavers Fork, Black Fork, and their tributaries flow through steep valleys resulting in relatively narrow, well defined 100-year floodplains that are restricted by adjacent valley walls. Flood flow is generally deeper and at a greater velocity in these smaller, restricted areas along the steep valley streams. Regulatory floodways associated with 100-year floodplains are most common on these streams.

Leading Creek, the South Branch of the Potomac River, and the Cacapon River have relatively wide floodplains on flat valley floors. Due to the flat, wide, and level nature of these floodplains, floodflow velocities and depth outside the main stream channel are relatively low. The most common flood areas found on these floodplains are the 100-year floodplains and flood hazard zones. Some regulatory floodways exist in more densely developed areas.

3. IMPACTS

The No Build Alternative would not cause additional encroachments to flood hazard zones, 100-year floodplains, or floodways. Such encroachments would occur under the IRA and the Build Alternative. Table III-41 identifies the type of flood area affected, the type of encroachment (longitudinal, transverse, or complex), and the area of encroachment by watershed and stream. The stations of the floodzone areas are shown in the *Alignment and Resource Location Plans*.

Table III-42 provides a summary of the flood hazard zone, 100-year floodplain, and floodway encroachments for each of the three alternatives and the option areas. The IRA would result in a slightly greater total flood zone encroachment than would Line A, but the IRA would encroach upon less floodplain and floodway than would Line A. There would be no flood zone encroachments within the Patterson Creek Option Area or the Hanging Rock Option Area. Line A would result in the least flood zone encroachments within the Interchange Option Area, the Forman Option Area, or the Baker Option Area. Within the Shavers Fork Option Area, Line S would avoid encroachment into a regulatory floodway. Within the Duck Run Option Area, Line D2 would avoid flood zone encroachments. Within the Lebanon Church Option Area, Line L would avoid flood zone encroachments.

TABLE III-41

SUMMARY OF FLOOD ZONE ENCROACHMENTS BY WATERSHED

IRA FLOOD ZONE ENCROACHMENTS

WATERSHED	STREAM NAME	LINE	STATION	AFFECTED FLOOD AREA			ENCROACHMENT TYPE			ENCROACHMENT AREA		HYDRAULIC STUDY	INCOMPATIBLE DEVELOPMENT
				FHZ	100-Yr	Way	Long.	Trans.	Comp.	Hectare	Acre		
Tygart Valley River	Leading Creek at Claylick Run	IRA	444+00 to 451+00		✓				✓	3.4	8.3	✓	None
	Leading Creek	IRA	547+00		✓			✓		0.2	0.6		None
	Leading Creek at Stalnaker Run	IRA	620+00	✓					✓	0.4	0.9		None
	Leading Creek	IRA	696+00	✓				✓		0.5	1.3	✓	None
	Leading Creek	IRA	710+00	✓				✓		0.4	1.0	✓	None
	Wilmoth Run	IRA	777+00	✓				✓		0.2	0.6		None
	Cherry Fork	IRA	1594+00	✓				✓		1.5	3.6		None
	Pond Lick Run	IRA	1714+00	✓				✓		0.2	0.5		None
Cheat River	Haddix Run	IRA	1895+00 to 2055+00		✓		✓			2.1	5.2		None
	Pendleton Creek	IRA	4283+00 to 4287+00	✓				✓		0.2	0.5		None
N. Br. Potomac River	Patterson Creek	IRA	5893+00	✓				✓		0.4	1.1		None
S. Br. Potomac River	Anderson Run	IRA	6371+00	✓				✓		0.6	1.4		None
	South Branch Potomac River	IRA	76480+00 to 5291+00	✓	✓				✓	7.7	19.1		None
	Fort Run	IRA	5396+00	✓				✓		0.4	1.1		None
Cacapon River	Baker Run	IRA	6025+00	✓					✓	0.5	1.2		None
	Lost River	IRA	6230+00 to 6310+00	✓			✓			3.1	7.6		None
	Lost River	IRA	6498+00	✓				✓		0.3	0.7		None
	Trout Run	IRA	6659+00	✓				✓		0.4	1.0		None
Shenandoah River	Turkey Run	IRA	453+00	✓				✓		0.6	1.4		None
	Mulberry Run	IRA	625+00	✓				✓		0.1	0.2		None
	Duck Run	IRA	102+00 to 198+00	✓					✓	2.0	4.9		None
	Cedar Creek	IRA	290+00	✓				✓		1.0	2.5		None

Where:

FHZ = Flood Hazard Zone
100-Yr = 100-Year Floodplain
Way = Floodway

Long. = Longitudinal Encroachment
Trans. = Transverse Encroachment
Comp. = Complex Encroachment

TABLE III-41 (CONT.)
SUMMARY OF FLOOD ZONE ENCROACHMENTS BY WATERSHED

BUILD ALTERNATIVE FLOOD ZONE ENCROACHMENTS

WATERSHED	STREAM NAME	LINE	STATION	AFFECTED FLOOD AREA			ENCROACHMENT TYPE			ENCROACHMENT AREA		HYDRAULIC STUDY	INCOMPATIBLE DEVELOPMENT
				FHZ	100-Yr	Way	Long.	Trans.	Comp.	Hectare	Acre		
Tygart Valley River	Leading Creek at Claylick Run	A	449+00		✓				✓	2.0	5.0	✓	None
	Leading Creek at Claylick Run	I	449+00		✓				✓	3.4	8.3	✓	None
	Leading Creek at Pearcy Run	A	569+00		✓				✓	0.7	1.8	✓	None
	Leading Creek	A	615+00 to 625+00		✓		✓			1.4	3.5	✓	None
	Leading Creek at Horse Run	A	637+00 to 647+00	✓					✓	1.3	3.3	✓	None
	Lazy Run	A	746+00	✓				✓		0.9	2.2		None
Cheat River	Slabcamp Run	A	3224+00	✓				✓		0.3	0.8		None
	Shavers Fork	A	3340+00		✓			✓		0.3	0.8	✓	None
	Shavers Fork	A	3460+00 & 3470+00			✓		✓	✓	3.4	8.5	✓	None
	Black Fork	A	3620+00		✓			✓		0.2	0.6	✓	None
	Pendelton Creek	A	4150+00	✓				✓		0.8	2.1		None
N. Br. Potomac River	Patterson Creek	A	5802+00	✓				✓		1.1	2.6		None
	Patterson Creek	F	5784+00	✓				✓		1.3	3.3		None
S. Br. Potomac River	South Branch Potomac River	A	6264+00 to 6277+00	✓				✓		3.0	7.3	✓	None
Cacapon River	Lost River	A	7087+00	✓				✓		0.4	0.9		None
	Lost River	B	7071+00	✓				✓		0.2	0.5		None
	Trout Run	A	7499+00	✓				✓		1.5	3.6		None
Shenandoah River	Duck Run	A	7939+00 & 8028+00	✓				✓		0.8	2.0		None
	Duck Run	D1	7923, 7939, 8028+00	✓				✓		0.8	2.1		None
	Cedar Creek	A	9110+00	✓				✓		1.1	2.7		None
	Mulberry Run	A	8408+00	✓				✓		0.5	1.2		None

Where:

FHZ = Flood Hazard Zone
100-Yr = 100-Year Floodplain
Way = Floodway

Long. = Longitudinal Encroachment
Trans. = Transverse Encroachment
Comp. = Complex Encroachment

TABLE III-42
COMPARISON OF FLOOD IMPACTS BY ALTERNATIVE AND OPTION AREA

COMPARISON OF ALTERNATIVES

AREA OF IMPACT	NO-BUILD	IRA						BUILD ALTERNATIVE: LINE A					
		WV		VA		TOTAL		WV		VA		TOTAL	
		ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac
Flood Hazard Zone	0.0	11.7	28.8	3.3	8.1	14.9	36.9	7.4	18.4	2.4	5.9	9.8	24.3
100-Year Floodplain	0.0	8.1	20.1	0.0	0.0	8.1	20.1	10.6	26.1	0.0	0.0	10.6	26.1
Floodway	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	9.2	0.0	0.0	3.7	9.2
Total Flood Zone	0.0	19.8	48.9	3.3	8.1	23.0	57.0	19.4	48.0	2.4	5.9	21.8	53.9

COMPARISON OF OPTION AREAS: West Virginia

AREA OF IMPACT	LINE A TOTAL IN WV		OPTION AREA COMPARISONS IN WEST VIRGINIA																								
			Interchange				Shavers Fork				Patterson Creek				Forman				Baker				Hanging Rock			
			Line I		Line A		Line S		Line A		Line P		Line A		Line F		Line A		Line B		Line A		Line R		Line A	
	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac
Flood Hazard Zone	5.4	13.3	3.4	8.3	2.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	3.3	1.1	2.6	0.6	1.4	0.2	0.5	0.0	0.0	0.0	0.0
100-Year Floodplain	10.3	25.5	0.0	0.0	0.0	0.0	0.0	0.0	3.4	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Floodway	3.7	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Flood Zone	19.4	48.0	3.4	8.3	2.0	5.0	0.0	0.0	3.4	8.5	0.0	0.0	0.0	0.0	1.3	3.3	1.1	2.6	0.6	1.4	0.2	0.5	0.0	0.0	0.0	0.0

COMPARISON OF OPTION AREAS: Virginia

AREA OF IMPACT	LINE A TOTAL IN VA		OPTION AREA COMPARISONS IN VIRGINIA									
			Duck Run						Lebanon Church			
			Line D1		Line D2		Line A		Line L		Line A	
	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac
Flood Hazard Zone	2.4	5.9	0.8	2.1	0.0	0.0	0.8	2.0	0.0	0.0	0.5	1.2
100-Year Floodplain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Floodway	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Flood Zone	2.4	5.8	0.8	2.1	0.0	0.0	0.8	2.0	0.0	0.0	0.5	1.2

The encroachments resulting from any of the proposed alignments would not induce development incompatible with the functions and values of any flood zone. A detailed analysis of secondary (induced) development performed for this project indicates that there is sufficient land suitable for development outside of flood zones to accommodate the projected development. Details and results of this study are documented in the *Secondary and Cumulative Impact Technical Report.*

a. Tygart Valley River Watershed

In the Tygart Valley River watershed, the IRA would encroach upon 6.8 hectares (16.8 acres) of the 100-year floodplain and flood hazard zones of Leading Creek and five of its tributaries. Detailed hydraulic studies have shown that the transverse Leading Creek crossings and the complex encroachment at Claylick Run would not increase floodwater elevations more than one foot.

Under the Build Alternative, Line A would encroach upon 5.4 hectares (13.6 acres) of the 100-year floodplain and flood hazard zones of Leading Creek and four of its tributaries. A longitudinal encroachment would occur where Line A crosses a low area between two hills. Complex encroachments would occur where Line A would cross a tributary near its confluence with Leading Creek. Detailed hydraulic studies have shown that these encroachments would not result in flood water elevation increases of more than one foot.

Within the Interchange Option Area, Line I would result in 66 percent more flood hazard zone encroachment than would Line A. Within the Tygart Valley River watershed, Line A would result in 20 percent less flood zone encroachments than would the IRA.

b. Cheat River Watershed

In the Cheat River watershed, the IRA would encroach on 2.3 hectares (5.7 acres) of 100-year floodplain and flood hazard zone. The IRA would encroach sporadically along a 4.9 kilometer (3 mile) length of the 100-year floodplain along Haddix Run. The IRA would also encroach on the Pendleton Creek flood hazard zone near its headwaters.

Under the Build Alternative, Line A would encroach upon 5 hectares (12.8 acres) of floodplain and floodway along Shavers Fork, the 100-year floodplain of the Black Fork near Hambleton, and the flood hazard zone encroachments at Slabcamp Run and Pendleton Creek. The encroachments along Shavers Fork and the Black Fork would not increase flood elevations more than one foot, as determined by a detailed hydraulic study.

Within the Shavers Fork Option Area, Line A would cross the Shavers Fork regulatory floodway near Porterwood on two bridges with a total encroachment of 3.4 hectares (8.5 acres). This would be the only encroachment into a regulatory floodway along Line A. Line S would avoid the regulatory floodway by remaining along the eastern side of Shavers Fork, traversing the western slopes of McGowen Mountain.

Within the Cheat River watershed, the IRA would result in 55 percent less flood zone encroachments than would Line A, and would avoid the regulatory floodway. The Build Alternative using Line S within the Shavers Fork Option Area would result in 18 percent less flood zone encroachment than would the IRA.

c. North Branch of the Potomac River Watershed

Within the North Branch of the Potomac River watershed, the IRA would encroach upon the Patterson Creek flood hazard zone downstream of reservoirs that are used for floodwater control.

The only flood zone encroachment along Line A within this watershed is within the Forman Option Area. Line A would encroach upon less of the flood hazard zone of Patterson Creek than would Line F. There would be no flood zone encroachments within the Patterson Creek Option Area.

Within the North Branch of the Potomac River watershed, the IRA would result in 60 percent less flood zone encroachments than Line A.

d. South Branch of the Potomac River Watershed

In the South Branch of the Potomac River watershed, the IRA would encroach upon 8.7 hectares (21.6 acres) of the 100-year floodplain and flood hazard zone of the South Branch of the Potomac River and the flood hazard zones of Fort Run and Anderson Run. The complex encroachment on the South Branch of the Potomac River floodplain would be due to the widening and relocation of US 220. The widening of existing roadway would not result in an elevated road surface and, therefore, would not impede flood flow.

Under the Build Alternative, Line A would transversely encroach upon the flood hazard zone of the South Branch of the Potomac River. At the location of the crossing, FEMA has not defined a 100-year floodplain. Because of the high flooding risk associated with this crossing, a detailed hydraulic study was performed to determine the appropriate bridge length. A 732 meter (2,400 foot) bridge would be required to cross the floodplain without increasing the 100-year flood elevations more than one foot. The limited encroachments would be due to the fill necessary to elevate the bridge approaches.

Within the South Branch of the Potomac River watershed, Line A would result in less flood zone encroachments than would the IRA.

e. Cacapon River Watershed

In the Cacapon River watershed, the IRA would encroach upon 4.3 hectares (10.5 acres) of flood hazard zone along Baker Run, Trout Run, and Lost River. Under the Build Alternative, Line A would result in 1.9 hectares (4.5 acres) of flood hazard zone encroachments along the Lost River and Trout Run. Within the Baker Option Area, Line B would result in 44 percent less encroachment than would Line A.

Within the Cacapon River watershed, Line A would result in 57 percent less flood zone encroachments than would the IRA.

f. Shenandoah River Watershed

In the Shenandoah River watershed, the IRA would encroach upon 3.7 hectares (9 acres) of the flood hazard zones of Mulberry Run, Turkey Run, Duck Run, and Cedar Creek.

Under the Build Alternative, Line A would encroach upon 2.4 hectares (5.9 acres) of the flood hazard zones of Cedar Creek, Duck Run, and Mulberry Run. Within the Duck Run Option Area, Line A and Line D1 would encroach upon the Cedar Creek flood hazard zone, but Line D2 would avoid these encroachments.

Within the Shenandoah River watershed, Line A would result in 34 percent less flood zone encroachments than would the IRA. The Build Alternative, using Line D2 within the Duck Run Fork Option Area, would result in 45 percent less flood zone encroachment than would the IRA.

4. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

Avoidance, minimization, and mitigation measures would not be necessary under the No-Build Alternative. The alignment development process for both the IRA and the Build Alternative included efforts to avoid or minimize floodplain encroachments. Detailed hydraulic studies were performed for all considerable unavoidable encroachments of regulated floodways or 100-year floodplains. In all cases, the final proposed structures would result in less than a foot increase in 100-year flood elevations. Both the IRA and the Build Alternative have been designed to mitigate increases in flood risk. This project is in compliance with Executive Order 11988 regarding floodplain management.

In cases where the initial hydraulic structure would result in an increase in the 100-year flood elevations of more than one foot, the structure was redesigned to accommodate a greater floodflow. The following modifications were incorporated into the design of the Build Alternative:

- Enlarged box culvert to reduce floodwater elevations
- Replaced box culvert with bridge to reduce floodwaters elevations
- Extended bridge over Shavers Fork near Pleasant Run by 700 feet to minimize encroachments
- Extended bridge over the Black Fork by 150 feet to minimize encroachments
- Replaced two short bridges and elevated roadway across the flood zone of the South Branch of the Potomac River with a single 732 meter (2,400 foot) bridge.

O. VEGETATION AND WILDLIFE

The vegetation and wildlife assessment describes the methodology used to identify and evaluate habitat loss, forest fragmentation, and highway induced wildlife mortality. Avoidance, minimization, and mitigation measures related to these impacts are also discussed. Details of the assessment and a further discussion by watershed are contained in the *Vegetation and Wildlife Habitat Technical Report.*

Upland forest is the dominant vegetation type within the proposed project area. As a result of the extensive logging and frequent fires that occurred throughout the upland forest region between 1870 and 1920, the present day forest vegetation is mostly a mosaic of second and third-growth forest communities (Stephenson, 1993). The present forest vegetation community within the proposed project area west of the Allegheny Front is composed primarily of two forest types: the Northern Hardwood Forest and the Appalachian Mixed Hardwood Forest. Northern Hardwood Forests generally occur at elevations above 915 meters (3,000 feet), but can extend down slope as low as 750 meters (2,460 feet) in rich moist loamy soils (Stephenson, 1993). The three dominant tree species of this forest type are sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), and yellow birch (*Betula allegheniensis*). Appalachian Mixed Hardwood Forests generally occur below 750 meters (2,460 feet) and are characterized by a great diversity in species composition. Overstory composition may range from nearly pure stands of red oak (*Quercus rubra*) or yellow poplar (*Liriodendron tulipifera*) to mixtures of twenty or more commercially valuable species.

The portion of the proposed project east of the Allegheny Front lies in the Middle Section of the Ridge and Valley Province. The present forest vegetation community within this area is composed primarily of Northern and Appalachian Mixed Hardwood Forests. However, the species composition of the Northern Hardwood Forest is somewhat different due to lower precipitation levels. This area receives markedly less rainfall than the project area west of the Allegheny Front. Most major air masses move across the Allegheny Mountains from west to east, depositing most of their moisture on the higher ridges west of the Allegheny Front. The resulting tree species are those tolerant of drier conditions. Several species of oak (chestnut oak, *Quercus prinus*; red oak, and white oak, *Quercus alba*) typically occur in association with various species of pine (Virginia pine, *Pinus virginiana;* pitch pine, *P. rigida*; and Table Mountain pine, *P. pungens*).

1. HABITAT LOSS

a. Methodology

The US Fish and Wildlife Service's (USFWS) Habitat Evaluation Procedure (HEP) (USFWS, 1980) was used to determine the wildlife habitat value of existing land use/land cover types in each watershed. The HEP analysis was developed to rate the quality and quantity of existing wildlife habitat in order to quantify the impacts resulting from land and water development projects. HEP provides information to evaluate the relative value of different habitat types at the same point in time, as well as the relative value of the same habitat area at future points in time.

A land use and land cover map was produced through the interpretation of 1" = 1,000' scale aerial photography and selected groundtruthing. This photography encompassed an area approximately 3.2 km (2 miles) wide and 192 km (120 miles) in length. Existing land use and land cover were classified to Anderson Level II (Anderson, et al., 1976). Land cover within the construction limits of the alignments was further classified according to the USFWS Cover Type Classification System (USFWS, 1981) to accommodate data entry into the HSI computer program (USFWS, Micro-HSI Version 2.1).

(1) Species Selection

A "guild" approach was employed to select HEP evaluation species, based on the range of habitats within each watershed. Guilds offer a way of evaluating large groups of animals by selecting several individual indicator species. A guild is a group of species that exploit a resource in a similar fashion (Root, 1967). Thus, if the impact of environmental change is determined for one species from the guild, the remaining species should be similarly affected. The guild-indicator concept is a cost and time-effective approach: the population levels of many birds, mammals, reptiles, and amphibians can be estimated by monitoring populations of a few guild-indicator species (Block et al., 1986).

The selection of evaluation species involved categorizing vertebrate species according to their feeding and reproductive habitat requirements. This information was collected through an extensive literature review on a number of terrestrial vertebrate species. DeGraaf and Rudis (1986) and individual *Habitat Suitability Index Models* provided the most comprehensive collection of information on species habitat requirements. The selection of evaluation species was predicated on several factors: the species had to be found within the watershed, either as a permanent resident or as a migratory species that potentially breeds there; the species had to represent a group of animals that exploits the same resources within particular cover types; and the species had to have an existing USFWS documented model for use with the HSI computer program. Nineteen evaluation species were selected to evaluate eleven USFWS habitat types within the proposed project area. These species are identified on Table III-43.

TABLE III-43
COVER TYPE USE BY EVALUATION SPECIES

U.S. FISH & WILDLIFE SERVICE LAND USE/LAND COVER TYPE	EVALUATION SPECIES																		
	American Woodcock	Barred Owl	Black-capped Chickadee	Brown Thrasher	Downy Woodpecker	Eastern Cottontail	Eastern Meadowlark	Eastern Wild Turkey	Gray Squirrel	Hairy Woodpecker	Mink	Muskrat	Pileated Woodpecker	Pine Warbler	Red-winged Blackbird	Ruffed Grouse	Veery	White-tailed Deer	Yellow Warbler
Cropland								✓										✓	
Orchards				✓		✓												✓	
Pasture/Hayland				✓		✓	✓	✓										✓	
Forbland				✓		✓	✓	✓										✓	
Deciduous Forest	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓		✓		✓	
Evergreen Forest	✓	✓	✓	✓	✓	✓		✓					✓	✓		✓		✓	
Grassland				✓		✓	✓	✓										✓	
Deciduous Shrubland				✓		✓		✓								✓		✓	✓
Palustrine Emergent Wetland												✓			✓			✓	
Palustrine Forested Wetland	✓	✓	✓		✓			✓	✓	✓	✓		✓				✓	✓	
Palustrine Scrub/Shrub Wetland											✓	✓					✓	✓	✓

(2) Data Collection

Data collection techniques included both physical measurement and visual estimation procedures (Hays, et al., 1981; Brower and Zar, 1984) to quantitatively measure the wildlife habitat variables produced by the HSI program. The wildlife habitat information was used to predict the habitat suitability of each cover type for each evaluation species. Baseline habitat suitability indices (HSI) were determined for each evaluation species. These values represent the habitat suitability for the evaluation species before project construction. The HSI values are an estimate of the habitat quality found within the proposed alignments for each evaluation species. Baseline habitat units (HUs) were calculated by multiplying the HSI values by the area of each cover type used by the evaluation species within the alignment construction limits. These numbers represent the wildlife habitat value before project construction.

(3) Impact Assessment

An impact assessment of wildlife habitat within each alignment's construction limits was performed using the HEP accounting program (USFWS HEP Accounting Software for Microcomputers, 1985). HUs were calculated for three target years; present or baseline conditions, during or immediately following construction, and five years after construction. It was assumed that, during or immediately following highway construction, no usable habitat would exist within the highway construction limits. Construction activities would have either removed existing vegetation or would result in disturbances sufficient to render remaining habitat unusable at this time. The HU calculation for five years after construction represents the predicted conditions of unpaved areas within the original construction limits based on standard WVDOT and VDOT right-of-way and roadside development practices. Numerous studies have shown that constructed right-of-way habitat is used by many wildlife species.

b. Direct Impacts

Impacts to wildlife habitat were assessed by comparing the existing habitat (baseline HUs) to the habitat that exists immediately following, and five years after construction (future HUs). As stated previously, it was assumed that, during or immediately following highway construction, activities would have either removed existing vegetation or would result in disturbances sufficient to render remaining habitat unusable by wildlife at this time.

The existing wildlife habitat area to be occupied by the IRA generated a total of 4,246 HUs; with 94 percent of the HUs in West Virginia and 6 percent in Virginia. The amount of wildlife habitat currently along the IRA is less than that along Line A for several reasons. First, a large portion of the IRA follows existing roads (minimal wildlife habitat). Second, areas adjacent to the existing roads where the IRA would be constructed are somewhat developed, thereby providing less productive wildlife habitat. Third, the area to be occupied by the IRA (predominantly two lanes) would be less than the area to be occupied by Line A (four lanes).

The existing wildlife habitat area to be occupied by Line A produced a total of 9,041 HUs; with 89 percent of the HUs in West Virginia and 11 percent in Virginia. The majority of this area would be deciduous forest habitat which was utilized by 70% of the HEP evaluation species.

A comparison of Line A to the option area alignments revealed the greatest differences in existing wildlife habitat within the Baker and Duck Run Option Areas. The area to be occupied by Line B in the Baker Option Area has an additional 79 HUs compared with the area to be occupied by Line A. The area to be occupied by Line D1 in the Duck Run Option Area has 42 fewer HUs than the area to be occupied by Line A.

Wildlife habitat within the construction limits of each alignment would be altered due to highway construction. It was assumed that, for five years after construction, no habitat units (potential wildlife habitat) would be available within the construction limits of any alignment. This would result in the initial loss of HUs equal to the above calculated baseline numbers (IRA - 4,246 HUs; Line A - 9,041 HUs). After five years, portions of each alignment would revegetate and recapture a portion of the wildlife habitat initially lost due to construction. It was assumed that this new habitat would be composed of 70% grassland, 10% shrub cover, and 5% tree cover.

Individual habitat variable values were estimated for the grassland habitat five years after construction. Using these values, future habitat suitability indices (HSIs) were determined for each evaluation species for each alignment. Future HUs for each evaluation species were then calculated. These numbers represent the estimated wildlife habitat value within each alignment five years after project construction. Only the species that use grassland habitat such as meadowlarks and brown thrashers produced future habitat units.

Table III-44 summarizes the baseline and predicted future habitat units by alternative and by option area. The No-Build Alternative would not result in construction-related impacts to wildlife habitat. Both the IRA and the Build Alternative would result in a projected net loss of wildlife habitat, as measured by HUs.

The IRA would result in the net loss of 3,199 HUs; of which, 95 percent would be in West Virginia and 5 percent would be in Virginia. Roadside revegetation would recapture 25 percent of the HUs initially lost to construction.

TABLE III-44
IMPACT SUMMARY OF BASELINE AND PREDICTED FUTURE HABITAT UNITS (HUs)

COMPARISON OF ALTERNATIVES

	ALTERNATIVE COMPARISON					
	IRA			BUILD ALTERNATIVE - LINE A		
HABITAT UNITS (HUs)	WV	VA	TOTAL	WV	VA	TOTAL
Baseline HUs	3,980	267	4,247	8,018	1,023	9,041
Predicted Future HUs	945	103	1,048	1,700	196	1,896
NET LOSS of HUs	***3,035***	***164***	***3,199***	***6,318***	***827***	***7,145***

COMPARISON OF OPTION AREAS

		OPTION AREA COMPARISONS IN WV												OPTION AREA COMPARISONS IN VA				
	LINE A (WV & VA)	INTERCHANGE		SHAVERS FORK		PATTERSON CREEK		FORMAN		BAKER		HANGING ROCK		DUCK RUN			LEBANON CHURCH	
HABITAT UNITS (HUs)		Line I	Line A	Line S	Line A	Line P	Line A	Line F	Line A	Line B	Line A	Line R	Line A	Line D1	Line D2	Line A	Line L	Line A
Baseline HUs	9,041	120	102	341	277	385	339	238	258	257	178	177	190	518	599	560	185	220
Predicted Future HUS	1,896	29	31	62	64	93	80	67	84	59	29	37	41	104	118	111	52	55
NET LOSS of HUs	***7,145***	***91***	***71***	***279***	***213***	***292***	***259***	***171***	***174***	***198***	***149***	***140***	***149***	***414***	***481***	***449***	***133***	***165***

Line A would result in the net loss of 7,145 HUs; of which, 88 percent would be in West Virginia and 12 percent would be in Virginia. Line A would result in twice as much of a loss of HUs than the IRA. This loss reflects the greater area and higher quality habitat impacted by construction of Line A. Under Line A, roadside revegetation would recapture 20 percent of the HUs initially lost to construction.

A comparison of the option areas revealed the following:

- Within the Interchange Option Area, Line I would result in 28 percent (20 HUs) greater loss of wildlife habitat would than Line A.
- Within the Shavers Fork Option Area, Line S would result in 31 percent (66 HUs) greater loss of wildlife habitat than would Line A.
- Within the Patterson Creek Option Area, Line P would result in 13 percent (33 HUs) greater loss of wildlife habitat than would Line A.
- Within the Forman Option Area, Line A would result in 2 percent (3 HUs) greater loss of wildlife habitat than would Line F.
- Within the Baker Option Area, Line B would result in 33 percent (49 HUs) greater loss of wildlife habitat than would Line A.
- Within the Hanging Rock Option Area, Line A would result in 6 percent (9 HUs) greater loss of wildlife habitat than would Line R.
- Within the Duck Run Option Area, Line D2 would result in 7 percent (32 HUs) greater loss of wildlife habitat than would Line A. Line D1 would result in 14 percent (35 HUs) less loss of wildlife habitat than would Line A.

Additional HEP analyses were performed to assess wildlife habitat within each of the six project watersheds. Table III-45 summarizes the baseline and predicted future habitat units by Alternative. The potential construction area within the IRA would generate the greatest loss of HU's within the North Branch of the Potomac River watershed. The potential construction area within Line A would generate the greatest loss of HU's within the Cheat River watershed. Please see *Vegetation and Wildlife Habitat Technical Report* for further details.

c. Secondary Impacts

Secondary impact assessment was limited to development related activities. These impacts are defined in the *Secondary and Cumulative Impacts Technical Report.*

TABLE III-45
IMPACT SUMMARY OF BASELINE AND PREDICTED FUTURE HABITAT UNITS (HUs)
BY WATERSHED

	TYGART VALLEY		CHEAT RIVER		N. BRANCH POTOMAC		S. BRANCH POTOMAC		CACAPON RIVER		SHENANDOAH RIVER - VA	
HABITAT UNITS	IRA	Line A	IRA	Line A	IRA	Line A	IRA	Line A	IRA	Line A	IRA	Line A
Baseline HUs	474	967	838	2,367	1,145	1,562	710	1,029	748	1,918	267	1,006
Predicted Future HUs	111	200	203	509	277	361	177	242	179	386	103	196
NET LOSS of HUs	***363***	***767***	***635***	***1,858***	***868***	***1,201***	***533***	***788***	***569***	***1,531***	***164***	***809***

(1) Habitat Unit Loss - Improved Roadway Alternative

Development related to the IRA involves commercial enterprises at intersections and interchanges. The required land area for this development was presented earlier in this report. Following that calculation the total number of hectares per land cover type was multiplied by the habitat units calculated for that particular land cover type for direct highway impacts. Results of those calculations are presented in Table III-46.

(2) Habitat Unit Loss - Build Alternative

Total hectares required for predicted development were calculated. Following that calculation, the total number of hectares per land cover type was multiplied by the habitat units calculated for that particular land cover type for direct highway impacts. Results of those calculations are presented in Table III-46. For this calculation all development related impacts are presented in the aggregate. That is, intersection/interchange, residential and service oriented development were combined by lands cover type to determine the total number of habitat units predicted to be lost because of predicted development requirements.

d. <u>Cumulative Impacts</u>

(1) Additive Direct Impacts

Additive direct impacts to wildlife habitat (as measured by Habitat Units lost) by watershed are summarized in Table III-45 for both the Improved Roadway and Build Alternatives. The IRA would cumulatively result in the loss of 2,968 HUs in West Virginia and 164 HUs in Virginia. Line A would cumulatively result in the loss of 6,145 HUs in West Virginia and 809 HUs in Virginia. Habitat Units lost in both Alternatives is less than 2% of the HUs found within the Regional project watersheds.

(2) Additive Direct and Secondary Impacts

The combination of direct and secondary impacts yielded an increase in HUs lost by the evaluation species due to predicted secondary development (Table III-47). Predicted secondary development is an aggregate of intersection/interchange, residential and service oriented development. The Shenandoah River watershed would have the greatest cumulative loss of HUs, while the North Branch of the Potomac River watershed would have the least. This calculated loss is based on a total removal of forest and farmland habitat from wildlife use. However, residential development is based on using 2 acre lots. Many of these parcels would not be completely converted from their present land use type and would still provide some benefits for a variety of wildlife species.

TABLE III-46
LAND COVER AND HABITAT UNITS LOST DUE TO PREDICTED DEVELOPMENT

IMPROVED ROADWAY ALTERNATIVE

Watershed	Land Cover Type	Total Hectares	Total Acres	Total HUs	Hectare Loss	Acre Loss	HUs Loss	% Total Watershed HUs Lost
Tygart Valley River	Forest	29,545	72,977	35,454	28	68	33	0.1
	Farmland	8,643	21,348	2,593	13	32	4	0.1
Cheat River	Forest	148,118	365,852	177,742	19	46	22	0.0
	Farmland	21,670	53,525	6,501	8	20	2	0.0
North Branch Potomac River	Forest	94,878	234,349	113,854	0	0	0	0.0
	Farmland	20,155	49,783	6,047	0	0	0	0.0
South Branch Potomac River	Forest	97,140	239,936	116,568	0	0	0	0.0
	Farmland	34,502	85,219	10,350	0	0	0	0.0
Cacapon River	Forest	98,364	242,960	118,037	2	4	2	0.0
	Farmland	20,393	50,370	6,118	6	14	2	0.0
Shenandoah River	Forest	45,945	113,484	55,134	10	25	12	0.0
	Farmland	35,022	86,504	10,507	14	35	4	0.1
Back Creek	Forest	22,515	55,611	27,017	0	0	0	0.0
	Farmland	10,775	26,614	3,232	0	0	0	0.0
Opequon Creek	Forest	2,097	5,180	2,517	0	0	0	0.0
	Farmland	9,164	22,635	2,749	0	0	0	0.0

1.2 HUs/Forest Hectare

0.3 HUs/Farmland (Pasture) Hectare

TABLE III-46 (CONT.)
LAND COVER AND HABITAT UNITS LOST DUE TO PREDICTED DEVELOPMENT

BUILD ALTERNATIVE

Watershed	Land Cover Type	Total Hectares	Total Acres	Total HUs	Hectare Loss	Acre Loss	HUs Loss	% Total Watershed HUs Lost
Tygart Valley River	Forest	29,545	72,977	35,454	794	1,960	952	2.7
	Farmland	8,643	21,348	2,593	296	732	89	3.4
Cheat River	Forest	148,118	365,852	177,742	506	1,251	608	0.3
	Farmland	21,670	53,525	6,501	376	929	113	1.7
North Branch Potomac River	Forest	94,878	234,349	113,854	216	533	259	0.2
	Farmland	20,155	49,783	6,047	88	218	26	0.4
South Branch Potomac River	Forest	97,140	239,936	116,568	1,712	4,228	2,054	1.8
	Farmland	34,502	85,219	10,350	963	2,378	289	2.8
Cacapon River	Forest	98,364	242,960	118,037	722	1,784	867	0.7
	Farmland	20,393	50,370	6,118	272	673	82	1.3
Shenandoah River	Forest	45,945	113,484	55,134	1,393	3,440	1,671	3.0
	Farmland	35,022	86,504	10,507	1,574	3,887	472	4.5
Back Creek	Forest	22,515	55,611	27,017	1,617	3,993	1,940	7.2
	Farmland	10,775	26,614	3,232	285	705	86	2.6
Opequon Creek	Forest	2,097	5,180	2,517	260	642	312	12.4
	Farmland	9,164	22,635	2,749	128	316	38	1.4

1.2 HUs/Forest Hectare

0.3 HUs/Farmland (Pasture) Hectare

TABLE III-47
CUMULATIVE HABITAT UNITS LOST DUE TO DIRECT HIGHWAY AND PREDICTED SECONDARY DEVELOPMENT IMPACTS

IMPROVED ROADWAY ALTERNATIVE

HABITAT UNITS LOST	Tygart Valley	Cheat	North Branch Potomac	South Branch Potomac	Cacapon	Shenandoah	Back	Opequon
Direct Impacts	363	635	868	533	569	164	0	0
Secondary Impacts	37	24	0	0	4	16	0	0
CUMULATIVE IMPACTS	***400***	***659***	***868***	***533***	***573***	***180***	***0***	***0***

BUILD ALTERNATIVE

HABITAT UNITS LOST	Tygart Valley	Cheat	North Branch Potomac	South Branch Potomac	Cacapon	Shenandoah	Back	Opequon
Direct Impacts	767	1,858	1,201	788	1,531	809	0	0
Secondary Impacts	1,041	721	285	2,343	949	2,143	2,026	350
CUMULATIVE IMPACTS	***1,808***	***2,579***	***1,486***	***3,131***	***2,480***	***2,952***	***2,026***	***350***

(3) Foreseeable Future Federal Actions

Cumulative impacts related to the development of foreseeable future projects was limited to known Federal actions that are currently ongoing or are in the formative stages of study. The five Federal actions considered were discussed previously. Table III-48 summarizes the potential wildlife habitat impacts due to the above five Federal actions. Two projects predict loss of wildlife habitat. The Moorefield floodwall project would involve impacts to approximately 21 acres of cropland and 2 acres of bottomland hardwoods. A comprehensive assessment of this wildlife habitat value was performed by the USFWS in conjunction with the US. Fish and Wildlife Coordination Act. To compensate for habitat losses, mitigation measures included the proposed acquisition and the planting of 18.8 acres of high habitat value trees and shrubs to replace 32 HUs lost (COE 1990). The Stony Run water supply dam would result in the loss of 70 acres of forested habitat. Based on an approximate value of 2.9 HUs/forested acre (based on SDEIS HEP study), this project would result in the loss of 203 HUs. However, the creation of open water habitat and the associated shoreline edge would provide food and cover resources for waterfowl, wading birds, and other species associated with aquatic environments. This could increase the overall species diversity in a region dominated by upland deciduous forest.

The proposed Canaan Valley National Wildlife Refuge would encompass nearly 11,330 hectares (28,000 acres) of relict boreal (northern) habitat with diverse flora and fauna communities. Canaan Valley's high altitude and cold, humid climate have maintained a unique relict boreal ecosystem which supports an assemblage of plant and animal life considered unusual for its latitude in the eastern United States. Nearly 288 species of mammals, birds, reptiles, amphibians, and fish are known or expected to occur here, including one threatened (Cheat Mountain salamander) and one endangered (Virginia northern flying squirrel) species. This area is nationally recognized as a breeding and fall migration concentration area for the American woodcock, and supports many other migratory species, including raptors, waterfowl, wading birds, shorebirds, and neotropical migrants.

Both National Forests have prepared Final Environmental Impact Statements that contain wildlife management plans that address the habitats needs of a variety of wildlife species. Each plan chose management indicator species to represent important game species, threatened and endangered species, species whose habitats may be influenced by management activities, and non-game species of special interest. Management plans call the monitoring of population levels of the indicator species and management of their habitats to maintain viable population numbers.

TABLE III-48
CUMULATIVE WETLAND AND WILDLIFE IMPACT ASSESSMENT MATRIX
FOR FORESEEABLE FUTURE FEDERAL ACTIONS
WITHIN 30-MINUTE CONTOUR

	WILDLIFE HABITAT IMPACTS	WETLAND IMPACTS	BIODIVERSITY IMPACTS	MITIGATION/ MANAGEMENT PLANS
FLOODWALL - MOOREFIELD, WV	Over 90% of impacts to cropland or urban land (21 ac)	1.9 acres forested wetlands	No involvement of threatened or endangered species.	Wetland and upland revegetation plan
STONY RUN WATER SUPPLY DAM - HARDY COUNTY, WV	Approx. loss of 70 acres forested habitat	None, no wetlands identified in feasibility study	No involvement of threatened or endangered species. Creation of open water habitat.	None proposed.
CANAAN VALLEY NATIONAL WILDLIFE REFUGE	Preservation of 28,000 acres	Preservation of largest wetland complex in West Virginia and the central and southern Appalachians.	Preservation of diverse plant and animal populations, including 1 threatened and 1 endangered species	Comprehensive management plan developed
GEORGE WASHINGTON NATIONAL FOREST	Multiple use management of over 100,000 forested acres	None proposed	Management plan to conserve specific elements of biodiversity and restore others where needed.	Comprehensive land and resource management plan
MONOGAHELA NATIONAL FOREST	Multiple use management of over 500,000 forested acres	None proposed	Plan to promote populations of management indicator species, including threatened and endangered species.	Comprehensive land and resource management plan

The cumulative effect of the above foreseeable actions is currently one of a positive nature for wildlife habitat. Over 30% of the land area within the 30-Minute Contour (240,000 hectares or 600,000 acres) is currently being managed to maintain species diversity and promote population levels of both game and non-game species. West Virginia Division of Natural Resources also owns and manages an additional 7,000 hectares (17,000 acres) for wildlife within Wildlife Management Areas located within the 30-Minute Contour.

e. Avoidance, Minimization, and Mitigation Measures

Where possible, alignments were developed to avoid known areas of unique wildlife habitat (caves, red spruce forest) where federally listed Threatened species have been documented. Alignment development also attempted to avoid impacts to wetland resources. Where avoidance was not possible, efforts were made to minimize the degree of impact.

The projected loss of habitat units for each alignment is based on the assumption that all wildlife habitat within the construction limits would be altered due to highway construction. Final design for the highway may not necessarily impact this entire area. Bifurcations in the roadway may leave portions of existing habitat intact, thereby reducing the net loss of wildlife habitat units. The proposed alignments also cross several areas of abandoned strip mines along WV 93 east of Davis, West Virginia. These areas are sparsely vegetated and presently provide little wildlife habitat. Right-of-way development, in conjunction with highway construction within these stripped sites, could provide additional habitat for wildlife use. In addition, this analysis projected future habitat variables five years after construction. Over time, the vegetative succession process would change species composition in areas that are not periodically maintained. Herbaceous species would gradually be replaced by shrub and tree species. This could provide the composition and diversity of vegetation necessary for additional use by the chosen evaluation species, and would likely result in an increase in calculated future habitat units.

2. FOREST FRAGMENTATION AND BIODIVERSITY

a. Literature Review

Natural landscapes are typically composed of a mosaic of habitats differing in size, shape, and vegetative structure and composition (Verner, 1986). If undisturbed long enough, such landscapes tend to reach a stage in which units of the mosaic retain fairly stable local plant communities or climax patterns (Whittaker, 1953). However, natural disturbances in the form of fires, storms, landslides, earthquakes and erosion contribute to reduce the patch size of existing habitat units and to alter their vegetative composition, often to earlier successional stages. These activities can produce a variety of direct and indirect impacts to existing plant and animal communities. Verner suggests that because so many species of terrestrial vertebrates are adapted to breed successfully in disturbed habitats, it might be inferred that natural disturbance has been a frequent and widespread occurrence in geologic history. In addition, many plant species have evolved to pioneer disturbed landscapes, serving to begin the vegetational succession process. Therefore, it is not possible to present all fragmentation of habitat as either "good" or "bad" since it operates at varying scales on each species (USDA, FEIS George Washington National Forest, 1993).

Human activities such as the construction of powerlines, residential and industrial developments, agricultural practices and roadways can produce habitat fragmentation resulting in a change to the vegetation of the successional community. Of particular concern in the central and eastern United States is the fragmentation of forest habitat and its resulting effect on biodiversity. Forest fragmentation is the process whereby large, continuous, and often homogenous areas of forest are broken into smaller often isolated tracts surrounded by a matrix of cultivated land, residential development, or other nonforest land use. Forest fragmentation is a function of several parameters:

- Patch size - the areal extent of the resulting habitat fragments;
- Patch isolation - the characteristics of the surrounding land use;
- Total reserve area - the sum of patches and contiguous forest;
- Edge - the transition area between two or more habitat types;
- Connectivity - the habitat linkages among patches.

Minimizing forest fragmentation promotes the natural patterns and connectivity of wildlife habitats that are key components of biodiversity (CEQ, 1993). The physical alteration of existing land use and changing land use patterns that lead to habitat simplification and fragmentation, disrupt species interactions and ecosystem processes. A regional assessment of forest fragmentation was used to determine potential effects on existing biodiversity within the 30-Minute Contour (see *Economic Environment Section* for definition of 30-Minute Contour).

A great deal of research has been done to evaluate the effect of forest fragmentation on the distribution and abundance of wildlife species. Due to the complex nature of the interacting parameters outlined above and the number of different wildlife species potentially involved, no consensus has been reached by the body of scientific researchers as to the overall effects of forest fragmentation on wildlife species. Most published scientific literature to date deals with avian species and their response to this phenomenon. A review of this literature was conducted to examine and summarize the major research findings on this topic.

Many researchers have studied the associated effects of forest fragmentation on avian communities. Robins *et al.* (1980) determined that gaps greater than 100 meters (330 feet.) in contiguous forest habitats produced isolation characteristics in the small habitat fragments created. Anderson (1979) showed that transmission-line corridors wider than 61 meters (200 feet) created grassland/shrub habitats within the forest. These corridors created new vegetative communities that when considered with the total bird population of the deciduous forest resulted in a greater variety and diversity of birds in the region. Rosenberg and Raphael (1986) found that bird and amphibian species richness increased significantly on more fragmented stands of Douglas-fir forests and in study plots containing more edge. A variety of species were able to utilize the more diverse vegetative component of the edge-forest ecotone.

A major topic of research has focused on the potential impact of forest fragmentation on neotropical migrant and interior forest dwelling songbirds. Neotropical migrants winter in Central America and the Caribbean, and to a lesser extent in South America, but breed in North America. A number of researchers have reported on the population decline of these species between the late 1940's and the late 1980's (see Finch, 1991). Several causes have been suggested for this decline; the loss of winter habitat in Latin America (Hall, 1984; Ambuel and Temple, 1982), brood parasitism by the brown-headed cowbird (*Molothrus ater*) (Brittingham and Temple, 1983), a low rate of colonization and a high rate of extinction in small, isolated woodlots (Whitcomb *et al.*, 1981), the lack of critical microhabitats (Lynch and Whigham, 1984) and higher rates of nest predation in small woodlots compared to large forest tracts (Robbins, 1980; Ambuel and Temple 1983; Wilcov, 1985). Hall suggests that some decreases in the number of neotropical species may be density dependent and result from the movement of bird species from optimal to suboptimal habitat as populations fluctuate over time.

Forest succession should be considered another potential factor influencing the changing diversity and population numbers of forest bird species. Martin (1960) reported on the changing bird populations that accompany vegetational succession. Freemark and Merriam (1986) found that habitat heterogeneity (spatial variability in habitat conditions within forest stands) was an important factor in determining bird species assemblages. Baird (1990) analyzed population changes in breeding birds in a Western New York forest from 1930 to 1980. He found the largest population decline among forest species that generally build nests less than 2 meters (6.6 feet) above the ground. He attributed this decline to the heavy browsing of white-tailed deer which has dramatically altered the understory vegetative composition. Baird observed both local increases and decreases over the past 50 years in a number of neotropical and short-distance migrants, as well as several permanent residents. Baird's study did not provide clear evidence that species which migrate to the Neotropics are declining more rapidly than short-distance migrants or permanent resident species.

Several research efforts on the effects of forest fragmentation on avian species have been conducted in the Midwest. In this area, once large expanses of contiguous forest have been replaced by small woodlots that have been extensively isolated by surrounding agricultural land. These woodland "islands" have served as study areas where the theories of island biogeography have been explored for terrestrial ecosystems. MacArthur and Wilson (1967) proposed that the number of species resident on an island is influenced primarily by area, but also by habitat diversity, age of the island, and its isolation. The Midwest's landscape mosaic has provided researchers the opportunity to study a number of fragmentation parameters such as patch size and edge effect. Temple (1986) defined the functional habitat unit for area sensitive species (core area) as the area of forest more than 100 m from an edge, instead of the total forest area observed. Further studies by Temple and Cary (1988), found significant differences in nesting success (18%, 58%, 70%) of forest interior dwelling birds within three distances from edge categories (< 100 meters, 100 to 200 meters, > 200 meters) and classified these as poor, marginal and good quality habitat respectively. They attributed these differences to nest predation, brood parasitism and competition that are associated with edge habitats. Robinson (1992) found that small isolated woodlots (< 70 hectares [170 acres]) appeared to serve as population sinks for many species of Neotropical migrants and contained several species that are considered area-sensitive elsewhere in their range, including the worm-eating warbler (*Helmitheros vermivorus)* and ovenbird (*Seiurus aurocapillus)*. However, most species suffered high nest predation and parasitism rates due to the edge-dominated forest patch configuration.

Blake and Karr (1987) studied breeding bird communities of isolated woodlots in Illinois. They found that the number and type of bird species breeding in these habitats were primarily dependent on the area of the woodlot. Differences observed among woodlot bird populations were attributed to the degree of isolation of each woodlot. Woodlots in this study were typically separated by many kilometers. They suggested that woodlots that were by themselves too small to support certain species, could do so if there were additional habitat located nearby. Lynch and Whigham (1984) studied breeding bird communities in upland forest patches of Maryland and found that vegetation characteristics, rather than patch geometry, appeared to play the dominant role in determining community composition and local abundance for the majority of bird species. Woodland patches in this study did not display the same degree of isolation as the Illinois study and were generally separated by small distances (0.1 to 1 kilometer). The complex inter-relationship between area, isolation and vegetative habitat characteristics influenced almost every bird species within the study area. Robbins *et al.*, (1989) found many similarities with the above study, but also some important differences. A more comprehensive sampling effort yielded data on a wider variety of habitat components and bird species. This study determined that 51% of the bird species were correlated with forest area as opposed to 26% in the Lynch and Whigham (1984) study.

Some researchers have attempted to determine the optimal forest patch size necessary to provide breeding habitat for all species of forest nesting birds. Blake and Karr (1984) found that forest interior species were not well represented in woodlots < 30 hectares (70 acres). However, species differ in many life history characteristics that influence occurrence in isolated patches of habitat and determination of optimal reserve size is dependent on species specific ecology. Robbins *et al.*, (1989) studied area requirements of forest birds in Maryland and adjacent counties in Pennsylvania, West Virginia, and Virginia.

Twenty-six avian species showed a significant increase in probability of occurrence as forest area increased and were considered to be area-sensitive. The authors emphasize that even in forest tracts > 3000 hectares (7410 acres), species such as the northern parula warbler (*Parula americana)* and cerulean warbler (*Dendroica cerulea)* had occurrence probabilities < 0.4. They suggest that if smaller forest tracts containing streams and bottom-land habitat (preferred by these species) were preserved, these birds could likely reside there. As in other studies, proximity to other forest stands (isolation) was also found to influence the minimum breeding area for some species.

In landscapes dominated by agricultural use (cropland, pastures), much of the remaining forest is in linear tracts along streams. These forested strips provide habitat for a variety of bird species, including several area-sensitive neotropical migrants (Keller *et al.,* 1993). In addition, these areas have been found to improve water quality by reducing the sediment and nutrient content of agricultural runoff (Peterjohn and Correll, 1984; Paterson and Schnoor, 1993). Croonquist and Brooks (1993) found that naturally vegetated riparian corridors > 125 meters (410 feet) were needed to support the full complement of bird communities. However, protecting at least a 25 meters (80 feet) wide corridor on each bank provided feeding, resting, or migrating corridors for uncommon, sensitive species including forest interior and neotropical migrants birds.

While some researchers (Whitcomb et al., 1981) indicate that populations in fragmented habitats are declining at a rapid rate for reasons associated with such fragmentation (e.g., habitat island size, high predation, and frequent brood parasitism), bird population declines have also been observed in relatively undisturbed forests. Holmes *et al.* (1986) conducted studies in an unfragmented (3,075 hectares [7,600 acres]), temperate, deciduous forest (Hubbard Brooks, New Hampshire) for 16 consecutive breeding seasons. Bird community dynamics varied over time with many species (70%) declining during this period. Individual species responded to a variety of environmental factors that operated on local, regional and global scales. Five major factors were identified that influence bird numbers in the forest; food abundance, breeding season weather, successional habitat changes, interspecific aggression, and winter mortality. Hall (1984) found that both the number of species and population of neotropical migrants had declined in an undisturbed portion of the Cheat Mountains in West Virginia. The author states that a precise reason for this decline cannot be assigned, but suggests that tropical deforestation as well as local climatic and weather factors may be contributing components.

Holmes and Sherry (1988) suggest that there is little agreement on the factors that regulate songbird populations. At the unfragmented Hubbard Brooks research area, 42% of the regularly occurring species declined from 1969 to 1986, including 4 neotropical migrant species. Based on their research findings, the authors conclude that forest fragmentation is probably not a factor in the observed decline of avian species over most of New Hampshire where forests predominate and where urban development is only beginning to affect the landscape. One neotropical migrant species that declined considerably was the least flycatcher (*Empidonax minimus*). This decline was attributed to the gradual maturing of the woodlands throughout the state of New Hampshire. This species favors conditions of intermediate succession with open subcanopies beneath dense upper canopy vegetation. Population trends varied for the least flycatcher from nearby states suggesting that regional land-use patterns may be an important factor in affecting habitat suitability for this species. Other species that may have been affected by changing habitat structure were the American redstart and the wood thrush. Both species reach maximal densities in mid-successional forests. The authors suggest that it is premature to attribute observed population trends in North America songbirds to any one causal factor.

Böhning-Gaese *et al.* (1993) used the Breeding Bird Survey (BBS) data to analyze trends in breeding populations of 47 insectivorous passerines in central and eastern North America, including long distance neotropical migrants. BBS data may be useful for identifying large scale trends in bird abundance and for providing perspective about the generality of those trends. The results suggest that those species that winter in the tropics did not experience strong decreases in their populations. Long distance neotropical migrants experienced a small, nonsignificant decreasing trend, whereas residents and short-distance migrants increased strongly. The declines observed were attributed to breeding ground predation and not to deforestation of wintering habitat in tropical America.

Finch (1991), as part of the USDA Forest Service's role in the Neotropical Migratory Bird Conservation Program, reviewed and summarized the current information on population trends of neotropical migratory birds and the factors affecting migrant populations on the wintering and breeding grounds. The author concluded that sufficient information was lacking on the population status and causes of population changes of neotropical migrants to develop an effective management plan to conserve these species.

b. Methodology

Large forested tracts are important habitat for area sensitive species and species requiring large territories. These forested areas contain other microhabitats such as streams and associated riparian corridors that are utilized by a wide variety of wildlife species for feeding and/or breeding purposes. To assess the effects which disturbance or fragmentation may have on species and biological communities, indicator species were chosen to represent area sensitive and landscape dependent (sensitive to changing land use patterns) species. Forest interior neotropical migrant bird species were used to assess the potential impacts of forest fragmentation on area sensitive species. Changing land use patterns were assessed to determine the potential effects on landscape dependent species such as the wild turkey (*Meleagris gallopavo*), black bear (*Ursus americanus*), and bobcat (*Felis rufus*) (Brook and Croonquist, 1990). This analysis was restricted to the Build and Improved Roadway Alternatives.

Breeding bird survey (BBS) data was obtained from the US. Fish and Wildlife Service's Office of Migratory Bird Management. Breeding bird population trend information was received for West Virginia and Virginia. This information was reviewed to determine the present population trends of neotropical migrant bird species within West Virginia and Virginia. As the cowbird (*Molothrus ater*) is implicated as one factor in the decline of neotropical migrants (Brittingham and Temple, 1983), population trends of this species were also reviewed.

Forest fragment size (patch size) is an important factor in determining utilization by forest-interior neotropical migrant species. Of particular concern was the creation of small forest patches that may be unusable by interior neotropical migrants for breeding purposes Impacts that would potentially create small forest patches were assessed using land use/land cover data acquired through the interpretation of 1" = 1,000' scale aerial photography and selected groundtruthing. This photography encompassed an area approximately 3.2 kilometers (2 miles) wide and 192 kilometers (120 miles) in length and provided an accurate account of the potential creation by the proposed highway of relatively small (less than 150 hectares or 370 acres) forest fragments that were entirely within the photography boundaries. Larger forest polygons (greater than 150 hectares or 370 acres) could extend beyond the limits of the photography, making an accurate assessment of their total size impractical using these data. GIS analysis determined the number of forest patches created by the potential construction of both Line A and the IRA. This information was used to assess the potential impact on minimum breeding area requirements for four neotropical migrants that occur within the proposed project area. These species were chosen to represent interior forest dwelling species whose breeding area requirements span a number of forest patch sizes.

Potential changes in land use patterns were assessed using USGS 1:250,000 scale digital Anderson Level II land use/land cover data. GIS analysis determined the amount of several land use/land cover types before and after proposed highway construction within the 30-Minute Contour. The 1:250,000 scale digital data provided a broad overview of the existing land use/land cover within a large geographic area and allowed an assessment of potential changes at a "regional" scale.

Total reserve area or the total amount of forest habitat is another important component of forest fragmentation. GIS analysis determined the total acreage of forest habitat within the 30-Minute Contour before and after highway construction.

Secondary impacts due to road construction were assessed by placing a 200 meter buffer on the construction limits of the proposed highway and recalculating the number and size of forest patches within the limits of the aerial photography. This was an attempt to define the core area available for area sensitive species after secondary effects of nest predation, brood parasitism and competition (associated with edge habitats) were considered (Temple and Cary, 1988). Further discussion of cumulative impacts resulting from induced development are discussed in the *Secondary and Cumulative Impact Technical Report*.

c. Existing Environment

Breeding bird survey (BBS) data and minimum breeding area requirements are summarized in Table III-49. Within West Virginia, the population trends showed an increase for three of the four indicator species with varying minimum breeding area requirements. Virginia had two species that had declining population trends. The cowbird showed a decreasing population trend in West Virginia (-4.1%) and a slight increase in Virginia (0.2%). This may reflect the overall land use patterns within the two states and the species ability to exploit these patterns. Cowbirds are able to utilize open areas of traditional foraging habitat (agriculture/pasture) as a base from which to parasitize forest dwelling species. West Virginia is predominantly a forested state, whereas Virginia has a larger agricultural component interspersed with forest. This is reflected in the land use patterns for the 30-Minute Contour. Of the 592,642 hectares (1,464,418 acres) in West Virginia and 136,137 hectares (336,394 acres) in Virginia, forested habitat comprises 80% and 52% of West Virginia and Virginia land use respectively, while agriculture/pasture makes up 42% in Virginia and 18% in West Virginia.

d. Impacts

Table III-50 summarizes the changes in the number of forest patches less than 150 hectares (370 acres) due to construction of the Build and Improved Roadway Alternatives. Based on the analysis of the 1"=1000' scale photointerpreted mapping, a total of 206 forest patches less than 150 hectares would be created due to the construction of the Build Alternative (Line A). Fifty three percent (110) of these patches would be less than 1 hectares (2.5 acres) in size. Based on the indicator species minimum breeding area requirements (Table III-49), parcels less than 1 hectare in size would not be suitable habitat for breeding purposes. However, forest patches smaller than that required for breeding may be used as foraging or resting areas. These areas can also serve as population sinks for non-breeding individuals (Robinson, 1992). These parcels comprise less than 1% of the forest habitat within the above mapped area. Forty seven percent (96) of the created forest patches could be utilized for breeding purposes by at least one species of interior forest dwelling neotropical migrant and 13% (27) could be utilized by all four indicator species.

A total of 133 forest patches less than 150 hectares would be created due to the construction of the Improved Roadway Alternative (IRA). Sixty eight percent (91) of these patches would be less than 1 hectare (2.5 acres) in size and would not be suitable breeding habitat for the neotropical migrant indicator species. Thirty two percent (42) of the created forest patches could be utilized for breeding purposes by at least one species of interior forest dwelling neotropical migrant and 10% (13) could be utilized by all four indicator species.

TABLE III-49
MINIMUM BREEDING AREA REQUIREMENTS AND BREEDING BIRD SURVEY DATA FOR PROPOSED PROJECT AREA FOREST INTERIOR NEOTROPICAL MIGRANTS1

SPECIES		MINIMUM BREEDING AREA		POPULATION2 TRENDS 1982-91	
		Hectares	Acres	WV	VA
Wood thrush	*Hylocichla mustelina*	1	2.5	-0.3	-2.7
Red-eyed vireo	*Vireo olivaceus*	2.5	6	0.7	3.9
Ovenbird	*Seiurus aurocapillus*	6	15	7.1	-0.9
Veery	*Catharus fuscescens*	20	49	6.6	*
Brown-headed cowbird	*Molothrus ater*			-4.1	0.2

1Robbins et al. 1989.

2Average percent annual change

* - No data available

TABLE III-50
FOREST PATCHES CREATED
COMPARED TO MINIMUM AREAL BREEDING REQUIREMENTS
OF NEOTROPICAL MIGRANT INDICATOR SPECIES

MINIMUM AREAL BREEDING REQUIREMENTS MET (# OF SPECIES)	PATCH SIZE		BUILD ALTERNATIVE - LINE A			IRA		
				CHANGE IN AREA			CHANGE IN AREA	
	Hectares	Acres	# OF PATCHES CREATED	Hectares	Acres	# OF PATCHES CREATED	Hectares	Acres
0	0-1	0-2.5	110	30	74	91	19	47
1	1 - 2.5	2.5-6	27	43	106	13	5	12
2	2.5-6	6.0-15	16	60	148	10	48	120
3	6-20	15-49	26	304	751	6	63	156
4	20-150	49-370	27	1,100	2,718	13	484	1,195

Approximately 1,585 hectares (3,916 acres) of existing land would be altered due to construction of Line A. This represents less than 1% of the total land within the 30-Minute Contour. From a regional perspective, no change in land use patterns would occur. Large forest patches (> 500 hectares or 1,235 acres) would remain to accommodate species with wide ranging territory requirements. Any effects on landscape dependent species, such as the wild turkey, black bear, and bobcat, would be minimal. The total amount of forest habitat after highway construction within the 30-Minute Contour would be 540,952 hectares (1,336,692 acres). This represents less than a 1% loss of regional forest lands.

Approximately 780 hectares (1,925 acres) of existing land would be altered due to construction of the IRA. This represents less than 1% of the total land within the 30-Minute Contour. From a regional perspective, no change in land use patterns would occur. The total amount of forest habitat after highway construction would be 541,757 hectares (1,335,870 acres). This represents less than a 1% loss of regional forest lands.

The 30-Minute Contour Anderson Level I land use/land cover is presented in Exhibit III-43. This area is dominated by a forested landscape and is overall, relatively unfragmented. Exhibit III-44 presents a more detailed view of the land cover within the Black Fork watershed. This watershed is representative of the existing land cover throughout West Virginia and portions of Virginia. This watershed is dominated by forested cover in relatively large, unfragmented parcels. Exhibit III-45 presents a detailed view of the land cover in the Strasburg, Virginia area. The mosaic of land use patterns in this area is representative of a fragmented landscape. Forest parcels are scattered and isolated by existing agricultural land thereby decreasing their habitat suitability for many neotropical migrant and other animal species. Based on the data discussed above, construction of either the Build Alternative or the IRA would not result in the development of the mosaic land cover patterns present in the Strasburg, Virginia area.

e. Edge Effects

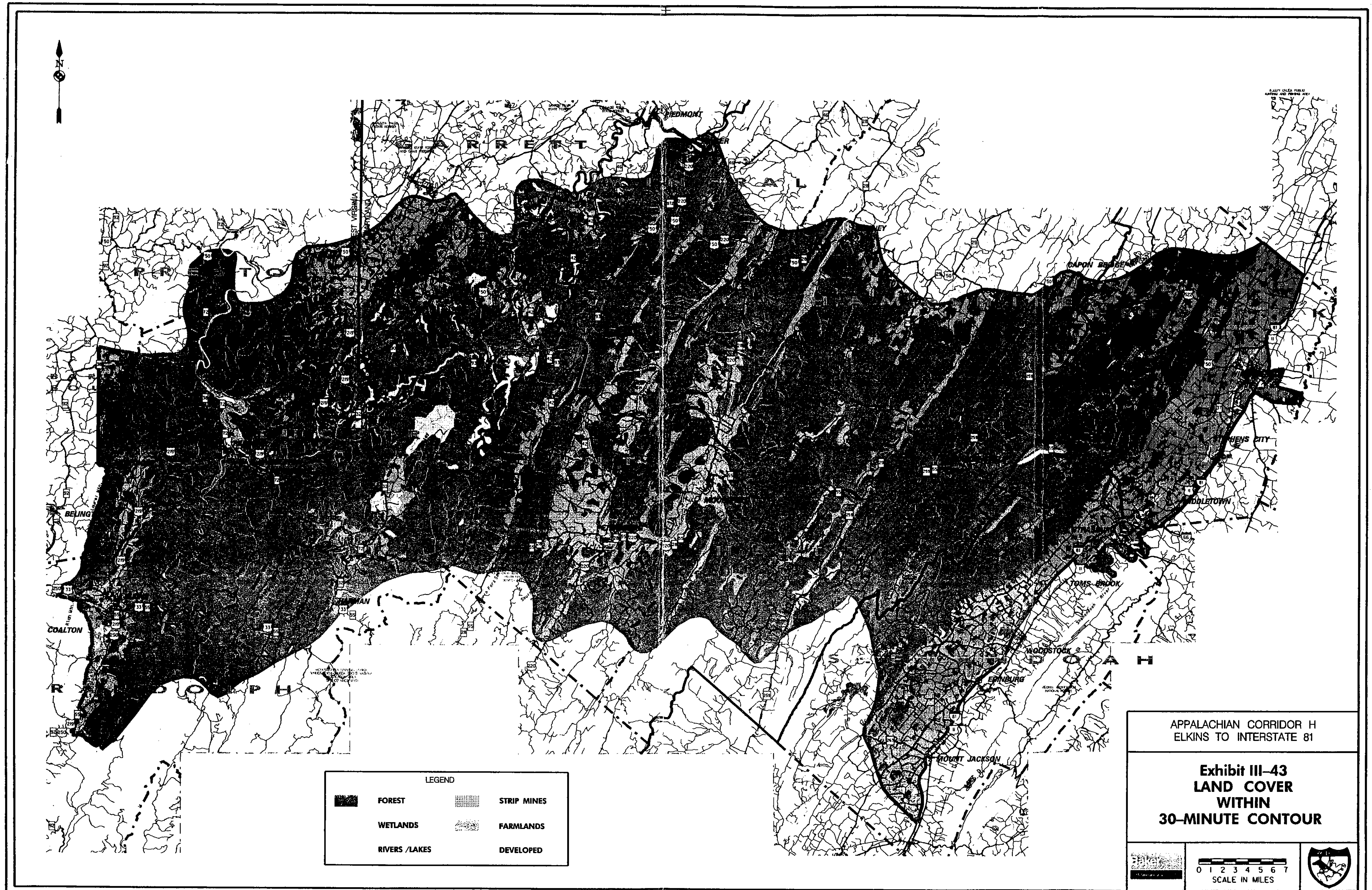
Table III-51 summarizes the changes in the number of forest patches less than 150 hectares (370 acres) available for area sensitive species after impacts of nest predation, brood parasitism and competition (associated with edge habitats) were considered. Additional habitat along highway construction limits was removed from adjacent forest parcels to address edge effect constraints. These impacts are associated with both the Build and Improved Roadway Alternatives. The number of forest patches created in each size category for the Build and Improved Roadway Alternatives is less than those in Table III-50. The expanded impact area, an additional 200 m perpendicular to the construction limits, "removes" many small forest patches from potential breeding use by the area sensitive indicator species due to edge effect constraints. However, these forest patches could be utilized by the breeding indicator species for foraging and resting, and could provide suitable habitat for non-breeding and immature individuals. This also does not preclude these areas from use by landscape dependent species, but it is likely that some, such as the wild turkey (Michael, 1975) would avoid this area. While the distribution of "usable" forest patch size would change slightly, large patches (> 500 hectares or 1,235 acres) would remain to accommodate species with wide ranging territory requirements. From a regional perspective, no change in land use patterns would occur.

Approximately 6,470 hectares (15,987 acres) of existing forested land could be influenced by impacts associated with edge effects of Line A, an 18% increase from the original forest impacts. Approximately 3,530 hectares (8,720 acres) could be influenced by the IRA, a 9% increase from the original forest impacts. Both figures represent nearly a 1% loss of regional forest lands for breeding use by the forest interior neotropical migrant indicator species.

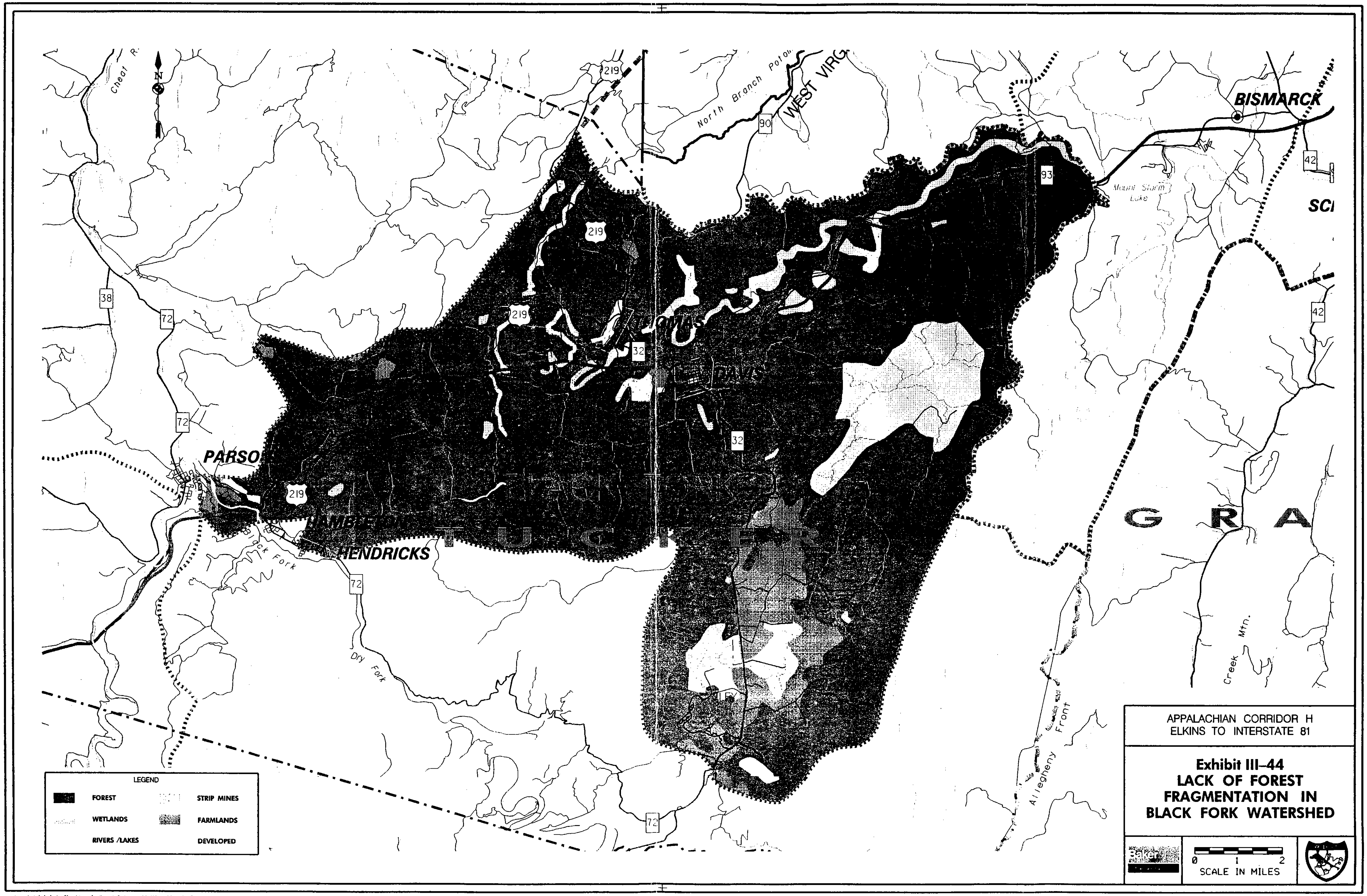
f. Cumulative Impacts

Cumulative forest fragmentation impacts were assessed by adding the direct impacts presented in Table III-50. A cumulative total of 133 forest patches less than 150 hectares would be created due to the construction of the Improved Roadway Alternative (IRA), which comprise less than 1% of the forest habitat within the 30-Minute Contour. For the Build Alternative (Line A), a cumulative total of 206 forest patches less than 150 hectares would be created. This also comprises less than 1% of the forest habitat within the 30-Minute Contour.

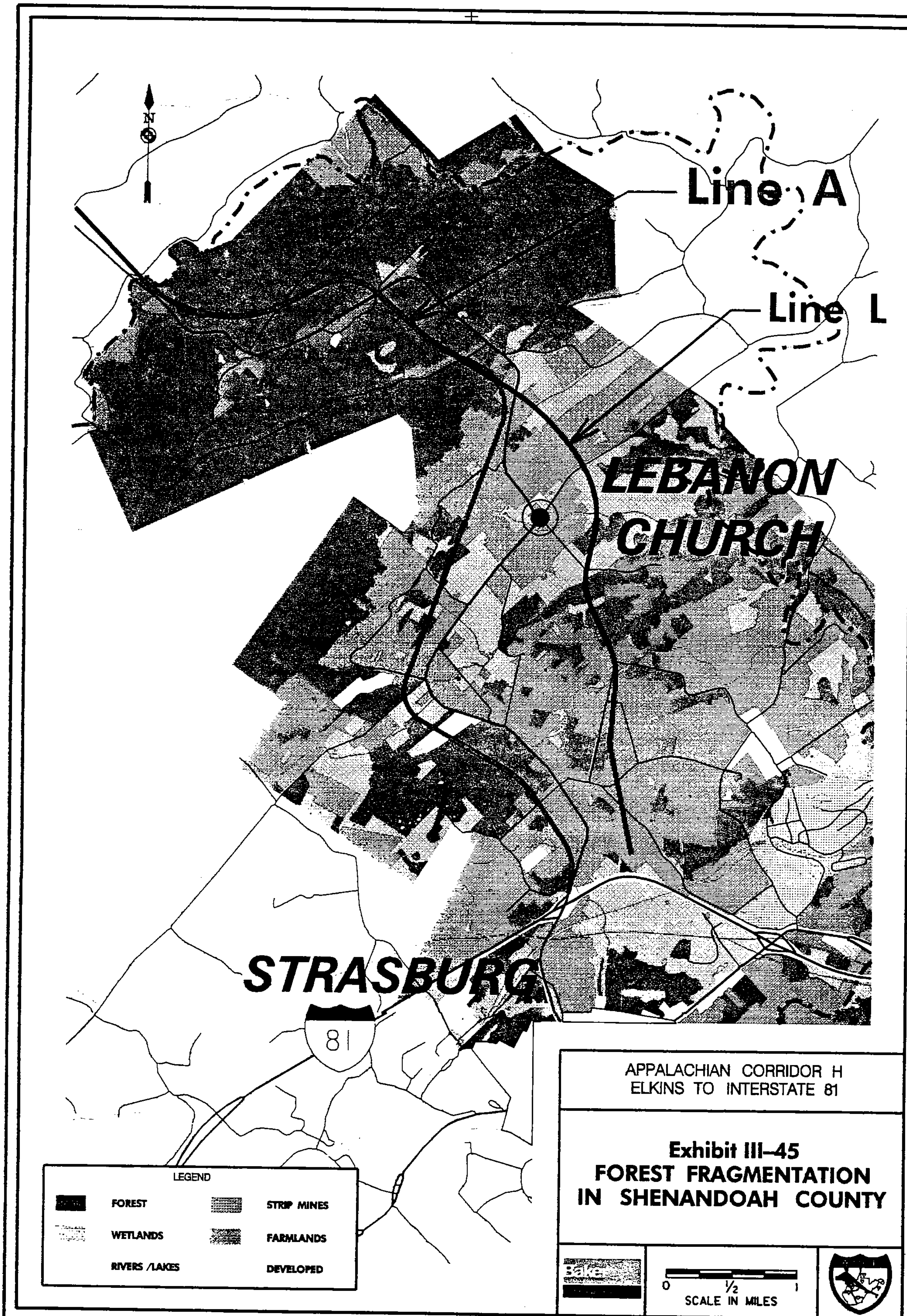
From a landscape perspective, a cumulative total of 780 hectares (1,925 acres) of existing land would be altered due to construction of the IRA and 1,585 hectares (3,916 acres) of existing land would be altered due to construction of Line A.. Both represent less than 1% of the total land within the 30-Minute Contour. From a regional perspective, no change in land use patterns would occur. Large forest patches (> 500 hectares or 1,235 acres) would remain to accommodate species with wide ranging territory requirements.



/corh/shtplot/final/socio/luse30m.dgn 07-NOV-1994 15:50



/corh/shtplot/final/socio/lusebf.dgn 08-NOV 1994 10:25



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-45
FOREST FRAGMENTATION IN SHENANDOAH COUNTY

/corrh/shtplot/find/socio/lusevc2.dgn 8-NOV-1994 15:55

TABLE III-51
EDGE EFFECTS ON CREATED FOREST PATCHES COMPARED TO MINIMUM AREAL BREEDING REQUIREMENTS OF NEOTROPICAL MIGRANT INDICATOR SPECIES

		# OF PATCHES CREATED	
MINIMUM AREAL BREEDING REQUIREMENTS MET (# OF SPECIES)	PATCH SIZE (HA)	BUILD ALTERNATIVE - LINE A	IRA
0	0-1	61	38
1	1 - 2.5	14	4
2	2.5-6	10	0
3	6-20	11	1
4	20-150	14	11

3. WILDLIFE MORTALITY

a. Literature review

The most visible effect of roads on wildlife is animal mortality resulting from collisions with motor vehicles. However, data that documents impacts to populations rather than individuals of avian or mammalian wildlife species remain unclear. Generally, highway construction results in the creation of a right-of-way (ROW) and a median strip that represents an edge where contiguous vegetation once existed. Many wildlife species are able to exploit and utilize the habitat created by the ROW and its associated edge habitat. One study suggests that ROWs are a source of potential wildlife habitat that have been largely ignored by resource managers (Oetting and Cassel, 1971). Highway mortality has been identified as a serious threat to the continued existence of the Florida panther (*Felis concolor coryi*), but this is a rare instance where the death of a few individuals directly impacts the survival of the entire species population. No wildlife species populations identified as occurring or potentially occurring within the study area would be impacted in this manner.

Several studies have documented the effects of highways on wildlife. Burke and Sherburne (1982) assessed the impact on the distribution, abundance and diversity of wildlife before, during and after construction of Interstate 95 in northern Maine. Data from this study suggest that the effect on the breeding-bird and small-, medium- and large-mammal populations has been limited to immediate loss of habitat and that this habitat loss is probably insignificant for those species studied. Furthermore, some wildlife species were documented exploiting and adapting to the newly created ROW habitat.

An intensive and geographically extensive investigation, funded as an FHWA research project and carried out by the USFWS, attempted to determine the effects, both positive and negative, of highways on the diversity, density and spatial distribution of a variety of wildlife species including birds, small and large mammals and amphibians and reptiles (Adams and Geis, 1982). This study was conducted along interstate highways and county roads in three geographic regions; the Southeast (the piedmont regions of Virginia, North Carolina, South Carolina), the Midwest (Illinois) and the Northwest (Oregon and northern California). No significant regional differences were observed. When the information from the three study areas was combined, the major results were:

- Seventy-six percent of the road wildlife mortality occurred on interstate highways;

- No differences were found in the distribution of the majority of bird species with respect to distance from roads;

- Small mammal community structure and abundance differed between ROW and adjacent habitats;

- No significant difference was detected in deer distribution in relation to interstate highways, but deer appeared to avoid county roads;

- Road mortality appeared to occur in a density-dependent manner, i.e. species killed in greatest numbers were those attracted to ROW habitat (meadowlark (*Sturnella magna*), indigo bunting (*Passerina cyanea*), field sparrow (*Spizella pusilla*), red-winged blackbird (*Agelaius phoeniceus*), Brewer's blackbird (*Euphagus cyanocephalus*), deer mouse (*Peromyscus maniculatus*) and several vole and rabbit species).

Michael (1975) conducted a study in Cooper's Rock State Forest in northern West Virginia to measure the impact of Interstate 68 (Corridor E) on wildlife populations. This area is dominated by deciduous upland forest with vegetative species similar to that found in the present study area. The major results of this study were:

- The majority of bird and mammal populations encountered during this study were not adversely affected as a result of highway construction;

- Game species populations were not affected by highway construction;

- Highway mortality observed appeared to be density dependent.

More detailed information is presented below on the effects of highways on individual groups of wildlife species.

(1) Reptiles and Amphibians

Adams and Geis (1982) reported that reptiles and amphibians made up 19% highway wildlife mortality. No salamander species were recorded during the road mortality study. The study concluded that salamanders do not readily cross interstate highways and are not attracted to ROW habitat. In the Southeast study area, the eastern box turtle (*Terrapene carolina*) was the most common species killed.

(2) Birds

Adams and Geis (1982) reported that birds made up the largest percentage (38%) of wildlife mortality. In the Southeast study region, 50% of the highway bird mortality was incurred by 5.5% of the species recorded in plots adjacent to highways. The high mortality for the eastern meadowlark, indigo bunting and field sparrow was the direct result of their greater abundance within habitats adjacent to the highway. These data indicate that such mortality is density-dependent. Many woodland species such as the Carolina chickadee (*Parus carolinensis*), tufted titmouse (*Parus bicolor*), wood thrush (*Catharus guttatus*), red-eyed vireo (*Vireo olivaceus*) and woodland warblers made up a significant portion (24%) of the bird community along highways but were not recorded during the road mortality survey. Statistical analyses were performed on twelve species of breeding birds (red-bellied woodpecker (*Melanerpes carolinus*), acadian flycatcher (*Empidonax virescens*), blue jay (*Cyanocitta cristata*), carolina chickadee, tufted titmouse, carolina wren (*Thryothorus ludovicianus*), wood thrush, red-eyed vireo, summer tanager (*Piranga rubra*), northern cardinal (*Cardinalis cardinalis*), indigo bunting and rufous-sided towhee (*Pipilo erythrophthalmus*)) recorded in upland forest habitat along highways. The wood thrush was more abundant away from the highways, while the remaining 11 species showed no difference in relative abundance with respect to distance from the roadway. Analyses were also conducted on wintering bird populations and produced similar results. The American kestrel (*Falco sparverius*) and red-tailed hawk (*Buteo jamaicensis*) were also observed using the ROW and median strip to hunt and capture small mammals.

Burke and Sherburne (1982) found breeding bird population densities in Maine did not vary between 0 and 400 m away from the highway either during the preconstruction or postconstruction phase of the study. Species composition appeared to change in response to the forest and ROW edge created along the highway. Several bird species, chipping sparrows (*Spizella passerina*) yellowthroats (*Geothlypis trichas*), chestnut-sided warblers (*Dendroica pensylvanica*), common crows (*Corvus brachyrhynchos*) and ravens (*Corvus corax*) exploited and utilized newly created ROW habitat. Other bird species continued to use the adjacent forest habitat and showed no adverse response to the created edge habitat. The ovenbird (*Seiurus aurocapillus*), a forest interior, neotropical migrant, was abundant in the adjacent forest habitat and appeared unaffected in relation to distance from the ROW.

Oetting and Cassel (1971) reported on the successful use of ROW habitat for nesting by a number of duck species. This study found that management of ROW habitat (adjusting the mowing maintenance schedule) can successfully enhance waterfowl reproduction. The authors also presented data from a number of studies in which game birds showed a preference for nesting along and within ROW habitats which comprised a small proportion of the total available nesting habitat.

Michael (1975) found the greatest number of individual birds, number of species and species diversity within the edge habitat separating the ROW from the upland forest. The most abundant birds within this habitat type were; European starling (*Sturnus vulgaris*), common crow, red-eyed vireo, indigo bunting, rufous-sided towhee, tufted titmouse, black-capped chickadee (*Parus atricapillus*), northern cardinal, wood thrush and red-winged blackbird. Species diversity indices increased in all three habitat types studied (ROW, edge, forest) after road construction. Several species of birds which appeared to increase in response to highway construction were the starling, indigo bunting, song sparrow (*Melospiza melodia*), killdeer (*Charadrius vociferus*) and common crow. Wild turkey (*Meleagris gallopavo*) distribution did not change in relation to the highway during and after highway construction. These birds continued to use the forested portion of the study area, but were not found using the area immediately adjacent to the highways.

(3) Mammals

Adams and Geis (1982) found that small mammals made up 17% of the wildlife mortality on highways, and that mortality was greatest for those species with highest densities in the ROW habitat (density dependent mortality). In the Southeast study area, the two most common species recorded in the road mortality study were the hispid cotton rat (*Sigmodon hispidus*) and the meadow vole (*Microtus pennsylvanicus)*. No evidence was found to indicate that road mortality was detrimental to the populations of these two species. Adams and Geis (1982, 1983) also found that small mammal diversity and density were greater in ROW habitat than in adjacent habitat and that the highway mortality observed did not appear to be detrimental to populations of these species. They suggest that ROW habitat and its accompanying edge are attractive not only to grassland species, but to many less habitat-specific species that make use of the ROW-edge-adjacent habitat complex. One grassland species, the meadow vole, has exploited the open, grassy roadside vegetation associated with interstate highway ROWs to expand its range through forested and intensive agricultural regions (Getz et al., 1978). The aggregation of large populations of small mammals (mice, moles, voles) represents a potential food resource that could be exploited by a number of avian and mammalian predators (Michael, 1975).

Available data appears to indicate that multilane highways inhibit movements of some small mammals adapted to forested habitats, while small mammals adapted to open country (meadow vole) readily venture onto the road surface (Oxley *et al.,* 1974). Adams and Geis (1982) found evidence that large roads and accompanying ROW habitat inhibited the movement of 28% of the 40 small mammal species and suggested additional research was needed in this area.

Large mammals made up 31% of the wildlife mortality along interstate highways (Adams and Geis 1982). However, species such as opossums (*Didelphis virginiana*) and skunks (*Mephitis mephitis*) persist for long periods of time and tend to inflate the actual large mammal mortality numbers. A more accurate reflection of mortality was obtained by estimating the road kill on a daily basis. When this was done, large mammals comprised 14% of the total highway mortality. White-tailed deer made up less than 1% of the total wildlife mortality in this study. The data in this study indicated that road size and traffic volume per se are not critical disturbing factors to deer. Other large mammals have shown an avoidance of highways. Brody and Pelton (1989) suggest that the behavior of bears in response to roads is probably learned and is linked to the "costs and benefits" experienced by individuals. In their North Carolina study, radio-collared bears demonstrated a pronounced avoidance of Interstate 40.

ROW and adjacent habitat use by large mammals has also been documented (Burke and Sherburne 1982, Adams and Geis 1982, Michael 1975). Cottontail rabbits (*Sylvilagus floridanus*) were more abundant in habitats adjacent to the highway than in areas farther away from the road. White-tailed deer were observed foraging within ROW habitat and red foxes (*Vulpes vulpes*) were found using ROW habitat to hunt for mice and moles.

b. Conclusions

The construction of the proposed highway project would convert current natural habitats (forests, agriculture, and pasture) to early successional grassy or shrubby vegetation commonly associated with highway right-of-ways. Potential highway-wildlife impacts would likely follow those observed on the Appalachian Corridor E (Interstate 68) study (Michael, 1975), which parallels other studies reviewed. These results indicate that highway construction and operation would not adversely affect the majority of birds and mammals, including game species, that exist within the project watershed. Highway mortality would be density dependent, species killed in greatest numbers would be those attracted to right-of-way habitat with high population densities, such as edge associated birds, and small/medium sized mammals. As no endangered, threatened or special concern species are associated with highway rights-of way habitat on this project, there would be no impact to these species. Highway wildlife mortality would continue to occur on existing roadways with the No Build Alternative. Impacts would be similar to those found by Adams and Geis (1981) for county roads. Highway wildlife mortality would potentially increase with the IRA. In conjunction with road improvements (widening), new segments of roadway would be constructed, thereby increasing the probability of vehicle/wildlife encounters. Wildlife mortality would potentially be the greatest for the Build Alternative. Adams and Geis (1981) found that 76 percent of road wildlife mortality occurred on four lane interstate highways. Line A would be expected to follow these observed results.

Long term cumulative effects of wildlife mortality due to collisions with motor vehicles has not been thoroughly researched. Over time, wildlife killed in greatest numbers would be those species with high population densities that are attracted to right-of-way habitat, such as edge associated birds, and small/medium sized mammals. Because research has shown that this mortality is density dependent, individuals killed represent a population surplus and as such, no long term effect on overall wildlife populations would be expected.

P. THREATENED AND ENDANGERED SPECIES

The Endangered Species Act (ESA) of 1973 (16 USC §1531-1543) declares the intention of Congress to protect all federally listed Threatened and Endangered species and designated Critical Habitat of such species occurring both in the United States and abroad. Section 7 of the ESA requires that federal agencies ensure that any federal action authorized, funded, or carried out is not likely to jeopardize the continued existence of any Endangered or Threatened species or result in the destruction or adverse modification of Critical Habitat. The USFWS is the primary regulatory agency responsible for ESA compliance. The USFWS maintains additional categories of species which are not legally protected, but should be considered in the planning process for any federal project. These additional categories are Proposed Threatened, Proposed Endangered, and Candidate Species. Coordination with state and federal resource agencies revealed no involvement with either Proposed or Candidate Species designated 'Category 1' or 'Category 3'. However, six 'Category 2' Candidate Species were identified within or near the project area and are discussed below.

The State of West Virginia relies upon federal legislation to protect vertebrate, invertebrate, and plant resources. The West Virginia Department of Commerce, Labor, and Environment's Natural Heritage Program (NHP), within the Division of Natural Resources (DNR), maintains a database with the known location of federally listed Threatened and Endangered species, as well as a list of Rare Species. The Natural Heritage Program places species on this list based on their population status within West Virginia. These species, which may be limited in West Virginia but more abundant and wide-spread in other states, are not afforded special legal protection as are federally listed Threatened and Endangered species. However, a review of the impacts to these species was considered in the planning process through coordination with the NHP.

In addition to federally protected species, there is state legislation that provides protection to plant and animal species deemed Threatened or Endangered within the Commonwealth of Virginia. These designations are based on population levels within Virginia and do not necessarily represent the population status of a particular species throughout its geographic distributional range. In Virginia, both the Virginia Department of Game and Inland Fisheries (VDGIF) and the Virginia Division of Natural Heritage (VDNH) maintain databases on the presence of federal and state listed Threatened and Endangered plant and animal species. A review of the impacts to these species was considered in the planning process.

One federally listed Threatened wildlife species and one federally listed Endangered plant species are known to exist within the proposed project area, but not necessarily within the construction limits of the proposed alignments. In addition, one state listed (Virginia) Threatened species, and a number of federally listed Candidate species and Species of Special State Concern (West Virginia) potentially exist within the proposed project area. The following discussion is based primarily on direct highway impacts. A separate discussion follows that summarizes potential secondary and cumulative impacts to the above referenced species. Table III-52 summarizes the occurrence of federal and state Threatened, Endangered, and Candidate species within the proposed project area. This information is presented by watershed. Detailed information on the threatened and endangered species analysis is contained in the *Vegetation and Wildlife Habitat Technical Report*.

1. FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

The Cheat Mountain salamander (*Plethodon nettingi*) was listed as a Threatened species by USFWS in September, 1989 (53 FR 188:37814-37818). Running buffalo clover (*Trifolium stoloniferum)* was listed as an Endangered species by USFWS on July 6, 1987, (50 FR 21478-21480).

a. Methodology

Dr. Thomas Pauley of Marshall University, a recognized expert on the Cheat Mountain salamander, was retained to lead the field investigations of potential salamander habitat. USFWS provided US. Geological Survey (USGS) quadrangles with the areas of potential salamander habitat designated for field review. After consultation with Dr. Pauley, two major areas of concern were investigated based on the existence of the following conditions: elevations near 915 meters (3,000 feet); suitable vegetation composition of the landscape; and suitable cover objects (rocks, logs, leaf material). The first area was located along WV 93 between Davis and Mount Storm Lake. The second suitable area was located between Olson Road (Forest Service Road 18) and Douglas. Pedestrian and vehicular surveys were conducted along the alignments within potential salamander habitat. Based on vegetative habitat characteristics and the presence of forest floor litter, those areas deemed suitable habitat for the Cheat Mountain salamander were delineated on USGS quadrangle maps.

USFWS also expressed concern over potential impacts to a known population of running buffalo clover. The population of concern is located west of Parsons, along Shavers Fork in the Cheat River watershed. USFWS provided USGS mapping with the approximate location of this population. Mr. William Tolen of the USFWS was consulted in the formulation of a sampling protocol. As approved by USFWS, a systematic survey was conducted of all pedestrian and vehicular trails and adjacent habitat that intersect the proposed alignments. The survey included an area up to 4 kilometers (2.5 miles) from the known clover population.

TABLE III-52
POTENTIAL INVOLVEMENT OF FEDERAL AND STATE ENDANGERED, THREATENED, AND CANDIDATE SPECIES

		WATERSHEDS																			
		TYGART VALLEY RIVER		CHEAT RIVER			N. BRANCH POTOMAC RIVER				S. BRANCH POTOMAC		CACAPON RIVER				SHENANDOAH RIVER				
SPECIES	**STATUS**	IRA	Line A	IRA	Line A	Line S	IRA	Line A	Line F	Line P	IRA	Line A	IRA	Line A	Line R	Line B	IRA	Line A	Line D1	Line D2	Line L
Cheat Mountain Salamander *(Plethodon nettingi)*	Federal Threatened	0	0	**A**	**A**	**A**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running Buffalo Clover *(Trifolium stoloniferum)*	Federal Endangered	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock Vole *(Microtus chrotorrhinus carolinensis)*	Fed/WV C2/S3	0	0	**B**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New England Cottontail *(Sylvilagus transitionalis)*	Fed/WV C2/S3	0	0	0	**C**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loggerhead Shrike *(Lanius ludovicianus)*	Fed/WV/VA C2/S1/Threat.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**B**	**C**	**C**	0	0	**C**
Wood Turtle *(Clemmys insculpta)*	VA Threatened	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**D**	**D**	**D**	**D**	0
Kate's Mountain Clover *(Trifolium virginicum)*	Fed/WV C2/S2S3	0	0	0	0	0	0	0	0	0	0	0	**B**	0	0	0	0	0	0	0	0
Mountain Pimpernal *(Taenidia montana)*	Fed/WV C2/S3	0	0	0	0	0	0	0	0	0	0	0	**B**	0	0	0	0	0	0	0	0

INVOLVEMENT CODES: A = Potential habitat surveyed May/June, 1994--No Cheat Mountain salamanders found within construction limits of proposed project
B = Documented occurrence by West Virginia Natural Heritage Program
C = Potential habitat exists, no documented records within project alternatives
D = VDGIF Documented occurrence along Duck Run, none observed during intensive stream and wetland work in this area
0 = No involvement

STATUS CODES: C2 = Category 2 species, under study for listing as Threatened or Endangered
S1 = Critically imperiled in the state; 5 or fewer occurrences
S2 = Imperiled in the state; 6 to 20 occurrences
S3 = Rare or uncommon in the state; 20 to 100 occurrences

b. Existing Environment

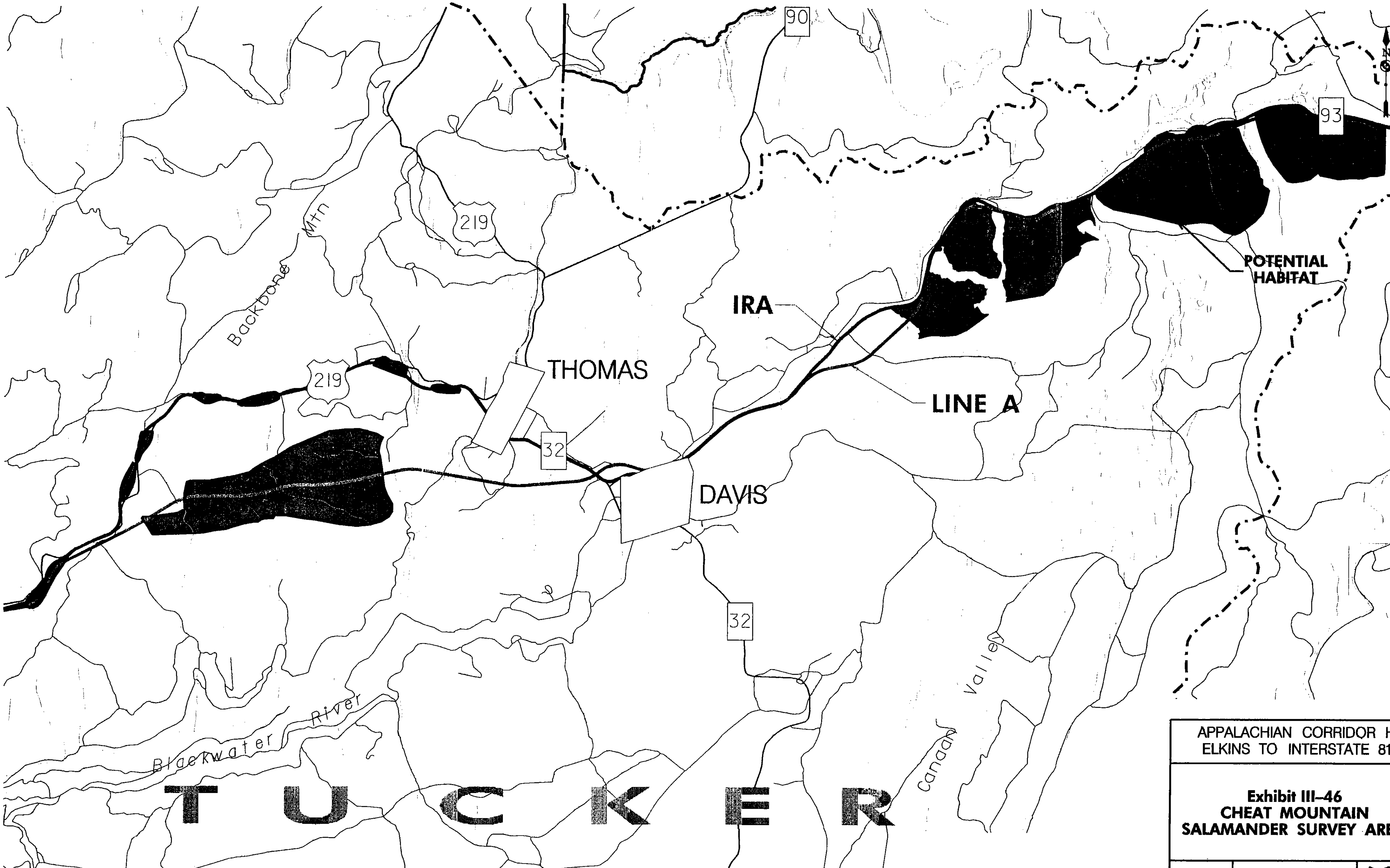
The Cheat Mountain salamander is a small woodland salamander currently known to exist at 68 sites within an approximately 1,813 square kilometer (700 square mile) area in West Virginia (USFWS 1991). This salamander species is found near elevations of 915 meters (3,000 feet) in red spruce (*Picea rubens*), hemlock (*Tsuga canadensis*), and mixed deciduous forests dominated by yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), and black cherry (*Prunus serotina*) (Pauley, 1994). The presence of forest floor litter such as decayed logs, flat rocks, fallen limbs, leaf material, is an important habitat component. These materials provide foraging cover and daytime refuge. Several confirmed populations of the Cheat Mountain salamander occur along Backbone Mountain; however, none of the confirmed populations occur within the construction limits of the proposed alignments.

Running buffalo clover is a plant species that is historically associated with migration trails of large herds of bison and elk. This clover species seems restricted to areas of moist fertile soils and partial shade. It also requires some sort of moderate habitat disturbance such as mowing or trampling (Cambell, et al., 1988; Cusick, 1989). This plant was once widely distributed from Kansas to West Virginia, but is currently found in only a small portion of its former range. Scientists speculate that a major reason for the decline of this species is the absence of the large migratory herbivores that once provided soil enrichment, periodic habitat disturbance, and seed dispersal apparently necessary for the proliferation of this plant (USFWS, 1989). Current populations are threatened by direct habitat destruction, excess human disturbance (such as all-terrain vehicle use), and by vegetative competitors that shade out and kill the individual plants.

c. Impacts

Habitat modifications that remove the forest canopy are probably the primary factors affecting the Cheat Mountain salamander. Man-made and natural events such as mining activities, utility rights-of-way, timbering, wildfires, insect infestations, and road development all contribute to canopy reduction. Highway construction would potentially impact the Cheat Mountain salamander through the direct loss of habitat and indirectly through habitat modification. Increased human activity may result in new pedestrian and vehicular trails, which could result in the removal of leaves and other forest floor litter, creating areas unsuitable for forage and shelter.

As shown on Exhibit III-46, the initial salamander field investigation revealed several areas of potentially suitable habitat that would be impacted by either the IRA or Line A. Dr. Pauley and a team of herpetologists conducted detailed field surveys in May and June of 1994 to search for Cheat Mountain salamander populations in these locations. No Cheat Mountain salamanders were found within the construction limits of the proposed project.



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-46
CHEAT MOUNTAIN SALAMANDER SURVEY AREA

0 3000 6000
SCALE IN FEET

SALGRPH.DGN

Exhibit III-47 shows where the proposed alignments potentially overlap running buffalo clover habitat west of Parsons. The field investigation of this potential habitat within the impact area revealed no running buffalo clover populations. Therefore, no impacts to this species would be expected to occur under either the IRA or the Build Alternative. The No-Build Alternative would not impact this species.

d. Avoidance, Minimization, and Mitigation Measures

Through detailed field investigations, alignments were developed to avoid known populations of the Cheat Mountain salamander and running buffalo clover. Based on the field work results and the current position of the alignments, mitigation measures would not be required as these species would not be impacted.

2. FEDERALLY LISTED CANDIDATE SPECIES

As required by 50 CFR 402.12, species under study for Federal listing as Threatened or Endangered that potentially occur within the project area were identified.

a. Methodology

Candidate Species that could be impacted by any of the proposed alignments were identified and evaluated. As shown on Table III-52, six 'Category 2' plant and animal species have been documented within or near the project area. Category 2 species are those species for which the information now in the possession of the USFWS indicates that it is possibly appropriate to list such species as Threatened or Endangered. However, further field studies by the USFWS are required to provide conclusive data on biological vulnerability before final determinations can be made.

b. Existing Environment and Impacts

Two plant species, Kate's mountain clover (*Trifolium virginicum*) and mountain pimpernal (*Taenidia montana*), are located in a group of shale barrens adjacent to WV 55, northeast of Wardensville. These plants were identified during a WVNHP rare species survey of these shale barrens. These species would not be impacted by the No-Build or the Build Alternative. However, the IRA would potentially impact these plant species in this area. Due to insufficient scientific information on the population status of these species, it is difficult to make an impact assessment at this time. If the IRA is selected, coordination with the appropriate resource agencies would be initiated and a detailed investigation would be conducted. Based on these results, design modifications could be made for the final EIS.

The rock vole (*Microtus chrotorrhinus carolinensis*) was documented by the WVNHP west of Parsons, adjacent to US 219 near Porterwood. This species is associated with rocky habitats within cool, moist forests of yellow birch, maple, and hemlock with a dense understory of herbaceous vegetation. This species would not be impacted by the No-Build or the Build Alternative. However, the IRA would potentially impact this species in this area. Due to insufficient scientific information on the population status of this species, it is difficult to make an impact assessment at this time. If the IRA is selected, coordination with the appropriate resource agencies would be initiated and a detailed investigation would be conducted. Based on these results, design modifications could be made for the final EIS.

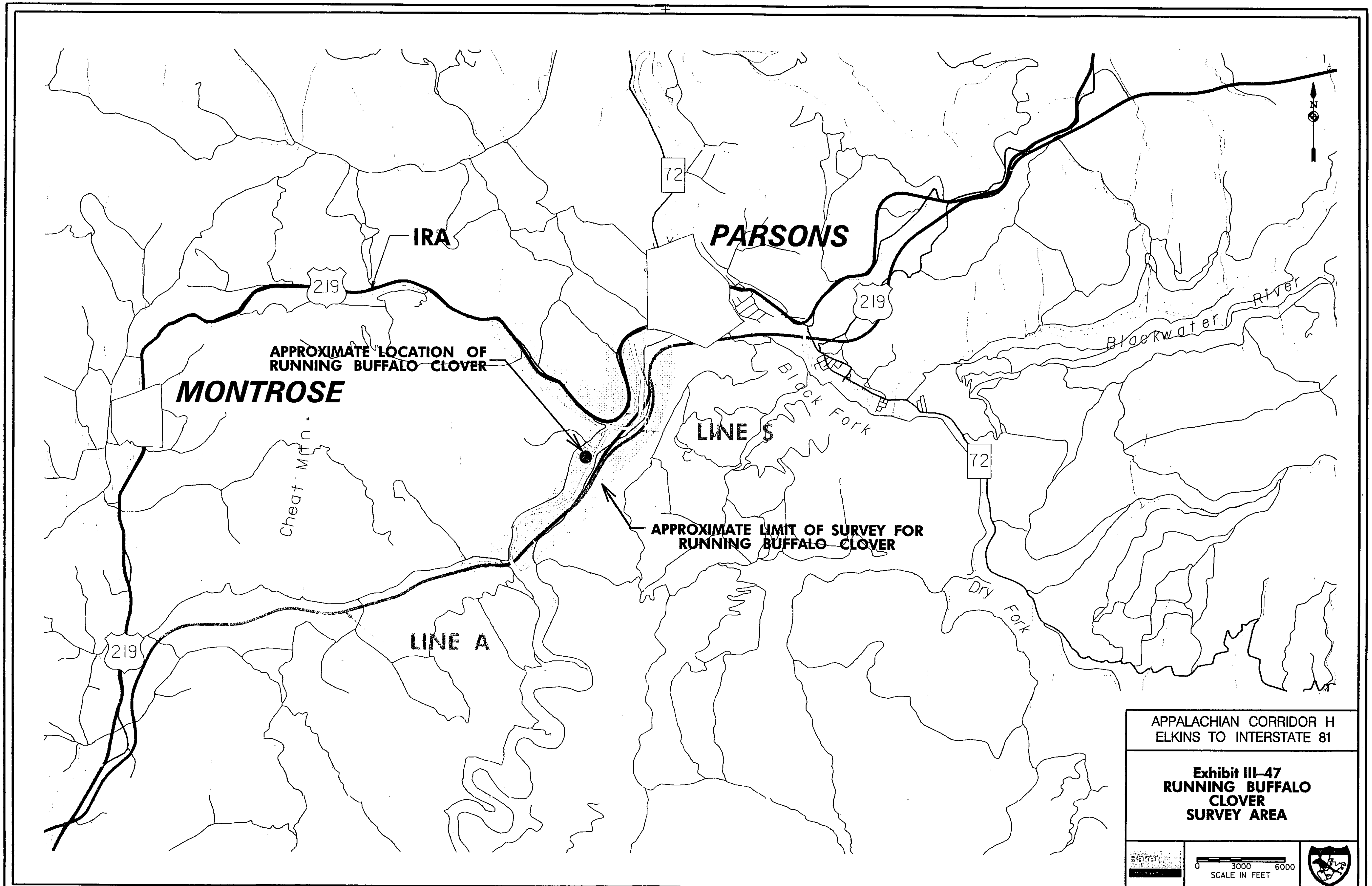
The New England cottontail (*Sylvilagus transitionalis*) was documented by WVNHP east of Davis and adjacent to WV 93. This species is associated with dense forests at higher elevations of both coniferous and deciduous canopy vegetation. This species would not be impacted by the No-Build, Build, or Improved Roadway Alternatives. General wildlife signs and observations were recorded during extensive stream sampling, wetlands delineation field work, and HEP data collection in this area. No New England cottontails were observed during these field efforts.

During a public meeting, an occurrence of the brook floater mussel (*Alasmidonta varicosa*) was reported within the North Fork of Patterson Creek, approximately 2.3 kilometers (1.4 miles) northeast of Medley. However, the WVNHP has not identified this location. This species would not be impacted by the No-Build or the Build Alternative. The IRA would cross the North Fork of Patterson Creek at this location by a simple span bridge and, as such, would have a minimal impact on any mussel species. If the IRA is selected, coordination with the appropriate resource agencies would be initiated to confirm the population status of this species at the above referenced location.

The loggerhead shrike is a medium sized bird found primarily in open country with scattered trees and shrubs. In addition to being a 'Category 2' Candidate Species, the shrike is listed as Threatened in the Commonwealth of Virginia. VDGIF documented the shrike nesting in the southeastern section of the Mountain Falls quadrangle and suggested that other nests may occur within the project area where suitable habitat conditions are present. Further discussions of the shrike are presented under the subject heading of Virginia State Listed Species.

c. Avoidance, Minimization, and Mitigation Measures

Where possible, alignments were developed to avoid known populations of candidate species. If warranted, further studies may be conducted to clarify any alignment impacts and design modifications could be made for inclusion in the final EIS. If impacts are unavoidable, coordination with the USFWS would be initiated and appropriate mitigation measures would be addressed.



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-47
RUNNING BUFFALO CLOVER SURVEY AREA

CLOGRPH.DGN

3. VIRGINIA STATE LISTED SPECIES

The wood turtle (*Clemmys insculpta)* and loggerhead shrike (*Lanius ludovicianus*) are listed by the Commonwealth of Virginia as Threatened species (Virginia Regulation 325-01-1, § 13) and have been identified by VDNH and VDGIF as having potential involvement with the proposed alignments.

a. Methodology

VDNH and VDGIF were contacted to identify potential habitat of the wood turtle and loggerhead shrike that could be affected by the proposed alignments. VDNH and VDGIF expressed concern over potential impacts to the wood turtle where Duck Run and Cedar Creek parallel and intersect the proposed alignments (the IRA, Line A, Line D1, and Line D2). VDGIF documented the shrike nesting in the southeastern section of the Mountain Falls quadrangle and suggested that other nests may occur within the project area where suitable habitat conditions are present. A Geographic Information System (GIS) was used to identify suitable habitat within the alignments. Suitable habitat was defined as Anderson Level 21 (Cropland and Pasture) and 31 (Herbaceous Rangeland).

b. Existing Environment

The wood turtle is a medium sized turtle found primarily in and near clear streams in deciduous woodlands in Virginia. These turtles are omnivorous and consume a wide variety of both terrestrial and aquatic plant and animal matter. Little is known of the ecological requirements or behavior of the wood turtle in Virginia. The presence of forest floor litter (decayed logs, flat rocks, fallen limbs, leaf material) is an important habitat component, providing foraging cover and daytime refuge.

In Virginia, the shrike's typical breeding and wintering habitats consist of short grassland such as closely grazed pasture; especially in areas with scattered hedgerows and fence lines. Insects, small reptiles, amphibians, birds, and small mammals make up the majority of the shrike's diet. Prey is habitually impaled in thorn trees or on barbed wire fences.

c. Impacts

In Virginia, the location of all alignments (the IRA, Line A, Line D1, and Line D2) would potentially overlap wood turtle habitat along Duck Run and Cedar Creek in the Shenandoah River watershed. General wildlife signs and observations were recorded during the extensive stream sampling and wetlands delineation field work in this area. No wood turtles were observed in the vicinity of Cedar Creek or Duck Run during these field efforts. The wood turtle would not be impacted under the No-Build Alternative.

Coordination with VDGIF documented recent nesting records of the loggerhead shrike in the southeastern section of the Mountain Falls quadrangle. The location of the proposed alignments would not impact this known nesting area. General wildlife signs and observations were recorded during the extensive stream sampling, wetlands delineation field work, and HEP data collection along the alignments. While no loggerhead shrikes were observed during the course of these field investigations, all alignments would impact potential shrike habitat. Line A would impact 21 hectares (52 acres) of potential habitat while the IRA would impact 9 hectares (22 acres). These impacts represent less than 1 percent of the potential shrike habitat within the 30' contour. The loggerhead shrike would not be impacted by the No Build Alternative.

d. Avoidance, Minimization, and Mitigation Measures

Where possible, alignments were developed to avoid known populations of state listed species. Should either of the above species be discovered during final project design, appropriate discussions with resource agencies would be initiated regarding impact minimization and/or possible mitigation scenarios.

4. WEST VIRGINIA RARE SPECIES

West Virginia Rare Species are assigned ranks based on their population status within West Virginia. These species, which may be limited in the state but more abundant and wide-spread on a regional basis, are not afforded special legal protection as are federally listed Threatened and Endangered species. However, a review of potential impacts to these species was considered in the planning process.

a. Methodology

Coordination with WVNHP documents the potential occurrence of nine Rare plant species within the proposed alignments. The nine species identified are: hoary sedge (*Carex canescens*), northern stitchwort (*Stellaria calycantha*), thread rush (*Juncus filiformis*), shale barren bindweed (*Convolvulus purshianus*), dodder (*Cuscata indecora*), milk pea (*Galactia volubilis*), pussytoes ragwort (*Senecio antennariifolius*), shale barren evening primrose (*Oenothera argillicola*), and shale barren goldenrod (*Solidago harrisii*). The *Vegetation and Wildlife Habitat Technical Report* contains greater detail on these species.

b. Existing Environment and Impacts

Six of the nine Special Concern species were located during a WVNHP rare species survey northeast of Wardensville in a group of shale barrens adjacent to WV 55. This area would be potentially impacted by development of the IRA. Three species occur within the Davis quadrangle along WV 93. These plants are associated with wetlands and wet areas near Beaver Creek. These species would be potentially impacted by both the IRA and Line A. Due to insufficient scientific information on the population status of these species, it is difficult to make a quantitative impact assessment at this time. Strausbaugh and Core

(*Flora of West Virginia*, 1977) list several localities for each species, but no indication of population size is available.

c. Avoidance, Minimization, and Mitigation Measures

Where possible, alignments were developed to avoid known populations of species of special state concern. Three of these species are associated with wetlands and/or riparian areas. Avoidance and minimization of wetland impacts across the proposed project area would minimize any potential impacts to the these species. The remaining species are associated with shale barrens that include two 'Category 2' Candidate Species. As stated above, if the IRA is selected, coordination with the appropriate resource agencies would be initiated and a detailed investigation would be conducted. Based on these results, design modifications could be made for the final EIS.

5. SECONDARY AND CUMULATIVE IMPACTS

Secondary and cumulative impacts related to induced development would need to comply with Federal and state threatened and endangered species regulatory guidelines, including the Endangered Species Act. As such, no impact to Federal or state listed species would be expected.

Cumulative impacts related to the development of foreseeable future actions were limited to five known Federal actions that are currently ongoing or are in the formulative stages of study (see *Secondary and Cumulative Impacts Technical Report* for further discussion). Two projects predict loss of wildlife habitat, but no impacts to threatened or endangered species is anticipated. The proposed Canaan Valley National Wildlife Refuge would encompass nearly 11,330 hectares (28,000 acres) of relict boreal (northern) habitat with diverse flora and fauna communities, including one threatened (Cheat Mountain salamander) and one endangered (Virginia northern flying squirrel) species. In addition, both the Monongahela and George Washington National Forests have prepared Final Environmental Impact Statements that contain wildlife management plans that address the habitat needs of a variety of wildlife species, including threatened and endangered species. Based on the above information, no cumulative impacts to threatened or endangered species would be expected.

Q. WETLANDS

Presidential Executive Order 11990 (EO 11990) entitled, "Protection of Wetlands", establishes a national policy to "avoid to the extent possible the long-term and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative." Wetlands within the project area have been evaluated in accordance with EO 11990. Greater detail of the methodologies used to evaluate wetland impacts, the affected wetland environment, and the results of the wetland impact evaluations is provided in the *Wetlands Technical Report.*

1. METHODOLOGY

a. Wetland Identification, Delineation, and Classification

Wetlands are defined by the Environmental Protection Agency (EPA) and the US Army Corps of Engineers (COE) as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (EPA, 40 CFR 230.3 and COE, 33 CFR 328.3). Wetlands were initially identified for this project by producing a land use and land cover map through the interpretation of 1" = 1,000' scale aerial photography and selected groundtruthing. Aerial photography encompassed an area approximately 3.2 kilometers (2 miles) wide and 192 kilometers (120 miles) in length. Existing land use/land cover was classified to Anderson Level II in accordance with Anderson *et al.* (1976).

After the land cover mapping was complete, the methods outlined in the Corps of Engineers *Wetlands Delineation Manual* (COE Manual, January, 1987) were used to identify and delineate wetlands in the field. The field delineations were conducted by environmental scientists trained in federal wetlands identification and delineation procedures. The Routine Onsite Determination Method, as detailed in the COE Manual, was used for wetlands identification and delineation. Wetland classification was further refined from the Anderson system by using the classification system developed by the USFWS (Cowardin *et al.*, 1979). Detailed data were collected for all wetlands located near the alternatives. All wetland data, including boundaries and vegetation classification, were entered into the geographic information system (GIS).

b. Functions and Values Assessment

A functions and values evaluation of each delineated wetland was conducted using the WET 2.1 computer model. This model is based on FHWA's *Wetland Evaluation Technique* (WET) (Adamus *et al.*, 1987). The WET methodology provides an estimate (qualitative probability) of the likelihood that a function or value will occur in a wetland in terms of social significance, effectiveness, or opportunity to perform the function. The estimate of likelihood is given in three qualitative probability levels: high, moderate, or low.

It is important to remember that these ratings are qualitative values that do not measure the degree of importance of a wetland's function to its watershed.

Two levels of WET assessments were performed on each wetland based on that wetland's size: the Social Significance Evaluation - Level 1; and Effectiveness and Opportunity Evaluation - Levels 1 and 2. The Social Significance Evaluation - Level 1 was applied to all wetlands, regardless of size. The Effectiveness and Opportunity Evaluation - Levels 1 and 2 was conducted on wetlands 0.4 hectares (one acre) or larger.

In addition to the WET analysis, a Habitat Evaluation Procedures (HEP) analysis was performed to evaluate wildlife habitat of forested, scrub-shrub, and emergent wetland systems within the study area. The methodology and results for the HEP analysis are summarized in Section III-O and the details can be found in the *Wildlife Technical Report.*

c. Watershed Impact Assessment

Wetland abiotic functions, such as floodflow alteration, sediment/nutrient retention, and toxicant removal, are important to the overall water quality of each watershed . Neither the WET assessment or a simple statement of hectares of encroachment measure watershed impact. To determine the importance to watersheds, a measure of areal wetland watershed loss was made. To measure this loss, it was first necessary to determine the total hectares of wetlands in each of the watersheds.

Total hectares of wetlands within each watershed was determined using National Wetland Inventory (NWI) mapping and the actual hectares of wetlands delineated. NWI mapping at 1"= 2000' is prepared from photointerpretation of aerial photography and smaller wetlands or those obscured by vegetation often do not appear on NWI mapping. To adjust for these "missing" wetlands, an adjustment ratio was calculated as follows. Hectares of wetlands by category (i.e., scrub shrub, emergent and forested) that were within the wetland delineated area were calculated by the GIS. The areal extent of these wetlands was than compared by the GIS to the areal extent of those wetlands that had been field delineated. From this comparison, a discrepancy ratio was calculated for each watershed. The ratio of discrepancy was then applied to the areal extent of NWI wetlands in each watershed to extrapolate to the predicted number of total hectares of wetlands within the watershed. The predicted number of total hectares of wetlands is referred to below as hectares of watershed wetlands.

d. Direct Impact Assessment

Proposed encroachments were assessed by using the GIS to determine the wetland size, wetland classification, and the extent of encroachment (hectares). Descriptive characteristics of wetlands encroached upon were devised to aid in the evaluation of the ecological importance of the proposed encroachment. These characteristics are landscape position and adjacent land cover.

Wetland landscape position was divided into three categories:

- Isolated wetlands were defined as those that have no connection to other surface waters;
- Headwater wetlands were defined as those that are connected to other surface waters and have a drainage area of less than 13 kilometers (5 sq. miles);
- "Other" wetlands were a category defined as those that are connected to surface waters and have a drainage area of more than 13 kilometers (5 sq. miles).

Adjacent land cover was divided into three categories:

- Agricultural cover was defined as areas of crops, pastures, or plowed fields;
- Disturbed cover was defined as areas modified by man, such as power line and road right-of-way, surface mined areas, or lawns;
- Undisturbed was defined as any natural area.

e. Functions and Values Impact Assessment

The predicted change in wetland functions and values caused by the proposed encroachment was assessed by conducting a hypothetical "post-construction" WET analysis for each wetland larger than 0.4 hectares (1 acre) and comparing this assessment to the wetland's "pre-construction" WET analysis. The changes in the WET qualitative probability ratings for each wetland were assigned functions and values change categories as follows:

- "No change" if none of the summary probability ratings changed;
- "Slight decrease" if one summary probability rating dropped;
- "Decrease" if two or more of the summary probability ratings dropped.

For those wetlands smaller than 0.4 hectare (1 acre) in size, a "post-construction" WET was not prepared because the Social Significance 1 analysis is not sensitive enough to detect the changes that might occur due to highway construction. Instead, a qualitative (best professional judgment) assessment of the likely functional change was made according to the extent of areal encroachment. The categories for these small wetlands encroached upon were:

- "No change" if less than 10 percent of the wetland size would be lost;
- "Slight decrease" for encroachments ranging from to 10 to 30 percent of the wetland size;
- "Decrease" for encroachments ranging from 30 to 80 percent of the wetland size.

The wetland's functions and values were considered "lost" if over 80 percent of the wetland's area would be encroached upon.

2. EXISTING ENVIRONMENT

a. General

The USFWS National Wetlands Inventory (Dahl, 1990) estimates that West Virginia contained 54,228 hectares (134,000 acres) of wetlands at the time of the European settlement and has lost approximately 24 percent of that area in the intervening 200 years (1780's to 1980's). This is an average annual loss rate of 0.12 percent for the period. The losses which occurred during that period resulted from drainage of wetlands in the floodplains of the Ohio, Kanawha, and Monongahela Rivers and their conversion to farmland and industrial uses. In Virginia, it is estimated that there were originally 748,264 hectares (1,849,000 acres) of wetlands at the time of European settlement. Virginia has lost an estimated 42 percent of that acreage in the intervening 200 years, an average annual loss of 0.21 percent.

The most current estimate of wetlands in West Virginia reports that there are 41,278 hectares (102,000 acres) of palustrine wetlands found in the state (Tiner, 1987). Approximately 14 percent of West Virginia's wetlands are concentrated in the Canaan Valley complex and the Meadow River complex, and the remaining 86 percent are scattered throughout the state. During the 23 year period from 1957 through 1980, West Virginia actually had an overall gain in wetlands of approximately 6,677 hectares (16,500 acres).

Current estimates for Virginia report that there are 422,856 hectares (1,044,900 acres) of wetlands, of which 77 percent are fresh water wetlands (Tiner, 1987). During the 23 year period from 1957 through 1980, Virginia had a net loss of approximately 8,903 hectares (22,000 acres) of wetlands.

b. Watersheds

The proposed project is located in two major physiographic provinces which are divided by the Allegheny Front. The portion of the proposed project west of the Allegheny Front, which includes the Tygart Valley River watershed and the Cheat River watershed, is located in the Allegheny Mountain Section of the Appalachian Plateau Province. This province is part of the Mixed Mesophytic Forest Biome, which consists of a variety of hardwood and softwood forests. Wetland types found in this zone are varied, ranging from man-made ponds and floodplain wetlands along the wider stream valleys, to high elevation bogs and fens dominated by mosses, sedges, and shrubs.

The Cheat River watershed contains a higher proportion of wetlands than any of the other watersheds. This is due largely to the concentration of wetlands along Beaver Creek. Wetlands found in the Cheat River watershed differ from those to the west and the east. These wetlands are typically high elevation bogs and fens that are dominated by mosses, sedges, and shrubs such as blueberries. A large portion of the land has been subjected to surface mining activities, and numerous wetlands are affected by acid mine drainage. Several restoration and reclamation projects are underway in the region. Many of the wetlands in this area are also influenced by beaver activity. There are two wetlands with special status in this region. Big Run Bog, on the eastern slope of Backbone Mountain, is a Monongahela National Forest Research Natural Area. Elder Swamp, along Beaver Creek, is designated in the Regional Wetland Concept Plan (USFWS, 1990) as an area worthy of protection.

The portion of the proposed project east of the Allegheny Front, which includes the watersheds of the North Branch of the Potomac River, the South Branch of the Potomac River, the Cacapon River, and the Shenandoah River, is located in the Middle Section of the Ridge and Valley Province. This province is part of the Oak-Chestnut Forest Biome, which consists largely of mixed hardwood forests. Wetland types found in this area are mostly small man-made ponds and floodplain wetlands formed along the wider stream valleys. There is one wetland with special status in this area. Vance's Cove is located in the George Washington National Forest in Virginia and is designated in the Regional Wetland Concept Plan (USFWS, 1990) as an area worthy of protection. The Forest and the Virginia Department of Game and Inland Fisheries have spent a substantial amount of money in maintaining and improving this area.

3. WETLAND IMPACTS

Proposed IRA and Build Alternative wetland encroachments by watershed are presented in Table III-53. All identified wetlands are shown on the *Alignment and Resource Location Plans*. Additional information on ecological characteristics of impacted wetlands is presented in Table III-54.

a. No-Build Alternative

The No-Build Alternative would maintain current roads with some minor improvements and ongoing maintenance activities. The No-Build Alternative would cause no direct wetland encroachments. However, secondary and cumulative impacts could occur to wetlands adjacent to the existing roadways due to routine highway operation and maintenance. Some commercial, industrial and residential development could also occur under the No-Build Alternative and could potentially result in wetland impacts.

TABLE III-53
WETLAND IMPACTS BY WATERSHED

Watershed		Forested			Scrub/Shrub			Emergent			Open Water			Total		
		#	Hectares	Acres	#	Hectares	Acres	#	Hectares	Acres	#	Hectares	Acres	#	Hectares	Acres
Tygart Valley River	Line A	0	0.00	0.00	2	0.03	0.07	14	1.87	4.62	1	0.11	0.26	17	2.00	4.95
	IRA	1	0.11	0.26	2	0.15	0.36	13	0.75	1.85	1	0.02	0.06	17	1.02	2.53
Cheat River	Line A	3	0.12	0.30	18	0.95	2.34	60	6.24	15.41	10	0.46	1.14	91	7.77	19.19
	IRA	3	1.02	2.51	5	0.42	1.05	16	3.11	7.68	3	0.33	0.82	27	4.88	12.06
North Branch Potomac River	Line A	2	0.06	0.14	0	0.00	0.00	16	3.07	7.59	5	0.25	0.62	23	3.38	8.35
	IRA	1	0.10	0.24	0	0.00	0.00	9	1.58	3.91	0	0.00	0.00	10	1.68	4.15
South Branch Potomac River	Line A	0	0.00	0.00	1	0.16	0.39	7	0.62	1.52	2	0.03	0.07	10	0.80	1.98
	IRA	0	0.00	0.00	0	0.00	0.00	6	0.56	1.39	2	0.00	0.00	8	0.56	1.39
Cacapon River	Line A	1	0.10	0.24	2	0.06	0.14	10	0.61	1.50	4	0.21	0.51	17	0.97	2.39
	IRA	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.08	0.19	1	0.08	0.19
West Virginia Total	Line A	6	0.28	0.68	23	1.19	2.94	107	12.40	30.64	22	1.05	2.6	158	14.92	36.86
	IRA	5	1.22	3.01	7	0.57	1.41	44	6.00	14.83	7	0.43	1.07	63	8.22	20.32
VA- Shenandoah River	Line A	1	0.11	0.28	0	0.00	0.00	4	0.12	0.30	2	0.10	0.24	7	0.33	0.82
	IRA	5	0.07	0.17	6	0.25	0.61	6	0.15	0.36	0	0.00	0.00	17	0.46	1.14
Combined Watershed Total	Line A	7	0.39	0.96	23	1.19	2.94	111	12.52	30.94	24	1.15	2.84	165	15.25	37.68
	IRA	10	1.29	3.18	13	0.82	2.02	50	6.15	15.19	7	0.43	1.07	80	8.68	21.46

TABLE III-54
CHARACTERISTICS OF IMPACTED WETLANDS BY WATERSHED

NUMBER OF WETLANDS WITH CHARACTERISTIC	Tygart Valley River		Cheat River		North Branch Potomac		South Branch Potomac		Cacapon River		West Virginia Total		Shenandoah River		Combined Total	
	Line A	IRA	Line A	IRA	Line A	IRA	Line A	IRA	Line A	IRA	Line A	IRA	Line A	IRA	Line A	IRA
Adjacent Land Cover																
Agricultural	12	9	9	3	16	7	9	7	13	1	59	27	3	5	62	32
Disturbed	1	1	65	15	1	2	0	1	0	0	67	19	0	6	67	25
Undisturbed	4	7	17	9	6	1	1	0	4	0	32	17	4	6	36	23
Landscape Position																
Isolated	1	0	24	4	1	2	0	3	0	0	26	9	0	1	26	10
Headwater	13	15	61	12	22	8	10	5	13	1	119	41	6	14	125	55
Other	3	2	6	11	0	0	0	0	4	0	13	13	1	2	14	15
Wetland Size																
Less Than 0.4 ha	13	14	31	15	16	4	8	4	13	1	81	38	7	15	88	53
Greater Than 0.4 ha	4	3	60	12	7	6	2	4	4	0	77	25	0	2	77	27
Functional Change																
No Change	4	4	24	11	2	3	3	5	5	0	38	23	1	8	39	31
Slight Decrease	2	4	19	8	7	3	2	1	1	0	31	16	2	3	33	19
Decrease	7	5	22	6	6	2	3	2	3	0	41	15	2	5	43	20
Lost	4	4	26	2	8	2	2	0	8	1	48	9	2	1	50	10

b. Improved Roadway Alternative

(1) Impacts by Watershed

The IRA would directly impact 8.69 hectares (21.46 acres) of wetlands in West Virginia and Virginia, combined. Of the six watersheds, the Cheat River watershed would experience the largest total wetland area impact, while the Tygart Valley River watershed would experience the greatest percentage wetland loss compared to the total area of wetlands in the watershed. The Cacapon River watershed would experience the smallest wetland area impact as well as the smallest proportion of wetland loss.

(a) Tygart Valley River

In the Tygart Valley River watershed, the IRA would impact 16 vegetated wetlands and one pond, comprising 1.02 hectares (2.53 acres). All encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.66 percent of the total wetland area of the watershed. The majority (13) of the impacted wetlands are palustrine emergent vegetation communities and eleven (11) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size.

(b) Cheat River

In the Cheat River watershed, the IRA would impact 24 vegetated wetlands and three ponds, comprising 4.88 hectares (12.06 acres). Twenty five (25) of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.05 percent of the predicted wetland area of the watershed. The majority (16) of impacted wetlands are palustrine emergent vegetation communities and sixteen (16) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size.

(c) North Branch of the Potomac River

In the North Branch of the Potomac River watershed, the IRA would impact 10 vegetated wetlands, comprising 1.68 hectares (4.15 acres). Nine of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.09 percent of the predicted wetland area of the watershed. The majority (9) of impacted wetlands are palustrine emergent vegetation communities and six of the wetlands impacted are greater than 0.4 hectares (1 acre) in total size.

(d) South Branch of the Potomac River

In the South Branch of the Potomac River watershed, the IRA would impact six vegetated wetlands and two ponds, comprising 0.56 hectares (1.39 acres). All of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.17 percent of the predicted wetland area of the watershed. All of the impacted vegetated wetlands are palustrine emergent vegetation communities and five (5) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size.

(e) Cacapon River

In the Cacapon River watershed, the IRA would impact one pond, comprising 0.08 hectares (0.19 acres). This is approximately 0.02 percent of the total wetland area of the watershed. This wetland is less than 0.4 hectares (1 acre) in size.

(2) IRA in West Virginia

The proposed IRA in West Virginia would directly impact a total 8.22 hectares (20.32 acres) in 63 separate wetland encroachments (Table III-53). The majority (60) of encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.07 percent of the predicted wetland area for the West Virginia watersheds. Most (44) of the impacted wetlands are palustrine emergent vegetation communities and thirty seven (37) of the wetlands impacted are less than 0.4 (1 acre) in total size. A summary of information on ecological characteristics of impacted wetlands in West Virginia is presented in Table III-54.

(3) IRA in Virginia

The IRA in Virginia would directly impact 0.47 hectares (1.14 acres) of wetlands in 17 separate wetland encroachments (Table III-53). All of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.18 percent of the predicted wetland area for the Virginia watershed (Shenandoah River). Six (6) wetland impacts occur in both palustrine scrub-shrub and palustrine forested vegetation communities. The majority (16) of impacts occur in wetlands that are less than 0.4 hectares (1 acre) in total size. A summary of information on ecological characteristics of impacted wetlands in Virginia is presented in Table III-54.

c. Build Alternative

(1) Impacts by Watershed

Line A in West Virginia and Virginia, would directly impact 165 separate wetland systems for a total encroachment of 15.25 hectares (37.68 acres). Of the six watersheds, the Cheat River watershed would experience the largest total wetland area impact, while the Tygart Valley River watershed would experience the greatest percentage wetland loss compared to the total area of wetlands in the watershed. The South Branch of the Potomac River watershed would experience the smallest wetland area impact, while the Cheat River watershed would experience the smallest percentage wetland loss compared to the total area of wetlands in the watershed.

(a) Tygart Valley River

In the Tygart Valley River Watershed, Line A would impact 16 vegetated wetlands and one pond, comprising 2.00 hectares (4.95 acres). All encroachments are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 1.29 percent of the predicted wetland area of the watershed. The majority (14) of impacted wetlands are palustrine emergent vegetation communities and eleven (11) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size.

(b) Cheat River

In the Cheat River Watershed, Line A would impact 81 vegetated wetlands and ten ponds, comprising 7.77 hectares (19.19 acres). Eighty nine (89) of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.09 percent of the predicted wetland area of the watershed. The majority (60) of impacted wetlands are palustrine emergent vegetation communities and sixty three (63) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size.

(c) North Branch of the Potomac River

In the North Branch of the Potomac River Watershed, Line A would impact 18 vegetated wetlands and five ponds, comprising 3.38 hectares (8.35 acres). Twenty one (21) of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.18 percent of the predicted wetland area of the watershed. The majority (16) of impacted wetlands are palustrine emergent vegetation communities and seventeen (17) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size.

(d) South Branch of the Potomac River

In the South Branch of the Potomac River Watershed, Line A would impact eight vegetated wetlands and two ponds, comprising 0.80 hectares (1.98 acres). All of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.24 percent of the predicted wetland area of the watershed. The majority (7) of impacted wetlands are palustrine emergent vegetation communities and seven (7) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size.

(e) Cacapon River

In the Cacapon River Watershed, Line A would impact 13 vegetated wetlands and four ponds, comprising 0.97 hectares (2.39 acres). All of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.28 percent of the predicted wetland area of the watershed. The majority (10) of impacted wetlands are palustrine emergent vegetation communities and fourteen (14) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size.

(2) Build Alternative in West Virginia

Line A in West Virginia would directly impact 158 individual wetlands, comprising 14.92 hectares (36.86 acres) (Table III-53). The majority (154) of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.12 percent of the predicted wetland area of the West Virginia Watersheds. Most (107) wetland impacts occur in palustrine emergent vegetation communities and one hundred twelve (112) of the wetlands impacted are less than 0.4 hectares (1 acre) in total size. A summary of information on ecological characteristics of impacted wetlands in West Virginia is presented in Table III-54.

(3) Build Alternative in Virginia

Line A in Virginia would directly impact five vegetated wetlands and two ponds, comprising 0.33 hectares (0.82 acres) in the Shenandoah River Watershed (Table III-53). All of the encroachment areas are less than 0.4 hectares (1 acre). This encroachment area accounts for approximately 0.13 percent of the total wetland area of the Virginia watershed. Most (4) wetland impacts occur in palustrine emergent vegetation communities and all of the wetlands impacted are less than 0.4 hectares (1 acre) in total size. A summary of information on ecological characteristics of impacted wetlands in Virginia is presented in Table III-54.

d. Alternative Comparisons

Following is a comparison of the proposed alignments (Line A versus the IRA). This and additional information on ecological characteristics of the impacted wetlands can be found in Tables III-53 and III-54.

(1) Alignments

Wetland impacts for the proposed alignments of Line A versus the IRA are summarized below. Line A would:

- Impact more individual wetlands;
- Impact more wetland area;
- Impact a greater proportion of wetlands that are smaller than 0.4 hectares (1 acre) in total size.

The IRA would impact more forested wetlands.

Figures III-7 to III-12 present a graphical comparison of the amount of impact within each wetland vegetative community of Line A and the IRA. Figures III-13 to III-16 compare wetland encroachment areas to total wetland size. A cluster of points is generally observed towards the bottom left corner of the graph. This indicated that the majority of wetland impact areas were small (less than 0.4 hectare or 1 acre) and occurred within individual wetland systems that were also small (less than 0.4 hectare or 1 acre). Both sets of figures present information by watershed.

(2) West Virginia

Wetland impacts for the proposed alignments of Line A versus the IRA within West Virginia are summarized below. Line A would:

- Impact more individual wetlands;
- Impact more wetland area;
- Impact a greater proportion of wetlands that are greater than 0.4 hectare (1 acre) in total size.

The IRA would impact more area of forested wetland.

Figure III-7
Impacted Wetlands in the Tygart Valley River Watershed

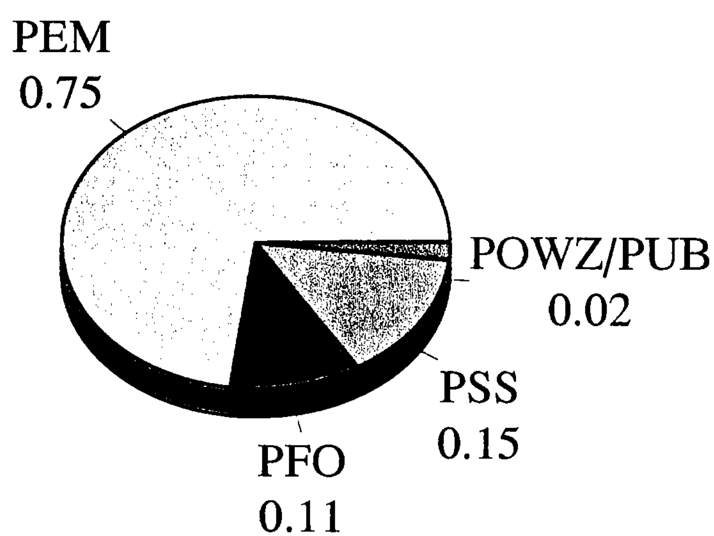
Wetland Hectares: 155.44

Percent Impacted - IRA: 0.663%

Line A: 1.287%

IRA

Hectares Impacted: 1.03



Line A

Hectares Impacted: 2.00

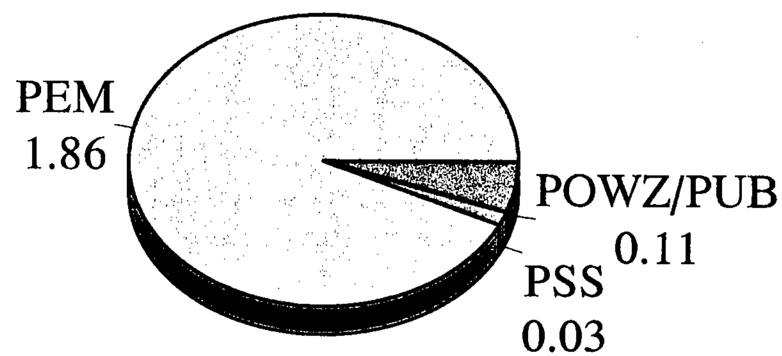


Figure III-8
Impacted Wetlands in the Cheat River Watershed

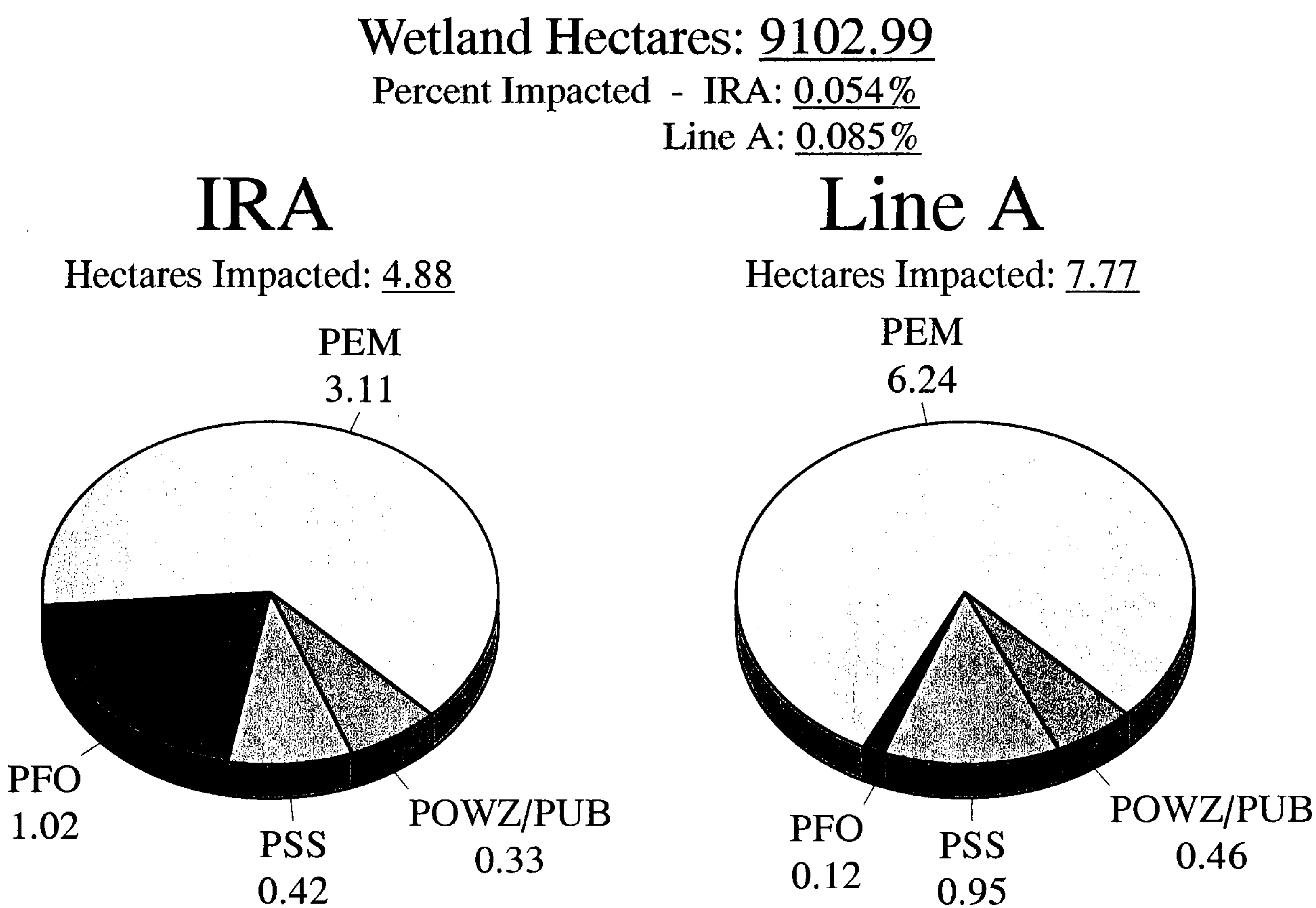


Figure III-9
Impacted Wetlands in the North Branch Potomac River Watershed

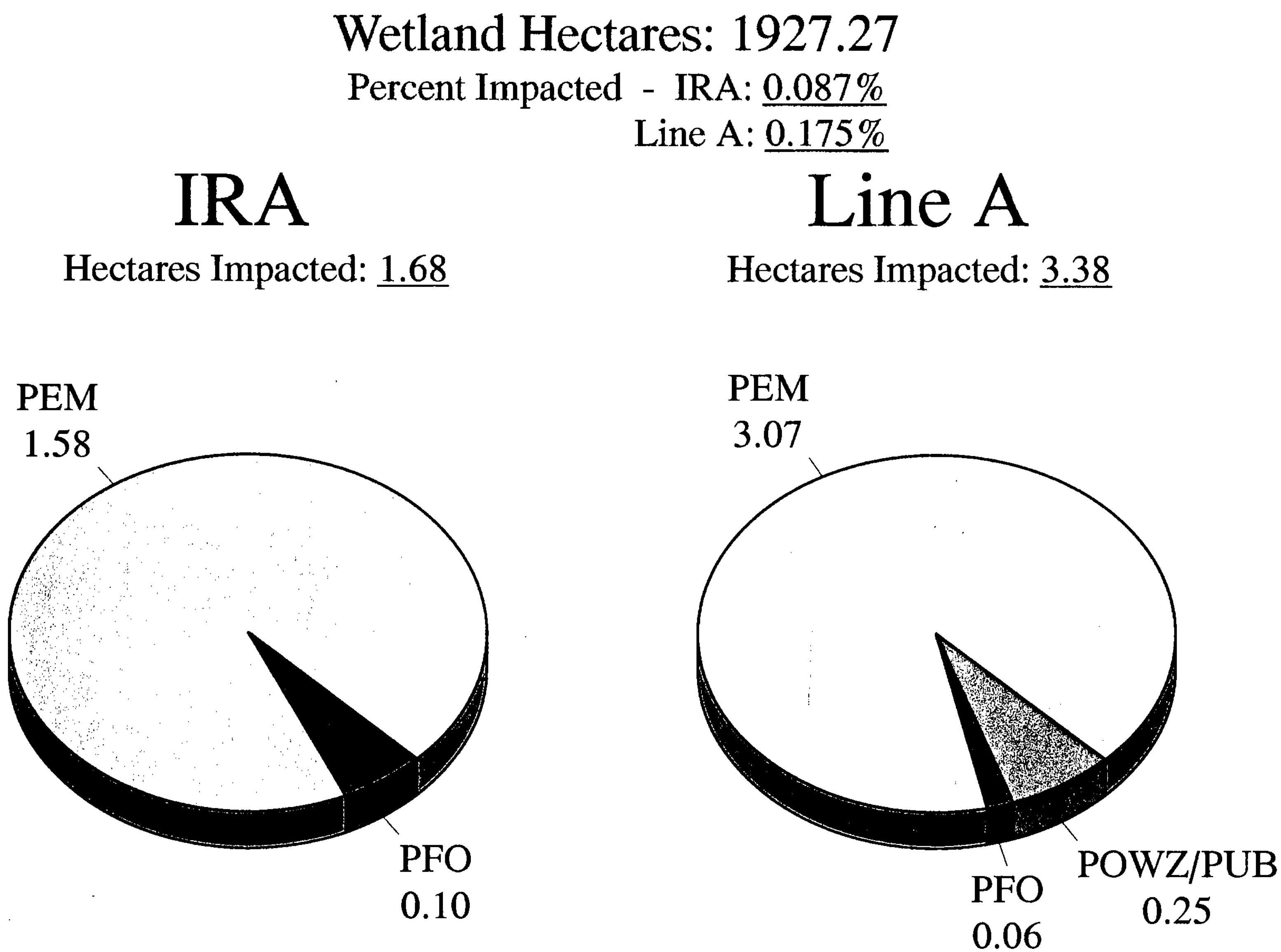
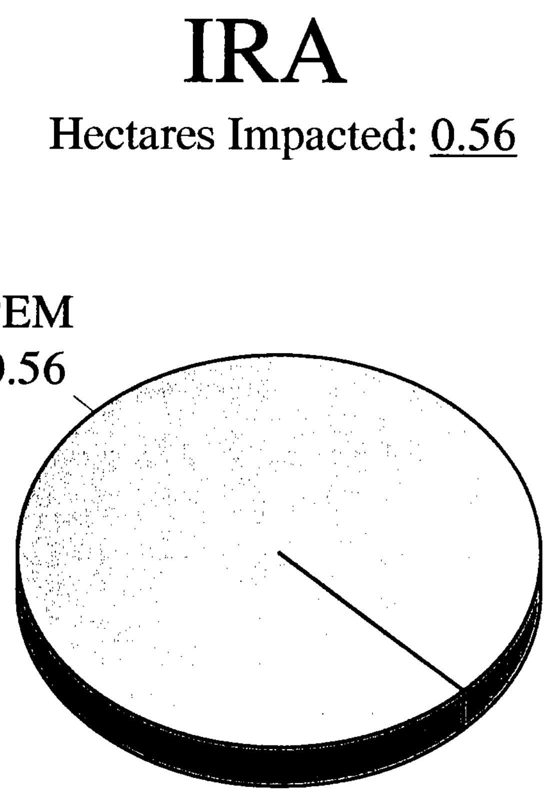


Figure III-10
Impacted Wetlands in the South Branch Potomac River Watershed

Wetland Hectares: 338.44

Percent Impacted - IRA: 0.165%

Line A: 0.239%



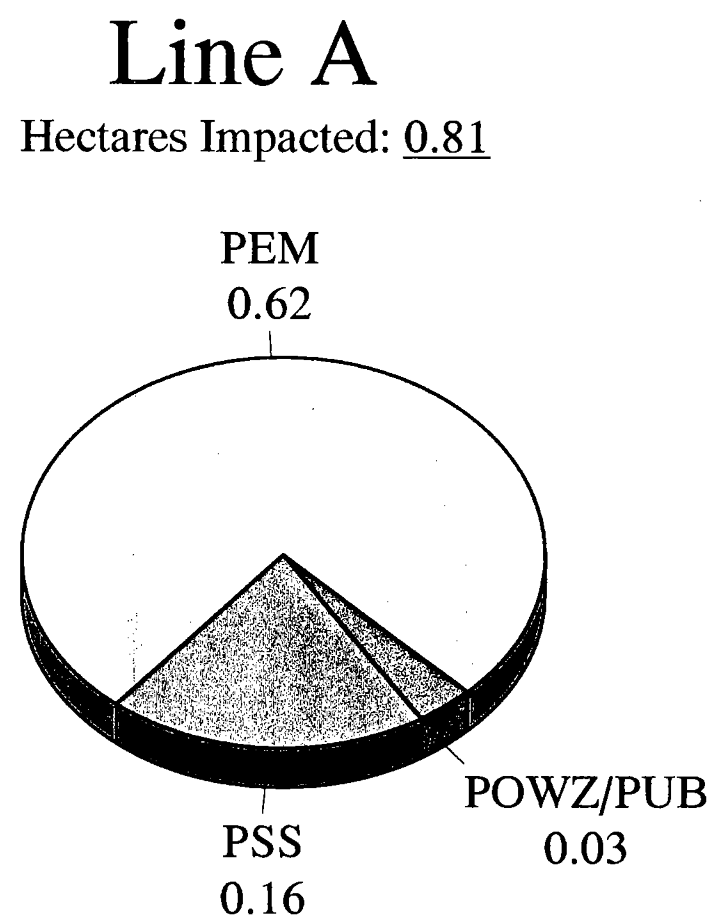
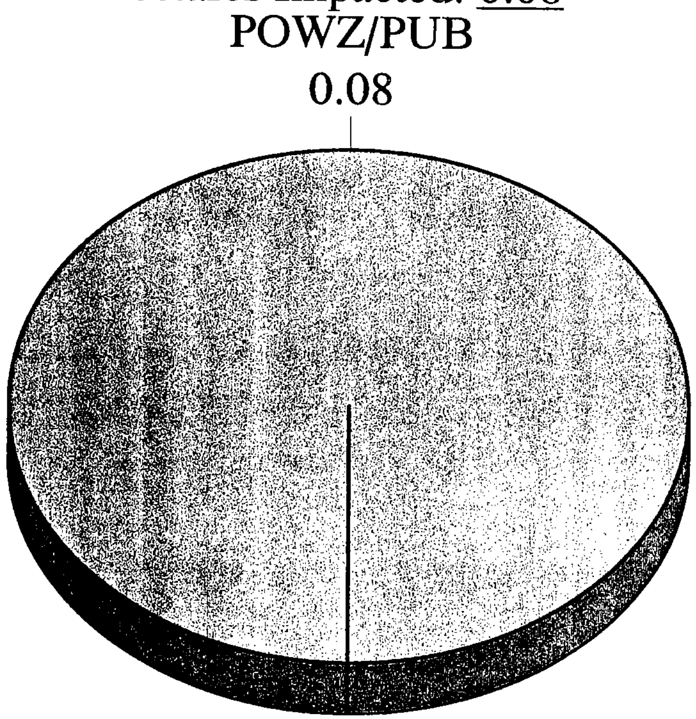


Figure III-11
Impacted Wetlands in the Cacapon River Watershed

Wetland Hectares: 349.39
Percent Impacted - IRA: 0.023%
Line A: 0.275%

IRA

Hectares Impacted: 0.08



Line A

Hectares Impacted: 0.98

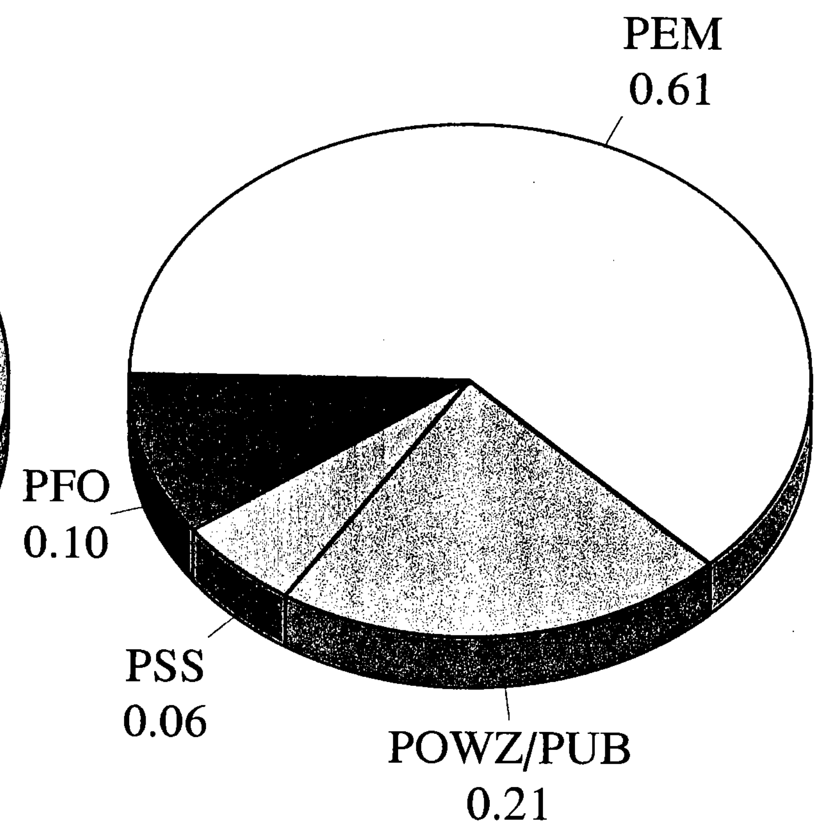


Figure III-12
Impacted Wetlands in the Shenandoah River Watershed

Wetland Hectares: 260.62

Percent Impacted - IRA: 0.177%

Line A: 0.127%

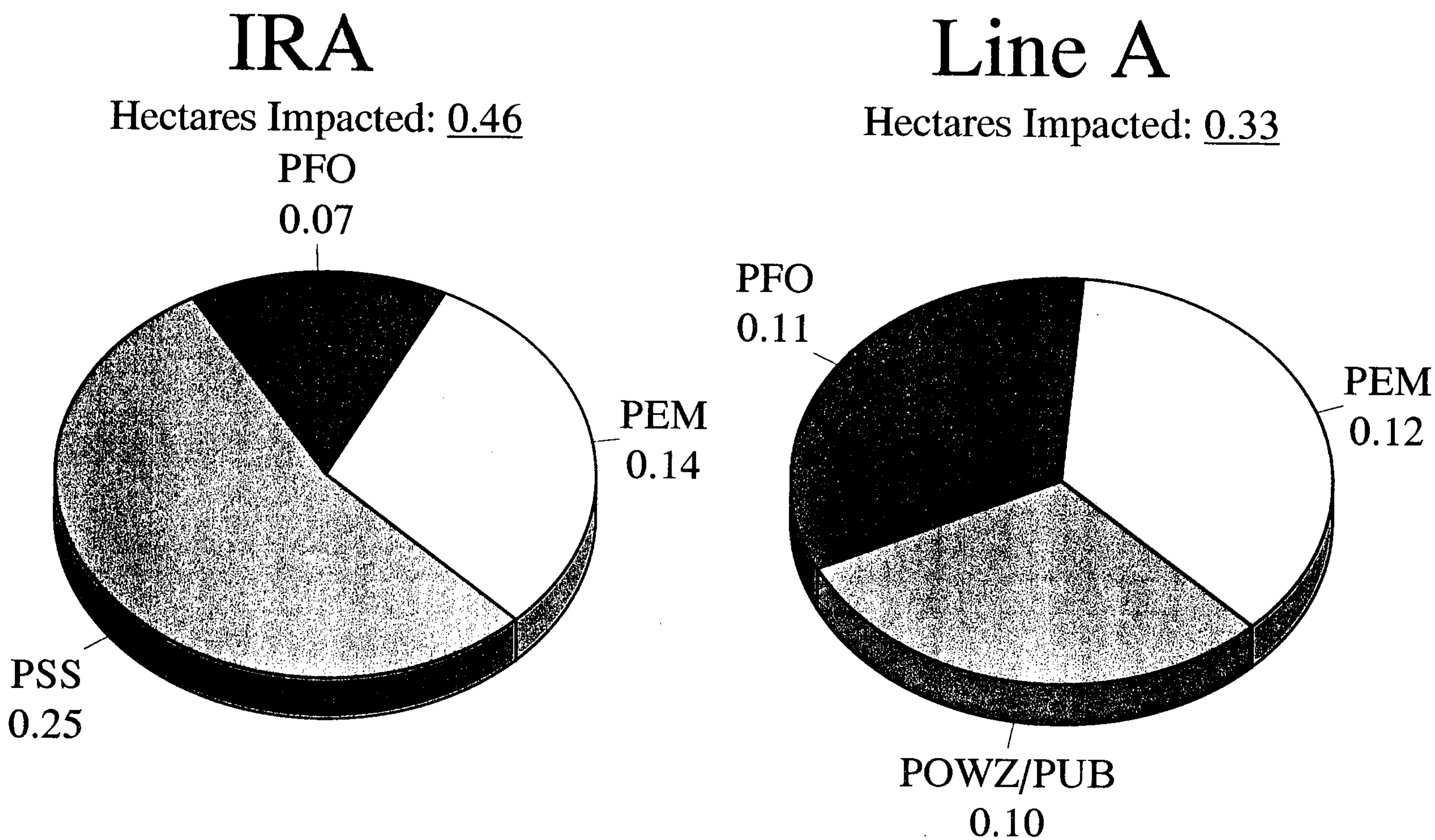
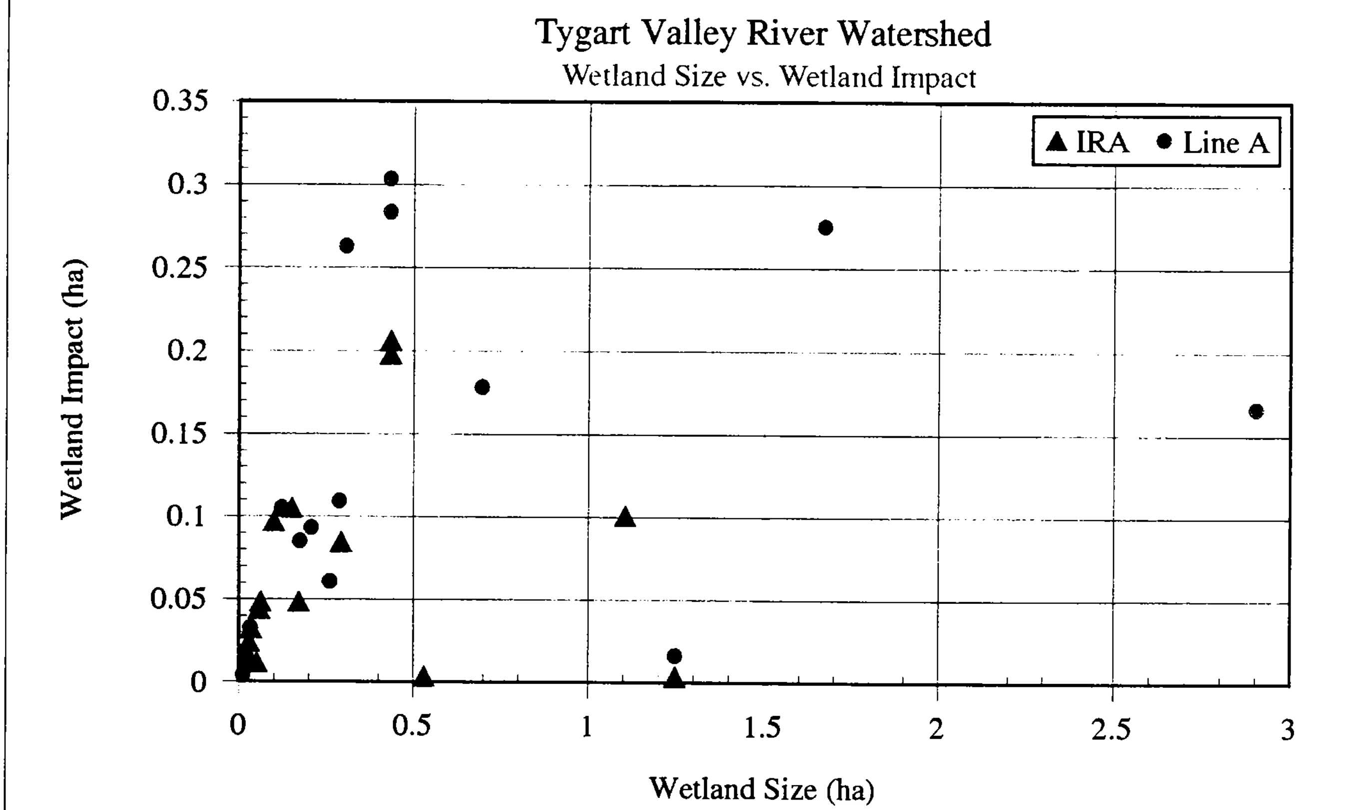


Figure III-13

Sizes of Wetlands Impacted in the Tygart Valley River and Cheat River Watersheds



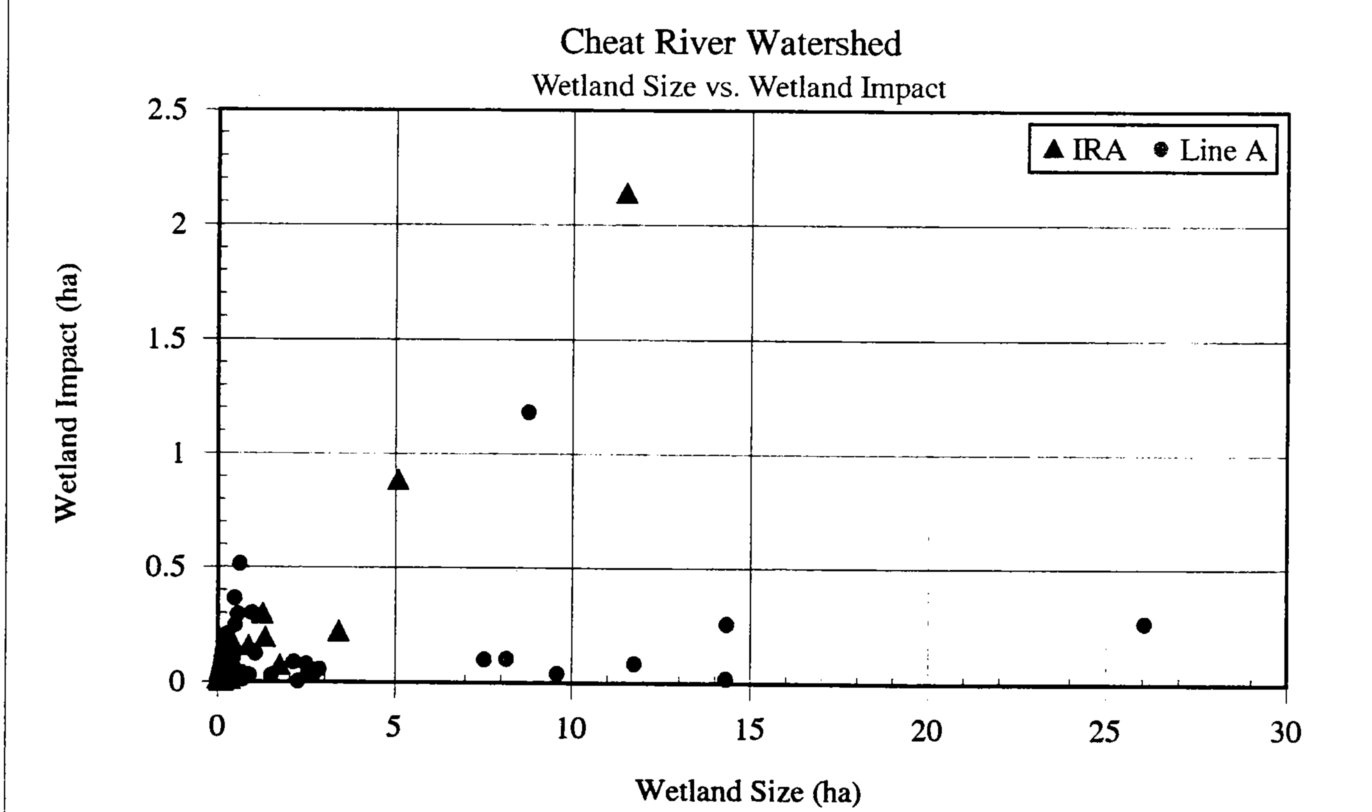
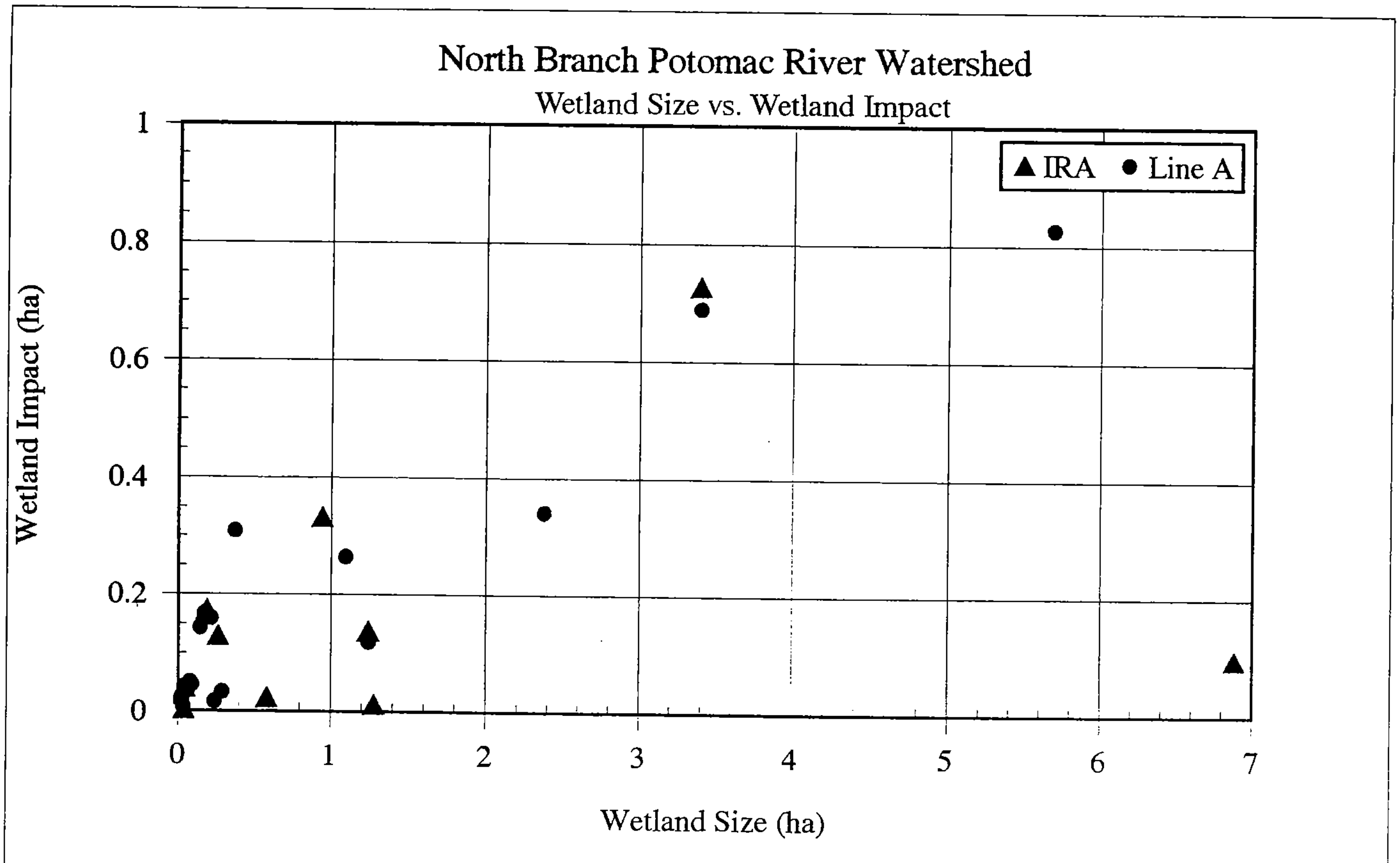


Figure III-14
Sizes of Wetlands Impacted in the North and South Branch Potomac River Watersheds



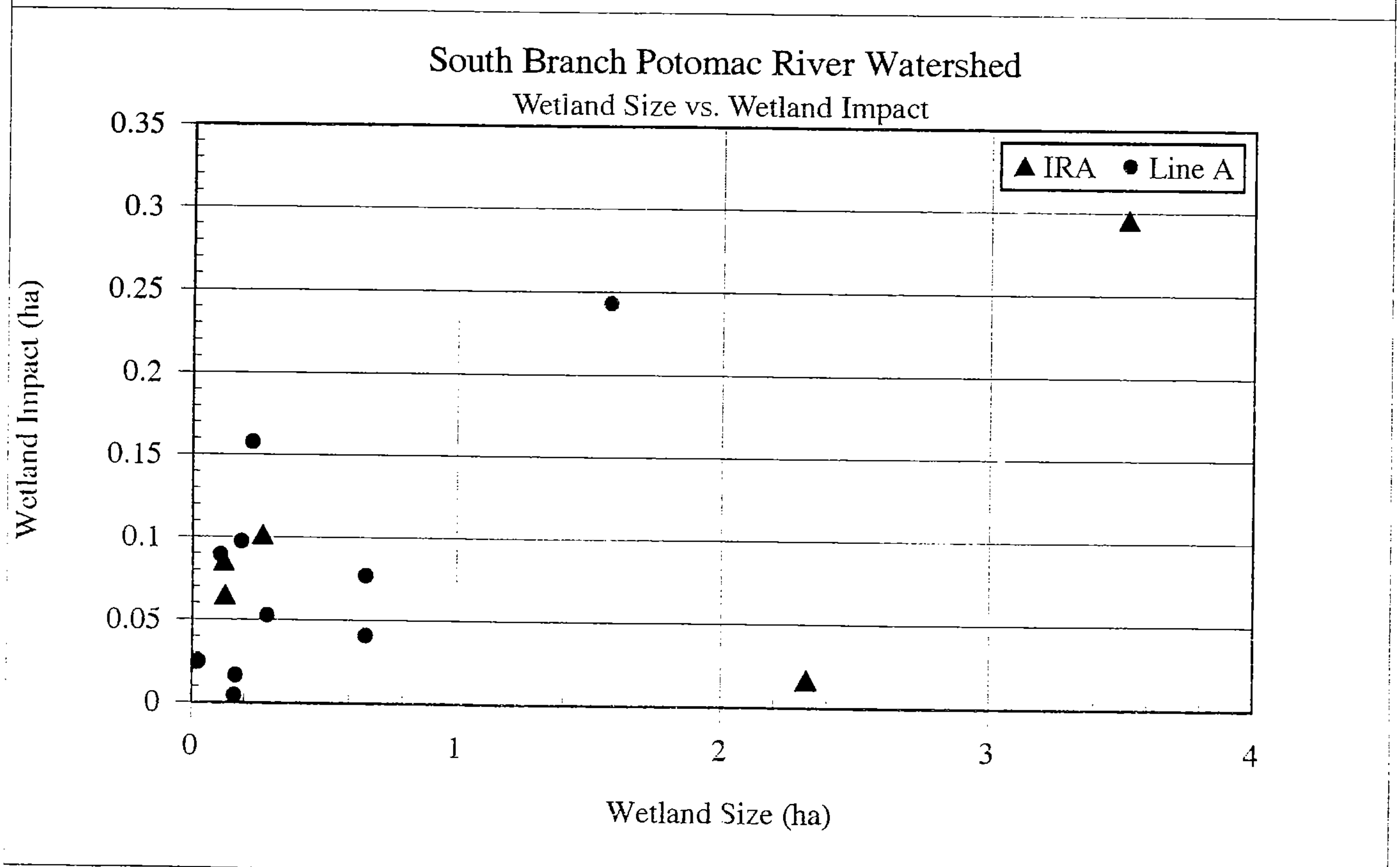
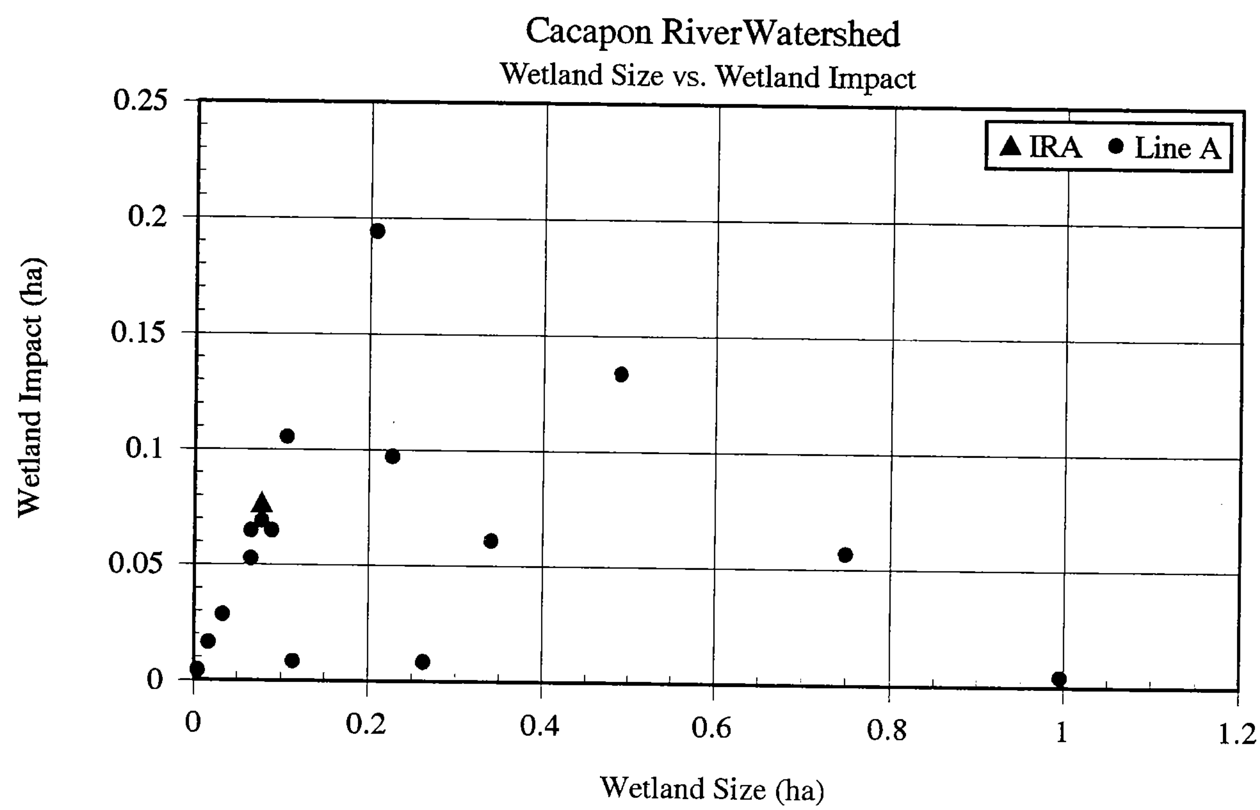


Figure III-15
Sizes of Impacted Wetlands in the Cacapon River and Shenandoah River Watersheds



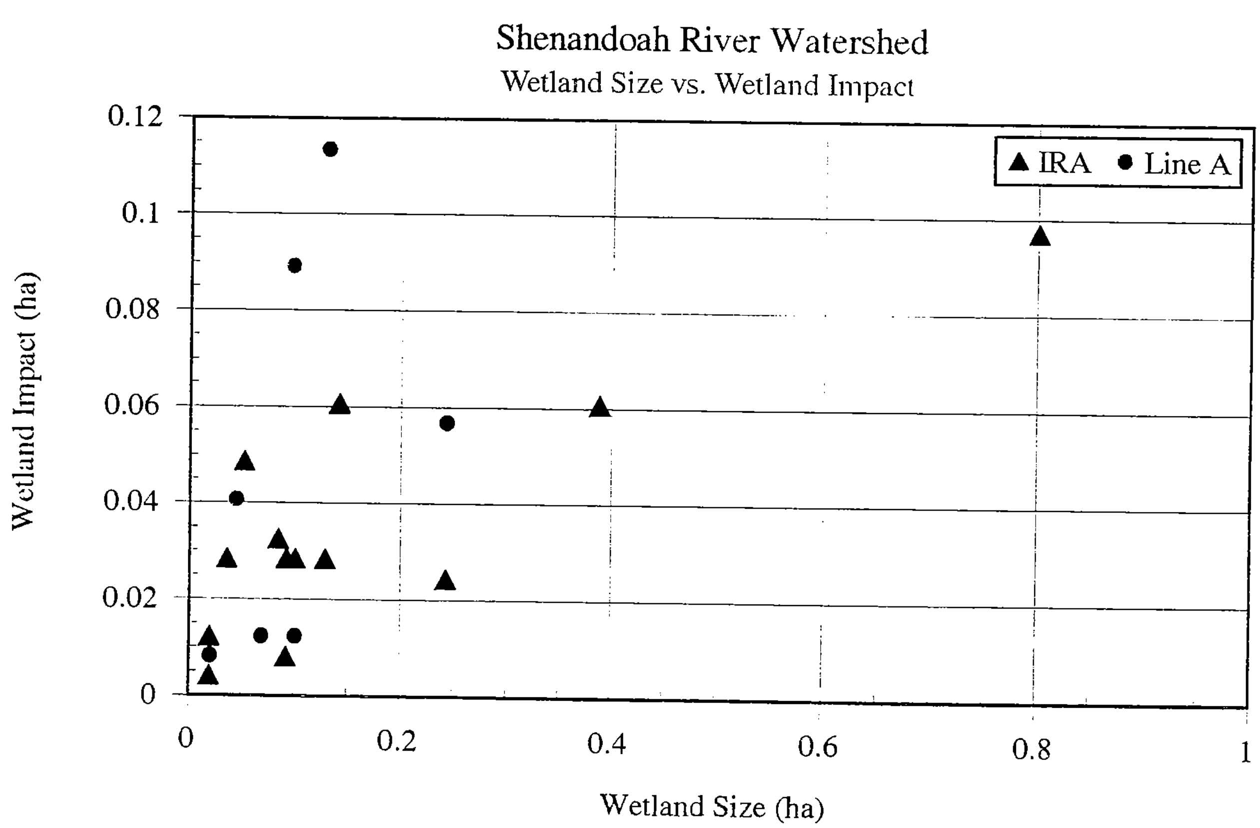
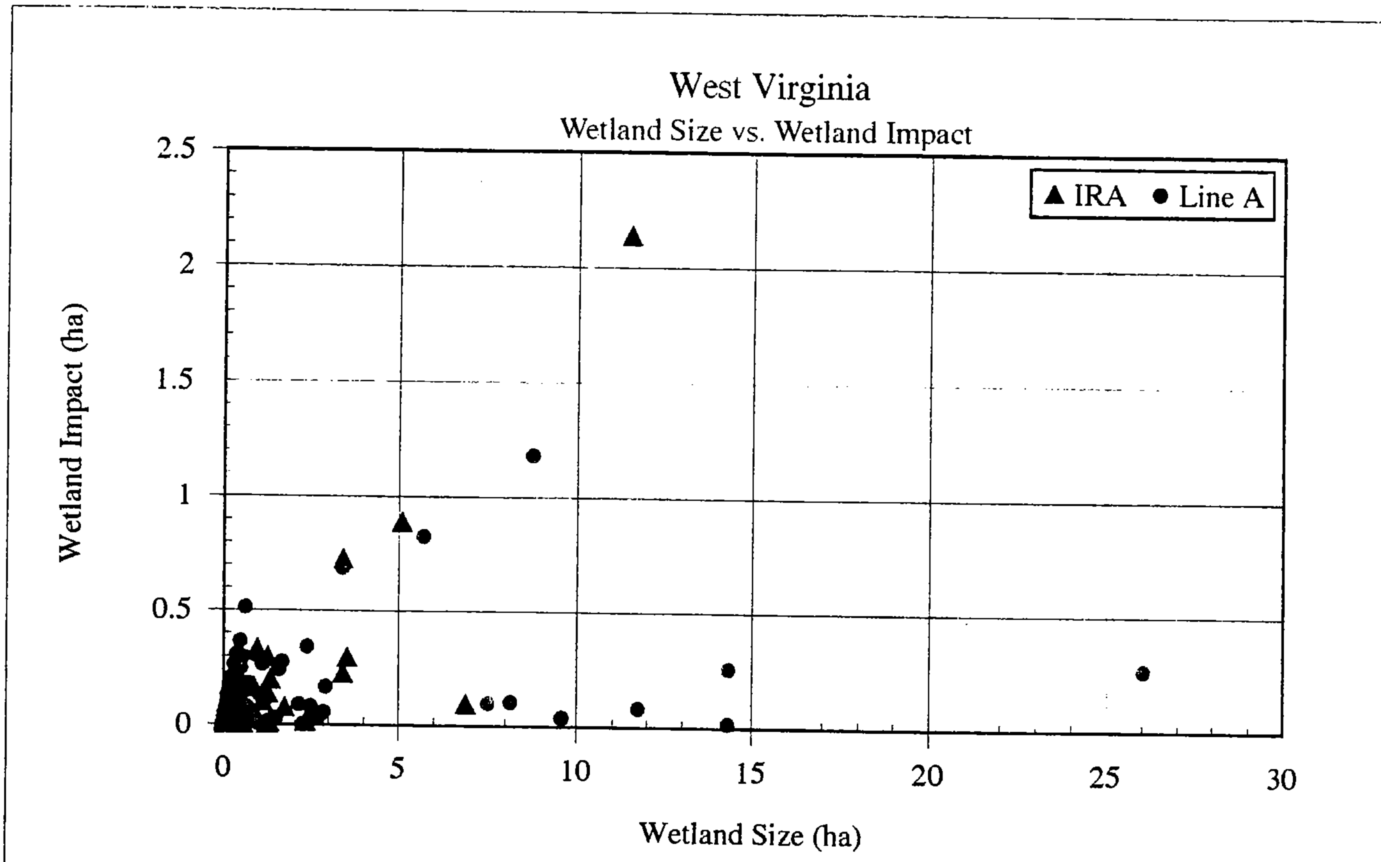
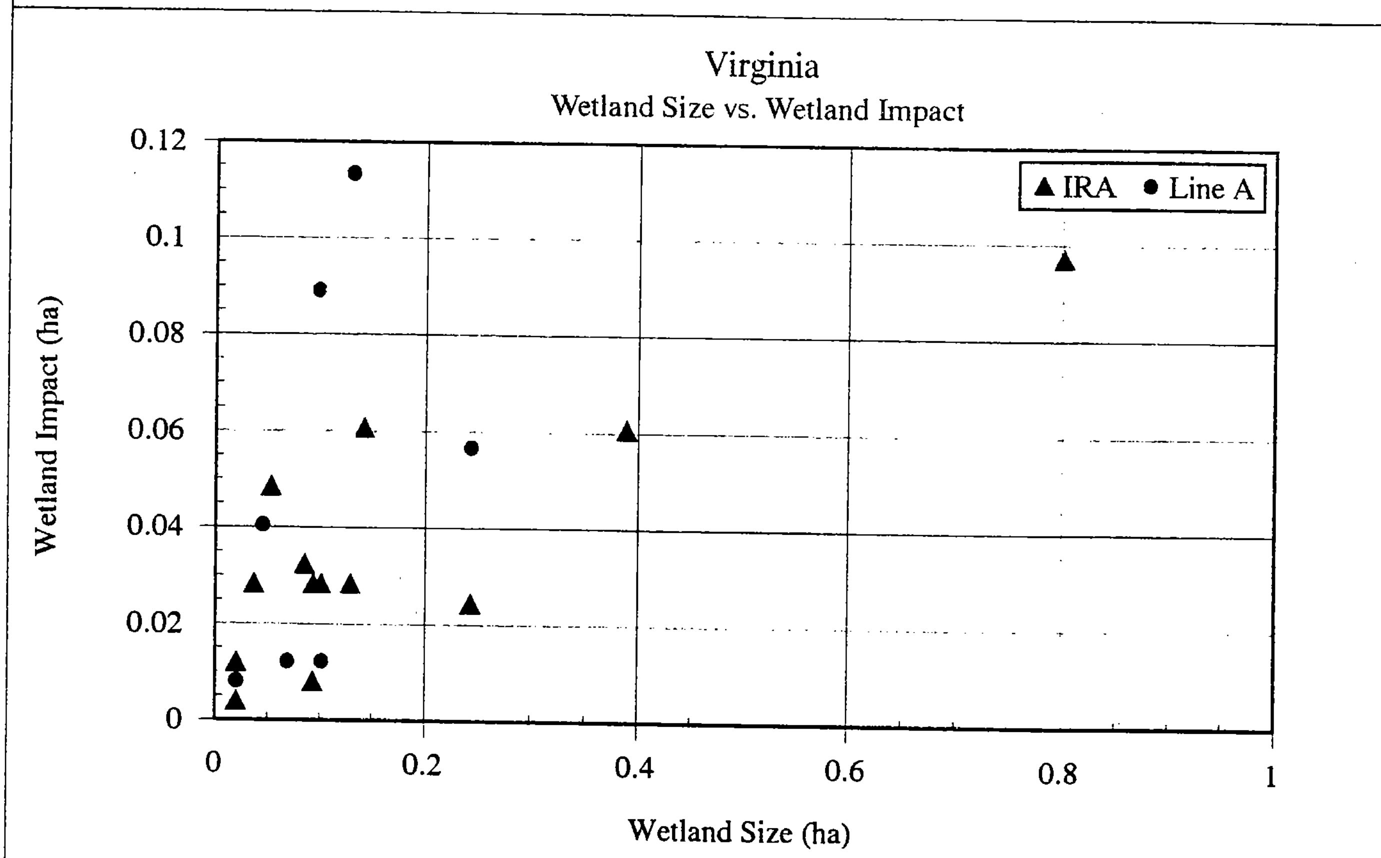


Figure III-16
Sizes of Impacted Wetlands





(3) Virginia

Wetland impacts for the proposed alignments of Line A versus the IRA within Virginia are summarized below. Line A would:

- Impact more forested and open water wetlands;
- Impact a greater proportion of wetlands that are greater than 0.4 hectare (1 acre) in total size.

The IRA would:

- Impact more individual wetlands;
- Impact more wetland area.

e. Option Areas

A comparison of the wetland impacts of the various alignments within each Option Area in West Virginia and Virginia is presented in Tables III-55 and III-56.

(1) Interchange Option Area

Within the Interchange Option Area, Line I and Line A would both impact four palustrine emergent wetlands. However, Line A would impact more wetland area than Line I (0.11 hectare or 0.27 acres; versus 0.05 hectare or 0.13 acres, respectively). Within both alignments, three of four wetlands impacted would be less than 0.4 hectares (1 acre) in total size.

(2) Shavers Fork Option Area

Within the Shavers Fork Option Area, Line S and Line A would both impact one palustrine emergent wetland. However, Line A would impact slightly more wetland area than Line S (0.03 hectare or 0.08 acre; versus 0.02 hectare or 0.4 acre, respectively). All wetlands impacted would be less than 0.4 hectares (1 acre) in total size.

(3) Patterson Creek Option Area

Within the proposed Patterson Creek Option Area, Line P would impact four palustrine emergent wetlands and two ponds, comprising 1.04 hectares (2.56 acres), while Line A would impact two palustrine emergent wetlands and one pond, comprising 0.66 hectares (1.62 acres). All encroachment areas are less than 0.4 hectares (1 acre). Four of the wetlands impacted by Line P are over 0.4 hectare (1 acre) in total size, while two of the wetlands impacted by Line A are less than 0.4 hectare (1 acre) in total size.

TABLE III-55
OPTION AREA WETLAND IMPACTS BY WATERSHED

Watershed			Forested			Scrub/Shrub			Emergent			Open Water			Total		
			#	Hectares	Acres	#	Hectares	Acres	#	Hectares	Acres	#	Hectares	Acres	#	Hectares	Acres
Tygart Valley River	Interchange	Line I							4	0.05	0.13				4	0.05	0.13
		Line A							4	0.11	0.27				4	0.11	0.27
Cheat River	Shavers Fork	Line S							1	0.02	0.04				1	0.02	0.04
		Line A							1	0.03	0.08				1	0.03	0.08
North Branch Potomac River	Patterson Creek	Line P							4	0.99	2.45	2	0.04	0.11	6	1.03	2.56
		Line A							2	0.65	1.60	1	0.01	0.02	3	0.66	1.62
	Forman	Line F	1	0.02	0.06				8	1.42	3.52	2	0.02	0.04	11	1.46	3.62
		Line A	1	0.02	0.06				5	1.28	3.17	2	0.06	0.14	8	1.36	3.37
South Branch Potomac River																	
Cacapon River	Hanging Rock	Line R															
		Line A															
	Baker	Line B							2	0.12	0.30	2	0.08	0.21	4	0.20	0.51
		Line A										1	0.03	0.07	1	0.03	0.07
Shenandoah River	Duck Run	Line D1				1	0.05	0.12				2	0.10	0.24	3	0.15	0.36
		Line D2	1	0.11	0.28										1	0.11	0.28
		Line A	1	0.11	0.28							2	0.10	0.24	3	0.21	0.52
	Lebanon Church	Line L							3	0.33	0.81	2	0.02	0.06	5	0.35	0.87
		Line A							3	0.11	0.27				3	0.11	0.27

TABLE III-56
CHARACTERISTICS OF IMPACTED OPTION AREA WETLANDS

NUMBER OF WETLANDS WITH CHARACTERISTIC	Tygart Valley River		Cheat River		North Branch Potomac				Cacapon River				Shenandoah River				
	Interchange Option Area		Shavers Fork Option Area		Patterson Creek Option Area		Forman Option Area		Hanging Rock Option Area		Baker Option Area		Lebanon Church Option Area		Duck Run Option Area		
	Line I	Line A	Line S	Line A	Line P	Line A	Line F	Line A	Line R	Line A	Line B	Line A	Line L	Line A	Line D1	Line D2	Line A
Adjacent Land Cover																	
Agricultural	4	4	1	1	6	3	10	5	0	0	2	0	5	3	3	0	2
Disturbed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Undisturbed	0	0	0	0	0	0	1	3	0	0	2	1	0	0	0	1	1
Landscape Position																	
Isolated	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Headwater	2	2	1	1	5	3	11	8	0	0	3	1	5	3	3	1	3
Other	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Wetland Size																	
Less Than 0.4 ha	2	2	1	1	3	1	8	2	0	0	3	1	5	3	2	1	3
Greater Than 0.4 ha	2	2	0	0	3	2	3	6	0	0	1	0	0	0	1	0	0
Functional Change																	
No Change	3	2	0	0	1	0	3	0	0	0	2	0	0	0	1	0	0
Slight Decrease	0	1	0	0	3	2	0	2	0	0	0	0	1	2	0	0	0
Decrease	0	0	1	1	0	0	3	1	0	0	1	0	3	0	1	0	1
Lost	1	1	0	0	2	1	5	5	0	0	1	1	1	1	1	1	2

(4) Forman Option Area

Within the Forman Option Area, Line F would impact nine vegetated wetlands (8 palustrine emergent, 1 palustrine forested) and two ponds, comprising 1.46 hectares (3.62 acres), while Line A would impact six vegetated wetlands (5 palustrine emergent, 1 palustrine forested) and two ponds, comprising 1.36 hectares (3.37 acres). Line F would create two encroachment areas greater than 0.4 hectare (1 acre), while Line A would create one. Line F impacts would occur in more wetlands greater than 0.4 hectare (1 acre) (3 versus 2).

(5) Hanging Rock Option Area

Within the Hanging Rock Option Area, neither Line R nor Line A would directly impact wetlands.

(6) Baker Option Area

Within the Baker Option Area, Line B would impact two palustrine emergent wetlands and two ponds, comprising 0.21 hectare (0.51 acre), while Line A would impact one pond comprising 0.03 hectare (0.07 acre). Line B would impact one palustrine emergent wetland greater than 0.4 hectare (1 acre) in total size.

(7) Duck Run Option Area

Within the Duck Run Option Area, Line D1 would impact one palustrine scrub-shrub wetland and two ponds, comprising 0.15 hectare (0.36 acre); Line D2 would impact one palustrine forested wetland, comprising 0.11 hectare (0.28 acre); while Line A would impact one palustrine forested wetland and two ponds, comprising 0.21 hectare (0.52 acre). All of the wetlands impacted are less than 0.4 hectare (1 acre) in total size.

(8) Lebanon Church Option Area

Within the Lebanon Church Option Area, Line L would impact three palustrine emergent wetlands and two ponds, comprising 0.35 hectare (0.87 acre), while Line A would impact three palustrine emergent wetlands, comprising 0.11 hectare (0.27 acre). Only one of the wetlands impacted (Line L) is greater than 0.4 hectare (1 acre) in total size.

f. Secondary Impacts

(1) Highway-Related Impacts

The secondary impacts discussed here are defined as the effects of construction and operation of the proposed project on wetlands farther removed in distance from the construction and operation limits. These effects may be the immediate consequences of road construction, or they may be a result of the road's long-term operation. The effects of highway construction may be more likely to occur in wetlands than in uplands because wetlands are the landscape units that receive, retain, and discharge surface water and groundwater (Southerland, 1993). Secondary impacts can affect wetlands through changing the vegetation communities, erosion and sediment deposition, or altering water regimes and water quality. The majority of these impacts are temporary in nature and their severity can be mitigated through use of management practices, as discussed in *Avoidance, Minimization, and Mitigation.*

Wetland water quality could be affected by temporary erosion and sedimentation caused by earth moving activities. Shuldiner, *et al.* (1979) report that highway construction is a major source of sediment loads in surface waters, and sediment loads from highway construction during an average storm can be 10 times greater than that from cultivated land and 200 times greater than that of grassed and forest land. Construction activities within the wetland itself can cause large amounts of organic and mineral matter to be suspended in the surrounding water. Runoff from cleared lands or highway fill is also a source of inorganic matter that could enter wetlands. This could decrease overall wetland productivity by increasing water turbidity, thereby lowering the amount of light available for photosynthesis. Deposition of sediment within wetlands could raise the surface elevation of the wetland, leading to eventual drop in the water table and loss of the wetland. Excess sediment also could smother certain plant species.

Data analysis determined that 2% of the potentially impacted wetlands for the Build Alternatives contained submerged aquatic vegetation such as American waterwort (*Elatine americana*), white water lily (*Nymphacaea odorata*), greater duckweed (*Spirodela polyrhiza*), and long-leaved pondweed (*Potamogeton nodus*) that could be susceptible to the above impacts. Further analysis revealed that within these wetlands, the submerged vegetation was a small component of the overall wetland vegetative community. The dominant existing emergent plants that surround these submerged species, may act as a vegetative buffer to reduce potential runoff and suspended solids impacts. The employment of proper erosion and sedimentation control practices should reduce and/or minimize these potential impacts.

Changes in water levels and water flow regimes are another potential effect of highway construction and operation. Movement of groundwater could be slowed by placement of impervious fills or compression of the substrate. This effect could cause ponding of water on the upstream side of the road and drying of the downstream side of the road. Channelization of water flows in a wetland due to placement of culverts also could cause lowering of the water table. The reverse could also occur - greater water levels could occur if water is directed into a wetland from an outside source. Many wetland plant species are sensitive to the amount and level of water that occurs in the wetland. In some cases changes in water levels could cause minor alterations in the vegetation community composition, and in other cases, the changes could be dramatic.

Data analysis for the Build and Improved Roadway Alternatives determined that proposed highway construction restricted the placement of culverts to existing streams, and as such, would not impact wetland vegetation.

Alteration of flooding patterns (timing and flow volume) can impact wetland productivity and vegetative community structure. Flooding provides periodic inputs of needed nutrients into wetlands. Drier conditions accelerate decomposition of dead plant material, and these added nutrients encourage rapid growth. Thus, loss of flooding could cause reduced wetland productivity and changes in wetland community structure and composition. During wetland field investigations, an assessment was made of potential sources of wetland hydrology. Three percent (18) of the delineated wetlands were solely dependent on seasonal flooding for their hydrology. Of these, only eight wetlands were within 100 feet of the construction limits. These wetlands could be susceptible to alterations in flood patterns due to construction activity.

Wetlands often function to regulate water flows in their watersheds. Wetlands can retain water during high flow conditions, much as ponds do. During dry periods, wetlands can discharge water downstream, preventing smaller streams from drying up during drought conditions. Highway construction could either increase or decrease water flows into and out of wetlands. Although increasing stormwater storage would be beneficial to the watershed, this could cause changes in the vegetation composition and community structure. Increasing water flows from the wetland could cause faster drying of the wetland and could cause greater fluctuations in water levels downstream.

Potentially harmful and toxic materials can be associated with stormwater runoff (Dupuis and Kobriger, 1985). These materials may include nitrogen, phosphorus, metals, salts, petroleum products, and pathogenic bacteria. However, it has been found that stormwater runoff from rural highways with traffic volumes less than 30,000 vehicles per day causes minimal to no impact on the aquatic environment. Projected traffic volumes for the year 2013 for the proposed highway project ranged from 1,000 to 23,000 vehicles per day with an average volume of 9,000. At these traffic volumes, the above effects would be minimal.

The GIS was used to evaluate the extent of potential secondary impacts; wetlands that sustained impacts to more than 80 percent of their total area were considered to suffer complete loss of their functions and values. When these wetland areas were added to the direct impact of the construction limits, Line A impacts would increase by 3% (0.53 hectare or 1.30 acres), and IRA wetland impacts would increase 0.4% (0.03 hectare or 0.08 acre).

(2) Development-Related Impacts

Only one industrial park site has not begun construction activities. All other industrial parks have been constructed or are currently under construction. This undeveloped site is located north of WV 93 and adjacent to Four Mile Run and contains a 2.3 hectare (5.5 acre) palustrine scrub-shrub wetland. Development of this site could encroach upon that wetland as well as impact Four Mile Run.

Intersection/Interchange development analysis revealed that such development could occur without encroaching upon any wetland resources, for the Build and Improved Roadway Alternatives.

Because the definition of raw land excludes wetlands and because sufficient raw land is available to support all predicted residential and service-oriented development, it is possible that the projected development could occur without wetland impacts.

g. Cumulative Impacts

(1) Additive Direct Impacts

Additive direct impact to wetlands by watershed are summarized in Table III-57 for both the Improved Roadway and Build Alternatives. The IRA in West Virginia would cumulatively impact 63 individual wetlands, comprising 8.22 hectares (20.32 acres), an encroachment area representing 0.07% of the predicted wetland area for the West Virginia Watersheds.

The IRA in Virginia would cumulatively impact 17 individual wetlands, comprising 0.47 hectares (1.14 acres), an encroachment area representing 0.18% of the predicted wetland area for the Virginia Watershed. Line A in West Virginia would cumulatively impact 158 individual wetlands, comprising 14.92 hectares (36.86 acres), an encroachment area representing 0.12% of the predicted wetland area of the West Virginia Watersheds. Line A in Virginia would cumulatively impact 7 individual wetlands, comprising 0.33 hectares (0.82 acre), an encroachment area representing 0.13% of the predicted wetland area of the Virginia Watershed.

TABLE III-57
WETLAND IMPACTS BY WATERSHED

Watershed		#	Hectares	Acres	% of Predicted Watershed Wetland Area
Tygart Valley River	Line A	17	2.00	4.95	1.29
	IRA	17	1.02	2.53	0.66
Cheat River	Line A	91	7.77	19.19	0.09
	IRA	27	4.88	12.06	0.05
North Branch Potomac River	Line A	10	3.38	8.35	0.18
	IRA	10	1.68	4.15	0.09
South Branch Potomac River	Line A	10	0.80	1.98	0.24
	IRA	8	0.56	1.39	0.17
Cacapon River	Line A	17	0.97	2.39	0.03
	IRA	1	0.08	0.19	0.02
West Virginia Total	Line A	158	14.93	36.86	0.12
	IRA	63	8.23	20.32	0.07
VA- Shenandoah River	Line A	7	0.33	0.82	0.13
	IRA	17	0.46	1.14	0.18

Leibowitz et al., (1992) presented three general categories of wetland functions that should be considered when evaluating cumulative impacts: habitat functions that provide support for wetland dependent species, including food, shelter, and breeding sites; water quality functions including water quality improvement, nutrient cycling and supply; and hydrologic functions such as flood attenuation and moderation of hydrologic flow. These functions are considered below.

Wildlife wetland habitat was assessed using the USFWS Habitat Evaluation Procedure (HEP). This procedure is discussed in detail in the *Vegetation and Wildlife Habitat Technical Report.* Overall, wetland habitat contributed less than 1% to the calculated HU total. The wetlands impacted appear to be of seasonal importance, providing limited breeding and feeding habitat during the spring and early summer. The majority of wetlands impacted for both Alternatives were relatively small palustrine emergent communities. As such, they did not provide vegetative habitat components in the quantities necessary to yield appreciable HUs for the chosen evaluation species. While small wetlands can play an important role in the population dynamics of many wetland associated small mammal, bird, amphibian, and insect species, the removal of this wetland area would not have a measureable cumulative effect on these wildlife populations within the regional project watersheds.

In addition, wetland mosaic patterns are an important feature for wetland associated species. Researchers have found that the approximate maximum migration distance for aquatic breeding amphibians, small birds, and small mammals is 1,000 m (Gibbs, 1993). Gibbs also found that small wetlands (less than 4 hectares or 10 acres) play an important role in the population dynamics of many wetland associated species by reducing interwetland distances, thereby increasing the probability of successful dispersal, and increasing the number of individuals dispersing among patches within the wetland mosaic. Over 90 % of the delineated wetlands met this size criteria. Alteration of the existing wetland mosaic pattern could result in wetlands becoming "isolated" (greater than 1,000 m, 3,280 ft, from the nearest wetland) which could impact the population dynamics of wetland associated species. GIS analysis examined the existing wetland mosaic pattern of the field investigated wetlands. Four percent (20) of the existing delineated wetlands were determined to be isolated based on the above definition. The average minimum distance between existing wetlands was 240 meters (790 feet).

Construction of the Build Alternative (Line A) could potentially isolate one additional wetland by creating an inter-wetland distance greater than 1,000 meters. Overall, the average minimum distance between wetlands would increase by 20 meters to 260 meters (850 feet). This increase in average minimum distance is not considered an impediment to those species present. Construction of the IRA similarly would isolate one small (< 0.5 hectare) wetland. Construction of either alternative would therefore not alter the current wetland mosaic pattern present.

A functions and values evaluation for each delineated wetland was conducted using the Wet 2.1 computer program. In summary, the WET 2.1 program assigns qualitative probability ratings to wetland functions and values including; groundwater recharge, floodflow alteration, sediment stabilization, sediment/toxicant retention, and nutrient removal/transformation. All watershed wetlands generally had high to moderate functional probability values for the above functions. Of the wetlands impacted, 25% were predicted to lose their ability to perform the above functions. These wetlands averaged approximately 0.08 hectare (0.2 acre) in total size and would likely have had limited functional capabilities. The cumulative impact of this wetland loss on watershed wetland functional values would be minimal considering the relatively small size of the impacted wetlands, and the relatively small percentage of total watershed wetlands they comprise (less than 1%).

(2) Additive Direct and Secondary Impacts

The combination of direct and secondary impacts yielded a slight increase in wetland impact area due to secondary industrial park development. A 2.3 hectares (5.5 acres) palustrine scrub/shrub community could potentially be impacted by the development of a new Grant County industrial park located in the North Branch of the Potomac River watershed. This would represent an increase of 26% for wetland impacts associated with the IRA and a 15% increase of wetland impacts associated with Line A. However, for both Alternatives, this increased wetland impact area is less than 1% of the total predicted wetland area within the North Branch of the Potomac River watershed. The loss of this wetland could impact floodflow alteration, sediment stabilization, sediment/toxicant retention, and nutrient removal/transformation functions within the immediate area. However, any development that removed this wetland would be required to replace this acreage through compliance with Federal and state wetland regulatory guidelines. Proper design of the wetland replacement site should replace and possibly enhance lost functions and values.

(3) Foreseeable Future Actions

Cumulative impacts related to the development of foreseeable future projects was limited to known Federal actions that are currently ongoing or are in the formulative stages of study. Because sufficient raw land is available within the regional project watersheds to support predicted development, encroachment on wetlands to support that development would not be necessary.

Five Federal actions and potential wetlands impacts associated with these actions were identified: 1) Moorefield, WV, in cooperation with the USDA's Soil Conservation Service, is considering construction of a reservoir on Stony Run to provide sufficient raw water to accommodate future predicted demands (USDA-SCS, 1994); 2) In addition, Moorefield, in cooperation with the Corps of Engineers, is considering construction of levees along the South Fork South Branch Potomac River to provide flood protection (COE, 1990); 3) The effort to establish the Canaan Valley National Wildlife Refuge; 4) The continued multiple resource use management of the George Washington National Forest (USDA, FEIS George Washington National Forest, 1993); and 5) The continued multiple resource use management of the Monongahela National Forest (USDA, FEIS Monongahela National Forest, 1986).

Table III-58 summarizes the potential wetland impacts due to the above five Federal actions. Only the Moorefield floodwall project would involve future wetland impacts within the South Branch of the Potomac River watershed. Approximately .8 hectares (2 ac) of forested wetlands would be removed by the construction of this project. Proposed mitigation measures include land acquisition and planting of .8 ha of bottomland hardwood species to replace wetland functions and values lost (COE, 1990). The proposed Canaan Valley National Wildlife Refuge would protect the largest wetland complex in both West Virginia and the central and southern Appalachians (wetland complex over 3,400 ha in size). Both National Forests have prepared Final Environmental Impact Statements that propose no wetland impacts for the immediate future. State and Federal regulatory agencies would be consulted if proposed changes to forest management plans or objectives would impact wetlands.

4. ALTERNATIVES ANALYSIS

Table III-59 presents the wetland impact data that supports the selection of Line A as the preferred Alternative. The Section 404 Permit Application and the Alternatives Analysis required by Section 404(b)(1) is included in Appendix G of this SDEIS. Avoidance measures relative to other environmental, cultural and social issues are documented in the Alternatives Analysis.

5. GENERAL WETLAND MITIGATION REQUIREMENTS

Mitigation requirements for impacts of the project have been evaluated in accordance with EO 11990 and Technical Advisory T 6640.8A. In addition, the wetland mitigation process integrated both National Environmental Policy Act and Section 404(b)(1) Guidelines from the Clean Water Act (40 CFR 230).

The 1990 Memorandum of Agreement (MOA) between the Corps of Engineers and the Environmental Protection Agency establishes general policy approaches to mitigation. A primary feature of the policy states that mitigation should be "appropriate and practical", meaning that the mitigation measures "should be appropriate to the scope and degree of those impacts and practicable in terms of cost, existing technology, and logistics in light of overall project purposes". Several topics are incorporated into this issue, including location of the mitigation site, replacement types and replacement amounts.

TABLE III-58
CUMULATIVE WETLAND AND WILDLIFE IMPACT ASSESSMENT MATRIX
FOR FORESEEABLE FUTURE FEDERAL ACTIONS
WITHIN 30-MINUTE CONTOUR

	WILDLIFE HABITAT IMPACTS	WETLAND IMPACTS	BIODIVERSITY IMPACTS	MITIGATION/ MANAGEMENT PLANS
FLOODWALL - MOOREFIELD, WV	Over 90% of impacts to cropland or urban land (21 ac)	1.9 acres forested wetlands	No involvement of threatened or endangered species.	Wetland and upland revegetation plan
STONY RUN WATER SUPPLY DAM - HARDY COUNTY, WV	Approx. loss of 70 acres forested habitat	None, no wetlands identified in feasibility study	No involvement of threatened or endangered species. Creation of open water habitat.	None proposed.
CANAAN VALLEY NATIONAL WILDLIFE REFUGE	Preservation of 28,000 acres	Preservation of largest wetland complex in West Virginia and the central and southern Appalachians.	Preservation of diverse plant and animal populations, including 1 threatened and 1 endangered species	Comprehensive management plan developed
GEORGE WASHINGTON NATIONAL FOREST	Multiple use management of over 100,000 forested acres	None proposed	Management plan to conserve specific elements of biodiversity and restore others where needed.	Comprehensive land and resource management plan
MONOGAHELA NATIONAL FOREST	Multiple use management of over 500,000 forested acres	None proposed	Plan to promote populations of management indicator species, including threatened and endangered species.	Comprehensive land and resource management plan

TABLE III-59
ALTERNATIVES ANALYSIS: SUMMARY OF WETLAND IMPACTS BY SECTION

SECTION	LINE DESIGNATIONS ON PREVIOUS PLANS*	WETLAND IMPACT	
		hectares	acres
3	3-A.1, 3-C, 3-A.1	0.5	1.2
	Line A	0.5	1.3
4	4-A.1	0.1	0.2
	4-A.1, 4-D, 4-A.1	0.2	0.4
	5-E, 4-A.1, 4-E,5-A.1	0.2	0.6
	Line A	0.1	0.2
5	5-A.1, 5-D, 5-A.1	0.4	0.9
	5-A.1, 5-E	0.4	1.1
	Line A	0.4	1.1
6	6-A.1, 6-C.1, 6-A.1	0.0	0.0
	Line A	0.0	0.0
7	7-A.1, 7-B, 7-A, 7-A.1	1.2	3.0
	7-A.1, 7-A, 7-A.1	2.4	6.0
	7-A.1	0.6	1.5
	Line A	0.7	1.7
8	8-A.1	1.9	4.8
	8-B, 8-A, 8-A.1, 8-D, 8-C	2.3	5.6
	8-A.1, 8-C	2.1	5.1
	Line A	2.1	5.1
9	9-A.1	0.2	0.4
	9-A.1, 9-B	0.2	0.4
	Line A	0.0	0.1
10	10-A.1, 10-A, 10-A.1	3.6	8.8
	Line A	1.3	3.2
11	11-A.1, 11-A, 11-A.1	4.0	9.9
	11-A.1	3.2	8.0
	11-A.1, 11-C, 11-B.1, 11-B, 11-B.1	3.4	8.5
	Line A	1.7	4.2
12	12-A.1, 12-A, 12-A.1, 12-A, 12-A.1	10.2	25.2
	12-A.1	10.8	26.8
	12-A.1, 12-B	5.5	13.5
	Line A	4.8	11.8
13	13-E, 13-A.1, 13-D, 13-A.1	0.6	1.5
	13-A.1, 13-A, 13-C	4.2	10.4
	13-A.1, 13-A, 13-B	3.2	8.0
	13-A.1	2.1	5.2
	Line A	0.7	1.6
14	14-A.1, 14-D, 14-A.1	0.6	1.4
	14-A.1, 14-B, 14-A.1	0.6	1.4
	Line A	0.6	1.4
15	15-A.1	0.2	0.6
	15-A.1, 15-C.1, 15-A.1	0.0	0.1
	Line A	0.0	0.1
16	16-A.1	2.8	6.8
	16-A.1, 16-B, 16-F	2.0	5.0
	Line A	2.0	5.0
TOTALS	**Sum of Maximums - Old Lines**	**32.2**	**79.6**
	Sum of Minimums - Old Lines	**19.2**	**47.3**
	Line A	**14.9**	**36.8**

* Previous plans include agency field review plans and those available after public meetings.

The MOA advises that mitigation should be undertaken in areas adjacent or contiguous to the discharge site (on-site), or if on-site mitigation is not practicable, off-site mitigation should be undertaken. It further advises that mitigation banking may be an acceptable form of mitigation.

6. PROJECT-SPECIFIC MITIGATION REQUIREMENTS - VIRGINIA

Mitigation strategies have not been developed by the Virginia Department of Transportation nor discussed with the Virginia agencies and would not be undertaken until the identification of a preferred alternative in that state.

7. PROJECT-SPECIFIC MITIGATION REQUIREMENTS - WEST VIRGINIA

Even after all practicable measures have been taken to avoid and minimize wetland impacts, Line A of the Build Alternative in West Virginia would impact wetlands. These impacts must be mitigated based on the general mitigation policies and requirements discussed above. Wetland replacement ratios and replacement sites were the main topics of a meeting held with state and Federal resource agencies having jurisdiction or special expertise in this resource. The meeting was held on April 28, 1994 and attended by the COE, Pittsburgh District; EPA; WVDNR; WVDEP; USFWS; SCS and the WVDOT. A consensus was reached on the need for at least two wetland replacement sites, one in each river basin, and the requirement for up-front construction of the wetlands. It was also agreed that the agencies would reconvene on the issue of replacement ratios and provide written consensus to the WVDOT. The agencies subsequently provided such correspondence with the following outcome for replacement ratios:

- Open Water, 1:1
- Palustrine Emergent, 1:1
- Palustrine Scrub/Shrub and Forested, 3:1.

Other requirements for wetland mitigation include the need to monitor the created wetlands for a five year period. The plan for such monitoring would be prepared by the WVDOT and agreed to by the agencies. The agencies stated that an attempt should be made to place the Monongahela River portion of the mitigation within the Beaver Creek watershed near Davis WV. It was stated that the resource agencies reserved the right to request higher replacement ratios if the replacement sites were not created in advance of encroachments (construction).

The following discussion presents the decision-making process for site selection, provides descriptions of existing conditions at selected sites and describes a conceptual mitigation plan for each of the two selected sites.

a. Site Selection

(1) Watershed Selection

A list of replacement goals was developed to compare regional project watersheds within each river basin. By comparison of these goals with existing wetland characteristics in each watershed, the most suitable regional project watershed was selected. The goals are:

- To replace wetlands in a watershed that has historically suffered wetland loss and has relatively few wetlands per areal unit of watershed;
- To replace vegetative communities eliminated by the proposed project with similar vegetative communities (in-kind replacement);
- To replace wetland functions and values that will be lost with similar functions and values;
- To maximize the probability of the replacement site success.

(a) The Monongahela River Basin

The two regional project watersheds in the Monongahela River Basin that would be impacted by the proposed highway are the Tygart Valley River watershed and the Cheat River watershed. A comparison of the four replacement site goals with watershed characteristics revealed that the Tygart Valley River watershed would be more likely to allow achievement of the goals.

The Tygart Valley River watershed is characterized by wide valleys and meandering stream channels. Tiled fields and prior converted wetlands are common in this watershed. Wetland vegetation is primarily sedges and herbaceous wetland species. Based on NWI wetlands, GIS calculations show that this watershed contains approximately 0.32 hectares of wetland per square kilometer (2.0 acres per sq. mi.).

Two local project watersheds make up the Cheat River watershed; Black Fork and Shavers Fork. Wetland types in the Black Fork local project watershed are primarily high elevation bogs and fens dominated by acidophillic plants (e.g., mosses, sedges, and ericacous shrubs). Those wetlands present in the Shavers Fork local project watershed are primarily palustrine forested or scrub shrub, although some emergent wetlands are present. The ratio of NWI wetlands to total watershed area is 2.17 hectares per square kilometer (14.0 acres per sq. mi.). Based on the discussion above, a replacement site in the Tygart Valley River watershed is more likely to meet wetland replacement site goals than a replacement site in the Cheat River watershed because:

- Data suggests that the Tygart Valley River watershed has suffered a larger historic loss of wetland acreage. The Tygart Valley River watershed has a wetland to total watershed area ratio seven times less than that of the Cheat River watershed.

- No high mountain bogs or fens would be impacted by the proposed highway. Those wetlands being impacted along the Build Alternative more closely resemble the vegetative communities that occur within the Tygart Valley River watershed.

- It is generally accepted that wetland replacement sites in high mountain areas are difficult to replace successfully, thus wetland replacement site success has a lower probability in the Cheat River watershed.

- The land cover adjacent to the proposed project near Davis, West Virginia is predominately wetlands. Locating a suitable site that is not already wet was difficult based on site visits. Further, the limited soil cover in the drainages of Beaver Creek would inhibit the success of the wetland.
- The WET 2.0 analysis of impacted wetlands revealed that their functions and values were more similar to those of wetlands within the Tygart Valley River watershed than those wetlands found in the Cheat River watershed.

(b) The Potomac River Basin

The Build Alternative impacts wetlands in four watersheds within the Potomac River Basin; North Branch Potomac River, South Branch Potomac River, Cacapon River and Shenandoah River watersheds. Of those four watersheds, the South Branch of the Potomac River watershed exhibits characteristics consistent with the four replacement goals. These characteristics include:

- South Branch of the Potomac River watershed has suffered the greatest historic wetland loss. Prior converted wetlands are common on the floodplain.

- The probability of success is high due to the area's history of supporting wetlands.

- Wetland vegetative communities that are present in the South Branch of the Potomac River watershed are similar to the majority vegetative of communities that would be disrupted due to the proposed highway.

- Functions and values of wetlands capable of being supported in the South Branch of the Potomac River watershed are most similar to the wetlands that would be impacted within the other local project watersheds.

(2) Site Selection

Seven sites were considered for wetland mitigation, three (3) in the Tygart Valley River watershed and four (4) in the South Branch of the Potomac River watershed. Selection of one site in each was based on criteria that have been developed by others (USDA, SCS, 1992; Kusler, et al., 1986 Pennsylvania Department of Environmental Resources, 1992; and Horner and Raedeke, 1989) and that have been successfully employed in the selection of wetland sites for other projects. Each of the seven sites within the two river basins (see Exhibits III-48 and III-49) were rated against the criteria on a scale of 1 to 5 (Table III-60). The two sites with the highest totals were then selected. The site with the highest rating for the Monongahela River Basin was the Wilmoth Run site (rating of 74), and for the Potomac River Basin, the Walnut Bottom Run site (rating of 74).

c. Mitigation Site Characteristics

Replacement areas for the appropriate wetland classes are given in Table III-61. A total of approximately eighteen hectares (45 acres) of wetland are required to be replaced in the two locations that were identified above. The eighteen replacement hectares were split equally among each wetland class to provide both replacement sites with half of the total required replacement area (9 hectares (22.5 acres)). This division maximizes the total replacement area for each site therefore optimizing the individual wetland functions and values. Characteristics of each mitigation site are discussed below.

(1) Monongahela River Basin: Wilmoth Run Site

The Wilmoth Run Site is located within the Leading Creek local project watershed of the Tygart Valley River. This site is located adjacent to Leading Creek and Israel Church Road, approximately 1/4 mile north of Kerens, WV (see Exhibits III-50 and III-51). Wilmoth Run, a perennial stream, flows through the southeast corner of the site into Leading Creek. This land is a prior converted wetland having been drained by a system of pipes and ditches to become agricultural land.

Hydrology for this site would be provided by Wilmoth Run and ground water. The groundwater level is expected to be near to the surface based on several soil probes taken within the site. Overbank flooding of Leading Creek and back water flooding of Wilmoth Run can also be expected. The soils on the site are listed as Philo Loam and Purdy Silt Loam. Philo Loam is described as moderately well drained and nearly level with a seasonally high water table about 0.5 to 1 meter below the surface. Purdy Silt Loam is listed as poorly drained or very poorly drained and is difficult to drain. Purdy Silt Loam comprises over 75% of the proposed site. Existing vegetation at the site primarily includes pasture species although there are limited areas of trees and shrubs along Leading Creek.

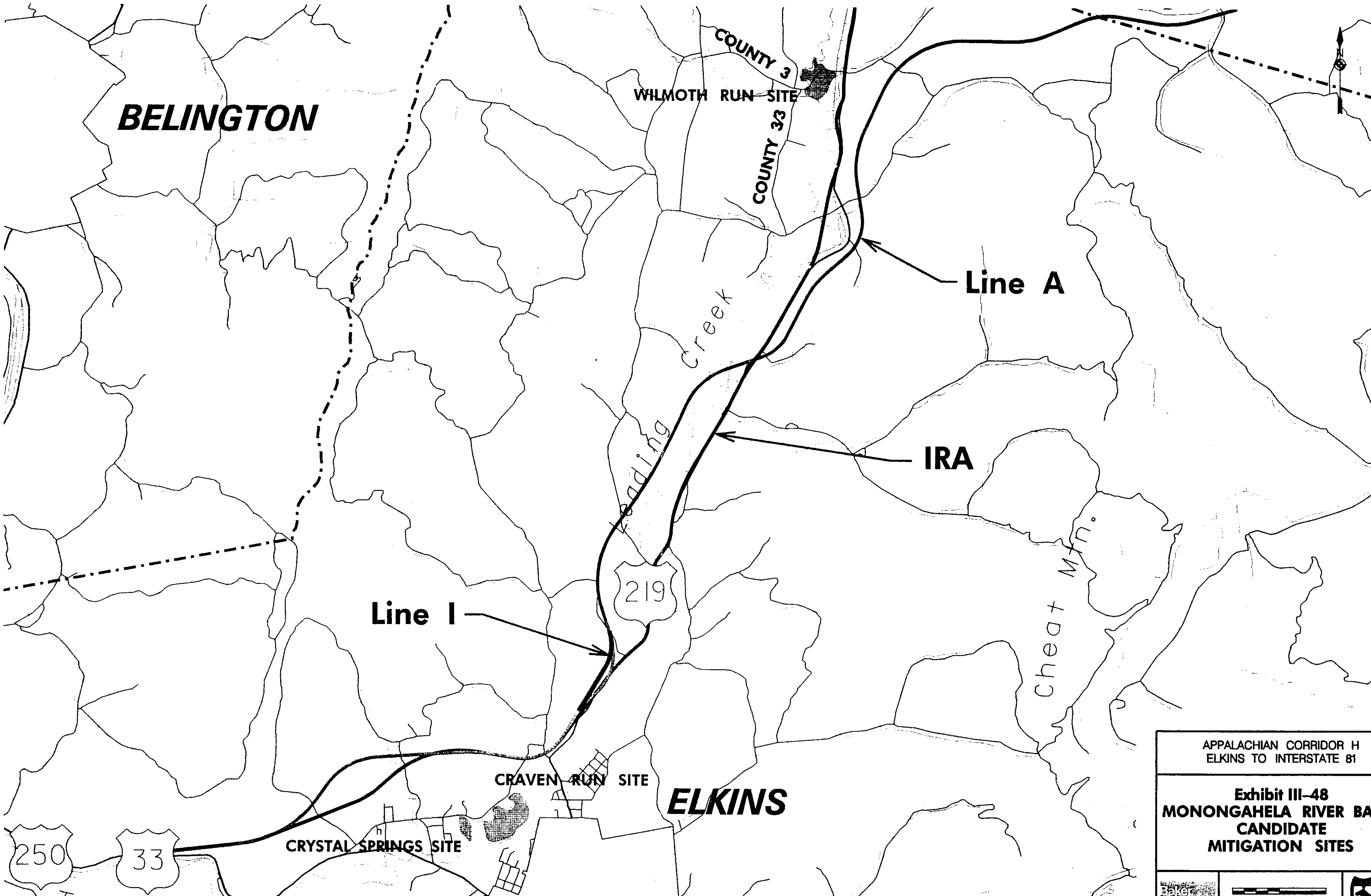
(2) Potomac River Basin: Walnut Bottom Run Site

The Walnut Bottom Run Site is located in the Anderson Run local project watershed of the South Branch of the Potomac River. It is located approximately 4 miles north of Moorefield along a tributary to Walnut Bottom Run (see Exhibits III-52 and III-53). Although presently used as pasture, it is probable that this area was once farmed, and because its topography is similar to other farmland in the area, it may be a prior converted wetland. The groundwater level is expected to be near the surface, based on the existence of a perennial stream bordering the site and soil descriptions. Soils in the area are Tygart silt loam, Massanetta loam, Purdy Silt Loam, and Berks-Weikert shaly silt loams. Tygart silt loam is characterized as poorly drained with a permeability listed as slow with seasonally high water table about six to eighteen inches below the surface. Tygart silt loam constitutes approximately 30% of this site. Purdy silt loam is characterized as very poorly drained with a very slow permeability. Massanetta loam is listed as moderately well drained and constitutes approximately 30% of this site. The Berks-Weikert shaly silt loam comprises a small portion of the site and is listed as well drained with moderate to moderately rapid permeability. Existing vegetation at this site includes pasture species and small pockets of trees.

d. Conceptual Mitigation Plans

(1) Monongahela River Basin: Wilmoth Run Site

The Monongahela River Basin wetland mitigation site would be constructed to contain approximately 9 hectares (23 acres) of forested, shrub, emergent, and open water wetlands. A conceptual plan is shown in Exhibit III-54. The site would contain approximately 0.4 hectares (1 acre) of open water, 6.2 hectares (15½ acres) of emergent wetland, 1.8 hectares (4½ acres) of scrub-shrub wetland, and 0.6 hectares (1½ acres) of forested wetland, surrounded by approximately 4¾ hectares (12 acres) of forested buffer. The site would be graded to the proper elevation to capture groundwater, the drainage tiles blocked, and streamflow from Wilmoth Run would be allowed to flow to a pond on the site through a diversion channel. The new shallow channel would be constructed at the downstream end of the pond, meandering through the site, until it finally re-enters Leading Creek at its natural confluence. It is anticipated that backwater flooding of Leading Creek from a 2-year return storm could also flood the site.



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-48
MONONGAHELA RIVER BASIN CANDIDATE MITIGATION SITES

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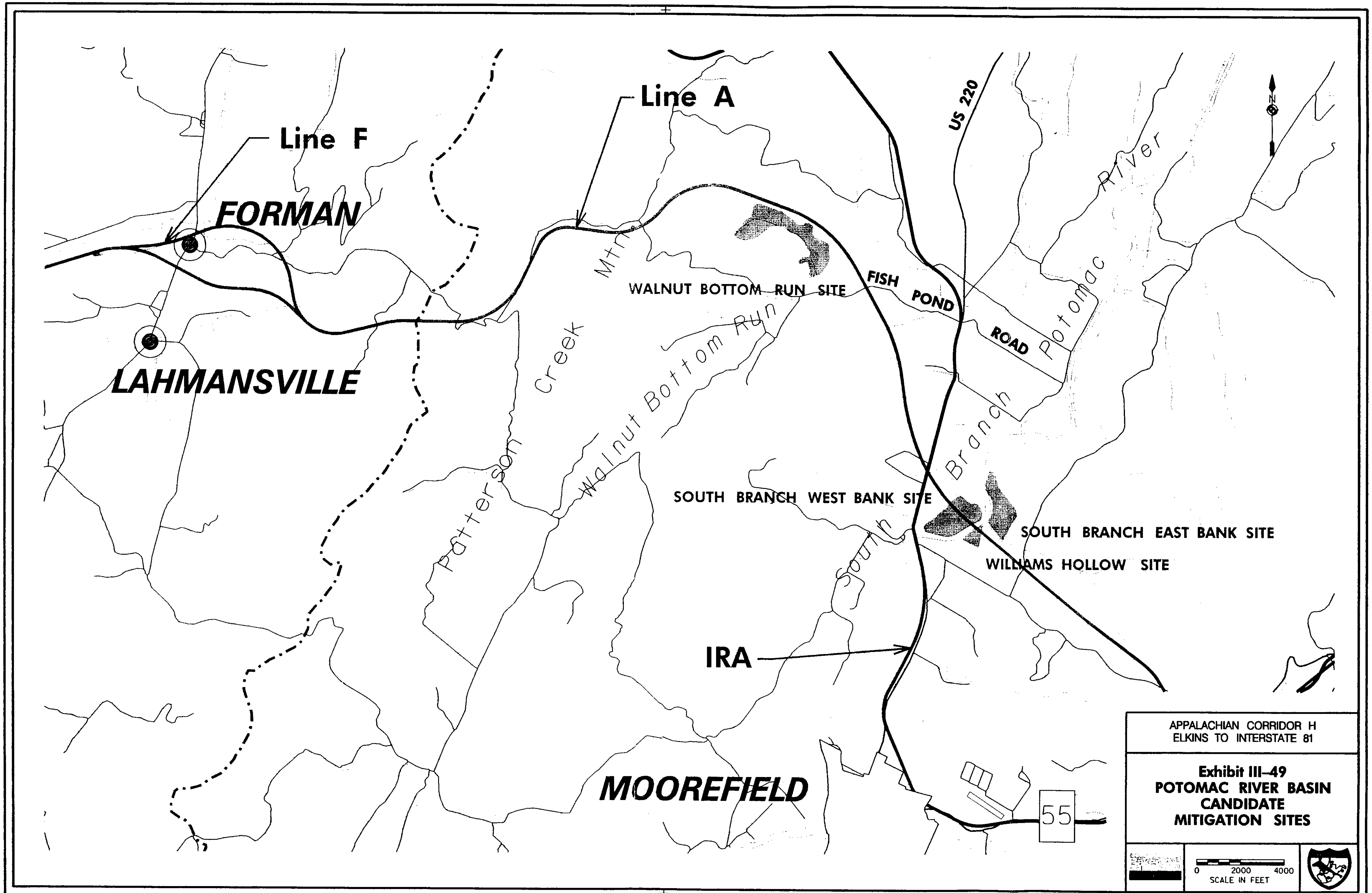

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-49
POTOMAC RIVER BASIN CANDIDATE MITIGATION SITES

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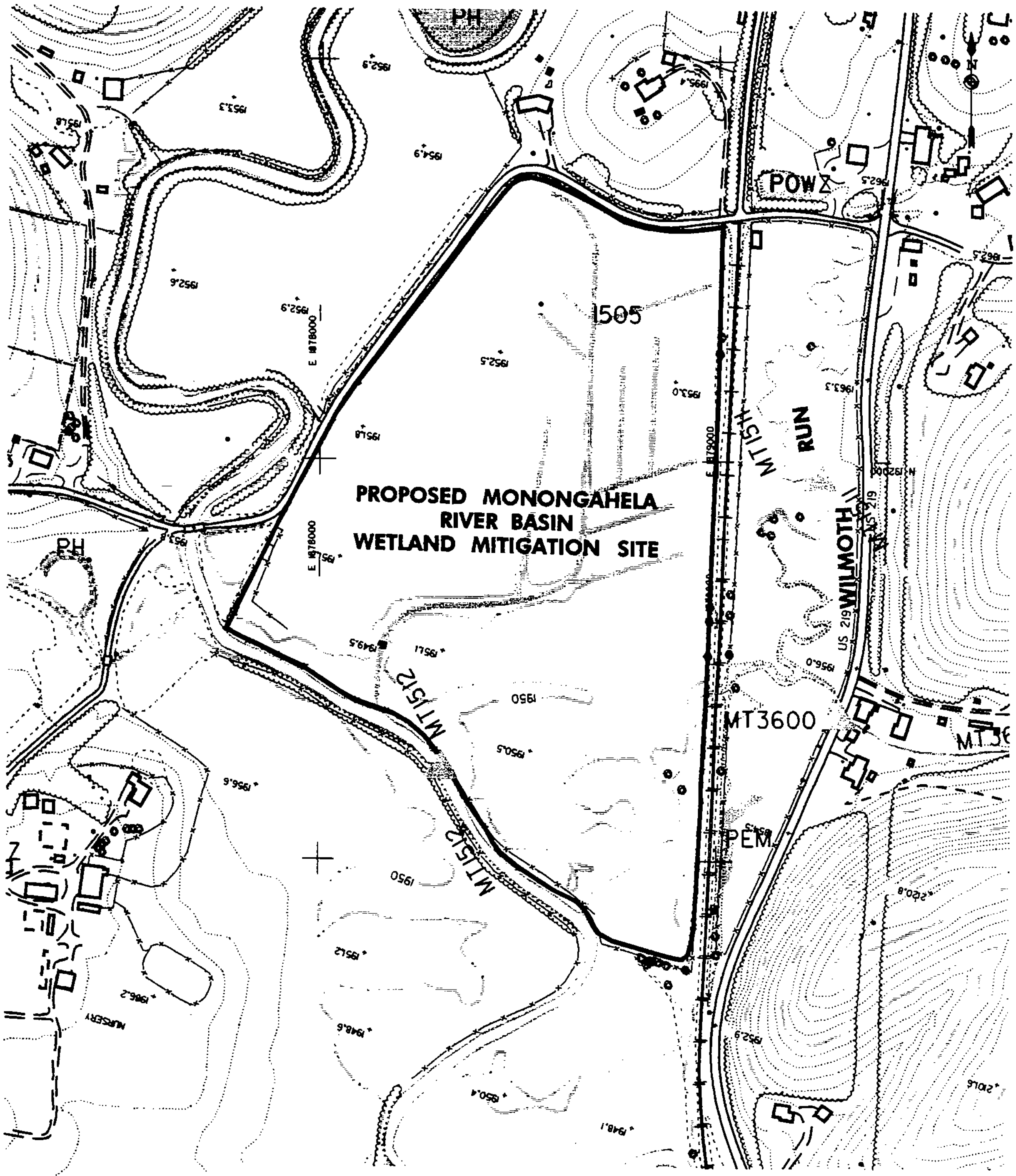


LEGEND

WETLANDS	STREAMS
PFO	PERENNIAL
PSS	INTERMITTENT
PEM	AS MAPPED
PHOTO INTERP.	**MISC.**
POWZ	UPLAND FORESTED BUFFER
PUB	

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-50
MONONGAHELA RIVER BASIN:
WILMOTH RUN SITE

0 200 400
SCALE IN FEET

Looking South-Southeast

Looking South-Southwest

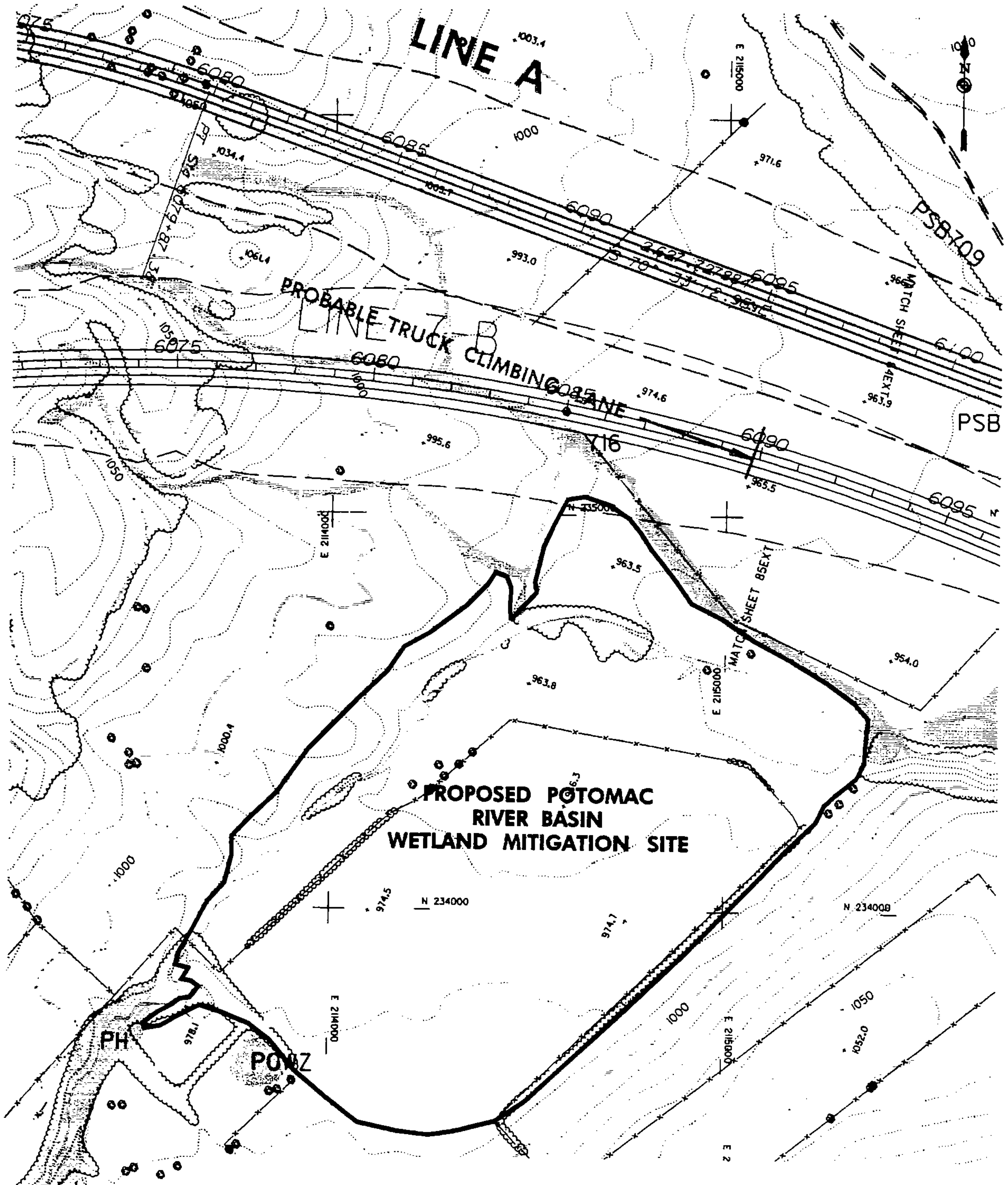
APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-51

WILMOTH RUN SITE

Baker
Michael Baker Jr., Inc.

WVDOT



LEGEND

WETLANDS

- PFO
- PSS
- PEM
- PHOTO INTERP.
- POWZ
- PUB

STREAMS

- PERENNIAL
- INTERMITTENT AS MAPPED

MISC.

- UPLAND FORESTED BUFFER

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-52
POTOMAC RIVER BASIN:
WALNUT BOTTOM RUN SITE

0 200 400
SCALE IN FEET

/oarh/shtpplot/final/wetlands/hwetm5.dgn 07-NOV-1994 09:21

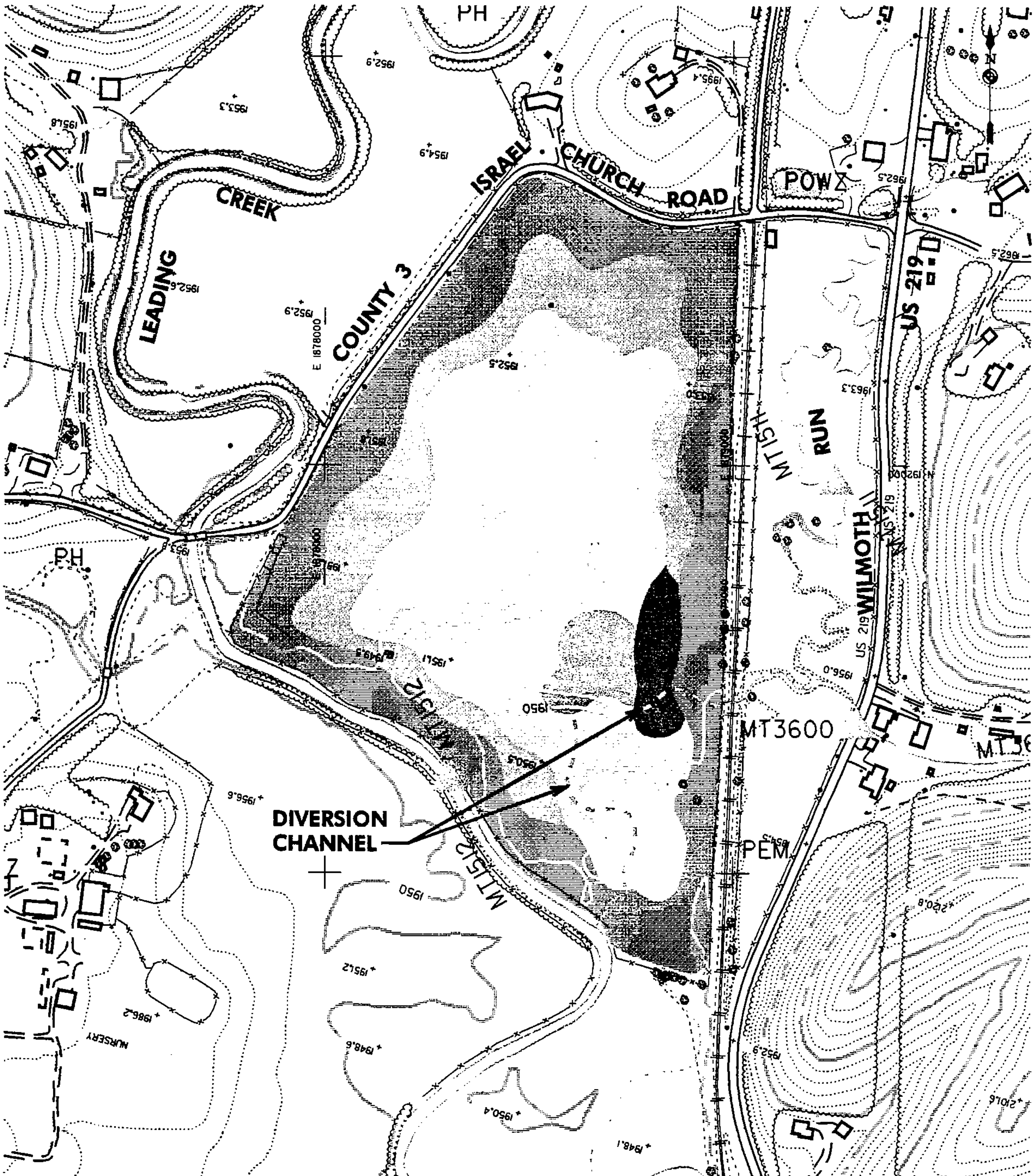
Looking Northeast

Looking West

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-53

WALNUT BOTTOM RUN SITE



LEGEND

WETLANDS		STREAMS	
	PFO		PERENNIAL
	PSS		INTERMITTENT
	PEM		AS MAPPED
	PHOTO INTERP.	MISC.	
	POWZ		UPLAND FORESTED BUFFER
	PUB		

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-54
WILMOTH RUN CONCEPTUAL MITIGATION PLAN

0 200 400
SCALE IN FEET

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TABLE III-60
DECISION MATRIX FOR WETLAND REPLACEMENT SITE LOCATION

Criteria		Rating Scale	Monongahela River Basin			Potomac River Basin			
			Crystal Springs Site	Craven Run Site	**Wilmoth Run Site**	Williams Hollow Site	South Branch West Bank Site	South Branch East Bank Site	**Walnut Bottom Run Site**
Appropriate Topography		5=Flat/Uncomplicated Topo. -to- 0=Steep/Complex Topography	5	4	**5**	5	5	5	**5**
One Site Replacement Possible		5=yes -or- 0=No	0	5	**5**	0	5	5	**5**
Hydrologic Support	Ground Water	5=Adequate -to- 0=Inadequate	3	4	**5**	3	2	3	**5**
	Flooding	5=Adequate -to- 0=Inadequate	2	5	**5**	3	5	3	**3**
	Runoff	5=Adequate -to- 0=Inadequate	3	4	**4**	3	5	4	**5**
Suitable Soil Characteristics		5=Poorly Drained -to- 0=Well Drained	2	2	**4**	3	2	3	**5**
Historical Wetland Area		5=Prior Converted (PC) -or- 3=High Probability of PC -or- 0=Not PC	0	0	**5**	5	3	5	**0**
Water Quality		5=Poor (preferred) -to- 0=Excellent	3	4	**3**	4	3	3	**4**
Wildlife Value of Site		5=Low wildlife value (preferred) -to- 0=High wildlife value	5	5	**5**	5	5	5	**5**
Wildlife Value of Adjacent Land		5=High wildlife value (preferred) -to- 0=Low wildlife value	1	1	**1**	1	2	1	**2**
Wooded Buffer Present or Possible		5=Present 3=Possible 0=Not attainable	3	4	**3**	3	5	3	**3**
Construction Intrusion on Adjacent Habitat		5=Low (preferred) -to- 0=High	2	5	**5**	5	5	5	**5**
Depth to Groundwater		5=Shallow -to- 0=Deep	2	2	**4**	4	2	3	**5**
Construction Access		5=Very Accessible -to- 0=Unaccessible	5	4	**5**	5	5	4	**4**
Constructibility		5=High -to- 0=Low	3	4	**5**	4	3	4	**5**
Distance to Right of Way		5=Adjacent to ROW -or- 3=Not adjacent but less than 1 mile -or- 0=Greater than 1 mile	0	0	**3**	4	5	5	**5**
Impact to Property Owners		5=Small Percentage -to- 0=Large Percentage	0	2	**2**	4	4	3	**5**
Number of Property Owners Affected		5=One -or- 3=Two 0=More than Two	5	0	**5**	5	5	5	**3**
TOTAL			**44**	55	**74**	66	71	69	**74**

TABLE III-61
WETLAND REPLACEMENT RATIOS AND IMPACTS

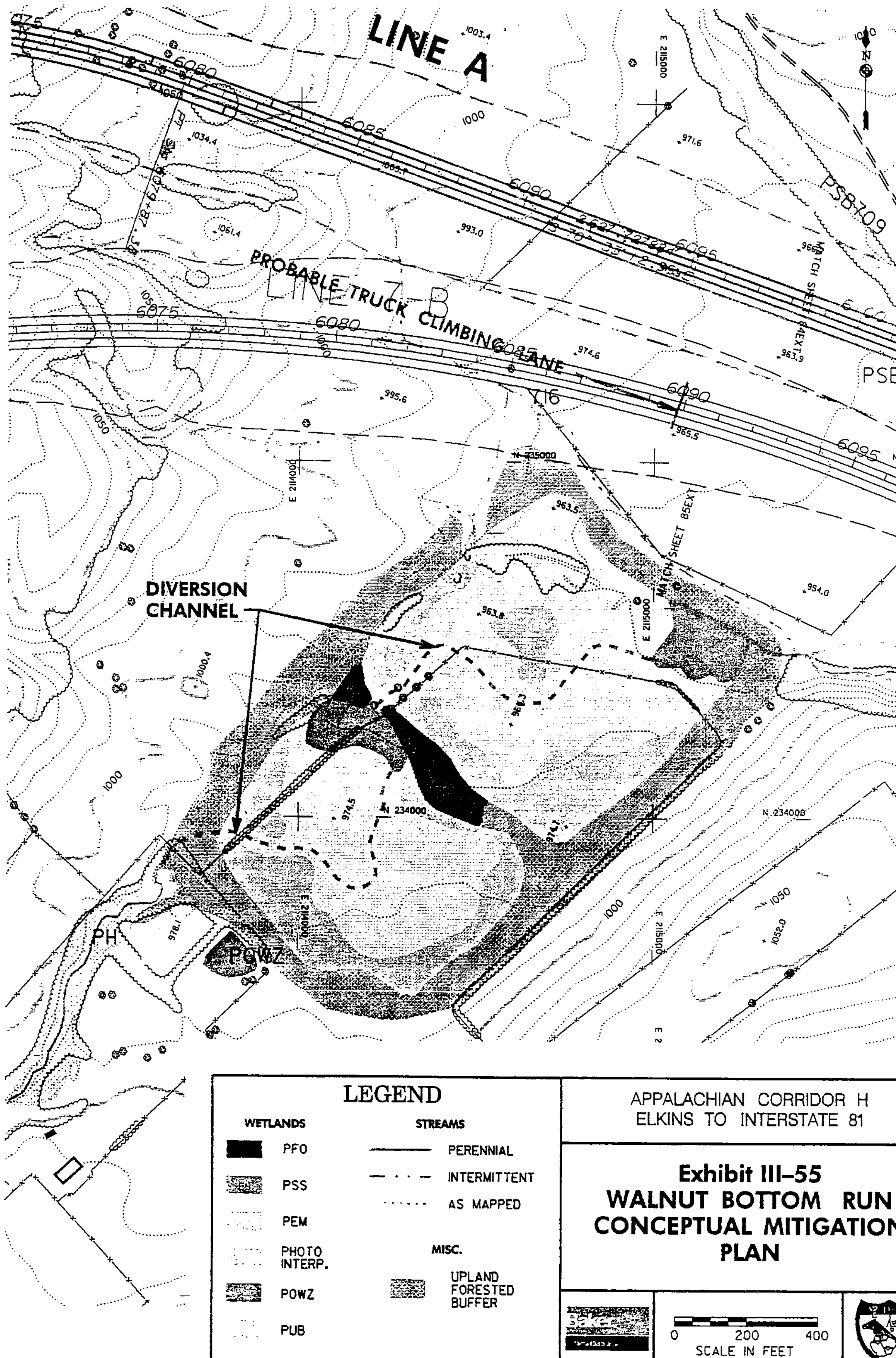
WETLAND CLASSIFICATION	REPLACEMENT RATIO	IMPACT AREA		REPLACEMENT AREA	
		Hectares	Acres	Hectares	Acres
Forested	3:1	0.4	1	1.2	3
Scrub/Shrub	3:1	1.2	3	3.6	9
Emergent	1:1	12.5	31	12.5	31
Open Water	1:1	0.8	2	0.8	2
TOTAL		15.0	37	18.2	45

A forested buffer, approximately 30 meters (100 feet wide), would surround the site. The forested wetland would be placed at the eastern side of the site and would serve as a riparian corridor along the diverted stream between the forested buffer and the pond. It would also shade the pond and stream for part of the day, lowering the evaporation rates of the open water area. The scrub-shrub portion of the site could be placed between the forested buffer and emergent zone to provide a ecological and hydrological transition between the two zones. The emergent wetland and open water zones would complete the remainder of the site.

(2) Potomac River Basin: Walnut Bottom Run Site

The Potomac River Basin wetland mitigation site is designed to incorporate 9 hectares (22.5 acres) of forested, shrub, emergent, and open water wetlands. The conceptual plan is shown Exhibit III-55. As in the Monongahela River Basin site, the site would contain approximately 0.4 hectares (1 acre) of open water, 6.2 hectares (15½ acres) of emergent wetland, 1.8 hectares (4½ acres) of scrub-shrub wetland, and 0.6 hectares (1½ acres) of forested wetland. This site would be graded to an elevation suitable for the capture of groundwater while blocking any drainage tiles.

This wetland system would consist of two wetland ponds connected by a forested wetland area. The site hydrology would be driven primarily by streamflow from a diverted unnamed stream and groundwater. Flow from the diverted stream would enter the upper pond and meander to the first open water area. The flow would then leave the upper pond through the forested wetland into the lower pond where a second open water area is centered. Water would exit the lower wetland pond and flow back into a tributary to Walnut Bottom Run. Emergent zones will encircle the open water areas in both the upper and lower wetland ponds. A scrub-shrub area could be placed between the forested buffer zone and emergent zone in the lower pond, and in two areas along the emergent zone of the upper pond to provide ecological and hydrological transitions between different zones. A contiguous forested buffer approximately 30 meters (100 feet wide) would surround the site.



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

Exhibit III-55
WALNUT BOTTOM RUN
CONCEPTUAL MITIGATION PLAN

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SCALE IN FEET

/corn/shtpplot/final/wetlands/nwetm5.dgn 7-NOV-1994 09:11

R. STREAMS

Perennial streams support the majority of surface water functions in the project area; ranging from recreational, economic, and aesthetic uses to fishery and wildlife habitat and other functions. Intermittent streams provide a number of these functions but to a lesser degree than perennial streams. The proposed project crosses two river systems: the Monongahela River and the Potomac River. Each river system is composed of several regional project watersheds (defined in Section III-M: *Watershed Overview*). Within West Virginia, the proposed project crosses five of these major watersheds: the Tygart Valley River, the Cheat River, the North Branch and South Branch of the Potomac River, and the Cacapon River. In Virginia, the proposed project crosses the Shenandoah River regional project watershed.

This section summarizes the following: the methods used in assessing aquatic habitat, water quality and impacts as a result of the proposed project; the existing condition of streams within the project area; the environmental impacts of project implementation by alternative; and avoidance, minimization, and mitigation measures. Details of the streams assessment conducted for this project are contained in the *Streams Technical Report*.

1. METHODOLOGY

A systematic watershed analysis was used to analyze the direct, secondary, and cumulative impacts to surface waters that would result from construction of the proposed project.

a. Stream Identification and Classification

Streams within the construction limits were identified and field investigated. Streams in both West Virginia and Virginia were classified as perennial if the West Virginia regulatory definition was met (Title 46, Series 1, Section 2.5). The location and extent of intermittent and perennial streams encroached upon are shown in the *Alignment and Resource Location Plans*. Streams that were not field investigated are represented as "mapped".

Secondary information relevant to streams was collected from the West Virginia Division of Natural Resources, the Virginia Department of Environmental Quality, and the Potomac and Monongahela River Basin Plans. West Virginia High Quality Streams were identified from the fifth edition of the published list of *West Virginia High Quality Streams.* Streams containing trout populations were identified based on several sources, including *West Virginia High Quality Streams*, pertinent maps from the West Virginia Division of Natural Resources, a listing of stocked trout streams published by the West Virginia Division of Natural Resources (1989), trout streams as listed in Virginia Department of Environmental Quality regulations (VR 680-21-00), and public comments. Stream order, a measure of a size of a stream, was determined based on USGS topographic and photogrammetric mapping. Streams in the project area progress from small, headwater streams (i.e. first order) to large streams such as Baker Run which is a third order stream.

In Virginia, the following criteria qualify a stream as "Outstanding State Resource Waters" (VR 680-21-07.2): all designated rivers under the Virginia Scenic Rivers Act; all Class I and II trout streams; and waters containing Threatened or Endangered species. "National Resource Waters" (NRW) is the West Virginia designation for streams which are afforded the highest level of protection. The following criteria qualify a stream as a NRW: presence of Threatened or Endangered species or habitat; presence of naturally reproducing trout populations; federally-designated rivers under the National Wild and Scenic Rivers Act; and streams located within a state or Federal forest or recreation area.

b. Stream Assessment Methodology

Macroinvertebrate and habitat assessment was based on EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers - Benthic Macroinvertebrates, Level II* (Plafkin et al., 1989). The Rapid Bioassessment Protocol, Level II (RBP II) uses basic field-collected data on ambient physical, chemical, and biological conditions. In addition, basic water quality samples were taken at the same time as the macroinvertebrate sampling.

(1) Habitat Assessment

Estimates regarding land use and physical stream characteristics were made at each stream crossing. As shown in Table III-62, habitat parameters assessed at each stream sample station were separated into three categories; primary, secondary, and tertiary (for definitions of habitat parameters, refer to the *Streams Technical Report*). At each sampling station, numerical scores were assigned to each of the nine habitat parameter characteristics. For this project, habitat assessment scores were divided into 5 classes. A total habitat assessment score, which is the sum of the habitat assessment scores for each parameter, were divided as follows: a score of 0 to 30 indicates severely impaired habitat; a score of 31 to 60 indicates impaired habitat; a score of 61 to 90 indicates moderate habitat; a score of 91 to 120 indicates good habitat; and a score of 121 or greater indicates excellent habitat.

(2) Benthic RBP Assessment And Data Analysis Methodology

In addition to data collected for habitat assessment, quantitative macroinvertebrate samples were collected at each stream crossing. Aquatic invertebrates were collected from riffle/run reaches using a kick net. Organisms were identified to the family taxonomic level using standard references. Each macroinvertebrate family was assigned a pollutant tolerance value ranging from 0 for the least tolerant to 10 for the most tolerant. The use of benthic communities based on family-level identifications have been used successfully to address water quality and biotic integrity issues in several states.

TABLE III-62
HABITAT ASSESSMENT PARAMETERS

PARAMETER LEVEL	PARAMETER CHARACTERISTICS	HABITAT ASSESSMENT RANKING*			
		Excellent	Good	Fair	Poor
PRIMARY	Bottom Substrate	16-20	11-15	6-10	0-5
	Embeddedness	16-20	11-15	6-10	0-5
	Streamflow	16-20	11-15	6-10	0-5
SECONDARY	Channel Alteration	12-15	8-11	4-7	0-3
	Bottom Scour and Deposition	12-15	8-11	4-7	0-3
	Pool:Riffle or Run:Riffle Ratio	12-15	8-11	4-7	0-3
TERTIARY	Bank Stability	9-10	6-8	3-5	0-2
	Bank Vegetation Stability	9-10	6-8	3-5	0-2
	Streamside Cover	9-10	6-8	3-5	0-2

Source: EPA, *Rapid Bioassessment Protocols for Use in Streams and Rivers - Benthic Macroinvertebrates and Fish.*

*Note: Parameter levels are numerically weighted whereby Primary parameters are weighted greater than Secondary and Tertiary parameters. The Categorical values (i.e. Excellent, Good, Fair, and Poor) reflect these weighted rankings.

Karr and Dudley (1981) define biological or biotic integrity as "the [habitat's] ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat of the region." Assessment of the biotic integrity requires a method that integrates ecological concepts of the structure and dynamics of populations, communities, and ecosystems (Karr, 1987; Miller *et al.*, 1988).

To characterize the Biotic Integrity (BI) of each stream sampled, the following seven parameters were calculated: number of macroinvertebrate families (taxa); modified family biotic index; ratio of scrapers versus filtering/collector functional feeding groups; ratio of intolerant taxa to tolerant taxa; intolerant taxa index; and community similarity indices (Plafkin et al., 1989).

A critical component of the RBP II is the comparison of field results to a reference site. For a given region (such as ecoregion, project, watershed, etc.), a reference site is selected that characterizes the most undisturbed existing condition within that region. A comparison of each stream station to the reference site indicates how similar the stream station is to the most undisturbed condition.

One reference site was selected to represent each stream order (first order, second order, and third order streams) from the streams sampled for this project. For each stream sampled, the seven parameters calculated were compared to the reference site parameters to determine the percent similarity of the sampled station to the reference site.

Biotic Integrity (BI) is expressed as a score (0-1) of the overall similarity between the sampled station and its reference site. The BI can be ranked from non-impaired (A) to severely impaired (D). Table III-63 presents the attributes that make up the various Biotic Integrity rankings.

Statistical analysis of the stream data was conducted to identify trends in the data, such as differences in Habitat Assessments or Biotic Integrity between ecoregions, watersheds, and/or stream orders. The parameters tested were number of individuals, number of taxa, habitat score, Family Biotic Integrity (FBI), and Biotic Integrity (BI). Because of the length and number of analyses performed in this study, only summary results are discussed in the following sections. For a comprehensive review of all analyses performed in this study, refer to the *Streams Technical Report*.

c. Direct Impact Assessment Methodology

Direct impacts to streams and rivers were evaluated using 200-scale engineering drawings. The following details the methodology used in assessing the impact of enclosures (i.e. culverts and pipes) and channel relocations on baseline aquatic habitat.

TABLE III-63
DESCRIPTION OF BIOTIC INTEGRITY RANKINGS

BIOTIC INTEGRITY SCORE[1]	BIOTIC INTEGRITY RANK (CATEGORY)	ATTRIBUTES
>0.79	Non-impaired (A)	Comparable to the best situation to be expected for a particular stream order. Large number of families and individuals. Many intolerant species present. Optimum community structure.
0.5-0.79	Moderately Impaired (B)	Fewer families due to loss of most intolerant forms.
0.21-0.49	Impaired (C)	Fewer families and individuals due to loss of most intolerant forms.
<0.21	Severely Impaired (D)	Few families present. Only tolerant organisms present. If high density of organisms, then dominated by one or two families.

[1]Biotic Integrity Score is based on percent comparison with reference site, where a score of 1 indicates a station with similar BI as the reference site.

The size and length of structure was determined for perennial streams that would be enclosed in a box culvert or pipe. Along portions of the IRA, replacement of existing drainage structures was evaluated based on age and the requirement to meet current highway drainage design criteria.

For the purposes of this assessment, stream relocation is defined as any longitudinal encroachment into a perennial stream channel, diversion of a perennial stream along the construction limits, or elimination of a perennial stream channel within the construction limits of an alignment. For each perennial stream so impacted, the length of the relocation was determined using GIS.

To assess the direct impacts of the proposed project at the regional project watershed scale, the total length of enclosed streams was compared to an estimate of the total length of perennial streams within each regional project watershed. This was accomplished by calculating the total length of perennial streams from USGS 7.5 minute quadrangles for each regional project watershed.

d. Riparian Habitat Assessment Methodology

To determine quantitatively impacts of the proposed project to existing riparian forest buffers, the following methodology was used. GIS analysis identified where the limits of proposed highway construction would be within 23 meters (75 feet) of perennial streams for both the IRA and Build Alternative. Construction of this nature would encroach upon the existing riparian buffer. This would produce a parallel strip of land, varying in width, between the proposed construction limits and the existing perennial streams. Croonquist and Brooks (1993) suggested that protecting a forested corridor at least 25 meters (80 ft.) wide on each bank provides feeding, resting, or migrating corridors for sensitive species, including forest interior neotropical migrants birds. Riparian buffer corridors could also serve as linear wildlife corridors, allowing movement between two or more formerly contiguous habitat areas. Welsch (1991) determined that a minimum width of 23 meters (75') of forested buffer is required to protect water quality and aquatic habitats. Based on the above literature, the average width and vegetative cover type within each riparian buffer was determined to assess wildlife utilization and highway runoff impacts associated with parallel stream construction. The nearest stream sampling station to each buffer was identified to provide a quantitative assessment of stream conditions within the impact area.

e. Cumulative Assessment Methodology

A cumulative watershed impacts analysis was conducted in order to identify areas where watershed degradation may occur. The methodology utilized in this study included analyzing baseline stream data (Rapid Bioassessment Protocol II results), basic water quality results, review of predominant local project watershed use, and review of published information on spatial and temporal changes in community structure as a result of catastrophic events (see the *Streams Technical Report*). The goal of this analysis is to predict, with some level of confidence at both the local project watershed scale and the regional project watershed scale, the magnitude and ecological importance of cumulative impacts as a result of the construction and operation of the proposed project on surface water resources.

2. EXISTING ENVIRONMENT

For each regional project watershed a general discussion is provided including the land use, length of perennial streams, miles of alignment in the watershed, and number of field investigations. In addition, the existing condition of the stream habitat and biological community are summarized based on the habitat assessments and macroinvertebrate results. The basic water quality and benthic macroinvertebrate data for each of the 251 sampling stations is presented in Table III-64.

a. Tygart Valley River

The Tygart Valley River regional project watershed drains approximately 396 square kilometers (153 square miles) north of Elkins, West Virginia. Approximately 26.7 kilometers (16.6 miles) of the proposed project would traverse this regional project watershed.

The Leading Creek local project watershed drains approximately 166 square kilometers (64 square miles) and contains 168 kilometers (59 miles) of perennial streams including Pearcy Run, Wilmoth Run, Claylick Run, and Horse Run. Within the Leading Creek local project watershed, there are neither native or stocked trout streams, Nationwide Rivers Inventory listed rivers, nor streams impacted by acid mine drainage.

There were 27 field investigations conducted of streams crossed by the proposed project. Leading Creek and many of its major tributaries have wide floodplains with fine substrates (gravel, sand, and silt), in contrast to narrow floodplains and course substrates typical of streams in the other local project watersheds. Agricultural activities dominate the floodplains, which is reflected in the degraded habitat and water quality of the streams.

Leading Creek and a number of its tributaries have been moderately to severely impaired by agricultural nonpoint source pollution which is reflected in low BI ranks. The majority of the streams have moderate to low abundance of macroinvertebrates. The majority of the streams have impaired or severely impaired biotic integrity. Habitat ranges from severely impaired to good.

TABLE III-64
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
Tygart Valley River	Leading Creek	MC3508	Haddix Run	1	7.0	10.0	7.5	83	5.75	28	9	0.40	C
Tygart Valley River	Leading Creek	MT1509	Wilmoth Run	1	20.5	8.7	7.8	75	4.39	18	7	0.67	B
Tygart Valley River	Leading Creek	MT1510	trib. Wilmoth Creek	1	17.5	4.2	7.3	65	5.50	4	2	0.07	D
Tygart Valley River	Leading Creek	MT1511	Wilmoth Run	2	19.3	4.3	7.3	53	7.91	23	4	0.20	D
Tygart Valley River	Leading Creek	MT1512	Leading Creek	3	21.8	5.4	7.0	67	5.40	45	6	0.40	C
Tygart Valley River	Leading Creek	MT1601	Davis Lick	2	23.6	7.6	7.5	64	6.91	33	6	0.27	C
Tygart Valley River	Leading Creek	MT1602	Horse Run	2	22.6	4.3	7.1	44	9.00	0	1	0.00	D
Tygart Valley River	Leading Creek	MT1603	Pearcy Run	2	21.5	6.4	6.9	76	6.52	21	6	0.27	C
Tygart Valley River	Leading Creek	MT1604	trib. Leading Creek	1	18.0	9.2	6.6	81	5.38	8	5	0.53	B
Tygart Valley River	Leading Creek	MT1605	Claylick Run	2	20.2	4.7	7.1	59	5.70	10	8	0.33	C
Tygart Valley River	Leading Creek	MT1606	trib. Claylick Run	1	19.4	8.7	6.3	59	3.00	2	2	0.13	D
Tygart Valley River	Leading Creek	MT1607	trib. Leading Creek	2	20.2	9.3	7.5	58	4.00	1	1	0.13	D
Tygart Valley River	Leading Creek	MT1608	Leading Creek	3	19.0	8.0	7.0	104	3.33	86	12	0.67	B
Tygart Valley River	Leading Creek	MT1609	Leading Creek	3				101	4.21	39	7	0.60	B
Tygart Valley River	Leading Creek	MT1610	trib. Leading Creek	3	19.0	7.8	7.0	108	3.98	127	13	0.73	B
Tygart Valley River	Leading Creek	MT1611	trib. Leading Creek	1				52	9.00	0	1	0.00	D
Tygart Valley River	Leading Creek	MT3500	trib. Leading Creek	1	5.0	9.0	6.0	28	6.64	33	7	0.47	C
Tygart Valley River	Leading Creek	MT3501	trib. Cherry Fork	1	4.5	0.0	6.5	36	6.82	11	6	0.33	C
Tygart Valley River	Leading Creek	MT3502	Cherry Fork	3	5.0	9.3	6.0	77	5.39	96	17	0.73	B
Tygart Valley River	Leading Creek	MT3503	Pond Lick Run	2	4.0	9.7	6.5	76	6.67	87	11	0.47	C
Tygart Valley River	Leading Creek	MT3509	trib. Leading Creek	2	5.0	11.0	6.5	43	7.84	68	5	0.20	D
Tygart Valley River	Leading Creek	MT3600	trib. Wilmoth Creek	1	6.0	9.0	6.0	38	7.20	75	9	0.27	C
Tygart Valley River	Leading Creek	MT3601	Leading Creek	3	4.5	10.4	6.0	95	3.66	117	12	0.87	A
Tygart Valley River	Leading Creek	MT3602	Leading Creek	3	6.0	9.7		91	7.09	125	9	0.47	C
Tygart Valley River	Leading Creek	MT3603	trib. Leading Creek	1	6.0	9.8	6.0	76	7.80	106	10	0.20	D
Tygart Valley River	Leading Creek	MT3604	Stalnaker Run	3	6.0	9.5	7.5	97	4.97	39	12	0.67	B

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
Tygart Valley River	Leading Creek	MT3605	trib. Leading Creek	2	7.0	9.2	6.5	105	7.86	37	4	0.13	D
Cheat River	Black Fork	MC1100	Four Mile Run	1	15.0	6.4	7.5	62	3.09	11	6	0.53	B
Cheat River	Black Fork	MC1101	trib. Four Mile Run	1	17.0	6.0	7.0	76	8.00	6	1	0.13	D
Cheat River	Black Fork	MC1102	trib. Beaver Creek	1	19.0	6.0	6.0	53	8.00	105	1	0.00	D
Cheat River	Black Fork	MC1103	trib. Beaver Creek	1	17.0	7.0	5.0	63	1.52	42	3	0.60	B
Cheat River	Black Fork	MC1104	trib. Beaver Creek	1	18.0	6.4	5.0	106	2.36	14	6	0.47	C
Cheat River	Black Fork	MC1105	trib. Beaver Creek	1	17.0		5.0	101	1.90	87	8	0.87	A
Cheat River	Black Fork	MC1106	trib. Beaver Creek	1	12.0	6.0	4.5	75	6.46	65	6	0.47	C
Cheat River	Black Fork	MC1107	trib. Beaver Creek	1	15.0	6.8	4.5	57	1.90	84	5	0.60	B
Cheat River	Black Fork	MC1108	trib. Beaver Creek	1	15.0	7.4	5.0	89	2.83	94	8	0.73	B
Cheat River	Black Fork	MC1109	trib. Beaver Creek	1	13.0	6.8	4.5	88	2.48	122	9	0.80	A
Cheat River	Black Fork	MC1110	trib. Beaver Creek	1	19.0	6.7	6.0	83	6.50	2	2	0.20	D
Cheat River	Black Fork	MC1111	trib. Beaver Creek	1	16.0	6.0	5.5	57	4.20	5	5	0.40	C
Cheat River	Black Fork	MC1112	trib. Beaver Creek	1	22.0	4.2	6.0	49	5.20	5	3	0.27	C
Cheat River	Black Fork	MC1200	trib. Beaver Creek	1	12.0	8.2	5.0	90	2.08	119	11	0.93	A
Cheat River	Black Fork	MC1201	trib. Beaver Creek	1	13.0	8.6	6.0	84	1.85	88	8	0.67	B
Cheat River	Black Fork	MC1202	trib. Beaver Creek	1	11.0	4.8	3.0	49	4.00	1	1	0.13	D
Cheat River	Black Fork	MC1203	trib. Beaver Creek	1	17.0	5.2	3.0	49	10.00	0	1	0.00	D
Cheat River	Black Fork	MC1204	trib. Beaver Creek	1	25.0	5.4	3.0	52	10.00	0	1	0.00	D
Cheat River	Black Fork	MC1205	trib. Beaver Creek	1	11.0	6.2	4.5	43	3.29	104	7	0.67	B
Cheat River	Black Fork	MC1206	trib. Beaver Creek	1	16.0	6.8	5.0	41	0.16	97	4	0.60	B
Cheat River	Black Fork	MC1207	trib. Beaver Creek	2	13.0	6.8	5.0	55	3.00	12	5	0.53	B
Cheat River	Black Fork	MC1208	Beaver Creek	3	18.0	6.6	4.5	68	6.67	104	3	0.27	C
Cheat River	Black Fork	MC1209	trib. Beaver Creek	1	14.0	3.2	6.0	60	8.00	0	1	0.00	D
Cheat River	Black Fork	MC1210	trib. Beaver Creek	1	13.0	4.4	6.5	62	7.49	53	5	0.20	D
Cheat River	Black Fork	MC1211	trib. Pendleton Creek	1	22.0	6.0	7.0	38	7.28	39	6	0.33	C

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
Cheat River	Black Fork	MC1212	Pendleton Creek	2	29.0	7.2	6.5	86	6.00	107	7	0.20	D
Cheat River	Black Fork	MC1213	trib. Pendleton Creek	1	26.0	6.4	7.0	32	6.28	47	7	0.27	C
Cheat River	Black Fork	MC1214	trib. Beaver Creek	1	22.0	5.2	3.0	80	5.05	118	4	0.20	D
Cheat River	Black Fork	MC1215	trib. Beaver Creek	1	21.0	5.2	5.5	57	4.78	41	3	0.53	B
Cheat River	Black Fork	MC1216	trib. Beaver Creek	2	23.0	7.0	5.0	42	4.33	12	5	0.40	C
Cheat River	Black Fork	MC1301	trib. Beaver Creek	1	13.0	10.9	5.1	74	2.50	8	5	0.47	C
Cheat River	Black Fork	MC1302	N.F. Blackwater River	3	14.4	10.6	6.9	87	10.00	0	1	0.00	D
Cheat River	Black Fork	MC1303	trib. N.F. Blackwater River	1	9.1	10.3	2.8	64	10.00	0	1	0.00	D
Cheat River	Black Fork	MC1304	N.F. Blackwater River	3	13.5	10.6	4.0	65	8.00	4	1	0.13	D
Cheat River	Black Fork	MC1305	Long Run	2	13.9	9.3	2.9	65	8.00	1	1	0.13	D
Cheat River	Black Fork	MC1306	Long Run	2	15.2	11.3	3.2	72	9.00	0	1	0.00	D
Cheat River	Black Fork	MC1307	Long Run	2	19.3	9.6	6.2	74	6.18	17	6	0.40	C
Cheat River	Black Fork	MC1308	Long Run	2	18.3	9.6	6.1	79	5.50	44	10	0.53	B
Cheat River	Black Fork	MC1309	Middle Run	2	10.0	7.6	6.0	57	5.92	39	13	0.60	B
Cheat River	Black Fork	MC1310	Tub Run	1	12.4	7.7	4.1	105	5.09	34	8	0.47	C
Cheat River	Black Fork	MC1311	Big Run	2	15.0	9.9	4.5	85	4.16	19	9	0.33	C
Cheat River	Black Fork	MC1312	trib. Big Run	1	12.8	6.3	4.5	91	3.67	21	11	0.73	B
Cheat River	Black Fork	MC1313	trib. Roaring Run	1	13.2	7.8	7.5	79	3.30	33	8	0.53	B
Cheat River	Black Fork	MC1314	trib. Roaring Run	1	13.6	8.0	7.7	99	3.04	26	10	0.67	B
Cheat River	Black Fork	MC1315	trib. Roaring Run	1	13.6	6.7	6.0	87	3.40	5	3	0.33	C
Cheat River	Black Fork	MC1316	trib. Roaring Run	1	13.4	9.4	7.2	111	3.28	40	9	0.73	B
Cheat River	Black Fork	MC1317	trib. Roaring Run	1	14.5	6.0	7.0	51	3.76	33	5	0.60	B
Cheat River	Black Fork	MC1318	trib. Black Fork	2	25.0	6.2	7.5	82	4.09	56	13	0.73	B
Cheat River	Black Fork	MC1319	Black Fork River	3	19.0	6.8	7.0	123	4.32	62	8	0.60	B
Cheat River	Black Fork	MC1320	Roaring Run	2	14.0	8.0	7.5	89	6.00	49	11	0.47	C
Cheat River	Black Fork	MC3301	N.F. Blackwater River	3	4.0	10.0	6.8	90	7.84	146	5	0.07	D

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
Cheat River	Black Fork	MC3302	Slip Hill Mill Run	1	3.0	10.0	6.5	56	6.29	7	5	0.47	C
Cheat River	Black Fork	MC3303	trib. Slip Hill Mill Run	1	5.0	14.0	5.0	66	2.33	3	2	0.27	C
Cheat River	Black Fork	MC3304	trib. Slip Hill Mill Run	1	10.0	12.0	4.0	66	2.17	6	3	0.33	C
Cheat River	Black Fork	MC3305	Roaring Run	1	4.0	12.0	7.0	111	2.50	24	9	0.67	B
Cheat River	Black Fork	MC3306	Roaring Run	2	3.0	12.0	7.5	117	5.32	97	10	0.53	B
Cheat River	Black Fork	MC3307	trib. Roaring Run	1	4.0	21.0	5.5	103	2.63	81	12	0.87	A
Cheat River	Black Fork	MC3308	Roaring Run	2	5.0	12.0	7.0	124	3.58	121	17	0.93	A
Cheat River	Black Fork	MC3309	Snyders Run	2	4.5	12.0	5.0	70	2.90	96	9	0.67	B
Cheat River	Black Fork	MC3310	trib. Snyder Run	1	4.0	8.0	6.0	68	8.00	0	1	0.00	D
Cheat River	Black Fork	MC3311	trib. Long Run	1	6.5	8.0	4.0	51	8.00	0	1	0.00	D
Cheat River	Black Fork	MC3312	Long Run	1	4.0	11.4	6.5	87	3.95	42	5	0.53	B
Cheat River	Black Fork	MC3400	Black Fork River	3	4.0	15.0	6.0	117	4.22	9	4	0.33	C
Cheat River	Shavers Fork	MC1400	Shavers Fork	3	31.5	8.0	7.0	120	4.39	71	10	0.67	B
Cheat River	Shavers Fork	MC1401	Shavers Fork	3	31.5	8.0	7.0	120	4.63	54	11	0.67	B
Cheat River	Shavers Fork	MC1402	trib. Shavers Fork	1	19.0	4.1	6.0	37	7.99	103	4	0.07	D
Cheat River	Shavers Fork	MC1501	Shavers Fork	3	23.8	7.5	7.9	104	4.00	84	15	1.07	A
Cheat River	Shavers Fork	MC1502	Pleasant Run	2	23.0	9.5	8.5	89	3.73	55	9	0.67	B
Cheat River	Shavers Fork	MC1503	Pleasant Run	2	18.3	11.1	7.0	104	2.92	39	10	0.87	A
Cheat River	Shavers Fork	MC1504	Slab Camp Run	2	19.3	10.5	7.3	75	4.89	18	5	0.27	C
Cheat River	Shavers Fork	MC1505	Pleasant Run	2	19.0	8.6	7.0	84	2.50	8	5	0.33	C
Cheat River	Shavers Fork	MC1506	trib. Pleasant Run	1	17.4		6.7	85	4.00	25	9	0.67	B
Cheat River	Shavers Fork	MC1507	trib. Pleasant Run	1	17.1	8.0	6.4	79	3.65	37	8	0.60	B
Cheat River	Shavers Fork	MC1508	Pleasant Run	2	12.3	9.6	6.7	79	4.03	29	7	0.53	B
Cheat River	Shavers Fork	MC3401	Shavers Fork	3	6.0	14.0	6.0	119	2.78	37	8	0.60	B
Cheat River	Shavers Fork	MC3402	Sugarcamp Run	1	5.0	14.0	6.0	105	2.30	94	6	0.60	B
Cheat River	Shavers Fork	MC3403	Haddix Run	3	6.0	12.8	6.5	108	3.39	28	9	0.60	B

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
Cheat River	Shavers Fork	MC3404	Shingle Tree Run	1	4.5	17.0	6.0	95	1.26	38	8	0.53	B
Cheat River	Shavers Fork	MC3405	Goodwin Run	1	5.0	18.0	6.0	103	5.32	22	6	0.40	C
Cheat River	Shavers Fork	MC3406	Hawk Run	1	6.0	12.0	6.0	90	4.64	100	16	0.73	B
Cheat River	Shavers Fork	MC3505	trib. Haddix Run	1	6.0	9.4	6.5	81	3.65	83	7	0.60	B
Cheat River	Shavers Fork	MC3506	trib. Haddix Run	1	6.0	9.8	6.0	79	1.31	36	4	0.60	B
Cheat River	Shavers Fork	MC3507	trib. Haddix Run	1	6.0	10.0	6.0	90	3.83	98	16	1.00	A
Cheat River	Shavers Fork	MT3504	trib. Leading Creek	1	6.5	9.2	6.5	96	2.91	32	10	0.67	B
North Branch Potomac River	Patterson Creek	PNB1007	trib. Elklick Run	1	19.0	10.0	7.5	101	5.89	38	10	0.73	B
North Branch Potomac River	Patterson Creek	PNB1008	trib. Elklick Run	1	19.0	10.0	7.5	112	7.88	33	2	0.00	D
North Branch Potomac River	Patterson Creek	PNB2800	Patterson Creek	3	5.5	13.0	8.0	116	5.00	99	17	0.80	A
North Branch Potomac River	Patterson Creek	PNB2801	N.F. Patterson Creek	2	6.5	11.0	8.0	110	3.76	126	8	0.47	C
North Branch Potomac River	Patterson Creek	PNB2802	trib. N.F. Patterson Creek	2	3.0	9.8	8.0	80	5.30	120	13	0.73	B
North Branch Potomac River	Patterson Creek	PNB2900	N.F. Patterson Creek	3	3.5	12.4	8.0	126	6.39	139	14	0.67	B
North Branch Potomac River	Patterson Creek	PNB2901	N.F. Patterson Creek	3	3.5	12.0	8.0	121	3.73	132	13	0.93	A
North Branch Potomac River	Patterson Creek	PNB2902	N.F. Patterson Creek	3	5.0	11.0	8.0	99	3.76	137	11	0.80	A
North Branch Potomac River	Patterson Creek	PNB2903	trib. N.F. Patterson Creek	2	3.0	9.0	7.0	89	4.31	106	21	0.80	A
North Branch Potomac River	Patterson Creek	PNB2904	trib. N.F. Patterson Creek	1	5.0	10.6	7.5	61	7.83	12	3	0.20	D
North Branch Potomac River	Patterson Creek	PNB2905	trib. N.F. Patterson Creek	1	5.0	10.7	7.5	74	3.30	122	11	0.87	A
North Branch Potomac River	Patterson Creek	PNB800	trib. Patterson Creek	1	27.0	6.5	8.0	34	7.90	10	2	0.00	D
North Branch Potomac River	Patterson Creek	PNB801	trib. Patterson Creek	2	19.0	8.0	8.0	87	7.66	89	4	0.13	D
North Branch Potomac River	Patterson Creek	PNB802	trib. Thorn Run	2	19.0	6.5	6.0	74	5.20	5	2	0.07	D
North Branch Potomac River	Patterson Creek	PNB803	trib. Thorn Run	1	15.5	7.6	6.0	86	3.00	1	1	0.13	D
North Branch Potomac River	Patterson Creek	PNB804	trib. Thorn Run	2	10.0	6.2	7.0	71	6.58	43	6	0.27	C
North Branch Potomac River	Patterson Creek	PNB805	trib. Patterson Creek	1	17.5	7.8	7.0	67	8.00	4	1	0.00	D
North Branch Potomac River	Patterson Creek	PNB806	trib. S.F. Patterson Creek	1	18.0	7.2	7.0	62	6.57	7	4	0.40	C
North Branch Potomac River	Patterson Creek	PNB807	Patterson Creek	3	22.0	1.8	6.5	48	6.47	97	11	0.47	C

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
North Branch Potomac River	Patterson Creek	PNB808	trib. N.F. Patterson Creek	1	0.5	12.8	7.0	51	6.50	2	2	0.20	D
North Branch Potomac River	Patterson Creek	PNB809	trib. Patterson Creek	1	8.5	9.2	8.0	64	4.92	26	12	0.87	A
North Branch Potomac River	Patterson Creek	PNB900	M.F. Patterson Creek	3	18.0	8.2	8.0	96	5.07	85	9	0.67	B
North Branch Potomac River	Patterson Creek	PNB901	trib. M.F. Patterson Creek	1	18.0	7.8	7.0	46	2.61	33	7	0.67	B
North Branch Potomac River	Patterson Creek	PNB902	N.F. Patterson Creek	3	14.0		8.0	109	4.36	86	11	0.80	A
North Branch Potomac River	Patterson Creek	PNB903	trib. Elklick Run	1	14.0	9.0	8.0	96	3.82	107	7	0.60	B
North Branch Potomac River	Patterson Creek	PNB904	trib. Elklick Run	2	16.0	8.6	8.0	78	3.98	41	4	0.47	C
North Branch Potomac River	Patterson Creek	PNB905	trib. Elklick Run	2	19.0	8.0	8.0	79	4.50	90	13	1.00	A
North Branch Potomac River	Patterson Creek	PNB906	Elklick Run	2	17.0	7.2	7.0	90	3.87	23	10	0.73	B
North Branch Potomac River	Patterson Creek	PNB907	M.F. Patterson Creek	3		8.2	8.0	93	5.30	110	15	0.73	B
North Branch Potomac River	Patterson Creek	PNB908	trib. N.F. Patterson Creek	1	8.5	11.2	8.0	77	4.07	84	13	0.87	A
North Branch Potomac River	Patterson Creek	PNB909	trib. N.F. Patterson Creek	2	7.0	10.4	6.5	93	5.13	135	15	0.87	A
North Branch Potomac River	Stony River	PNB1000	Little Creek	2	25.0	4.5	3.0	51	9.00	0	1	0.00	D
North Branch Potomac River	Stony River	PNB1001	Abrams Creek	2	20.0	5.2	4.0	50	9.00	0	1	0.00	D
North Branch Potomac River	Stony River	PNB1002	trib. Abrams Creek	1	14.0	7.6	7.0	53	7.34	95	9	0.20	D
North Branch Potomac River	Stony River	PNB1003	trib. Abrams Creek	1	14.0	7.0	5.5	68	2.45	98	12	0.87	A
North Branch Potomac River	Stony River	PNB1004	trib. Abrams Creek	1	14.0	9.0	4.5	80	2.20	98	9	0.87	A
North Branch Potomac River	Stony River	PNB1005	trib. Stony River	1	15.0	7.6	6.5	97	2.72	32	11	0.87	A
North Branch Potomac River	Stony River	PNB1006	Stony River	2	26.0	7.0	5.0	123	4.42	19	3	0.33	C
North Branch Potomac River	Stony River	PNB1009	trib. Little Creek	1	21.0	6.5	4.0	78	8.00	0	1	0.00	D
South Branch Potomac River	Anderson Run	PSB2700	Anderson Run	2	7.0	12.0	8.0	62	6.86	139	10	0.47	C
South Branch Potomac River	Anderson Run	PSB702	Walnut Bottom	3	16.2	11.2	7.5	95	3.98	86	10	0.67	B
South Branch Potomac River	Anderson Run	PSB703	Walnut Bottom	3	17.9	11.0	8.3	81	6.14	97	10	0.40	C
South Branch Potomac River	Anderson Run	PSB704	trib. Walnut Bottom	2	19.7	10.8	7.0	67	4.42	36	6	0.47	C
South Branch Potomac River	Anderson Run	PSB705	trib. Walnut Bottom	2	18.0	10.3	6.3	78	3.75	48	15	0.80	A
South Branch Potomac River	Anderson Run	PSB706	trib. Walnut Bottom	2	14.5	12.4	6.6	116	7.15	131	9	0.47	C

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
South Branch Potomac River	Anderson Run	PSB707	Toombs Hollow Run	2	12.3	11.5	8.0	89	5.49	59	10	0.60	B
South Branch Potomac River	Anderson Run	PSB708	Walnut Bottom	2	28.0	7.2	8.0	67	4.93	81	14	0.80	A
South Branch Potomac River	Anderson Run	PSB709	trib. Walnut Bottom	2	21.0	7.2	7.5	66	2.49	61	8	0.67	B
South Branch Potomac River	Clifford Hollow	PSB601	trib. Clifford Hollow	1	13.5	8.7	7.0	66	6.09	23	10	0.60	B
South Branch Potomac River	Clifford Hollow	PSB602	trib. Clifford Hollow	1	13.3	8.6	7.0	86	2.70	66	15	1.00	A
South Branch Potomac River	Main Channel	PSB2600	Fort Run	2	5.0	12.0	7.0	104	3.43	108	5	0.60	B
South Branch Potomac River	Main Channel	PSB2601	Dumpling Run	2	-1.0	10.0	7.0	88	8.00	0	1	0.00	D
South Branch Potomac River	Main Channel	PSB2602	Fort Run	2	-1.0	10.0	7.0	52	8.00	0	1	0.00	D
South Branch Potomac River	Main Channel	PSB2603	Dumpling Run	2	0.0	10.0	6.0	48	8.00	0	1	0.00	D
South Branch Potomac River	Main Channel	PSB2604	trib. Dumpling Run	1	0.0	10.0	6.0	32	8.00	0	1	0.00	D
South Branch Potomac River	Main Channel	PSB2605	Dumpling Run	2	0.5	10.0	6.5	60	8.00	0	1	0.00	D
South Branch Potomac River	Main Channel	PSB603	Clifford Hollow	2	13.3	10.1	7.0	112	5.40	60	12	0.67	B
South Branch Potomac River	Main Channel	PSB604	trib. Fort Run	1	17.3	3.9	6.5	68	5.40	5	3	0.27	C
South Branch Potomac River	Main Channel	PSB605	trib. S.B. Potomac River	1	23.4	4.9	6.2	55	6.14	7	3	0.13	D
South Branch Potomac River	Main Channel	PSB606	S.B. Potomac River	3	24.3	13.5	7.4	101	5.11	107	19	0.73	B
South Branch Potomac River	Main Channel	PSB701	trib. S.B. Potomac River	1	18.6	4.3	7.1	53	6.51	72	9	0.53	B
Cacapon River	Baker Run	PC2500	Baker Run	3	6.0	9.8	7.5	103	4.00	133	12	0.80	A
Cacapon River	Baker Run	PC2501	trib. Long Lick Run	1	2.5	11.0	6.5	58	4.29	117	13	0.80	A
Cacapon River	Baker Run	PC2502	trib. Long Lick Run	1	2.5	11.0	7.5	88	2.81	54	11	0.80	A
Cacapon River	Baker Run	PC412	Baker Run	3	17.3	9.6	7.5	97	2.93	138	13	1.00	A
Cacapon River	Baker Run	PC501	trib. Baker Run	1	13.3		6.5	67	4.38	21	9	0.73	B
Cacapon River	Baker Run	PC502	Baker Run	3	16.5	8.8	7.5	89	3.85	109	12	0.93	A
Cacapon River	Baker Run	PC503	Baker Run	3	17.3	8.5	7.5	89	3.15	109	12	0.93	A
Cacapon River	Baker Run	PC504	Long Lick Run	2	17.8	8.5	7.7	80	2.74	50	13	0.80	A
Cacapon River	Baker Run	PC505	trib. Long Lick Run	1	14.3	9.0	6.0	56	1.83	12	6	0.53	B
Cacapon River	Baker Run	PC506	trib. Long Lick Run	2	16.0	8.3	6.5	66	4.29	7	3	0.20	D

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
Cacapon River	Baker Run	PC507	Long Lick Run	2	14.5	9.1	7.5	72	4.33	45	13	0.80	A
Cacapon River	Baker Run	PC508	Long Lick Run	2	13.3	9.5	8.0	76	2.71	38	11	0.67	B
Cacapon River	Baker Run	PC517	trib. Baker Run	2	6.0	11.1	6.0	109	2.59	102	15	1.00	A
Cacapon River	Central Cacapon River	PC2400	trib. Lost River	2	10.0	9.0	7.5	105	1.58	111	8	0.53	B
Cacapon River	Central Cacapon River	PC2401	trib. Lost River	2	9.0		7.0	55	2.37	35	6	0.47	C
Cacapon River	Central Cacapon River	PC314	trib. Trout Run	1	14.5	7.6	7.2	57	3.53	103	11	0.80	A
Cacapon River	Central Cacapon River	PC315	Trout Run	3	12.8	10.5	7.6	99	5.76	25	3	0.33	C
Cacapon River	Central Cacapon River	PC401	Lost River	3	20.3	8.2	7.6	97	6.17	133	10	0.47	C
Cacapon River	Central Cacapon River	PC402	Sauerkraut Run	2	16.0	9.2	7.8	101	3.06	105	15	1.07	A
Cacapon River	Central Cacapon River	PC403	trib. Lost River	1	12.0	5.2	6.1	76	8.00	2	1	0.00	D
Cacapon River	Central Cacapon River	PC404	trib. Lost River	1	12.0	5.4	6.6	81	6.20	10	4	0.33	C
Cacapon River	Central Cacapon River	PC405	trib. Lost River	1	11.8	8.2	6.8	55	4.29	42	9	0.87	A
Cacapon River	Central Cacapon River	PC406	trib. Lost River	2	11.8	5.2	7.1	93	2.00	6	3	0.27	C
Cacapon River	Central Cacapon River	PC407	trib. Lost River	1	11.8	7.0	6.8	84	5.08	37	7	0.53	B
Cacapon River	Central Cacapon River	PC408	Lost River	3	15.8	9.2	7.7	100	6.15	99	12	0.73	B
Cacapon River	Central Cacapon River	PC409	trib. Lost River	1	13.5	8.4	7.4	55	4.04	48	10	0.73	B
Cacapon River	Central Cacapon River	PC410	trib. Lost River	1	14.5	8.8	7.5	64	3.56	9	6	0.47	C
Cacapon River	Central Cacapon River	PC411	Lost River	3	17.0	9.8	7.7	101	4.09	101	12	0.80	A
Cacapon River	Central Cacapon River	PC413	Lost River	3	25.0	7.6	7.5	120	3.19	108	12	0.80	A
Cacapon River	Skaggs Run	PC2503	trib. Skaggs Run	1				56	5.82	33	10	0.53	B
Cacapon River	Skaggs Run	PC2504	trib. Skaggs Run	1	3.0	10.2	8.0	87	2.73	30	8	0.67	B
Cacapon River	Skaggs Run	PC509	Skaggs Run	1	11.0	10.1	6.5	53	4.18	28	7	0.53	B
Cacapon River	Skaggs Run	PC510	trib. Skaggs Run	1	10.8	10.5	6.0	76	3.00	3	3	0.33	C
Cacapon River	Skaggs Run	PC511	trib. Skaggs Run	1	11.0	11.1	7.0	105	4.43	30	10	0.53	B
Cacapon River	Skaggs Run	PC512	trib. Skaggs Run	1	11.8	10.2	6.0	83	3.38	29	7	0.53	B
Cacapon River	Skaggs Run	PC513	Skaggs Run	2	12.5	9.5	7.5	86	3.35	97	10	0.60	B

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
Cacapon River	Skaggs Run	PC514	trib. Skaggs Run	1	12.0	9.6	6.0	64	5.87	30	8	0.33	C
Cacapon River	Skaggs Run	PC515	trib. Skaggs Run	1	12.8	9.4	7.0	75	2.84	25	16	0.93	A
Cacapon River	Skaggs Run	PC516	trib. Skaggs Run	1	11.5	8.2	6.0	59	4.64	25	6	0.40	C
Cacapon River	Slate Rock Run	PC2300	trib. Slate Rock Run	1	4.0	12.0	7.0	86	3.13	45	14	0.80	A
Cacapon River	Slate Rock Run	PC2301	trib. Slate Rock Run	1	4.0	12.0	7.0	85	5.36	11	4	0.27	C
Cacapon River	Slate Rock Run	PC2302	Slate Rock Run	2	5.0	12.0	7.0	89	5.18	17	6	0.47	C
Cacapon River	Slate Rock Run	PC300	trib. Sine Run	1	12.0	10.0		83	6.33	121	9	0.40	C
Cacapon River	Slate Rock Run	PC301	trib. Sine Run	1	12.0	9.1		80	3.83	60	8	0.60	B
Cacapon River	Slate Rock Run	PC302	trib. Sine Run	1	12.5	8.9	6.5	85	3.33	84	15	0.93	A
Cacapon River	Slate Rock Run	PC303	trib. Sine Run	1	14.5	9.2	7.0	79	2.55	71	14	1.00	A
Cacapon River	Slate Rock Run	PC304	trib. Slate Rock Run	1	14.0	9.0	7.0	103	3.63	71	12	1.07	A
Cacapon River	Slate Rock Run	PC305	Slate Rock Run	2	15.0	8.8	7.0	115	2.46	83	16	1.00	A
Cacapon River	Waites Run	PC2303	Waites Run	3	7.0	11.0	7.5	112	3.56	119	16	1.00	A
Cacapon River	Waites Run	PC306	Waites Run	2	11.1	10.0	7.3	121	4.61	118	16	0.93	A
Cacapon River	Waites Run	PC307	trib. Waites Run	1	15.0	6.8	6.8	57	5.19	58	10	0.60	B
Cacapon River	Waites Run	PC308	Waites Run	2	14.7	9.5	7.2	106	3.74	109	14	1.00	A
Cacapon River	Waites Run	PC309	trib. Waites Run	1	13.3	7.4	6.8	74	4.25	92	10	0.67	B
Cacapon River	Waites Run	PC310	trib. Slate Rock Run	1	17.3	7.0	6.8	47	7.47	135	11	0.27	C
Cacapon River	Waites Run	PC311	trib. Waites Run	1	12.7	10.0	7.2	83	3.31	35	12	1.00	A
Cacapon River	Waites Run	PC312	trib. Waites Run	1	13.0	9.6	6.5	52	5.11	57	7	0.47	C
Cacapon River	Waites Run	PC313	trib. Waites Run	2	13.1	8.8	6.8	90	4.65	54	11	0.93	A
Shenandoah River	Cedar Creek	PS100	Town Run	2	19.0	7.8	8.0	88	5.57	37	12	0.53	B
Shenandoah River	Cedar Creek	PS101	Town Run	1	21.0	5.4	7.0	51	7.91	43	2	0.13	D
Shenandoah River	Cedar Creek	PS102	trib. Mulberry Run	2	20.0	7.2	8.0	86	5.06	78	9	0.53	B
Shenandoah River	Cedar Creek	PS103	trib. Mulberry Run	2	21.0	7.8	8.0	101	4.59	92	9	0.53	B
Shenandoah River	Cedar Creek	PS104	trib. Cedar Creek	1	21.0	2.8	8.0	101	7.56	9	2	0.20	D

TABLE III-64 (CONT.)
SUMMARY TABLE: BASIC WATER QUALITY

Regional Project Watershed	Local Project Watershed	Site ID	Stream Name	Stream Order	Temperature (C)	Dissolved Oxygen (mg/l)	pH	Habitat Assessment Score	Family Biotic Index (FBI)	# Individuals	# of Families (taxa)	Biotic Integrity Score	Biotic Integrity Rank
Shenandoah River	Cedar Creek	PS105	trib. Mulberry Run	1	24.0	3.0	7.5	45	7.72	83	6	0.47	C
Shenandoah River	Cedar Creek	PS106	Mulberry Run	2	21.0	7.0	8.0	83	5.54	39	13	0.60	B
Shenandoah River	Cedar Creek	PS107	trib. Mulberry Run	1	24.0	7.2	8.0	69	6.11	9	5	0.33	C
Shenandoah River	Cedar Creek	PS108	trib. Mulberry Run	1	23.0	6.0	8.0	101	5.36	64	8	0.47	C
Shenandoah River	Cedar Creek	PS109	Cedar Creek	3	22.0	7.2	8.0	110	3.62	102	12	0.93	A
Shenandoah River	Cedar Creek	PS110	Cedar Creek	3	22.0	7.2	7.5	114	3.33	104	9	0.87	A
Shenandoah River	Cedar Creek	PS111	trib. Mulberry Run	1	23.0	8.0	8.0	66	7.55	20	3	0.27	C
Shenandoah River	Cedar Creek	PS112	Mulberry Run	2	24.0	7.8	8.0	97	5.02	89	14	0.60	B
Shenandoah River	Cedar Creek	PS113	Turkey Run	2	6.5	9.8	7.5	88	4.68	110	12	0.53	B
Shenandoah River	Cedar Creek	PS200	Duck Run	2	21.0	7.0	7.5	95	3.68	19	6	0.47	C
Shenandoah River	Cedar Creek	PS201	Duck Run	2	20.0	7.8	7.0	112	3.14	58	11	0.60	B
Shenandoah River	Cedar Creek	PS202	Duck Run	2	20.0	7.8	7.0	112	2.58	66	13	0.60	B
Shenandoah River	Cedar Creek	PS203	trib. Duck Run	1	21.0		7.0	48	3.30	20	6	0.60	B
Shenandoah River	Cedar Creek	PS204	trib. Duck Run	2	29.0	5.9	6.0	48	3.41	22	10	0.87	A
Shenandoah River	Cedar Creek	PS205	trib. Duck Run	2	24.0	5.9	6.5	45	2.19	16	6	0.53	B
Shenandoah River	Cedar Creek	PS206	trib. Duck Run	1	21.0	6.8	7.0	47	3.11	19	9	0.60	B
Shenandoah River	Cedar Creek	PS207	trib. Paddy Run	1	21.0	7.8	7.0	61	4.81	36	13	0.60	B

b. Cheat River

The Cheat River regional project watershed is comprised of parts of Randolph, Tucker, and Preston Counties in West Virginia. This regional project watershed drains approximately 1,750 square kilometers (675 square miles) of West Virginia. Much of the watershed is composed of undeveloped rural land dominated by deciduous and mixed forests (84%) with cropland and pasture comprising 12% of the existing land use. Part of the Monongahela National Forest (MNF), including the Congressionally-designated Otter Creek and Dolly Sods Wilderness areas, lie within the Cheat River regional project watershed. These Wilderness areas are not impacted by the proposed alignments.

There are 293 kilometers (183 miles) of perennial streams within the Cheat River local project watershed, including the major drainages of Shavers Fork and the Black Fork. Within portions of the regional project watershed which have not been subjected to mining, excellent streams and rivers, including Shavers Fork, and three trout streams (Roaring Run, Pleasant Run, and Slip Hill Mill Run) exist. Shavers Fork is listed on the Nationwide Rivers Inventory.

In total, there were 84 field investigations conducted of streams crossed by the proposed project within this watershed: 63 were in Black Fork and 21 were in Shavers Fork. Approximately 41 percent of the streams have non-impaired biotic integrity and 31 percent of the streams have good to excellent habitat. A majority of streams with good water quality and habitat are located within the MNF. Naturally acidic conditions are found in the headwaters of Big Run, Tub Run, Long Run, and Middle Run. These waters drain bog-like wetlands resulting in tannic water and naturally low pH. Big Run and Tub Run are located on Backbone Mountain within the MNF. The headwaters of Long Run and Middle Run are located in the MNF but these streams flow through strip mined areas where the water quality of the stream is affected by acid mine drainage from numerous seeps and springs. A number of streams which drain wetlands along Beaver Creek also exhibited tannic water, low pH, and low dissolved oxygen. Out of 84 streams, 16 exhibited substantial evidence of acid mine drainage. These streams included Beaver Creek and some of its tributaries, Pendleton Creek, the North Fork of the Blackwater River, and the lower portions of Long Run and Middle Run. These streams are located in either previously mined areas, are surrounded by mining spoil, or receive acidic groundwater discharges.

The Shavers Fork local project watershed drains 186 square kilometers (72 square miles) of land along the eastern slopes of Cheat Mountain and the western slopes of Shavers Mountain. There are an estimated 106 kilometers (66 miles) of perennial stream including Pleasant Run and Haddix Run. The project would cross approximately 12.6 kilometers (7.8 miles) of this local project watershed. Within this local project watershed, only Pleasant Run is reported to contain trout. None of the streams sampled within this local project watershed have been impacted by acid mine drainage. The Shavers Fork local project watershed within the vicinity of the proposed project is dominated by deciduous and mixed forests. The majority of the streams within this local project watershed had moderately impaired biotic integrity and good to excellent habitat. Out of 21 streams, only one stream had severely impaired biotic integrity and habitat.

The Black Fork local project watershed drains 396 square kilometers (153 square miles) of land along Backbone Mountain, Canaan Mountain, Canaan Valley, and Beaver Creek. There are an estimated 188 kilometers (117 miles) of perennial stream within this local project watershed, including the North Fork of the Blackwater River, Long Run, Big Run, Pendleton Creek, Blackwater River, and Beaver Creek. The proposed project would cross approximately 38.6 kilometers (24 miles) of this local project watershed. A large portion of the land has been subjected to deep and surface coal mining, including the drainage areas for Beaver Creek, the North Fork, Pendleton Creek, Long Run, and Middle Run. There are two native trout streams (Roaring Run and Slip Hill Mill Run) within the vicinity of the project. None of the streams are listed on the Nationwide Rivers Inventory. The majority of the streams within this local project watershed have moderate habitat. There are only five streams out of 64 which had non-impaired biotic integrity.

Several restoration and reclamation projects are currently being undertaken along the Blackwater River and portions of the Black Fork, Long Run, and Middle Run. WVDEP is constructing a limestone treatment station along the Blackwater River, approximately one mile upstream from Davis and above the confluence with Beaver Creek. The goal is to reduce the acidity of a five mile segment of the river sufficiently to sustain a year-round trout population. Completion of this project is anticipated for late 1994. Portions of the watersheds of Middle Run, Long Run, and the North Fork of the Blackwater River have been recently modified as part of the Albert Highwall and Douglas Highwall Reclamation projects. These projects included grading, covering, and planting highwall areas and the partial treatment of acid mine drainage.

c. North Branch of the Potomac River

The North Branch of the Potomac River regional project watershed covers 1,200 square kilometers (460 square miles) in Grant and Mineral Counties, West Virginia. The North Branch of the Potomac River watershed is dominated by deciduous and mixed forests (79%) with cropland and pasture comprising 17 percent of the existing land use. A portion of Seneca Rocks National Recreation Area lies in the southwest portion of this watershed. Greenland Gap, located near the town of Scherr, West Virginia, is a unique topographic feature within this watershed. The gap is considered to be the least disturbed and most distinctive water gap in West Virginia, with towering sandstone cliffs that arch upward over 244 meters (800 feet). The above two areas are not impacted by the proposed alignments.

There were 39 field investigations conducted on streams crossed by the proposed project. This project watershed can be divided into two local project watersheds: the Patterson Creek local project watershed and the Stony River local project watershed.

The Stony River drains 285 square kilometers (110 square miles) including the valley west of the Allegheny Front surrounding Mount Storm Lake. The proposed project would cross approximately 8.3 kilometers (5.2 miles) of the Stony River local project watershed. This local project watershed contains approximately 114 kilometers (71 miles) of perennial streams, as well as the Mount Storm Reservoir. Four of the eight streams sampled exhibited impacts by acid mine drainage. West of the Allegheny Front, the major streams are adversely affected by acid mine drainage, including Little Creek, Abrams Creek, and the Stony River. There are no streams listed on the Nationwide Rivers Inventory or which contain native or stocked trout. There are a number of very small, headwater streams located south of Bismarck which have high (non-impaired) biotic integrity.

The Patterson Creek local project watershed lies between Patterson Mountain on the east and the Allegheny Front to the west. The Patterson Creek local project watershed drains approximately 166 square kilometers (64 square miles) of agricultural and forested land. The project would cross approximately 24 kilometers (15 miles) of the local project watershed. This local project watershed contains approximately 55 kilometers (32 miles) of perennial streams, including one native trout stream (Elklick Run), and one stocked trout stream (North Fork of Patterson Creek). None of the streams have been impacted by acid mine drainage or are listed on the Nationwide Rivers Inventory. The small streams east of Patterson Creek are located in pasture which results in low habitat and biotic integrity. The Middle Fork and North Fork of Patterson Creek, including tributaries, have good to excellent habitat and moderately impaired to non-impaired biotic integrity. This reflects the predominately forested headwater streams.

d. South Branch of the Potomac River

The South Branch of the Potomac River regional project watershed is dominated by deciduous and mixed forests (72%) with cropland and pasture comprising 26 percent of the existing land use. The South Branch rises in Highland County, Virginia and flows in a general northeast direction into West Virginia to its confluence with the North Branch of the Potomac River. Within West Virginia, the South Branch of the Potomac River regional project watershed drains 1,330 square kilometers (510 square miles) within Grant, Hardy, and Hampshire Counties.

Existing land use within this regional project watershed is dominated by deciduous forests, cropland, and pasture. Although the water quality of the South Branch is considered excellent and is renowned for its small mouth bass (*Micropterus dolomieui*) fishery, a number of its tributaries are impacted by non-point source pollution associated with agriculture, cattle, swine, rabbit, poultry, and forestry production. Of growing concern is the effect of the poultry industry on ground and surface waters (USFWS 1994; Constantz, 1990; Ritter, 1986; Ritter and Chirnside, 1987). There are no native or stocked trout streams or streams impacted by acid mine drainage, but the tributaries to Anderson Run exhibit impacts from crop and livestock production. The South Branch of the Potomac River is listed on the Nationwide Rivers Inventory.

Within the project area, the South Branch of the Potomac River Watershed contains approximately 102 kilometers (64 miles) of perennial streams and is divided into three local project watersheds: Clifford Hollow, Main Channel of the South Branch, and Anderson Run.

The Clifford Hollow local project watershed is located at the eastern edge of the South Branch watershed. This local project watershed drains approximately 31 square kilometers (12 square miles) of the western slope of South Branch Mountain. The proposed project crosses approximately 8.4 kilometers (5.2 miles) of the headwaters of Clifford Hollow local project watershed, near existing WV 55. This local project watershed contains approximately 16.7 kilometers (10.4 miles) of perennial streams.

The Main Channel local project watershed drains 106 square kilometers (41 square miles) including Williams Hollow, Fort Run and several small tributaries. The proposed project would require 10 kilometers (6.2 miles) of construction, including a crossing of the South Branch. This local project watershed contains approximately 29 kilometers (18 miles) of perennial streams.

The Anderson Run local project watershed is located west of the community of Old Fields and drains approximately 104 square kilometers (40 square miles) of predominantly agricultural land along the eastern flank of Patterson Mountain. The proposed project would cross 7.6 kilometers (4.75 miles) of the southern portion of the local project watershed and involve Walnut Bottom Run and Toombs Hollow. This local project watershed is drained by an estimated 56 kilometers (35.3 miles) of perennial streams.

There were 22 field investigations conducted on streams crossed by the proposed project. Less than half of the streams have good to excellent water quality. The majority of the streams have moderate to low abundance of macroinvertebrates. The majority of the streams had moderate habitat. The South Branch of the Potomac River has high diversity and abundance, as well as good to excellent habitat. High quality (non-impaired) streams were located in Clifford Hollow and the upper portions of Walnut Bottom Run, both of which are forested. Streams which have impaired habitat and biotic integrity are affected by surrounding agricultural land use and included Dumpling Run, Fort Run, Walnut Bottom Run, Anderson Run, and small tributaries to the South Branch and Clifford Hollow.

e. Cacapon River

The Cacapon River originates in the southeastern portion of Hardy County on West Mountain and flows north through Hampshire County. This watershed encompasses 1,190 square kilometers (460 square miles) in Hardy and Hampshire Counties. This regional project watershed contains two unique geologic features; the Lost River and Hanging Rock. This regional project watershed also contains several regions of karst topography. Karst topography is created by the chemical solution of carbonate rocks, more commonly know as limestone. This topography is characterized by landscape features such as sinkholes, dry valleys, springs, caves, and sinking streams (the Lost River). Subsurface features include groundwater flow through caves, or other dissolutionally enlarged cavities.

The Cacapon River's water quality varies significantly depending on location and water level (Constantz et al., 1993). Both the Lost River and Middle Cacapon River sections receive non-point source pollutants and have been identified by Constantz et al. (1993) as being relatively more polluted than other stream reaches further downstream in the basin. It is also assumed that fecal coliform levels within this watershed are high and, depending upon the season, exceed state water quality standards (Constantz et al., 1993). Many of the non-point source pollution problems that plague the South Branch of the Potomac River were observed in the upper reaches of the Lost River basin and its tributaries. However, as a whole, the Lost/Cacapon River system is in relatively "good" health (Constantz et al., 1993). The streams analysis performed for this project supports the findings of Constantz et al. (1993). Furthermore, this report also identifies a number of tributaries within this regional project watershed that are either severely degraded or of excellent water quality.

The Cacapon River regional project watershed contains an estimated 153 kilometers (96 miles) of perennial streams, including Baker Run, Trout Run, Waites Run, Slate Rock Run, and Skaggs Run. Approximately 35.4 kilometers (22 miles) of the proposed project crosses this watershed. The Cacapon River regional project watershed is dominated by deciduous and mixed forests (82%) with cropland and pasture comprising 17 percent of the existing land use. The eastern portion of this watershed lies within the George Washington National Forest. Water quality within the watershed is excellent, with limited nonpoint source pollution associated with agricultural and timber harvesting activity. Waites Run, Trout Run, and portions of the Lost River are stocked with trout and the Lost River is listed on the Nationwide Rivers Inventory. This watershed is divided into five local project watersheds: Skaggs Run, Baker Run, Central Cacapon River, Waites Run, and Slate Rock Run.

There were 57 field investigations conducted on streams crossed by the proposed project. The majority of the streams have good to excellent water quality and a high diversity of macroinvertebrates but moderate to low abundance of macroinvertebrates. The low abundance of organisms reflects the number of headwater streams which typically have low productivity. There are no streams affected by acid mine drainage.

Skaggs Run is located at the western edge of the Cacapon River regional project watershed. This local project watershed drains approximately 20 square kilometers (8 square miles) toward North River, a major tributary to the Cacapon River north of the project area. The proposed project crosses 4.5 kilometers (2.8 miles) of the headwaters of Skaggs Run. There are an estimated 11.3 kilometers (7 miles) of perennial streams within this local project watershed. The majority of the streams sampled in this local project watershed have moderate habitat and moderately impaired biotic integrity.

The Baker Run local project watershed drains 62 square kilometers (24 square mile) including Baker Run, Long Lick Run, Camp Branch, Parker Hollow Run, and Bears Hell Run. The proposed project crosses 9 kilometers (5.6 miles) of the local project watershed, following the general course of Baker Run from its mouth to its headwaters. There are an estimated 29.6 kilometers (18.4 miles) of perennial streams within this local project watershed. Half of the streams sampled in this local project watershed have non-impaired (high quality) biotic integrity although most have moderate habitat.

The Central Cacapon local project watershed drains 243 square kilometers (94 square miles) including the main channel of the Lost/Cacapon River from Wardensville upstream to Baker, as well as the drainage area for the major tributaries along this length including Trout Run, Sauerkraut Run, and Three Springs Run. These headwater streams are located on steep forested slopes and are naturally low in macroinvertebrate diversity and density. The proposed project crosses 15 kilometers (9.3 miles) following the general west to east orientation of the Lost River and WV 55. There are an estimated 85 kilometers (53 miles) of perennial streams within this local project watershed. Trout Run and portions of the Lost River are stocked with trout. The Lost River is listed on the Nationwide Rivers Inventory. Half of the streams sampled in this local project watershed have good to excellent habitat.

Waites Run local project watershed drains 49 square kilometers (19 square miles) of mostly forested land along the western slopes of Paddy Mountain and Great North Mountain. The proposed project crosses approximately 2.6 kilometers (1.6 miles) of this local project watershed, east of Wardensville. There are an estimated 21 kilometers (13.1 miles) of perennial streams within this local project watershed. Waites Run is a stocked trout stream. Over half of the streams sampled in this local project watershed are non-impaired with good to excellent habitat.

The proposed project crosses approximately 4.7 kilometers (2.9 miles) of the headwaters of Slate Rock Run, Harness Run, and Sine Run along the western flank of Great North Mountain. The Slate Rock Run local project watershed drains approximately 27.6 square kilometers (10.6 square miles) of forested land. The majority of the land in this local project watershed is within the George Washington National Forest. There are an estimated 7.7 kilometers (4.8 miles) of perennial streams within this local project watershed. Over half of the streams sampled in this local project watershed are non-impaired.

f. Shenandoah River

The Shenandoah River regional project watershed drains approximately 875 square kilometers (340 square miles) in Frederick and Shenandoah, Counties in Virginia. The Hardy/Frederick County line and the axis of Great North Mountain mark the division between the Shenandoah River regional project watershed and the Cacapon River regional project watershed to the west. Existing land use within the Shenandoah River watershed is composed mainly of deciduous and mixed forests (52%) and cropland and pasture (40%). The western portion of this watershed lies within the George Washington National Forest.

The proposed project lies within the Cedar Creek local project watershed of the Shenandoah River regional project watershed. Cedar Creek drains approximately 414 square kilometers (160 square miles) within Frederick and Shenandoah Counties. There are approximately 209 kilometers (130 miles) of perennial streams within this local project watershed, including Duck Run, Eishelman Run, Turkey Run, Zanes Run, and Mulberry Run. Approximately 21 kilometers (13 miles) of the proposed project crosses this watershed. The headwaters of Town Run are located along the eastern end of the project. To simplify the discussions, Town Run has been included in the Cedar Creek local project watershed.

The Cedar Creek local project watershed is largely private property, predominately forest or agriculture. Cedar Creek has been stocked with trout under the state's put-and-take program. Cedar Creek is listed on the Nationwide Rivers Inventory. Duck Run, located along the eastern slope of Great North Mountain is an important native trout stream and protected as an Outstanding State Water. A headwater tributary to Paddy Run is a native trout stream. This tributary is located along the western edge of the watershed. There are no streams impacted by acid mine drainage.

There were 22 field investigations conducted of streams crossed by the proposed project. Almost half of the streams have good to excellent habitat, including Cedar Creek and Duck Run. The majority of the stream have moderately impaired biotic integrity, including Duck Run.

g. Habitat Assessment Results

A total of 251 habitat assessments were conducted to document the existing stream habitat. The habitat assessment scores for each stream crossing is presented in Table III-64. A number of statistical tests were conducted to determine if statistically significant differences exist between the habitat assessments conducted for streams in different ecoregions, watershed or stream order.

At the ecoregion scale, no statistically significant differences in habitat assessment scores were observed. The Ridge and Valley Ecoregion (Ecoregion A) and the Central Appalachian Ecoregion (Ecoregion B) had an average habitat assessment score of 80.1, and 77.2, respectively, both indicating moderate habitat.

Habitat scores in Ecoregion A ranged from 32, indicating impaired habitat, to 126, indicating excellent habitat. Habitat scores in Ecoregion B ranged from 28, indicating severely impaired habitat, to 124, indicating excellent habitat.

There were no statistically significant differences in average habitat assessment scores for regional project watersheds or local project watersheds due to the wide variation in habitat scores. All regional project watersheds were categorized as possessing moderate habitat.

Statistically significant differences were identified between average habitat assessment scores based on stream order. Third order streams had higher average habitat assessment scores than first and second order streams, while second order streams had a statistically significant higher habitat assessment score than first order streams. There were no statistically significant differences in mean total habitat assessment score between ecoregions for first and third order streams.

At the regional project watershed scale, no statistically significant differences in average habitat assessment scores were detected for first and third order streams. However, for second order streams, Ecoregion A had a statistically significant greater average habitat assessment score than Ecoregion B. This is presented in Figure III-17.

h. Macroinvertebrate Results

For the streams sampled for this project, a total of 93 families and 13,421 individuals were identified. Table III-64 provides the number of individuals, number of families, family biotic indices and Biotic Integrity score and ranking for each stream studied.

i. Biotic Integrity Results

The Ridge and Valley Ecoregion (BI=0.57) has statistically greater BI than the Central Appalachian Ecoregion (BI=0.44), indicating that, on average, the streams in the Ridge and Valley Ecoregion were substantially less impaired than those in the Central Appalachian Ecoregion. This may reflect the impacts of acid mine drainage in the Cheat River regional project watershed and agricultural pollution in the Tygart Valley River regional project watershed. Figure III-18 presents this comparison.

A comparison of the average BI for the six regional project watersheds indicates that, on average, the streams in the Cacapon River regional project watershed are substantially less impaired than are the streams in the South Branch of the Potomac River or Tygart Valley River regional project watershed. Figure III-19 presents this comparison.

At the local project watershed scale, statistically significant differences existed in mean BI ranks. The Baker Run and Waites Run local project watersheds are less impaired than the Leading Creek and the Main Channel local project watersheds. The Shavers Fork and Slate Rock Run local project watershed are less impaired than the Main Channel local project watershed. Figure III-20 presents this comparison.

When streams were grouped by stream order, several statistically significant differences were detected. On average, third order streams where statistically less impaired (i.e. greater BI score) than second or first order streams. When streams were further broken down by stream order and ecoregion, Ecoregion A was less impaired (greater BI scores) than Ecoregion B for second and third order streams.

When streams were further analyzed by stream order and regional project watershed, differences were detected between several of the regional watersheds. Both the Cacapon River and the Shenandoah River regional project watersheds have less impaired streams than the Tygart Valley River regional project watershed. For third order streams, the Cacapon River regional project watershed was less impaired than that of the Cheat River regional project watershed.

3. IMPACT ASSESSMENT

This impact assessment summarizes the direct impacts to specific regional project watersheds for each alternative, provides a comparison of watershed impacts by alternative and option area, and provides a comparison of both secondary and cumulative impacts. In some instances, direct impacts have been determined to be "substantial". For the purposes of this assessment, a substantial impact is one that permanently alters or degrades a stream system from which incomplete ecological recovery is the result of such a disturbance (i.e., a permanent and measurable reduction in Biotic Integrity).

a. No-Build Alternative

The No-Build Alternative would not result in direct impacts to streams due to construction, but the streams would be subject to on-going impacts related to the operation and maintenance of existing roads. Routine highway operation and maintenance would result in impacts to streams currently crossed by existing roadways. Traffic volumes would increase under the No-Build Alternative, but not to the extent that they would under the IRA or the Build Alternative. Commercial, industrial, and residential development would also occur under the No-Build Alternative, adding to incremental impacts to surface water resources.

FIGURE III-17
CLUSTERING OF HABITAT ASSESSMENT SCORES BY ECOREGION AND STREAM ORDER

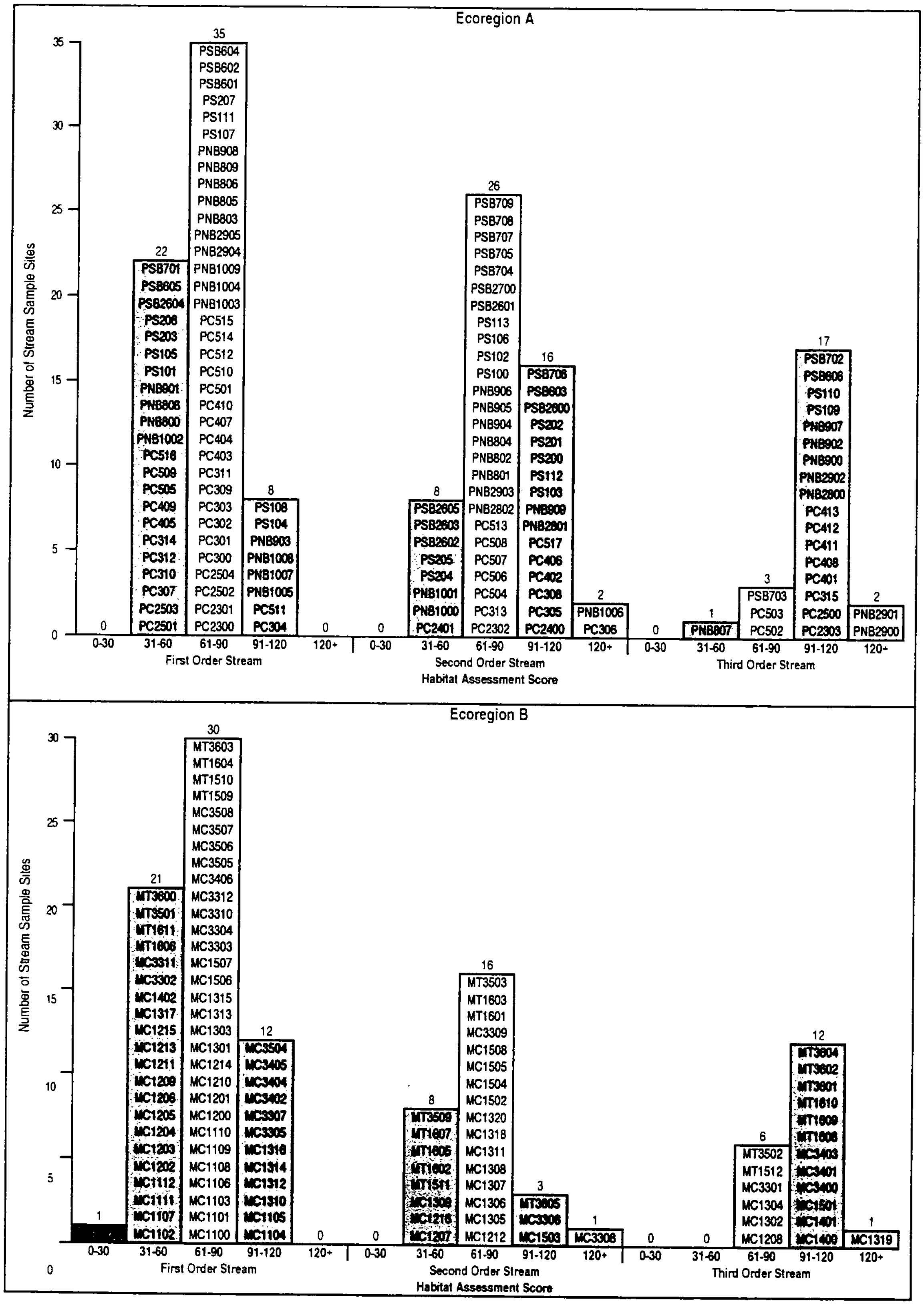


FIGURE III-18
CLUSTERING OF BIOTIC INTEGRITY RANKS BY ECOREGION

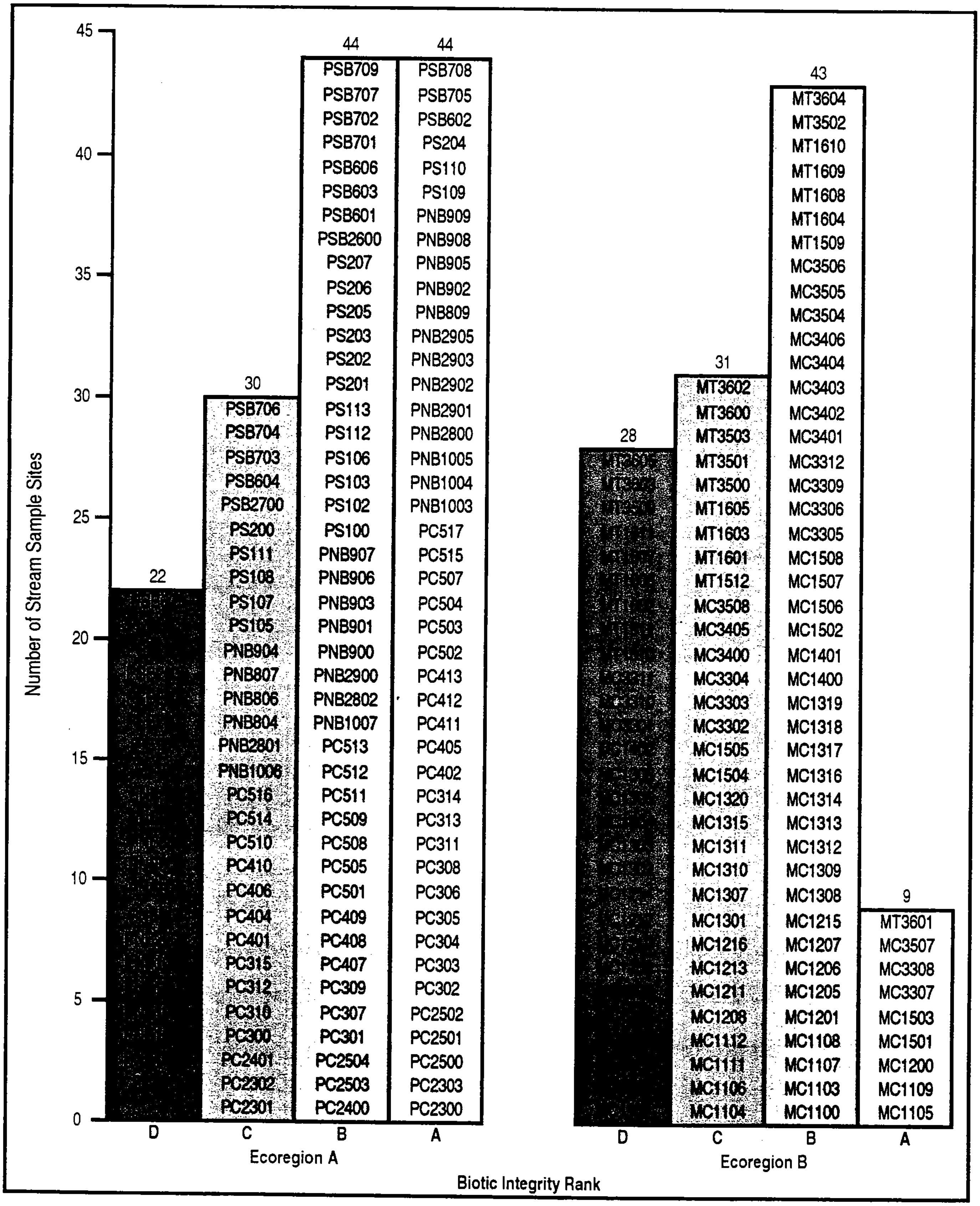


FIGURE III-19
CLUSTERING OF BIOTIC INTEGRITY RANKS BY REGIONAL PROJECT WATERSHED

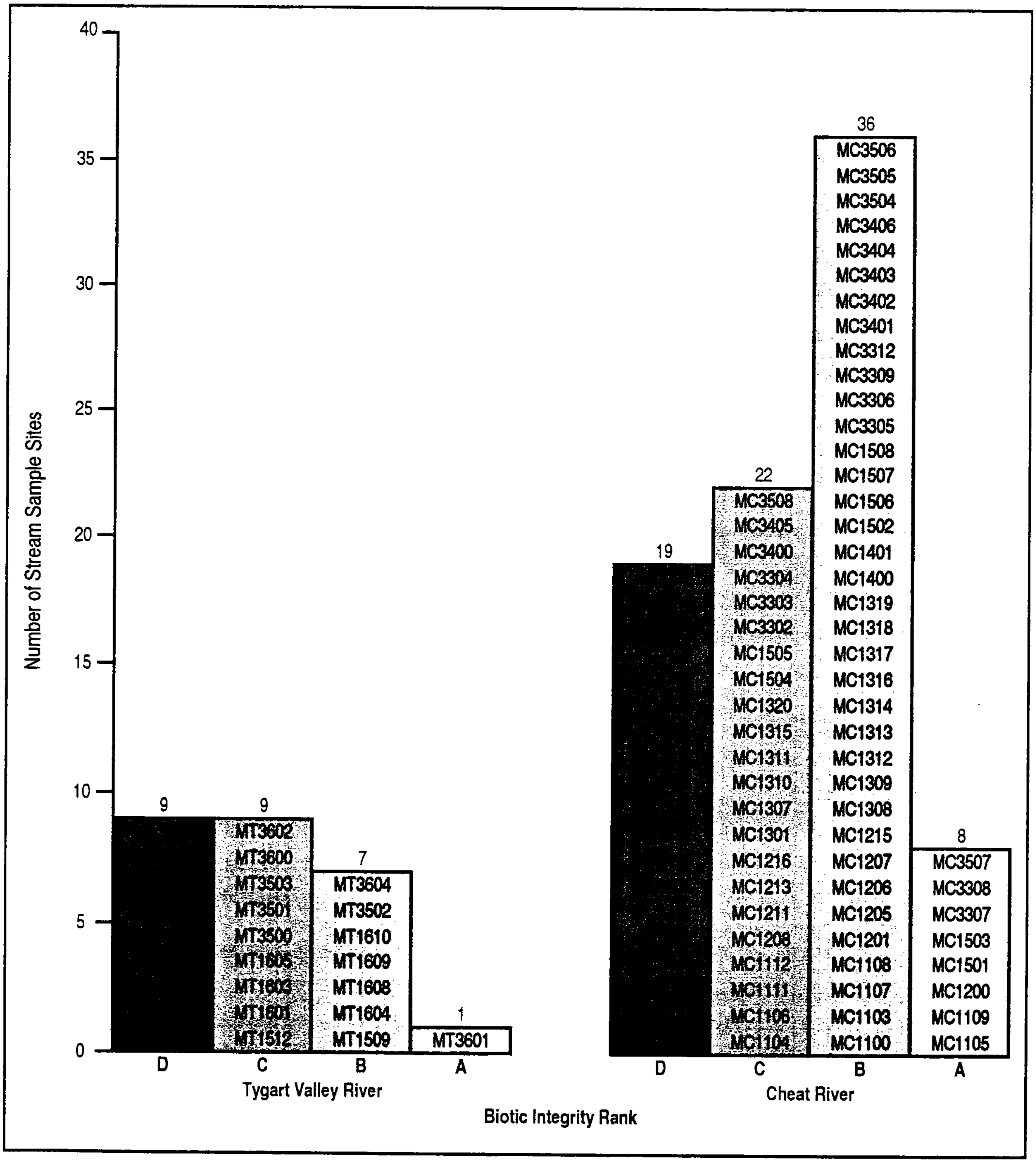


FIGURE III-19
CLUSTERING OF BIOTIC INTEGRITY RANKS BY REGIONAL PROJECT WATERSHED

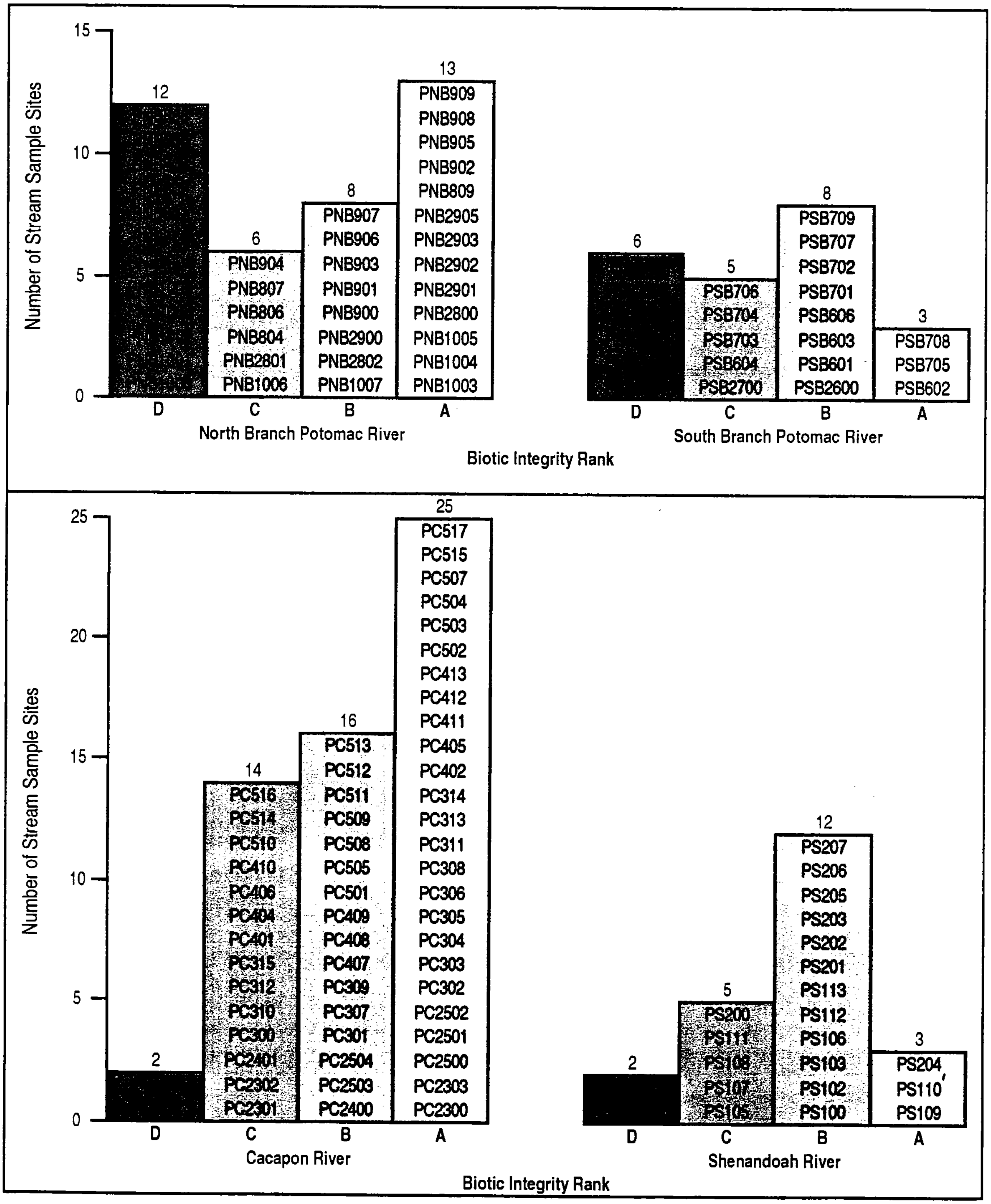


FIGURE III-20
CLUSTERING OF BIOTIC INTEGRITY RANKS BY LOCAL PROJECT WATERSHED

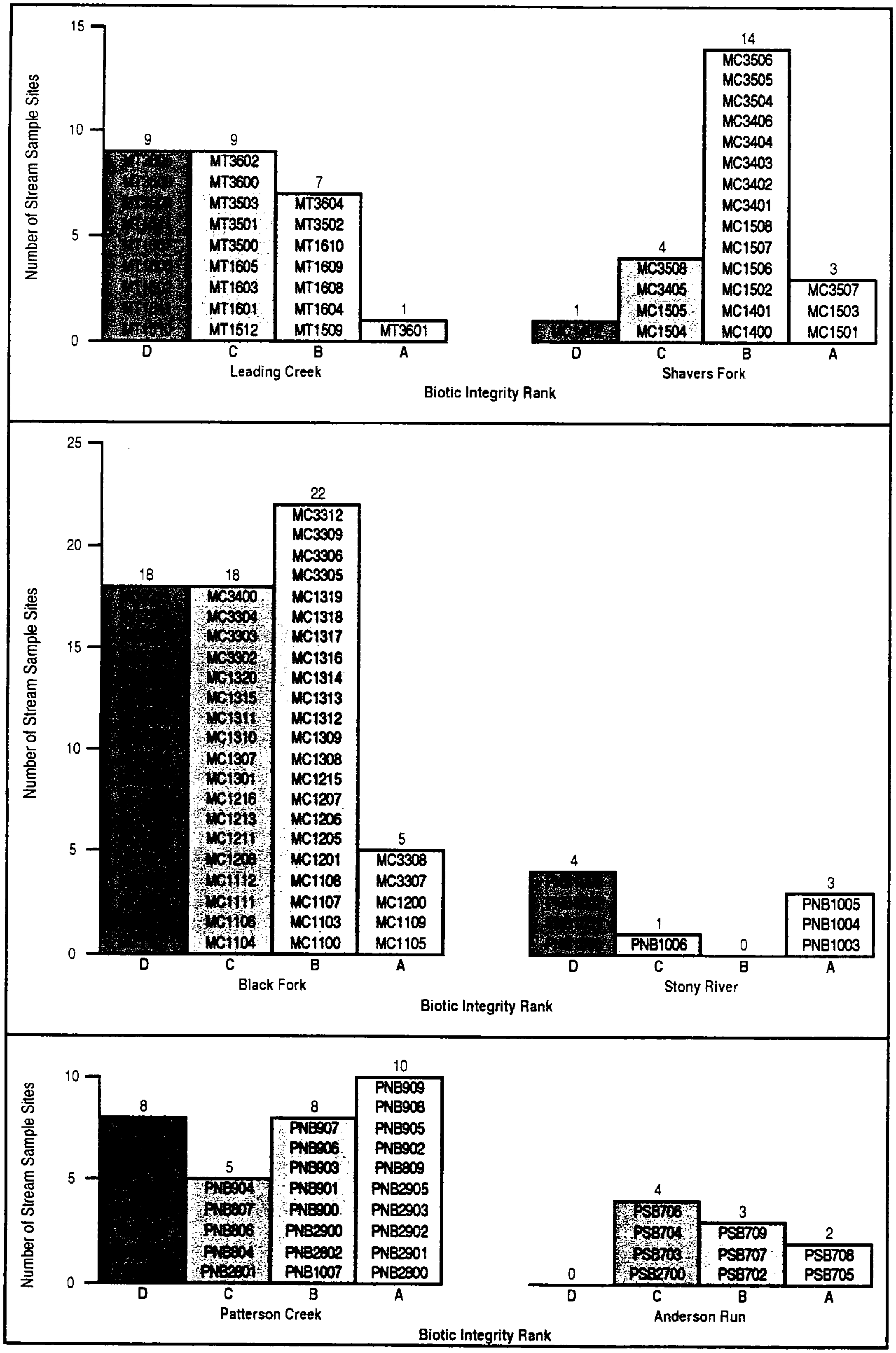
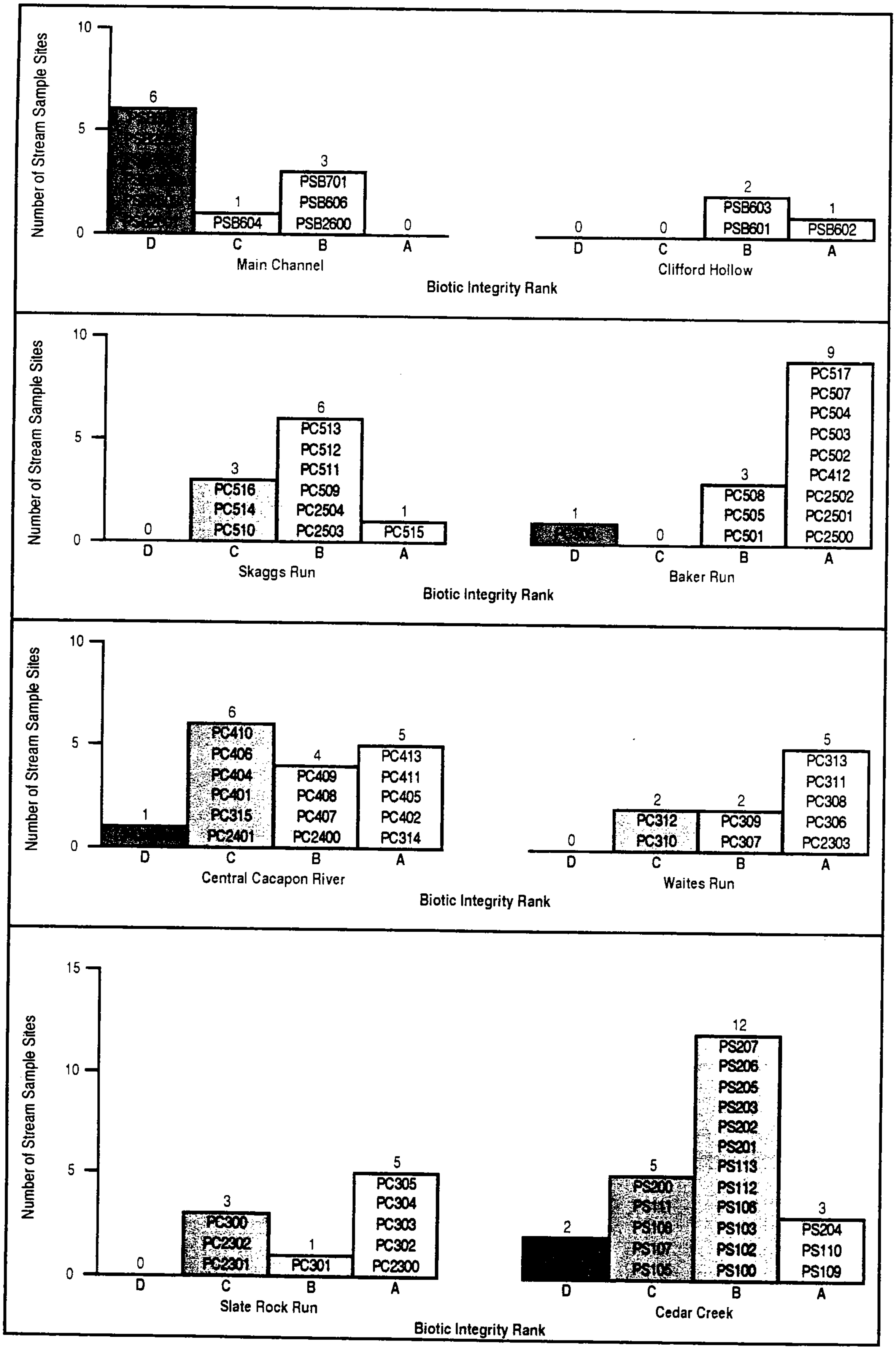


FIGURE III-20
CLUSTERING OF BIOTIC INTEGRITY RANKS BY LOCAL PROJECT WATERSHED



b. Improved Roadway Alternative

The direct impact of the IRA on perennial streams is presented in Table III-65. Figure III-21 clusters individual stream crossing samples by BI rank and Figure III-22 clusters stream crossings by habitat assessment score for the six regional project watersheds. Table III-66 provides the total length of enclosures and relocations for each regional project watershed and a comparison against the total length of perennial streams within each regional project watershed. In general, only minor and temporary direct impacts are expected in the local project watersheds as a result of the IRA. The following summarizes the direct impacts to surface waters for each regional and local project watershed.

(1) Tygart Valley River Regional Project Watershed

Within the Tygart Valley River regional project watershed, the IRA would require two box culverts, ten pipes, and one stream relocation. Based on the estimate of the total length of perennial streams within the Leading Creek local project watershed, the proposed stream enclosures and relocation would impact approximately 0.8 percent of the total length of perennial streams. Based on baseline conditions within this local project watershed, no substantial direct impacts to stream systems are expected.

(2) Cheat River Regional Project Watershed

Within the Shavers Fork local project watershed, the IRA would require six pipes and one stream relocation. The IRA may measurably impact Haddix Run based on the proximity, number, and location of cuts adjacent to Haddix Run. This impact may alter surface water hydrology, water temperature, and reduced aquatic habitat as a result of sedimentation and encroachment into the floodplain of Haddix Run.

Within the Black Fork local project watershed, the IRA would require three box culverts, 24 pipes, and two stream relocations. The IRA may impact a small tributary to Slip Hill Mill Run, thereby resulting in increased silt loads to Slip Hill Mill Run. No other stream systems within the Black Fork local project watershed are expected to experience a reduction in biotic integrity as a result of the construction of the IRA based on existing land use and surface water quality.

Based on the estimate of the total length of perennial streams within the Cheat River regional project watershed, the proposed stream enclosures and relocations for both the Shavers Fork and Black Fork local project watersheds would impact approximately 0.6 percent of the total length of perennial streams within this regional project watershed.

TABLE III-65
COMPARISON OF DIRECT STREAM IMPACTS BY ALTERNATIVE

	Tygart Valley River				Cheat River				North Branch Potomac				South Branch Potomac				Cacapon River				Shenandoah				TOTAL			
AREA OF IMPACT	IRA		Line A		IRA		Line A		IRA		Line A		IRA		Line A		IRA		Line A		IRA		Line A		IRA		Line A	
	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet
Number of Box Culverts	2		2		3		10		2		4		0		1		2		7		0		3		9		27	
Length of Box Culverts	130	425	226	740	122	400	1,047	3,435	94	310	503	1,650	0	0	198	650	52	170	1,097	3,600	0	0	326	1,070	398	1,305	3,397	11,145
Number of Pipes	10		3		30		19		5		6		1		0		22		16		6		3		74		47	
Length of Pipes	469	1,540	366	1,200	1,350	4,430	1,859	6,100	460	1,510	762	2,500	70	230	0	0	1,606	5,270	1,817	5,960	271	890	268	880	4,228	13,870	5,072	16,640
Total Number of Enclosures	12		5		33		29		7		10		1		1		24		23		6		6		83		74	
Total Length of Enclosures	599	1,965	591	1,940	1,472	4,830	2,906	9,535	555	1,820	1,265	4,150	70	230	198	650	1,658	5,440	2,914	9,560	271	890	594	1,950	4,625	15,175	8,469	27,785
Number of Relocations	1		2		3		4		1		8		1		1		1		3		1		1		8		19	
Length of Relocations	122	400	366	1,200	389	1,275	884	2,900	38	125	1,119	3,670	35	115	335	1,100	305	1,000	411	1,350	38	125	30	100	927	3,040	3,146	10,320

FIGURE III-21
CLUSTERING OF IRA
STREAM CROSSINGS - BIOTIC INTEGRITY RANK
BY REGIONAL PROJECT WATERSHED

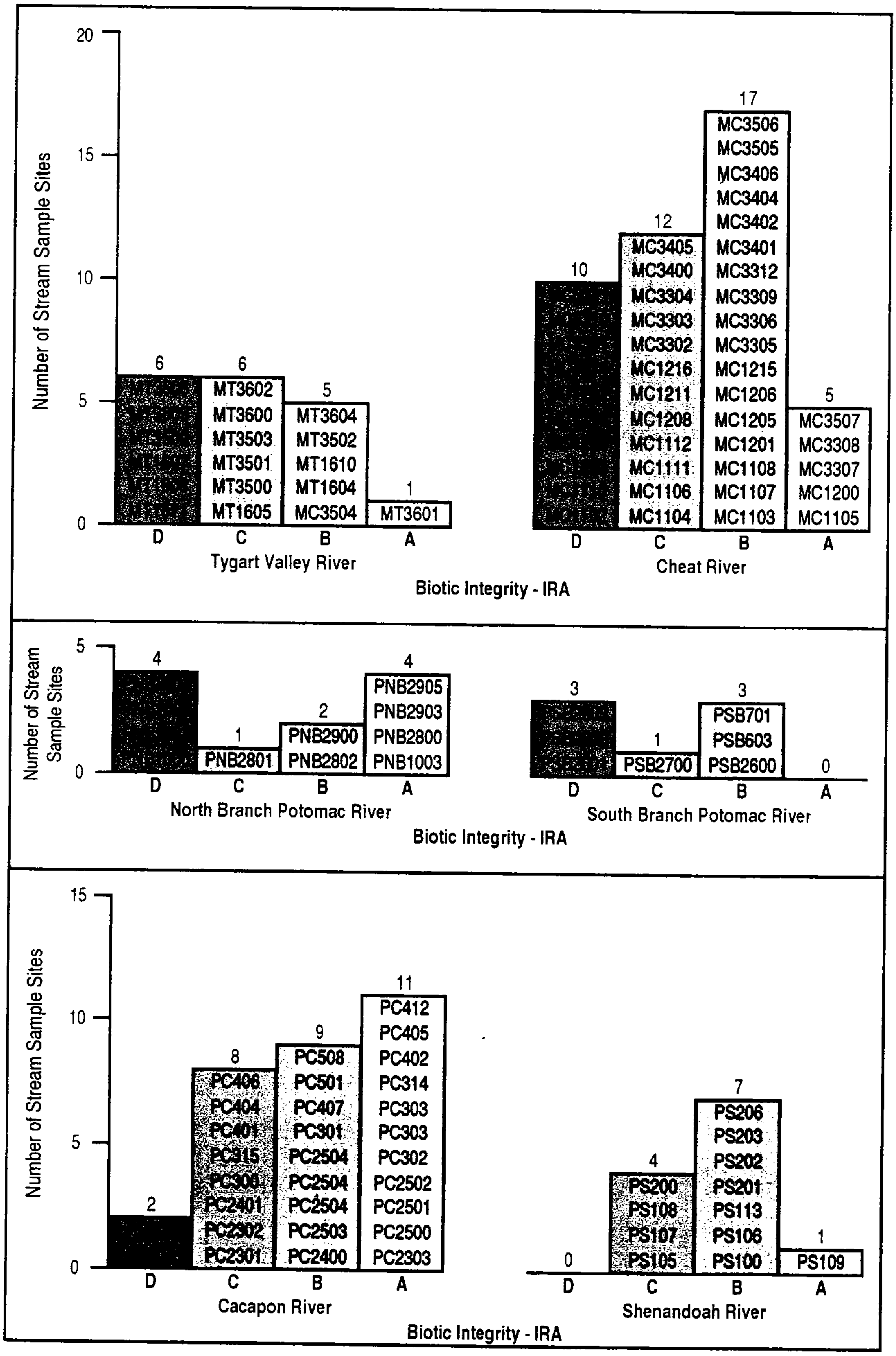


FIGURE III-22
CLUSTERING OF IRA
STREAM CROSSINGS - HABITAT ASSESSMENT SCORE
BY REGIONAL PROJECT WATERSHED

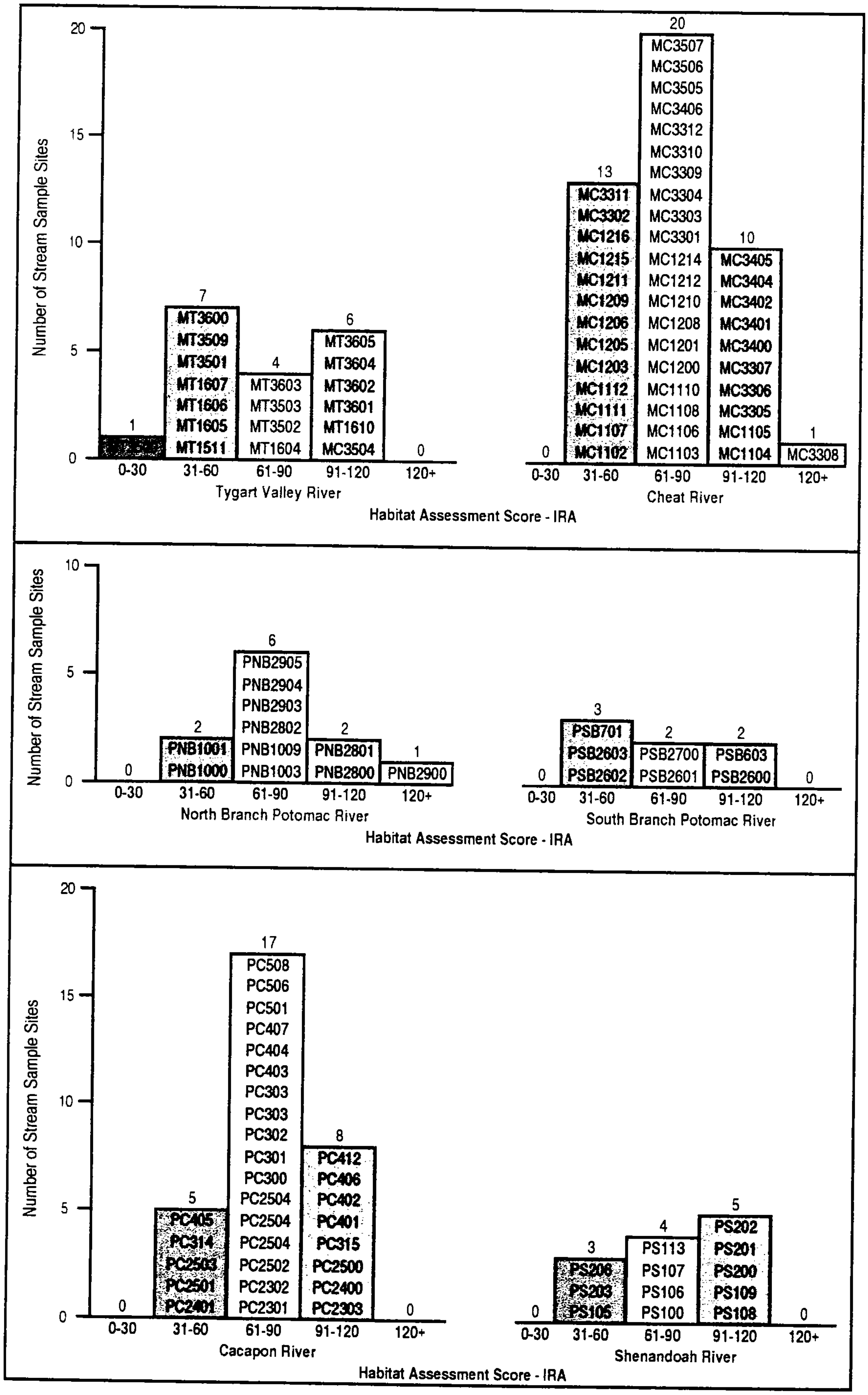


TABLE III-66
SUMMARY OF IMPACTS BY WATERSHED: IRA AND LINE A

IMPROVED ROADWAY ALTERNATIVE

AREA OF IMPACT	Tygart Valley River		Cheat River		North Branch of Potomac		South Branch of Potomac		Cacapon River		Shenandoah River		Total	
	Metric	English	Metric	English	Metric	English	Metric	English	Metric	English	Metric	English	Metric	English
Total Perennial Streams in Watershed (kilometers/miles)	93	58	293	183	163	102	101	63	154	96	205	128	1,008	630
Length of Enclosures (meters/feet)	599	1,965	1,478	4,850	555	1,820	70	230	1,608	5,275	271	890	4,581	15,030
Length of Relocations (meters/feet)	122	400	389	1,275	38	125	35	115	305	1,000	38	125	927	3,040
Enclosures and Relocations as a Percentage of Total Streams		0.8%		0.6%		0.4%		0.1%		1.2%		0.2%		0.5%

BUILD ALTERNATIVE - LINE A

AREA OF IMPACT	Tygart Valley River		Cheat River		North Branch of Potomac		South Branch of Potomac		Cacapon River		Shenandoah River		Total	
	Metric	English	Metric	English	Metric	English	Metric	English	Metric	English	Metric	English	Metric	English
Total Perennial Streams in Watershed (kilometers/miles)	93	58	293	183	163	102	101	63	154	96	205	128	1,008	630
Length of Enclosures (meters/feet)	591	1,940	2,937	9,635	1,265	4,150	198	650	2,914	9,560	594	1,950	8,499	27,885
Length of Relocations (meters/feet)	366	1,200	884	2,900	1,119	3,670	335	1,100	411	1,350	30	100	3,146	10,320
Enclosures and Relocations as a Percentage of Total Per. Streams		1.0%		1.3%		1.5%		0.5%		2.2%		0.3%		1.1%

(3) North Branch of the Potomac River Regional Project Watershed

Within the Stony River local project watershed, the IRA would require four pipes and one stream relocation. Within the Patterson Creek local project watershed, the IRA would require two box culverts and one pipe crossing. Proposed stream enclosures and relocations for both local project watersheds would impact approximately 0.4 percent of the total estimated length of perennial streams within this regional project watershed.

(4) South Branch of the Potomac River Regional Project Watershed

The IRA would have little impact on streams in this regional project watershed. No stream crossings are proposed within the Anderson Run local project watershed. Within the Main Channel local project watershed, the IRA would require one pipe and one stream relocation. The proposed stream enclosure and relocation would impact approximately 0.1 percent of the total length of perennial streams within this regional project watershed.

(5) Cacapon River Regional Project Watershed

Within the Skaggs Run local project watershed, the IRA would require four pipe crossings of streams. Within the Baker Run local project watershed, the IRA would require 5 pipe crossings. Within the Central Cacapon local project watershed, the IRA would require two box culverts and seven pipe crossings. Within the Slate Rock Run local project watershed, the IRA would require six pipe crossings and two stream relocations. The proposed stream enclosures and relocations for local project watersheds would impact approximately 1.2 percent of the total estimated length of perennial streams within this regional project watershed.

(6) Shenandoah River Regional Project Watershed

The IRA would require six pipe crossings and two stream relocations. Habitat degradation and alterations in water quality could also occur along Duck Run. The proposed stream enclosures and relocations would impact approximately 0.2 percent of the total estimated length of perennial streams within this regional project watershed.

(7) Proposed Bridges: IRA

Within West Virginia, the proposed IRA would bridge rivers listed on the Nationwide Rivers Inventory (Shavers Fork, the South Branch of the Potomac River, and Lost River). The IRA would also cross six native or stocked trout streams in West Virginia. Of the six trout streams, four would be bridged by the IRA: the North Fork of Patterson Creek, Lost River, Waites Run, and Trout Run. The remaining two trout streams, Slip Hill Mill Run and Roaring Run, would have piped crossings. Slip Hill Mill

Run would require piping since the IRA crosses at the extreme headwaters of the stream. The IRA would require a piped crossing of Roaring Run at its headwaters and a short relocation further downstream. Within Virginia, the IRA would bridge Cedar Creek (Nationwide Rivers Inventory, Stocked Trout). Table III-67 identifies the bridges associated with the IRA.

c. Build Alternative: Line A

The direct impact of Line A on perennial streams in each local project watershed is presented in Table III-65. Figure III-23 clusters individual stream crossing samples by BI rank and Figure III-24 clusters stream crossings by habitat assessment score for the six regional project watersheds. Table III-66 provides the total length of enclosures and relocations for each regional project watershed and a comparison against the total length of perennial streams within each regional project watershed. In general, only minor and temporary direct impacts are expected in the local project watersheds as a result of the IRA. Line A would result in substantial impacts to Pleasant Run, Roaring Run, and Duck Run. The following summarizes the direct impacts to surface waters for each regional and local project watershed.

(1) Tygart Valley River Regional Project Watershed

Line A would require two box culverts, three pipes, and two stream relocations. The proposed stream enclosures and relocations would impact approximately 1.0 percent of the total length of perennial streams within this regional project watershed.

(2) Cheat River Regional Project Watershed

Within the Shavers Fork local project watershed, Line A would require one pipe crossing and one stream relocation. Line A could impact Pleasant Run, a native trout stream. Although Line A would impact marginal riparian areas, Line A would require substantial deforestation and cuts on a steep slope paralleling the entire length of Pleasant Run.

Within the Black Fork local project watershed, Line A would require ten box culverts, eighteen pipe crossings, and four stream relocations. Measurable direct impacts to Roaring Run are expected as a result of construction of Line A. A small tributary to Slip Hill Mill Run may be impacted by Line A, thereby resulting in increased silt loads to Slip Hill Mill Run. The proposed stream enclosures and relocations for both Shavers Fork and Black Fork local project watersheds would impact approximately 1.3 percent of the total length of perennial streams within this regional project watershed.

TABLE III-67
BRIDGES: IRA

Watershed	Stream Name	Station	Structure Length (meters / feet)		Comments
Tygart Valley River	Claylick Run	445+00	213	700	
Tygart Valley River	Leading Creek	547+00	53	175	WVHQ
Tygart Valley River	Stalnaker Run	620+00	23	75	
Tygart Valley River	Leading Creek	697+00	91	300	WVHQ
Tygart Valley River	Leading Creek	710+00	61	200	WVHQ
Tygart Valley River	Cherry Fork	1594+00	91	300	
Cheat River	Sugarcamp Run	2212+00	61	200	
Cheat River	Shavers Fork	2242+00	213	700	WVHQ
Cheat River	Black Fork	2270+00	274	900	
Cheat River	Roaring Run	2298+00	61	200	Native Trout, WVHQ
Cheat River	Roaring Run	2327+00	91	300	Native Trout, WVHQ
Cheat River	Snyder Run	4170+00	183	600	
Cheat River	NF Blackwater	4231+00	427	1,400	
Cheat River	Beaver Creek	4468+00	30	100	WVHQ
Cheat River	Trib. to Beaver Creek	4582+00	24	80	
Cheat River	Trib. to Beaver Creek	4593+00	24	80	
Cheat River	Trib. to Beaver Creek	4841+00	46	150	
North Branch of Potomac	Trib. to NF Patterson Creek	5527+00	61	200	
North Branch of Potomac	NF Patterson Creek	5640+00	183	600	Stocked Trout, WVHQ
North Branch of Potomac	NF Patterson Creek	5893+00	61	200	Stocked Trout, WVHQ
North Branch of Potomac	Patterson Creek	5937+00	116	380	WVHQ
South Branch of Potomac	Anderson Run	6371+00	61	200	
South Branch of Potomac	SB Potomac River	6450+00	107	350	NRI, WVHQ
South Branch of Potomac	Fort Run	5196+00	61	200	
South Branch of Potomac	Dumpling Run	5245+00	61	200	
South Branch of Potomac	Dumpling Run	5308+00	61	200	
South Branch of Potomac	Fort Run	5396+00	70	230	
South Branch of Potomac	Clifford Hollow	5584+00	152	500	
Cacapon River	Baker Run	6025+00	34	110	
Cacapon River	Baker Run	6139+00	37	120	
Cacapon River	Lost River	6498+00	116	380	Stocked Trout, WVHQ, NRI
Cacapon River	Trout Run	6659+00	30	100	Stocked Trout, Native Trout, WVHQ
Cacapon River	Waites Run	6745+00	61	200	Stocked Trout, NRI
Cacapon River	Slate Rock Run	6790+00	24	80	
Shenandoah River	Duck Run	198+00	24	80	Native Trout, OSRW
Shenandoah River	Cedar Creek	290+00	55	180	Stocked Trout, NRI
Shenandoah River	Turkey Run	463+00	30	100	
Shenandoah River	Trib. to Mulberry Run	597+00	30	100	
Shenandoah River	Mulberry Run	625+00	52	170	Relocation
	Total Bridge Length		**3,456**	**11,340**	

** Bridges substituted for box culverts in response to agency field reviews*

AMD= Acid Mine Drainage

NRI = Nationwide Rivers Inventory; WVHQ = WVa. High Quality Stream; OSRW = Va. Outstanding State Resource Waters

FIGURE III-23
CLUSTERING OF LINE A
STREAM CROSSINGS - BIOTIC INTEGRITY RANK
BY REGIONAL PROJECT WATERSHED

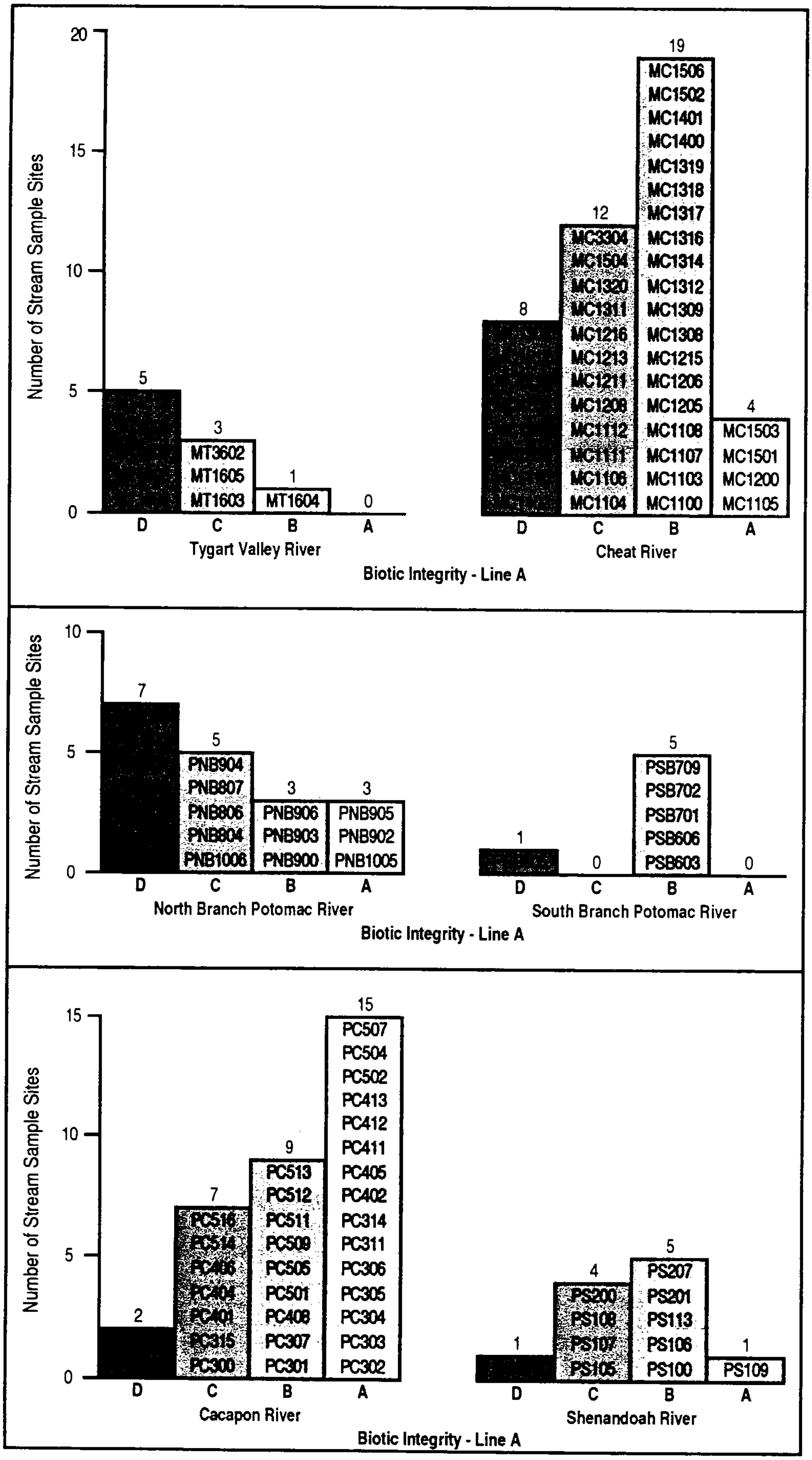
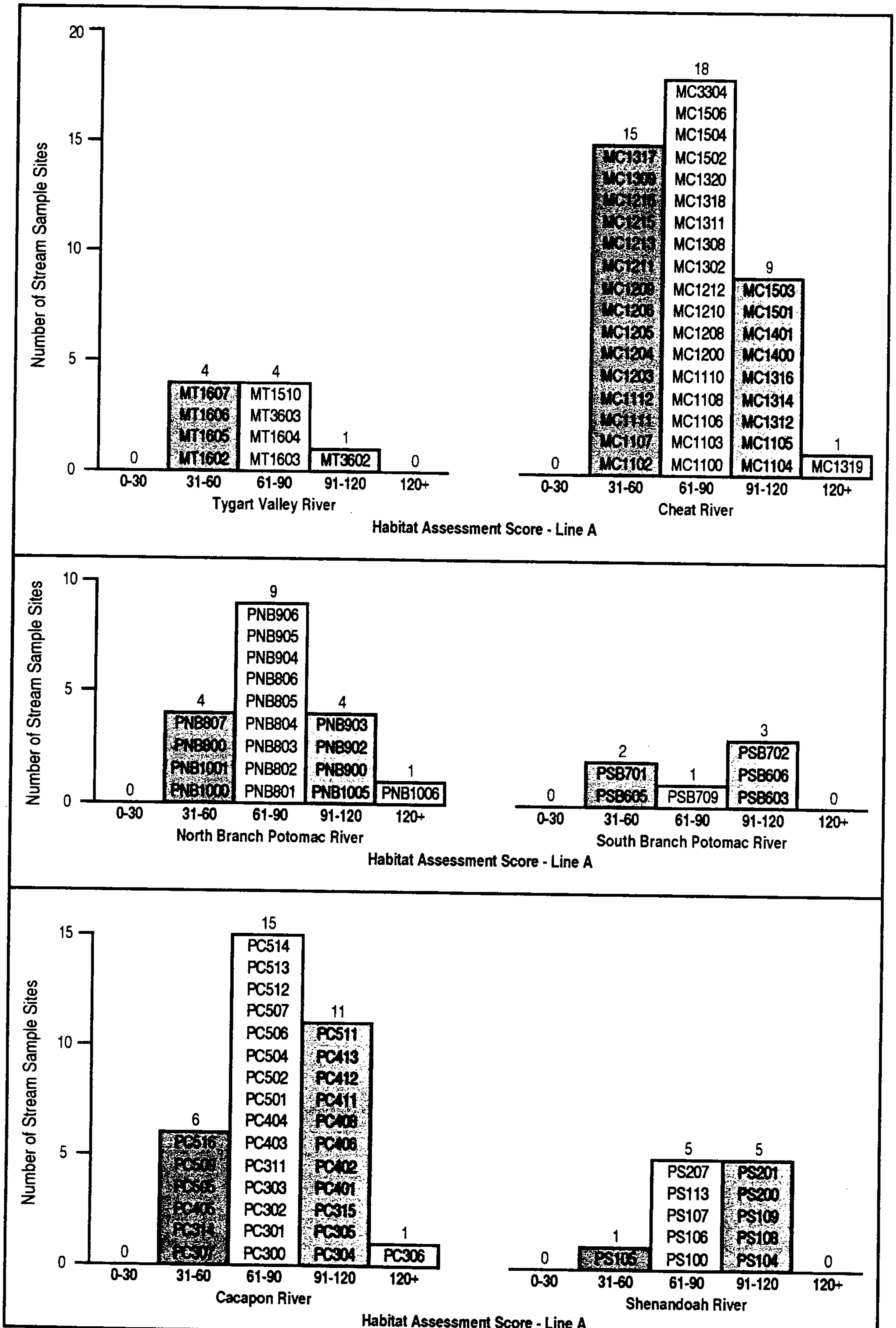


FIGURE III-24
CLUSTERING OF LINE A
STREAM CROSSINGS - HABITAT ASSESSMENT SCORE
BY REGIONAL PROJECT WATERSHED



(3) North Branch of the Potomac River

Within the Stony River local project watershed, Line A would require two box culverts, one pipe crossing, and four stream relocations. Within the Patterson Creek local project watershed, Line A would require two box culverts, five pipe crossings, and four stream relocations. The proposed stream enclosures and relocations for both local project watersheds would impact approximately 1.5 percent of the total length of perennial streams within this regional project watershed.

(4) South Branch of the Potomac River Regional Project Watershed

One box culvert crossing is proposed within the Anderson Run local project watershed for Line A. Within the Main Channel local project watershed, Line A would require one stream relocation. The proposed stream enclosures and relocations for both local project watersheds would impact approximately 0.5 percent of the total length of perennial streams within this regional project watershed.

(5) Cacapon River Regional Project Watershed

Within the Skaggs Run local project watershed, Line A would require two box culverts, four pipe crossings, and two stream relocations. Within the Baker Run local project watershed, Line A would require one box culvert and three pipe crossings. Within the Central Cacapon local project watershed, Line A would require one box culvert, four pipe crossings, and one stream relocation. Within the Waites Run local project watershed, Line A would require one box culvert and one pipe crossing. Within the Slate Rock Run local project watershed, Line A would require two box culverts and four pipe crossings. The proposed stream enclosures and relocations for local project watersheds would impact approximately 2.2 percent of the total length of perennial streams within this regional project watershed.

(6) Shenandoah River Regional Project Watershed

Line A would require three box culverts, three pipes, and two stream relocations. Line A (including alignments within the Duck Run Option Area) would traverse a large portion of the Duck Run watershed. Line A and Lines D1 and D2 would require substantial cuts, fill, and deforestation, resulting in alterations in hydrology, increased sedimentation, and variability in surface water temperature. Line A would require a box culvert crossing of a tributary to Paddy Run, a native trout stream. No other stream systems are expected to incur direct impacts within this regional project watershed. The proposed stream enclosures and relocations for the Cedar Creek local project watershed would impact approximately 0.3 percent of the total length of perennial streams within this regional project watershed.

(7) Proposed Bridges: Line A

Within West Virginia, Line A would bridge the three rivers listed on the Nationwide Rivers Inventory: Shavers Fork, the South Branch of the Potomac River, and Lost River. Line A would bridge all nine native or stocked trout streams crossed in West Virginia (Pleasant Run, Roaring Run, Elklick Run, North Fork of Patterson Creek, Lost River, Waites Run, and Trout Run) and 13 of 15 West Virginia High Quality Streams.

Within Virginia (Shenandoah regional project watershed), Line A would bridge Cedar Creek (Nationwide Rivers Inventory, Stocked Trout) and Duck Run (Native Trout and Outstanding State Resource Water) and avoid all of Duck Run's perennial tributaries. Line A would require a box culvert crossing of a tributary to Paddy Run (Native Trout). Table III-68 identifies the bridges associated with Line A.

d. Comparison of Alternatives: The IRA versus Line A

A comparison of direct impacts to streams was conducted between the IRA and Line A. For the entire project, the IRA and Line A would require a similar number of stream crossings and relocations. However, Line A would result in approximately twice the amount of direct stream impacts as would be expected under the IRA. The following summarizes the direct stream impacts of the IRA and Line A for each regional project watershed and local project watershed. Refer to Table III-4 for a comparison of the direct impacts of each alternative within each regional project watershed.

(1) Tygart Valley River Regional Project Watershed

Line A would require 7 stream enclosures compared to the 13 proposed for the IRA, however, the length of stream impact for Line A would be approximately 33 percent greater than that of the IRA. The IRA would impact more streams, but Line A would impact a greater length of stream including a greater number and length of moderately impaired streams.

(2) Cheat River Regional Project Watershed

Overall, Line A and the IRA would impact similar numbers of streams within this regional project watershed, but Line A would impact nearly twice the length of streams as would the IRA.

Within the Shavers Fork local project watershed, Line A would require fewer stream enclosures or relocations but greater total length of stream impact than the IRA. The IRA would impact a greater number of streams, and enclose or relocate a greater number and length of streams with greater BI than would Line A.

TABLE III-68
BRIDGES: LINE A

Regional Project Watershed	Stream Name	Station	Structure Length meters / feet		Comments
Tygart Valley River	Clay Lick Run	451	213	700	
Tygart Valley River	Pearcy Run	568	137	450	
Tygart Valley River	Leading Creek	646	137	450	WV HQ
Tygart Valley River	Trib. to Wilmoth Creek	805	122	400	
Cheat River	Slabcamp Run	3224	114	375	
Cheat River	Pleasant Run	3300	61	200	Native Trout
Cheat River	Shavers Fork	3338	518	1,700	NRI, WVHQ
Cheat River	Shavers Fork	3460	137	450	NRI, WVHQ
Cheat River	Shavers Fork	3476	195	640	NRI, WVHQ
Cheat River	Black Fork	3621	366	1,200	
Cheat River	Roaring Run	3627	38	125	Native Trout
Cheat River	Big Run*	3922	113	370	
Cheat River	NF Blackwater River	4091	320	1,050	AMD
Cheat River	Trib. to Pendleton Creek	4185	46	150	
Cheat River	Beaver Creek	4325	38	125	AMD, WVHQ
Cheat River	Trib. to Beaver Creek	4742	107	350	Includes MC1103
North Branch of Potomac	Stoney River	4912	262	860	AMD
North Branch of Potomac	Elklick Run	5265	198	650	Native Trout, WVHQ
North Branch of Potomac	Trib. to Elklick Run*	5293	198	650	
North Branch of Potomac	NF Patterson Creek	5415	137	450	Stocked Trout, WVHQ
North Branch of Potomac	MF Patterson Creek*	5534	366	1,200	
North Branch of Potomac	Trib. to MF Patterson Creek	5597	131	430	
South Branch of Potomac	Walnut Bottom Run	6142	91	300	
South Branch of Potomac	SB Potomac River and tribs	6243	732	2,400	NRI, WVHQ
South Branch of Potomac	Clifford Hollow*	6515	366	1,200	
Cacapon River	Long Lick Run	6925	122	400	
Cacapon River	Baker Run	7000	171	560	
Cacapon River	Baker Run	7068	43	140	
Cacapon River	Lost River	7087	128	420	Stocked Trout, WVHQ, NRI
Cacapon River	Lost River	7170	265	870	Stocked Trout, WVHQ, NRI
Cacapon River	Sauerkraut Run	7327	152	500	
Cacapon River	Lost River	7352	168	550	Stocked Trout, WVHQ, NRI
Cacapon River	Trout Run	7498	91	300	Native Trout, Stocked Trout, WVHQ
Cacapon River	Waites Run	7585	76	250	Stocked Trout, WVHQ
Shenandoah River	Duck Run	7948	137	450	Native Trout, OSRW
Shenandoah River	Duck Run	8028	82	270	Native Trout, OSRW
Shenandoah River	Cedar Creek	8111	137	450	NRI, Stocked Trout
Shenandoah River	Turkey Run	8259	183	600	
Shenandoah River	Trib. to Mulberry Run	8403	46	150	
	Total Bridge Length		**6,945**	**22,785**	

** Bridges substituted for box culverts after field reviews*

AMD = Acid Mine Drainage; NRI = Nationwide Rivers Inventory; WVHQ = WVa. High Quality Stream; OSRW = Va. Outstanding State Resource Waters

Within the Black Fork local project watershed, Line A would have approximately 122 percent more direct stream impacts than the IRA. Both alternatives would directly impact a similar number of streams (i.e., 29 crossings for the IRA and 32 crossings for Line A).

(3) North Branch of the Potomac River Regional Project Watershed

Within this regional project watershed, Line A would impact twice the number of streams and nearly four times the length of streams as would the IRA.

Within the Stony River local project watershed, although the IRA and Line A impact a similar number of streams, Line A would have twice the direct stream impacts of the IRA. In addition, Line A would impact higher quality (higher BI ranks) streams than would the IRA.

Within the Patterson Creek local project watershed, Line A would impact considerably greater number and length of stream than would the IRA. However, the IRA would impact more higher quality streams than would Line A.

(4) South Branch of the Potomac River Regional Project Watershed

Within the South Branch of the Potomac River regional project watershed, Line A would have the same number of stream impacts but result in five times greater stream length impacts as would the IRA.

The IRA would not impact streams in the Anderson Run local whereas Line A would require one stream crossing. Within the Main Channel local project watershed, Line A would have three times the length of direct stream impacts as would the IRA.

(5) Cacapon River Regional Project Watershed

Overall, Line A and the IRA would impact similar numbers of streams within this regional project watershed, but Line A would impact a greater stream length than the IRA. The majority of the difference would be due to streams in the Skaggs Run and Central Cacapon River local project watershed. The number of higher quality streams impacted (BI rank A or B) would be similar under either alternative, but Line A would impact twice the length of higher quality streams.

Within the Skaggs Run local project watershed, Line A would impact twice the number of streams and have more than four times greater direct stream impacts than would the IRA. For the Baker Run local project watershed, Line A would have nearly the same impacts as would the IRA. Within the Central Cacapon local project watershed, Line A would impact fewer streams, but would have approximately

64 percent greater direct stream impacts than would the IRA. Within the Waites Run local project watershed, Line A would impact 213 meters (700 feet) of direct stream impacts, whereas the IRA would avoid all impacts. Within the Slate Rock Run local project watershed, Line A and the IRA would have approximately the same stream impacts.

(6) Shenandoah River Regional Project Watershed

Within the Cedar Creek local project watershed, although the IRA and Line A would impact the same number of streams, Line A would result in approximately twice the direct stream impacts as would the IRA. Line A would utilize more culverts while the IRA would utilize more pipes.

e. Comparison of the Option Areas

A summary comparison of the impacts of the Build Alternative alignments within each option area in West Virginia and Virginia is presented in Table III-69 and Table III-70, respectively. The following summarizes the differences in alignments for each option area.

Within the Interchange Option Area, Line A and Line I would have similar impacts on streams. Within the Shavers Fork Option Area, Line A and Line S would require no enclosures and minimal relocations of perennial streams. Line A would require a double bridge crossing of Shavers Fork while Line S would avoid crossing Shavers Fork by remaining along the slope of McGowen Mountain. Within the Patterson Creek Option Area, Line A would minimize impacts to perennial streams, particularly the Middle Fork of Patterson Creek. Line P would require a greater number and longer enclosures and relocations of perennial streams. Line A would bridge the Middle Fork of Patterson Creek while Line P would use a box culvert. Within the Forman Option Area, Line A and Line F would have similar lengths of stream enclosures.

TABLE III-69

OPTION AREA COMPARISON: WEST VIRGINIA

			OPTION AREA COMPARISONS IN WEST VIRGINIA																							
			Interchange				Shavers Fork				Patterson Creek				Forman				Baker				Hanging Rock			
AREA OF IMPACT	(WV)		Line I		Line A		Line S		Line A		Line P		Line A		Line F		Line A		Line B		Line A		Line R		Line A	
	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet
Number of Box Culverts	21		0		0		0		0		2		1		1		1		1		0		0		0	
Length of Box Culverts	2,681	8,795	0	0	0	0	0	0	0	0	351	1,150	137	450	152	500	152	500	198	650	0	0	0	0	0	0
Number of Open Bottom Culverts	3		0		0		0		0		0		0		0		0		0		0		0		0	
Length of Open Bottom Culverts	390	1,280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Pipes	43		2		2		0		0		5		2		2		2		0		1		0		0	
Length of Pipes	4,811	15,760	335	1,100	351	1,150	0	0	0	0	632	2,075	183	600	381	1,250	360	1,180	0	0	94	310	0	0	0	0
Total Number of Enclosures	67		2		2		0		0		7		3		3		3		1		1		0		0	
Total Length of Enclosures	7,882	25,835	335	1,100	351	1,150	0	0	0	0	983	3,225	320	1,050	533	1,750	512	1,680	198	650	94	310	0	0	0	0
Number of Relocations	19		2		2		1		1		1		1		2		2		0		0		0		0	
Length of Relocations	3,115	10,220	305	1,000	305	1,000	183	600	183	600	116	380	116	380	625	2,050	351	1,150	0	0	0	0	0	0	0	0
Length of Perennial Streams	12,500	41,009	741	2,431	807	2,646	77	254	94	307	1,392	4,568	472	1,549	1,292	4,239	1,304	4,277	191	627	94	310	0	0	0	0
Length of Intermittent Streams	26,294	86,267	269	884	265	869	1,755	5,757	1,650	5,414	696	2,284	869	2,850	1,539	5,050	1,686	5,531	346	1,135	639	2,095	457	1,499	467	1,532

TABLE III-70
OPTION AREA COMPARISON: VIRGINIA

AREA OF IMPACT	TOTAL LINE A (VA)		OPTION AREA COMPARISONS IN VIRGINIA									
			Duck Run						Lebanon Church			
			Line D1		Line D2		Line A		Line L		Line A	
	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet
Number of Box Culverts		2		0		0		0		0		2
Length of Box Culverts	189	620	0	0	0	0	0	0	0	0	158	520
Number of Open Bottom Culverts		1		0		1		1		0		0
Length of Open Bottom Culverts	137	450	0	0	137	450	137	450	0	0	0	0
Number of Pipes		3		0		0		0		1		2
Length of Pipes	268	880	0	0	0	0	0	0	107	350	189	620
Total Number of Enclosures		6		0		1		1		1		4
Total Length of Enclosures	594	1,950	0	0	137	450	137	450	107	350	347	1,140
Number of Relocations		1		0		0		0		0		1
Length of Relocations	30	100	0	0	0	0	0	0	0	0	30	100
Length of Perennial Streams	658	2,159	0	0	137	448	137	448	109	359	405	1,330
Length of Intermittent Streams	2,843	9,328	1,358	4,456	1,332	4,371	1,148	3,766	863	2,830	400	1,313

Within the Baker Option Area, Line A would require a bridge over the Lost River, two bridges over Baker Run, and piping of a perennial tributary to Baker Run. Line B would require a bridge over Lost River but would avoid crossing Baker Run. Line B would require a 650 foot box culvert of a perennial tributary to Baker Run. Within the Baker Option Area, Line A would result in the least impacts to perennial streams. Within the Hanging Rock Option Area, both Line A and Line R would bridge the Lost River. There would be minimal differences in impacts to perennial streams between Line A and Line R.

There are three alignments within the Duck Run Option Area: Line A, Line D1, and Line D2. Line A would bridge Duck Run (native trout, Outstanding State Resource Waters) twice and require a culvert across a tributary of Paddy Run (native trout). Line D1 would require bridging Duck Run three times, but would avoid the tributary to Paddy Run and minimize construction within the George Washington National Forest. Line D2 would not cross Duck Run, but would cross the tributary to Paddy Run and require the greatest amount of construction within the George Washington National Forest.

Line A within the Lebanon Church Option Area is aligned across the headwaters of Mulberry Run and Town Run. This position in the watershed results in the crossing of several tributaries to these streams. Line L, on the other hand, is located further to the north which minimizes the number of perennial streams the line crosses but increases the number of intermittent streams crossed. Within the Lebanon Church Option Area, Line L would result in the least number of impacts to perennial streams.

f. Secondary Impacts

Secondary impacts to surface waters include degradation of water quality and aquatic habitat as a result of: stormwater runoff carrying sediment and highway pollutants into streams; hindered movement of aquatic organisms in streams and rivers due to enclosures; and reductions in forested riparian buffers adjacent to waterways.

(1) Erosion And Sedimentation

Sedimentation of streams during and after construction of the proposed project could adversely impact both aquatic invertebrates and fishes by altering the existing substrate. When sedimentation of the stream results in the silt content of the substrate exceeding 15 percent, trout populations are reduced by 50 percent (Hunter, 1991). Sedimentation can also have acute and chronic effects on aquatic invertebrates and fish. Elevated suspended sediment concentrations (above 20,000 ppm) can cause mortality in adult fish by clogging the gill filaments and preventing normal water circulation and aeration of blood. However, abrasion damage to gills begins to occur at sediment concentrations as low as 200 ppm (Welsch, 1991). Additionally, low concentrations can cause behavioral changes and disrupt normal reproduction by smothering spawning areas and preventing the emergence of fry.

The effects of silt (suspended particulate matter) has also been reported to be a limiting factor in the distribution and density of invertebrate organisms (Bartsch, 1916; Ellis, 1936; National Technical Advisory Committee, 1968; Luedtke and Brusven, 1976; Marking and Bills, 1980; Brzezinski and Holton, 1981; Gray and Ward, 1982; Buikema et al., 1983; Cowie, 1985; Duncan and Brusven, 1985; Garie and McIntosh, 1986; Aldridge et al., 1987; Dewalt and Olive, 1988; Wolcott and Neves, 1990; Hogg and Norris, 1991; Corkum, 1992; Layzer and Anderson, 1992; Houp, 1993). As silt settles out of the water column, the rate of accretion can be greater than the escape rate of many invertebrates that are less mobile or sedentary in nature. The modification in substrates as a result of sedimentation excludes many invertebrate species that use the interstitial zones of cobble/gravel stream beds.

(2) Highway Pollutants

After construction of the proposed project, major sources of pollutants include vehicles, dustfall, and precipitation (Charbeneau et al., 1993). A variety of factors (e.g., traffic volume and type, local land use, and weather patterns) affect the type and amounts of pollutants. Additionally, roadway maintenance practices such as sanding, deicing, and application of herbicides on highway rights-of-way can also act as sources of pollutants. Table III-71 lists the types of contaminants associated with roadway operation. From this list, deposition of pollutants from vehicles (both direct and indirect) is the largest source of pollutants during most of the year, while deicing salts (sodium chloride and calcium chloride) and abrasives are the largest source of pollutants during periods of snow and ice (Gupta et al., 1981). The rate of deposition and subsequent magnitude of these pollutants in highway runoff are site-specific and affected by traffic characteristics, highway design, maintenance activities, surrounding land use, climate, and accidental spills.

Highway pollutants are removed from the highway through a number of mechanisms which include stormwater runoff, wind, vehicle turbulence, and the vehicles themselves. The effects of highway runoff on streams are variable and dependent on the length of time since the last storm event, traffic volume, natural surface winds, the quantity of stormwater runoff delivered to the stream, volume of flow in the stream, and the duration of the storm event (Charbeneau et al., 1993). The most important factor contributing to the accumulation of pollutants from highway operation and maintenance is the build up of fine particulate matter. Many toxic compounds such as heavy metals and hydrocarbons adhere to fine particles and are easily transported by stormwater runoff to nearby streams. The accumulation of particulate matter on a highway is also directly proportional to the amount of traffic on the highway. However, vehicle turbulence can also remove solids and other pollutants from highway lanes and shoulders (Kerri et al., 1985; and Asplund et al., 1980) which distorts the relationship between traffic volume and pollutant concentrations in runoff.

TABLE III-71
POLLUTANTS IN HIGHWAY RUNOFF

POLLUTANT	PRIMARY SOURCES*
Particulates	Pavement wear, vehicles, atmosphere, maintenance
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Leaded gasoline (auto exhaust), tire wear (lead oxide filler material), lubricating oil and grease, bearing wear
Zinc	Tire wear (filler material), motor oil (stabilizing additive), grease
Iron	Auto body rust, steel highway structures (guardrails, etc.), moving engine parts
Copper	Metal plating, bearing and bushing wear, moving engine parts, brake lining wear, fungicides and insecticides applied by maintenance operations
Cadmium	Tire wear (filler material), insecticide application
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline (exhaust), lubricating oil, metal plating, bushing wear, brake lining wear, asphalt paving
Manganese	Moving engine parts
Bromide	Exhaust
Cyanide	Anticake compound (ferric ferrocyanide, Prussian Blue or sodium ferrocyanide, Yellow Prussiate of Soda) used to keep deicing salt granular
Sodium, Calcium	Deicing salts, grease
Chloride	Deicing salts
Sulphate	Roadway blends, fuel, deicing salts
Petroleum	Spills, leaks or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate
Polychlorinated Biphenyls	Spraying of highway right-of-ways, background atmospheric deposition, PCB catalyst in synthetic tires
Pesticides, Pathogenic bacteria	Soil, litter, bird droppings and trucks hauling livestock and stockyard waste
Rubber	Tire wear
Asbestos	Clutch and brake lining wear

* Source: Kobriger, 1984

Highway runoff may adversely affect the water quality through acute (i.e. short-term) loadings (i.e. storm events) and through chronic effects as a result of long-term accumulation and exposure. Research on rural highways similar to the proposed project indicates few substantial effects from highway runoff are apparent for highways with an average daily traffic (ADT) of less than 30,000 vehicle per day and that toxic effects are limited to urban highways with high ADTs (>50,000 ADT) (Maestri, et al., 1981). Driscoll et al. (1990) concluded that runoff concentrations are two four times higher for highways that are subject to ADTs > 30,000. Dupuis and Kobriger (1985) reported that there were no apparent water quality impacts during storm events on benthic invertebrates. Based on the volume of traffic predicted for the proposed project (23,000 vehicles per day), it is anticipated that there would be no measurable differences in water quality on receiving streams.

(3) Aquatic Habitat

As described in previous sections, impacts to streams include alterations in stream hydrology, geometry, and the degradation of water quality. These impacts could impact the stream's capacity to provide habitat suitable for aquatic wildlife, including game and non-game fish, amphibians, and invertebrates.

Impacts to the aquatic environment change with time and space. Spatially, the movement of aquatic invertebrates and fish within streams is important to the colonization of portions of streams temporarily disturbed during construction and to the natural colonization of undisturbed streams (Lancaster et al., 1990). During periods of low stream flow, movement of fish and aquatic invertebrates along a stream to areas of deeper water is necessary. Colonization of stream substrate by aquatic invertebrates come from four major sources: downstream drift, upstream movement, vertical movement from deep within the substrate, and aerial movements of adults (Waters, 1961,1962a, 1962b, 1965: as cited by Pearson and Krame,r 1972; Hynes, 1970; William and Hynes, 1976; Williams and Levens, 1988).

A number of macroinvertebrate species are known to move vertically into gravel and cobble substrate to depths of at least 100 centimeters. Movement vertically, horizontally, and laterally within the substrate can contribute substantially to the colonization of disturbed streams. Additionally, disturbed areas can be colonized by adult insects depositing eggs into the stream or substrate. Upstream movement of adults have been documented in Tricoptera, Plecoptera, Ephemeroptera, and Simuliidae. Some caddisflies undertake a definite upstream migration estimated at 2 to 3 kilometers (Pearson and Kramer, 1972). The importance of adult deposition of eggs for colonization varies based on the location of the stream within the watershed. Headwater streams are more dependent on adult deposition than are streams located lower in the watershed. In headwater streams, adult recruitment can lead to restoration of the trophic structure of a disturbed stream within two years. However, the taxa may differ from pre-construction conditions due to the lack of taxa with poor dispersal abilities such as some stoneflies (Wallace et al., 1986).

Bridging avoids permanent impacts to aquatic habitat, but enclosures and relocations would have temporary and permanent impacts. The use of bridges to cross 39 streams avoids impacts to the aquatic habitat of those streams.

Enclosures (e.g. pipes and box culverts) would have temporary and permanent impacts on aquatic habitat. Streams would be temporary diverted or dammed while the pipe or culvert is constructed. A portion of the streams immediately adjacent to the construction of the enclosure would be disturbed during construction. However, counter sinking the enclosure below the level of the streambed would allow upstream and downstream movement of aquatic invertebrates and fish within the stream.

If proper mitigation measures are implemented, the relocation of stream channels should not detrimentally impact the movement of aquatic invertebrates or fish in areas where an acceptable ratio of pools and riffles are established.

(4) Riparian Habitat

The proposed project would impact the terrestrial environment immediately adjacent to stream corridors. The productivity of a stream, its water quality, and aquatic habitat, are affected by the type of riparian habitat along its banks and associated floodplain.

Overland surface runoff conveys nutrients and pollutants into streams, thereby affecting aquatic habitat and water quality. Forested riparian buffer strips adjacent to streams substantially reduce the impacts of overland surface runoff on receiving streams. Forested riparian buffer strips perform these functions through the process of filtering and transforming organic and inorganic material (Welsch, 1991; Croonquist and Brooks, 1993). The minimum width of a forested riparian buffer strip required to protect the functions that the riparian forests provides in improving water quality and aquatic and terrestrial habitats varies with soils types, slope, and permeability. According to Welsch (1991), at least 23 meters (75 feet) of riparian forest is needed to protect stream water quality and aquatic habitat.

Within the project area, most of the smaller, mountainous first order streams possess a riparian forest composed of hardwoods (oaks, yellow birch, maples, and sycamore), while steeper stream valleys with cooler and moister climates support hemlock and rhododendron. Along relatively flat second and third order stream valleys within the project area, much of the valley bottom has been converted to agricultural use, resulting in the complete loss of a forested riparian buffer strip or reduced to a narrow fringe along the stream banks. Many of the existing roadways in the study area are located along streams, thus reducing the abundance of riparian habitat.

Any construction near streams would result in some level of impact to the existing riparian habitat. The greatest potential for impact would be along streams which have well developed riparian forests. Construction along stream valleys could not be avoided but impacts to riparian forests were minimized where possible by placing the alignments a minimum of 23 meters (75 feet) up slope of the stream.

(5) Estimated Secondary Impacts: IRA

Table III-72 presents a summary of the impact to riparian buffers under the IRA. The IRA would impact 59 riparian buffers paralleling 9,463 meters (31,045 feet) of perennial stream. Riparian buffers less than 23 meters (75 feet) are less capable of providing water quality and wildlife benefits. A majority of these narrower riparian buffers (88%) would contain either forest, shrub and brush, or emergent wetlands thus providing some benefits for wildlife and water quality. The IRA would impact almost five times the amount of riparian buffer as would Line A.

(6) Estimated Secondary Impacts: Line A

Table III-73 presents a summary of the impact to riparian buffers under Line A. Line A would impact 19 riparian buffers paralleling 1,739 meters (5,792 feet) of perennial stream. A majority of these narrower riparian buffers (79%) would contain either forest, shrub and brush, or emergent wetlands thus providing some benefits for wildlife and water quality. Agricultural land, which comprises the remaining 21 percent, would be of limited water quality and wildlife value.

(7) Alignment Comparison

The IRA would impact 43 riparian buffers paralleling 7,899 meters (25,909 feet) of streams categorized as non-impaired or moderately impaired (BI rank A or B), while Line A would impact 7 riparian buffers paralleling 909 meters (3,014 feet). The water quality and aquatic communities of these streams may be more susceptible to construction induced runoff than streams with lower categorical rankings (BI rank C or D).

The Cheat River regional project watershed has the greatest number of riparian buffer impacts for both the IRA and Line A (28 vs. 6). The greatest length of IRA riparian impact would also occur in this watershed (4,072 meters, 12,330 feet) while the North Branch of the Potomac River regional project watershed contains the greatest length of riparian impact for Line A (457 meters, 1,384 feet).

TABLE III-72
SUMMARY OF IMPACTS TO RIPARIAN BUFFER ZONES: IRA

Regional Project Watershed	Local Project Watershed	Perennial Streams	Stream Order	Length of Parallel Construction Within 23 m (75') of Stream*		Number of Riparian Buffers Impacted
				Meters	Feet	
Tygart Valley River	Leading Creek	trib. Leading Creek	1	27	89	1
		Wilmoth Run	2	142	466	3
		Leading Creek	3	196	643	6
Cheat River	Shavers Fork	Haddix Run	1	472	1,548	2
		trib. Shavers Fork	1	113	372	1
		Haddix Run	2	1,252	4,106	8
		Haddix Run	3	1,049	3,441	8
	Black Fork	Roaring Run	1	203	666	1
		trib. Beaver Creek	1	309	1,015	2
		trib. Slip Hill Mill Run	1	216	710	1
		Roaring Run	2	422	1,386	4
		Beaver Creek	3	36	119	1
S. Branch Potomac	Main Channel	Dumpling Run	2	404	1,324	1
		Fort Run	2	362	1,187	1
Cacapon River	Skaggs Run	trib. Skaggs Run	1	174	572	2
	Baker Run	trib. Long Lick Run	1	155	507	1
		trib. Baker Run	1	197	646	1
		Baker Run	3	650	2,131	4
	Central Cacapon	Lost River	3	772	2,533	4
	Slate Rock Run	trib. Sine Run	1	230	756	1
		trib. Slate Rock Run	1	1,280	4,201	2
Shenandoah River	Cedar Creek	Duck Run	2	801	2,627	4
TOTAL				9,463	31,045	59

* Based on Proposed Limits of Construction

TABLE III-73
SUMMARY OF IMPACTS TO RIPARIAN BUFFER ZONES: LINE A

Regional Project Watershed	Local Project Watershed	Perennial Streams	Stream Order	Length of Parallel Construction Within 23 m (75') of Stream*		Number of Riparian Buffers Impacted
				Meters	Feet	
Tygart Valley River	Leading Creek	Pearcy Run	2	46	153	1
		Leading Creek	3	123	411	4
Cheat River	Black Fork	trib. Beaver Creek	1	29	95	1
		Pendleton Creek	2	172	573	1
	Shavers Fork	trib. Shavers Fork	1	123	411	1
		Pleasant Run	2	15	51	1
		Pleasant Run	3	59	195	1
		Shavers Fork	3	48	160	1
N. Branch Potomac	Patterson Creek	trib. Patterson Creek	1	84	279	1
		trib. N.B. Patterson Creek	1	227	756	2
		M.F. Patterson Creek	3	146	485	1
S. Branch Potomac	Anderson Run	Toombs Hollow	2	515	1,715	2
Cacapon River	Skaggs Run	Skaggs Run	2	152	508	2
Shenandoah River	Cedar Creek	None	N/A	0	0	0
TOTALS				1,739	5,792	19

Within both the Cacapon and Shenandoah River regional project watersheds, the IRA would impact a greater number and length of riparian buffer zone than would Line A. Both the Cacapon and Shenandoah River regional project watersheds contain sensitive water resources such as the Lost River, Baker Run and Duck Run. The loss of forested riparian buffers could result in an increase in water temperature and a reduction of the dissolved oxygen concentration. This could negatively affect existing aquatic organism populations, including the native brook trout (*Salvelinus fontanalis*) population in Duck Run.

g. Cumulative Impacts

(1) Additive Direct Impacts

The additive effects of direct impacts to streams systems have been addressed in the watershed discussions. Although Roaring Run would experience substantial impacts due to the total length of enclosures (direct impacts) under the Build Alternative, no cumulative effects of this impact are anticipated within the Cheat River watershed. The total of all enclosures in the Cheat River watershed represents 1.3% of the total length of perennial streams.

(2) Additive Direct and Secondary Impacts

Highway-related secondary impacts would be due to riparian buffer zone encroachment and deforestation. Under the IRA, three stream systems would experience such impacts: Haddix Run and Roaring Run in the Cheat River watershed, and Duck Run in the Shenandoah River Watershed. Under the Build Alternative, Pleasant Run and Roaring Run in the Cheat River watershed and Duck Run would experience secondary impacts. It is not anticipated that these impacts would measurably affect the Cheat River or the Shenandoah River watersheds, based on a study discussed in detail in the *Streams Technical Report*. This study evaluated baseline stream data and water quality, and reviewed existing surrounding land use. The overall Biotic Integrity ranking of the local project watersheds within the Cheat River and the Shenandoah watersheds was "B", moderately impaired. In view of this ranking, the impacts anticipated are not expected to reduce the BI to rank "C". Additionally, riparian buffer zone encroachments can be mitigated, along with the ability to minimize further the lengths of buffers less than 23 meters (75 feet) during final design.

Roaring Run would experience the additive effects of direct and secondary impacts under the Build Alternative based on total enclosures and deforestation, respectively. No stream under the IRA would experience measurable cumulative effects due to direct and secondary impacts.

The only identified potential development-related impact to streams is associated with the Grant County Industrial Park and Four Mile Run. This impact could be avoided during site planning efforts of the park. A study of the direct impacts in the North Branch of the Potomac River watershed indicates that cumulative effects in this watershed would be minimal. The BI of the streams studied in this regional project watershed are ranked as "C", impaired and "B", moderately impaired, for the Stony River and Patterson Creek watersheds. Existing land use and minimal predicted residential development are not expected to reduce the Biotic Integrity to "C".

Other non-quantifiable development such as new residential plans have been addressed in the watershed analysis contained in the cumulative impacts discussion of the *Streams Technical Report.*

(2) Foreseeable Future Federal Actions

The Canaan Valley Wildlife Refuge is a preservation measure and as such is a positive impact to the stream systems and aquatic habitat in this portion of the Cheat River Watershed. Stony Run Dam would impact the flora and fauna of the Stony Run watershed. However, these impacts are not associated with those of direct or secondary nature due to the proposed project, and are not expected to have a combined effect on the watershed. The Moorefield floodwall project would have temporary impacts on the aquatic habitat within the South Branch channel but would have no long term effects. Therefore, no cumulative impacts of this action are anticipated. The Monongahela and the George Washington National Forests adhere to Best Management Practices in the preparation of erosion and sedimentation control plans.

4. AVOIDANCE, MINIMIZATION, AND MITIGATION

The preliminary design of the proposed project included employing general avoidance and minimization measures. During the later stages of the design process, field reviews by highway engineers, environmental scientists, and regulatory agency personnel identified additional opportunities where avoidance and minimization measures could be incorporated into the design.

a. General Avoidance and Minimization Measures

During the preliminary design process, impacts to streams were avoided, to the extent possible, by avoiding native and stocked trout streams, longitudinal impacts to streams and riparian forests, bridging streams, and minimizing culverts, relocations, and transverse crossings of perennial streams. Avoidance and minimization measures included adjustments to the location of the alignment (horizontal alignment) and the width of the construction limits (vertical alignment). The horizontal and vertical alignments were adjusted to avoid and/or minimize the number and length of stream relocations and enclosures. However, the adjustments were constrained by the presence of other sensitive resources (e.g. adjacent streams, wetlands, known cultural resources, residences). Where practicable, the vertical alignment was modified to reduce the width of the construction limits to avoid stream encroachments. Construction limits were also narrowed by increasing the steepness of fill slopes. The changes in vertical alignment and slopes avoid 2,006 meters (6,580 feet) of stream relocations or encroachments. In three cases, retaining walls were included in the preliminary design to avoid an additional 579 meters (1,900 feet) of stream relocations. A total of 2,585 meters (8,480 feet) of stream relocations were avoided during the design process. Table III-74 presents the various measures employed to avoid stream relocations. Avoidance and minimization of stream impacts is also discussed in Appendix G: *Section 404 Permit Application and Alternatives Analysis*.

b. Specific Avoidance and Minimization Measures

Specific avoidance and minimization measures were developed and incorporated into the preliminary alignments following stream sampling and field reviews with state and federal resource agencies. The following sections detail specific avoidance and mitigation measures that would reduce the direct and ecological impacts of the proposed project on surface waters within the immediate vicinity of the proposed project.

(1) Bridges

Prior to alignment field reviews with resource agencies, 35 bridge crossings had been proposed for Line A representing approximately 5,902 meters (19,385 linear feet) of construction. The 35 bridges represent a cost of approximately $217.6 million and would avoid approximately 3,889 meters (12,760 feet) of stream enclosures. Following the alignment field reviews, four additional streams were identified for bridging where box culverts were initially proposed. The four bridges would avoid an additional 1,146 meters (3,760 feet) of stream enclosures at an additional cost of approximately $27.4 million. For Line A, the 39 proposed bridge crossings represent 6,945 meters (22,785 linear feet) of construction at a cost of approximately $184 million. Table III-75 presents additional avoidance and minimization measures developed following field reviews.

Line A would bridge the four rivers listed on the Nationwide Rivers Inventory, as well as nine of the ten native or stocked trout streams (Pleasant Run, Roaring Run, Elklick Run, North Fork of Patterson Creek, Lost River, Waites Run, Trout Run, Duck Run, and Cedar Creek). Thirteen out of fifteen West Virginia designated High Quality Streams crossed by Line A would be bridged, as well as Duck Run, which Virginia lists as Outstanding State Resource Waters.

(2) Enclosures

After alignment field reviews with resource agencies, additional opportunities to minimize the length of direct impacts to surface waters were identified. This included alignment shifts and reductions in construction limits which, as a whole, reduced the length of box culverts and pipes by approximately 175 meters (575 feet).

TABLE III-74

MEASURES TAKEN TO AVOID STREAM RELOCATIONS

Regional Project Watershed	Stream Avoided	Measure Taken	Station	Impact Avoided meters / feet		Comments
Tygart River	Leading Creek	Retaining Wall	573	122	400	WVHQ
Tygart River	Leading Creek	Increased Slopes	620	152	500	WVHQ
Cheat River	Trib. to Roaring Run	Increased Slopes	3725	335	1,100	
North Branch of Potomac	Trib. to Elklick Run	Shifted construction limits	5230	335	1,100	
North Branch of Potomac	MF of Patterson Creek	Retaining Wall	5565	320	1,050	
North Branch of Potomac	Thorn Run	Increased Slopes	5650	305	1,000	
North Branch of Potomac	Toombs Hollow	Retaining Wall	5950	137	450	
North Branch of Potomac	Williams Hollow	Increased Slopes	6340	366	1,200	
Cacapon River	Trib. to Long Lick	Increased Slopes	6830	85	280	
Cacapon River	Baker Run	Changed vertical grade	6950	427	1,400	
		TOTAL		2,585	8,480	

AMD= Acid Mine Drainage

NRI = Nationwide Rivers Inventory; WVHQ = WVa. High Quality Stream; OSRW = Va. Outstanding State Resource Waters

TABLE III-75
ADDITIONAL AVOIDANCE AND MINIMIZATION MEASURES DEVELOPED FOLLOWING FIELD REVIEWS

Regional Project Watershed	Stream	Measure Taken	Station	Stream Impact Reduction meters / feet		Comments
Cheat River	Trib. to Roaring Run	Steepen slopes to reduce length of pipe	3731	76	250	
Cheat River	Big Run	Replace box culvert with 350 ft. bridge	3925	274	900	
Cheat River	Middle Run	Change in grade reduces culvert length	4055	8	25	
North Branch of Potomac	Abrams Creek	Increase slope to reduce length of culvert	5029	15	50	AMD
North Branch of Potomac	Trib. to Elklick Run	Replace box culvert with 650 ft. bridge	5293	137	450	
North Branch of Potomac	MF of Patterson Creek	Replace box culvert with a 1,200 ft. bridge	5534	427	1,400	
North Branch of Potomac	Trib. to Patterson Creek	Shifted line and reduced length of box culvert	5850	76	250	
South Branch of Potomac	Clifford Hollow	Replace box culvert with a 1,200 ft. bridge	6515	308	1,010	
		TOTAL		1,321	4,335	

AMD= Acid Mine Drainage

NRI = Nationwide Rivers Inventory; WVHQ = WVa. High Quality Stream; OSRW = Va. Outstanding State Resource Waters

Culverts and pipes should be countersunk, allowing substrate to fill the culverts and pipes. The natural substrate re-establishes aquatic habitat within the enclosures and aids in the movement of aquatic organisms. This design measure requires larger pipes and culverts, thus increasing the cost of construction. Other design measures which mitigate surface water impacts include low flow diversions. Low flow diversions would be used on all multiple barrel box culverts to insure stream flow during periods of low flow. This design measure allows fish and other organisms to retreat and maintains uninterrupted flow to downstream users.

Streams with non-impaired or moderately impaired biotic integrity (BI rank A or B) and good to excellent habitat (habitat assessment >90) are identified in Table III-76. These streams are proposed for use of open bottom box culverts to minimize further direct impacts to stream habitat and hydrology.

(3) Relocations

Relocations of major streams were avoided by shifting alignments, increasing slope angles, and using retaining walls. Approximately 2,585 meters (8,480 feet) of stream relocations were avoided. Relocations were generally limited to small first order headwater streams. In many cases, a small stream was aligned perpendicular to a larger stream. The relocation of the smaller stream was often required to minimize impacts to the larger stream.

c. Avoidance and Minimization of Secondary Impacts

Permanent and temporary direct and secondary impacts would occur as a result of the construction of the proposed project. These impacts would be avoided or minimized by incorporation of environmentally sensitive construction techniques

(1) Bridges

Bridging would avoid permanent impacts to streams but would result in temporary impacts during construction due to temporary stream crossings, bank stabilization, placement of piers for larger bridges, and clearing of riparian vegetation. General construction measures which would be employed to minimize impacts during bridge construction include: temporary construction access with nonerodible materials; stabilization of stream slopes with nonerodible materials or with vegetation where practicable; construction of all instream piers for large bridges within nonerodible cofferdams; adequate settlement and filtration of water pumped from cofferdams prior to discharge into streams; and selective removal of vegetation which interferes with the construction of the proposed bridge.

TABLE III-76
STREAMS PROPOSED FOR OPEN BOX CULVERTS AND BURIED INVERTS BASED ON TOTAL HABITAT ASSESSMENT SCORE AND BI

Alternative	Regional Project Watershed	Local Project Watershed	Stream Name	Streams ID	Drainage Structure	Length meters / feet		BI Rank	Habitat Assessment Score
IRA	Tygart Valley River	Leading Creek	Trib. Haddix Run	MC3504	Pipe	30	100	B	96
IRA	Cheat River	Black Fork	Trib. Beaver Creek	MC1105	Box Culvert	61	200	A	101
IRA	Cheat River	Black Fork	Trib. Roaring Run	MC3307	Pipe	61	200	A	103
IRA	Cheat River	Black Fork	Roaring Run	MC3305	Pipe	244	800	B	111
IRA	Cheat River	Shavers Fork	Shingle Tree Run	MC3404	Pipe	37	120	B	95
IRA	South Branch Potomac River	Main Channel	Fort Run	PSB2600	Pipe	70	230	B	104
IRA	Cacapon River	Central Cacapon River	Sauerkraut Run	PC402	Box Culvert	24	80	A	101
IRA	Cacapon River	Central Cacapon River	Trib. Lost River	PC2400	Pipe	49	160	B	105
IRA	Shenandoah River	Cedar Creek	Duck Run	PS201	Pipe	24	80	B	112
IRA	Shenandoah River	Cedar Creek	Duck Run	PS202	Pipe	40	130	B	112
						640	2100		
Line A	Cheat River	Black Fork	Trib. Beaver Creek	MC1105	Box Culvert	55	180	A	101
Line A	Cheat River	Black Fork	Trib. Big Run	MC1312	Box Culvert	61	200	B	91
Line A	Cheat River	Black Fork	Trib. Roaring Run	MC1314	Box Culvert	274	900	B	99
Line A	Cheat River	Black Fork	Trib. Roaring Run	MC1316	Pipe	271	890	B	111
Line A	North Branch Potomac River	Stony River	Trib. Stony River	PNB1005	Pipe	91	300	A	97
Line A	Cacapon River	Slate Rock Run	Trib. Slate Rock Run	PC304	Pipe	168	550	A	103
Line A	Cacapon River	Skaggs Run	Trib. Skaggs Run	PC511	Box Culvert	186	610	B	105
Line A	Cacapon River	Slate Rock Run	Slate Rock Run	PC305	Box Culvert	131	430	A	115
						1237	4060		
Line B	Cacapon River	Baker Run	Trib. Baker Run	PC517	Box Culvert	198	650	A	109
Line P	North Branch Potomac River	Patterson Creek	Trib. M.F. Patterson Creek	PNB909	Pipe	168	550	A	93
Line P	North Branch Potomac River	Patterson Creek	M.F. Patterson Creek	PNB907	Box Culvert	213	700	B	93

Biotic Integrity Rank - A = Non- Impaired
Biotic Integrity Rank - B = Moderately Impaired

Habitat Assessment Score
Good Habitat = 90-120
Excellent Habitat = 121+

(2) Enclosures

General construction measures taken to avoid or minimize impacts to perennial streams during construction of enclosures would include: erosion and sedimentation controls; proper instream construction techniques, including temporary diversions; minimizing clearing adjacent to stream channels; and construction during periods of low stream flow.

(3) Relocations

General construction measures taken to minimize impacts to perennial streams being relocated would include: providing a natural, meandering stream channel design; design of adequate pool-riffle ratios to maximize fish habitat; and stabilizing the relocation channels "in the dry" prior to diversion of water.

(4) Erosion and Sedimentation

For each section of highway designed, a comprehensive erosion and sedimentation control plan would be implemented to minimize impacts. The erosion and sedimentation plans would include best management practices (BMP's), as described in WVDOT's *Erosion and Sedimentation Control Manual* (1993) and *Standard Specifications Road and Bridges (1993).* In Virginia, the construction of the proposed project would adhere to Virginia's Stormwater Management Regulations (1990) and VDOT's *Road and Bridge Specification*, as well as the *Virginia Erosion and Sedimentation Control Handbook* (1993).

After construction of the facility is completed, permanent erosion control measures would be instituted. These measures would include stabilizing cut and fill slopes, shoulders, medians, and any other areas of exposed soils as well as drainage swales and ditches. Stabilization could be established with perennial vegetation or the use of non-erosive materials (i.e. riprap, geotextiles, etc.).

(5) Highway Stormwater Runoff

Mitigation measures designed to control storms producing less than one inch of rainfall would control nonpoint pollution discharges for approximately 90 percent of the storms each year. The majority of pollutant loads from a storm are delivered by a relatively small percentage of the runoff volume during the initial stages of the storm. Mitigation measures in the final design should address the control of this "first flush" and the removal of heavy metals and other pollutants which tend to adhere to sediment particles.

Two methods have been shown to be highly effective in removing pollutant from runoff (Masestri et al., 1981). The first is the use of vegetated surfaces (grass) to manage highway stormwater runoff pollution which capitalizes on the natural capability of vegetated surfaces to reduce runoff velocity, enhance sedimentation, filter suspended solids, and increase infiltration. Secondly, the use of wet detention basins which maintain a permanent pool of water capable of highly effective pollutant removal, principally through sedimentation. These methods have been found to be the most effective in removing a significant percentage of the pollutant load from stormwater runoff (Table III-77).

In Virginia, the project would be subject to Virginia's *Stormwater Management Regulations (1993)*. Numerous studies have shown that the greatest concentrations of highway pollutants are contained within the first "pulse" of a storm event. By requiring the detainment of the first 0.5 inches of rainfall, the water quality of receiving streams would not be subjected to this initial pulse. In West Virginia, there are no requirements for permanent management of highway stormwater quantity or quality.

In addition to control of stormwater runoff during the operation of the highway, proper application and storage of deicing chemicals, pesticides, and herbicides would minimize the introduction of these pollutant into surface waters.

(6) Riparian Habitat

Where possible, alignments were developed to avoid riparian buffers along perennial streams. However, some encroachment upon riparian buffers of perennial streams is unavoidable. One possible mitigation strategy would be to make design modifications during final design that would provide a minimum riparian buffer of 23 meters (75 feet). A commitment would also be made to re-vegetate areas that are disturbed during the construction process within 30 meters (100 feet) of perennial streams. Existing riparian buffers, particularly those composed of agricultural or disturbed land, could also be improved through mitigation measures designed to enhance wildlife and/or water quality functions. A riparian buffer management plan could be developed to plant tree and shrub species that would both increase sedimentation/nutrient reduction capabilities and provide more productive habitat for a variety of wildlife species.

(7) Stream Channel Enhancement

During construction, clearing of riparian vegetation would be limited to the minimum required to accommodate the construction of the facility. Areas not intended to be cleared would be protected from accidental intrusion by flagging or fencing. After clearing and grading, riparian areas would be revegetated to control erosion and sedimentation.

TABLE III-77
EFFECTIVENESS OF STORMWATER MITIGATION MEASURES

POLLUTANT	WET DETENTION BASIN	GRASS SWALES AND BUFFER STRIPS
Suspended Sediment	80-90%	50-60%
Phosphorus	50-60%	10-15%
Nitrogen	30-40%	5-10%
Lead	70-80%	45-55%
Zinc	40-50%	25-30%
Copper	40-50%	30-35%

Source: Virginia Stormwater Management Regulations (1993)

There are a number of structures that could be used to increase fish and macroinvertebrate habitat. Such structures include log dams, channel deflectors, over hanging bank cover, lunker structures, and introduced boulders. Priority should be given to the use of natural materials such as locally collected logs and boulders. The installation of 25 stream structures per mile of stream is considered ideal, but would vary depending on the quality of the existing habitat within the stream and the amount of habitat being replaced (i.e. amount of habitat lost to stream relocation).

(8) Fencing

In agricultural areas, many of the streams and rivers crossed by the proposed project possess minimal vegetative cover. Fencing could be used to physically block livestock from access to surface waters within 150 feet of proposed construction limits. This serves two purposes: first, it would protect stream habitat and reduce organic input from livestock; second, it would provide, in time, a vegetated riparian buffer along stream reaches.

S. WILD AND SCENIC RIVERS

In 1968, Congress passed the National Wild and Scenic Rivers Act, Public Law 90-542, to preserve and protect wild and scenic rivers and their immediate environments. This act identifies federally administered rivers included in the National Wild and Scenic Rivers System (NWSRS), identifies additional rivers to be studied for possible inclusion in the System, and provides guidance for the management of rivers within the System.

The Virginia Scenic Rivers Act of 1970 (Title 10, Chapter 15, Section 10-167 through 10-175 of the Code of Virginia) also provides a means to identify and protect those rivers or streams with natural, scenic, historic, and/or recreational qualities that are deemed of significance in the Commonwealth of Virginia. West Virginia does not have a state level scenic rivers program.

As a result of the National Wild and Scenic Rivers Act, the National Park Service prepared and maintains the Nationwide Rivers Inventory (NRI) of significant free-flowing rivers. The rivers included in the NRI are presented in the National Park Service's *Final List of Rivers,* which includes the *Final List of Wild and Scenic Rivers* (January, 1979) and the *Final List of Recreational Rivers* (January, 1981). Segments of rivers included in the NRI have been identified as meeting the minimum requirements for further study and/or potential designation to the System. Federal agencies are requested but not mandated to minimize the adverse impacts of their projects on the NRI rivers.

From the NRI, river segments are selected for further study pursuant to Subsection 5(a) of the National Wild and Scenic Rivers Act (i.e., Study River) to determine if they warrant inclusion in the System. Certain federal projects that could adversely affect Study Rivers are prohibited during the river study period; such prohibited projects include dredge and fill activities associated with channel relocation or encroachment that would affect the free-flow conditions of the river. The construction of river crossings is not prohibited during the river study period, but may alter the eligibility status of a Study River.

Rivers can be studied by other federal agencies involved in land management planning. The Wild and Scenic Rivers and National Trails Memorandum (August 2, 1979) states that federal agencies administering public lands must take the rivers identified in the NRI into consideration during their ongoing land use planning and management activities and environmental review processes. As such, each agency must determine whether those rivers identified in the NRI, and which are administered by them, are suitable for inclusion in the System. This is a separate process from that which is applied to Congressionally designated Study Rivers. Suitability studies include determining if the river segment is eligible for designation and its probable classification. Federal agencies assess their land use and management plans for lands within 0.4 kilometers (0.25 miles) of each NRI listed river to determine the effect of their management plans on the eligibility of the river segment. The support of private citizens, local governments, and public agencies is also taken into account in determining the suitability of a river segment for designation.

An eligibility study or a Section 5(a) Study determines a river's segment classification eligibility and its suitability for inclusion in the System. The three possible river segment classifications are as follows:

- **Wild:** Those rivers or river segments that are free of impoundments and generally inaccessible, except by trail, and with watersheds or shorelines essentially primitive and waters unpolluted.
- **Scenic:** Those rivers or river segments that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational:** Those rivers or river segments that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

River crossings are not prohibited by the Act if they do not affect free-flow conditions, but they may affect the potential classification or suitability. A typical bridge replacement or new bridge crossing would not substantially alter the free-flow conditions of a stream. A bridge crossing would eliminate that segment of a river's eligibility for Wild status. However, the same crossing would not eliminate a river segment from eligibility for Scenic or Recreational status unless the crossing would destroy unique or significant river values for which the river segment was listed on the NRI.

Channel relocation or encroachments may result in the alteration of the free-flow conditions of the river that would preclude the river segment from eligibility for Wild status, but would not affect the river's eligibility for Scenic or Recreational status. Parallel construction along an NRI river segment may impact the qualities for which the river segment was nominated, thus potentially affecting the river's segment eligibility for designation as Wild, Scenic, or Recreational.

This assessment focuses on how the proposed project may affect a river's eligibility for protection under the Act, as part of the National Wild and Scenic River System (System).

1. METHODOLOGY

Four river segments listed in the NRI were identified which are either crossed by the proposed project or where there would be parallel construction within 0.4 kilometers (0.25 miles) of the river segment.

For each river segment identified, the potential effect on its eligibility for designation as Wild, Scenic, or Recreational status was determined by evaluating the potential impacts on free-flowing conditions, as well as the potential to impact the characteristics for which the river segment was listed in the NRI.

2. EXISTING ENVIRONMENT

The Monongahela National Forest (MNF) is preparing a legislative environmental impact statement concerning the suitability of twelve river segments in the MNF for inclusion in the National Wild and Scenic Rivers System. Of the twelve rivers being considered, six are NRI rivers (Shavers Fork, Dry Fork, Blackwater River, Glady Fork, South Branch of the Potomac River, and the North Fork of the South Branch of the Potomac River). The remaining six rivers (Laurel Fork, Otter Creek, Williams, North Fork of the Cherry River, Red Creek, and Seneca Creek) under consideration have been proposed by environmental groups. The MNF has determined the eligibility and probable classification for the twelve rivers for potential inclusion in the System.

As shown on Exhibit III-56, the proposed project would not involve the following segments under study by the MNF: Dry Fork, Glady Fork, North Fork of the Cherry, Laurel Fork, Otter Creek, Williams, Red Creek, South Branch of the Potomac, North Fork of the South Branch of the Potomac, or Seneca Creek. The alignments would cross tributaries to the segment of the Blackwater River currently under study, but would not result in a direct crossing of this river segment. Therefore, the suitability of the Blackwater River segment for Scenic or Recreational status would not be affected by the proposed project.

There are four river segments listed in the NRI that occur along the alignments: Shavers Fork, South Branch of the Potomac River (different segment than under study by MNF), Cacapon River, and Cedar Creek (Exhibit III-56). None of these river segments have been designated as Wild, Scenic, or Recreational Rivers within the System or are currently Study Rivers under Subsection 5(a) of the Act. None of these river segments would qualify for Wild status due to existing development and roads.

a. Shavers Fork

The NRI listed segment of Shavers Fork extends for 46 kilometers (29 miles) from the confluence of the Cheat River at Parsons, upstream to Faulkner, WV. The MNF study has made the preliminary determination that the 4.8 kilometer (3 mile) portion of Shavers Fork, from Jobs Run upstream to the Cheat River, is not eligible for designation due to the development associated with Porterwood and Parsons. The 42 kilometer (26 mile) segment of Shavers Fork from Jobs Run south of Porterwood, downstream to the US 33/8 bridge, is eligible for Scenic or Recreational status based on the MNF's preliminary determination.

b. South Branch of the Potomac River

The NRI listed segment of the South Branch of the Potomac River extends 54 kilometers (34 miles) from its confluence with the North Branch of the Potomac River upstream to the US 220 bridge north of Moorefield. This segment is NRI listed due to a geological feature called the 'Trough', a 9.7 kilometer (6 mile) long gorge with near-wilderness qualities. The portion of the river segment between the Trough and the US 220 bridge is predominately agricultural within a wide floodplain.

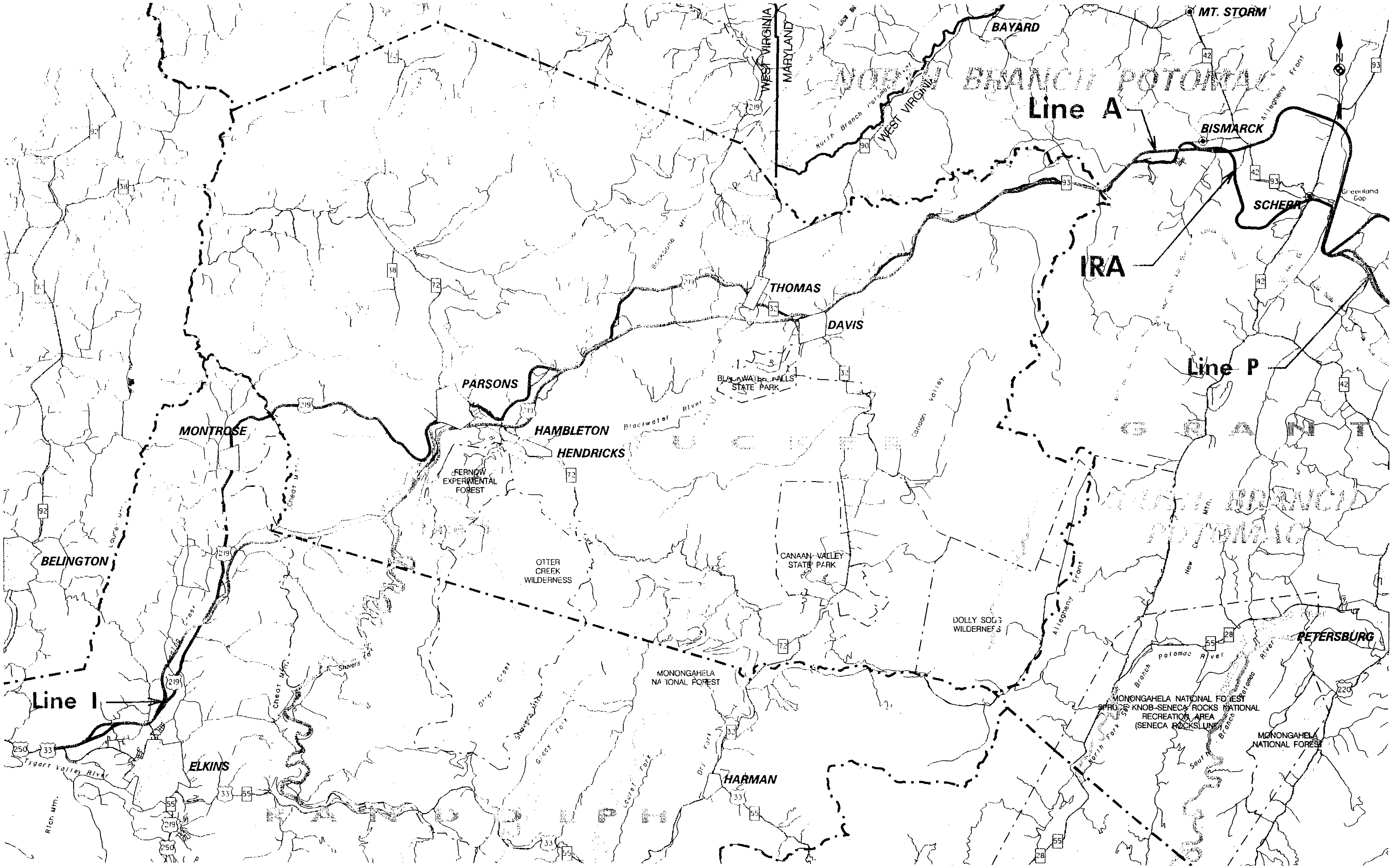
c. Cacapon River

The 142 kilometer (89 mile) NRI listed segment of the Cacapon River begins at the dam below Great Cacapon, WV and ends at Baker. A portion of this river was a congressionally mandated Study River. A study by the Department of the Interior found the river to be eligible for classification as Scenic but unsuitable for designation due to a lack of public support. As a result, the Department of the Interior did not recommend its inclusion in the System. The George Washington National Forest and the Virginia Department of Conservation and Recreation conducted a subsequent eligibility study of streams in the Forest, but did not give further consideration to the Cacapon River due to the earlier findings of the Department of the Interior.

d. Cedar Creek

Cedar Creek, from its headwaters to the North Fork of the Shenandoah River, merits evaluation to determine if it qualifies for inclusion in the Virginia Scenic Rivers System. The river segment studied extends from the VA 622 bridge upstream 40 kilometers (25 miles) to the headwaters (Shenandoah and Franklin Counties, Virginia). The majority of the land along Cedar Creek is privately owned agricultural or forest land.

The GWNF and the Virginia Department of Conservation and Recreation conducted an eligibility study of this stream. The study categorized the various values for which the stream could be listed: Minimal, Common, or Distinctive. Cedar Creek was determined to have Common scenic, recreational, and geologic value. Fish and Wildlife Values were categorized as Minimal due to acid deposition in the headwaters. Historic and Cultural Values were categorized as Distinctive. Stevens Fort, an old iron furnace, and two tannery sites are located within the river corridor and have potential historical significance. In addition, Cedar Creek Battlefield and Belle Grove Mansion are in close proximity, both of which are on the National Register of Historic Places. Cedar Creek is eligible for designation under the National Wild and Scenic Rivers Act. The creek is free-flowing and has historic and cultural values. A total of 32 kilometers (20 miles) of Cedar Creek would qualify for inclusion in the System under the Scenic classification.



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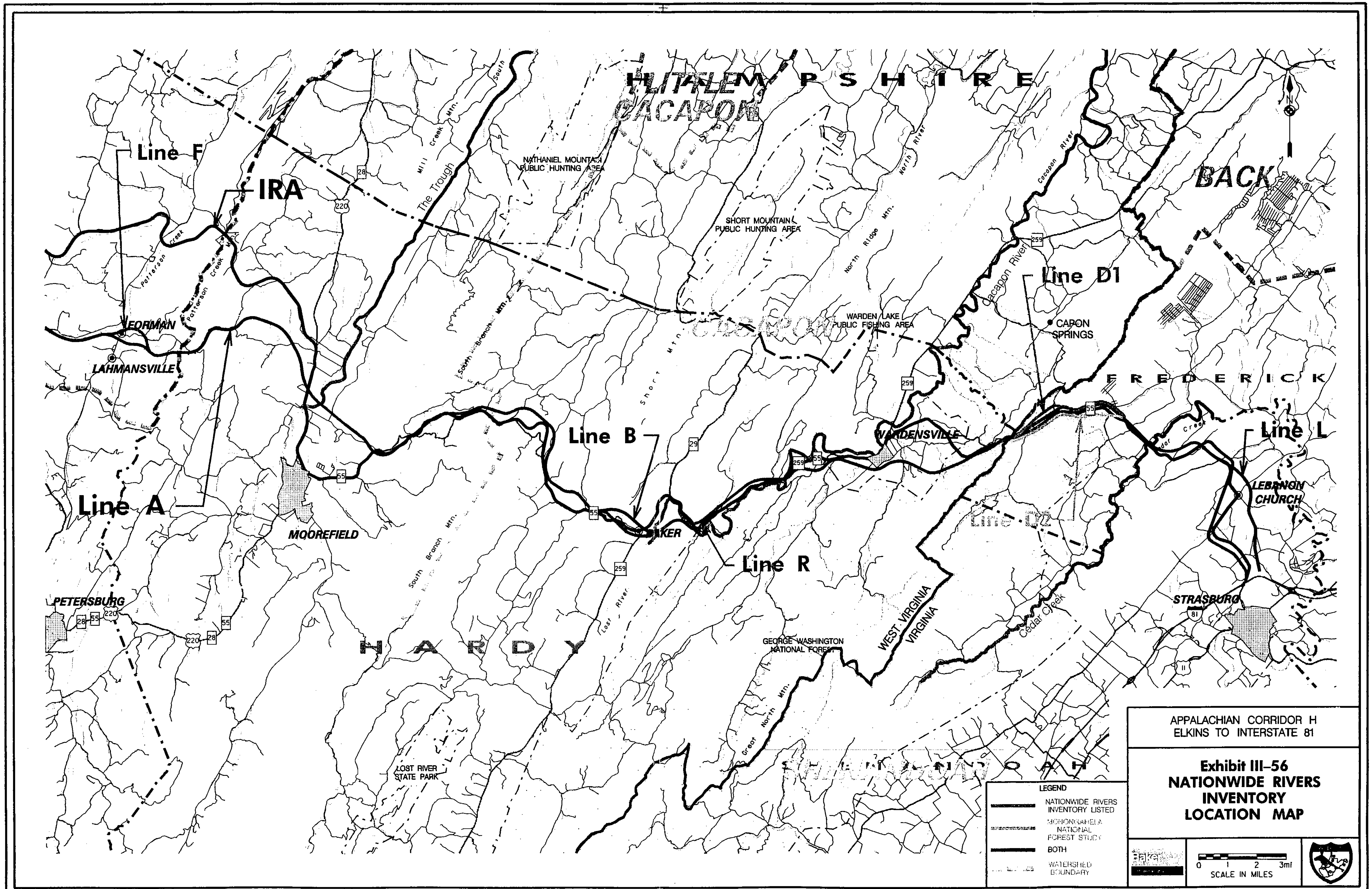

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Exhibit III-56
NATIONWIDE RIVERS INVENTORY LOCATION MAP

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3. IMPACTS

In the proposed project area, there are no river segments currently within the National Wild and Scenic Rivers System. However, there are four NRI river segments within the proposed project area. None of the four river segments are eligible for Wild status due to existing road access. The potential impacts to the eligibility of these four river segments for Scenic or Recreational status have been assessed.

a. Shavers Fork

Within the section of Shavers Fork determined to be eligible for Scenic status by the MNF, Line A would require two bridge crossings and approximately 3 kilometers (2 miles) of construction within 0.4 kilometer (0.25 mile) of the river. The main crossing of Shavers Fork would be near Pleasant Run and would require a bridge 518 meters (1,700 feet) long and approximately 28 meters (92 feet) above the river. A second, much smaller bridge would be required across Shavers Fork to provide public access to Shavers Fork Road. Both bridges would have sufficient vertical clearance so as not to impede recreational use of the river and would avoid channel relocations and minimize encroachments into the channel and floodplains. Construction of Line A may affect the eligibility of this portion of the river segment to be classified as Scenic, but likely would not interfere with its eligibility for Recreational status.

The Shavers Fork Option Area and the IRA are located downstream (north) of the portion of Shavers Fork that the MNF has determined to be eligible for Scenic status. Therefore, neither the No-Build Alternative, the IRA, Line A, or Line S within this area would impact eligibility.

b. South Branch of the Potomac River

Line A would require a crossing of the South Branch of the Potomac River approximately 6 kilometers (3.8 miles) south of the Trough, for which the segment is NRI listed. The proposed bridge on Line A would not impact the river segment's eligibility for Scenic or Recreational status. The IRA would utilize the existing US 220 bridge, approximately 7 kilometers (4.3 miles) south of the Trough. Neither the No-Build Alternative, the IRA, nor the Build Alternative would impact the river segment's eligibility for Scenic or Recreational status.

c. Cacapon River

Considering the determination of the Department of the Interior and the George Washington National Forest that the Cacapon River segment should not be considered for the System, the construction of the proposed project would not affect the current status of this river segment. The eligibility of the river segment for Scenic or Recreational status would not be affected by the No-Build Alternative, the IRA, Line A, either alignment within the Hanging Rock Option Area, or either alignment within the Baker Option Area. The IRA would require fewer new bridge crossings and less construction on new right-of way than would the

Build Alternative, but long stretches of the IRA would be located closer to the river than would the Build Alternative.

d. Cedar Creek

Line A would require a crossing of Cedar Creek approximately 100 meters (300 feet) downstream of the existing VA 55 bridge. The IRA would use the existing WV 55 bridge, thereby eliminating the need for a new crossing of Cedar Creek. Neither the No-Build Alternative, the IRA, nor the Build Alternative would impact the historical or cultural features in the vicinity of Cedar Creek; neither would interfere with its designation as Scenic or Recreational; and neither would interfere with its designation to the Virginia Scenic Rivers System.

e. Summary

The proposed project crosses three NRI river segments in West Virginia and one in Virginia. The following can be summarized about the effect of the alternatives on the Scenic or Recreational eligibility of the river segments.

- None of the river segments currently qualify for Wild status;
- Shavers Fork (West Virginia): Line A south of the Shavers Fork Option Area may have an effect on eligibility for Scenic status but not for Recreational status. The No-Build Alternative, the IRA, and Line S would have no effect on eligibility;
- South Branch of Potomac River (West Virginia): The No-Build Alternative, the IRA, and the Build Alternative (Line A) would have no effect on eligibility;
- Cacapon River (West Virginia): Based on previous determinations concerning eligibility, none of the alignments (Line A, Line R, Line B and the IRA) nor the No-Build Alternative would affect eligibility;
- Cedar Creek (Virginia): The No-Build Alternative, the IRA, and the Build Alternative (Line A) would have no effect on eligibility.

4. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

Avoidance, minimization, and mitigation measures would not be necessary under the No-Build Alternative. The alignment development process for both the IRA and the Build Alternative included efforts to avoid or minimize impacts to NRI rivers. General measures used to minimize or mitigate impact to NRI rivers included:

- Minimizing channel relocations or encroachments;
- Minimizing parallel construction;
- Minimizing impacts to the resources for which the river segment was deemed eligible for listing;
- Ensuring that bridge structures would provide sufficient vertical clearance so as to not impede recreational boating for river segments eligible for Recreational status; and
- Minimizing the visual impacts of bridge crossings for river segments eligible for Scenic and Recreational status.

Specific measures used to minimize or mitigate impact to NRI rivers are presented below.

a. Shavers Fork

Alignment shifts to the east and west of Line A, between Pleasant Run and Jobs Run, were investigated as a means to avoid impacting Shavers Fork. Based on the following reasons, neither shift proved to be prudent or feasible.

If Line A were shifted to the east of its current location, the shift would begin at Shavers Fork, near station 3340, and end to the north of Porterwood, near station 3510. The shift would eliminate the two crossings of Shavers Fork at Porterwood because the shifted alignment would need to tie in to Line S of the Shavers Fork Option Area. The shift to avoid the crossings of Shavers Fork would also eliminate the at-grade connector road to Porterwood; thereby eliminating Corridor H access to and from the community. The shift in alignment would require a much higher elevation on the mainline, resulting in a grade on the proposed connector road that is physically unachievable. This shift to the east would also create a condition where a grade on the connector road at station 3390 would not be achievable. Additional impacts resulting from this eastern alignment shift would include a bridge over County 41, loss of access to County 41, and a higher and longer bridge over Shavers Fork at station 3350. The feasibility of constructing the shifted alignment in this location would likely be impossible due to the severe terrain and the excavation required.

If Line A were shifted to the west of its current location, the shift would begin south of Pleasant Run, near station 3315, and end east of Porterwood, near station 3460. The shifted alignment could tie in to either Line A or Line S in the Shavers Fork Option Area. Shifting Line A to the west would require an additional crossing of Shavers Fork near station 3440 south of Porterwood. This crossing would likely impact wetlands and cultural resources, and would require an additional structure approximately 305 meters

(1,000 feet) in length, over Shavers Fork. Additional impacts resulting from this western alignment shift would include additional crossings of County 39, Laurel Run, County 39/3, and Pleasant Run. This shift in Line A would likely impact cultural resource sites adjacent to Pleasant Run. Due to the severe terrain, excavation would be much greater; thereby increasing the degree of erosion and sedimentation impacts.

As noted above, complete avoidance of this river crossing is not possible and impacts to eligibility have been minimized. Within the portion of Shavers Fork that has been determined to be eligible for Scenic status by the MNF, Line A would avoid encroachments into the channel but would require a bridge crossing and parallel construction. The crossing of Shavers Fork near Pleasant Run would be necessary to avoid impacts to the community of Porterwood, located along the western shore of Shavers Fork. The height of the bridges over the river would avoid interference with recreational use of the river. Recreational access to the river may be provided near the proposed bridge. No mitigation would be required for Line A.

The IRA would not impact the portion of the river determined to be eligible for Scenic status. Therefore, no mitigation would be required.

<u>b.</u> <u>South Branch of the Potomac River</u>

Complete avoidance of this river crossing would not be possible and there would be no impacts to its eligibility for Scenic or Recreational status. The Line A bridge crossing at the South Branch of the Potomac River would avoid channel relocations or encroachments, parallel construction, and the Trough for which the river segment was listed in the NRI. The height of the bridge over the river would avoid interference with recreational use of the river. Recreational access to the river could be provided near the proposed bridge. No mitigation would be required for Line A.

The IRA would use the existing US 220 bridge and would not require mitigation.

<u>c.</u> <u>Cacapon River</u>

Complete avoidance of these river crossings would not be possible and there would be no impacts to eligibility considering the previous eligibility determinations. Channel relocations or encroachments would be avoided. Although there would be construction parallel to the river, the majority of the proposed project would not be visible from the river except at bridge crossings. The three bridge crossings of the Cacapon River would not impede recreational use of the river. No mitigation would be required for Line A.

The IRA would use WV 55 and thus no mitigation would be required.

d. Cedar Creek

Complete avoidance of this river crossing would not be possible and there would be no impacts to eligibility for Scenic or Recreational status. The Line A bridge crossing at Cedar Creek would avoid channel relocations or encroachments, parallel construction, and the cultural resources for which the river segment was listed in the NRI. Visual impacts would be minimized due to the placement of the proposed bridge adjacent to the existing VA 55 bridge. The height of the bridge over the river would avoid interference with recreational use of the river and additional recreational access to the river could be provided near the proposed bridge. No mitigation would be required for Line A.

The IRA would use the existing VA 55 bridge thus not changing the rivers current eligibility; no mitigation would be required.

T. GEOLOGY, MINES, AND MINERALS

Following the selection of a preferred corridor, the 1992 *Corridor Selection SDEIS* stated that a representative of the US Department of Interior, Bureau of Mines would conduct a field investigation to determine the extent of the potential project-related mineral resource impacts. Due to federal budget constraints and scheduling complications, the Bureau of Mines was unable to do so. The Bureau has indicated it will provide comments on the alignment selection phase of the SDEIS following its distribution.

1. METHODOLOGY

To gain an understanding of the potential impacts to geology, mines and minerals associated with the proposed project, a literature search of state and federal sources was conducted. Sources included reports by the West Virginia Geologic and Economic Survey, the Virginia Division of Minerals and Mines, and the US Geologic Survey.

Geologic units and formations presented on geologic mapping developed by the West Virginia Geologic Survey in the 1920's and 1930's differ from the geologic map of West Virginia published by Cardwell *et al.* (1986). Nomenclature and classification changes made by Cardwell *et al.* were used to describe the geologic units. However, the older mapping was used to describe the structural features along with the orientation and extent of the geologic units.

2. EXISTING ENVIRONMENT

To provide a better understanding of the affected geologic environment, background information has been divided into two categories. The first category provides a general description of the proposed project area's geology by watershed. The second category provides more detailed background information on the existing coal mining conditions within the proposed project area.

a. Geologic Overview by Watershed

The six watersheds traversed by the proposed project lie in two distinct physiographic provinces: the Appalachian Plateau Province and the Valley and Ridge Province. A major divide known as the Allegheny Front runs northeast to southwest along the western borders of Pendleton and Grant Counties. This high ridge of the Alleghenies separates the Appalachian Plateau Province to the west from the Valley and Ridge Province to the east. West Virginia and Virginia geologic maps of the proposed project area are presented on Exhibits III-57 and III-58, respectively. Anticlines and synclines are common geologic features. Anticlines are generally convex folds in bedrock, the core of which contains stratigraphically older rocks. Synclines are generally concave folds in bedrock, the core of which contains stratigraphically younger rocks.

The Appalachian Mountain Section of the Appalachian Plateau Province includes areas of Tucker County, the northern section of Randolph County, and the westernmost edge of Grant County. These areas are drained by Shavers Fork, Dry Fork, and the Blackwater River into the basin of the Cheat and Monongahela Rivers, which flow to the Mississippi River. Side slopes of the mountains are generally steep, except for the valleys of the Cheat River north of Parsons. Valleys are narrow with broad mountain tops. The drainage system is a well developed dendritic system which typically develops over homogeneous sedimentary rocks. Gorges are fairly common and most streams decrease in elevation rapidly.

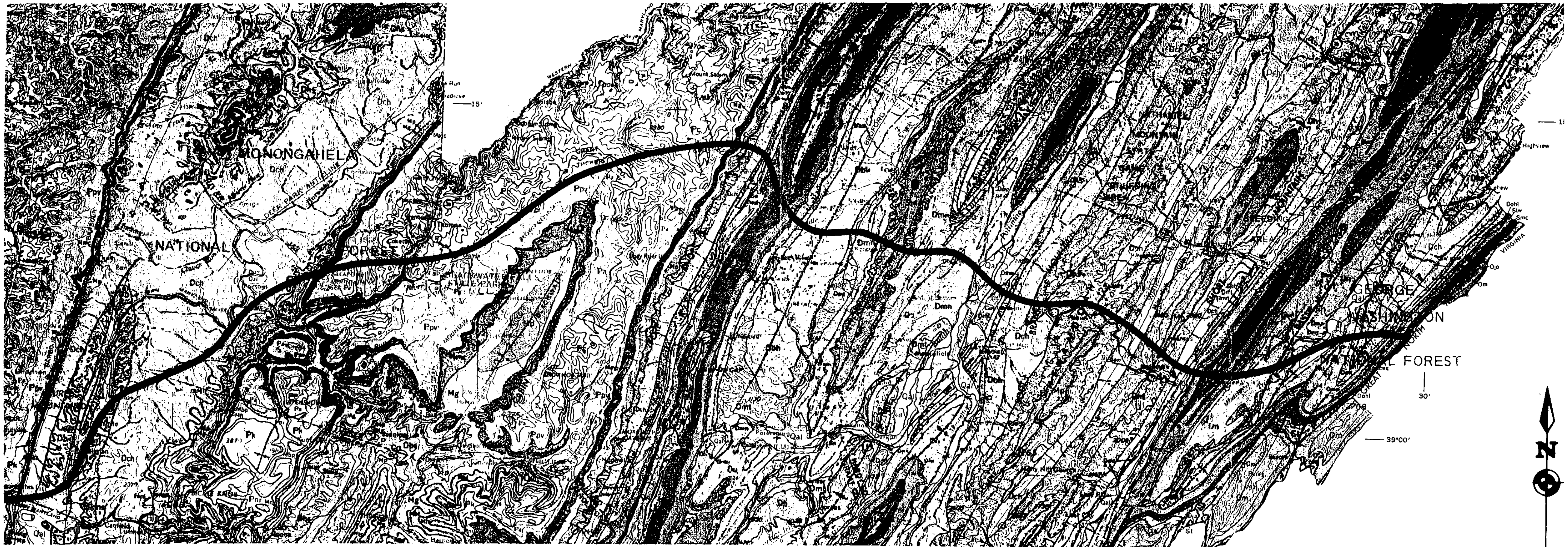
The Valley and Ridge Province is bounded on the west by the Allegheny Front and includes Hardy County and portions of Grant County, as well as the Virginia Counties of Frederick and Shenandoah. This province consists of tight folds, wide valley bottoms, and a trellised drainage pattern. The structurally controlled trellis drainage patterns trace the shape, size, and location of the underlying bedrock. The pattern is formed by the headwaters of the Potomac River which flow to the Atlantic Ocean. Major tributaries in the study area include Patterson Creek, the North and South Branch of the Potomac River, the Cacapon River, and the Shenandoah River. Unique topographic features in this portion of the study area include the Allegheny Front, Greenland Gap, and the Lost River.

In West Virginia and Virginia, sedimentary rocks of the Paleozoic Era are found throughout the study area. These rocks were deposited during the Pennsylvanian, Mississippian, Devonian, Silurian, and Ordovician Periods. Throughout the project area, the geologic age of the sedimentary rocks becomes progressively older from the west to the east. Surficial rocks in the Appalachian Plateau Province are predominantly of Pennsylvanian, Mississippian, and Devonian age while rocks throughout the Valley and Ridge Province are of Devonian, Silurian, and Ordovician age.

The following summarizes the stratigraphy, geologic age, and relevant structural features encountered in each watershed along the IRA and the Build Alternative. Because all alignments are within close proximity to each other, the geologic units are the same. Unique geologic features along the IRA, Line A, or the Option Areas are addressed separately, where necessary.

(1) Tygart Valley River Watershed

The eastern boundary of the Tygart Valley River Watershed lies approximately 4.8 kilometers (3 miles) to the west of Elkins and generally parallels the western edge of the Monongahela National Forest and the crest of Cheat Mountain. The western terminus of the project is approximately 6.4 kilometers (4 miles) west of Elkins and is bounded by Laurel Mountain to the north and Rich Mountain to the south. Laurel Ridge is asymmetrical; its western slope being gentle and the eastern side being uniformly steeper with many low foot-hills toward the base. Rocks of the Pottsville Series compose the resistant rocks



IDENTIFICATION KEY

CENOZOIC

Qal	Quaternary Alluvium

PALEOZOIC SYSTEMS

PENNSYLVANIAN SYSTEM

Pm	Monongahela Group
Pc	Conemaugh Group
Pa	Allegheny Formation
Pk	Kanawha Formation
Pnr	New River Formation

MISSISSIPPIAN SYSTEM

Mg	Greenbriar Group
Mp	Pocono Group
Mmc	Mauch Chunk Group

DEVONIAN SYSTEM

Dhs	Hampshire Formation
Dch	Chemung Group
Db	Brallier Formation
Dm	Marcellus Formation
Do	Oriskany Sandstone
Dhl	Helderberg Group

SILURIAN SYSTEM

Stw	Tonoloway Formation
Smc	Mckenzie Formation & Clinton Group
St	Tuscarora Sandstone

APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

EXHIBIT III-57

Geologic Map of West Virginia

0 1 2 3 4
Miles

IDENTIFICATION KEY

SILURIAN

SKRT	Keefer, Rosehill & Tuscarora Formations

DEVONIAN

Dhs	Hampshire Formation
Db	Brallier Formation
Dmrn	Marcellus Shale & Needmore Shale
Dsu	Ridgely Sandstone, Helerberg & Cayagan Groups

ORDOVICIAN

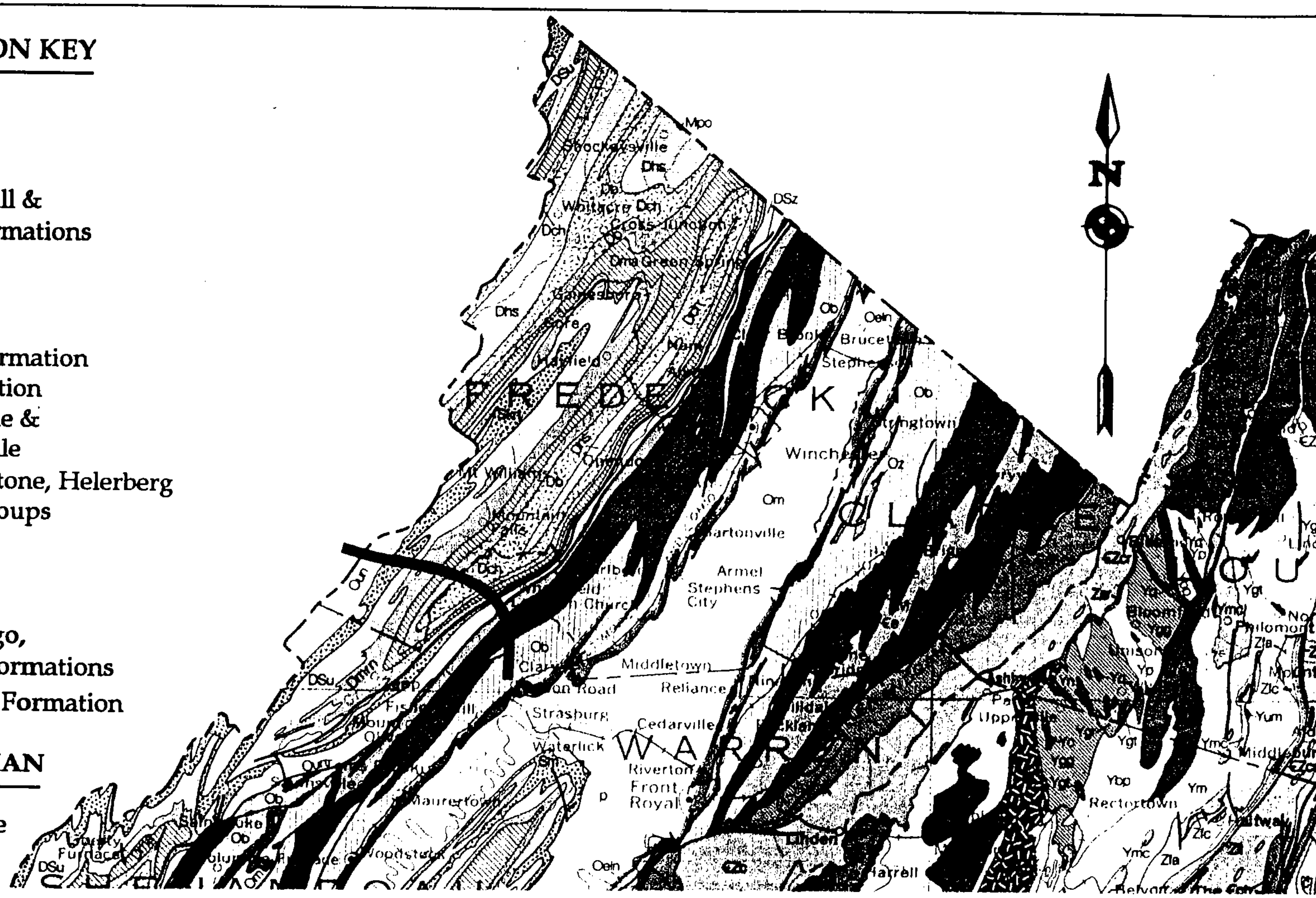
Oun	Juniata, Oswego, Martinsburg Formations
Ob	Beekmantown Formation

CAMBRIAN/ORDOVICIAN

OCoo	Conococheague Formation

CAMBRIAN

Ce	Elbrook Formation



APPALACHIAN CORRIDOR H
ELKINS TO INTERSTATE 81

EXHIBIT III-58

Geologic Map of Virginia

Scale 1:500,000
1 inch equals approximately 8 miles

that form this ridge. Rich Mountain is similar in geologic structure and is located on the southern side of the Tygart Valley River. Quaternary alluvial deposits are found along the river bottom. East of Laurel Ridge, rocks are predominantly composed of olive-green sandstones and sandy or argillaceous shales of the Devonian Chemung Series. Approaching Elkins, the alignments turn northward and generally follow US 219, encountering Quaternary alluvial deposits formed by Leading Creek. Sandy shales of the Devonian Brallier Formation can be found upslope of the river deposits. The Deer Park Anticline is the only structural feature found in the area. The axis of the anticline generally bisects the valley formed by the Tygart Valley River and Leading Creek (Reger, 1931).

(2) Cheat River Watershed

The eastern portion of the Cheat River Watershed coincides with the western boundary of Tucker County. Rocks are sedimentary in origin and formed during the Pennsylvanian and Mississippian Periods. Formations include the shales of the Mauch Chunk, limestones of the Greenbriar, and sandstones of the Pocono Group found along Backbone Mountain. Pennsylvanian deposits include sandstones, shales, and coal seams of the Pottsville, Allegheny, and Conemaugh Series. Relevant coal deposits include the Upper Freeport and Bakerstown coal seams. Major structural features in western Tucker County include the North Potomac Syncline (which bisects the town of Douglas) and the Blackwater Anticline, located approximately 8 kilometers (5 miles) east of Davis (Reger, 1923).

The western portion of the Cheat River Watershed primarily consists of recent Quaternary alluvial deposits found along the Cheat River and Shavers Fork, as well as sandstones of the Chemung Series (Devonian age) which form the upland areas. Major structural features include the Parsons and Deer Park Anticlines.

(3) North Branch of the Potomac River Watershed

This watershed is generally located within Grant County. Sedimentary rocks of the Pennsylvanian Conemaugh Series are encountered in the western portion of Grant County in the Appalachian Plateau Province. Strip mines of the Bakerstown or Upper Freeport coal seams can be found extending from the Tucker/Grant County line to slightly east of Mount Storm Lake. Major structural features include the Stony River Syncline, the Blackwater Anticline, and the Allegheny Front.

East of the Allegheny Front lie sedimentary rocks within the Valley and Ridge Province. These rocks are predominantly of Devonian and Silurian age, with the exception of Quaternary deposits found along stream channels. Major structural features include the Wills Mountain Anticline and the Bedford Syncline. The Wills Mountain Anticline (New Creek Mountain) is capped by the resistant Tuscarora Sandstone of Silurian Age. The Bedford Syncline bisects rocks of the Upper Devonian greenish-gray shales with interbedded sandstone beds of the Brallier Formation. The axis of Patterson Creek Mountain generally follows the Grant/Hardy County line.

(4) South Branch of the Potomac River Watershed

The South Branch extends from the Grant/Hardy County line to approximately 5.6 kilometers (3.5 miles) east of Moorefield. Patterson Creek Mountain is composed of Devonian and Silurian aged limestones with a few outcrops of the Oriskany Sandstone. To the east of the limestones, sedimentary rocks encountered are relatively flat-lying and of Devonian age. A few minor synclines and anticlines, such as the Kessel Anticline, Clearville Syncline, and Middle Mountain Syncline, can be found west of Moorefield. East of Moorefield, the Devonian rocks become extensively thicker at the surface and form the western boundary of the Cacapon River Watershed.

(5) Cacapon River Watershed

This watershed extends generally from 5.6 kilometers (3.5 miles) east of Moorefield to the Virginia state line. In the western portion of the watershed, Devonian aged rocks of the Portage Series, Chemung Series, and Catskill Series can be encountered. However, Short Mountain is capped by the Pennsylvanian aged Pocono Formation. East of the Lost River is the Hanging Rock Anticline. The anticline is composed of Silurian aged rocks which include the Tuscarora Sandstone, Keefer Sandstone, the Juniata Formation, and limestones of the Helderberg Formation. Ridges east of Hanging Rock are formed by the Oriskany sandstone which include Sandy Ridge and Anderson Ridge. Structural features in eastern Hardy County include the Wardensville Syncline, composed of the Marcellus Shale and Quaternary alluvial deposits, and the Meadow Branch Syncline (Tilton, 1927).

(6) Shenandoah River Watershed

This watershed marks the boundary between the states of West Virginia and Virginia which is also the location of the northwestern limb of Great North Mountain Anticline. The Oswego, Juniata, and Tuscarora Formations have been eroded away from the crest of the anticline to form a deep intermontane valley which occurs in the relatively soft Martinsburg Shale. Both sides of the valley have high ridges made up of resistant sandstones. The southeastern limb of the anticline is a ridge named Paddy Mountain. Immediately to the east is a valley composed of the Marcellus Shale, fine grained sandstones of the Hamilton Formation, and micaceous shales of the Brallier Group (Butts, 1966).

Cedar Creek is the dividing line between Frederick and Shenandoah Counties. Little North Mountain, located east of Cedar Creek, forms the western boundary of the Shenandoah Valley. The mountain is an overturned monocline with steep, southeasterly dips. It is capped by the Tuscarora sandstone and is associated with the Keefer and Rosehill Formations. The mountain is bounded on the east by the Little

North Mountain Fault and on the west by a broad syncline of Devonian rocks. The Juniata, Oswego, and Martinsburg Formations can be found on the eastern flank of Little North Mountain which have been displaced by the Little North Mountain Fault.

East of Wheatfield, the alignments turn southward into the Shenandoah Valley, passing Lebanon Church and Clary to Interstate 81. Bedrock found beneath the Shenandoah Valley include Ordovician carbonates comprised of the Beekmantown and Conococheague Formations. The Cambrian Elbrook Formation is present is the vicinity of Little North Mountain (Cady, 1936).

b. Specific Geologic Concerns

Throughout the history of the Corridor H project, concern has been expressed over the project's involvement with and impact to previous mining activities and resources, as well as karst topography. An overview of these existing areas is provided below.

(1) Mining

The principal past and present mining activity in the watersheds is coal mining. The Upper Freeport and Bakerstown Coal seams of the Pennsylvanian Conemaugh Group have been extensively mined near the towns of Davis, Thomas, Douglas, and the Mount Storm Lake area. The Bakerstown Coal is located above the Freeport Coal seam. The coal beds extend from slightly west of Thomas near Long Run eastward, toward Mount Storm Lake. Typically, coal deposits are mapped by the base of the seam; therefore, elevations pertaining to the coal seams are base elevations, not top elevations. Chemically, both the Upper Freeport Coal and the Bakerstown Coal are low in sulfur and volatile matter and have a medium to high phosphorus content (Reger, 1923).

The Bakerstown Coal ranges from 0.9 to 2.4 meters (3 to 8 feet) in thickness. It has been extensively mined near Davis and Thomas. The Bakerstown Coal outcrops northeast of Douglas, high on the hill tops, then decreases in elevation northeastward, going under drainage just above Thomas. Outcrops of the Bakerstown also extend on Pendleton Creek 2.4 kilometers (1.5 miles) northwest of Davis and northeastward, up the side of Beaver Creek, and passing across the Blackwater Anticline where it runs southward into Grant County.

The Upper Freeport Coal varies from 1.5 to 2.4 meters (5 to 8 feet) thick. Outcrops can be found in certain high summits southwest of Douglas, along the North Fork of the Blackwater River near Coketon, then extending toward Pendleton Creek where the seam goes under drainage to the east. The Upper Freeport Coal also outcrops near Long Run at an elevation of 1,006 meters (3,300 feet) and then structurally dips to the east. Strip mined areas related to the Upper Freeport Coal are found along the extent of Long Run and the North Fork of the Blackwater River.

(2) Karst Topography

Karst topography is made up of a landscape and its subsurface and is characterized by surface water flow and groundwater flow through caves or other dissolutionally enlarged cavities, and a variable suite of distinctive surface landforms and hydrologic features. These features include sinkholes, dry valleys, springs, caves, sinking streams (otherwise known as swallet), enlarged joints or bedding planes, and cutters or soil karren (soil filled joints or grooves). Most karsts are developed in carbonate rocks, but may also be found in gypsum, salt, and carbonate-cemented sandstones (Quinlan, 1992).

Sinkholes are the most commonly known karst feature. Sinkholes occur naturally or can be induced. Induced sinkholes are the result of interference with the natural hydrologic framework of karst terrain. Changes made to the surface hydrology can result in fluctuations of the groundwater table. These changes can cause a loss of support and subsequent collapse of the underlying cavities, resulting in the creation of a sinkhole. In addition, an increase in groundwater velocity can produce subsurface erosion and induced recharge.

Throughout the Valley and Ridge Province of West Virginia, limestones can be found in valleys, on the flanks of ridges formed by resistant sandstones, and as ridges. Limestones also provide recharge to the groundwater system. Generally, the limestone formations provide good cut-slope and foundation stability and serve as a good source of road material. Limestones are hard sedimentary rocks. However, limestones are subject to chemical weathering due to the presence of carbon dioxide in the groundwater system. Encountering subsurface solution channels/cavities during excavation is a possibility and the potential exists for groundwater contamination. When limestones are exposed at the surface or are the first bedrock beneath the soil, the potential for karst features exist. The lack of karst features on the surface does not necessarily mean an absence of karst in the subsurface.

3. IMPACTS

The IRA and the Build Alternative have the potential to impact the geologic environment by disturbing soils, geologic features, and mined lands. Disturbances of previously mined areas could result in the formation of acid mine drainage. Other environmental consequences could include impacts to the scenic geologic features of Hanging Rock and Greenland Gap.

a. Coal Mining

The primary geologic hazard within the proposed project area is the presence of surface and underground coal mining. Strip mining is a concern along the Build Alternative and the IRA. The strip mine reclamation process requires backfilling and grading. For contour backfilling, the edge of the highwall is removed and the spoil is graded back toward the highwall as close to the original contour as possible. Load bearing capacities of backfilled areas are generally uncertain due to a lack of compaction associated with backfilling. Compaction problems are typically caused by grading bare spoil that has been kept in storage for long periods of time and allowed to settle and harden. Construction through reclaimed areas can disturb buried wastes and/or overburden that contain sulfur bearing materials within coal or disturbed overburden. Exposure of coal waste as a result of construction activities would more than likely induce the formation of acid mine drainage (AMD).

Deep mines present the potential for subsidence and collapse if a roadway is not properly designed. Subsidence can be caused by such factors as the lack of integrity of the remaining coal pillars, shallow depth to the mine cavity and its structural integrity, as well as thin overlying bedrock. The possibility of encountering vertical mine shafts poses an additional design consideration.

(1) No-Build Alternative

The No-Build Alternative would not impact existing or inactive mined areas.

(2) Improved Roadway Alternative

West of Thomas, the IRA would not impact any active strip or underground mining operations. Inactive strip mining activities near Thomas would be impacted as the IRA crosses the North Fork of the Blackwater River and along Synder Run.

Along WV 93 to the north of Davis, the IRA would pass to the south of inactive strip and underground mining of the Bakerstown Coal. On its proposed location, the IRA would not impact any strip or underground mining associated with the Bakerstown or Upper Freeport Coal seams.

As the IRA approaches Mount Storm Lake, it would be bounded to the north by inactive strip mining of the Upper Freeport Coal. Once entering Grant County, the Upper Freeport goes under drainage and the IRA would pass over underground mining of the Upper Freeport Coal. The IRA would not impact any mining activities associated with the Bakerstown or Upper Freeport Coal to the east of Mount Storm Lake.

(3) Build Alternative

Using the coal contours provided by the West Virginia Geological and Economic Survey, underground location of the coal seams were compared to the Build Alternative elevations to determine potential conflicts with the coal deposits.

The Build Alternative crosses Long Run west of Douglas and would impact old strip mine areas of the Upper Freeport Coal. The Build Alternative would also impact old strip mines of the Bakerstown Coal where it crosses the North Fork of the Blackwater River. This crossing would impact old strip mines of the Bakerstown Coal and would pass directly over abandoned underground mines of the Upper Freeport Coal.

The Build Alternative would impact active strip mines of the Upper Freeport seam west of the intersection of WV 93 and WV 42. North and east of Davis along WV 93, the Build Alternative would pass to the south of Bakerstown Coal strip mines, causing no impact. The Build Alternative would encounter old strip mines associated with the Upper Freeport Coal, located 792 meters (2,600 feet) east of the WV 93 crossing of Beaver Creek. Underground mines of the Bakerstown Coal are located to the north of WV 93 and would not be impacted by the Build Alternative. As WV 93 crosses Brown Mountain, strip mines of the Upper Freeport Coal are located to the north of the Build Alternative.

The elevation of the Upper Freeport coal near the Tucker/Grant County line is approximately 1,067 meters (3,500 feet) while the proposed finished elevation for the Build Alternative is 1,068 meters (3,503 feet). Therefore, the Build Alternative would cut through the Upper Freeport Coal seam. Cutting through and exposure of the Upper Freeport Coal seam near the Tucker/Grant County line could cause acid mine drainage, depending on the groundwater table in this area.

To the east of Mount Storm Lake, the Upper Freeport Coal is located beneath the Build Alternative. Even though the Build Alternative would not impact any underground mines of the Upper Freeport Coal, it may impact the northernmost extent of a strip mining operation of this seam located to the southeast of Bismarck. Coal, at its highest elevation, is 884 meters (2900 feet) at Station 5045, between Abrams and Little Creek. The Build Alternative would be about 71 feet above the crest of the coal and would not impact the Upper Freeport Coal.

b. Natural Gas

There are very few natural gas wells in the project area, and they are typically found penetrating sandstone ridges composed of Oriskany sandstone. No gas wells or gas fields would be impacted by the No-Build Alternative, the IRA, or the Build Alternative.

c. Sandstone and Limestone Quarries

No quarries would be impacted by the No-Build Alternative.

On US 219, the IRA would pass an active sandstone quarry west of Thomas and would pass through and impact an active limestone quarry at Greenland Gap. Along VA 55, the IRA would pass two inactive quarries. The first is located along Cedar Creek north of VA 55 and was a sandstone and shale quarry used in the 1940s and 1950s by the Virginia Department of Transportation. The second inactive quarry is located near Short Mountain on VA 55. The IRA would have no impact on these inactive quarries. Additionally, high calcium Ordovician limestone mining has occurred in the Shenandoah Valley near I-81 in Virginia. These quarries or mines would not be impacted by the IRA.

The Build Alternative would pass 4.3 kilometers (2.7 miles) to the south of a limestone quarry located along Backbone Mountain and would pass 2.1 kilometers (1.3 miles) to the south of a sandstone quarry located adjacent to US 219 on Backbone Mountain. The Build Alternative would also pass approximately 122 meters (400 feet) to the east of a limestone quarry at Greenland Gap. The Build Alternative would not impact any of these active quarries. The high calcium Ordovician limestone mining in the Shenandoah Valley near I-81 would not be impacted by the Build Alternative.

d. Unique Geologic Features

(1) Hanging Rock

Hanging Rock is a unique rock formation and is an example of the geologic process called differential weathering. Typically, differential weathering occurs when the resistant cap rock is underlain by rocks of calcareous composition which weather faster than the cap rock. The result is an undercutting of the cap rock, creating the "hanging" feature of Hanging Rock. However, previous construction of WV 55 may have accentuated the "hanging" feature of the cap rock by further undercutting the rock beneath to allow for roadway construction. Visual impacts to this area are discussed and presented in Section III-K: *Visual.*

The No-Build Alternative would not impact Hanging Rock.

The IRA would require a 23 meter (75 feet) cut immediately to the east of Hanging Rock where it overhangs WV 55. In order to improve the horizontal curvature of the roadway, construction activities would most likely impact the integrity of the geologic structure. In the Hanging Rock Option Area, Line R would cross Hanging Rock Ridge 610 meters (200 feet) to the northwest.

Line A would pass 229 meters (750 feet) to the east of Hanging Rock, thereby avoiding any direct impact to the structure. Line A would avoid Hanging Rock and its distance from the feature would minimize and likely avoid any impact to the integrity of the geologic structure. While directly avoiding Hanging Rock, Line R would require a cut 168 meters (550 feet) across the ridge to a depth of 30 meters (100 feet), and could create a potential impact on the integrity of the remaining geologic structure.

(2) Greenland Gap

Greenland Gap is located approximately 1.6 meters (1 mile) east of the town of Scherr along WV CR 3/3, between the towns of Falls and Scherr. The West Virginia Chapter of the Nature Conservancy owns and manages the Greenland Gap Nature Preserve, a 255 acre area which includes Greenland Gap. The most spectacular feature of the gap, a National Natural Landmark, is its towering sandstone cliffs that arch upward, over 244 meters (800 feet) high. Neither the No-Build Alternative, the IRA, nor the Build Alternative would impact Greenland Gap.

4. ECONOMIC IMPACT TO MINERAL RESOURCES

Within the project area, significant bituminous coal deposits are located in the West Virginia Counties of Randolph, Tucker, and Grant. According to *Coal Facts '92,* released by the West Virginia Coal Association, Randolph County has a reserve of 2,421.1 million tons, Tucker County has a reserve of 179.9 million tons, and Grant County has a reserve of 507.0 million tons. Hardy County, West Virginia and Frederick and Shenandoah Counties in Virginia do not have such deposits bituminous coal. With the exception of Randolph County, the availability of coal reserves within the project area is low compared to other counties located in the southern parts of West Virginia and Virginia.

Using information provided in *Coal Facts '90,* and Section III-A: *Economic Environment*, the coal mining industry employed 288 people (2%) in Randolph County, 55 people (2%) in Tucker County, and 692 people (10%) in Grant County. In 1990, the employment in the mining industry was 554 people (5%) in Randolph County, 271 people (8%) in Tucker County, and 1,419 people (20%) in Grant County. With the exception of Grant County's coal mining activities, mineral resources have a relatively low impact on the economy of the project area.

5. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

Avoidance, minimization, and mitigation measures would not be necessary under the No-Build Alternative. The alignment development process for both the IRA and the Build Alternative included efforts to avoid or minimize impacts to mines, mineral resources, and important geologic features.

a. Mining

The alignment development process included measures to avoid encounters with coal seams and mined-out areas. However, information on mined areas was not recorded during early periods of mining. Generally, information necessary to avoid or minimize such impacts is not obtained until geotechnical drilling investigations are conducted as part of the design phase of the Highway.

Mitigation measures taken during construction through active or reclaimed/non-reclaimed strip mined areas would include the proper treatment or removal of waste deposits and/or any acidic materials that would contribute to the formation of acid mine drainage. During final design, drainage control devices/methods would be determined on a site-specific basis. During construction, surface treatment would be implemented to minimize erosion potential and densification of the subgrade. In addition, revegetation and proper soil cover procedures would be used to minimize or eliminate the formation of acid mine drainage.

Mitigation measures concerning underground mines would be based on site-specific problems. Depending on the problems encountered, measures would include bridging, sealing, subsurface reinforcement, backfilling, or capping the deep mine area. Areas where the coal seams are relatively close to the surface would require saturation grouting with a cement/fly ash mix. Where open cavities are present, underpinning the roof overburden by grout columns would be required.

Measures to avoid exposure of coal seams would be considered in final design. The exact depth to the coal seam would be determined through the use of exploration borings into the underlying rock stratum. Adjustments to the finished grade of the proposed highway to an elevation above that of the coal seam could then be made. When avoidance is not possible, exploration borings would be used to determine the exact depth, thickness, and slope of the coal seam in relation to the local groundwater table. If the groundwater level is beneath the coal seam, then construction activities and subsequent exposure of the coal seam would not likely produce acid mine drainage. If the coal seam is located below the local groundwater table and drainage is visible from the seam, then a chemical analysis of the groundwater would be performed to determine whether the groundwater exhibits the typical chemical characteristics of acid mine drainage. If found to contain acid mine drainage, then proper diversion and treatment of the acid drainage would be executed so as not to degrade the quality of surface waters down gradient of the proposed highway cut.

b. Unique Geologic Features

(1) Hanging Rock

The No-Build Alternative would not impact Hanging Rock.

Because the IRA follows the existing roadway and because Hanging Rock is in close proximity to the existing roadway, measures to avoid impacts from construction will be difficult. At this time, no mitigation measures are feasible other than not improving this section of the existing roadway.

During the time of design and construction of the Build Alternative, geologic information would be gathered to insure the integrity of the design. This data would also be used to design blasting plans to minimize any possible disturbance.

(2) Greenland Gap

None of the Alternatives would impact any geological features of Greenland Gap; therefore, no minimization or mitigation measures would be necessary.

U. ENVIRONMENTAL PERMITS

1. PERMIT REQUIREMENTS

Federal and state laws and regulations require that various environmental permits be acquired prior to the start of project-related construction activities; this would be the case under the IRA or the Build Alternative. The No-Build Alternative would not require the acquisition of the permits discussed below.

In West Virginia, the IRA or the Build Alternative would require the issuance of two federal permits, two state permits, and one state certification. WVDOT would have to obtain a Section 404 Clean Water Act Permit and a Section 10 Rivers and Harbors Act Permit from the Pittsburgh District of the US Army Corps of Engineers prior to construction activities. Issuance of the Section 404 Permit would be contingent upon obtaining from West Virginia a Section 401 Water Quality Certification. The WVDOT would also have to obtain a National Pollution Discharge Elimination System (NPDES) permit, issued through the State, and a Stream Activity Permit, issued through West Virginia's Public Land Corporation.

In Virginia, the IRA or the Build Alternative would require the issuance of one federal permit and four state permits. The VDOT would have to obtain a Section 404 Clean Water Act Permit from the Norfolk District of the US Army Corps of Engineers and receive a Virginia Water Protection Permit (which incorporates Section 401 Water Quality Certification) from the Commonwealth of Virginia. The State would also require the VDOT to obtain a Stormwater Permit for Construction and a Stormwater Permit for Industrial Activities. The latter permit is required for transportation projects. Finally, because of encroachment on streambeds, the VDOT would have to obtain a Subaqueous Bed Permit from the Virginia Marine Resources Commission.

2. STATUS OF PERMITS

The application for the Section 404 Permit for the preferred alternative, Build - Line A, for the West Virginia portion of the proposed project has been prepared and submitted to the Pittsburgh District of the US Army Corps of Engineers. In accordance with Corps regulations, a Public Notice, which includes the permit application package, has been sent to all adjacent property owners. The Public Hearings on this SDEIS will be held in conjunction with the Corps Public Hearing on the Section 404 Permit. A copy of the permit package is included in Appendix G. Comments on the Permit Application should be sent to all of the following: the US Army Corps of Engineers, Pittsburgh District; the WVDOT; and the West Virginia Department of Environmental Protection.

The Alternatives Analysis required in the Section 404(b)(1) Guidelines is included in Appendix G. Conceptual wetland mitigation plans are included in Section III-Q: *Wetlands* of this SDEIS.

A Section 404 Permit has not been prepared for the Virginia portion of the project. If VDOT identifies the Build or Improved Roadway Alternatives as the preferred alternative, a Section 404 Permit would be prepared and submitted to the Norfolk District of the US Army Corps of Engineers. The selection of the No-Build Alternative in Virginia would not require a Section 404 Permit.

V. HAZARDOUS MATERIALS

The hazardous materials analysis has been conducted in accordance with WVDOT's *Guidelines for Identifying and Dealing with Hazardous Waste on Highway Projects, 1989*, guidelines set forth in FHWA's *Technical Advisory T 6640.8A*, and FHWA's *Interim Guidance: Hazardous Waste Sites Affecting Highway Project Development, August 1988.*

Several federal regulatory programs involve the implementation of regulating hazardous waste sites. These programs include the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), including the Superfund Amendents and Reauthorization Act (SARA). These federal laws give EPA responsibility for regulating hazardous waste. In response to this directive, EPA is inventorying uncontrolled sites and has published the National Priorities List (NPL). The objective of placing sites on the NPL is their ultimate cleanup.

1. METHODOLOGY

Coordination with the West Virginia Division of Waste Management and the Virginia Department of Environmental Quality was undertaken to determine the location of known permitted and non-regulated hazardous waste sites within the proposed project area. Letters of inquiry were sent to the West Virginia Division of Waste Management and the Virginia Department of Environmental Quality to obtain information regarding county-wide lists of hazardous waste sites.

In addition to resource agency coordination, a background data search throughout the proposed project area was performed by Environmental Risk Information and Imaging Services (ERIIS). The following EPA databases were used for the search: National Priorities List (NPL); Comprehensive Environmental Response, Compensation, and Liability Information Systems (CERCLIS); Facility Index Systems (FINDS); Emergency Response Notification Systems (ERNS); Toxic Release Inventory System (TRIS); Resource Conservation and Recovery Information System (RCRIS); Registered Leaking Underground Storage Tanks (LUST); Registered Underground Storage Tanks (UST); Landfill List; State Hazardous Site Lists; Nuclear Power Reactors; and Open Dumps. Sites identified by ERIIS but not affected by the project were eliminated from further investigation. RCRA identifies those materials considered to be hazardous and regulates their production, transportation, and disposal. RCRA sites are either producers, transporters, or disposers of such regulated hazardous materials. CERCLA provides a system for cleaning up chemical and hazardous substances released into the groundwater, air, land, and water. CERCLA, in part, bases its definition of hazardous materials on the RCRA definitions. CERCLA sites are sites in which hazardous materials have been released and are targeted for clean-up or have been cleaned.

2. HAZARDOUS MATERIALS IMPACTS

The EPA database search performed by ERIIS and the county listing of hazardous waste sites identified no CERCLA sites, leaking underground storage tank sites, or landfills within the proposed construction limits of the IRA or the Build Alternative.

a. No-Build Alternative

Under the No-Build Alternative, there would be no project-related involvement with known hazardous material sites or generators.

b. Improved Roadway Alternative

The IRA would not impact CERCLA sites, leaking underground storage tanks, or landfills within the proposed construction limits, nor would it directly impact RCRA sites. Four sites close to, but not affected by, the IRA comply with regulations stipulated under RCRA. In addition, the IRA would potentially impact gasoline dispensers and underground storage tanks (UST) associated with nine stores.

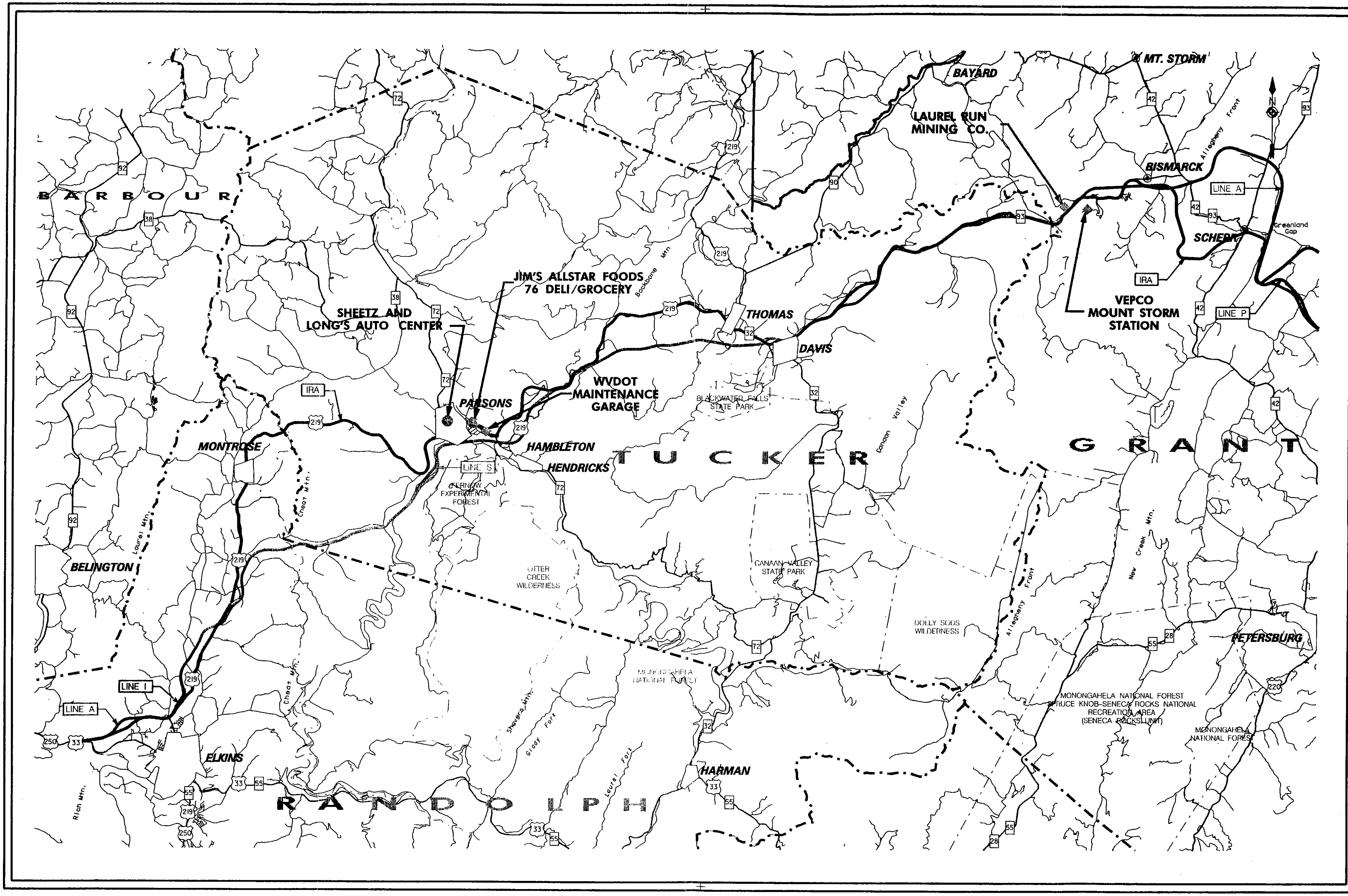
RCRA sites are classified according to the quantity of waste produced. The generator class descriptions are as follows:

- Class 1: Large generators producing 1,000 kg or more of hazardous waste or 1 kg of acutely hazardous waste per month.

- Class 2: Generators producing between 100 kg to 1,000 kg of hazardous waste or up to 1 kg of acutely hazardous waste per month.

- Class 3: Small generators producing up to 100 kg of hazardous waste or less than 1 kg of acutely hazardous waste per month. Given the relatively small quantities of hazardous waste generated by Class 3 facilities, EPA has determined that they are conditionally exempt from reporting.

Of the four RCRA sites identified, three are Class 2 waste generators and two are Class 3 waste generators; all are located in West Virginia. Roadway widening under the IRA would utilize additional property from both the Class 2 generator (VEPCO Mount Storm Station) and the Class 3 generators (WVDOT maintenance areas in Parsons and Moorefield) sites, but this property acquisition would not impact the above waste generators. The RCRA sites and their impact assessment related to the IRA are presented on Exhibit III-59 and Table III-78.



MT. STORM
BAYARD
LAUREL RUN MINING CO.
BISMARCK
LINE A
SCHERR
Greenland Gap
IRA
VEPCO MOUNT STORM STATION
LINE P
BARBOUR
JIM'S ALLSTAR FOODS 76 DELI/GROCERY
SHEETZ AND LONG'S AUTO CENTER
THOMAS
DAVIS
WVDOT MAINTENANCE GARAGE
PARSONS
BLACKWATER FALLS STATE PARK
MONTROSE
HAMBLETON
HENDRICKS
TUCKER
GRANT
LINE S
FERNOW EXPERIMENTAL FOREST
BELINGTON
OTTER CREEK WILDERNESS
CANAAN VALLEY STATE PARK
DOLLY SODS WILDERNESS
PETERSBURG
MONONGAHELA NATIONAL FOREST
MONONGAHELA NATIONAL FOREST SPRUCE KNOB-SENECA ROCKS NATIONAL RECREATION AREA (SENECA ROCKS UNIT)
LINE I
LINE A
ELKINS
HARMAN
RANDOLPH

LTWSTE.DGN

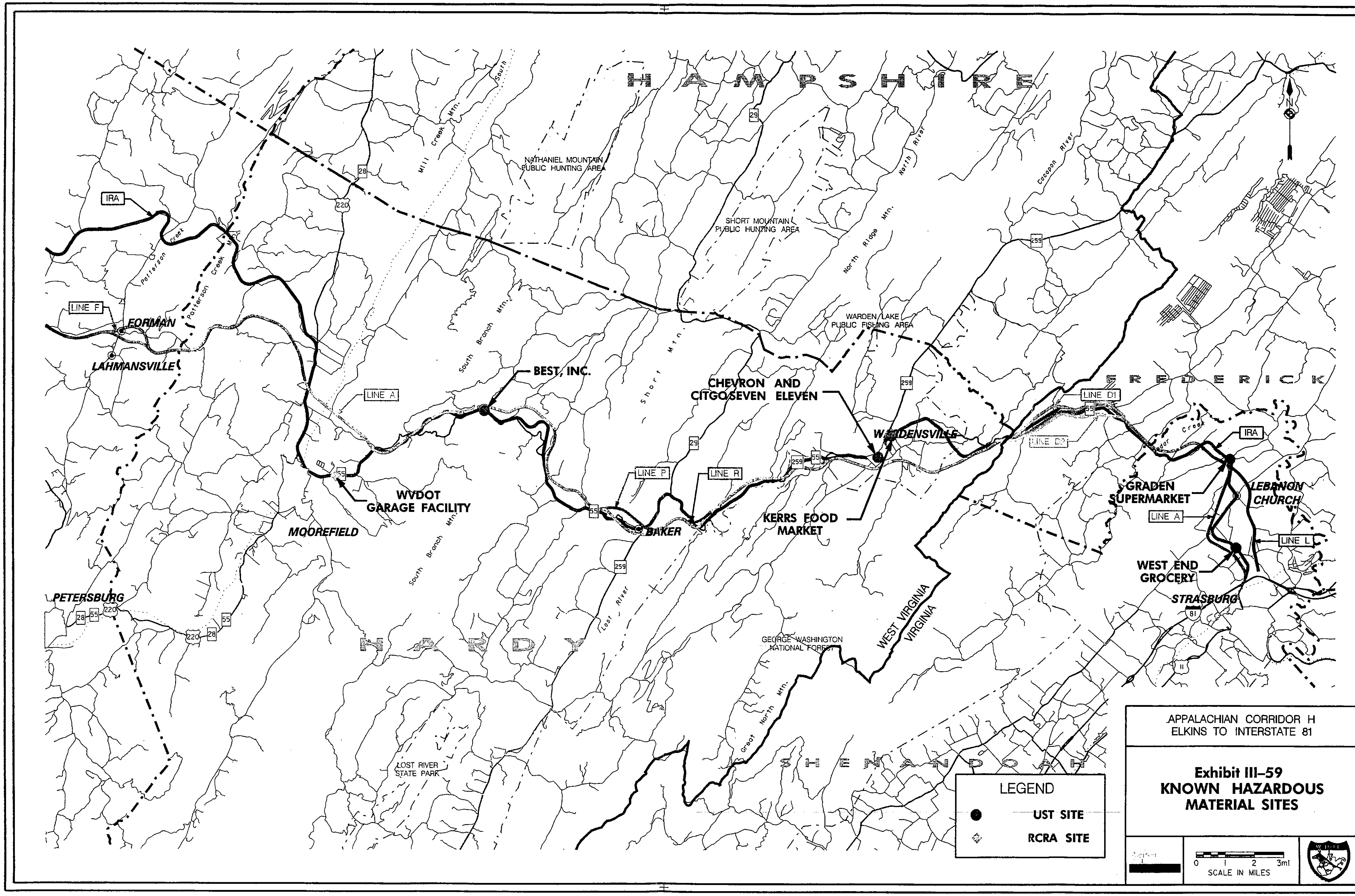


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Exhibit III-59
KNOWN HAZARDOUS MATERIAL SITES

TABLE III-78
RCRA SITE LOCATIONS AND IMPACTS

LINE	IMPACT	LOCATION	SITE NAME	SITE TYPE & CLASS	EPA I.D. NUMBER
IRA	None	Station 2334 ◆ The site is approximately 11 m (35') northeast of existing US 219 in Parsons, WV. ◆ The site would be approximately 6 m (20') northeast of the IRA construction limits along US 219.	WVDOT - Maintenance Facility/Garage	RCRA - Class 3	WVD982673600
IRA	None	Station 5067 ◆ The site fronts WV 93 and is bounded to the east by Mount Storm Lake in Mount Storm, WV. ◆ The site is approximately 1,207 m (3,960') south of the IRA construction limits along WV 93.	Vepco Mount Storm Station	RCRA - Class 2	WVD080548191
IRA	None	Station 5362 ◆ The site is approximately 6 m (20') south of existing WV 55, east of Moorefield, WV. ◆ The site would be approximately 3 m (10') south of the IRA construction limits along WV 55.	WVDOT - Maintenance Facility/Garage	RCRA - Class 3	WVD988679154
IRA	None	Station 4855 ◆ The site is approximately 1060 m(3,480 ft) north of the IRA construction limits along WV 93	Laural Run Mining Company	RCRA - Class 3	WVD988766465

Widening of existing roadways under the IRA would also require right-of-way acquisition from nine properties with gasoline dispensers and underground storage tanks. Of these nine properties, seven are located in West Virginia and two are located in Virginia. The underground storage tanks at eight of these properties would not be impacted by the IRA. However, one site in West Virginia would require property acquisition and the subsequent removal of the underground storage tanks. The UST sites and their involvement with the IRA are presented on Exhibit III-59 and Table III-79.

c. Build Alternative

Neither Line A nor any of the Option Areas would have an involvement with CERCLA sites, RCRA sites, UST sites, LUST sites, or landfills.

3. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

WVDOT's Hazardous Waste Guidelines state that it is the West Virginia Department of Transportation, Division of Highway's practice to avoid known waste sites. Avoidance of hazardous waste facilities is often the most practical alternative due to the potential costs of handling, sampling, treatment, storage, and transportation and disposal of these materials. Because hazardous waste sites are not located within the construction limits of the Build Alternative, no site-specific mitigation measures would be necessary.

Geophysical investigations would be performed at UST sites that were identified to be adjacent to the construction limits of the IRA. These investigations would be conducted to locate accurately the lateral extent of the USTs. In cases where the USTs require relocation as a result of the IRA, proper planning and implementation of site-specific investigations and the subsequent removal/relocation of the UST would be necessary.

The IRA would require the displacement of one UST site; the BEST facility in Needmore, located along WV 55. During final design, an environmental site assessment would be performed prior to the acquisition of the property. This assessment would establish the overall risk or liability the property represents to the purchaser. The site investigations would be conducted in accordance with WVDOT's *Guidelines for Identifying and Dealing with Hazardous Waste on Highway Projects* (1989) and the guidelines set forth in FHWA's Technical Advisory T 6640.8A.

TABLE III-79
UNDERGROUND STORAGE TANK LOCATIONS

LINE	SITE NAME	IMPACT	LOCATION
IRA	Kerr's Food Mart	No	Station 6732 ◆ The site is approximately 12m (40') southeast of existing WV 55, approximately 838m (2750') northeast of the town of Wardensville, WV. ◆ The site would be approximately the same distance 40' (12m) from the IRA construction limits along WV 55.
IRA	Citgo/Seven-Eleven	No	Station 6687 ◆ The site is approximately 31m (100') south of existing WV 55 in Wardensville, WV. ◆ The site would be approximately the same distance 91m (31') from the IRA construction limits along WV 55.
IRA	Chevron	No	Station 6685 ◆ The site is approximately 12m (40') south of existing WV 55 in Wardensville, WV. ◆ The site would be approximately the same distance (12m) 40' from the IRA construction limits along WV 55
IRA	Best, Inc.	Yes	Station 5697 ◆ The site is approximately 15.2m (50') south of existing WV 55 in Hardy County, WV. ◆ The site would be located within the southern side of the IRA construction limits along WV 55.
IRA	Jims Allstar Foods 76 Deli/Grocery	No	Station 2305 ◆ The site is approximately 7.6 m (25') north of existing US 219 in Parsons, WV.
IRA	Sheetz	No	Station 2262 ◆ The site is located approximately 12.1 m (40') south of existing US 219 in Parsons, WV.
IRA	Longs Auto Center (Exxon)	No	Station 2256 ◆ The site is located approximately 7.6 m (25') south of existing US 219 in Parsons, WV.
IRA	West End Grocery	No	Station 678 ◆ The site is approximately 18.3m (60') northwest of existing VA 55 in Clary, VA. ◆ The site would be approximately 12.2m (40') northwest of the IRA construction limits along VA 55.
IRA	Graden Supermarket	No	Station 472 ◆ The site is approximately 40m (130') northeast of existing VA 55 in Wheatfield, VA. ◆ The site would be approximately 33.5m (110') northeast of the IRA construction limits along WV 55.

W. ENERGY

The energy analysis is a comparison of the energy requirements of the daily energy consumption for the No-Build Alternative, Improved Roadway Alternative and Build Alternatives. Three categories of energy consumption were analyzed; construction, maintenance, and operational. Total energy consumption is also provided for a comparison of the No-Build Alternative, the IRA, and the Build Alternative.

1. METHODOLOGY

Construction-related energy consumption is based on the construction cost of the alternatives. The energy analysis methodology, contained in *Energy and Transportation Systems* (July, 1983), was developed for the FHWA by the California Transportation (CALTRANS) Laboratory. It determines the total amount of British Thermal Units (BTUs) required for the production and placement of materials (asphalt, structures, cut, fill, etc.) based on the project's construction cost. These BTU estimates are then converted to liters of gasoline. Approximately 125,000 BTU's equals approximately 3.8 liters (1 gallon) of fuel.

Maintenance and operational energy consumption were calculated using the manual, *Energy Requirements for Transportation Systems* (June, 1980), prepared by the US Department of Transportation (USDOT), FHWA, and the Office of Environmental Policy (OEP). Maintenance energy for the alternatives was based on an annual consumption factor of 1.20×10^8 BTU per 1.7 lane km (per lane mile).

Operational energy consumption is influenced by vehicle size, vehicle weight, traffic conditions, engine size, vehicle accessories, roadway design, and driving mode (highway vs. city). Vehicle Miles Traveled (VMTs) were developed for the alternatives for the year 2013. This data was combined with vehicle fuel consumption tables to develop total vehicle consumption totals for the alternatives.

Each alternative's total energy requirement equals the sum of the energy required for construction, maintenance, and operation of the proposed facility.

2. EXISTING ENVIRONMENT

The existing energy consumption environment is not normally analyzed. The No-Build Alternative, the IRA, and the Build Alternative were analyzed and compared for the design year 2013.

3. IMPACTS

The No-Build Alternative is predicted to consume the least amount of energy because of the lack of construction. However, the predicted consumption levels of the No-Build do not take into account the additional fuel consumed by longer traveling times and fluctuating acceleration resulting from driving the mountainous terrain. The traffic prediction model estimates speeds and travel times by links that cover a large distance of roadway section. This has a tendency to 'flatten out' speeds over long distances instead of showing slower speeds in specific areas which may need to be improved for better travel flow. This could be the case for the No-Build Alternative now or in the future, regardless of the proposed project. These potential projects would also consume energy that would need to be added to the No-Build network, thereby increasing the No-Build Alternative's actual predicted energy consumption values. Such an addition would bring the predicted values closer to those of the IRA and the Build Alternative. Table III-80 summarizes construction, maintenance and operational energy requirements for each of the alternatives.

4. AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

Mitigation measures for energy consumption are not normally employed, primarily due to the avoidance of environmentally sensitive areas and single family residences, as well as basic engineering laws. However, recovery of the construction energy may be calculated to predict when the benefits gained by the predicted operational consumption equal or exceed the construction energy loss.

This project is intended to attract people into this area; therefore, recovery of the construction energy that would normally result from the relief of congestion is not applicable to this project. However, as mentioned previously, energy that is not predicted to be used for this project may have to be used for other roadway improvements resulting from the non-implementation of the IRA or the Build Alternative.

TABLE III-80
TOTAL ENERGY CONSUMPTION

CONSUMPTION COMPARISON IN WEST VIRGINIA

					OPTION AREA COMPARISON: WEST VIRGINIA											
ENERGY TYPE	CONSUMPTION UNIT (in millions)	WV No-Build	WV Line IRA	WV Line A	Interchange		Shavers Fork		Patterson Creek		Forman		Baker		Hanging Rock	
					Line I	Line A	Line S	Line A	Line P	Line A	Line F	Line A	Line B	Line A	Line R	Line A
Construction	Annual liters	n/a	18.613	45.655	0.758	0.842	0.707	1.590	2.103	2.136	1.339	1.940	1.699	1.244	1.290	1.601
	Annual gallons	n/a	4.918	12.062	0.200	0.222	0.187	0.420	0.556	0.564	0.354	0.513	0.449	0.329	0.341	0.423
Maintenance	Annual liters	0.186	0.199	0.246	0.044	0.044	0.029	0.029	0.044	0.044	0.029	0.029	0.029	0.044	0.015	0.015
	Annual gallons	0.049	0.053	0.064	0.012	0.012	0.008	0.008	0.012	0.012	0.008	0.008	0.008	0.012	0.004	0.004
Operational	Annual liters	44,472.207	55,720.163	60,277.596	1,054.134	1,083.921	408.746	408.746	450.117	450.117	402.126	321.039	529.549	595.743	200.236	200.236
	Annual gallons	11,749.592	14,721.311	15,925.389	278.503	286.373	107.991	107.991	118.921	118.921	106.242	84.819	139.907	157.396	52.902	52.902
TOTAL	Annual liters	44,472.393	55,738.975	60,323.497	1,054.936	1,084.807	409.482	410.365	452.264	452.297	403.494	323.008	531.277	597.031	201.541	201.852
	Annual gallons	11,749.641	14,726.282	15,937.515	278.715	286.607	108.186	108.419	119.489	119.497	106.604	85.340	140.364	157.737	53.247	53.329

CONSUMPTION COMPARISON IN VIRGINIA

					OPTION AREA COMPARISON: VIRGINIA				
ENERGY TYPE	CONSUMPTION UNIT (in millions)	VA No-Build	VA IRA	VA LINE A	Duck Run			Lebanon Church	
					Line D1	Line D2	Line A	Line L	Line A
Construction	Annual liters	n/a	1.249	5.884	3.952	3.288	3.397	1.616	1.548
	Annual gallons	n/a	0.330	1.555	1.044	0.869	0.898	0.427	0.409
Maintenance	Annual liters	0.056	0.056	0.071	0.058	0.058	0.058	0.073	0.073
	Annual gallons	0.015	0.015	0.018	0.015	0.015	0.015	0.019	0.019
Operational	Annual liters	51,468.876	52,918.517	55,940.257	905.198	905.198	905.198	1,444.677	1,509.215
	Annual gallons	31.102	31.978	33.804	0.547	0.547	0.547	0.873	0.912
TOTAL	Annual liters	51,468.932	52,919.822	55,946.212	909.208	908.544	908.653	1,446.366	1,510.836
	Annual gallons	31.117	32.323	35.377	1.606	1.431	1.460	1.319	1.340

X. CONSTRUCTION IMPACTS

Construction activities for any of the Scheme Options would affect the residents of the immediate project area and those traveling in the vicinity. These impacts could include the temporary degradation of air, noise, and water quality, the temporary impedance to the maintenance and control of traffic, additional safety concerns as a result of changes in traffic flow patterns; the stockpiling and disposal of construction materials; and the use and mitigation of borrow areas.

1. AIR QUALITY

Construction activities for the IRA or the Build Alternative could have a short-term impact on local air quality during periods of site preparation. Particulate matter, also known as fugitive dust, has the greatest impact during construction activities. This impact would occur in association with excavation and earth moving; cement, asphalt, and aggregate handling; heavy equipment operation; the use of haul roads; and wind erosion of exposed areas and material storage piles. The effect of fugitive dust would be temporary and would vary in scale depending on local weather conditions, the degree of construction activity and the nature of the construction activity.

a. West Virginia

During construction of either the IRA or the Build Alternative, this effect would be minimized by requiring the contractor to adhere strictly to dust control measures as outlined in the WVDOT's Standard Specifications on page 423, "636.4 Aggregates and Dust Palliatives". Where fugitive dust is likely to be a problem, effective dust control measures could be implemented following standard roadway construction procedures. These measures may include:

- Minimizing the area of exposed erodible earth;
- Stabilizing exposed earth with grass, mulch, pavement, or other cover as early possible;
- Periodic sweeping or the application of water or stabilizing agents to the working and haulage areas;
- Covering, shielding, or stabilizing stockpiled material, as necessary, and;
- Using covered haul trucks.

All open burning would be done in accordance with all applicable laws, ordinances and regulations, and would be further subject to the applicable provisions of Office of Air Quality's West Virginia Administration Regulations, Chapter 126-20, Series IV.

b. Virginia

During construction of the IRA or the Build Alternative, the Contractor should comply with the provisions of Section 107.01 (LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC, Laws to Be Observed) and especially with the State Air Pollution Control Law and Rules of the State Air Pollution Control Board, including notifications required therein.

Burning should be done in accordance with applicable local laws and ordinances. Burning should be performed under the constant surveillance of competent watch persons. The Contractor should not burn rubber tires, asphaltic materials, used crankcase oil, or similar materials which produce dense smoke, either to dispose of such materials or as an ignitor or promoter in the burning of other materials. Care should be exercised so that the burning of materials does not destroy or damage public or private property, or cause excessive air pollution.

2. NOISE

Under either the IRA or the Build Alternative, heavy equipment operations and certain construction activities, such as pile driving and the vibratory compaction of embankments would result in temporary noise increases within the area. All such potential impacts would be limited in duration to the actual construction period and limited to the immediate vicinity of the work in progress.

a. West Virginia

Any anticipated noise impacts would be confined to time periods considered relatively "noise tolerant" periods generally accepted to be normal weekday working hours as well as the possible use of temporary sound barriers or any additional measures recommended and contained in WVDOT's *Standard Specifications*. To reduce the construction noise impact, WVDOT may recommend the following mitigation measures:

- The contractor would be required to use construction equipment with operable mufflers.
- The contractor would be prohibited from working on the approaches in residential areas during the hours between 10 PM and 6 AM.

The construction noise abatement measures described would be included in contract plans for the project.

b. Virginia

The Contractor's operations should be performed in such a manner that the exterior noise levels measured at a noise sensitive activity should not exceed 80 dB(A) during periods of such activity.

Noise sensitive activity is defined as any activity for which lowered noise levels are essential if such activity is to serve its intended purpose. Noise sensitive activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.

VDOT reserves the right to monitor construction-related noise, as deemed necessary. In the event construction noise levels exceed the criteria herein, the Contractor should take such action as necessary to conform before proceeding with operations. The Contractor should be responsible for all costs associated with the abatement of construction noise and with the delay of operations due to non-compliance with these requirements. VDOT also reserves the right to prohibit or restrict to certain portions of the project, any work which produces objectionable noise during normal sleep hours (10 p.m. to 6 a.m), unless other hours are established by local ordinance. In such instances, the local ordinance should govern the hours of construction operation. Equipment should in no way be altered so as to result in noise levels which are greater than those produced by the original equipment. When feasible, the Contractor should establish haul routes which direct vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.

These requirements are not applicable if the ambient noise (noise produced by sources other than the Contractor's operation) at the point of reception is greater than the noise from the Contractor's operation at the same point.

3. WATER QUALITY

Effects to water quality resulting from erosion and sedimentation, as well as from pollutants such as chemicals, fuels, lubricants, bitumins, raw sewage, and other harmful waste, would be strictly controlled in accordance with Sections 107 and 642 of WVDOT's *Standard Specifications,* as well as WVDOTs *Erosion and Sedimentation Control Manual* (1993) and Sections 107 and 303 of VDOT's *Specifications*. The Contractor would exercise every reasonable precaution necessary during construction to prevent pollution of rivers, streams, or impoundments. All construction discharge would be adequately filtered prior to discharge into waters and would meet the requirements of the West Virginia Administrative Regulations, State Water Resources Board, Chapters 20-5 and 20-5A. During spawning seasons, discharges and construction activities in spawning areas would be restricted so as not to disturb or inhibit aquatic species. In the event the contractor dumps, discharges, or spills any contaminate which may affect water quality, he/she would immediately notify all appropriate local, state, and federal agencies and would take immediate action to contain and remove the contaminate.

4. MAINTENANCE AND CONTROL OF TRAFFIC

Under either the IRA or the Build Alternative, maintenance of the current flow of traffic on the existing roadway network would be planned and scheduled to minimize adverse impacts to the traveling public. Within construction areas, traffic control measures using standard practices would be used, as outlined in West Virginia's *Traffic Control for Streets and Highway Construction and Maintenance* and the Virginia's *Work Area Protection Manual*. In addition to using these standards, news releases of construction activities and schedules would be made available to the public.

Construction of the IRA would disrupt the daily users of the existing roadways being upgraded. Most of the IRA would follow existing roadways with short areas of relocation to improve vertical and horizontal curves. The primary areas where the IRA would be on new alignment include the area around Elkins, Roaring Run, Thomas, the area between Moorefield and Bismarck, Patterson Mountain, Moorefield, and east of Great North Mountain. Construction would be sequenced to upgrade large roadway segment to avoid disturbing an entire geographical area. However, because the IRA would involve upgrading much of the existing roadway, disturbances would be lengthy in terms of the area affected and the duration of construction. Therefore, traffic control patterns would require the use of temporary widening and temporary roadways. The use of detour routes would not be effective because the area is rural and the number of alternate routes is limited. Because the IRA would use existing roads where businesses and homes are located, extensive efforts would be made to provide accessibility. Regardless of the amount of planning, ingress and egress would be hampered by the IRA's construction activities.

Because the Build Alternative would be on new alignment, maintenance of traffic for its construction would mostly impact the existing roadway network where it crosses existing roads. Disturbances would be relatively short in terms of the length of road affected. The number of disturbances within a geographic area could be limited to protect communities or geographical areas from being inundated with construction zones. Because these disturbances are limited, most work would use flagging operations or the temporary widening of existing roads.

5. HEALTH AND SAFETY

During the course of construction, the Contractor would comply with all federal, state, and local laws governing safety, health, and sanitation. All reasonable safety considerations and safeguards necessary to protect the life and health of employees on the job, the safety of the public, and the protection of property in connection with roadway construction, would be taken.

6. POLLUTION CONTROL

Project construction would consist of roadways and bridges requiring excavation of unsuitable materials, placement of embankments, and the use of materials such as aggregates, bituminous, and portland cement concrete. The stockpiling and disposal of the construction and excavation materials may be visually displeasing to some of the residents along the construction corridor. However, this would be a temporary condition and should pose no permanent problems with the use of the required temporary erosion control features. The Contractor would be responsible for his/her methods of placing the necessary features of pollution control on haul roads, borrow and other materials pits, areas used for the disposal of waste materials, and other potential pollutants associated with the construction of the project. Temporary erosion control features would consist of berms, dikes, temporary seeding, sediment traps, fiber mats, silt fences, slope drains, mulches, crushed stone, and others, as specified in Section 642 and Section 107, respectively, of WVDOT's and VDOT's *Specifications*.

Existing conditions that would pose problems to the constructability of Corridor H, such as large cuts and fills, rockfall areas, deep-mined and strip-mined areas, stream crossings and relocations, etc., would be handled individually during preliminary and final design. The final alignment would be placed in the most practical location to avoid construction problem areas and sensitive natural resource areas. In-depth geotechnical research, reconnaissance, and core borings would be used to make sound engineering judgments to solve difficult construction problems as they arise.

Y. RELATIONSHIP OF LOCAL SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

Under either the IRA or the Build Alternative, the construction phase of the project would cause limited adverse effects on the environment which have been deemed to be short-term. Adverse effects have been evaluated in detail and mitigation measures identified. In addition, careful attention would be given to the problems identified during design. Proposed mitigation measures, some temporary and some permanent, would minimize adverse short-term effects and avoid any substantial long-term damage.

The proposed project would be classified as a long-term productive facility. This project, with its desirable design characteristics, would provide for safe and efficient vehicle operation for future, as well as present, traffic volumes. The benefits such as reduced operating costs, reduced travel time, reduced accidents, and general economic enhancement of the area offered by the long-term productivity of this project should more than offset the short-term inconvenience and adverse effects on the human environment.

Z. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Implementation of the IRA or the Build Alternative would involve a commitment of a range of natural, physical, human, and fiscal resources. Land used in the construction of the proposed facility is considered an irreversible commitment during the period that the land is used for a highway facility. However, if a greater need arises for use of the land, or if the highway facility is no longer needed, the land can be converted to another use. At present, there is no reason to believe such a conversion would be necessary or desirable.

Considerable amounts of fossil fuels, labor, and highway construction materials such as cement, aggregate, and bituminous material would be expended. In addition, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are not generally retrievable. They are not in short supply, and their use would not have an adverse effect upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of both state and federal funds which are not retrievable.

The commitment of these resources is based on the concept that residents in the immediate area, state, and region would benefit by the improved quality of the transportation system. These benefits would consist of improved accessibility and safety, savings in time, fuel savings, and greater availability of quality services which are anticipated to outweigh the commitment of these resources.

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SECTION IV:
SECTION 4(f)/6(f) CONSIDERATIONS

SECTION IV:
SECTION 4(F) AND SECTION 6(F) RESOURCES

In accordance with Section 4(f) of the 1966 Department of Transportation Act and Section 6(f) of the 1965 Land and Water Conservation Fund Act (LWCFA), overall evaluations have been conducted for properties determined to be qualified for Section 4(f) and Section 6(f) evaluations.

While the Section 4(f) statute does not require the preparation of any written document, the FHWA has developed procedures for the preparation, circulation, and coordination of Section 4(f) documents via its 1987 "Section 4(f) Policy Paper". This evaluation has been prepared in accordance with the guidelines set forth in the FHWA's Policy Paper. As stated in the FHWA Policy Paper, "a project may proceed without consideration under Section 4(f) if that land was purchased for transportation purposes prior to the designation or prior to a change in the determination of significance and if an adequate effort was made to identify properties protected by Section 4(f) prior to the acquisition." In accordance with this policy provision, an appropriate effort was made to identify all Section 4(f) resources. At this time, the resources evaluated are the only known Section 4(f) resource affected by the proposed project.

FHWA's Section 4(f) Policy Paper indicates it is not required to have the Section 4(f) evaluation in the EIS because they are two separate processes; the EIS is prepared in accordance with NEPA and the Section 4(f) evaluation is prepared in accordance with Section 4(f) of the 1966 Department of Transportation Act (FHWA Policy Paper, p. 8). All Section 4(f) evaluations are approved at the FHWA Regional Office. If the Section 4(f) evaluation is contained in an EIS, the Region will make the Section 4(f) approval either in its approval of the final EIS or in the Record of Decision (ROD). In those cases where the Section 4(f) approval is made in the final EIS, the basis for the Section 4(f) approval will be summarized in the ROD (FHWA Policy Paper, p. 8).

A. SECTION 4(F)/6(F) APPLICABILITY

Section 4(f) is applicable only to agencies within the US Department of Transportation and applies to publicly owned parks, recreation areas, and wildlife and waterfowl refuges, as well as historic and archaeological sites listed or eligible for listing on the National Register of Historic Places (NRHP). When a project uses land protected by Section 4(f), a Section 4(f) evaluation must be prepared.

There are often concurrent requirements of other federal agencies when Section 4(f) lands are involved in highway projects. This includes the approval of land conversions protected by Section 6(f) of the Land and Water Conservation Fund Act (LWCFA). State and local governments often obtain grants through the LWCF to acquire or make improvements to parks and recreation areas. Section 6(f) of the LWCF prohibits the conversion of property acquired or developed with these grants to a non-recreational purpose without the approval of the US Department of Interior - National Park Service. Based on coordination with the Department of Interior, the West Virginia Division of Community Development, and the Virginia Department of Conservation and Recreation, there would be no Section 6(f) property conversions under either the No-Build, Improved Roadway, or Build Alternative. Therefore, the provisions of Section 6(f) of the LWCFA would not be applicable.

The 1992 *Corridor Selection SDEIS* initiated the Section 4(f) coordination process for the project. Because national forests are multiple-use federal properties, representatives of the Monongahela National Forest and the George Washington National Forest were asked to provide their recommendations of Section 4(f) applicability within their managed lands. Representatives of the George Washington National Forest responded that the project would not involve resources they considered Section 4(f). Representatives of the Monongahela National Forest provided recommendations as to which management prescriptions they felt Section 4(f) status would and would not be applicable. FHWA accepted the Forest Service's recommendations that management prescription (MP) 6.2 and 5 qualify as Section 4(f) resources. The alignment development process specifically avoided all lands within the MNF that fall under MP 6.2 or MP 5.

The alignment selection process initiated a second round of Section 4(f) coordination activities, once the detailed alignments were developed. Jurisdictional authorities contacted included the US Department of Housing and Urban Development, the US Department of Interior, and the US Department of Agriculture, as well as the West Virginia Division of Community Development, the Virginia Department of Conservation and Recreation, and numerous local officials. On the basis of this coordination, neither the IRA nor the Build Alternative would require the use of any publicly owned land from a park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance, as determined by the Federal, state, and local officials having jurisdiction thereof.

The IRA and the Build Alternative may require the use of land from historic resources either listed or eligible for listing in the National Register of Historic Places (NRHP). However, due to the status of the separate but related Section 106 process, the final determinations of eligibility and the boundaries of Section 4(f) properties are not currently known. Coordination with the West Virginia Division of Culture and History and the Virginia Department of Historic Resources will continue so that these evaluations can be completed.

SECTION V:
LIST OF PREPARERS

SECTION V:
LIST OF PREPARERS

This document was prepared by the US Department of Transportation, Federal Highway Administration, and the West Virginia Department of Transportation, with assistance from Michael Baker Jr., Inc., consulting engineers and planners.

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Ms. Jennifer M. Graf Environmental Scientist ***Wetlands***	B.S. degree in Natural Resource Management with 7 years experience in environmental assessments and impact statements.
Mr. William J. Jeffords, Jr. Environmental Scientist ***Water Resources***	B.S. degree in Secondary Science Education with 8 years experience in natural resource field investigation.
Mr. Laurence D. Gale Environmental Scientist ***Water Resources***	M.S. degree in Marine Biology with 7 years experience in water resources and wetland ecology.
Mr. Timothy J. Smith Environmental Scientist ***Threatened & Endangered Species, Wildlife Studies***	M.S. degree in Wildlife Sciences with 6 years experience in threatened and endangered wildlife studies.
Mr. Daniel P. Wallace Environmental Engineer ***Floodplains***	M.S. degree in Water Resources with 6 years experience in civil engineering, specializing in hydrology and water resources.
Mr. David Bednar, Jr., P.G. Geologist ***Geology, Hazardous Waste, and Hydrology***	M.S. degree in Geology with 5 years experience in groundwater studies and hydrogeology.
Mr. Andrew P. Kuchta Environmental Scientist ***Air, Noise, and Energy***	B.A. degree in Geography/Community Urban and Regional Planning with 11 years experience in air quality and noise studies.
Mr. Kenneth R. Mobley Senior Planner ***Socioeconomics and Land Use***	M.S. degree in Public Policy and Management with 5 years experience in economic and development impacts.
Mr. Edward J. Siemon, III Cultural Resources Section Manager ***Cultural Resource Studies***	B.A. degree in Anthropology with 18 years experience in archaeology and cultural resource management.
Mr. Ronald C. Carlisle, Ph.D. Senior Historian ***Historic Studies***	Ph. D degree in Anthropology with 22 years experience in prehistoric and historic archaeological and historic studies.
Mr. William C. Johnson, Ph. D. Senior Archaeologist ***Prehistoric Studies***	Ph. D. degree in Anthropology with 25 years experience in prehistoric and historic archaeological studies.
Ms. Denise L. Grantz Archaeologist ***Cultural Resource Studies***	M.A. degree in Social Sciences/Cultural Resources Management with 16 years experience in prehistoric and historic archaeological and historic studies.

MICHAEL BAKER JR., INC. (Cont.)

Mr. Keith Bastianini Archaeologist ***Cultural Resource Studies***	B.A. degree in Anthropology with 9 years experience in archaeology.
Mr. Bryan C. West Archaeologist ***Cultural Resource Studies***	B.A. degree in Anthropology with 7 years experience in archaeology.
Mr. Max L. Heckman, P.E. Assistant Manager ***Traffic Analysis***	B.S. degree in Civil Engineering with 15 years experience in transportation and traffic planning.
Mr. Michael A. Babusci Senior Designer ***Traffic Analysis***	B.S. degree in Civil Engineering with 10 years experience in traffic engineering.
Mr. Thomas Brandon, P.E. Chief Engineer, Southeast Region ***Design Engineering***	B.S. degree in Civil Engineering with 17 years experience in the design of highways and related transportation facilities.
Mr. J. Allen Lane, L. S. Assistant Project Manager ***Design Engineering***	28 years experience in the design of highways and related transportation facilities.
Mr. Thomas J. Yucha Assistant Engineer I ***Design Engineering***	B.S. degree in Civil Engineering with 5 years experience in highway design.
Mr. William F. Mackey, Jr. IGDS Operating Systems Analyst ***Design Engineering***	B.S. degree in Applied Mathematics and Computer Science with 5 years experience in highway design and computer applications.
Mr. David T. Caudill, P.E. Structural Engineer ***Major Drainage Structure, HEC 2 Analysis***	B.S. degree in Civil Engineering with 9 years experience in bridge design and related computer applications.
Mr. Jack Gilbert, P.E. Manager ***Design Engineering***	B.S. degree in Mechanical Engineering with 35 years experience in transportation design.
Mr. Robert A. Alvis, P.E. Senior Engineer ***Design Engineering***	B.S. degree in Civil Engineering with 31 years experience in transportation design.

SUB-CONSULTANTS

Thomas K. Pauley, Ph.D. Pauley Biological Consultants, Inc. ***Cheat Mountain Salamander Survey***	Ph.D. degree in Ecology with 28 years of experience studying salamander ecology and 18 years of experience studying the Cheat Mountain Salamander.
Mr. Thomas J. Aley, P.G. Ozark Underground Laboratory, Inc. ***Hydrogeology and Spring Studies***	M.S. degree in Forestry with an emphasis in wildland hydrology; 27 years experience in ground water and surface water hydrology, pollution control investigation, and spring system studies with dye tracing.

SECTION VI:
DISTRIBUTION OF STATEMENT

SECTION VI: DISTRIBUTION OF STATEMENT

Copies of the Alignment Selection Supplemental Draft Environmental Impact Statement have been distributed to the following agencies and organizations:

FEDERAL AGENCIES

1. Advisory Council on Historic Preservation - Washington, DC
2. Environmental Protection Agency Office of Federal Activities (A-104) - Washington, DC
3. Environmental Protection Agency - Philadelphia, PA
4. Federal Highway Administration - Baltimore, MD
5. Federal Highway Administration - Charleston, WV
6. Federal Highway Administration - Washington, DC
7. Federal Railroad Administration - Washington, DC
8. Federal Transit Administration - Washington, DC
9. National Park Service - Philadelphia, PA
10. Secretary of Transportation, US Department of Transportation - Washington, DC
11. US Army Corps of Engineers - Norfolk, VA
12. US Army Corps of Engineers - Pittsburgh, PA
13. US Department of Agriculture, George Washington National Forest - Edinburgh, VA
14. US Department of Agriculture, Monongahela National Forest - Elkins, WV
15. US Department of Agriculture, Soil Conservation Service - Keyser, WV
16. US Department of Agriculture, Soil Conservation Service - Moorefield, WV
17. US Department of Agriculture, Soil Conservation Service - Petersburg, WV
18. US Department of Agriculture, Natural Resource Conservation Service - Romney, WV
19. US Department of Agriculture, Soil Conservation Service - Winchester, VA
20. US Department of the Interior Office of Environmental Project Review - Washington, DC
21. US Department of the Interior, Fish and Wildlife Service - Elkins, WV

STATE OF WEST VIRGINIA

1. WV Board of Education - Charleston, WV
2. WV Department of Employment Security - Charleston, WV
3. WV Department of Transportation - Charleston
4. WV Department of Transportation District 5 - Burlington, WV
5. WV Department of Transportation District 8 - Elkins, WV
6. WV Department of Health & Human Services - Charleston, WV
7. WV Development Office, Community Development Division - Charleston, WV
8. WV Development Office - Charleston, WV
9. WV Division of Environmental Protection - Charleston, WV
10. WV Division of Environmental Protection - MacArthur, WV
11. WV Division of Culture & History - Charleston, WV
12. WV Division of Natural Resources Operations Center - Elkins, WV
13. WV Division of Natural Resources - Charleston, WV
14. WV Division of Tourism & Parks - Elkins, WV
15. WV Office of Emergency Services - Charleston, WV

COMMONWEALTH OF VIRGINIA

1. VA Council on the Environment - Richmond, VA
2. VA Department of Conservation & Recreation - Richmond, VA
3. VA Department of Environmental Quality - Glen Allen, VA
4. VA Department of Game & Inland Fisheries - Richmond, VA
5. VA Department of Historic Resources - Richmond, VA
6. VA Department of Transportation - Edinburgh, VA
7. VA Department of Transportation - Richmond, VA
8. VA Department of Transportation - Staunton, VA

STATE OF MARYLAND

1. Garrett County Clerk - Oakland, MD
2. Garrett County Development Corporation - Oakland, MD

OTHER GOVERNMENT AGENCIES - West Virginia

1. City Clerk - Parsons, WV
2. City Clerk - Petersburg, WV
3. City Clerk - Romney, WV
4. Executive Director Hardy County Rural Development Authority - Moorefield, WV
5. Executive Director Reg. VII Planning & Development Council - Buckhannon, WV
6. Executive Director Reg. VIII Planning & Development Council - Petersburg, WV
7. Grant County Clerk - Petersburg, WV
8. Grant County Commissioner - Burlington, WV
9. Grant County Development Authority - Petersburg, WV
10. Hampshire County Clerk - Romney, WV
11. Hampshire County Commissioner - Romney, WV
12. Hampshire County Development Authority - Romney, WV
13. Hampshire County Planning Commission - Romney, WV
14. Hardy County Clerk - Moorefield, WV
15. Hardy County Commissioner - Moorefield, WV
16. Hardy County Planner - Moorefield, WV
17. Keyser City Administrator - Keyser, WV
18. Mayor of Bayard, WV
19. Mayor of Davis, WV
20. Mayor of Elkins, WV
21. Mayor of Hambleton, WV
22. Mayor of Hendricks, WV
23. Mayor of Keyser, WV
24. Mayor of Montrose, WV
25. Mayor of Moorefield, WV
26. Mayor of Parsons, WV
27. Mayor of Petersburg, WV
28. Mayor of Romney, WV
29. Mayor of Thomas, WV
30. Mayor of Wardensville, WV
31. Mineral County Chamber of Commerce - Keyser, WV
32. Mineral County Clerk - Keyser, WV
33. Mineral County Commissioner - Keyser, WV
34. Mineral County Development Authority - Keyser, WV
35. Preston County Chamber of Commerce - Kingwood, WV
36. Preston County Commissioner - Rowlesburg, WV

37. Randolph County Chamber of Commerce - Elkins, WV
38. Randolph County Clerk - Elkins, WV
39. Randolph County Commissioner - Elkins, WV
40. Randolph County Development Authority - Elkins, WV
41. Town Recorder - Moorefield, WV
42. Town Recorder - Wardensville, WV
43. Tucker County Chamber of Commerce - Buckhannon, WV
44. Tucker County Clerk - Parsons, WV
45. Tucker County Commissioner - Parsons, WV
46. Tucker County Development Authority - St. George, WV
47. Tucker County Planning Commission, Davis, WV

OTHER GOVERNMENT AGENCIES - Virginia

1. 7th Planning District Commission Lord Fairfax Planning District - Front Royal, VA
2. County Office - Winchester, VA
3. Frederick County Parks & Recreation Department - Winchester, VA
4. Frederick County Chamber of Commerce - Winchester, VA
5. Frederick County Clerk - Winchester, VA
6. Frederick County Economic Development Commission - Winchester, VA
7. Frederick County Planning Commission - Winchester, VA
8. Mayor of Strasburg, VA
9. Mayor of Winchester, VA
10. Shenandoah County Parks & Recreation Department - Woodstock, VA
11. Shenandoah County Board of Supervisors - Woodstock, VA
12. Shenandoah County Chamber of Commerce - Woodstock, VA
13. Shenandoah County Clerk - Woodstock, VA
14. Shenandoah County Economic Development Council - Woodstock, VA

UNITED STATES POST OFFICES

1. Post Master - Baker, WV
2. Post Master - Bayard, WV
3. Post Master - Capon Springs, WV
4. Post Master - Davis, WV
5. Post Master - Elkins, WV
6. Post Master - Fisher, WV
7. Post Master - Hambleton, WV
8. Post Master - Hendricks, WV
9. Post Master - Kerens, WV
10. Post Master - Keyser, WV
11. Post Master - Lahmansville, WV
12. Post Master - Maysville, WV
13. Post Master - Montrose, WV
14. Post Master - Moorefield, WV
15. Post Master - Mt. Storm, WV
16. Post Master - Old Fields, WV
17. Post Master - Parsons, WV
18. Post Master - Petersburg, WV
19. Post Master - Romney, WV
20. Post Master - Scherr, WV
21. Post Master - Star Tannery, VA
22. Post Master - Strasburg, VA
23. Post Master - Thomas, WV
24. Post Master - Wardensville, WV
25. Post Master - Winchester, VA

LIBRARIES

1. Rivers Library - Parsons, WV
2. Allegheny Mountain Top Public Library - Mt. Storm, WV
3. Elkins - Randolph County Public Library - Elkins, WV
4. Hampshire County Public Library - Romney, WV
5. Hardy County Public Library - Moorefield, WV
6. Keyser Public Library - Keyser, WV
7. Handley Regional Library - Winchester, VA
8. Strasburg Community Library - Strasburg, VA

HIGH SCHOOLS

1. East Hardy High School - Baker, WV
2. Elkins High School - Elkins, WV
3. Tucker County High School - Hambleton, WV
4. Keyser High School - Keyser, WV
5. Moorefield High School - Moorefield, WV
6. Union High School - Mt. Storm, WV
7. Petersburg High School - Petersburg, WV
8. Hampshire High School - Romney, WV
9. Shenandoah High School - Stephens City, VA
10. Park View High School - Sterling, VA
11. Strasburg High School - Strasburg, VA
12. James Wood High School - Winchester, VA

INTEREST GROUPS

1. West Virginians for Corridor H - Elkins, WV
2. Sierra Club - Morgantown, WV
3. Corridor H Alternatives Central West Virginia - Kerens, WV
4. Corridor H Alternatives Eastern West Virginia - Wardensville, WV
5. Corridor H Alternatives Northern West Virginia - New Creek, WV
6. Corridor H Alternatives Virginia - Strasburg, VA
7. Virginia Advisory Committee

SECTION 106 CONSULTING PARTIES

1. Capon Springs & Farms - Capon Springs, WV

SECTION VII:
COMMENTS AND COORDINATION

SECTION VII: COMMENTS AND COORDINATION

A Public Involvement Program has been developed and is being carried out as an integral part of this project. The purpose of this program is to establish and maintain communication with the public at-large and individuals and agencies concerned with the project and its potential impacts. To ensure open communication and agency and public input, and to provide a substantial issue identification/problem solving effort, WVDOT has carried out the scoping process as required by the Council on Environmental Quality Guidelines. Detailed information on the early scoping meeting held prior to the Corridor Selection SDEIS is available from WVDOT. This section of the document details WVDOT's program to identify fully , address, and resolve all project-related issues identified through the public involvement program. This section summarizes the following:

- Resource Agency Meetings and Coordination
- Public Involvement Meetings and Coordination
- Resource Agency and Public Comments Prior to the Alignment Selection SDEIS

A. AGENCY COORDINATION

Resource agency meetings and coordination efforts have been ongoing throughout the alignment selection process. Coordination efforts included requests for agency input at the initiation of the alignment selection process; during the alignment development process via field reviews; during the identification of alignments to be eliminated or carried forward; and during the alignment study efforts. Appendix C contains copies of the agency comments received, as well as responses to them.

1. AGENCY COORDINATION MEETINGS

Following the selection of a preferred corridor, resource agencies and officials were given an opportunity to comment at the initiation of the alignment selection process. The purpose of the initial meetings was to discuss the project status, discuss how alternatives and alignments would be developed, and present the methodologies for assessing project-related impacts. Resource agencies were active participants throughout the alignment selection process. Table VII-1 identifies the meeting dates and agencies represented at the initial alignment selection coordination meetings. The table also identifies the primary issues discussed at each of the meetings.

TABLE VII-1
COORDINATION MEETINGS THROUGHOUT THE ALIGNMENT SELECTION PROCESS

DATE & LOCATION	MEETING ATTENDEES	MEETING PURPOSE	ISSUES DISCUSSED
7/6/93	WVDNR, WVDEP, FWS, Baker	Initial agency coordination for alignment selection process	◆ *Corridor Selection Decision Document* status ◆ Development of alternatives ◆ Technical methodologies.
7/8/93	EPA, Baker	Initial agency coordination for alignment selection process	◆ *Corridor Selection Decision Document* status ◆ Development of alternatives ◆ Secondary and cumulative impact assessments ◆ Technical methodologies.
7/9/93	WVDNR, Baker	Initial agency coordination for alignment selection process	◆ *Corridor Selection Decision Document* status ◆ Development of alternatives ◆ Technical methodologies.
7/12/93	ACOE, Baker	Initial agency coordination for alignment selection process	◆ *Corridor Selection Decision Document* status ◆ Development of alternatives ◆ Technical methodologies.
7/16/93	VDHR, Baker	Initial agency coordination for alignment selection process	◆ Section 106 process
7/19/93 & 7/20/93	VDEQ-Waste, Air, Water Div., VDHR, VMRC, VDCR, VDOT, ACOE - Norfolk District, FWS, EPA, CHA, Baker	VDOT's monthly Interagency Coordination Meeting Corridor H was one of many items on VDOT's monthly meeting agenda	◆ Meeting served as initial Virginia agency coordination for alignment selection process ◆ Development of alternatives ◆ Technical methodologies.
8/24/93	FWS, Baker	On-site field methodologies	◆ Wetland & water quality field techniques
8/25/93	MNF, Baker	Initial agency coordination for alignment selection process	◆ *Corridor Selection Decision Document* status ◆ Development of alternatives ◆ Technical methodologies
9/7/93	VAC, VDOT, Baker	VAC kick-off meeting	◆ Brainstorm community goals ◆ Brainstorm how Corridor H could help meet these goals
10/12/93	VAC, VDOT, Baker	VAC meeting	◆ Project status overall and in Virginia ◆ Discussion of alternatives in Section 2
10/26/93	Grant County Development Authority, Baker	Coordination on secondary development methodology and data collection	◆ Secondary development process, projections, utility availability and access issues ◆ Comparison of IRA impacts
10/26/93	Region VIII Planning & Development Council, Baker	Coordination on secondary development methodology and data collection	◆ Secondary development process, projections, utility availability and access issues ◆ Comparison of IRA impacts
10/28/93	VAC, VDOT, Baker	VAC meeting	◆ Project status overall and in Virginia ◆ Commonwealth Transportation Board's resolution on Corridor H ◆ Discussion of alternatives in Section 1 ◆ Discussion of whether or not Corridor H alternatives could help meet community goals
12/10/93	ACOE - Pittsburgh District, Baker	Initiation of Section 404 Permit Applications	◆ Joint Public Notice ◆ Manner in which to handle project location due to magnitude of project

TABLE VII-1 (CONT.)
COORDINATION MEETINGS THROUGHOUT THE ALIGNMENT SELECTION PROCESS

DATE & LOCATION	MEETING ATTENDEES	MEETING PURPOSE	ISSUES DISCUSSED
1/13/94	VAC, VDOT, WVDOT, Baker	VAC meeting	• Completed discussion on whether Corridor H could help meet community goals
2/16/94 & 2/17/94	Wardensville, Capon Springs & Farms, OUL, Baker	Hydrogeology issues related to Lost River, Capon Springs, and Wardensville	• Discuss method to evaluate and assess potential impacts
3/9/94	EPA, FWS, SCS, FHWA, GWNF, MNF, ACHP, WVDEP, WVDNR, WVDCH, WVDHHS, WVDOT, Baker	Agency concurrence on alternatives carried forward	• Review of all alignments to date • Presentation of alignments considered but eliminated • Discussion of alignments to be carried forward
3/11/94	ACOE, Baker	Agency concurrence on alternatives carried forward	• Review of all alignments to date • Presentation of alignments considered but eliminated • Discussion of alignments to be carried forward
3/15/94	ACHP, WVDCH, WVDOT, Baker	Integration of Section 106 process in Corridor H tiered process	• Specific discussions focused on inclusion of archaeological resources in the *Alignment Selection SDEIS* • Discuss methods to field test Baker's predictive settlement pattern model
3/16/94	Capon Springs & Farms, WVDCH, FHWA, WVDOT, Baker	Potential impacts to Capon Springs & Farms, Inc.	• Capon Springs concerns over proposed project
3/29/94	EPA, Baker	Agency concurrence on alternatives carried forward	• Review of all alignments to date • Presentation of alignments considered but eliminated • Discussion of alignments to be carried forward
4/13/94	WVDCH, WVDOT, Baker	Proposed aboriginal settlement pattern model and testing	• Discuss acceptable and appropriate field testing methodologies for cultural resource analyses • Identify appropriate testing locations and methodologies
4/19/94	VDEQ, VDGIF, VDHR, VDCR, VDOT, WVDOT, Baker	Agency concurrence on alternatives carried forward	• Review of all alignments in Virginia • Presentation of alignments considered but eliminated in Virginia • Discussion of alignments to be carried forward in Virginia
4/28/94	EPA, FWS, ACOE, SCS, WVDNR, WVDEP, WVDOT, Baker	Wetland mitigation	• Wetland mitigation replacement ratios and conceptual plan
5/5/94	ACOE - Pittsburgh District, Baker	Section 404 Permit Application	• Agreed on application format and contents
5/5/94	WVDCH, WVDOT, Baker	Proposed aboriginal settlement pattern model and testing	• Discuss proposed statistical methodology for testing of settlement pattern • WVDCH accepted methodology proposed by WVDOT and Baker
5/6/94	FWS, EPA, WVDNR, WVDEP	Wetland mitigation	• Interagency teleconference to concur on mitigation rations and location of sites

TABLE VII-1 (CONT.)
COORDINATION MEETINGS THROUGHOUT THE ALIGNMENT SELECTION PROCESS

DATE & LOCATION	MEETING ATTENDEES	MEETING PURPOSE	ISSUES DISCUSSED
5/12/94	Lord Fairfax Planning District, VDOT, Baker	Coordination on secondary development methodology and data collection	◆ Secondary development process ◆ Regional plans for Frederick and Shenandoah Counties ◆ Comparison of IRA impacts
5/13/94	Tucker County Planning Department, Baker	Coordination on secondary development methodology and data collection	◆ Secondary development results ◆ Land use availability in Tucker County ◆ Canaan Valley Refuge ◆ Utility expansions and access issues ◆ Comparison of IRA impacts
5/13/94	Hardy County Planning Department, Baker	Coordination on secondary development methodology and data collection	◆ Secondary development model preliminary results ◆ Poultry industry and new projects ◆ IRA economic impacts
6/21/94	VAC, VDOT, Baker	VAC meeting	◆ Discuss scenic design features as applied to Corridor H
6/28/94	ACHP, WVDCH, FHWA, WVDOT, Baker, public	Section 106 meeting	◆ Public meeting on Section 106 (Historic Preservation) issues regarding Corridor H
7/15/94	VDHR, VDOT, Baker	Proposed aboriginal settlement pattern model and testing	◆ Discuss proposed statistical methodology for testing of settlement pattern in Virginia
7/27/94	VAC, VDOT, WVDOT, Baker	VAC meeting	◆ Present preliminary data to be contained in *Alignment Selection SDEIS*
8/2/94	Garrett County Planning Department, Baker (telephonic)	Coordination on secondary development methodology and data collection	◆ Status of comprehensive plans ◆ Results of development model
9/15/94	VAC, VDOT, Baker	VAC meeting	◆ Preparation of Statement of Consensus
9/27/94	VAC, VDOT, Baker	VAC meeting	◆ Preparation of Statement of Consensus
10/20/94	ACOE, EPA, FWS, MNF, WVDEP, WVDNR, WVDCH, FHWA, WVDOT, VDOT, Baker	Alignment Selection SDEIS Technical Presentation	◆ Review of study results ◆ Release of SDEIS ◆ Public Hearing schedule

Where:

ACHP = Advisory Council on Historic Preservation
ACOE = US Army Corps of Engineers
EPA = US Environmental Protection Agency
FHWA = Federal Highway Administration
FWS = US Fish and Wildlife Service
GWNF = USDA - George Washington National Forest
MNF = USDA - Monongahela National Forest
SCS = Soil Conservation Service
C = Virginia Advisory Committee
DCR = VA Department of Conservation and Recreation
VDEQ = VA Department of Environmental Quality
VDGIF = VA Department of Game and Inland Fisheries
VDHR = VA Department of Historic Resources
VDOT = VA Department of Transportation
VMRC = VA Marine Resources Commission
WVDCH = WV Division of Culture and History
WVDEP = WV Division of Environmental Protection
WVDHHS= WV Department of Health and Human Services
WVDNR = WV Division of Natural Resources
WVDOT = WV Department of Transportation
CHA = Corridor H Alternatives
OUL = Ozark Underground Laboratories
Baker = Michael Baker Jr., Inc.

2. AGENCY FIELD REVIEWS

Participating resource agencies were invited to field reviews of proposed alignments for both the IRA and the Build Alternative. Their comments, concerns, and suggestions were incorporated into the design of the alignments. Table VII-2 presents the dates of the field reviews by design section, as well as those agencies represented at the field reviews.

3. CONCURRENCE MEETING ON ALTERNATIVES CARRIED FORWARD

The culmination of the field reviews was the agency concurrence meetings in West Virginia (3/9/94) and Virginia (4/19/94). This concurrence step is an important point in the Integrated NEPA/Section 404 Process. The agency concurrence meetings were held to determine which alignments would be eliminated from further consideration and which would be carried forward for further evaluation in the *Alignment Selection SDEIS*. Table VII-1 identifies the agencies in attendance at both of these meetings. Letters requesting agency concurrence on alternatives to be carried forward were distributed by WVDOT and VDOT on April 8 and June 1, respectively. Table VII-3 identifies the agencies to whom the letters were sent, as well as the responses received to date. Copies of the agency concurrence responses are presented on Exhibits VII-1 through VII-9.

4. CONCURRENCE MEETING ON WETLAND MITIGATION

Appropriate wetland mitigation measures were evaluated following agency approval of alternatives to be carried forward. As shown on Table VII-1, a meeting was held on April 28, 1994 with affected resource agencies to obtain concurrence on the proposed measures in West Virginia. Those attending the meeting were in agreement with the proposed wetland mitigation plan to be submitted to the Army Corps of Engineers; the Section 404 permitting authority. At the meeting, representatives of the Corps stated they were in agreement with the plan and indicated their intention to approve the proposed mitigation strategy, barring any unforeseen circumstances. In addition to verbally approving the plan at the meeting, WVDNR, WVDEP, and EPA provided formal letters of concurrence. Copies of the agency mitigation concurrence responses are presented on Exhibits VII-10 through VII-12.

TABLE VII-2
FIELD REVIEW DATES AND ATTENDEES

SECTION	FIELD REVIEW DATE	RESOURCE AGENCIES AND GROUPS REPRESENTED																
		WVDOT	VDOT	FHWA	BAKER	USFS - Monongahela NF	USFS - George Washington NF	US FWS	US EPA - Region 3	US SCS	US ACOE - Pittsburgh District	US ACOE - Norfolk District	WV DNR	VA DEQ	VA DCR	GAI Engineering	Virginia Power	Corridor H Alternatives
1 & IRA	Oct. 27, 1993	✓	✓		✓		✓	✓				✓		✓	✓			✓
2 & IRA	Oct. 27, 1993	✓	✓		✓		✓	✓				✓		✓	✓			✓
3	Sept. 1 & 2, 1993	✓			✓		✓	✓					✓					
4	Sept. 1 & 2, 1993	✓			✓		✓	✓					✓					
5	Sept. 1 & 2, 1993	✓			✓		✓	✓					✓					
6	Sept. 8 & 9, 1993	✓			✓			✓		✓			✓					
7	Sept. 8 & 9, 1993	✓			✓			✓		✓			✓					
8	Sept. 8 & 9, 1993	✓			✓			✓		✓			✓					
9	Sept. 8 & 9, 1993	✓			✓			✓		✓			✓					
10	Sept. 22 & 23, 1993	✓			✓	✓		✓			✓		✓			✓	✓	
11	Sept. 22 & 23, 1993	✓			✓	✓		✓			✓		✓			✓	✓	
12	Sept. 22 & 23, 1993	✓			✓	✓		✓			✓		✓			✓	✓	
13	Oct. 6 & 7, 1993	✓			✓	✓		✓	✓				✓					
14	Oct. 6 & 7, 1993	✓			✓	✓		✓	✓				✓					
15	Oct. 20 & 21, 1993	✓			✓	✓		✓					✓					
16	Oct. 20 & 21, 1993	✓			✓	✓		✓					✓					
IRA in WV	Jan. 24, 25, & 26, 1994	✓		✓	✓	✓	✓	✓			✓							

TABLE VII-3

AGENCY CONCURRENCE ON ALTERNATIVES CARRIED FORWARD

AGENCIES TO WHOM LETTERS REQUESTING CONCURRENCE WERE SENT	CONCURRENCE LETTER RECEIVED
Advisory Council on Historic Preservation	nlr
NOAA National Marine Fisheries Service	June 20, 1994
US Army Corps of Engineers - Norfolk District	August 10, 1994
US Army Corps of Engineers - Pittsburgh District	April 18, 1994
US Environmental Protection Agency	May 4, 1994
US Fish and Wildlife Service	October 12, 1994
USDA George Washington National Forest	nlr
USDA Monongahela National Forest	May 18, 1994
USDA Soil Conservation Service	April 26, 1994
WV Department of Health and Human Services	May 13, 1994
WV Division of Culture and History	nlr
WV Division of Environmental Protection	nlr
WV Division of Natural Resources	April 27, 1994

Where: nlr = No letter received

EXHIBIT VII-1: ACOE - PITTSBURGH DISTRICT CONCURRENCE ON ALTERNATIVES

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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
Division of Highways
1900 Kanawha Boulevard East • Building Five • Room 109
Charleston, West Virginia 25305-0430 • 304/558-3505

Gaston Caperton
Governor

Charles L. Miller, P.E.
Secretary

Fred VanKirk, P.E.
Commissioner
State Highway Engineer

April 8, 1994

Mr. Robert Neill
US Army Corps of Engineers
Pittsburgh District
1000 Liberty Avenue
Pittsburgh, Pennsylvania 25222-4186

Dear Mr. Neill:

Appalachian Corridor H
Elkins to I-81
Concurrence Document
Alternatives to be carried forward

This is a follow-up to the March 9, 1994 meeting at the Civic Center in Charleston to discuss concurrence on the alternatives carried forward for the alignment phase of Corridor H. Your input has been and will continue to be important to the development of this project. As discussed at the close of the meeting, I have attached the results of the discussions in the form of a revised table, which lists the lines that will be carried forward in the Alignment Selection Supplemental Draft Environmental Impact Statement (SDEIS).

Please note the following revisions to the preliminary recommendations that came as a result of the meeting. In Section 5, line 5-A.1 will be carried forward and line 5-D will be eliminated. Two lines that were originally recommended to be carried forward, will not be eliminated as a result of your input, these are Lines 7-A.1 and 16-A.1. Note that in all cases, any line shown as eliminated will be described in detail in the Draft, shown on the plans (most likely in black), and the reasons for elimination from further consideration will be given.

The agency and signature line below can be used to state your concurrence in the alternatives carried forward and we would appreciate return receipt of this letter by May 13, 1994.

A list of meeting attendees is also attached. Thank you once again for your participation in this process.

Very truly yours,

Fred VanKirk
Commissioner
State Highway Engineer

FV:Ecb

Attachment

Agency: Corps of Engineers
Authorized Signature: Robert D. Neill
Date: 18 April 1994

EXHIBIT VII-2: SCS CONCURRENCE ON ALTERNATIVES

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
Division of Highways
1900 Kanawha Boulevard East • Building Five • Room 109
Charleston, West Virginia 25305-0430 • 304/558-3505

Gaston Caperton
Governor

Charles L. Miller, P.E.
Secretary

Fred VanKirk, P.E.
Commissioner
State Highway Engineer

April 8, 1994

RECEIVED
APR 26 1994
DEPT. OF TRANSPORTATION

Mr. Ed Kesecker
Soil Conservation Service
HC & Box 301
Industrial Park
Moorefield, West Virginia 26836

Dear Mr. Kesecker:

Appalachian Corridor H
Elkins to I-81
Concurrence Document
Alternatives to be carried forward

This is a follow-up to the March 9, 1994 meeting at the Civic Center in Charleston to discuss concurrence on the alternatives carried forward for the alignment phase of Corridor H. Your input has been and will continue to be important to the development of this project. As discussed at the close of the meeting, I have attached the results of the discussions in the form of a revised table, which lists the lines that will be carried forward in the Alignment Selection Supplemental Draft Environmental Impact Statement (SDEIS).

Please note the following revisions to the preliminary recommendations that came as a result of the meeting. In Section 5, line 5-A.1 will be carried forward and line 5-D will be eliminated. Two lines that were originally recommended to be carried forward, will not be eliminated as a result of your input, these are Lines 7-A.1 and 16-A.1. Note that in all cases, any line shown as eliminated will be described in detail in the Draft, shown on the plans (most likely in black), and the reasons for elimination from further consideration will be given.

The agency and signature line below can be used to state your concurrence in the alternatives carried forward and we would appreciate return receipt of this letter by May 13, 1994.

A list of meeting attendees is also attached. Thank you once again for your participation in this process.

Very truly yours,

Fred VanKirk
Fred VanKirk
Commissioner
State Highway Engineer

FV:Ecb

Attachment

Agency: S.C.S

Authorized Signature: [signature]

Date: 4-26-94

EXHIBIT VII-3: WVDNR CONCURRENCE ON ALTERNATIVES

STATE OF WEST VIRGINIA
DEPARTMENT OF COMMERCE, LABOR AND ENVIRONMENTAL RESOURCES
DIVISION OF NATURAL RESOURCES
State Capitol Complex
Building 3, Room 812
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0664
TDD 558-1439 TDD 1-800-354-6087
Telephone (304) 558-2771 Fax (304) 558-3147

GASTON CAPERTON
Governor

JOHN M. RANSON
Cabinet Secretary

CHARLES B. FELTON, JR.
Director

April 27, 1994

Mr. Fred VanKirk
Commissioner, State Highway Engineer
WV Division of Highways
1900 Kanawha Blvd., East
Building 5, Room 109
Charleston, WV 25305-0430

Dear Mr. VanKirk:

Pursuant to your amended April 8, 1994 letter and attachments describing Appalachian Corridor H Elkins to I-81 and requesting concurrence on alternatives to be carried forward, I wish to provide the following recommendations.

We believe the West Virginia Division of Highways has provided adequate coordination and acceptable documentation of viable project alternatives concerning the Corridor H Elkins to I-81 project. The WV Division of Natural Resources concurs that the Division of Highways move forward with the development and documentation of the Alignment Selection Supplemental Draft Environmental Impact Statement.

We look forward to continued coordination on this project. If I can be of further assistance, please do not hesitate to contact me or Mr. Roger Anderson of my staff.

Sincerely,

Charles B. Felton, Jr.
Director

CBF/raf

EXHIBIT VII-4: EPA - REGION III CONCURRENCE ON ALTERNATIVES

RECEIVED
EPA ... ON III
APR 1 8
WATER DIVISION

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
Division of Highways
1900 Kanawha Boulevard East • Building Five • Room 109
Charleston, West Virginia 25305-0430 • 304/558-3505

Gaston Caperton
Governor

Charles L. Miller, P.E.
Secretary

Fred VanKirk, P.E.
Commissioner
State Highway Engineer

April 8, 1994

MAY 0 9 1994

DIVISION OF HIGHWAYS

Ms. Susan McDowell
US Environmental Protection Agency
841 Chestnut Street
Philadelphia, Pennsylvania 19107

Dear Ms. McDowell:

Appalachian Corridor H
Elkins to I-81
Concurrence Document
Alternatives to be carried forward

This is a follow-up to the March 9, 1994 meeting at the Civic Center in Charleston to discuss concurrence on the alternatives carried forward for the alignment phase of Corridor H. Your input has been and will continue to be important to the development of this project. As discussed at the close of the meeting, I have attached the results of the discussions in the form of a revised table, which lists the lines that will be carried forward in the Alignment Selection Supplemental Draft Environmental Impact Statement (SDEIS).

Please note the following revisions to the preliminary recommendations that came as a result of the meeting. In Section 5, line 5-A.1 will be carried forward and line 5-D will be eliminated. Two lines that were originally recommended to be carried forward, will not be eliminated as a result of your input, these are Lines 7-A.1 and 16-A.1. Note that in all cases, any line shown as eliminated will be described in detail in the Draft, shown on the plans (most likely in black), and the reasons for elimination from further consideration will be given.

The agency and signature line below can be used to state your concurrence in the alternatives carried forward and we would appreciate return receipt of this letter by May 13, 1994.

A list of meeting attendees is also attached. Thank you once again for your participation in this process.

Very truly yours,

Fred VanKirk

Fred VanKirk
Commissioner
State Highway Engineer

FV:Ecb

Attachment

Agency: USEPA - Region III
Authorized Signature: Roy E. Denmark Jr.
Date: 4 May 1994

EXHIBIT VII-5: WVDHHR CONCURRENCE ON ALTERNATIVES

STATE OF WEST VIRGINIA
DEPARTMENT OF HEALTH AND HUMAN RESOURCES

Gaston Caperton
Governor

May 13, 1994

RECEIVED MAY 19 1994 ROADWAY DESIGN DIVISION WV DIVISION OF HIGHWAYS

RECEIVED WV DEPT. OF HIGHWAYS ENGINEER DEVELOPMENT

Mr. Fred VanKirk, Commissioner
West Virginia Department of Transportation
Capitol Complex Building 5, Room 109
Charleston WV 25305

Appalachian Corridor H
Concurrence Document

Dear Mr. VanKirk:

Thank you for the opportunity to review the concurrence document regarding Appalachian Corridor H. We continue to have concerns about line 3-A.1. This line would bisect Anderson Ridge above the Town of Wardensville's spring; thereby placing their drinking water supply at risk. Two representatives of our Wellhead Protection Program, Mr. Viola and Mr. Baker, communicated this concern at your meeting on March 9, 1994. We note that the concurrence document did not acknowledge the threat to the water supply as regards line 3-A.1.

We will need to review the WV Division of Transportation's draft environmental impact statement for Corridor H in order to comment on its assessment of the risk to the Wardensville spring. We will reserve comment until DOT's consulting hydrogeologists, Mr. Aley and Mr. Bednar, have reported their findings regarding the spring.

For the above reasons it would be premature to apply my signature to the Corridor H concurrence document at this time.

Sincerely,

Donald A. Kuntz, P.E.
Director
Environmental Engineering Division

RECEIVED 18 DIVISION OF HIGHWAYS CORRESPONDENCE

DAK:GTV:nsf
cc: John Bowman, Mayor of Wardensville
Hardy County Health Department
OEHS Kearneysville District Office
Gary T. Viola

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
Division of Highways
1900 Kanawha Boulevard East • Building Five • Room 109
Charleston, West Virginia 25305-0430 • 304/558-3505

Gaston Caperton
Governor

Charles L. Miller, P.E.
Secretary

Fred VanKirk, P.E.
Commissioner
State Highway Engineer

June 8, 1994

Mr. Donald A. Kuntz, P.E.
Director
Environmental Engineering Division
WV Department of Health and
Human Resources
815 Quarrier Street, Suite 418
Charleston, West Virginia 25301

Dear Mr. Kuntz:

Thank you for your May 13, 1994 response to our letter requesting concurrence on the alternatives carried forward. We understand your agency's concerns regarding potential impacts to the Wardensville Water Supply. As you noted, we are continuing our studies of the spring, and Mr. Baker took part in the dye injection efforts conducted on May 19, 1994. The results will be fully addressed in the Alignment Selection SDEIS at which time we will receive comments from your agency.

The concurrence document lists "Requires bisecting Anderson Ridge" as a disadvantage for Line 3-A.1 because it was well understood and discussed that this alignment could involve the spring as a result of its location on the ridge. Also, Line 3-C list "Closer to Wardensville Spring" as a disadvantage. We have been actively investigating the Wardensville Spring since April 1993 when our consultant first met with Holly Alkire of the Wardensville Water Department. Be assured that the Division of Highways and our consultant have been and will continue to appropriately investigate this matter. I hope this will answer your concerns. Should you have any questions please contact this office.

Very truly yours,

ORIGINAL SIGNED BY
FRED VanKIRK
Fred VanKirk
Commissioner
State Highway Engineer

FV:Eh

cc: Ms. Patty Gessing, Michael Baker, Jr., Inc.

EXHIBIT VII-6: MNF CONCURRENCE ON ALTERNATIVES

United States Department of Agriculture | Forest Service | Monongahela National Forest | 200 Sycamore Street Elkins, West Virginia 26241 304-636-1800

RECEIVED
MAY 20 1994
ROADWAY DESIGN DIVISION
WV DIVISON OF HIGHWAYS

Reply To: 7700

Date: May 18, 1994

DV (thru [illegible]) w/attach
Handle
5/19/94

Mr. Fred VanKirk
West Virginia Department of Transportation
Division of Highways
State Capitol Complex, Building Five
Charleston, West Virginia 25305

Dear Mr. VanKirk;

We concur with the lines to be carried forward for the alignment phase of Corridor H. Attached is page two of your April 8, 1994 letter with the Agency concurrence block completed.

Thank you for the opportunity to participate in this process. Please do not hesitate to call if we can be of further assistance.

Sincerely,

JIM PAGE
Forest Supervisor

Attachment

RECEIVED
MAY 19 94
DIVISION OF HIGHWAYS
CORRESPONDENCE

RECEIVED
1994
W VA DEPT OF HIGHWAYS

Mr. Jim Page
Page Two
April 8, 1994

A list of meeting attendees is also attached. Thank you once again for your participation in this process.

Very truly yours,

Fred VanKirk
Commissioner
State Highway Engineer

FV:Ecb

Attachment

Agency: U.S.D.A. Forest Service
Authorized Signature: [signature]
Date: 5/17/94

EXHIBIT VII-7: NOAA - NMFS CONCURRENCE ON ALTERNATIVES

RECEIVED
JUN 27 1994
ENVIRONMENTAL DIV.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat and Protected Resources Division
904 South Morris Street
Oxford, Maryland 21654

20 June 1994

Mr. Earl T. Robb
Environmental Engineer
Department of Transportation
1401 East Broad Street
Richmond, Virginia 23219

RE: Appalachian Corridor H

Dear Mr. Robb:

Based on review of relevant information, we have determined that the project will not affect resources within the purview of the National Marine Fisheries Service. Therefore, we have no comments to offer on the proposal and further involvement in the ongoing NEPA process is not necessary.

Should the corridor change, or should the proposal be otherwise modified, we will re-evaluate our position.

Please call John Nichols at (410) 226-5771 if you have any questions.

Sincerely,

Timothy E. Goodger
Assistant Coordinator

cc: COE
EPA-Philadelphia
FWS-White Marsh

EXHIBIT VII-8: ACOE - NORFOLK DISTRICT CONCURRENCE ON ALTERNATIVES

COMMONWEALTH *of* VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, 23219

DAVID R. GEHR
COMMISSIONER

AUG 15 1994

EARL T. ROBB
ENVIRONMENTAL ENGINEER

June 1, 1994

DESIGN
WV DIVISON OF HIGHWAYS

Colonel Andrew M. Perkins, Jr.
Department of the Army
Norfolk District
Corps of Engineers
803 Front Street, Fort Norfolk
Norfolk, Virginia 23510-1096

U. S. ARMY CORPS OF ENGINEERS
RECEIVED
JUN 6 1994
BY

Attention: Ms. Alice Allen-Grimes

Dear Colonel Perkins:

Appalachian Corridor H
Elkins to I-81
Concurrence Document
<u>Alternatives to be Carried Forward</u>

At the April 19, 1994, Interagency Coordination meeting, the Appalachian Corridor H project was presented for concurrence on the alternatives to be carried forward for the alignment phase. Attached are the tables which were presented at that meeting and show the alignments which have been recommended to be carried forward.

The agency and signature line below can be used to state your concurrence in the alternatives carried forward and we would appreciate return receipt of this letter by June 15, 1994.

On behalf of the West Virginia Department of Transportation, Division of Highways and the Virginia Department of Transportation, thank you for your participation in this project.

Sincerely,

Earl T. Robb

Earl T. Robb
Environmental Engineer

Corps of Engineers, Norfolk District

EXHIBIT VII-9: FWS CONCURRENCE ON ALTERNATIVES

United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
Post Office Box 1278
Elkins, West Virginia 26241

October 12, 1994

Mr. Fred VanKirk, Commissioner
West Virginia Department of Transportation
Division of Highways
State Capitol Complex, Building Five
Charleston, West Virginia 25305

Dear Mr. VanKirk:

Reference is made to your April 8, 1994 letter regarding the selection of alternatives to be carried forward for the alignment phase of Corridor H, Elkins, West Virginia to Strasburg, Virginia. The Service participated in the Fall 1993 - Winter 1994 field reviews for the 4-lane alternatives and the Improved Roadway Alternative (IRA) and offers the following comments. These comments do not constitute the review of the Secretary of the Interior as provided for by: Section 2(b) of the Fish and Wildlife Coordination Act (P.L. 83-624); the National Environmental Policy Act of 1969 (42 U.S.C. 4231 et seq.); the Clean Water Act of 1977, as amended (P.L. 95-217); the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.); or other pertinent legislation.
In addition, the Service participated in the March 9, 1994 discussions of the alternatives to be carried forward in the Alignment Selection Supplemental Draft Environmental Impact Statement (AS-SDEIS).

Field reviews and related meetings have shown that the West Virginia Department of Transportation went to considerable effort to avoid sensitive natural resources to the extent practicable. The majority of 4-lane alternatives proposed to be carried forward reflect the least damaging alternatives available. The IRA provides further potential to avoid sensitive natural resource areas and the No-Build avoids impacts altogether. The Service, therefore, will not object to the WVDOT carrying the selected 4-lane and IRA alignments forward in the AS-SDEIS. Final comments and approval on the selected alternative will depend on the WVDOT's ability to successfully mitigate environmental impacts.

We appreciate the opportunity to review and provide comments.
Please direct questions to Mr. John Schmidt of my staff at (304) 636-6586.

Sincerely,

Christopher M. Clower
Christopher M. Clower
Supervisor

cc:
WVDNR - Ross
WVDEP - Scott
USEPA - Forren
PAFO - Kulp
Readers file
Project file
ES:WVFO:JESchmidt:tlp:10/14/94
File Name:\NEPA\CORHALTS.CON

EX..BIT VII-10: WVDNR CONCURRENCE ON WETLAN.. MITIGATION

STATE OF WEST VIRGINIA
DEPARTMENT OF COMMERCE, LABOR AND ENVIRONMENTAL RESOURCES
DIVISION OF NATURAL RESOURCES
OPERATIONS CENTER
P.O. Box 67
Elkins, West Virginia 26241-0067
Telephone (304) 637-0245 Fax (304) 637-0250

GASTON CAPERTON
Governor

JOHN M. RANSON
Cabinet Secretary

CHARLES B. FELTON, JR.
Director

May 13, 1994

MEMORANDUM TO: Mr. Randy Epperly/Ms. Patty Gesing

FROM: Roger Anderson

SUBJECT: Conditions for Wetland Mitigation on Corridor H, Elkins to Virginia Line.

Pursuant to our April 28, 1994 meeting, the resource agencies in attendance agreed to formulate conditions for the subject project.

After extensive review, the U.S. Fish and Wildlife Service, Environmental Protection Agency, WV Division of Environmental Protection and WV Division of Natural Resources have reached a consensus on the attached wetland mitigation conditions for the project.

Each agency will provide concurrence regarding these conditions and other impact mitigation issues as the information becomes available.

RA/pf

Attachment

PERMIT CONDITIONS FOR APPALACHIAN CORRIDOR H
ELKINS TO WV/VA LINE

According to information provided by Michael Baker, Inc., wetland impacts in West Virginia resulting from this project will total 37 acres. Thirtyone acres are palustrine emergent, one acre is forested, three acres are shrub/scrub and two acres are open water.

1. Mitigation for these wetland impacts will be provided at the following ratios:

   Palustrine Emergent 1:1;
   Palustrine Forested and Shrub/Scrub 3:1;
   Open Water 1:1.

   These ratios will result in the creation/restoration of 45 acres of wetlands. The use of these replacement ratios is contingent upon the concurrent construction of these wetlands with the first highway contract.

   If, for any reason, this concurrent wetland creation does not occur, or if the created wetlands are not functioning at the time wetland impacts occur, the replacement ratios will be as follows:

   Open Water 1:1;
   Palustrine Emergent 2:1;
   Palustrine Forested and Shrub/Scrub 3:1.

   These ratios would result in the creation of 76 acres of wetlands.

2. Wetland impacts will be mitigated at two (2) separate locations, one each within the Monongahela and Potomac river drainages. Attempts will be made to split the required acreage equally. A concentrated effort will be made to place the Monongahela River portion of the mitigation within the Beaver Creek watershed near Davis, West Virginia.

3. All constructed wetlands will require the implementation of a five year monitoring plan to determine the success of the mitigation. The plan will be developed by the Department of Highways and approved by the resource agencies. The plan will include, but not be limited to, the monitoring of wetland water quality, vegetation, functions, values and potential mitigation failure.

4. These conditions involve mitigation for wetland impacts only; unmitigated impacts (i.e., streams) will be included in another mitigation plan/agreement which will be a condition of state certification and federal agency approval. In evaluating stream impact mitigation, consideration should be given to efforts which have minimized stream impacts and also to the application of Best management Practices by the consultant during highway design and construction.

EXHIBIT VII-11: WVDEP CONCURRENCE ON WETLAND MITIGATION

DEPARTMENT OF COMMERCE, LABOR & ENVIRONMENTAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
General Delivery
MacArthur, WV 25873-9999

Gaston Caperton
Governor

John M. Ranson
Cabinet Secretary

David C. Callaghan
Director

Ann A. Spaner
Deputy Director

MEMORANDUM

May 16, 1994

TO:	Randy Epperly - Division of Highways	FAX:	558-2385
	Patty Gesing - Michael Baker, Inc.		412/269-2048
FROM:	Barbara Taylor BT		
RE:	Wetland Mitigation for Corridor H; Elkins to the Virginia Line		

Following discussion of the attached conditions with staff from the Office of Water Resources (OWR), no additional concerns were raised regarding wetland mitigation. OWR agrees with the wetland mitigation conditions which were developed in coordination with the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and the Division of Natural Resources.

However, the attached conditions do not represent issuance of State 401 Certification by OWR, nor do they represent the final form of conditions which may be contained in the State Certification. State Certification conditions will likely include specific information regarding components of the monitoring plan and mitigation agreements as well as necessary timelines for reporting.

Should you have any questions, please feel free to call me at 304/256-6850. I also take this opportunity to notify you of my new office address. The office has not changed locations, but we now have mail delivery. The new address is as follows:

West Virginia Division of Environmental Protection
Office of Water Resources
2006 Robert C. Byrd Drive
Beckley, West Virginia 25801-8320

PERMIT CONDITIONS FOR APPALACHIAN CORRIDOR H
ELKINS TO WV/VA LINE

According to information provided by Michael Baker, Inc., wetland impacts in West Virginia resulting from this project will total 37 acres. Thirty one acres are palustrine emergent, one acre is forested, three acres are shrub/scrub and two acres are open water.

1. Mitigation for these wetland impacts will be provided at the following ratio:

Palustrine Emergent 1:1;
Palustrine Forested and Shrub/Scrub 3:1;
Open Water 1:1.

These ratios would result in the creation/restoration of 45 acres of wetlands. The use of these replacement ratios is contingent upon the concurrent construction of these wetlands with the first highway contract.

If, for any reason, this concurrent wetland creation does not occur, or if the created wetlands are not functioning at the time wetland impacts occur, the replacement ratios will be as follows:

Open Water 1:1;
Palustrine Emergent 2:1;
Palustrine Forested and Shrub/Scrub 3:1.

These ratios would result in the creation of 76 acres of wetlands.

2. Wetland impacts will be mitigated at two (2) separate locations, one each within the Monongahela and Potomac river drainages. Attempts will be made to split the required acreage equally. A concentrated effort will be made to place the Monongahela River portion of the mitigation within the Beaver Creek watershed near Davis, West Virginia.

3. All constructed wetlands will require the implementation of a five year monitoring plan to determine the success of the mitigation. The plan will be developed by the Division of Highways and approved by the resource agencies. The plan will include, but not be limited to, the monitoring of wetland water quality, vegetation, functions, values and potential mitigation failure.

4. These conditions involve mitigation for wetland impacts only; unmitigated impacts (i.e., streams) will be included in another mitigation plan/agreement which will be a condition of state certification and federal agency approval. In evaluating stream impact mitigation, consideration should be given to efforts which have minimized stream impacts and also to the application of Best Management Practices by the consultant during highway design and construction.

EXHIBIT VII-12: EPA - REGION III CONCURRENCE ON WETLAND MITIGATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

MAY 17 1994

Mr. Randolph T. Epperly
Director, Roadway Design
West Virginia Division of Highways
1900 Kanawha Boulevard East
Building Five
Charleston, WV 25305-0430

re: Appalachian Corridor H: Wetland Mitigation Proposal Review

Dear Mr. Epperly:

Thank you for arranging a meeting with your consultant, Michael Baker, Jr. Inc., and other agencies to discuss the proposed plan for mitigation of impacts to wetland systems. At that meeting on April 28, 1994, the agencies agreed to provide you with our comments and/or recommendations on the wetland mitigation proposal. In conjunction with the US Fish and Wildlife Service, West Virginia Division of Environment Protection, West Virginia Division of Natural Resources, the following conditions were agreed upon. This letter serves to reiterate our expectations and conditions as part of the 404 permit application.

According to information provided by Michael Baker, Jr. Inc., direct wetland impacts in West Virginia as a result of highway construction will total 37 acres. Wetland impacts in Virginia will result in less than one acre. In West Virginia, 31 acres are palustrine emergent, one acre is palustrine forested, three acres are palustrine shrub/scrub and two acres open water.

1. Wetlands compensation completed prior to wetlands impacts will be provided at the following ratios:

Open Water 1:1
Palustrine Emergent 1:1
Palustrine Forested and Shrub/Scrub 3:1

These ratios will result in the creation/restoration of 45 acres of wetlands in West Virginia. The use of the above ratios are contingent upon the creation or restoration of fully functional and mature wetlands prior to actual construction impacts to wetlands.

If for any reason, the created or restored wetlands are not fully functional and mature before the time wetland impacts are incurred, the replacement ratios will be as follows:

Open Water 1:1
Palustrine Emergent 2:1
Palustrine Forested and Shrub/Scrub 3:1

These ratios would result in the creation of 76 acres of wetlands in West Virginia.

2. Wetlands will be mitigated at two separate locations, one each within the Monongahela and Potomac river drainages. Attempts will be made to divide the required acreage equally in each drainage. A concerted effort will be made to locate the Monongahela River mitigation site within the Beaver Creek watershed near Davis, WV.

3. All constructed wetlands will require the implementation of a five year monitoring plan to evaluate the success of mitigation. The plan will be developed by the Division of Highways and approved by our agency in conjunction with other appropriate state and federal agencies. The plan will include monitoring of wetland water quality, vegetation, functions, values, and potential mitigation failures.

4. The above conditions involve mitigation of wetland impacts only; unmitigated impacts (i.e. streams) will be included in a comprehensive mitigation plan/agreement which will be a condition of state certification and federal agency approval. For instance, in evaluating stream impact mitigation, consideration should be given to efforts which minimize stream impacts and also to the application of Best Management Practices during highway design and construction.

As stated in previous correspondence with your agency, EPA cannot dismiss the severity of potential environmental impacts associated with this project, regardless of the corridor/alignment location. The above conditions apply to wetland mitigation only; EPA will continue to work with your agency to formulate strategies that will mitigate for impacts to other natural resources including terrestrial habitat.

Thank you for the opportunity to provide our comments at this time. Should you have any questions, please do not hesitate to contact me or Susan McDowell, of my staff.

Sincerely,

Roy E. Denmark, Jr.
NEPA Review Coordinator

cc: John Schmidt, USFWS
Roger Anderson, WV DNR
Barbara Taylor, WV DEP

B. PUBLIC INVOLVEMENT MEETINGS AND COORDINATION

An extensive public involvement effort was maintained throughout the alignment selection process. WVDOT received hundreds of letters from individuals. All letters received individual responses from WVDOT. Appendix C contains copies of the representative public comments received and the responses to them. In addition to the written coordination efforts, numerous meetings were held to disseminate project-related information. Formal meetings included a series of Virginia Citizens Advisory Committee meetings, a series of Preliminary Alignments and Alternatives Workshops in West Virginia and Virginia, and the planned series of Public Information Meetings and Public Hearings on the *Alignment Selection SDEIS*.

1. VIRGINIA CITIZENS ADVISORY COMMITTEE

Following WVDOT's circulation of the 1992 *Corridor Selection SDEIS* and the identification of Scheme Option D5 as the preferred corridor, the Virginia Commonwealth Transportation Board voted to approve further study of alignments for the Corridor H project. The Board's May 20, 1993 adopted resolution states:

> . . . (T)hat the study seek to develop alternatives that could facilitate designs of the highway in keeping with the broad community goals to develop the region as a tourist and visitor attraction which highlights the unique historical and cultural attractions of the region.
>
> . . . (T)hat the Board directs that all alternatives be explored to achieve the goals expressed above although it is the sense of the Board that in order to achieve such goals and accommodate desired traffic, the alignment and ultimate design of the highway should be more parkway in character in preference to a traditional four lane interstate or arterial standard facility; and
>
> . . . (T)hat the Department is hereby directed to work with the local governments in the region to establish an appropriate advisory committee to participate in the Tier II study pursuit . . .

In conjunction with the Board's study approval, a seven-member citizens advisory committee was established to assist VDOT in the alignment selection process. The Board-nominated members of this committee, called the Virginia Advisory Committee (VAC), represented the following: the Winchester-Frederick County Chamber of Commerce, the Frederick County Department of Planning, the Lord Fairfax Planning District Commission, the town of Strasburg, the Cedar Creek Battlefield Foundation, and Shenandoah County. Shenandoah County was represented by two people, including a resident from Lebanon Church. The VAC was responsible for providing input on questions such as what improvements to VA 55 might satisfy the Corridor H objectives and what type of parkway concept design would be desirable. In addition, the VAC was to provide input on location of the alternatives in terms of meeting community goals and objectives. The VAC met eight times between September 7, 1993 and September 27, 1994, with attendance by VDOT, WVDOT and the consultant. Input from the VAC was taken into consideration throughout the alignment development process. Appendix D contains copies of the VAC meeting minutes.

Prior to the distribution of the *Alignment Selection SDEIS* and the public comment period, the Virginia Citizens Advisory Committee adopted a statement of consensus that they did not have all the information necessary to state a position on the project. It further stated that the VAC recommends that a separate study be conducted to evaluate improvements to existing VA 55. Most of the information requested by the VAC is included in this SDEIS. Exhibit VII-13 shows the VAC statement of consensus and WVDOT's response to the issues raised.

2. SECTION 106 PROCESS

Section 106 of the National Historic Preservation Act requires that federal agencies take into account the effect of proposed undertakings on properties included in or eligible for listing in the National Register of Historic Places (36 CFR 800). A requirement of the Section 106 process is that the public have an opportunity to comment of the project's effect on historic properties. In view of this requirement, the WVDOT along with the WVDCH and the Advisory Council on Historic Preservation hosted a Section 106 Public Meeting on June 28, 1994. The purpose of this meeting was to explain the Section 106 process to the public and obtain comment.

Within the Section 106 process, consultation is the vehicle through which the Advisory Council on Historic Preservation accommodates historic preservation concerns with the needs of federal undertakings. This step in the Section 106 process is initiated after there has been a determination of adverse effect on a historic property. Under Section 106, the federal agency proposing an undertaking consults with the State Historic Preservation Officer (SHPO) and "interested persons".

As defined in 36 CFR 800.2(h), "interested persons" are those organizations and individuals that are concerned with the effects of an undertaking on historic properties. Such interested persons can include owners of affected lands who hold title to real property within an undertaking's area of potential effect. Capon Springs and Farms, Inc. has been identified as such an "interested person". Capon Springs and Farms, Inc. owns and operates the Capon Springs Resort which comprises the Capon Springs National Historic District in Hampshire County, West Virginia. Representatives of Capon Springs have expressed concern over the potential effect Corridor H would have on their National Register property, their water supply, and their business. As a result, FHWA has made Capon Springs a consulting party in the Section 106 process for Corridor H, even though there has not yet been a determination of adverse effect.

EXHIBIT VII-13: VAC STATEMENT OF CONSENSUS

CORRIDOR H VIRGINIA CITIZENS
ADVISORY COMMITTEE'S STATEMENT OF CONSENSUS

WHEREAS, it is the consensus of the Virginia Citizens Advisory Committee (VCAC) that citizens of Virginia, and in particular the citizens of Frederick and Shenandoah Counties, are overwhelmingly opposed to the construction of Corridor H, and,

WHEREAS, it is the clear consensus of the VCAC that the expenditure of federal and Virginia tax dollars would be wasteful if spent on Corridor H, and would be better used on other projects, and,

1 **WHEREAS, it has not been demonstrated the Commonwealth of Virginia, the Staunton Highway District, and in particular the citizens of Frederick and Shenandoah Counties, would realize any economic benefits from the construction of Corridor H. Furthermore, it has not been demonstrated that Corridor H would generate any long term, sustainable business, employment, local tax revenue, or other such benefits, to the Commonwealth of Virginia, the Staunton Highway District, and in particular the citizens of Frederick and Shenandoah Counties, and,**

2 **WHEREAS, the information presented does not give sufficient direct and indirect cost projections relating to the project's construction, maintenance, and right of way acquisition, and,**

3 **WHEREAS, it is the consensus of the VCAC that West Virginia review or study every prudent and feasible intermodal alternatives as mandated by the Intermodal Surface Transportation Efficiency Act (ISTEA), e.g., rail linkages for port access, and,**

Response to VAC:
Statement of Consensus

1. Information regarding industrial and commercial development, job growth and tax benefits are included in Section III-A, Economic Environment, of this SDEIS.
2. Complete cost estimates, appropriate for this type of study are included in Section II and Appendix A of this SDEIS.
3. Other modes of travel were evaluated in the 1992 *Corridor Selection SDEIS.*

EXHIBIT VII-13: VAC STATEMENT OF CONSENSUS

Statement of Consensus
Corridor H Virginia Citizens Advisory Committee
September 27, 1994

WHEREAS, after considering all the information presented at the eight (8) work sessions of the VCAC, and after thorough debate and discussion on such information and the complex issues raised thereby, the Corridor H Virginia Citizens Advisory Committee concludes that Corridor H would significantly harm the communities of Frederick and Shenandoah Counties.

Therefore:

IF WEST VIRGINIA DOES NOT BUILD ITS PORTION OF CORRIDOR H:

- **Virginia should not undertake any Corridor H "Build" alternative; however, existing Route 55 should be evaluated for safety enhancements.**

IF WEST VIRGINIA BUILDS ITS PORTION OF CORRIDOR H:

4 • **The two (2) "Build" alternatives presented to date by the engineers retained by West Virginia are too limited and thus insufficient for the Corridor H VCAC to fulfill the resolves prescribed in the Commonwealth Transportation Board's May 20, 1993 Resolution.**

5 • **In particular, the alternatives provided fail to address the issue of "alternative funding mechanisms . . . to avoid expenditure of scarce Virginia and Staunton District transportation resources." A variety of planned and discussed primary and Interstate improvements are more important to the area than Corridor H. Funding should not be provided for Corridor H if it will delay**

Response to VAC:

Statement of Consensus

4. Several four-lane alignments as well as the Improved Roadway Alternative were reviewed by the VDOT.
5. It is not the purpose of this SDEIS to evaluate funding mechanisms. VDOT has not committed any funding for the construction of Corridor H in Virginia. The Commonwealth Transportation Board must approve all funds for the construction of state supported transportation projects.

EXHIBIT VII-13: VAC STATEMENT OF CONSENSUS

Statement of Consensus
Corridor H Virginia Citizens Advisory Committee
September 27, 1994

funding for other road projects in the area.

6 • The alternatives are devoid of data or projections regarding partial condemnations of private property that would be required (e.g., rights of way), which would cause partial displacements of Virginia citizens, and the related costs of such condemnations/-displacements which could more than double projected costs.

7 • The alternatives provided do not constitute a "study that comprehensively evaluates alternative improvements to existing highways . . . without requiring construction of a new highway . . ." Rather, they essentially constitute "build" alternatives that were drawn up before the Board's Resolution.

8 • The alternatives provided fail to address "the broad community goals to develop the region as a tourist and visitor attraction that highlights the unique historical and cultural attractions of the region." In this regard, no information has been provided to the VCAC regarding any projected local employment or tax-generating opportunities that would accompany either of the build alternatives presented. Moreover, the alternatives fail to address the issue of the adverse impact either would have (directly or indirectly) on several National Landmark and National Register of Historic Places properties located on both sides of existing Interstate 81 (along Cedar Creek) between

Response to VAC:

Statement of Consensus

6. The right-of-way acquisition costs provided herein have been prepared by the VDOT in accordance with VDOT procedures.
7. The design criteria of the Build and the Improved Roadway Alternatives was the subject of the first coordination meeting held in Richmond on July 27, 1993, over two months following the Board resolution. Subsequent submissions of preliminary alignments, including the Improved Roadway Alternative were submitted to VDOT between September 13, 1993 and October 20, 1993.
8. The design and location of the alternatives does not preclude this type of local initiative. A presentation made to the VAC on June 21, 1994 included a suggestion of interpretive trails that would connect various historic battlefields and other cultural interest points. Also suggested was a visitor's center that would highlight historic sites in the region and promote this type of tourism.

An assessment of effects to all sites potentially eligible, eligible or listed on the National Register of Historic Places located within the project limits is included in this study. This study also addresses secondary impacts to historic sites.

EXHIBIT VII-13: VAC STATEMENT OF CONSENSUS

Route 55 (where Corridor H would terminate) and Interstate 66.

9 • Further, the proposed alternatives fail to provide sufficient roadway design features/criteria that "should be more parkway in character in preference to a traditional four lane interstate or arterial standard facility."

10 • The alternatives fail also to provide reliable traffic flow projections.

- During work sessions, the members of the VCAC agreed that the following constituted the "Community Goals" of Frederick and Shenandoah Counties:
  - Moderate Economic Growth
  - Maintain Quality of Life
  - Maintain LOS (Level of Service) "C" or Better on Roads
  - Increase Safety on Roads
  - Maintain Character of Area
  - Ease of Use of Roads
  - Use Appropriate Signage
  - Historic Tourism Development
  - Battlefield Preservation
  - (Promote) Tourism
  - Add New Businesses
  - Retain Existing Businesses
  - Maintain Agricultural Sector

Response to VAC:

Statement of Consensus

9. The alternatives presented can incorporate scenic design features.
10. The traffic analysis for this project has been conducted using accepted and reliable methods. The results of the traffic analysis were presented and explained to the committee at the July 27, 1994 meeting. The results were reviewed and discussed with VDOT and modifications suggested by VDOT were incorporated.

EXHIBIT VII-13: VAC STATEMENT OF CONSENSUS

Statement of Consensus
Corridor H Virginia Citizens Advisory Committee
September 27, 1994

- **Wisely Invest Tax Dollars**
- **Prevent Community Displacements**
- **Provide Infrastructure**
- **Develop Pro-active Long Range Plans**
- **Manage Growth**
- **Promote Stability**
- **Broaden Economic Base**
- **Community Self-Determination**
- **Define Relevant Information**

- **Consistent with these Community Goals, and in light of the fact that the build alternatives presented to date are too limited and thus insufficient, the VCAC recommends that a separate study be conducted to evaluate improvements to existing Route 55, as follows:**
  - **Designate Route 55 as a National/Virginia Scenic Byway/Parkway.**
  - **Determine whether ISTEA funding is available.**
  - **Draft an improved Route 55 roadway alignment alternative with local bypass features in order to minimize citizen/-business displacements and deviations from existing route 55, to enhance safety, and to avoid adverse impacts on historic sites and other cultural resources.**
  - **Project detailed costs for construction, maintenance, and**

EXHIBIT VII-13: VAC STATEMENT OF CONSENSUS

rights of way; such cost projections must illustrate <u>all</u> anticipated costs, direct and indirect, short- and long-term —to Virginia and the Staunton District.

- **Such improved Route 55 roadway alignment and design must involve Scenic Byway and Parkway expertise, landscape architecture, and local public direct involvement and comment in the design process.**

Adopted by the Corridor H Virginia Citizens Advisory Committee September 27, 1994 corridor selection process; the official transcripts and comments received from the corridor selection Public Hearing process; and documentation for the basis of WVDOT's preferred corridor selection. Information on how to review or obtain these documents is available by contacting the WVDOT office in Charleston, WV or the VDOT offices in Edinburg, VA.

SECTION VIII: INDEX

SECTION VIII: INDEX