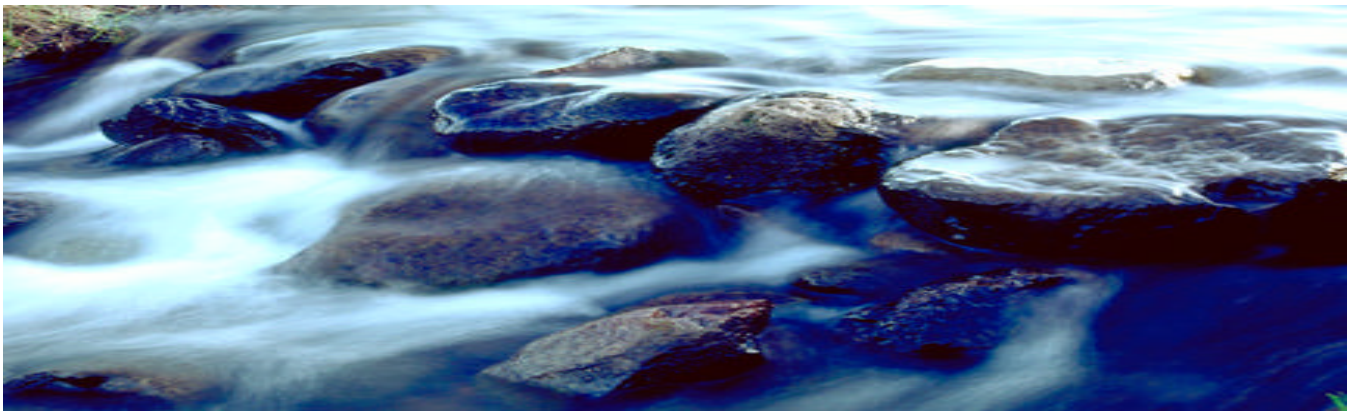

WEST VIRGINIA FLOOD PROTECTION PLAN

1. Introduction

a. Authority for the Study. West Virginia has endured years of uncoordinated efforts to reduce flood damages by numerous Federal and State agencies. In 1991, the West Virginia Conservation Agency (previously known as the West Virginia Soil Conservation Agency) was directed to prepare a Flood Damage Assessment and Mitigation Plan for West Virginia in an attempt to understand and control flood damages.

Chapter 19-21A of the State Code establishes the State Conservation Committee and Conservation Districts. The Conservation Agency, as an agent of the State Committee, is charged to conserve natural resources, control floods, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, conserve wildlife, protect the tax base, protect public lands, and protect and promote the health, safety, and general welfare of the people. The Conservation Agency coordinates these activities with the State's Conservation Districts.

All State and Federal agencies having responsibilities related to floodplain management and flood mitigation activities in the State were invited to participate. An interim draft of this plan

entitled "West Virginia Statewide Flood Damage Assessment and Mitigation Plan" was prepared in 1993. A final version of the plan was never produced.

In 1998, Senator Robert C. Byrd obtained funding for the Corps of Engineers (USACE) to formulate a comprehensive strategy for reducing economic, property, and personal losses due to flooding in West Virginia. Those funds were provided to match State funds and in-kind resources to complete the 1993 Plan. Due to the time lapse since completion of the interim draft plan in 1993, portions of the current Plan would be updated with new chapters added.

The West Virginia Conservation Agency and the Corps of Engineers have developed a partnership with numerous Federal and State agencies to formulate a comprehensive strategic plan for reducing flood damages in the State. The first step in that process was the creation of a Task Force composed of Federal, State, and quasi-public organizations that have participated in

past flood protection and floodplain management activities. Over 20 agencies and organizations participated in this effort. This group has been identified as the West Virginia Flood Protection Task Force (Task Force). Contact information for organizations participating in the Task Force and other organizations involved in flood preparation, mitigation, response and recovery can be found in Appendix O.

In 2001, a series of intense storms crossed southern West Virginia. As these storms vividly demonstrated, flooding remains a hazard to life and property throughout the State. In addition to millions of dollars in property damages and emergency costs, several lives were lost in the flood.

Figure 1-1. Severe Thunderstorms Are Common in West Virginia

Governor Bob Wise requested that the Task Force refocus the statewide plan on a regional plan that would significantly reduce the impacts of future flooding in the six counties hardest hit. The regional plan was used as a template to prepare this statewide plan. This statewide plan incorporates and supersedes the Regional Plan produced in October 2002.

b. Goals and Objectives of the Statewide Plan. Despite the many flood protection programs available through Federal and State agencies and the many existing flood protection projects, flooding continues to be West Virginia's most common and widespread natural disaster. A comprehensive statewide study of flooding has never been undertaken and until now, only a gross estimate of the severity of the problem could be made.

The Task Force recognizes that certain components of the problem are largely out of our control. The incidence of storms, rainfall, and runoff and the State's rugged topography are components of the flooding problem that cannot be significantly altered by any government plan, program or

agency. High water events where waters overflow stream banks and invade normally dry land will continue to occur and floodplains will serve their natural function as avenues of conveyance for floodwaters. Other components of the flooding problem such as the volume of rainfall runoff, placement of undersized or incorrectly designed stream crossings, unwise placement of floatable debris in the floodplain, or the placement of damageable property within the floodplain can be modified to reduce damages.

Figure 1-2. Flooding in Southern West Virginia

The Plan is intended to be a vision for the future, spelling out both long-term and short-term goals and objectives and recommending strategies for attaining those goals. The strategies include optimum use of existing Federal, State, local, and private resources for creating a reliable warning system, for strengthening floodplain management and reducing flood damages.

This Plan is not a "magic bullet". It is not a cure-all for those living in the State's floodplains. This Plan provides a roadmap for reducing flood damages, but a portion of the responsibility for reducing damages must reside with each citizen of the State. The daunting tasks of reducing flood damages, identifying potential flood situations and issuing warnings, restoring damaged streams, reducing stormwater runoff, and strengthening floodplain management in the State will not be accomplished tomorrow, next week or next year. Successful deployment of the strategies recommended in this Plan will take many years of sustained effort and require significant amounts of Federal, State and local funds. More importantly, successful deployment of these strategies will require cooperation and coordination between all levels of government and the public.

To ensure the Plan will be viable for the future, all of the agencies involved have committed to regular meetings of the Task Force to guide the development of the Plan, to review its findings and recommendations, and to implement the Plan through their respective missions and authorities. The Task Force members have also committed to revising the Plan in response to an ever expanding and improved database, to experiences (lessons learned) in implementation,

changes in resources (funds and staff) and expertise, and with changes in disaster situations and the needs of West Virginia citizens.

This Plan does not belong to any one agency. Instead, the Plan is a dynamic approach to reducing flood impacts with all agencies having ownership. This plan does not replace response and recovery plans developed by and for individual agencies. The Plan incorporates response and recovery plans into a unified "plan of plans" or compilation of each agency's mission, action plans, and procedures. This compilation should reduce fragmented planning and ensure that all agencies are knowledgeable about each other's activities.

Past flood reduction efforts provide the foundation for today's efforts. West Virginia is now in a position to improve and extend yesterday's advances in flood protection. This Plan not only builds upon past efforts, but stretches toward the ultimate goal of a reduction in potential flood losses and loss of life and a reduction in the loss of natural and beneficial floodplain resources.

The West Virginia Office of Emergency Services and other cooperating agencies have developed a well-conceived plan for responding to the catastrophic effects of flooding throughout the State and recovering after a flooding event.

Past flood-damage reduction efforts have been reactionary in nature resulting in site-specific projects designed to solve damages at a single geographic location. This plan is different in that it stresses strategic concepts and a proactive approach rather than a reactive one. The need for a proactive plan is driven by the value of the lives, property, and resources at risk in the State's floodplains weighed against the catastrophic and destructive forces of anticipated future flooding.

The Plan recognizes the leadership and expertise at all levels of government and provides data and information to support the needs of local jurisdictions, community organizations, and local sponsors in floodplain management and flood-damage reduction. The plan goals address:

(1) reducing the loss of life due to flooding, (2) reducing property damages, (3) developing programs and tools that will assist in implementing a sound program of flood damage reduction and floodplain management, (4) reducing economic losses while supporting a viable State economy, and (5) protecting the floodplain environment.

The plan goals and objectives were formulated based upon the combined experience and institutional knowledge of the Task Force members and the comments received from advisory groups, public officials and citizens during statewide workshops. The goals and their corresponding objectives are listed below.

Goal 1: Reduce the unnecessary loss of lives due to flooding in West Virginia.

Objective 1: Develop and maintain an effective and reliable flood warning system for West Virginia that includes recommendations for needed gages (new and upgraded), software, and hardware needs, and coordination between Federal and State agencies.

Objective 2: Identify available education, information, and equipment necessary for floodplain occupants to receive and comprehend flood warnings.

Objective 3: Identify needed equipment and training for public officials in each county so that flood warnings are received and disseminated in an effective and timely manner.

Objective 4: Develop a framework for creation of emergency evacuation plans for each county that identifies emergency service resources, escape routes, and temporary evacuation centers, and establishes a communications network between emergency service organizations.

Objective 5: Identify education and information resources to be disseminated to floodplain residents on the hazards of the floodplain and potential for loss of life due to flooding.

Objective 6: Prioritize proposed flood damage reduction projects and programs such that structures located within the regulated floodway are expeditiously evacuated.

Goal 2: Reduce private and public property damages.

Objective 1: Identify floodplain mapping needs for previously unmapped areas and areas with outdated mapping.

Objective 2: Identify financial and technical resources to acquire needed floodplain mapping.

Objective 3: Identify educational data and information that can be disseminated to county and municipal floodplain managers to enable more informed permit decisions.

Objective 4: Promote avoidance of floodplain development (structures and facilities) by public (Federal, State, county and municipal) agencies.

Objective 5: Identify needs for county and municipal floodplain managers and legislative action to require State certification of floodplain managers.

Objective 6: Promote and identify financial support for both structural and non-structural flood damage reduction measures through Federal and State agencies.

Objective 7: Identify the need for and sources of funding for flood insurance subsidies.

Goal 3: Develop technical, administrative, regulatory enforcement, and legislative tools that will facilitate implementation of a sound program of flood loss reduction and floodplain management.

Objective 1: Identify effective hydrologic / hydraulic models that can be implemented at the county and municipal level to predict and plan for future flooding.

Objective 2: Promote continued collection and analysis of watershed level hydrologic and hydraulic data to better define flood frequencies, runoff characteristics, and flooding risks.

Objective 3: Formalize the roles, tasks, and responsibilities of the Task Force and execute a partnership agreement among the members that will ensure its continuation and effectiveness.

Objective 4: Identify legislative proposals (either new legislation or modification of existing law) that will facilitate needed infrastructure protection, establish flood damage reduction funding sources, and enable more effective enforcement of existing programs.

Objective 5: Develop and deploy an education and training package for county and municipal floodplain managers, county commissioners, and city councils based upon existing FEMA data and information.

Objective 6: Recognize and legitimize the role of Watershed Associations in the planning and implementation of flood damage reduction and floodplain management activities through State legislation.

Goal 4: Promote technical, administrative, regulatory enforcement, and legislative tools that will reduce incrementally excessive runoff from land-conversion activities in West Virginia.

Objective 1: Identify needs for stormwater management and deployment (legislation, program enforcement, and State subsidies) of technical, administrative and legislative components.

Objective 2: Identify potential agency or agencies responsible for oversight of statewide stormwater management program.

Objective 3: Identify needs for State subsidies to assist counties and municipalities in establishing stormwater ordinances and enforcement administration.

Objective 4: Identify land-conversion activities that generate excessive runoff leading to property damages from flooding.

Objective 5: Use appropriate available data and information existing or being developed to determine the potential effects of runoff from resource extraction activities on streams and floodplain development.

Goal 5: Reduce personal and economic losses due to flooding while supporting a viable State economy.

Objective 1: Identify a long-range strategy for reducing personal and economic losses due to flooding.

Objective 2: Identify property damage reduction solutions that are economically efficient and leverage Federal matching funds.

Objective 3: Identify sources of Federal funds to support implementation of the Plan's goals.

Objective 4: Identify potential State revenue sources for property damage reduction projects and floodplain management activities.

Objective 5: Identify alternative development processes that facilitate economic growth (jobs and revenues) while avoiding unnecessary impacts to the State's floodplains.

***Goal 6*: Protect the State's waterway and floodplain environments.**

Objective 1: Identify stable reaches of streams to be protected from dredging, modification, restoration, or inundation.

Objective 2: Identify streams or stream reaches with aquatic or terrestrial resources protected by laws or regulations.

Objective 3: Prepare and execute a Memorandum of Agreement between Federal and State agencies on protected streams.

Objective 4: Identify streams or reaches of streams requiring restoration of aquatic resources that can be addressed by available State and Federal restoration programs.

Objective 5: Promote wise use of the State's streams and floodplains through the State's education system.

c. Flooding in West Virginia.

Floods have been documented in West Virginia since the earliest settlements. The highest known flood on the Greenbrier River occurred in 1812.

Between 1996 and 2004, there have been 16 Federal disaster declarations in West Virginia. Eight of these involved flooding. All 55 counties have been included in at least one of these floods. During this period, the Federal Emergency Management Agency (FEMA) has disbursed over $500 million in assistance payments to individuals and communities for property damages in West Virginia.

In addition to the Federal disaster declarations, West Virginia has declared several flood disasters since 1996 that did not generate sufficient property damages to be declared Federal disasters. While not as widespread or damaging as the floods that were declared Federal disasters, these floods were just as devastating to the people affected by them.

The dollar amounts in Table 1-1 merely indicate the amounts of money dispersed by FEMA for those items covered by the provisions of the disaster declarations. It does not fully capture the total damage to residential and business property or structure contents. These dollar amounts do not include funds expended by other State and Federal agencies providing assistance. Nor does it include the dollars spent by counties or municipal governments, individuals, faith-based organizations and charities after the floods.

Table 1-1

FEMA Aid to Individuals and Communities for Disasters in West Virginia, 1996-2001

(All totals as of December 2001.)

Date of Flood Event	Aid to Individuals	Aid to Communities (Infrastructure Repairs)	Hazard Mitigation	State Funds Expended	Total Combined Aid
January 1996	$12,589,172	$21,966,279	$5,985,342	$10,135,198	$50,675,991
May 1996	$7,442,239	$5,379,933	$1,982,319	$2,533,799	$17,338,290
July 1996	$2,024,199	$1,567,717	$631,471	$3,167,249	$7,390,636
September 1996	$2,862,082	$11,423,311	$2,069,837	$3,959,061	$7,390,636
March 1997	$8,122,201	$4,942,615	$2,576,444	$3,910,315	$20,314,291
June 1998	$8,153,859	$6,606,081	$1,969,318	$4,182,315	$19,551,575
February 2000	$2,896,637	$5,402,158	$570,714	$2,217,377	$11,086,886
May-July 2001	$77,292,490	$42,940,000	$9,000,000	$18,092,549	$147,325,039
Totals	**$121,382,879**	**$100,228,094**	**$24,785,445**	**$48,197,863**	$294,594,281

These numbers do not account for expenditures by railways to repair and replace infrastructure and rolling stock damaged by the floods. In addition to these expenditures, the West Virginia Housing Development Fund contributed to flood recovery operations from 1996 through 2001. These figures also do not include the dollar amount spent by the West Virginia Department of Transportation rebuilding roads, bridges and other parts of our transportation infrastructure. (See Table 1-2).

Floods impact or destroy people's homes, schools, churches, businesses, and places of work. Floods have recurring adverse effects on individual's physical and mental health. Many flood victims report that they are unable to sleep when it rains because of the potential for disastrous floods like those they have experienced.

Table 1-2

Department of Transportation Expenditures
Related to Flooding in West Virginia, 1996 to 2001
(Not FEMA- or Federal Highway Administration-Reimbursed)

Event	Department of Transportation Expenditures
January 1996	$3,566,318
May 1996	$1,178,714
July 1996	$120,813
September 1996	$2,110,230
March 1997	$808,065
June 1998	$1,235,719
Feb. 2000	$1,434,323
May-July 2001 (estimated)	$10,000,000
	Total $20,454,182

Figure 1-3. Example of Transportation Damages in July 2001

In addition to creating safety and public health hazards, floods result in loss of life. Floods are the leading cause of death from natural disasters in the United States. Between 1960 and 1996, there were 252 deaths from floods or flash floods in West Virginia. This is more than any other state except Texas (619) and California (258). If the 125 deaths caused by the Buffalo Creek disaster in 1972 are excluded, West Virginia would still rank tenth in flood fatalities during this period. West Virginia has a long history of deaths, mental trauma, and property damage attributable to flooding. Six people perished in southern West Virginia during the July 2001

flooding. National statistics show that 59% of flood-related fatalities in the last 10 years occurred in vehicles.

d. Issues Raised by the Study. The Task Force held public meetings around West Virginia to obtain public input on the issues surrounding flooding. Each of the meetings addressed issues raised by local government officials as well as the views and concerns of the general public. Table 1-3 summarizes the most frequent comments received. A complete summary of the comments received is included in Appendix N.

Table 1-3
Most Frequent Comments Received from Statewide Public Meetings
(January through December 2001)

Subject	Comment	Frequency
Dredging	Dredge streams.	22
Debris	Debris blocks small streams, causing local flooding.	15
Mapping	Improve and update floodplain mapping.	15
Culverts	Old culverts cannot handle stormwater flows from new development and other changes.	14
Development	Development such as new housing, commercial and industrial development, is causing floods.	14
Highway	Department of Highways and railroad bridges are too low and catch debris, causing flooding.	11
Permitting	Streamline the permitting process and clarify permit requirements and agency authority.	10
Problem	Roads are blocked during high water.	10
Dam	Dam the Greenbrier River.	9
Timbering	Logging is causing floods.	9
Highway	"New" highway construction projects cause flooding.	8
Enforcement	Require retention/detention ponds at every new development.	7
Small ponds	Need more small watershed dams and retention ponds.	7
Stormwater	Stormwater management is needed.	7
Coordination	Coordinate plan and future flood protection activities with towns and cities.	6
Coordination	Coordination and cooperation among State federal and local agencies needs to be in place.	6
Dam	Do not dam the Greenbrier River.	6
Enforcement	Enforce floodplain regulations.	6

Figure 1-4. Example of Flood Damages in July 2001

e. Planning Constraints and Opportunities. The Plan is based on both existing and newly generated data. Time and personnel constraints limited the development of new data. Existing data was analyzed and updated to current conditions and price levels. Newly generated data is based upon 2000 Census figures and information supplied by the West Virginia Department of Tax and Revenue among others. The professional judgment and experience of agency personnel played a large part in identifying viable damage reduction options and in the formulation of the overall plan. Where possible, data is categorized by 11-digit watershed units.

Several opportunities were realized during the planning for flood damage reduction programs in West Virginia. Chief among those were opportunities for improved emergency communications through improvements to the flood warning system, opportunities for stream restoration and improvement of housing quality through floodplain relocations. These opportunities would surface as by-products of the planning for reductions in loss of life and property damages.

f. Implementing The Plan. It should be obvious from examining the recommendations included in this plan that no one solution will eliminate flooding in West Virginia. Even implementing all of the recommendations provided in this plan will not completely eliminate the risk of flooding. Man does not have the power to eliminate these dangers. However, implementing the recommendations included in this plan will reduce the flood related risks to lives and properties in West Virginia.

Implementing these recommendations will cost time, resources and money that could be allocated to other pressing State issues. Implementing the recommendations included in this plan would cost billions of dollars if they were implemented concurrently. Fortunately, the benefits of the recommendations are cumulative in nature. Therefore, a sustained annual program of expenditures well within the budget capabilities of the Federal and State governments would be

effective in reducing the loss of life and flood damages. Regardless of the final costs, implementing these recommendations will be cheaper than the continuing financial and social costs of lives and property lost to flooding each year (See Tables 1-1 and 1-2).

The recommendations are not arranged in a priority list. Nor should it be assumed that all of one group should be accomplished before starting on the items in another group or that one group is more important than another. Nor should it be assumed that these recommendations are all that should ever be done to reduce the effects of flooding. As our knowledge grows, as technology develops and as we succeed in reducing the effects of flooding, we will learn new and even more effective ways to reduce the effects of flooding.

g. Description of the Plan Area.

The Plan area encompasses the entire State of West Virginia. There are approximately 15.5 million acres of land (24,231 square miles) within the State contained within 55 counties and approximately 240 municipalities. About 145 square miles of the State are covered by water features (primarily streams and rivers). The mean elevation of the State is approximately 1,500 feet above sea level leading to the State's nickname "the Mountain State". There are 32 major river watersheds in the State that contain approximately 31,000 miles of rivers and streams. Figure 1-5 shows the distribution and extent of the major watersheds in the State.

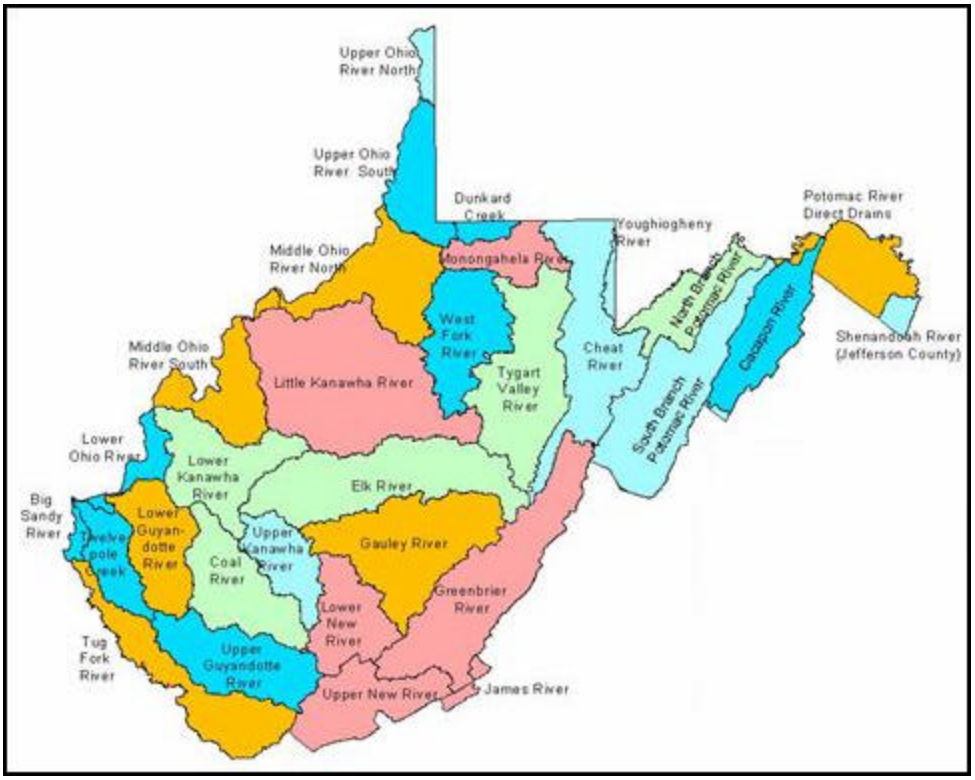

Figure 1-5. Major Watersheds in West Virginia

According to the 2000 Census, there are approximately 1,806,000 people residing in the State. The 1990 Census population count was 1,793,477. Table 1-4 shows the distribution of the 2000 population by county within the State. The ten most populous counties are shown in yellow, all have populations in excess of 50,000. Each of the fifty-five counties contains one or more major

municipalities and commercial/residential centers that support the daily needs of the county population.

Table 1-4. Population by County (2000 Census)

County	Population	County	Population
Barbour	15557	Mercer	62980
Berkeley	75905	Mineral	27078
Boone	25535	Mingo	28253
Braxton	14702	Monongalia	81866
Brooke	25447	Monroe	14583
Cabell	96784	Morgan	14943
Calhoun	7582	Nicholas	26562
Clay	10330	Ohio	47427
Doddridge	7403	Pendleton	8196
Fayette	47579	Pleasants	7514
Gilmer	7160	Pocahontas	9131
Grant	11299	Preston	29334
Greenbrier	34453	Putnam	51589
Hampshire	20203	Raleigh	79220
Hancock	32667	Randolph	28262
Hardy	12669	Ritchie	10343
Harrison	68652	Roane	15446
Jackson	28000	Summers	12999
Jefferson	42190	Taylor	16089
Kanawha	200073	Tucker	7321
Lewis	16919	Tyler	7592
Lincoln	22108	Upshur	23404
Logan	37710	Wayne	42903
Marion	27329	Webster	9719
Marshall	56598	Wetzel	17693
Mason	35519	Wirt	5873
McDowell	25957	Wood	87986
		Wyoming	25708

The majority of the State's population is clustered into several Metropolitan Statistical Areas (MSA) located wholly or partially within the State. Those MSA's are Charleston, Cumberland, MD (includes portions of Mineral County), Huntington/Ashland, Parkersburg/Marietta, Weirton/Steubenville, Washington, DC (includes portions of Berkeley and Jefferson counties) and Wheeling/Bridgeport. Major transportation routes, employment centers, and municipalities within these regions support these population density patterns. Figure 1-6 shows the distribution of population density within the State with major interstate routes superimposed.

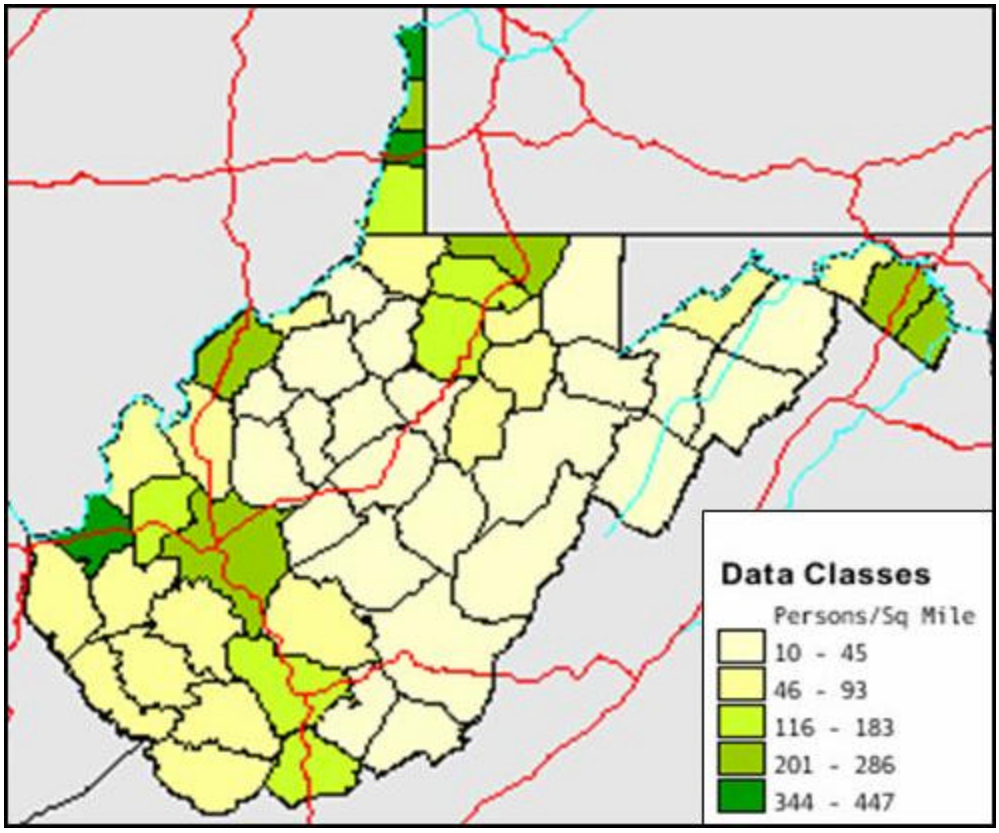

Figure 1-6. Distribution of Population Densities by County

According to the 2000 Census, there are 844,623 residential housing units in the State (an increase of 8% over that same category in the 1990 census). Of those total units, 736,841 are occupied and of those occupied units, 553,699 (75%) are occupied by the unit's owner. Of the total 844,623 residential housing units, 583,695 (69 percent) are single-family detached units and 142,728 (17 %) are identified as mobile homes. At least 70% (591,236) of the residential units identified in the 2000 Census were constructed before 1980. The majority of these units were constructed before the enactment of floodplain management ordinances in the State.

The State's population has been financially supported by coal mining, wood products, steel manufacturing, tourism/recreation and chemical processing industries. Total non-farm payroll employment in 2001 was 792,000 persons. Of that total, 133,600 worked in the goods production sector and 601,800 worked in the services sector. Total agricultural-related employment in 2001 was approximately 4,292 persons. The State's average unemployment rate in 2001 was 4.9% (41,000 persons). Table 1-6 shows the number of places of employment, number of employees, and total wages by two-digit industrial codes in the State. This table shows that the State's labor

force is concentrated in business sectors such as Manufacturing, Mining, Construction, Transportation and public utilities, Wholesale and retail trade, Services, Finance, Insurance and Real Estate (F.I.R.E.), and government.

Table 1-6. Employment Statistics by Industrial Code

INDUSTRY BY 2-DIGIT CODE	UNITS	EMPLOYMENT	WAGES (in $$)
TOTAL, ALL INDUSTRIES	46,584	685,771	19,189,237,777
AGRICULTURE	664	4,292	82,162,380
01 Agricultural Production-Crops	73	692	11,002,481
02 Agricultural Production-Livestock	60	303	7,792,873
07 Agricultural Services	496	3,162	59,201,677
08 Forestry	31	116	3,814,804
MINING	861	22,457	1,124,685,481
10 Metal Mining	6	83	2,958,107
12 Coal Mining	416	17,599	945,289,742
13 Oil and Gas Extraction	391	3,883	140,354,643
14 Nonmetallic Minerals, except Fuels	48	892	36,082,989
CONSTRUCTION	5,420	34,197	1,108,468,865
15 General Building Contractors	2,067	9,480	250,509,552
16 Heavy Construction, exc. Building	525	7,479	298,282,802
17 Special Trade Contractors	2,828	17,238	559,676,511
MANUFACTURING	2,080	77,401	2,957,948,279
20 Food and Kindred Products	58	4,405	111,532,221
22 Textile Mill Products	6	544	13,072,020
23 Apparel and Other Textile Products	42	916	16,026,945
24 Lumber and Wood Products	757	11,054	268,450,828
25 Furniture and Fixtures	35	599	13,285,599
26 Paper and Allied Products	17	1,243	38,374,609
27 Printing and Publishing	222	5,840	143,318,801
28 Chemicals and Allied Products	76	13,411	890,419,650
29 Petroleum and Coal Products	23	727	31,563,410
30 Rubber and Misc. Plastics Products	52	3,777	105,952,587
32 Stone, Clay, and Glass Products	146	5,932	180,917,911
33 Primary Metal Industries	44	9,955	460,226,798
34 Fabricated Metal Products	136	5,831	209,706,749
35 Industrial Machinery and Equipment	286	5,124	176,156,404
36 Electronic & Electric Equipment	27	1,610	57,666,795
37 Transportation Equipment	38	3,793	167,526,772
38 Instruments and Related Products	43	1,495	46,653,669
39 Misc. Manufacturing Industries	69	908	19,938,809
TRANSPORTATION & PUBLIC UTILITIES	2,644	34,084	1,329,868,383
41 Local and Interurban Passenger	115	1,582	27,672,108
42 Trucking and Warehousing	1,401	10,919	305,454,213
44 Water Transportation	55	1,220	48,480,125
45 Transportation By Air	96	2,119	68,538,744
47 Transportation Services	98	654	18,145,641
48 Communications	488	8,381	328,308,339
49 Electric, Gas, and Sanitary Services	390	9,168	531,776,261

INDUSTRY BY 2-DIGIT CODE	UNITS	EMPLOYMENT	WAGES (in $$)
WHOLESALE TRADE	3,353	29,828	1,034,056,501
50 Wholesale Trade-Durable Goods	2,225	18,363	656,089,147
51 Wholesale Trade-Non-durable Goods	1,129	11,465	377,967,354
RETAIL TRADE	10,113	131,777	1,950,650,796
52 Building Materials & Garden Supplies	547	5,939	129,097,588
53 General Merchandise Stores	441	19,465	290,522,215
54 Food Stores	1,379	20,342	277,902,247
55 Automotive Dealers & Service Stations	1,704	16,869	386,493,934
56 Apparel and Accessory Stores	496	4,730	60,204,738
57 Furniture & Home furnishings Stores	701	4,316	86,110,737
58 Eating and Drinking Places	2,969	45,117	445,900,168
59 Miscellaneous Retail	1,877	15,001	274,419,169
FINANCE, INSURANCE, & REAL ESTATE	3,508	26,807	805,269,293
60 Depository Institutions	728	10,631	285,830,866
61 Non-depository Institutions	218	2,197	68,824,198
62 Security and Commodity Brokers	163	810	64,430,225
63 Insurance Carriers	226	3,212	121,079,256
64 Insurance Agents, Brokers, & Service	820	4,490	129,205,701
65 Real Estate	1,257	4,891	102,081,125
67 Holding and other Investment Offices	98	576	33,817,922
SERVICES	14,901	190,185	4,660,290,459
70 Hotels and Other Lodging Places	382	9,581	149,649,371
72 Personal Services	1,031	6,249	102,699,333
73 Business Services	2,164	31,135	592,319,577
75 Auto Repair, Services, and Parking	1,158	5,247	103,963,004
76 Miscellaneous Repair Services	428	3,043	89,990,099
78 Motion Pictures	211	1,523	18,423,768
79 Amusement & Recreation Services	530	9,108	128,811,793
80 Health Services	3,231	74,805	2,339,891,565
81 Legal Services	1,017	5,452	182,757,060
82 Educational Services	155	4,335	107,333,859
83 Social Services	1,193	19,839	308,390,873
84 Museums, Botanical, Zoological Gardens	14	173	3,052,024
86 Membership Organizations	790	5,503	79,582,897
87 Engineering & Management Services	1,639	12,485	431,796,291
88 Private Households	937	1,615	19,826,826
89 Services, n.e.c.	23	92	1,802,119
NON-CLASSIFIABLE ESTABLISHMENTS	423	764	23,402,601
99 Non-classifiable Establishments	423	764	23,402,601
GOVERNMENT	2,619	133,981	4,112,434,739
Federal Government	811	21,807	1,000,849,551
State Government	869	40,845	1,241,792,300
Local Government	940	71,329	1,869,792,888

Coal mining and processing remains one of the largest employers and revenue generators within the State. Appendix L shows the dollar value of the Coal Severance Taxes distributed throughout the State. Significant volumes of coal are exported from the State to fuel power plants along the lower Ohio River and industrial uses in Europe. In 2000, West Virginia mines produced 169 million tons of coal, accounting for approximately 15% of all coal produced in the nation. The State exports over 50 million tons of coal to twenty-three nations accounting for approximately 47% of all U.S. coal exports. Remaining, recoverable coal resources in the State indicate that mining will continue to be a strong influence in the State's economy unless environmental concerns and global market forces turn towards alternative energy sources. Figures 1-7 and 1-8 show the distribution of surface and underground mining permits in the State.

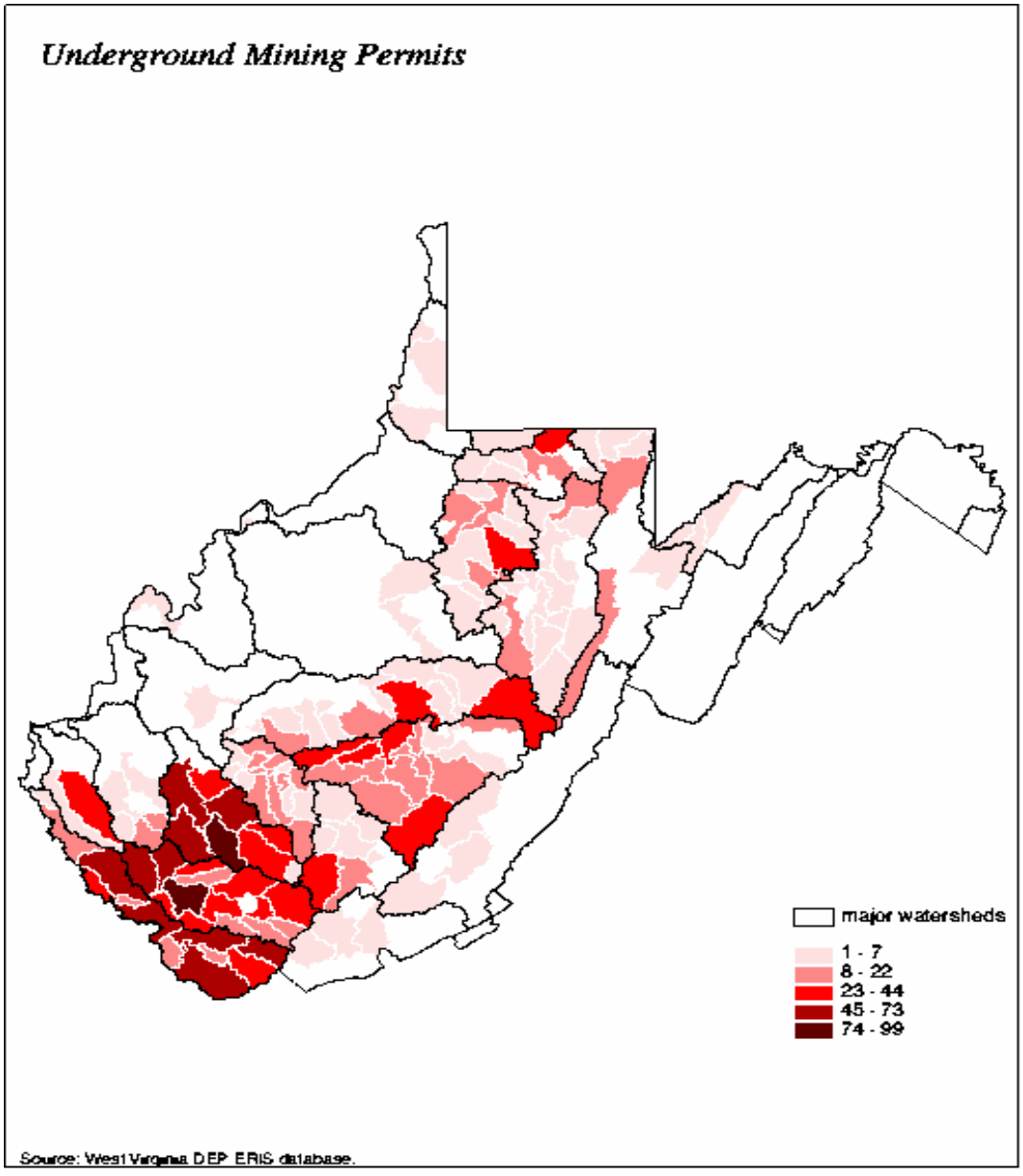

Figure 1-7. Underground Mining Permits

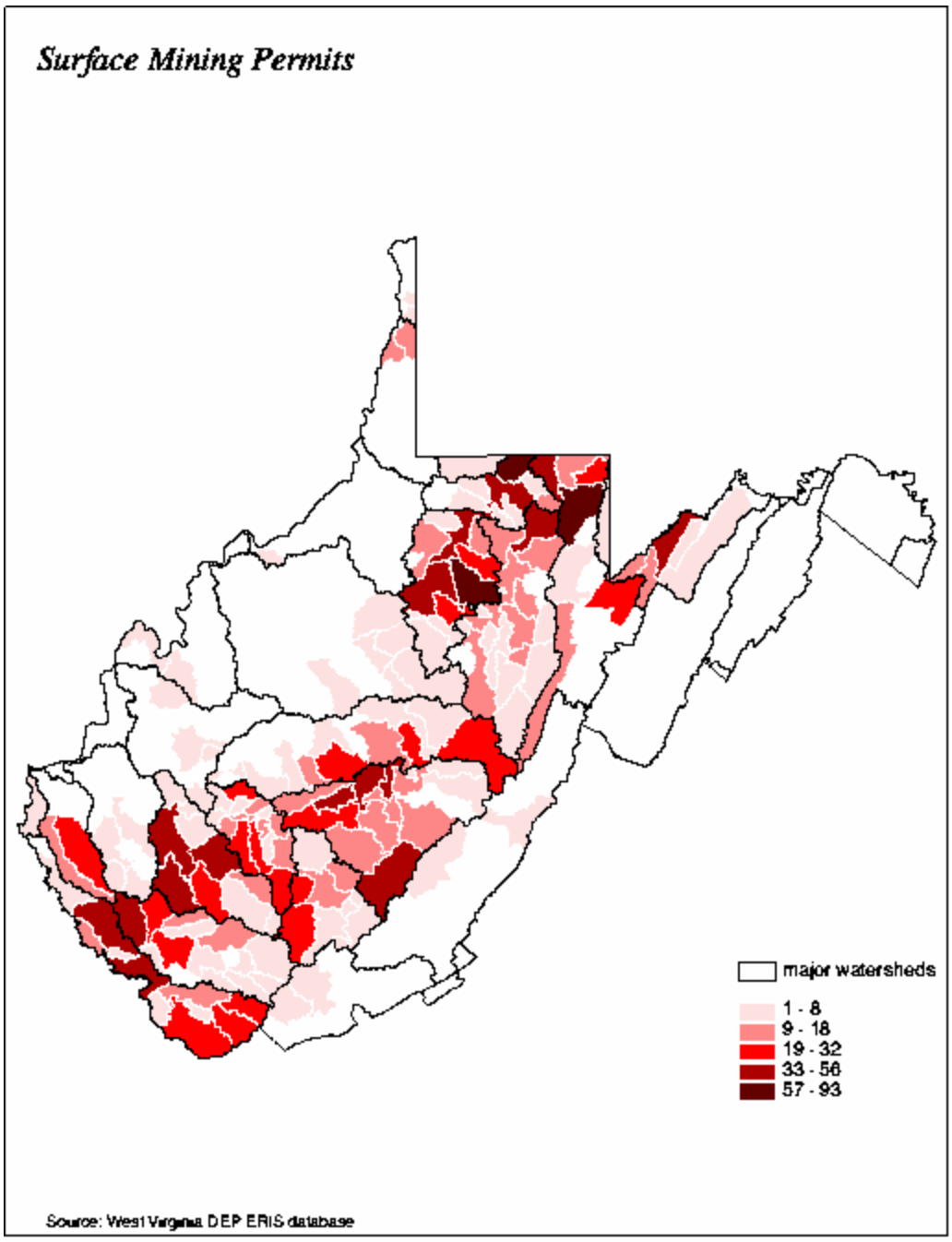

Figure 1-8. Surface Mining Permits

Harvesting and processing of wood resources in the Mountain State is a significant part of the economy for several regions of the State. As a part of the great mixed-mesophytic Appalachian Forest complex, the State's forests represent a renewable resource of inestimable value. Most of the prime forest resources are located within the most scenic and fragile ecosystems within the State. Figure 1-9 shows the percentage of each watershed covered by mixed forest (deciduous and coniferous) resources.

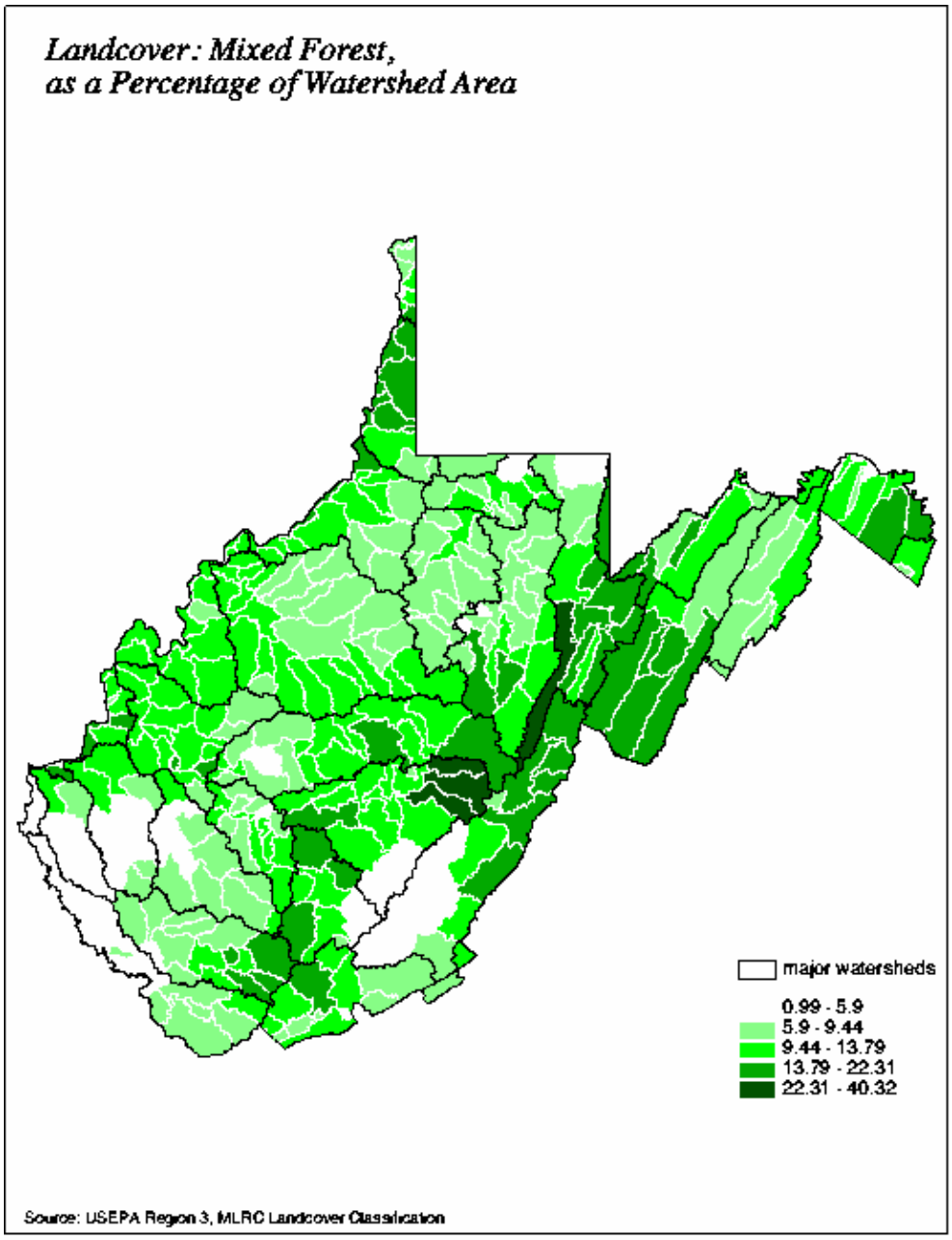

Figure 1-9. Mixed Forest Coverage by Watershed

Through wise silvicultural practices, the State's forests could provide endless employment opportunities in timber harvesting, processing and end-product development and manufacturing. Advances in wood product manufacturing and forest development have uncovered numerous opportunities within the State. Significant volumes of wood products are exported from the State to both national and international markets. However, wood resources must be developed in a responsible manner to assure that the State's forests and associated aquatic ecosystems are not irretrievably damaged.

Although not as extensive as the coal and forest resources described above, gas and oil resources in the State are substantial and provide both employment and revenue to the population. Figure 1-10 shows the extent of the gas and oil fields in the State. The majority of these fields are located within the Little Kanawha River, Lower Kanawha River, Coal River, Lower Guyandotte River and Twelvepole Creek watersheds. Several of the now depleted fields are used to store gas supplies. Exploration, extraction and processing of these resources must be accomplished with consideration for protection of surface and groundwater resources. Construction of exploration roads and preparation of drilling sites can seriously affect adjacent waterways and critical species areas. Likewise, potential flooding of these fields results in losses in production and damages to transmission facilities.

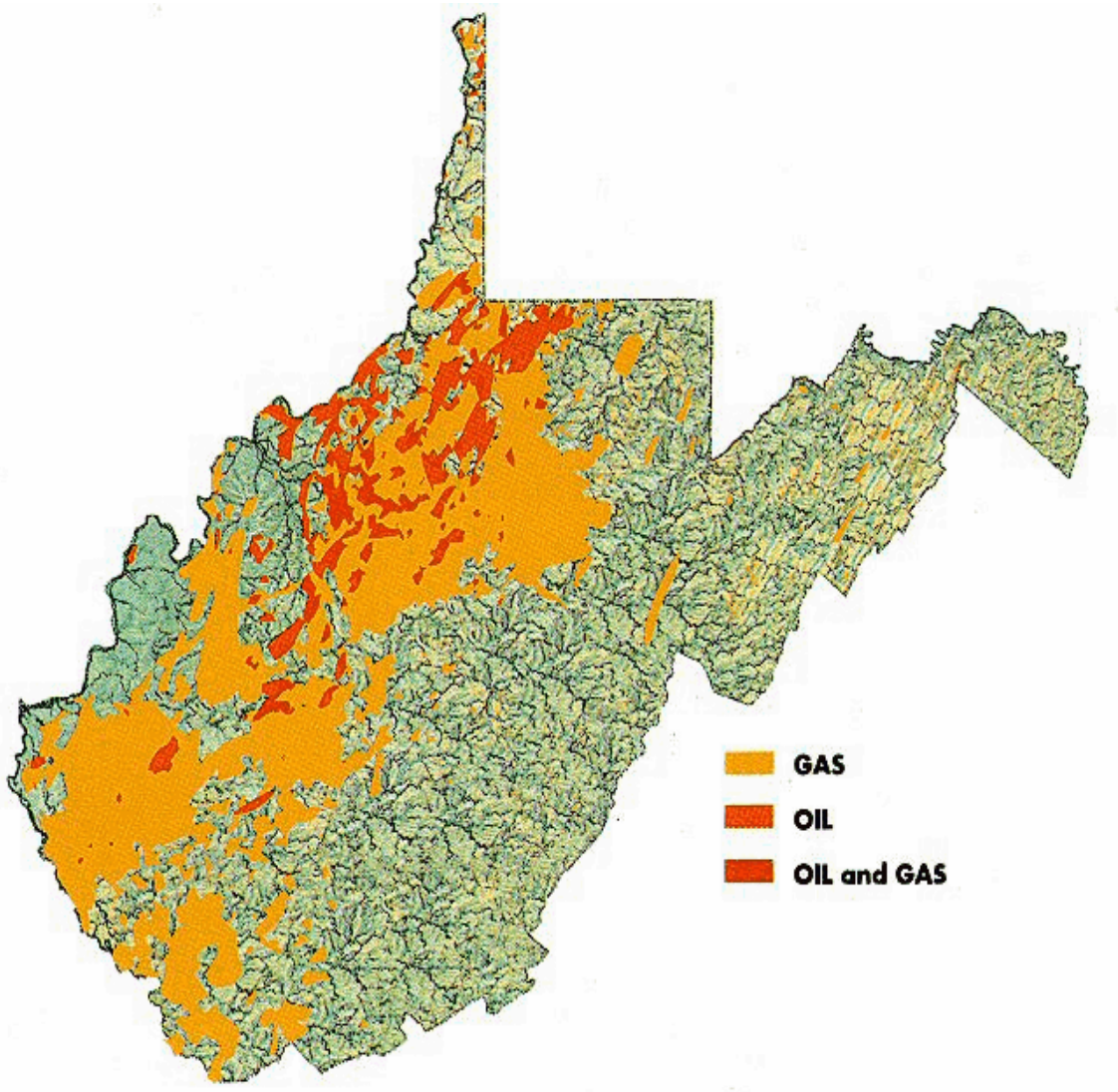

Figure 1-10. Location of Oil and Gas Fields

Small communities inhabit the narrow floodplains in the valleys and coalmines sprawl across and through the mountains. Residential, institutional, and commercial development in the region is generally found in the floodplains. In addition to the 55 county seats, there are approximately 190 other municipal areas in the State that provide employment and services to the surrounding rural county population. Many of these communities are located within floodplain areas. Figure 1-11 shows the population density for each of the watersheds in the State. Most transportation arteries, including railways and highways, as well as most utility distribution networks and facilities, are located in the floodplains. Fortunately, most cellular phone and radio transmission facilities that are critical to emergency communications during floods are located on the ridges and mountaintops.

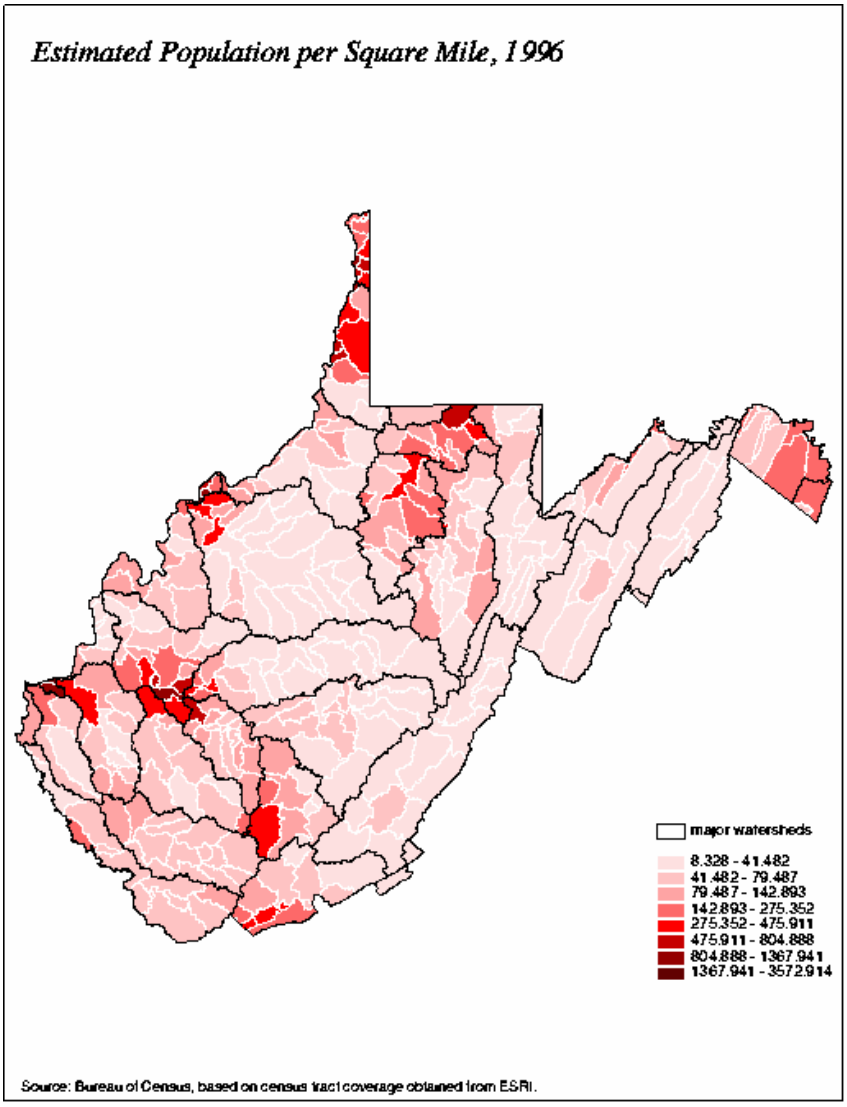

Figure 1-11. Population Density by Watershed

Historically many of the State's largest industrial complexes were located within floodplains to take advantage of transportation routes (roads, railroads, and waterways) and large expanses of flat land for production and storage facilities. Major industrial complexes in the Kanawha River Valley and along the Ohio River are largely protected by upstream dams and floodwalls.

Of the State's many assets, colleges, universities and vocational schools provide the intellectual capital necessary to power the State's research, production, and service industries. Many of these institutions are located at municipalities within floodplain areas and therefore subject to flood damages. These institutions also provide substantial employment opportunities and act as magnets for residential and service industry growth.

West Virginia is blessed with great natural beauty and a varied landscape that contains a wide variety of terrestrial and aquatic ecosystems. Many of these ecosystems are linear in nature following river corridors within the floodplain. Figure 1-12 shows the distribution and concentration of wetland acres within the State.

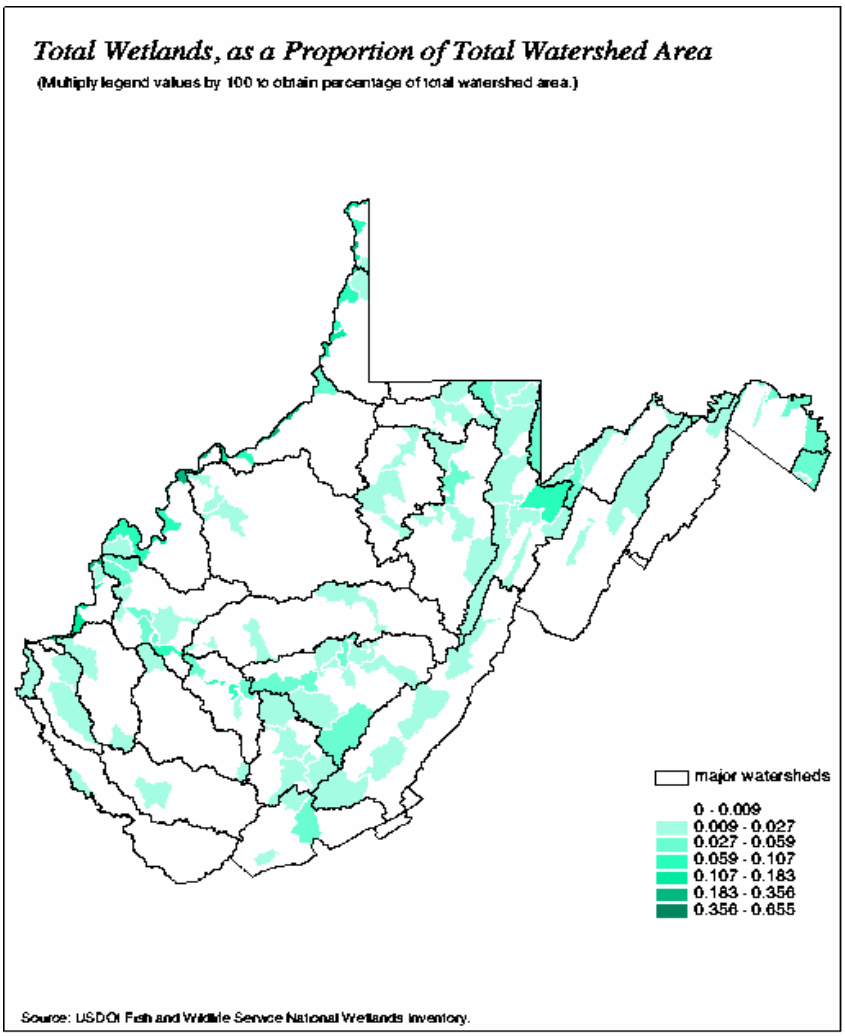

Figure 1-12. Acres of Wetlands as Percentage of Total Land Area by Watershed

These sensitive ecosystems are continually at risk from land development (structures, transportation routes and utility corridors), resources extraction and pollution. Our environmental resources represent a significant component of the foundation of the tourism industry in the

State. In 2000, approximately 21 million visitors contributed $3.9 billion to West Virginia's economy supporting 83,900 jobs.

The beauty and landscape of the State concurrently entices and hinders settlement by humans. Historically, development in the "Mountain State" has occurred within the floodplains of steep-sided, narrow valleys where most transportation routes and the majority of developable land are located. The State is likewise blessed with abundant natural resources including timber, coal, minerals, natural gas, and abundant water resources located in numerous watersheds.

Unfortunately, development of the natural resources in these watershed areas has led to significant non-point pollution and sedimentation in the State's streams. This process has been accompanied by permanent occupation of residential, commercial and industrial uses that increase stormwater runoff volumes well beyond the conveyance capacity of the resident streams. This largely unplanned combination of human settlement, natural resources development and floodplain intrusion has led to flood damages throughout the recorded history of the State. Recurring cycles of statewide damages continues to drain the financial and service resources of the local and State governments and further depresses the morale of the citizens. The correction of flood damages within the State is one of many significant issues facing State and local government.