ORBES

WEST VIRGINIA BASELINE

PHASE II

OHIO RIVER BASIN ENERGY STUDY

WEST VIRGINIA BASELINE

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WEST VIRGINIA BASELINE

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PREFACE

This volume has been written for the Ohio River Basin Energy Study (ORBES). Most of the research, complilation of data, analysis, and writing for this report was carried out at the West Virginia University in Morgantown, West Virginia. The scope of the work was designed by ORBES Core Team Members Robert E. Bailey, Steven I. Gordon, James C. Randolph, and Hugh T. Spencer, all of whom would eventually be using this information in their own work. The information contained herein parallels that previously gathered for Illinois, Indiana, Kentucky, and Ohio, and that which was simultaneously being gathered for Pennsylvania.

While this information was put together primarily for use by ORBES researchers in their studies, it appeared to the ORBES Core Team that the work, gathered at government expense, would be useful to other government agencies, academic institutions, private research institutions, and the general public. For this reason it is being published as a formal document.

The baseline data was divided into six different sections, each one written separately, primarily by the identified authors. The organizing, editing, and in some cases extensive rewriting, was performed by the editor. The chapter on Terrestrial Ecology was written by Charles Baer, Professor Emeritus in Biology at West Virginia University. For help on scope and format, he consulted with Professor J.C. Randolph and Mr. William Jones, both of the School of Public and Environmental Affairs at Indiana University.

The chapter on aquatic ecology was written by Mr. Dennis Rankin, who worked as an assistant to Professor Edward Keller at the West Virginia University Biology Department during part of the time he was working on this project. For help on scope and format, Mr. Rankin consulted with Professors Hugh T. Spencer and Clara Leuthart of the University of Louisville.

The chapter on geology and climatology was written by Mr. Thomas Hall, a graduate student in the West Virginia University Geology Department. Professor Robert Behling of that Department helped with initial discussions on the scope and use of appropriate baseline data.

The chapter on socioeconomic data was written by Ms. Anna Graham of the Department of City and Regional Planning at the Ohio State University. Ms. Graham consulted with Professor Steven I. Gordon of that Department on the scope and format of this chapter.

Much of the preliminary socioeconomic data gathering and synthesis was performed by Ms. Susan Gurski, a graduate student in the Biology Department of West Virginia University, and Professor George Stepko, then with West Virginia University in the Geography Department.

The chapter on laws and institutions was written by Mr. Thomas Sweet, an attorney working as a Research Associate at the West Virginia University College of Law.

The baseline information on electricity generation by fuel type and demand by sector was written by Professor Walter Page of the West Virginia University Department of Economics, and by Professor James P. Hartnett, Director of the Energy Research Center at the University of Illinois at Chicago Circle. This baseline data has been published as part of an ORBES document by the Energy Research Center in "Electrical Generating Inventory, 1976-1986: Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia", and does not appear in this volume.

The important baseline data on air quality for West Virginia has been gathered by Tecknekron Inc., of Berkeley, California under a separate ORBES support study. It is not clear whether this data will be published.

A number of other people helped on this volume with advice, and information. Mr. Joseph Farrell and Mr. Homer Speaker, law students at the West Virginia University College of Law, helped with some of the related administrative tasks.

Finally, appreciation is due Mrs. Jane Kitzmiller and Mrs. Sandy Stiles, for the great amount of work they did in co-ordinating authors, maps, meetings, tables, and telephone calls, and for typing the information contained in this volume.

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1. INTRODUCTION

The Ohio River Basin Energy Study (ORBES) is a three-year technology assessment funded by the United States Environmental Protection Agency under a mandate from Congress. This interdisciplinary effort is charged with the task of assessing the social, environmental and economic impacts of projected energy development in the Ohio River Basin through the year 2000.

To carry out the second and third years of the study, grants were awarded to thirteen faculty members located at eight universities in the six state region to be studied. These researchers make up the study's Core Team. The Core Team is responsible for designing and carrying out the assessment of the impacts, assisted by support researchers engaged under subcontracts, and advised by a public Advisory Board.

Representing a variety of fields, including engineering, ecology, sociology, biology, political science, regional planning, law, and economics, the Core Team members are from the Univerisity of Pittsburgh, Purdue University, and West Virginia University. Two of the researchers, Professor Boyd R. Keenan, Department of Political Science, University of Illinois at Chicago Circle, and Professor James J. Stukel, Department of Civil Engineering and Department of Mechanical Engineering, University of Illinois at Champaign-Urbana, are also members of the group responsible for managing the project.

The major part of the ORBES study involves the development of hypothetical future scenarios, each containing varying mixes of economic growth rates, electricity production levels, environmental control standards, and energy production technologies. From an examination of each of these scenarios will come a projection of the first and second-order impacts on the biological and physical characteristics of the region. An assessment of these impacts will yield information about possible higher order physical, biological, health, social and economic impacts. These impacts will then be examined for institutional, legal, and other policy issues, and these issues in turn will be analyzed.

In order to formulate hypothetical future scenarios for purpose of study, and in order to project what possible impacts these future developments might have on the area's social, environmental, and economic characteristics, it is necessary to first produce a description of that area's present social, environmental and economic characteristics. This volume is

an attempt to gather together this information for West Virginia. In the trade it is called "baseline data" or baseline information." Previous ORBES Reports, have contained similar information for Illinois, Indiana, Kentucky, Ohio, and Pennsylvania.

The study region is designed to include most of a six state area drained by the Ohio River or lying within the Eastern Interior Coal Field. This region includes most of Illinois, Indiana, and Ohio, (excluding several rows of counties along the northern borders of these states), all of Kentucky, the western 40% of Pennsylvania and all but the eastern panhandle of West Virginia, (see Fig. 1-1). In total, the region is composed of 425 counties. In West Virginia, all of the state except Pendleton, Hardy, Hampshire, Mineral, Morgan, Berkeley, and Jefferson Counties are included. Grant County lies outside of the Ohio River watershed, but was included in the study region because the Mt. Storm Power Plant is located in that county. Because most of the state lies within the study region, the Core Team decided to use state-wide data where county totals were not available.

Instead of selecting one calendar year as its baseline period, ORBES selected the mid-1970's. This enabled researchers to use statistical data collected in each of a number of years, thereby making better sources available. The text should note those places where information is based on data collected in years outside the mid-1970's.

The information contained in this volume is broken down into five subject areas: terrestrial ecology, aquatic ecology, geology and climatology, socioeconomic data, and laws and institutions. This breakdown results in part from the different disciplinary work being done by the Core Team personnel who helped design the scope of West Virginia baseline effort, and in part from the number and disciplines of those people selected to write this baseline report.

As mentioned in the Preface, data on West Virginia air quality, and electricity generation and consumption in West Virginia, is not contained in this volume. The air quality work was done by Teknekron Inc. of Berkeley, California for ORBES as a Support study. The data on electricity generation by fuel type and electricity consumption by economic sector is contained in an ORBES report published by the Energy Research Center at the University of Illinois at Chicago Circle.

OHIO RIVER BASIN ENERGY STUDY REGION

PHASE II

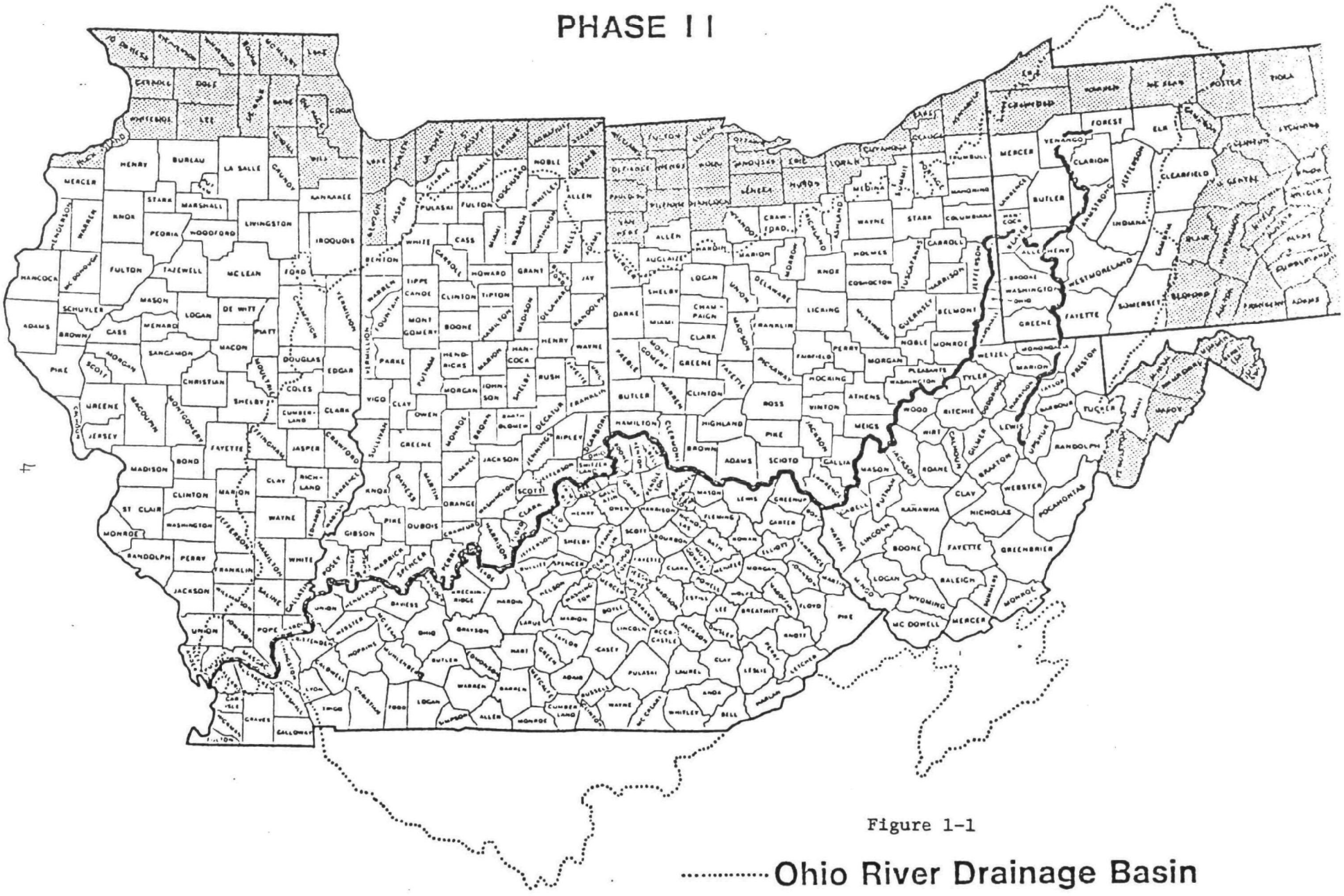

Figure 1-1

..... Ohio River Drainage Basin

2. TERRESTRIAL ECOLOGY

2.1 INTRODUCTION

This chapter is an expansion of the earlier ORBES baseline studies of the terrestrial ecology of the lower Ohio River Basin in Illinois, Indiana, Ohio and Kentucky. The information covered in these reports concerns the nature of the natural ecosystems prior to the settlement by Europeans, the impacts that these imigrants and their descendents have had on the natural and altered environments, and the current status of neo-natural ecosystems.

It is apparent that the hill country and mountainous parts of the upper Ohio River Basin present a different physiographic setting than that of the glaciated lowlands in the lower Ohio River basin. Although there are inherent similarities between the biota and ecosystems of the upper and lower basins, there are also significant differences, particularly in the relative abundance of individual species and vegetative cover types, and in land use patterns. Past and prevailing similarities and differences in the biota and habitats of the upper and lower parts of the basin are elucidated by statistical data, maps and other illustrations, and by interpretations.

Much of the information in the earlier baseline study by Indiana, Ohio State, and Purdue Univeraities (ORBES, Preliminary Technology Assessment Reports, Indiana University, et. al., Vol. II-A, 1977, hereinafter referred to as ORBES, Indiana Report) is applicable to the upper Ohio River Basin. In order that the reader have immediate access to that comprehensive treatment of the terrestrial ecosystems, part of the earlier report is incorporated into the text of this West Virginia report. Also an attempt has been made to follow the format and data array of the earlier study as closely as possible so that the site selection criteria could be applied uniformly. The uniqueness of the Appalachia Plateaus region, when compared to the ecology of the Gentral Lowlands portion of the Basin, should be given special consideration in formulating a master, energy-development plan for the region as a whole.

2.2 VEGETATION

This section first describes the natural vegetation of the ORBES region of West Virginia as it existed prior to settlement of the area by Europeans and their descendants, and then describes the present-day forest vegetation of this same region.

2.2.1 PRE-SETTLEMENT VEGETATION

Inasmuch as no careful studies of vegetation were recorded prior to settlement by the white man, any description of original natural vegetation is to some extent conjectural. However, using current distributions and detailed reconstructions from historical records as guides (Gordon, 1969), ecologists have come to agree as to the original character of this vegetation.

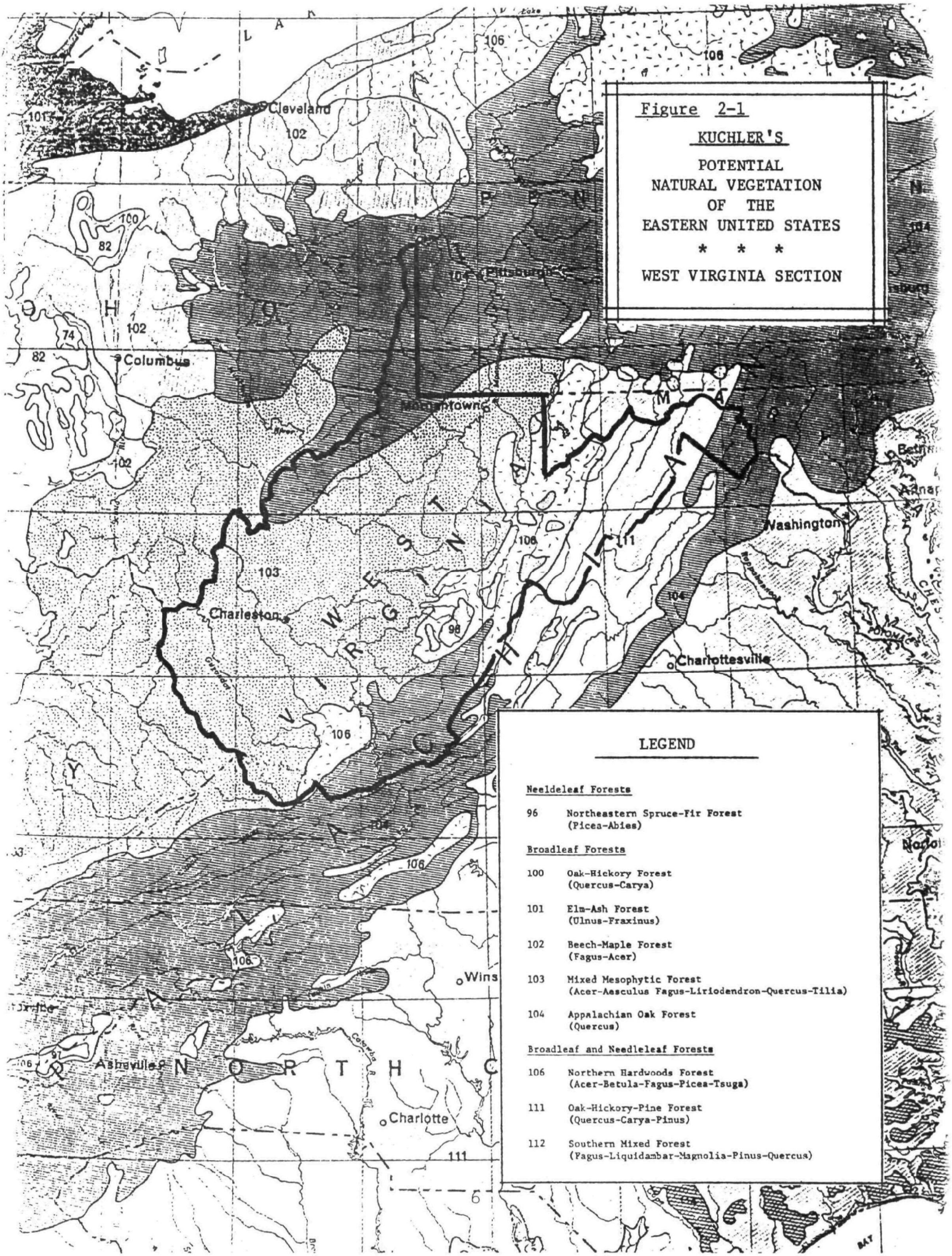
Figure 2-1
KUCHLER'S
POTENTIAL
NATURAL VEGETATION
OF THE
EASTERN UNITED STATES
* * *
WEST VIRGINIA SECTION
LEGEND
Needleleaf Forests
96 Northeastern Spruce-Fir Forest (Picea-Abies)
Broadleaf Forests
100 Oak-Hickory Forest (Quercus-Carya)
101 Elm-Ash Forest (Ulnus-Fraxinus)
102 Beech-Maple Forest (Fagus-Acer)
103 Mixed Mesophytic Forest (Acer-Aesculus Fagus-Liriodendron-Quercus-Tilia)
104 Appalachian Oak Forest (Quercus)
Broadleaf and Needleleaf Forests
106 Northern Hardwoods Forest (Acer-Betula-Fagus-Picea-Tsuga)
111 Oak-Hickory-Pine Forest (Quercus-Carya-Pinus)
112 Southern Mixed Forest (Fagus-Liquidambar-Magnolia-Pinus-Quercus)
Cleveland
Columbus
Pittsburgh
Morgantown
Washington
Charleston
Charlottesville
Asheville
Charlotte
WEST VIRGINIA
NORTH CAROLINA

TABLE 2-1

PRE-SETTLEMENT VEGETATION OF THE ORBES STATES

1. Northern Hardwoods (Acer-Betula-Fagus-Tsuga) [K-106]*

   Physiognomy: Tall, broadleaf deciduous forest with an admixture of needleleaf evergreen trees

   Dominants: Sugar maple (Acer saccharum); Yellow birch (Betula allegheniensis); Beech (Fagus grandifolia); Hemlock (Tsuga canadensis)

2. Beech-Maple Forest (Fagus-Acer) [K-102]

   Physiognomy: Tall broadleaf deciduous forest

   Dominants: Sugar maple (Acer saccharum); Beech (Fagus grandifolia)

3. Maple-Basswood Forest (Acer-Tilia)

   Physiognomy: Medium tall, broadleaf deciduous forest

   Dominants: Sugar maple (Acer saccharum); Basswood (Tilia americana)

4. Mixed Mesophytic Forest (Acer-Aesculus-Fagus-Liriodendron-Quercus-Tilia) [K-103]

   Physiognomy: Tall broadleaf deciduous forest

   Dominants: Sugar maple (Acer saccharum); Buckeye (Aesculus octandra); Beech (Fagus grandifolia); Tulip tree (Lirioden tulipifera); White oak (Quercus alba); Northern red oak (Quercus rubra); Basswood (Tilia heterophylla)

5. Appalachian Oak Forest (Quercus) [K-104]

   Physiognomy: Tall broadleaf deciduous forest

   Dominants: White oak (Quercus alba); Northern red oak (Quercus rubra)

6. Oak-Hickory Forest (Quercus-Carya) [K-100]

   Physiognomy: Medium tall to tall broadleaf deciduous forests

   Dominants: Bitternut hickory (Carya cordiformis); Shagbark hickory (Carya ovata); White oak (Quercus alba); Red oak (Quercus rubra); Black oak (Quercus velutina)

*Numbers shown in brackets [--] correspond to vegetation type numbers of Kuchler's vegetation map, West Virginia section (Figure 2-1) of this report.

7. Bluestem Prairie (Andropogon-Panicum-Sorghastrum) [K-74]
Phy
Physiognomy: Dense vegetation of tall grasses and many forbs

Dominants: Big bluestem (Andropogon gerardi); Little bluestem (Andropogon scoparius); Switchgrass (Panicum virgatum); Indian grass (Sorghastrum nutans)

8. Oak-Hickory Breaks (Quercus-Carya-Andropogon) [K-82

Physiognomy: A mosaic of oak-hickory forest and bluestem

Dominants: (see types 6 and 7)

9. Oak Savanna (Quercus-Andropogon) [K-81]

Physiognomy: Tall grass prairie with broadleaf deciduous trees scattered singly or in groves

Dominants: Big bluestem (Andropogon gerardi); Little bluestem (Andropogon scoparius); Bur oak (Quercus macrocarpa)

10. Elm-Ash Forest (Ulmus-Fraxinus) [K-101]

Physiognomy: Medium tall to tall boradleaf deciduous forest

Dominants: White ash (Fraxinus pennsylvanica); American elm (Ulmus americana)

11. Southern Floodplain Forest (Quercus-Nyssa-Taxodium) [K-113]

Physiognomy: Dense, medium tall to tall forest of broadleaf deciduous and evergreen trees and shrubs and needle-leaf deciduous trees

Dominants: Tupelo (Nyssa aquatica); Oak (Quercus spp.); Bald cypress (Taxodium distichum)

12. Northeastern Spruce-Fir Forest (Picea-Abies) [K-96]

Physiognomy: Dense needleleaf evergreen forest, low to medium tall, or in the form of krumholz in high altitudes, with a modest admixture of broadleaf deciduous trees.

Dominants: Red spruce (Picea rubens); Balsam fir (Abies balsamea)

13. Northern Hardwoods-Spruce Forest (Acer-Betula-Fagus-Picea-Tsuga) [K-108]

Physiognomy: Tall, dense forest of broadleaf deciduous and needleleaf evergreen trees

Dominants: Sugar (or red) maple (Acer saccharum, A. rubrum); Yellowbirch (Betula alleghenienses); Beech (Fagus grandifolia); Red spruce (Picea rubens); Hemlock (Tsuga canadensis)

TABLE 2-2

PRINCIPAL FOREST TYPES OF THE ORBES REGION
FOLLOWING THE CLASSIFICATION BY THE SOCIETY OF AMERICAN FORESTERS

SAF TYPE	A. FOREST COMMUNITIES
SAF-5	Balsam fir (Abies balsamea)
SAF-16	Aspen (Populus)
SAF-17	Pin cherry (Prunus pensylvanica)
SAF-20	White pine -- northern red oak -- white ash (Pinus strobus--Quercus rubra--Fraxinus americana)
SAF-21	White pine (Pinus strobus)
SAF-22	White pine--hemlock (Pinus strobus--Tsuga)
SAF-23	Hemlock (Tsuga)
SAF-24	Hemlock-yellow birch (Tsuga--Betula alleghaniensis)
SAF-25	Sugar maple--beech--yellow birch (Acer saccharum--Fagus--Betula alleghaniensis)
SAF-26	Sugar maple-basswood (Acer saccharum--Tilia spp.)
SAF-27	Sugar maple (Acer saccharum)
SAF-28	Black cherry--sugar maple (Prumus serotina--Acer saccharum)
SAF-29	Black cherry (Prumus serotina)
SAF-30	Red spruce-yellow birch (Picea rubens--Betula alleghaniensis)
SAF-31	Red spruce--sugar maple--beech (Picea rubens--Acer saccharum--Fagus)
SAF-32	Red spruce (Picea rubens)
SAF-33	Red spruce--balsam fir (Picea rubens--Abies balsamea)
SAF-38	Tamarack (Larix laricina)
SAF-39	Black ash--American elm--red maple (Fraxinus nigra--Ulmus americana--Acer rubrum)
SAF-40	Post Oak--black oak (Quercus stellata--Q. velutina)
SAF-41	Scarlet oak (Quercus coccinea)
SAF-43	Bear oak (Quercus ilicifolia)
SAF-44	Chestnut oak (Quercus prinus)
SAF-45	Pitch pine (Pinus rigida)
SAF-46	Eastern redcedar (Juniperus virginiana)
SAF-47	Eastern redcedar--pine (Juniperus virginiana--Pinus)
SAF-48	Eastern redcedar--hardwood (Juniperus virginiana)
SAF-49	Eastern redcedar--pine--hardwood (Juniperus virginiana--Pinus)
SAF-50	Black locust (Robinia pseudoacacia)
SAF-51	White pine-chestnut oak (Pinus strobus--Quercus prinus)
SAF-52	White oak-red oak--hickory (Quercus alba--Quercus spp.--Carya)
SAF-53	White oak (Quercus alba)
SAF-54	Northern red oak-basswood--white ash (Quercus rubra--Tilia spp.--Fraxinus americana)
SAF-55	Northern red oak (Quercus rubra)
SAF-56	Northern red oak--mockernut hickory--sweetgum (Quercus rubra--Carya tomentosa--Liquidambar styraciflua)
SAF-57	Yellow-poplar (Liriodendron tulip
SAF-58	Yellow-Poplar--hemlock (Liriodendron tulipifera--Tsuga)
SAF-59	Yellow-poplar--white oak-- northern red oak (Liriodendron tulipifera--Quercus alba--Q. rubra)
SAF-60	Beech--sugar maple (Fagus--Acer saccharum)
SAF-61	River birch-sycamore (Betula nigra--Platanus)
SAF-62	Silver maple--American elm.(Acer saccharinum--Ulmus americana)
SAF-63	Cottonwood (Populus)
SAF-64	Sassafras--persimmon (Sassafras albidum--Diospyros virginiana)
SAF-65	Pin oak--sweetgum (Quercus palustris--Liquidambar styraciflua)
SAF-75	Shortleaf pine (Pinus echinata)
SAF-76	Shortleaf pine--oak (Pinus echinata--Quercus)
SAF-77	Shortleaf pine--Virginia pine (Pinus echinata--P. virginiana)
SAF-78	Virginia pine--southern red oak (Pinus virginiana--Quercus falcata)
SAF-79	Virginia pine (Pinus virginiana)
SAF-87	Sweetgum--yellow poplar (Liquidambar styraciflua--Liriodendron tulipifera)
SAF-95	Black willow (Salix nigra)

(Source: Bones, 1976, USDA)

Figure 2-2
Change in cropland acreage in West Virginia since 1930.

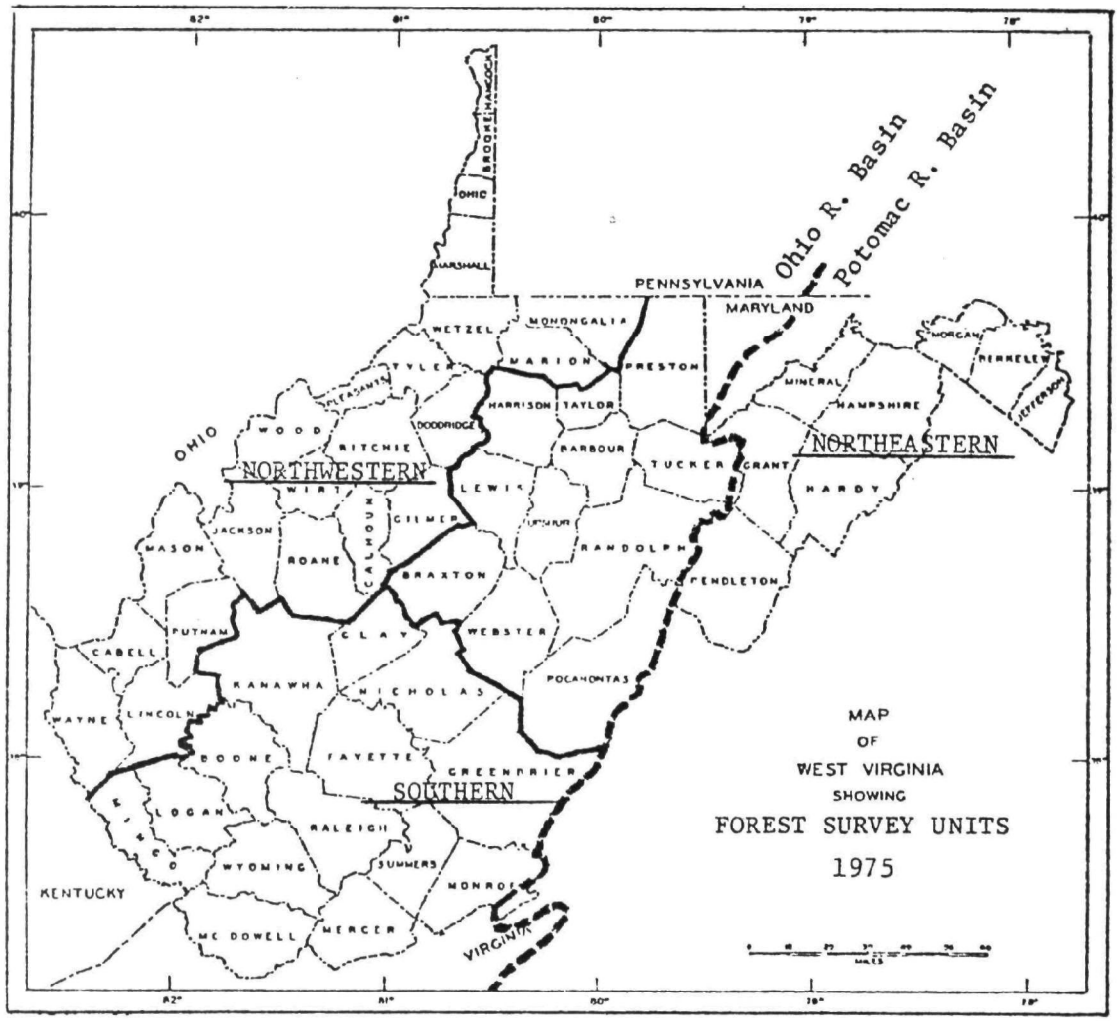

Figure 2-3

Forest Survey Units of West Virginia, United States Department of Agriculture. The dashed line shows the eastern border of the Ohio River Basin which bisects the Northeastern unit. Such units bear little relationship to the Ecological Regions of the state (see Figure 2-22) recognized by the West Virginia Department of Natural Resources.

Prior to settlement by European immigrants, temperate-climate, broadleaf, deciduous forests occupied over 90 percent of the ORBES region lying within Indiana, Illinois, Ohio, Kentucky, and 100 percent of the ORBES region in West Virginia and Western Pennsylvania. To the early settlers the forest represented a formidable challenge to the establishment of agriculture. Geographically this massive forest represented the north central phase of the more extensive Eastern Deciduous Forest Formation or Biome which extended from the Atlantic and Gulf Coasts, north to Canada and westward to the prairies.

The broadleaf tree dominated forests of the eastern United States vary in composition, structure, and productivity in response to ecological factors imposed by geographic and physiographic differences within the major vegetative unit, the Eastern Deciduous Forest. At the broadest level, the major subdivisions are the Mixed Mesophytic, the Beech-Maple, the Appalachian Oak, the Oak-Hickory and Oak-Hickory-Pine Forests Regions. These regions identified by the predominant forest association are readily subdividable into forest types (Table 2-2) and other plant communities (Table 2-7). Generally the foregoing regional forest associations and their variants occupy the warmer sections of West Virginia at elevations below 3000' msl. Above that elevation forests of more northerly affinities prevail. From 3000' to 4000' Northern Hardwoods and Hemlock-Hardwoods forests predominate the landscape. The roughness of the topography throughout West Virginia and the rest of the Appalachian Plateaus causes a complex mosaic of vegetation types, which is only moderately related to elevation effects. Thus, drawing boundaries between major units of vegetation is highly arbitrary.

The Appalachian extension of the Boreal Coniferous Forest Biome is found in disjunctive stands in the highest mountain areas of West Virginia. Although designated in Figure 2-1 and Table 2-1 as Northeastern Spruce-Fir, both the original and present-day stands in West Virginia could best be called Red Spruce Forest, balasam fir seldom being found in appreciable numbers. Most of the original Spruce (-Fir) forest stands have been replaced by Northern Hardwoods, Hardwood-Hemlock, and Hemlock-Hardwood stands. It is possible that some of these stands, if spared from future cutting, will eventually return to spruce dominated forests through the slow mechanism of plant succession and soil accumulation.

The remaining vegetation types of the ORBES region included southern flood plain forest, hemlock cove forest, and tall-grass prairie, none of which covered extensive areas. Wetlands were significant along the northern border of the region in Indiana and Ohio where glaciated-topography predominated, but riverside wetlands were never important (Gordon, 1969, Kuchler, 1964, Lindsey, 1965).

Only about half of Illinois was forested; the rest was covered by extensive prairies. The largest of these was the Grand Prairie a backland prairie mostly in the central part of the state.

There is less agreement among ecologists as to the geographical distribution of various community types within the forest. A.W. Kuchler's rendition (1964) of the original distribution of the major vegetation

types is given in Figure 2-1. Maps of the original vegetation of individual states representing the views of other ecologist are available for Ohio (Gordon, 1966), Indiana (Lindsey, 1965, Gordon,1936, et. al.), and Illinois (Vestal, 1931).

A general conclusion relevant to the present study that can be drawn from the figures and tables referred to in the preceding paragraphs is that oaks, hickories, sugar maples, beeches, and ashes were important species in pre-settlement forests of Indiana, Ohio, Illinois, and central Kentucky and indeed remain so today. These species in general are also common in the Appalachian Plateaus sections of Ohio, Pennsylvania, West Virginia, and eastern Kentucky; but tuliptree, red maple, sweet buckeye, basswood, birches and magnolias gain importance as mixed mesophytic forests gradually predominate slightly over oak forests along the western slopes of the Appalachian range.

2.2.2 CHANGES IN VEGETATIVE COVER

Data on present-day forest vegetation are presented at two levels of resolution in this section. The most extensive data have been assembled by regional experiment stations of the U.S. Forest Service. These have been summarized in maps showing approximate geographical distributions of forests and forest community types in each of the ORBES states.

Data of higher resolution are available through summaries of quantitative census of forest resources according to regional land areas known as "forest survey units." Data on fourteen of these units, thirteen of which border the Ohio River (including one in West Virginia) were included in ORBES, Indiana Report,(See Figure 2.1-66 and Tables 2.1-24 and 25 of the report). Comparable data for West Virginia are found in Tables 2-3,4,5 of this West Virginia ORBES, report.

The following sections contain information on changes in the original vegetation with respect to forest coverage, stand age, and community composition.

2.2.3 CHANGES IN FOREST COVERAGE

The major changes in the original vegetation brought about by settlement of the land by Europeans has been the conversion of forest into treeless agricultural land. On many of the glaciated soils on the flat land of the northern part of the ORBES region, trees have been eradicated, except for those in hedgerows, in ravines, and along river edges. Most of this cleared land is cultivated. The portion of the region near the Ohio River in the lower basin and in the Appalachian Plateaus have been subjected to less sustained deforestation. The more rugged and largely unglaciated terrain away from the Ohio river is not suited for tillage and not extensively suitable for grazing. Thus, in these rugged parts of the region, a forested-pastoral mosaic has replaced the original forest continuum. Unforested lands predominate

in the Blue Grass unit, where the land is relatively level and farmed (Gansner, 1968). Reversion of pastureland to forest cover is responsible for the 16 percent increase in forested lands in West Virginia since 1961. (Bones, 1976).

Reduction in forested lands in the ORBES region as a whole is still proceeding, though at a slower rate, in the more cultivable and more quickly urbanizing northern portions of the ORBES region in Indiana, Illinois, and Ohio. Conversely, the reduction of agriculture in the Appalachian mountain and hill country of the eastern ORBES region including West Virginia has resulted in appreciable increases in forested lands, (Fig. 2-2).

2.2.4 CURRENT FOREST RESOURCES

Forests occupy 11.6 million acres or 75 percent of all land in West Virginia (Bones, 1976). As previously stated, this represents a 16 percent increase over the 9.9 million acres in 1964, accountable primarily to reversion of pastureland to forest cover. Oaks account for 40 percent of the growing stock volume and 44 percent of the sawtimber volume. Of the 166.1 million cubic feet of timber harvested in 1974, only 10.6 million cubic feet was from softwoods, while 155.5 million cubic feet was made up of hardwood species. The net volume of standing hardwood sawtimber on commercial forest land is led by yellow poplar (Lirodendron tulipifera), followed closely by northern red oak (Quercus rubra), white oak (Q. alba), other "red" oak species combined, and other "white" oak species combine. The remaining significant species, in descending order of volume, are hickories, beech, sugar and red maples, black cherry, ash, sweet birch, basswood, yellow birch, cucumbertree, black gum, and black walnut. Virginia pine has the greatest standing sawtimber volume of all the soft woods, followed by hemlock, red spruce, white pine and other yellow pines (pitch and shortleaf). (See Table 2-3).

In recent years, the U.S. Forest Service (Bones, 1976) has reduced the number of forest survey units in West Virginia from seven to three (Fig. 2-3). Although these three geographic units are useful for forest inventories, they bear little relationship to the ecology or inventory tables (Table 2-3, 2-4, 2-5) combine the data from ecologically and floristically different forest types; ie. the boreal forest extension, the northern hardwoods and the southern hardwoods. The consolidation of all forests types into five timber types (Table 2-4) gives an unclear picture of the natural forest vegetation of the Appalachian portion of ORBES. The most abundant forest cover in West Virginia according to the 1975 Forest Survey statistics was oak-hickory, occupying 6,828,100 acres or over 50 percent of the commercial forest acreage in the state. The maple-beech-birch type covering 2,618,000 acres was the second most abundant, two thirds of which are located in the Monongahela National Forest. The applicability of such Forest Survey statistics to site selection for electrical power generating plants is dubious. However, such statistics concerning forest resources are the best available index of the potential role of forest industries in the economy of subregions within the Ohio River Basin.

TABLE 2-3

NET VOLUME OF GROWING STOCK ON COMMERCIAL FOREST LAND, BY SPECIES AND DIAMETER CLASSES, WEST VIRGINIA, 1975*

[In millions of cubic feet]

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Virginia pine	416.5	55.7	99.2	100.5	86.8	47.3	20.2	6.8	--	--	--
Other yellow pines	115.1	6.4	23.4	26.9	23.5	17.1	11.7	2.8	3.3	--	--
White pine	125.5	16.4	27.3	12.4	14.0	7.5	5.3	9.8	12.4	13.5	6.9
Red spruce	153.3	4.4	13.7	19.7	30.7	25.2	29.8	15.5	8.6	5.7	--
Hemlock a/	184.6	31.2	24.1	14.5	20.9	20.1	20.1	18.1	14.6	20.3	.7
Total softwoods	995.0	114.1	187.7	174.0	175.9	117.2	87.1	53.0	38.9	39.5	7.6
Select white oaks b/	1,293.0	132.0	178.2	201.7	200.3	182.5	140.5	99.0	70.4	68.6	19.8
Select red oaks c/	1,294.1	84.2	108.6	158.2	151.2	157.5	167.9	132.8	102.7	194.8	36.2
Other white oaks d/	1,384.7	158.7	187.4	213.8	175.2	182.0	130.2	114.5	83.5	121.1	18.3
Other red oaks e/	1,427.1	131.4	162.5	177.8	149.9	215.9	177.3	137.3	90.0	153.9	31.1
Red maple	829.9	156.1	168.5	161.7	122.8	93.6	41.7	32.8	11.6	36.6	4.5
Sugar maple	758.6	133.8	133.6	149.4	87.0	77.7	56.3	33.0	19.4	61.0	7.4
Yellow birch	142.5	34.6	35.9	24.0	9.4	3.1	8.0	4.1	7.4	16.0	--
Sweet birch	250.7	71.2	57.7	51.9	24.1	21.9	7.9	5.1	7.4	3.5	--
Hickory	1,173.8	210.5	225.8	222.4	175.8	131.2	89.9	58.7	27.5	30.7	1.3
Beech	612.3	57.2	61.4	77.7	89.3	74.6	94.2	56.7	32.6	58.6	10.0
Ash	282.2	33.8	39.4	29.1	51.3	41.5	37.6	20.7	8.6	16.0	2.2
Black walnut	107.2	11.4	14.3	20.4	15.9	16.6	11.6	6.4	3.4	7.2	--
Yellow-poplar	1,412.8	117.1	157.4	189.0	213.2	236.9	201.3	133.3	71.4	78.2	5.0
Cucumbertree	124.7	11.2	23.2	16.3	26.4	15.4	17.2	8.2	5.8	1.0	--
Blackgum	132.5	24.7	17.0	6.7	13.2	15.4	11.6	13.5	10.7	19.7	--
Black cherry	453.6	33.6	41.6	63.4	68.0	101.3	57.5	35.2	31.7	21.3	--
Basswood	207.5	13.7	18.4	45.0	39.1	22.6	19.0	13.9	11.6	24.2	--
Other hardwoods	633.2	82.0	120.1	107.8	90.4	77.3	58.7	36.0	22.1	32.6	6.2
Total hardwoods	12,520.4	1,497.2	1,751.0	1,916.3	1,706.5	1,669.0	1,334.4	941.2	617.8	945.0	142.0
All species	13,515.4	1,611.3	1,938.7	2,090.3	1,882.4	1,786.2	1,421.5	994.2	656.7	984.5	149.6

a/ Includes 1.8 million cubic feet of red cedar

b/ Includes 1,289.9 million cubic feet of white oak, 1.0 million of swamp white oak, and 2.1 million of chinkapin oak

c/ Includes only Northern red oak.

d/ Includes 1,379.0 million cubic feet of chestnut oak and 5.7 million of post oak.

e/ Includes 915.5 million cubic feet of black oak; 499.3 million of scarlet oak, 10.6 million of pin oak, and 1.7 million of willow oak.

*** Reproduced from The Forest Resources of West Virginia., Bull. NE-1976.**

TABLE 2-4

AREA OF COMMERCIAL FOREST LAND IN WEST VIRGINIA BY FOREST TYPE, COUNTY, AND GEOGRAPHIC UNIT, 1975*

[In thousands of acres]

County	Virginia and pitch pine	Other softwood types	Oak-hickory	Maple-beech-birch	Other hardwood types	All types
Barbour	0.7	1.9	74.5	37.4	21.4	135.9
Berkeley	13.5	1.5	72.9	8.0	22.1	118.0
Braxton	1.2	3.9	136.9	73.2	36.8	252.0
Grant	26.1	2.4	142.3	20.9	44.5	236.2
Hampshire	31.9	3.9	199.3	19.4	65.1	319.6
Hardy	32.4	3.2	183.5	18.8	59.8	297.7
Harrison	.6	2.7	73.6	36.3	31.6	144.8
Jefferson	3.4	.3	23.3	3.0	6.5	36.5
Lewis	1.2	2.7	93.6	44.8	25.3	167.6
Mineral	24.7	1.7	96.2	10.1	33.2	165.9
Morgan	16.4	1.0	62.8	6.5	23.6	110.3
Pendleton	27.5	5.3	178.5	26.4	63.5	301.2
Pocahontas	1.6	33.5	177.8	242.2	48.2	503.3
Preston	1.8	4.2	167.3	84.9	42.5	300.7
Randolph	1.6	9.1	270.6	236.2	51.6	569.1
Taylor	.3	1.1	34.1	16.8	12.6	64.9
Tucker	.5	5.8	102.7	77.4	24.3	210.7
Upshur	.8	2.1	84.5	44.0	22.6	154.0
Webster	1.3	3.5	162.6	119.0	30.4	316.8
Northeastern Unit	187.5	89.8	2,337.0	1,125.3	665.6	4,405.2
Boone	--	2.8	160.4	92.3	8.5	264.0
Clay	2.6	3.2	127.3	43.8	12.8	189.7
Fayette	4.9	4.4	225.2	78.1	23.1	335.7
Greenbrier	5.5	12.4	281.4	166.2	35.4	500.9
Kanawha	7.4	8.5	305.3	105.4	31.5	458.1
Logan	--	3.6	150.4	68.1	10.5	232.6
McDowell	--	4.6	174.0	81.8	16.6	277.0
Mercer	2.2	2.6	126.3	45.6	12.5	189.2
Mingo	--	3.3	139.8	68.7	11.0	222.8
Monroe	7.0	3.9	122.3	37.5	15.3	186.0
Nicholas	6.1	3.9	217.8	85.8	23.7	337.3
Raleigh	4.5	5.1	199.7	69.5	20.6	297.4
Summers	2.3	2.8	104.7	38.3	10.9	159.0
Wyoming	5.7	11.3	171.4	57.7	17.4	263.5
Southern Unit	48.2	70.4	2,506.0	1,038.8	249.8	3,913.2
Brooke	1.2	--	17.7	3.8	3.9	26.6
Cabell	13.1	--	79.7	17.8	20.8	131.4
Calhoun	17.1	--	79.7	18.4	23.3	138.5
Doddridge	4.2	--	103.1	21.7	21.3	150.3
Gilmer	5.1	--	109.7	22.2	23.9	160.9
Hancock	.9	--	16.5	4.3	3.6	25.3
Jackson	19.4	--	116.3	27.1	28.4	191.2
Lincoln	7.8	--	161.0	39.5	38.6	246.9
Marion	4.5	--	91.3	18.2	18.2	132.2
Marshall	4.8	--	75.3	18.6	17.8	116.5
Mason	27.4	--	90.6	20.9	24.1	163.0
Monongalia	4.2	--	102.5	21.6	21.2	149.5
Ohio	1.5	--	24.6	5.9	5.4	37.4
Pleasants	3.3	--	45.7	10.0	9.4	68.4
Putnam	23.3	--	89.2	21.6	22.2	156.3
Ritchie	12.2	--	139.9	31.0	32.3	215.4
Roane	19.4	--	128.8	31.4	31.8	211.4
Tyler	7.4	--	76.6	17.2	18.1	119.3
Wayne	21.1	--	163.1	38.1	42.8	265.1
Wetzel	5.4	--	120.3	27.7	28.5	181.9
Wirt	20.9	--	67.1	16.9	18.2	123.1
Wood	25.3	--	86.4	20.6	22.4	154.7
Northwestern Unit	249.5	--	1,935.1	454.5	476.2	3,165.3
Total, State	485.2	160.2	6,528.1	2,618.6	1,391.6	11,483.7

* Reproduced from The Forest Resources of West Virginia., Bull. NE-1976.

TABLE 2-5

NET VOLUME OF GROWING STOCK ON COMMERCIAL FOREST LAND IN WEST VIRGINIA, BY STAND-SIZE CLASS, COUNTY, AND GEOGRAPHIC UNIT, 1975*

County	Sawtimber stands	Poletimber stands	Other stands	Total	Sampling error of total
	Million cubic feet				Percent
Barbour	79.2	57.3	10.4	146.9	17
Berkeley	46.1	45.4	7.5	99.0	15
Braxton	175.6	103.5	16.8	295.9	11
Grant	127.3	95.1	12.6	235.0	11
Hampshire	140.4	140.2	18.1	298.7	10
Hardy	140.1	135.3	15.6	291.0	10
Harrison	51.2	51.8	14.9	119.9	23
Jefferson	9.3	9.9	2.8	22.0	31
Lewis	86.8	70.0	14.9	171.7	14
Mineral	73.7	71.2	10.3	155.2	15
Morgan	48.3	47.3	6.7	102.3	18
Pendleton	148.8	125.1	15.3	289.2	11
Pocahontas	653.5	188.0	16.3	857.8	14
Preston	191.4	128.2	22.0	341.6	12
Randolph	751.5	219.5	18.5	989.6	9
Taylor	26.9	24.6	6.3	57.8	23
Tucker	253.1	80.0	8.5	341.6	17
Upshur	103.0	64.6	10.2	177.8	15
Webster	365.0	136.9	14.1	516.0	9
Northeastern Unit	3,473.3	1,793.9	241.8	5,509.0	2.8
Boone	195.4	61.9	13.0	270.3	18
Clay	134.2	78.3	12.6	225.1	13
Fayette	234.9	135.1	23.0	393.0	11
Greenbrier	516.3	187.2	24.9	728.4	8
Kanawha	325.9	180.6	32.0	538.5	8
Logan	173.2	51.3	11.8	236.3	17
McDowell	168.4	70.4	20.7	259.5	21
Mercer	147.3	71.1	11.9	230.3	11
Mingo	153.4	52.7	13.8	219.9	17
Monroe	96.3	76.5	18.9	191.7	14
Nicholas	253.9	137.0	25.5	416.4	12
Raleigh	211.0	114.1	21.0	346.1	11
Summers	120.6	59.8	10.7	191.1	13
Wyoming	179.3	110.9	19.7	309.9	12
Southern Unit	2,710.1	1,386.9	259.5	4,556.5	3.2
Brooke	13.3	7.6	2.9	23.8	29
Cabell	75.3	42.5	13.7	131.5	15
Calhoun	73.6	43.6	15.6	132.8	14
Doddridge	120.8	44.5	10.8	176.1	13
Gilmer	119.1	49.0	12.8	180.9	13
Hancock	14.8	8.3	2.3	25.4	29
Jackson	121.4	62.5	17.6	201.5	12
Lincoln	170.0	88.7	20.1	276.8	11
Marion	100.5	36.8	10.7	148.0	14
Marshall	61.1	37.2	12.3	110.6	16
Mason	100.7	51.6	16.5	168.8	13
Monongalia	117.9	44.8	10.6	173.3	14
Ohio	22.2	12.1	3.6	37.9	24
Pleasants	69.2	22.0	2.8	94.0	17
Putnam	115.2	53.1	12.7	181.0	12
Ritchie	168.9	71.4	15.1	255.4	10
Roane	112.6	68.9	23.1	204.6	12
Tyler	82.5	37.6	10.5	130.6	16
Wayne	149.7	88.0	27.8	265.5	10
Wetzel	128.1	61.3	14.3	203.7	12
Wirt	103.0	44.0	7.3	154.3	12
Wood	109.2	51.0	13.2	173.4	12
Northwestern Unit	2,149.1	1,024.5	276.3	3,449.9	2.9
Total, State	8,532.5	4,205.3	777.6	13,515.4	1.6

*Reproduced from the Forest Resources of West Virginia, Bull. NE-1976.

TABLE 2-6

CHANGE IN FOREST AREA AND TIMBER VOLUME, 1961 - 75

	1961	1975	Change
Commercial forest land: (thousand acres)	11,389.0	11,483.7	+94.7
Growing stock volume: (million cubic feet)			
Softwoods	532.0	995.0	+463.0
Hardwoods	10,290.0	12,520.4	+2,230.4
TOTAL	10,822.0	13,515.4	+2,693.4
Sawtimber volume: (million board feet)			
Softwoods	1,378.0	2,599.7	+1,221.7
Hardwoods	20,458.0	25,031.1	+4,573.1
TOTAL	21,836.0	27,630.8	+5,794.8

(Source: Bones, 1976, USDA)

2.2.5 CHANGES IN FOREST COMMUNITY COMPOSITION

Although it seems probable that the composition of present-day forest communities with respect to the mere presence or absence of individual species is similar to that of pre-settlement communities, the relative proportions of species, especially in different size or age classes, have undoubtedly changed. Some of these differences become apparent when the map of original vegetation types (Fig. 2-1) is compared with the maps of present-day vegetation types (Fig. 2.1-58 to 2.1-65 in ORBES, Indiana Report, Part 1 and Fig..2-5 of this report). These changes have included major losses of beech-maple forests, increases in pine plantations and in pines as a component of Ohio, Kentucky, and West Virginia oak forests, and a relatively greater abundance of bottomland forests, due perhaps to losses of upland forests in adjacent areas.

Present-day forest community types are defined in Table 2-2 of this report and in Tables 2.1-20 and 2.1-22 in ORBES, Indiana Report. The geographical distributions of these types are revealed by county statistics in Tables 2.1-18 and 2.1-19 of the ORBES, Indiana Report and Table 2-4 of this report, and tabulated by forest survey units in Table 2.1-23 in ORBES, Indiana Report and also in Table 2-5 of this report. From these tables it is evident that the oak-hickory forest is (USFS units) now the predominant community type in the lower Ohio River Basin. Other important community types include the mixed hardwood (mixed mesophytic), elm-ash-cottonwood types, and mixtures of maple with beech and oak. The mixed hardwood types occupy over 50 percent of the upland forests in the unglaciated Allegheny Plateau Section of Pennsylvania, West Virginia and western Kentucky.

The maps and tables should not be interpreted to mean that there is uniform species composition within the major forest types designated. Naturally caused local variations in species composition may be expected as a result of differential orientation of hillsides with respect to solar radiation (insolation), the presence of drainage channels, erosion and deposition of alluvium and deposit of alluvium and the extant stages of secondary biotic succession. Communities attributable to man's manipulation of nature, such as herb dominated old field communities, successional forests on abandoned cropland, and wetland communities on the margins of artificial impoundments are all of temporary nature. Strip-mined lands support a variety of depauperate plant communities including small-scale pond and marsh communities, but very rarely mature hardwood forest stands.

The woody flora of the ORBES region includes about eighty species of broad-leaved trees capable of growing to a height of forty feet or more. Some species are much more abundant and important than others. In Indiana and Kentucky, for example, seven species comprise 53 percent of the standing timber volume (Table 2.1-24 ORBES, Indiana Report). In the Ohio River Basin as a whole, the oaks (genus Quercus, about seventeen species) constitute over 40 percent of the timber volume, as might be expected from the prevalence of the oak-hickory community. Six species of the hickories (genus Carya), tuliptree and American beech are other important trees. However, tuliptree and American beech are relatively rare in the southwestern forest survey units (Randolph, 1976).

Members of the genus Quercus (oaks) constitute the predominant genus of trees in the deciduous forest of the Ohio River Basin including West Virginia. Statewide in West Virginia, the red oak group and the white oak group of species occur in nearly equal proportions in the Ohio River Basin representing 21.7 percent and 20.6 percent respectively of the total growing hardwood forest stock. In 1961 the northern red oak (Q. rubra) was the most abundant timber species in the state followed closely by yellow poplar or tuliptree Liriodendron tulipfera), and white oak (Q. alba). However, the 1975 statistics show that tuliptree, known as yellow poplar by the foresters, is now the prevalant timber species in West Virginia. (Barnard and Bowers, 1977.) Other significant species in descending order of abundance in the growing stock are red maple, sugar maple, beech, black cherry, hickories, sweet birch, ash, basswood, yellow birch, black gum, cucumber tree and black walnut. The remaining five percent of the hardwoods include twenty-some miscellaneous timber species. Conspicuous by its absence is the once prolific, now nearly extinct, American chestnut (Castanea dentata).

The woody flora of the ORBES region includes twelve or thirteen needle-leaf, coniferous species, nine of which are native. Only one of these native species, the eastern redcedar (Juniperus virginiana), is widely distributed throughout the region. In West Virginia and Pennsylvania it is generally associated with less acidic soils. Natural stands of other conifers including hemlock, red spruce, balsam fir, white pine, arbor vitae, and eastern larch (Larix laricina) occur as disjunct communities in special ecosystems where conditions of climate or soils differ from the norm. These represent the central Appalachian outliers of the northeastern coniferous forests of the New England states and Canada, occurring only at high elevations in West Virginia and western Pennsylvania. (Fig. 2-1).

Softwood (coniferous) tree species in West Virginia comprise only 7.4 percent of the growing stock, nearly half of which is Virginia pine (Pinus virginiana). Nearly pure stands of immature Virginia pine occupy sizable areas in southeastern Ohio, eastern Kentucky, and western West Virginia. These represent natural succession on abandoned farmlands with generally acidic, low fertility soils. Virginia pine, "old field pine" or "scrub pine" has in recent years become important as pulpwood in the state, growing best in the west-central and eastern counties. Several methods have been tried to increase the production of yellow pine pulpwood, including aerial spraying of young stands with selective herbicides to destroy or typo herbicides to retard the growth of hardwood trees. Uncontrolled, hardwoods will outgrow and eliminate the Virginia pine. Industrial air pollution seems to affect Virginia pine less than most other comercially valuable species.

The next most abundant conifer is hemlock, (Tsuga canadensis), a species with inferior wood properties. It is found in stands throughout the West Virginia ORBES region, but is more abundant and luxuriant at higher elevations. As an unwanted species in the past, it often escaped cutting and now is the major species in the remaining virgin forests of the state.

2.2.6 CHANGES IN FOREST STAND AGE

Generally, only a quarter to a half of all the lower Ohio River valley forestland supports an abundance of mature trees. The remainder is dominated by small trees or by a combination of small trees and brush. In 1975, mature trees occupied 44 percent of West Virginia forest lands. Since a greater proportion of the land in West Virginia was too steep to farm efficiently, relatively early abandonment of farmed lands to forest regeneration has resulted in a greater abundance of mature trees in the forests of West Virginia than in the forests of the lower Ohio River Basin states.

Several studies have suggested reasons for the prevalence of immature forests in the various ORBES states. In general some forest community types have been cut for lumber more severely than others. Thus, while oak-hickory and elm-ash-cottonwood stands generally contain an abundance of mature trees, mixed-hardwood forests tend to be immature. According to Kingsley and Mayer (1970), the excessive proportion of brushland and immature forest in Ohio has resulted from excessive cutting of large trees in the past without adequate allowance for regrowth, and from development of young forest on abandonded agricultural and strip-mined lands. Gansner and DeBold (1966) attribute the immature status of Kentucky Blue Grass survey unit forests to overharvest of timber, livestock grazing, and exclusion of forests from the most productive lands. DeBold and Gansner (1966) give overharvest and recent reforestation of farmland as reasons for the preponderance of immature forests in the Western coalfield unit.

These young and brushy forests can be quite different in species composition from the original climax vegetation and also tend to support animal communities significantly different from those of mature forests. Red cedars are common in young Kentucky forests, but as the forests age they are succeeded by hardwoods in whose shade they cannot survive. Other successional forests developing by abandoned farmlands and drastically overcut woodlands are populated by such trees as black locust (Robinia pseudo-acacia), wild black cherry (Prunus serotina), sassafrass (Sassafras albidum), American elm (Ulmus americanum), Ohio buckeye (Aesulus glabra), tree of heaven (Ailanthus altissima), hawthorns (Crataegus spp.), and large-toothed aspen (Populus grandidentata), flowering crabapple (Pyrus coronaria), persimmon (Disosporus virginiana), sumacs (Rhus typhina, R. glabra), holly (Ilex opaca), and hemlock (Tsuga canadensis). Examples of such communities reported in the impact assessment literature include an osage orange-black locust-honey locust riparian community and a black cherry-ash-elm upland community in Clark County, Indiana (U.S. Army Corps of Engineers, 1977), and a tulip-sassafras upland community in Jefferson County, Indiana (Public Service of Indiana, 1975),

In West Virginia, where most soils are acidic, old fields are often invaded by the grasses broom sedge (Andropogon virginicus), and poverty grass (Danthonia spicata) and associated herbs. In turn, these are replaced by sassafras, sumac-sourwood, black locust, virginia pine, or other temporary arboreal communities. As the canopy closes these shade intolerant species are gradually replaced with the more stable forest communities. Such trends will be described in more detail under Sections 2.2.7 and 2.2.8 which follow.

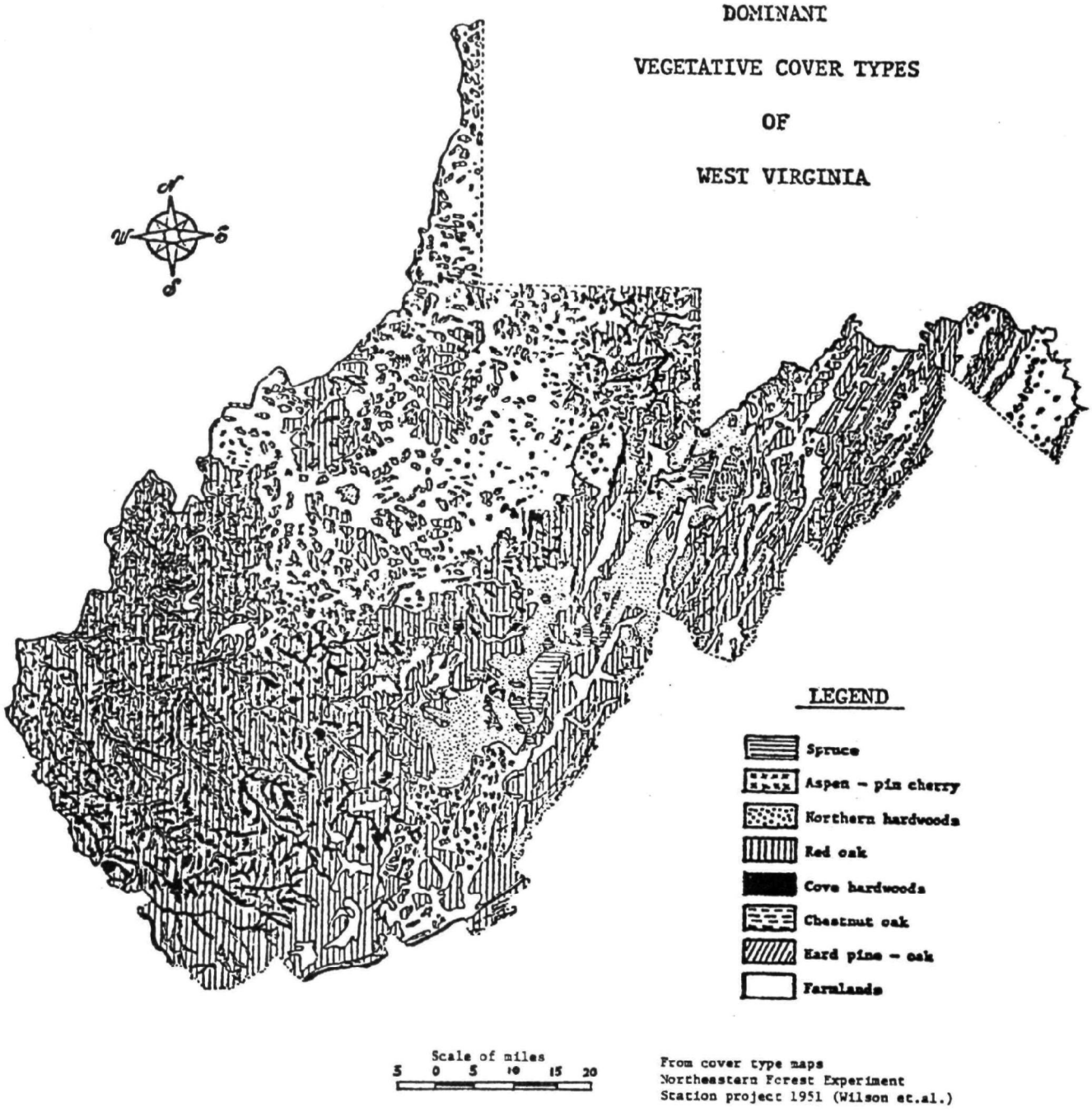

Figure 2-4

This map of the vegetative cover types of West Virginia as it was just prior to 1950 was produced from aerial photography and ground-control data using forest sampling techniques. The complex distribution patterns are caused by the extreme erosional disection of the Appalachian Plateaus section of the ORBES region.

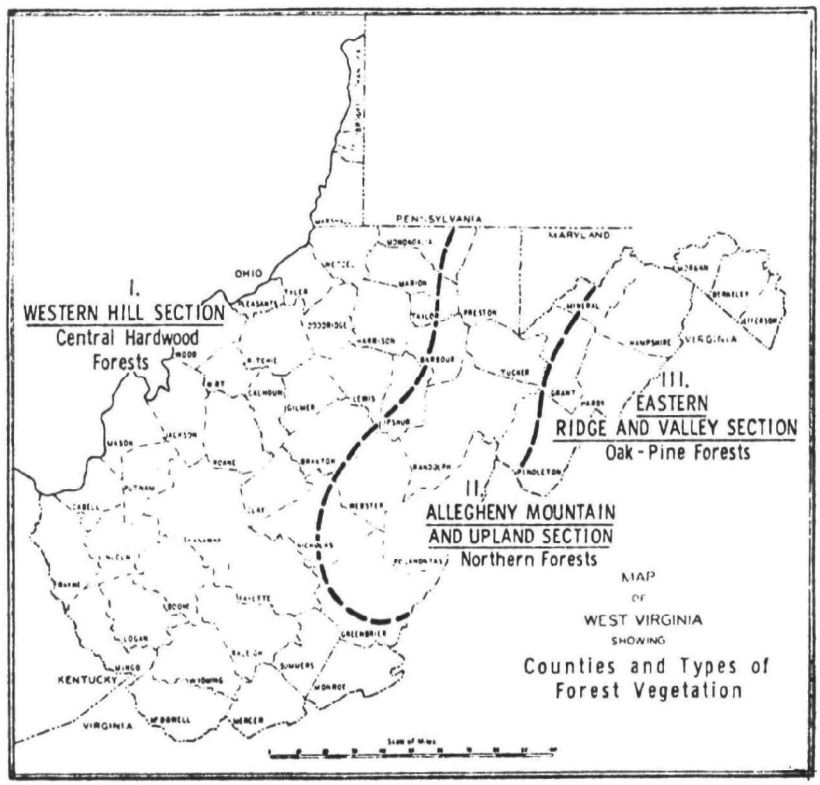

Figure 2-5

Map of the regional forest vegetation of West Virginia. (After Strausbaugh and Core, 1971)

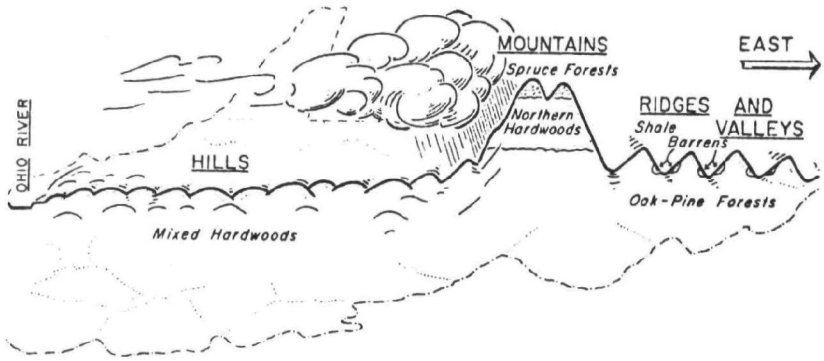

Figure 2-6

A diagrammatic profile across West Virginia, indicating the region of highest rainfall and chief phytogeographic regions. (After Strausbaugh and Core, 1971)

TABLE 2-7

AN ECOLOGICAL CLASSIFICATION SYSTEM FOR NATURALLY OCCURRING TERRESTRIAL PLANT COMMUNITIES FOUND IN THE APPALACHIAN PLATEAUS REGION OF ORBES

A. Forest Communities

1. Boreal Forest (Upland sites a-d, Lowlands e-h).
    a. Spruce-Fir (climax)
    b. Red Pine
    c. Boreal Hardwoods (Birch-Aspen-Cherry-Maple)
    d. Spruce (Red or Black)
    e. Tamarack
    f. Arborvitae
    g. Conifer-Hardwood Swamp Forest
    h. Other

2. Hemlock-Hardwood-White Pine (Appalachian Transition) Forests (Lake Forest)
    a. Hemlcok-White pine - Northern Hardwoods
    b. Pine (White; rarely Red or Jack pine)
    c. Aspen
    d. Northern Hardwoods - Hemlock (and vice versa)
    e. Other

3. Eastern Deciduous Forests (Upland sites a-k, Lowland sites l-o)
    a. Mixed Mesophytic
    b. Mixed Oak
    c. White Oak
    d. Chestnut Oak
    e. Tuliptree
    f. Oak-Hickory
    g. Oak-Maple
    h. Maple
    i. Beech-Maple
    j. Pine-Oak
    k. Other upland forest communities
    l. Willow-River Birch-Sycamore
    m. Elm-Ash-Soft Maple
    n. Red Maple-Red Gum-Swamp Oaks
    o. Other lowland forest communities

B. Scrub and Shrub Communities

1. Low Tree Scrub (less then 10 meters high)
    a. Pin Cherry
    b. Sassafras-Sourwood-Sumac
    c. Black locust
    d. Deciduous holly
    e. Dwarfed hardwoods
    f. Mixed Scrub
    g. Other

(TABLE 2-7 Continued)

B. Continued (Scrub and Shrub Communities)

2. Tall Shrub (1 m +)
    a. Alder
    b. Spirea
    c. Dogwood (Cornus)
    d. Hawthorne (Crataegus)
    e. Rhododendron
    f. Bear (or scrub) oak
    g. Blueberry
    h. Other

3. Low Shrubs (1 m -)
    a. Blueberry (Vaccinium)
    b. Huckleberry (Gaylussicia)
    c. Chokeberry (Pyrus)
    d. St. Johnswort (Hypericum)
    e. Brambles (Rubus)
    f. Other

4. Creeping Shrubs (bogs, muskegs)
    a. Cranberry (Vaccinium)
    b. Buckbean (Menyanthes)
    c. Bog rosemary (Andromeda)
    d. Dewberries (Rubus)

C. Narrowleaf Herb Communities

1. Balds and Sods
    a. Mountain oatgrass (Danthonia compressa)
    b. Bluegrass (Poa)
    c. Broomsedge (Andropogon virginicus)
    d. Poverty grass (Danthonia spicata)
    e. Other

2. Savannas (with scattered or colonies of trees)
    a. Oak openings (Herbs-Quercus)
    b. Pine openings (Herbs-Pinus)
    c. Cedar openings (Herbs-Juniperus)
    d. Other

3. Marshes-Fens
    a. Cattail (Typha)
    b. Sedge-Rush (Carex, Scirpus, etc.)
    c. Marsh grasses (Leersia, Glyceria)
    d. Other

(TABLE 2-7 Continued)

D. Moss-Fern-Lycopod Communities

1. Polytrichum moss bog
2. Sphagnum moss bog
3. Bracken fern brake
4. Other

E. Broadleaf Herb Communities

1. Annual herbs
2. Perennial herbs
3. Mixed herbs (including grasses)
4. Herb-scrub savanna
5. Herb-tree savanna
6. Other

F. Open Aggregations and Sparse-cover Communities (less than 50% cover) named for habitats

1. Shale barren Invaders and Colonizers
2. Limestone I & C's
3. Sandstone I & C's
4. Talus I & C's
5. Sand and Gravel I & C's
6. Mud flat and bark I & C's
7. Abandoned field I & C's
8. Abandoned pasture I & C's
9. Roadside I & C's
10. Mine spoils I & C's
11. Other I & C's

2.2.7 CHANGES IN TERRESTRIAL VEGETATION

The composition and form of the vegetative cover of West Virginia before the intrusion by Europeans can only be deduced from fragmentary evidence left by untrained observers. The rugged topography of the wilderness and lack of ready access by navigable streams or natural trailways led most settlers around the foreboding forests south of Pennsylvania and north of the Cumberland Gap as they crossed the Appalachians. The few pre-settlement accounts of western Virginia forests were tales of fear-packed adventure followed by a great relief upon the explorers' return to the inhabited broad valleys east of the Allegheny Front. At the close of the 19th century the new state of West Virginia was still largely forested. A reliable estimate of untapped timber reserves by A.B. Brooks (1911), shows some 1.5 million acres of virgin timber still remained, mostly boreal types in the higher mountain counties. During the next decade most of these magnificent forests were decimated and the environments so drastically altered that the spruce forests were incapable of regenerating. The three-foot deep forest litter dried upon exposure and soon thereafter burned along with the slash left by the loggers. The soluable material nutrients were washed downstream to the Ohio and the Potomac. Northern hardwoods took the place of the spruce and white pine forests, much as they did under similar conditions in the New England states. Roy B. Clarkson in his book Tumult on the Mountain, (1964), gives a graphic history of the early logging history in West Virginia. Various opinions have been expressed concerning the eventual species composition of the future forests which will develop in areas that supported the virgin red spruce forest type before logging. It is likely that most of the forests occupying these high mountain areas will continue to be harvested before conditions favorable to the dominance of the shade tolerant, habitat-specific red spruce are able to develop. The current northern hardwoods and hemlock-hardwoods forests will thus persist as a subclimax type or a disclimax perpetuated by periodic logging. Even in those few wilderness or preserve areas where logging ostensibly will be banned, the spruce forests may not return if the intrinsic regional climate has truly become significantly warmer over the past several centuries as some climatologists contend. The spruce forests at the time of their removal, a century or less ago, thus may have represented a self-perpetuating, relict disclimax forest of Pleistocene origin. Their persistance since glacial times could be due to the dense spruce forests' abilities to modify the regional climate by virtue of its own action of creating a cool, moist sub-canopy environment ideal for germination, seedling survival, and early growth of red spruce trees, uninhibited by conpetition from normally faster growing hardwoods. This perplexing question of which forest type will emerge as the true, ultimate, climax-vegetation form of the mountain crests in the central Appalachians is an intriguing one.

By comparison, the history and ecology of the deciduous hardwood forest regions of West Virginia have received much less attention by the botanists and ecologists. This is probably because of its lesser attractiveness and greater complexity of the forest biome of which it belongs. The most comprehensive theories concerning the ecology of the Eastern Deciduous Forest thus far published are those of E. Lucy Braun (1950, revised 1964).

The West Virginia segment of this deciduous forest owes its diverse floristic composition, in part, to the many environmental fluctuations and inward migrations of species, first from its epicenter in the Great Smokey Mountains, and then from the circumpolar Boreal Forests and Arctic tundra regions, and finally from the mid-continent prairie and dry complex in Post-Pleistocene times.

2.2.8 CURRENT VEGETATION PATTERNS

Geographic distributions of the present-day plant and animal communities and species in the Ohio River Basin and West Virginia, like all natural biotic distributions, are a function of past and present physical and biotic interactions, and the impacts of modern man. This section will attempt to describe the patterns of distribution of major types of vegetation in three dimensions as depicted by vegetative cover maps, and vertical cross sections relating elevation and slope characteristics.

The Potential Natural Vegetation map (Fig. 2-1) prepared by Kuchler (1964) is a theoritical extrapolation prepared from historical records and from interpretations of recent and extant patterns of vegetation. The current forest cover exemplifies a state of extreme and repeated disturbance by man. Almost all of the present vegetative cover types are second-growth forests with varying degrees of similarity to the original, virgin forests. In ecological logic these were the ultimate, climax, or potential vegetative cover types, whose distributions closely parallel climatic patterns.

One step closer to a true depiction of the current vegetative cover of West Virginia is the cover type map prepared by Wilson and others in 1951 (Fig. 2-5). The apparent, fine-textured distribution pattern of forest cover types shown in Figure 2-6 is, by necessity far less detailed than the actual distributions mapped by Wilson and his associates on fifteen minute topographic quadrangles. Copies of their individual topo-quadrangle vegetation maps have not been published, although the original copies are accessible for viewing upon request at the Wildlife Research Laboratory of the West Virginia Department of Natural Resources, Elkins, West Virginia.

The major physical factors controlling the vegetation patterns in West Virginia are: 1) geologic/encompassing, bedrock minerology, erosion-deposition actions, elevation, slope exposure, and slope inclination); 2) edaphic (soil conditions as related to plant and animal life); and 3) climatic (both macro and microclimatic).

A cross-section of the topography of West Virginia (Fig. 2-16) depicts the changes in the physiography and the gradual increase in mean elevation from the Ohio River eastward to the Allegheny Front. This trend of increasing elevation is followed in the Ridge and Valley Province by an abrupt decline in the mean elevation resulting in a dry, "rain-shadow" effect in counties just to the east of the Front. Although there is a latitudinal effect on the climate and vegetation from north to south in West Virginia, it is not as significant as the elevation effect (Fig. 2-1, 2-4, 2-6). Thus, the species of plants and animals with northern affinities are most abundant

or found exclusively in the mountains, generally above 2500' elevation; while the southern species inhabit the western and southern regions of the state at elevations generally below 2500' elevation. Southern species tend to be less abundant or absent in the northwestern region of the state even at lower elevations.

In evaluating the aquatic or the terrestrial ecosystems in areas or counties where siting of energy extraction or conversion facilities may be feasible, the local distribution patterns and significance of specific ecosystems should be determined. Few generalities can be applied from stream to stream or forest to forest. Most of the current vegetative cover of West Virginia has not been adequately mapped. The outdated, small-scale maps available are of little value in planning natural resource development or in preparation of environmental impact statements. Fortunately, the data base suitable for large scale vegetation mapping is available in the form of repeatedly updated aerial and satellite imagery. The space age remote-sensing techniques, for vegetational analysés and mapping, are proving to be less expensive and often more reliable than data collected by ground crew surveys.

A broad conceptualization of the most common ecological units (ecozones) encountered in the ORBES area is requisite to good regional planning. Therefore, the following summary of the readily recognizable units, even to the casual observer or student or geography, is included in hopes of clarifying the broad picture. The internal ecological variants within these broad, regional forest zones are so many and their nomenclatures so esoteric that it seems expedient to bypass them at this time.

At the highest level of classification, two major ecoregions or biomes are represented in West Virginia, the Spruce-Fir Boreal Forest biome at higher elevations and the Eastern Deciduous Forest at lower elevations. These are described briefly in order to characterize their biogeographic differences and to relate the current vegetative cover, most of which is of youthful, second-growth forest stages of regeneration. In essence, the deciduous forests are far from homogeneous. They contain communities with a full range of habitat "preference," from cool and moist to hot and dry during the growing season as a result of topographic differences.

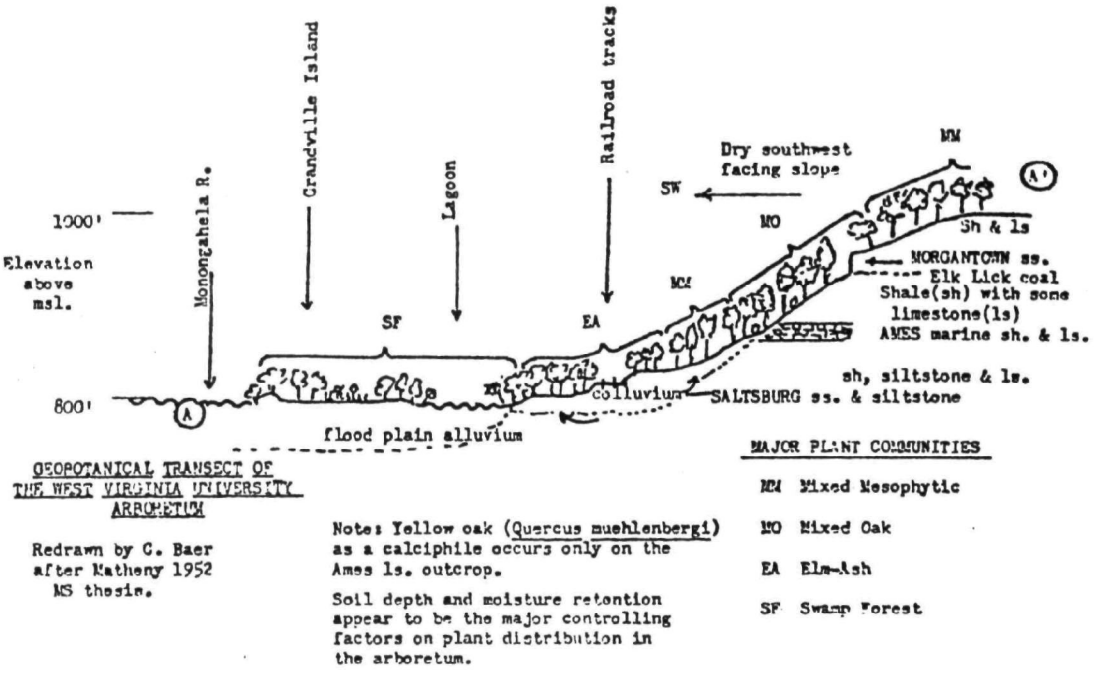

Figure 2-7

Ecological relationships of the forest communities in the Core Arboretum of West Virginia University on the Monongahela River. The vegetation belongs to the mixed mesophytic forest region.

TABLE 2-8

THE DISTRIBUTION OF TREE SPECIES ALONG THE COOPERS ROCK TRANSECT IN RELATION TO SOIL REACTION (pH)

Species	Number of Individuals by pH Groupings I. pH less than 5.0	II. pH 5.0-6.0	III. pH greater than 6.0
"Acidophiles"			
Quercus montana chestnut oak	107	15	5
Acer rubrum red maple	43	6	0
"Calciphiles"			
Acer saccharum sugar maple	5	36	68
Tilia americana basswood	0	0	13
Juglans nigra black walnut	1	1	9
Celtis occidentalis hackberry	0	0	5
"Moderate Calciphiles"			
Magnolia acuminata cucumbertree	0	11	19
Quercus muehlenbergii yellow oak	0	8	9
Carya ovata shagbark hickory	3	0	12
Gymnocladus dioica Kentucky coffeetree	0	5	9
Liriodendron tulipifera tuliptree	1	3	4
Cercis canadensis redbud	0	3	4
"Indeterminants"			
Robinia pseudoacacia black locust	12	8	14
Quercus rubra red oak	9	6	13
Carya glabra pignut hickory	6	10	12
Cornus florida flowering dogwood	3	5	3

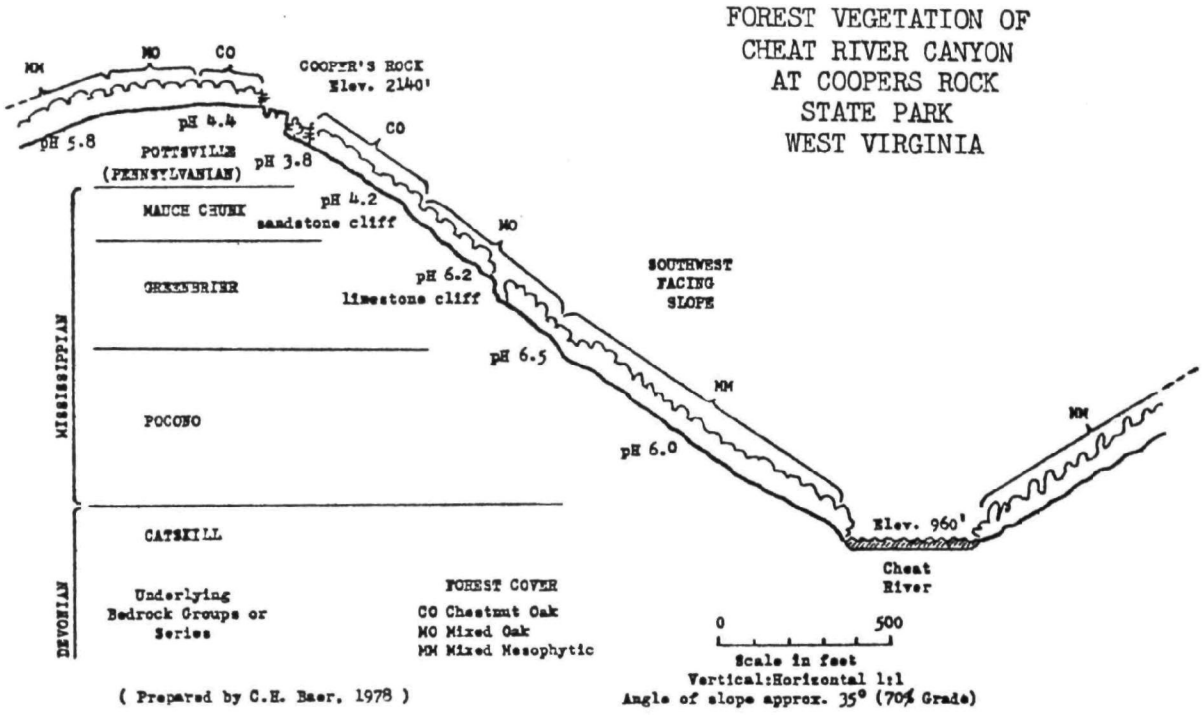

Figure 2-8

The distribution of forest community types throughout the Appalachians is closely linked to topography, slope aspect and inclination. The steep southwest-facing slope at Cooper's Rock is characteristically dry and excessively heated during the summer growing season. The most xeric (dry) habitat, on the cliff-top supports a narrow zone of oak-pine forest. Slightly less dry is the habitat supporting the chestnut oak forest (CO). Mixed oak (MO) indicates moderately dry conditions and mixed mesophytic (MM) or cove hardwoods a mesic (moist) condition. The right-hand, northeast-facing slope is almost uniformly moist from the river to the cliff-top with an elevation close to that of Cooper's Rock. Variations in the minerology of the bedrock strata is reflected in the acidity (pH) of the soils and success of pH-sensitive plant species. See Table 2-8.

The Appalachian Extension Of The Northeastern Spruce-Fir (Boreal Coniferous) Forest---

In West Virginia a red spruce forest is the prevalent type counterpart of the spruce-fir forest which characterizes the Boreal Forest Biome farther north and occurs in isolated stands in the Blue Ridge Mountains of North Carolina and Tennessee. The red spruce forests occur in West Virginia as disjunct stands on mountain tops and in swamps, mostly above 3500' elevation. Similarly, but even more restricted, balsam fir is now reduced to a few small stands in the Allegheny Mountain section of West Virginia. Aspens (Populus tremuloides, P. grandidentata) and pin cherry (Prunus pensylvanica) form open-stands or groves as successional stages in mountain areas once occupied by red spruce forests. This type of patchy, regenerative forest cover persisted as late as 1950 in the Davis area of Tucker County (Fig. 2-3). By the early 1920's most of the virgin spruce forests and closely associated northern hardwood-hemlock-white pine forests were clearly cut. The fallen tops and branches soon dried, and the slash burned and in turn set fire to the abundant humus which is said to have burned for months (Clarkson, 1964).

These temporary, savanna-like stands were characterized by scattered trees and groves of aspens, cherries, black locust, sumac, and hawthornes almost randomly dispersed throughout the less advanced continuum of bracken ferns, grasses, goldenrods, and asters. Large expanses of heath dominated shrub mats, locally known as "huckleberry plains", occupied many of the rocky areas and hundreds of acres still persist along the crest of the Allegheny Front in Grant, Tucker, Randolph and Pendleton Counties. However, by 1975 most of the savanna-like expanses on the acidic soils had become reforested with scrubby northern hardwoods stands interspersed with scatterings of hemlock, spruce and white pine. This youthful forest complex shows a progression toward the recognized northern hardwoods forest type and various mixed northern hardwoods-conifer types. The more mature second-growth forest stands on the rolling uplands and plains along the Allegheny Front are approaching the mixed oak community type, oak-maple, chestnut oak, or the foresters' (SAF) red oak type which is dominated by northern red oak, black oak, and scarlet oak, with white oak and chestnut oak as subdominants.

The Eastern Deciduous Forest---

The mixed mesophytic forest association described by Braun (1950, 1964) seldom reaches above 3000' elevation in West Virginia. This forest community type increases in abundance and richness of species southward in West Virginia. The nomenclature of these mixed hardwood forest stands, wherein no one or few species are clearly dominant, is unresolved. This more or less "catch-all" type includes species which are dominant in other forest types, and others which seldom, if ever, are present in sufficient numbers to lend their name to any community type. Table 2-9 shows the variations in species composition of several West Virginia mixed mesophytic forest stands. Such stands, rich in tree species requiring moderate and sustained soil moisture supplies indicate the presence of optimum conditions

for suitable growth of numerous, typical Appalachian deciduous forest species. Such climatic and edaphic (soil) conditions prevail on the west slopes of the eastern continental divide from West Virginia southward to northern Alabama where rainfall is abundant and winter temperatures are moderate.

Appalachian Oak, Oak-hickory, and Oak-pine forests, which also occur abundantly in West Virginia, occupy dry slopes and ridges throughout the state but become uncommon at higher elevations. Although Braun (1950) and Kuchler (1964) include a high proportion of such stands in the Mixed Mesophytic region (Fig. 2-1) they can also be considered as extensions or counterparts of the Central Hardwoods of Tennessee and Kentucky or the extension of the southern Appalachian Oak region of the Valley and Ridge physiographic province of Virginia, North Carolina, and eastern Tennessee (Fig. 2-1).

Numerous forest types are recognized by foresters (Society of American Foresters 1967, Table 2-2) and the ecologists' as plant community types or associations (Table 2-7). Each occupies specific environmental niches in the fine-textured distribution pattern of West Virginia vegetation (Fig. 2-5). Like all plant communities, they are dependent upon definite ranges of moisture availability, temperature, and solar energy which combined characterize the habitats. Thus, each forest type reflects a special set of slope exposures and inclinations. Essentially, level areas on the land surface of the Mountain State are a rare commodity. Elevation effects and edaphic (soil) condition also exert considerable influences on the success of new, invading species, and their chances of reproducing their own kind. A few examples of West Virginia environments and associated vegetation types are shown in Figures 2-7, 2-8, 2-13, and 2-14.

Productive farmlands have always been at a premium in West Virginia, primarily because of the extreme steepness of the slopes (Fig. 2-17, 2-18, 2-19, Table 2-12). The best farmlands occupy the limited bottomlands along the major rivers, limestone bedrock areas, and the rolling uplands of the Appalachian Plateaus. The distribution of non-forested, agricultural lands are concentrated in three parts of the state; the eastern panhandle (outside the ORBES region), the Greenbrier-Monroe county limestone forest area, and a broad swath of hilltop farmlands extending northward from Charleston towards Elkins and Parkersburg and northward towards the Mason-Dixon Line and the Northern Panhandle (Fig. 2-5). The youthful, yet highly dissected, topography of nearly the entire ORBES region of West Virginia precludes broad floodplains except along the larger rivers. Glades, wetlands and gently rolling grazing lands are more common in the Allegheny Mountain Section.

Three-quarters of West Virginia's surface is covered with forests, and probably represents the best use for such steep land. The forests on lands with soil capability classes III, IV, and V are in various stages of recovery from the denudation caused by the wasteful practices of early logging. The recent application of better forest management, particularly on the National Forests, is reflected in the increasing stocks of high quality standing timber (Table 2-5). Of major threat to the forests,

TABLE 2-9

IMPORTANCE VALUES* OF FIVE MAJOR FOREST SPECIES TABULATED FROM MATURE MIXED MESOPHYTIC STANDS IN FOUR STATE OWNED AREAS WITHIN THE ORBES REGION OF WEST VIRGINIA

	MIXED MESOPHYTIC FOREST			
Species	Kanawha	Holly River	North Bend	Pipe-stem
Sugar maple (Acer saccharum)	0%	21%	15%	14%
Yellow-poplar (Liriodendron tulipifera)	24	17	11	13
White basswood (Tilia americana)	12	10	9	16
Beech (Fagus grandifolia)	6	13	24	2
Red Oak (Quercus rubra)	7	4	11	17
All Other Species	51	34	30	38

(after R. Sturm - 1977, M.S. Thesis, W.V.U.)

*Importance value - a calculated value which includes the relative abundance and timber volume of each species.

streams and soils of the state are the extraction of coal, the disturbances of land surfaces, and the pollution of the waters and atmosphere by industrial and domestic wastes. Where properly controlled, periodic harvests of timber in West Virginia offer little threat to the flora and fauna or the recreational uses of the forests.

2.3 FAUNA

2.3.1 ORIGINAL AND CURRENT FAUNA

The original fauna[1] of the ORBES region was predominantly a deciduous-woodland fauna. Wetland faunas were well represented, although somewhat localized inasmuch as wetlands were extensive only along the northern border of the ORBES region. Other localized faunas included those of prairies, caves, and rock outcroppings and other forms of steep relief. The only fauna that was, and is largely endemic to the seven-state ORBES region, and thus unique, is the karst (cave) fauna, which is especially well represented in southern Indiana (Lindsey, 1966), Kentucky, and southeastern West Virginia (Table 2-10).

The current regional faunas of the counties judged suitable for power plant location and coal mine operation have been influenced by man. There was selective elimination of the larger animals followed by assisted return of deer, beavers, and wild turkeys. Patchwork clearing of forests permitted certain prairie and forest-edge species to increase in numbers at the expense of species of the forest proper; for example, fox squirrels replaced gray squirrels, opossums and raccoons became more numerous, and bobcats became rarer (Lindsey 1966, Anonymous 1974, 1975, 1976). Many of the amphibian, reptile, and bird species characteristic of rivers in the suitable counties appear to be declining in population, although the causes of this have not been adequately studied. On the other hand, several large impoundments in the Ohio coal counties especially in the southeastern Muskingum River watershed, serve as new stopping points for large numbers of ducks and geese (USDA, 1975).

Distributions and population trends are elaborated upon in the following subsections for game animals and fur bearers and for unique, endemic, and endangered species.

2.3.2 GAME ANIMALS AND FURBEARERS

Much is known regarding the status of populations of game animals and furbearers in the ORBES region. Knowledge of their life cycles and the quality of available habitats permits inferences to be made as to the general welfare of their populations. More importantly, all fish and game authorities monitor abundances of most species on an annual basis through extrapolation from indices of abundance. Data are also

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[1]"Fauna" here is taken to mean all vertebrates exclusive of fishes, except under the heading "Unique Species" (Section 2.1.4.3 of the ORBES, Indiana Report are included.)

TABLE 2-10

AN ALPHABETICAL LISTING OF CAVE FAUNA COLLECTED IN CAVERNS OF WEST VIRGINIA

Acarina
Adritylidae
Ambystoma jeffersonianum
Ambystomidae
Aneides aeneus
Anthrobia mammouthia
Apochthonius paucispinosus
Apocrangonyx parvus
Artodus pristinus
Asellus
Asellus cannulus
Asellus holsingeri
Asellus pricei
Asellus sinonini
Asellus sinuncus
Astocidae
Attheyella carolinensis
Bufo a americanus
Cambarus b bartoni
Cambarus nerterius
Catops gratiosus
Chamberlinochthonius henroti
Chelonethida
Chionea aspera
Chitrella regina
Chordeumida
Chthonildae
Cleidogonidae
Collembola
Conotylidae
Coprinus micaceous
Corynorhinus macrotis
Corynorhinus r rafinesquii
Corynorhinus rafinesquii
Dasypus
Decapoda
Desmognathus f fuscus
Desmognathus m monticola
Desmognathus o ochrophaeus
Diemictylus v viridescens
Dixidesmes branneri
Drassylus depressus
Entomobryidae
Eptesicus f fuscus
Euarctos americanus
Eurycea b bislineata
Eurycea l longicauda
Eurycea longicauda
Eurycea lucifuga
Felis concolor couguar
Fontigens tartarea
Gammaridae
Gammarus fasciatus
Gammarus minus
Gammarus minus tenuipes
Gammarus propinquus
Geocentrophora cavernicola
Gyrinophilus p porphyriticus
Gyrinophilus palleucus
Gyrinophilus porphyriticus
Habrocestum pulex
Hadenoecus
Hemidactylium scutatum
Horologion speokoites
Hydrobiidae
Kleptochthonius
Kleptochthonius henroti
Kleptochthonius orpheus
Kleptochthonius proserpinae
Lasionycteris noctivagans
Lasiurus borealis
Leiobunum bicolor
Mammut americanum
Marmota monax
Megalonyx
Megalonyx jeffersonii
Merulius lachrymans
Meta menardi
Mylohyus exortius
Myotis
Myotis l lucifugus
Myotis lucifugus
Myotis sodalis
Myotis subulatus leibii
Neobisiidae
Neotoma pennsylvanica
Odocoilus virginianus
Opiliones
Phalangodidae
Pipistrellus
Pipistrellus s subflavus
Pipistrellus subflavus
Pipistrellus subflavus obscurus
Platygonus intermedius
Plecotus townsendii virginianus
Plethodon c cinereus
Plethodon g glutinosus
Plethodon glutinosus
Plethodon r richmondi
Plethodon w wehrlei
Plethodon wehrlei
Plethodontidae
Pluslocampa fielding
Pseudanophthalmus
Pseudanophthalmus fuscus
Pseudanophthalmus grandis
Pseudanophthalmus henroti
Pseudanophthalmus hypertrichosis
Pseudanophthalmus lallemanti
Pseudanophthalmus orthosulcatus
Pseudanophthalmus p potomaca
Pseudanophthalmus potomaca senecae
Pseudonophthalmus higginbothami
Pseudonophthalmus hypertrichosis
Pseudosinella gisini
Pseudotremia
Pseudotriton p porphyriticus
Pseudotriton r ruber
Quedius spelaeus
Rana clamitans melanota
Sinella hoffmani
Spelerpes maculicaudus
Sphalloplana percoeca
Sphalloplana pricei
Stygonectes cooperi
Stygonectes emarginatus
Stygonectes gracilipes
Stygonectes spinatus
Syarinidae
Tomocerus bidentatus
Trechinae
Trichopetalinae
Zygonopus packardi
Zygonopus weyerlensis

available from the Fur Resources Committee of the International Association of Game, Fish and Conservation Commissioners for fur harvests between 1970 and 1975 (Henderson, 1977). The latter set of data is, of course, biased as a population indicator by state and local trapping regulations, species-specific traditional hunting and trapping preferences, and variability across species and years with respect to monetary incentives.

According to Fred Brooks (1911) the American bison or buffalo once roamed over the greater part of West Virginia and large herds were observed in pre-revolution era along the valleys of the Ohio and Kanawha Rivers. The last buffalo killed in the state was about 1825, near Valley Head in Randolph County. Elk were of rather common occurrence in the higher mountainous regions at the time of early settlement, but by the middle 1800's the last of this magnificent species was killed. The Virginia white-tail deer was abundant throughout West Virginia. Venison and buckskin were nearly indispensible in the home of the settler. One hunter, Mr. Van Buren Arbogast, kept records of his deer kills which exceed 600 by 1910. In spite of laws protecting the deer its numbers declined greatly, reaching an estimated low of approximately 1000 in 1900. A complete ban on killing deer of either sex was in effect from 1924 through 1926. The deer populations have increased 100 percent since the 1940's, and the estimated population for the year 1975 was approximately 200,000 head with the harvest by hunters reaching 28,995 (Fig. 2-10).

The black bear, although surviving the period of settlement and deforestation, has not fared as well as the deer. Its range in West Virginia is reduced to two major roadless backcountry areas in the high mountain counties of the ORBES region, both within the Monongahela National Forest (Fig. 2-9). Their estimated population was 586 in 1970 (Cantner, 1974).

Among the smaller mammals which were extirpated in the 1800's or early 1900's were the beaver, the porcupine, the martin or fisher, the otter, the Canada lynx and the gray timber wolf. The beaver, like the wild turkey, was introduced into the state in the 1930's and has flourished under the influence of natural forest regeneration, and protection by laws governing trapping which was legalized in 1948.

In his Mammals of West Virginia published in 1911, Brooks stated that after tracing down numerous "panther stories" the proof of their existence in West Virginia at that time was "not entirely convincing". The belief by many at that time that a few cougar or panther still existed in the most remote sections of the state has not changed by the middle of 1970's (Cantner, 1974). As a matter of fact, two live cougars were taken with tranquilizer darts by state wildlife personnel in 1976 in Pocahontas County, but there was at least some evidence that the animals had been reared in captivity and released by their owners as an expedient means of shedding the responsibilities of their care. The mystery of the existence of truly wild panthers in West Virginia will continue to heighten the pulse of the hunters and backpacking campers during their trips into the most isolated parts of the mountain counties.

The eastern wild turkey ranks as one of the six most hunted game species in West Virginia (Cantner 1974). The state ranks 10th largest in size of turkey populations in the Nation with West Virginia and Pennsylvania leading the northeastern states. The eastern wild turkey is a forest dweller. Mosby and Handley (1943) believed that 15,000 acres or more was needed for successful management of turkeys, although they are known to exist in dairy lands of New York, where few woodlots exceed 250 acres. During the fall harvest of 1970 the population of wild turkeys in West Virginia was in excess of 25,000 birds, and 914 percent were reported to have been harvested. Turkeys are helped by management practices on forest lands which encourage the production of acorns which are their primary winter food source, but the wild turkey is an omnivorous opportunist, eating whatever acceptable items are available (Mosby and Handley, 1943).

Since the major turkey range in West Virginia is in the mountainous headwaters of the Ohio River tributaries (Fig. 2-11), expansion of strip mining associated disturbances including the greater presence of man may cause significant reduction in wild turkey populations. More study of this relationship is needed.

Gray and fox squirrels are the most hunted game species in West Virginia. The gray squirrel inhabits primarily extensive hardwood forests with nut-producing trees, characteristic of much of the present-day unglaciated Appalachian Plateau. Oak-hickory forests cover 7 million acres or 47 percent of the state. The second largest forest area is the northern hardwood group, with over 2 million acres, but it is not a favorable habitat for squirrels, particularly where oaks and hickories are absent (Allen, 1943). The fox squirrel is generally found in woodlots, forest margins, and open oak-hickory stands.

The 1966 population of squirrels in West Virginia was estimated to be 12.5 million (Riffle 1970). Since squirrels are not particularly shy of human activities other than hunting, the effects of coal mining and power plant siting should be approximately proportional to the quantity of food and den trees destroyed in the process. An incipient decline in squirrel populations may be attributable to the damaging effects of increased air pollution on nut bearing trees.

Cottontail rabbits are found in every county of the state, usually in valleys and floodplains, on the rolling hill-top farms and at high elevations where the forests are discontinuous. The ideal rabbit habitat consists of about equal parts of cropland, grassland, brushland, and woodland (Cantner 1974). This is the second most important game species in terms of the numbers killed by hunters, estimated at 881,000 during the 1969-70 season. Because rabbits are the most abundant game animal on floodplains and farmlands adjoining the major rivers of the state, sitings of power plants would often coincide with good hunting sites. However, rabbit populations do not appear to be appreciably reduced on lands adjoining power plants. Some cover crops used in strip mine land reclamation and roadside plantings are much more supportive of cottontail rabbits than were the forests which were eliminated.

Snowshoe hares (Lepus americanus) exemplify boreal mammals found at high elevations in West Virginia. They are found along the Allegheny

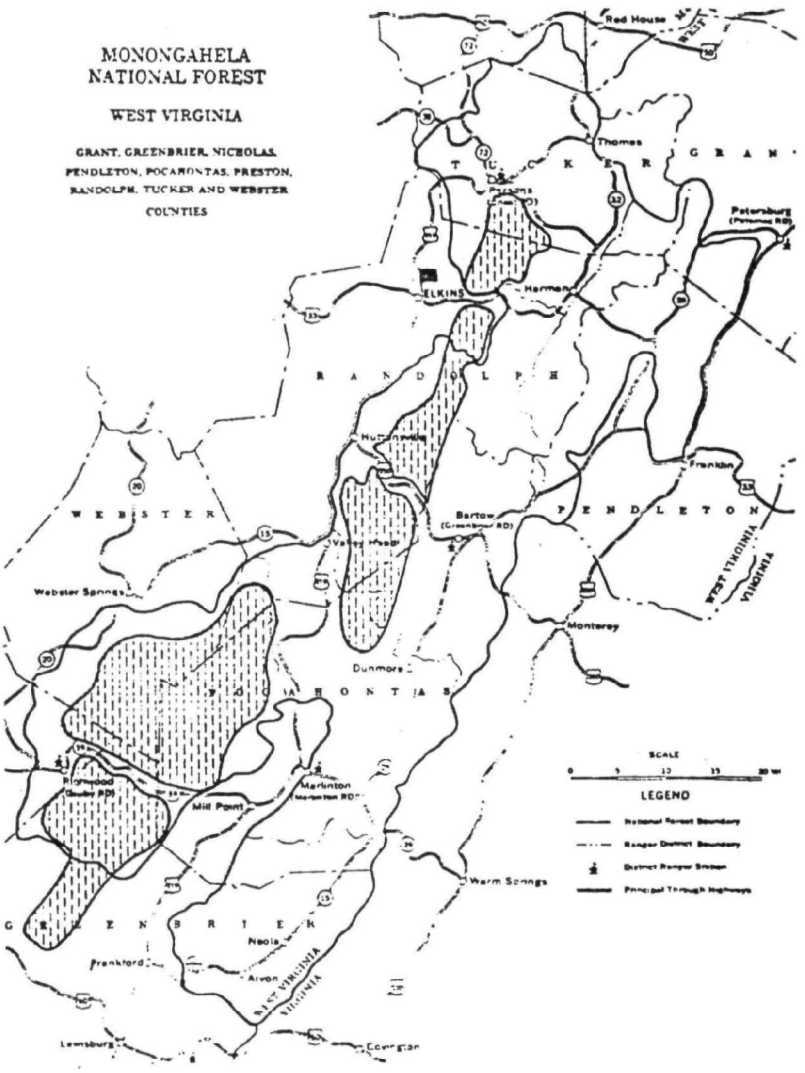

Figure 2-9
Black bear breeding areas relative to the Monongahela National Forest Boundary.

Figure 2-10

Estimated buck deer population densities by counties in West Virginia, based on hunter success.

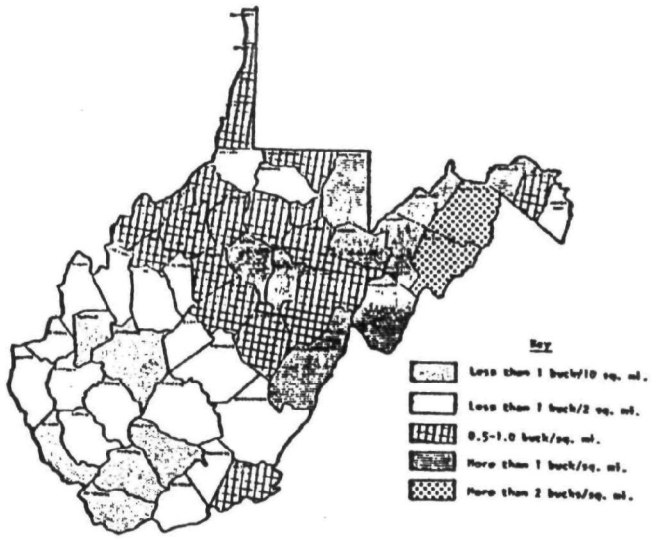

Figure 2-11

Primary wild turkey range in West Virginia coincides with remoteness from man and adequate forest cover and mast.

Figure 2-12

Snowshoe hare range in West Virginia, showing coincidence with the region of heavy snow-cover and boreal type vegetation, eg. the spruce-fir forest.

Mountains where the Canadian life zone projects southward (Fig. 2-12) in the higher mountains where the snowfall is heavy. Although they are legal game in the state, their scarcity, coupled with their generally remote habitats results in low hunting pressure (Cantner, 1974). The mere siting of a snowshoe hare is a treat for the nature devotee or the backpacker.

Ruffed grouse and quail are the two most important upland game birds in West Virginia other than turkey. The ringneck pheasant is generally limited to the northern panhandle counties of the state where enough corn and other row crops are grown. It is not an abundant game bird in the state.

Waterfowl are not extensively hunted in West Virginia, although the wood duck (Aix sponsa) the black duck (Anas rupripes), and mallards (A. platyrhyncas) are known to nest in the state. Canada geese (Branta canadensis) have been reintroduced and now nest in two widely separated colonies where numerous ponds are found. Waterfowl are in continual conflict with man and his activities, and thus their continued nesting in this state is always threatened by water based development and recreation.

2.3.3 NON-GAME WILDLIFE

At least 299 species of birds have been recorded in West Virginia, and 44 species of aesthetically important non-game mammals (Hall, 1969). The annual forays for songbirds, conducted by the Brooks Bird Club, in numerous counties in the state during the breeding season consistently tallies between 100 and 125 species of birds present in each of the 15 mile radius study areas.

Human activities have and will continue to have an impact on non-game wildlife. Pollution, pesticides, mining, impoundments and uncontrolled development of roads and recreation are listed by the West Virginia Department of Natural Resources biologists as problems facing certain forms of non-game wildlife. They suggest that such populations should remain stable if sufficient concern and cooperation are put into action by governmental agencies and citizens of West Virginia. A carefully planned program for non-game wildlife is needed (WV Department of Natural Resources, 1974).

West Virginia, including the ORBES region, has a wealth of extensive hardwood forest habitat which harbor a variety of non-game wildlife. Passerine (perching) birds, especially, are numerous. The state also has sufficient agricultural and urban areas to support wildlife indigenous to such areas.

Wetland habitats in West Virginia are very limited due to the steep topography. A single pumped-storage power project being highly contested by the Department of Natural Resources and various conservation organizations would eliminate over 60 percent of the woodcock habitat of Canaan Valley located in Tucker County. This high mountain valley containing the largest wetlands area in the state, is also a registered Natural Landmark, and is under consideration for establishment of West Virginia's first National Wildlife Refuge. A momentous decision concerning the future of this prime area is pending. Many of the Tucker

County residents favor the flooding of 7000 acres of the valley to create the large lower reservoir for the electric power interests' energy storage system, primarily because of the projected high tax revenues and flat-water recreation opportunities promised by the power company. The unique ecology of the valley, particularly its diversity of wildlife habitats, stands to be diminished by construction of the power facility and the associated real estate and recreational developments. No other area in the state could arouse such conflict between the expansion of electric power generation and the preservation of the most outstanding wetland component of the state's natural heritage.

Preservation of West Virginia's fauna, including its game and non-game species hinges on preservation of a broad diversity of habitats. Those in short supply warrant greater protection from unnecessary degradation. There is an abundance of upland hardwood forest land in the state and the flora and fauna of this cover type are, for the most part, in little danger of extinction. Conversely, wetland habitats are critically reduced in number and constitute an endangered class of natural ecosystems in West Virginia.

2.4 COMMUNITY DYNAMICS [1].

The animals and plants described in the preceding sections interact with each other and with their physical environment in a dynamic fashion. Though a detailed discussion of community dynamics is beyond the scope of this report, this section contains brief descriptions of some of the ecological interactions occurring within each of the three most common rural biotic communities of the ORBES region: upland hardwood forests, farmlands, and ribarian communities (Randolph, 1977).

Two additional regional biotic complexes occur above 3500' elevation in West Virginia along the Eastern Continental Divide: the Northeastern spruce-fir forests, and the Northern hardwoods forests (Fig. 2-1). These climax forest types and their associated developmental (seral) communities are presented in the form of a successional diagram of the Allegheny Mountain section (Fig. 2-13). This is in contrast to the course of plant succession at lower elevations in the Glaciated Allegheny Plateaus section (Fig. 2-14).

2.4.1 UPLAND HARDWOOD FOREST

One of the most important community interactions is that of energy flow through the food web. Food sources vary from animal to animal and from time to time. Of the upland hardwood forest fauna, only insects feed on the mature leaves of hardwood trees. Most herbivorous vertebrates find the leaves too high in fiber relative to the nutrient content, and tend to eat buds and flowers in the spring and early summer and berries, nuts, seeds and tubers in the late summer, fall and winter. Nuts in particular are present in

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1. Large segments of this discussion have been taken from the earlier baseline work of Indiana, Ohio State and Purdue (published in ORBES, Indiana, Vol II-A Part 2, 1977). It is included herewith because it applies also to West Virginia and will help complete West Virginia's baseline data in one volume.

UPLAND PLANT SUCCESSION IN THE DOLLY SODS WILDERNESS AREA OF THE ALLEGHENIES

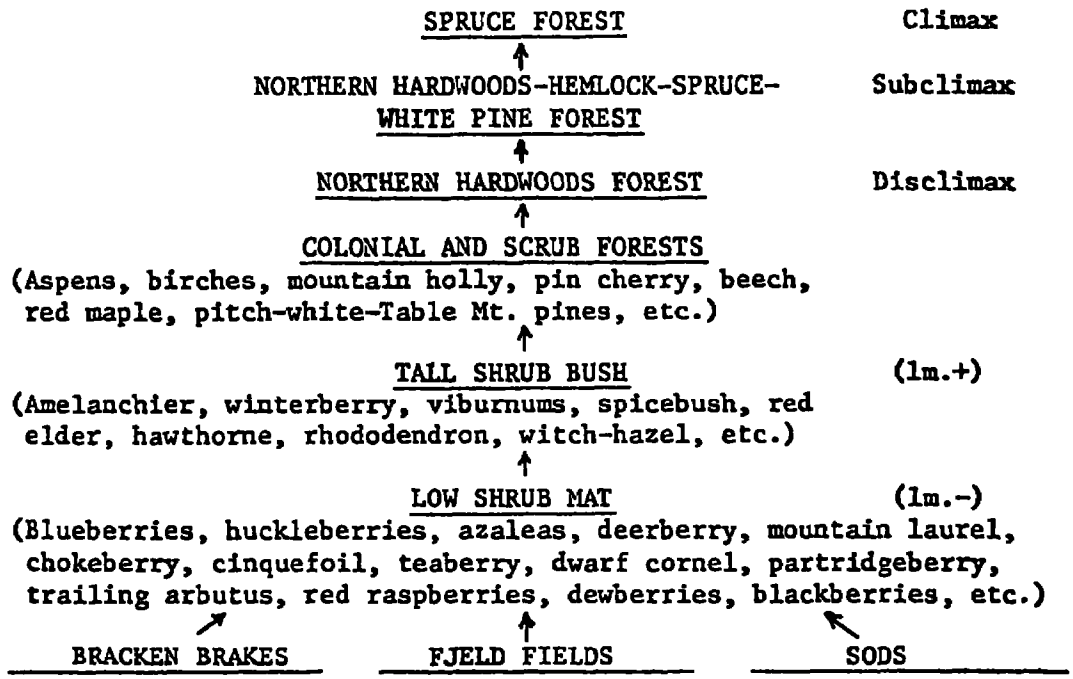
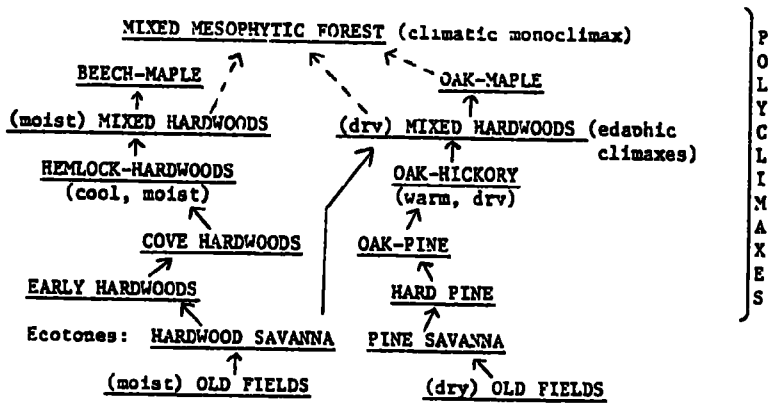


Figure 2-13

This generalized terrestrial succession applies to most of the mountain tops and windswept plateau areas above 3000' elevation in the central Appalachians. The species listed are only representative and may be found in various combinations, constituting commonly occurring plant communities. Wetland succesions from ponds, muskegs, sedge meadows which also trend toward the red spruce or spruce-fir climax in the mountain region are not shown.

Plant Successional Trends in the Gauley River Region



II. Plant Community Types (Associations) of the Gauley River Region

Forests:

BM	Beech-Maple
CH	Cove Hardwoods - tuliptree predominant
CO	Chestnut Oak
HH	Hemlock-Hardwood
MH(d)	Mixed Hardwoods (dry phase) oaks predominant
MH(m)	Mixed Hardwoods (moist phase) cherry, birch, N. red oak, etc.
MM	Mixed-Mesophytic: the regional climax forest type
OH	Oak-Hickory
OM	Oak-Maple
OP	Oak-Pine

Transient Invasion Forest and Savanna Ecotone Communities:

OF(h)	Early hardwood trees, prior to canopy closure (better soils)
OF(p)	Yellow pines: pitch, Virginia, scattered hardwoods, prior to canopy closure (poorer soils)

Farmlands with managed communities:

OF	Old Fields: grasses, forbs, and shrubs (trees sparse)
FG	Pasture or Hay fields: bluegrass, broomsedge, orchard-grass
FC	Row Crops in plowed fields
TP	Tree Plantations: usually evergreens but some black locust

Figure 2-14

Plant succession on abandoned farmlands in the Gauley River region of east-central West Virginia at elevations below 2500'. Vegetative cover type maps were prepared from 9 x 9" aero-ectachrome photographs taken at peak autumnal coloration, allowing good discrimination of various hardwood forest and old field communities.

rich supply in the oak-hickory forest, helping to support abundant populations of squirrels, and in the past, turkey. Green bark is an alternative winter food source for some species, such as mice, rabbits, and deer.

Occupying other niches in the forest food web are the birds, most of which are insectivorous; the salamanders, which form a common and diverse group of forest floor predators; and the reptiles, which range in food habits from the carnivorous snakes to the omnivorous box turtle. The large forest predators of past and present include the bobcat, the gray fox and the owls.

Nutrient cycles in general play an important part in community dynamics. The annual growth cycle of the hardwood trees is the most prevading feature influencing the nutrient cycle of the upland hardwood forest and the growth cycles of other plants. Before leaf production by trees in the spring, the herbaceous plants of the forest floor are especially active, accounting for the commonly observed spring woodland wildflowers and the generally green aspect of the mid to late spring forest floor. Generally, nutrient movement in the form of dissolved or particulate chemicals tends to be low in the soils because dead leaf cover and decomposing humus retain the chemicals or alternatively give them up to the roots and above ground structures of living trees.

The upland hardwood forest community tends not to be continuous and uniform over broad areas, because it experiences periodic alterations in response to timber removal, wildfires, diseases, tornadoes, and local individual tree falls. These phenomena open up patches of the forest floor to direct sunlight in summer when adjacent areas are shaded. These open areas provide a stock of "weed trees" and brushland and afford reptiles a place for their required summer retreat from the forest.

2.4.2 FARMLAND COMMUNITIES

Farmland communities in the lower Ohio River Basin vary from large areas of continuously cropped land interspersed with farmsteads (buildings and any yard trees, bushes, and flower gardens), through fields interrupted by woody hedgerows and small wood lots, to large wooded tracts interspersed with grazed brushland and small tilled areas. A major feature is the transitional "edge" community occurring at the interface between wooded and nonwooded land.

The animal portion of farmland communities is composed of livestock, wildlife, and agricultural insect pests. In intensively farmed areas, the vertebrate wildlife tends to be highly mobile, consisting of birds and mammals. If there are farm ponds, toads, and to a lesser extent frogs, may be present.

As land use departs from agriculture and moves toward abandoned old fields and brushlands, particularly in association with forest areas, wildlife diversity may increase substantially with the inclusion of snakes, voles, deer, and more songbirds.

In the Appalachian Plateaus portion of the Ohio River Basin farming has experienced a drastic decline over the past several decades. Millions of acres of family operated farmlands were abandoned in the 1940's and now support timber stands of marketable size. The fast growing, high quality tuliptree or yellow poplar which is a predominant invader of old fields throughout the central and southern Appalachians is the top ranking saw timber species in the hill country of eastern Ohio and Kentucky, most of West Virginia and western Pennsylvania. This example of natural regeneration of youthful forests following a revolution in land use is apparently unique globally in that the soils were not first depleated of their natural fertility. Recovery of the natural nutrient cycles has been phenomenal. Gradually there will be a return to the many mixed mesophytic, climax forest types.

2.4.3 RIPARIAN COMMUNITIES

The most obvious feature of riparian communities is the juxtaposition of land and moving water. A number of habitats are possible at the land-water interface. Temporal and geographical variations in the effects of streamflow upon the land. Such habitats include open and snag-covered high banks and sand bars associated with the main stream; oxbow ponds, marshes, and swamps of severed channels; and annual floodplains and alluvial terraces.

The vertebrae fauna of riparian communities is probably the most diverse within the ORBES region. The fauna of the alluvial terraces often includes species also found in upland hardwood communities, some as permanent residents and some as upland visitors that have come to the river to drink. The annual floodplains support a uniquely riparian amphibian community and also moles that burrow through exposed soils.

The total number of animal species that feed on aquatic life but reproduce on land is quite large, so that loss of aquatic life through degraded water quality may result in loss of these terrestrial animals. Other animals not associated with any particular riparian community include snakes and turtles; migratory ducks and geese that rest on water and feed in grain fields; raccoon and striped skunk, which feed in uplands as well as lowlands; and bats that winter in upland caves and feed over streams and possibly reproduce in riparian trees (Table 2-10).

2.5 PHYSICAL FACTORS DETERMINING WEST VIRGINIA'S NATURAL ECOSYSTEMS

2.5.1 COMPONENTS OF THE ECOSYSTEM

The presence and relative abundance of each component species in an ecosystem is determined by (1) a ready source of propagative stock (seeds, spores, animal mates, etc.), (2) an adequate complement of compatible and often interdependent species, and (3) a suitable physical environment. Thus, the composition, structure, and function of each biotic community reveals the capacity of the physical complex to support the resident and migrant organisms. The ecosystem is any functional unit composed of biota (the biotopes) and their physical environment (the ecotope). Biogeographers and ecologists are concerned with correlations between the spacial distributions of species, the communities to which they belong, and the nature of their environmental complexes. Some

apparent biotopic-ectopic correlations reflect direct cause-and-effect relationships, some are patently coincidental, and others are obscured by complex, chain reactions.

The first step in any study of local ecosystems is a search for correlations between the distribution patterns of biotic populations and physical factors such as geologic conditions and soils. The first part of this chapter on terrestrial ecology dealt with the past and present patterns of vegetative cover types and the predominant animal life of the ORBES region. The second part will deal briefly with the nature of the physical environments and how they appear to control the successful life forms in the West Virginia ORBES region.

The physical environments of organisms should be examined stratigraphically; that is all organisms are directly or indirectly, depended upon the soil environment as well as the visable above-ground and atmospheric environments. In a still broader sense, all organisms are conditioned by geologic, edaphic (soil), climatic, and extra-terrestrial variables, including solar energy and the earth's loss of energy to space. Therefore this baseline study includes mental factors which impinge on, and interact with, both natural and man dominated ecosystems. Some of these fundamental components of the biosphere can be expected to be altered by expansion of energy-conversion and energy uses in the Ohio River Basin.

2.5.2 GEOBIOTIC FACTORS

(1) Chemical nature of the bedrocks: essentially all are of sedimentary origin. Soils produced are commonly low in phosphorus, calcium and magnesium, and high in sulfur, manganese, iron and aluminum. Natural acidity poses a problem to agriculture (Fig. 2-16, 2-23).

(2) Particle size of clastics: range from quartz pebbles in conglomerates down to clay micelles; vary greatly with conditions during deposition, have a marked affect on soil texture, structure, hydrology, minerology; vary greatly in the multilayered bedrock formations and members; intrinsic productivity of residual soils is extremely variable over short distances on slopes (Fig. 2-8, 2-9) regional differences in predominant bedrock types are reflected in the array species and communities of plants (Fig. 2-8, 2-9, 2-14, 2-15, Table 2-9).

(3) Elevation of land surfaces: The highest mean elevation of any state east of the Mississippi, increasing gradually from the Ohio River to the Allegheny Front, then undulating greatly with parallel ridges and valleys (Fig. 2-5, 2-17) all of this causes great climatic variability in temperatures, cloud cover, in rainfall, in snowfall and accumulation in evapotranspiration potentials, and in wind patterns (See Fig. 4-10 thru 4-21 by Hall, and Fig. 2-20 and Table 2-13) these result in zonation of major vegetation and animal life (Fig. 2-1, 2-3, thru 2-6, 2-10 thru 2-13).

(4) Diastrophism (folding) of the earth's crust: has predetermined West Virginia's topography and the three major west-east physiographic regions, and the major ecozones in West Virginia (Fig. 2-1, 2-4, 2-5, 2-6) these major subdivisions are distinguishable in several ways, e.g. erosional and stream patterns, slope steepness regions, and the major subdivisions are distinguishable in several ways, e.g. erosional and stream patterns, slope steepness and orientations, habitat patterns, and in the relative abundances and frequencies of various vegetation types and biotic populations within the major physiographic regions.

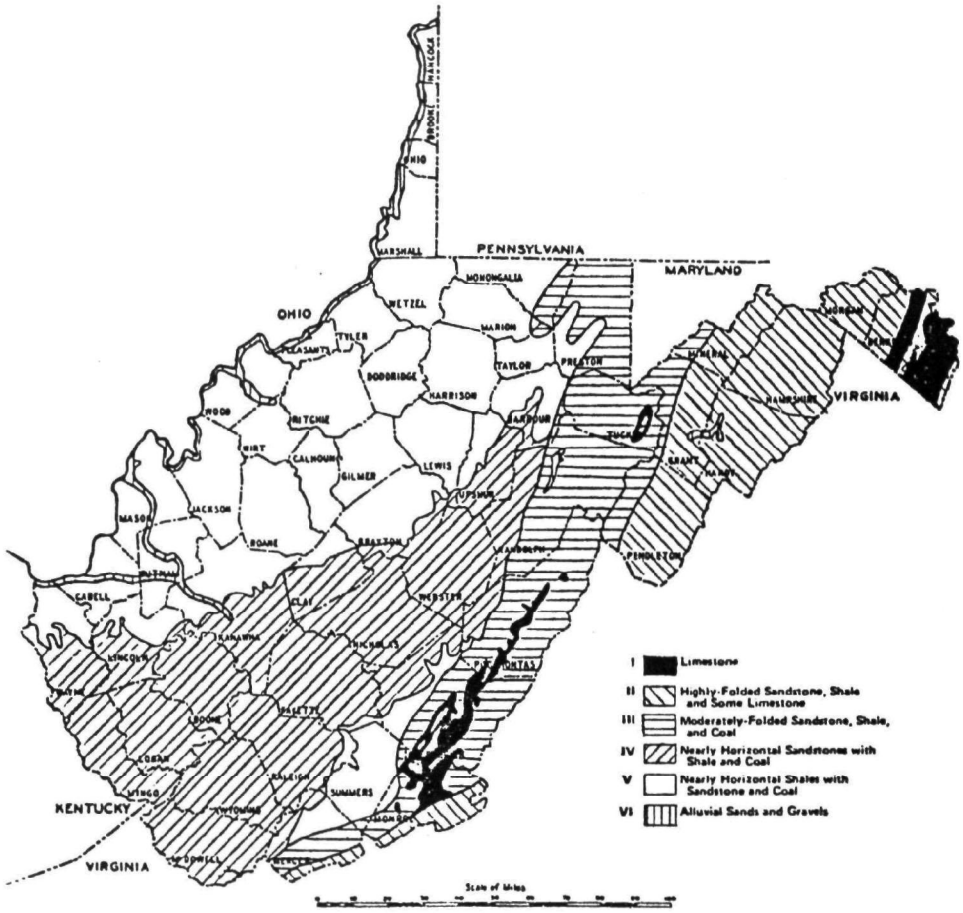


Figure 2-15

The bedrock geology of West Virginia strongly affects the soil texture, minerology, tilth, and productivity, as well as slope stability and steepness. Coupled with elevation and its related climatic effects the bedrock determines the compatible native vegetation types and the component species.

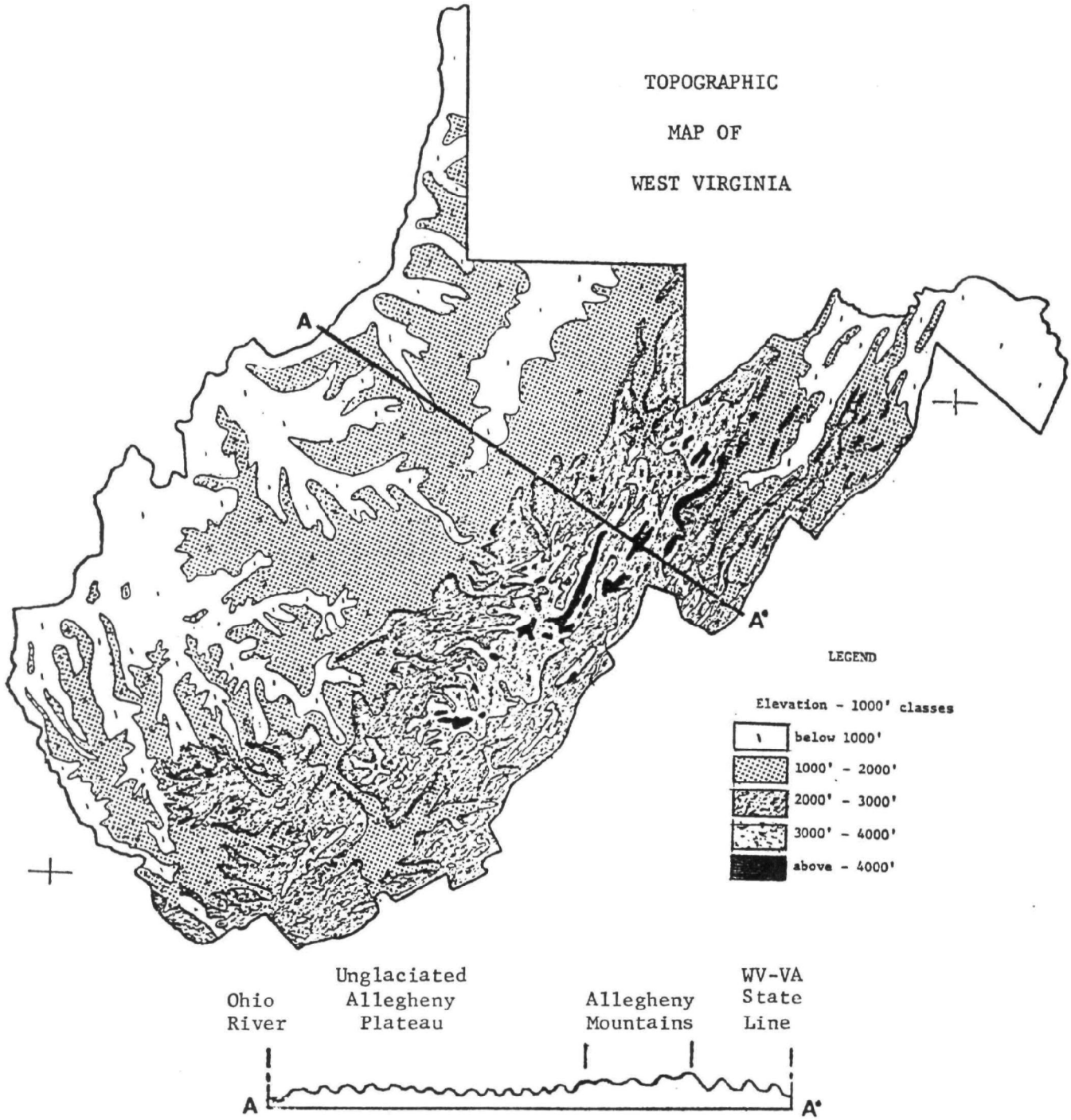


Figure **2-16**
Elevation is a significant factor in determining the vegetation of West Virginia. The increasing mean and maximum elevations of the land surfaces from the Ohio River to the eastern continental divide induces a decrease in air temperatures and an increase in annual precipitation. East of the Allegheny Front is a rain shadow zone of low rainfall. Topographic profile A--A' depicts Line A--A'.

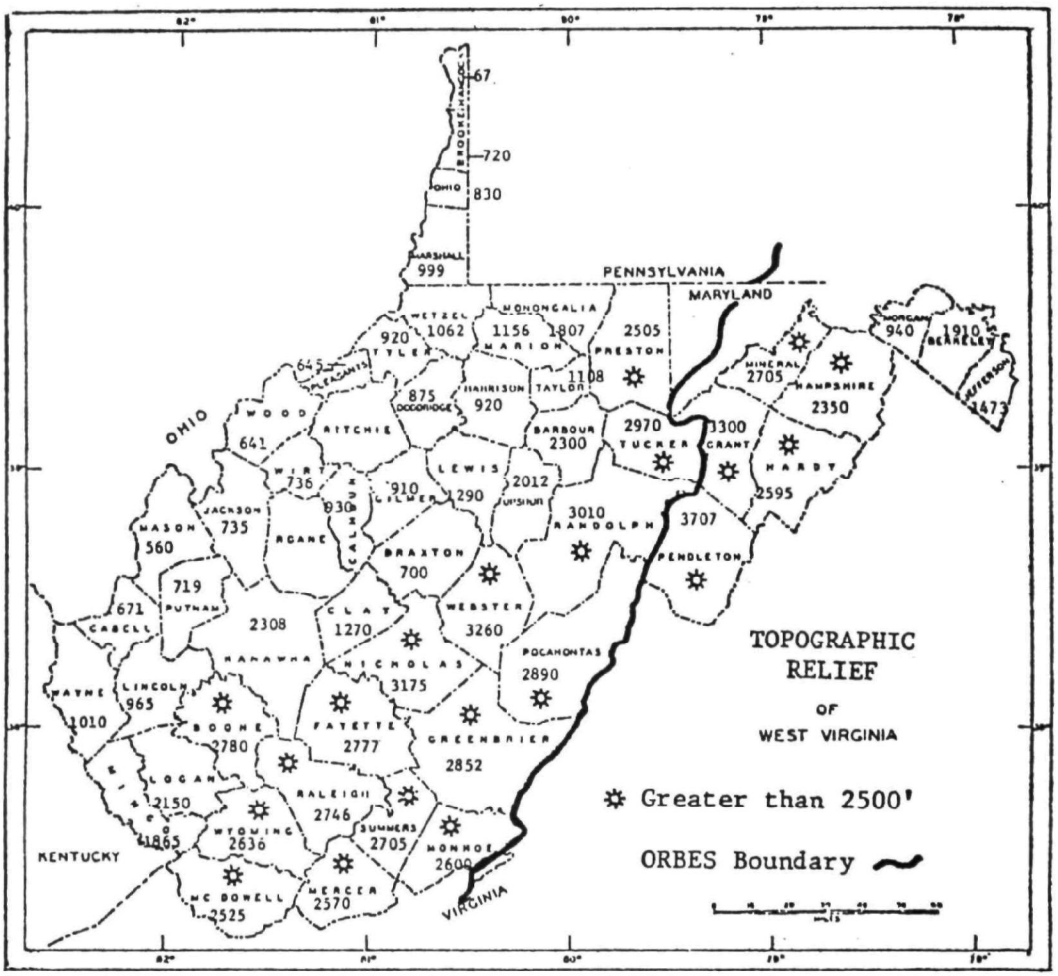


Figure 2-17

The degree of roughness of the topography is indicated, in part, by the relief within the county. As a general rule the counties with the greatest topographic relief are the most scenic. Notable exceptions are found in those counties marred by degradation of the forests, farms, air and waters by extractive industries.

TABLE 2-11

ELEVATION DATA CONCERNING THE FIFTY-FIVE COUNTIES OF WEST VIRGINIA

County	Maximum	Minimum	Mean	Difference
Barbour	3300'	1000'	2650'	2300
Berkeley	2220	310	1265	1910
Boone	3375	595	1985	2780
Braxton	2160	760	1460	700
Brooke	1377	657	1017	720
Cabell	1165	494	830	671
Calhoun	1560	630	1095	930
Clay	1875	605	1240	1270
Doddridge	1600	725	1162	875
Fayette	3375	598	1986	2777
Gilmer	1600	690	1195	910
Grant	4150	850	2500	3300
Greenbrier	4372	1520	2946	2852
Hampshire	2870	520	1695	2350
Hancock	1337	666	1002	671
Hardy	3320	725	2022	2595
Harrison	1800	880	1340	920
Jackson	1260	525	892	735
Jefferson	1720	247	984	1473
Kanawha	2850	542	1696	2308
Lewis	1950	760	1355	1290
Lincoln	1500	535	1018	965
Logan	2750	600	1675	2150
Marion	2003	847	1425	1156
Marshall	1590	591	1090	999
Mason	1070	510	790	560
McDowell	3400	875	2138	2525
Mercer	4020	1450	2735	2570
Mineral	3250	545	1898	2705
Mingo	2450	585	1518	1865
Monongalia	2600	793	1696	1807
Monroe	4050	1450	2750	2600
Morgan	2320	380	1350	940
Nicholas	3850	675	2262	3175
Ohio	1440	610	1025	830
Pendleton	4862	1155	3008	3707
Pleasants	1232	587	910	645
Pocahontas	4342	1952	3397	2890
Preston	3380	875	2128	2505
Putnam	1232	513	872	719
Raleigh	3566	820	2193	2746
Randolph	4760	1750	3255	3010
Ritchie	1380	605	993	675
Roane	1500	615	1058	885
Summers	3945	1240	2592	2705
Taylor	2003	895	1449	1108
Tucker	4420	1450	2935	2970
Tyler	1500	580	1040	920
Upshur	3050	1038	2044	2012
Wayne	1500	490	995	1010
Webster	4200	940	2570	3260
Wetzel	1650	588	1119	1062
Wirt	1325	569	957	736
Wood	1204	563	884	641
Wyoming	3536	900	2218	2636

(5) Erosion of elevated surfaces: the strong relief of the West Virginia hills and mountains results in an absence of natural lakes, a paucity of wetlands, and an infinite variety of slope, ridge, cove, ravine, cliff, and gorge habitats; severe erosion of soils is commonplace; landslides are common; climatic-climax vegetation types are uncommon, with successional stands of forests predominating (Fig. 2-17, 2-18 and 2-19). Competitive agriculture is restricted to grazing type animal production in most parts of the ORBES region of West Virginia; there are few filled valleys or flood plains available for highly productive row crops.

(6) Fossil carbon fuel extraction: activities of coal mining have destroyed or degraded aquatic life in the majority of those West Virginia streams located in coal producing counties; salt brine from wells is a problem locally, vegetation and wildlife has been badly treated in coal mining regions; spoils deposits and "overburden" is a poor environment for most plant species (except sulfur bacteria), but most can be "reclaimed" at great expense; strip mining devastation of natural vegetation is obvious and documented and this leaves large acres of land surfaces unproductive with a few notable exceptions; some species of plants and animals are favored by mining disturbances; the effects of oil and gas wells, and of quarries are very localized.

(7) Secondary effect of fuel extraction and utilization: burning coal spoils (gobpiles) once cause widespread pollution of the air with hydrogen sulfide and sulfur dioxide, a few still being tolerated; SO_2 injury to plant-life (Baer, 1967) and some animals (Decker and Menendez, 1974) is documented in the state: the major source of SO_2 pollution is coal-fired, electric power generating plants; damming of streams and rivers to supply navigational waters, cooling water, and coal-linked hydro-electric generation and storage systems have resulted in losses of wetlands, flood plains, and free-flowing stream fisheries; air and stream pollution have been accelerated by concentration of fossil fuel utilizing industries; general adequacy of vegetative cover and supply of wildlife in air polluted areas seems to limit public concern.

2.5.3 CLIMATOLOGIC FACTORS

The regional or mesoclimatic patterns in West Virginia have been adequately presented in Chapter 4 by Thomas Hall. The correlations of forest types and lesser, successional plant communities with elevation zones, slope exposure and inclination have been described elsewhere in this chapter.

It should be reiterated here that the microclimate of any small space near the earth's surface (Geiger, 1965) is unique, yet predictable within limits and is classifiable. Microclimates are thus cells within the larger meso- and macroclimatic units. The microclimates of the northeast-facing and southwest-facing slopes of any gorge such as Cheat River Gorge in northern West Virginia are nearly as different as the macroclimatic of two comparable level land surfaces in Ontario and Alabama. Therefore, the common practice of using data collected at the

nearest weather station of the National Oceanographic and Atmospheric Authority for a specific area in the hills of West Virginia or another part of the Appalachians is unreliable. Each basically homogeneous forest stand or other biotic community represents nature's "computerized read-out" of the total environmental complex, most certainly its microclimatic complex.

To complete this picture, it must be recognized that the climate near the ground is modified by vegetation or any other intercepting structures. Thus, it has been demonstrated that the microclimates of the upper and lower surfaces of a leaf are markedly different. It is remarkably well demonstrated that regional or state climate maps reveal a close correlation of climate with generalized vegetation (Fig. 2-1, 2-3, 2-4, 2-5, 2-6 and 2-20). However, in the hills of West Virginia, the chances of finding the kind of vegetation specified by Kuchler (1964), or the climates specified on climatological maps are remote. Since topographic variations are too diverse to register on small scale maps (scales 1:100,000 or greater), so, also, are the variations in plant cover.

2.5.4 ATMOSPHERIC POLLUTANT DISPERSION

Specific climatic data for use in the siting of energy conversion units, as compelled by the permit requirements of the Federal Clean Air Act and by related state statutes, are inadequate. The interactions of climatic and topographic variables in determining dispersion patterns of by-products of fossil fuel burning are well established. Less well documented are the biologic impacts of the hydrothermal and atmospheric pollution. The observable degradation of plant life around coal burning power stations is well documented. The growth retarding effects of sulfurous gases, oxidants (NO_x, PAN, and ozone), acid rainfall, and suspended particulates in sublethal dosages is a matter of serious ecological and economic concern.

From the standpoint of natural terrestrial ecosystems, climatic and topographic variations play a major role in determining not only type of vegetative cover present prior to construction of a generating faciltiy, but also whether severe or chronic environmental impacts of atmospheric pollution are likely to occur. Natural air stagnation pockets are abundant in hilly topography.

2.5.5 TOPOGRAPHIC FACTORS

Elevation effects have been previously discussed in section 2.2.8 as they relate to major vegetation patterns of the ORBES region and West Virginia.

The exposure-inclination (E/I) character of each slope in West Virginia is probably the most limiting factor determining both the soil and the biotic potential of any given site. Exposure to the sun's rays determines the energy budget and thus the temperature regimes imposed upon the biotic communities. Studies of the micro-environments of north and south facing slopes (Bennett, 1971) in West Virginia indicated that the ultimate critical factor is not temperature, but soil moisture stress and induced plant moisture deficits which in turn determine the plant

species able to survive and dominate the stand. Thus, each plant community type or forest cover type reveals the soil and atmospheric moisture conditions where it is found. In a very simplistic scheme, the driest forest sites are dominated by certain oaks, hickories, and pines, while moist river banks and floodplains support elms, soft maples, ash, willow, cottonwood, sycamore, and river birch. The mixed mesophytic communities (Braun, 1950) and the cove hardwoods and mixed Appalachian hardwoods communities or forest types of the Society of American Foresters (1967) have intermediate moisture requirements quite similar to their hard maple-beech-basswood counterparts prevalent in the upper midwestern states.

2.5.6 EDAPHIC FACTORS

Two systems of soil classification are currently in use in West Virginia and elsewhere in the ORBES region. The older system of designation names soil types based on the visible and readily measurable, morphogenic characteristics of the various soil horizons (discrete strata). Each unique soil profile was given a colloquial name usually derived from locale where it was first described, for example, Monongahela, Muskingum, and Huntington. These identifications are now the lowest category in the international system of nomenclature or in Soil Taxonomy (USDA Agric. Handbook 436, 1975), and are called soil series. An update of soil classification for West Virginia was published by van Eck in 1976. A working copy of a soils map of West Virginia's agricultural and forest soils is supplied herein for the purpose of showing the three-way correlation between the soils, geology, vegetation and climates of major ecological regions of the state (Fig. 2-22). The new system, masterminded by Dr. Guy Smith of the USDA Soil Survey Staff, recognizes the growing need for more precise description and definition of the agricultural eco-system. Soil climate is used as a criterion throughout the system, primarily temperature and moisture (van Eck, 1976).

Soil fertility and its related acid-base(pH) balance may be a major factor in accounting for the marked differences in the flora and vegetation types prevailing in the Appalachian Plateaus Province as compared to those of the Central Lowlands Province of the ORBES region. Soils derived from Pennsylvania strata are more often acidic. The same holds true for soils produced from Mississippian sandstones and some of the shale sediments of that period. The plant communities found on Mississippian limestone and calcareous shales in the Appalachians tend to approximate the groupings of species prevalent in the glaciated portions of the midwestern ORBES states and on Mississippian and Devonian bedrocks. Devonian bedrock areas in the ORBES region of West Virginia are restricted to a zone along the prominent Deer Park Anticline and associated anticlines, stretching from Greenbrier County in the southeast to Preston County in the north and then crossing into western Maryland. The bedrock and soil minerology in this zone differs greatly from that of the remainder of the ORBES region of the state, as do the plant species and vegetation types (Fig. 2-5, 2-15, 2-21).

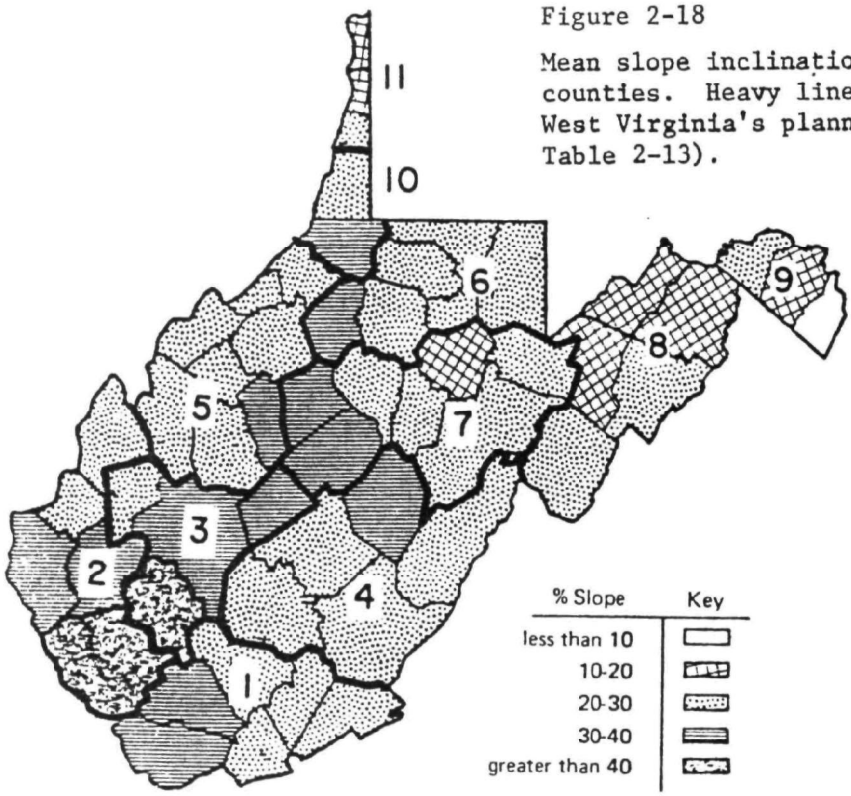


Figure 2-18

Mean slope inclination classes by counties. Heavy lines enscribe West Virginia's planning regions (see Table 2-13).

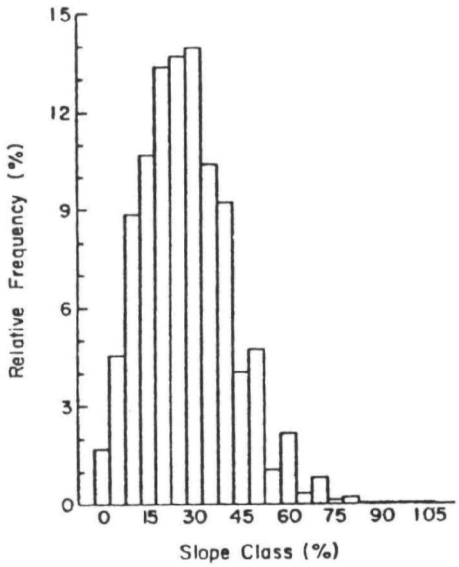


Figure 2-19

The relative frequency distribution of slope classes in West Virginia. Slope inclination and direction of exposure strongly influences the kinds of successful biotic communities and the potential to produce biomass, natural or cultivated.

TABLE 2-12

SLOPE INCLINATION (%) OF WEST VIRGINIA'S ELEVEN PLANNING REGIONS

Region	N	Maximum	Mean	Standard Deviation
1	2768	100	28.9	15.3
2	2451	90	36.3	15.6
3	2012	105	36.5	14.9
4	3652	85	25.4	13.5
5	2556	70	27.1	11.0
6	2168	95	25.2	11.7
7	3267	80	26.1	12.2
8	2655	85	21.2	12.7
9	738	80	12.9	11.5
10	771	75	31.5	11.9
11	171	60	19.6	11.9
State	23209	105	27.5	14.4

(Table and figures above from Lee, Chang and Hill, 1976)

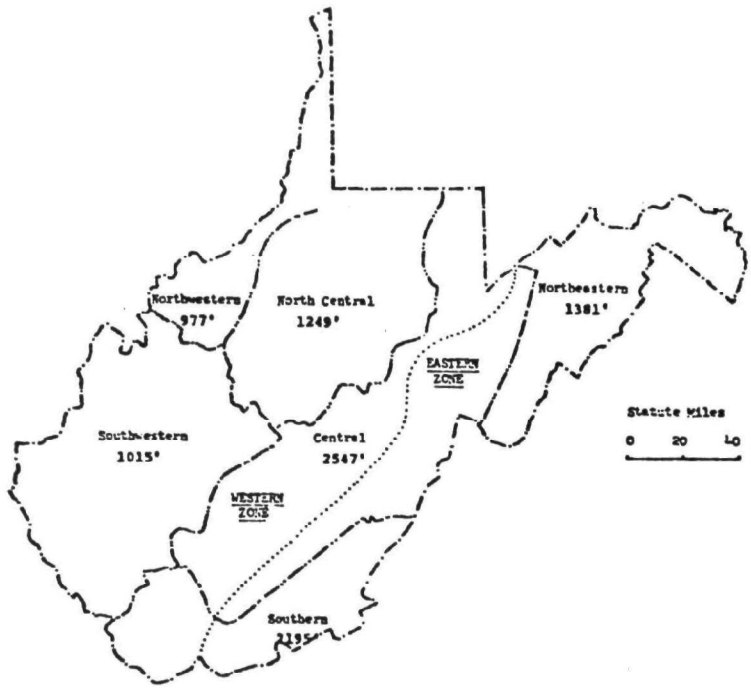


Figure 2-20

Map showing the climatological divisions of West Virginia and their mean elevations. Lee, Chang and Calhoun (1973) found the mean elevation of the state to be 1,654 feet, 500 feet higher than the second highest state east of the Rockies. Elevation markedly affects the climate and biota of West Virginia. Only the Northeastern division lies outside the ORBES boundary.

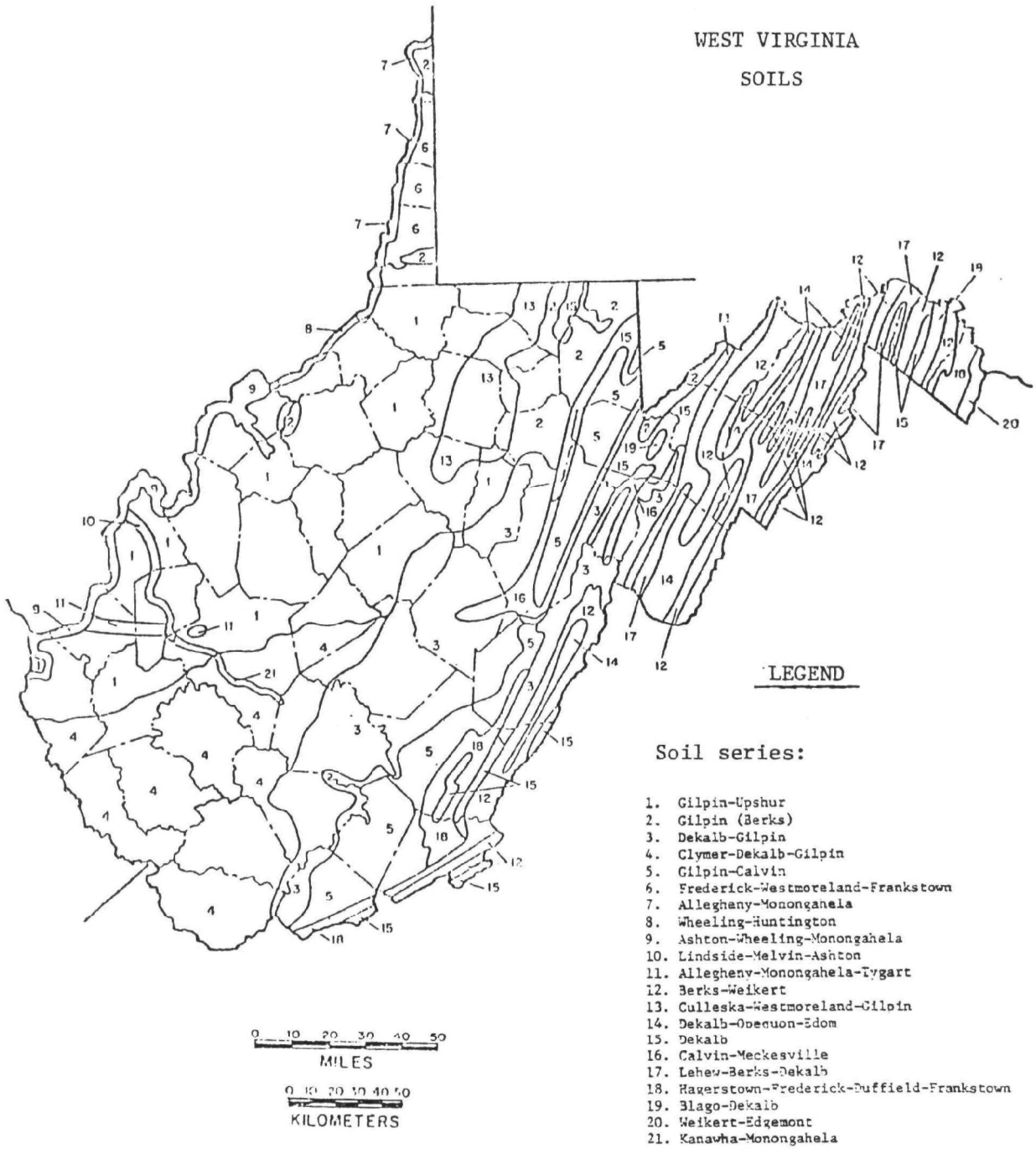


Figure **2-21**

General soils map of West Virginia, showing the distribution of the dominant soil series. A comparison with geologic, climatic and vegetation maps shows certain coincident areas and boundaries.
(Pre-publication map supplied courtesy of Plant Sciences, WVU)

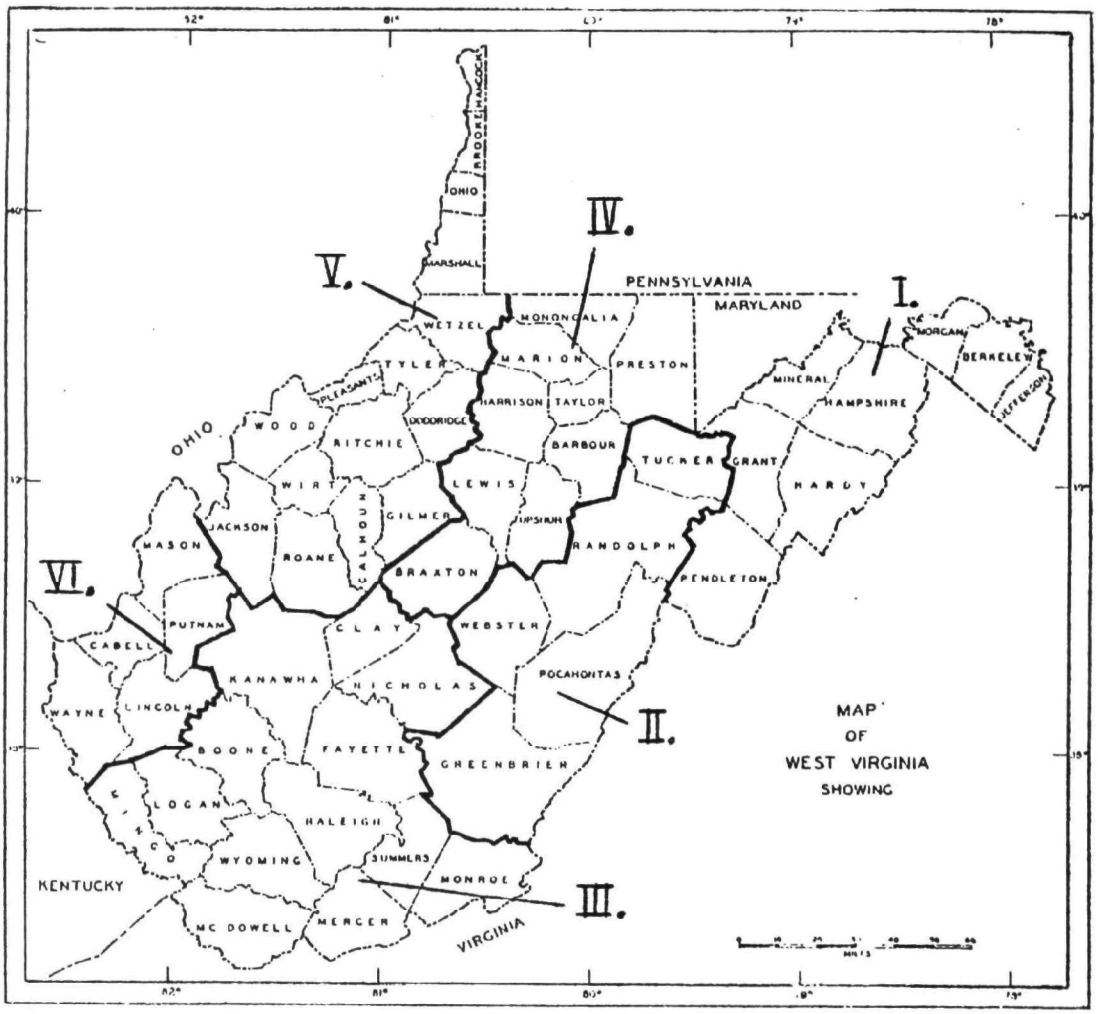


Figure 2-22
Ecological Regions of West Virginia identified by the Division of Wildlife Resources of the State Department of Natural Resources (1975).

PROBABLE ORIGINAL MINABLE EXTENT
OF THE
BITUMINOUS COAL SEAMS
IN
WEST VIRGINIA

WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

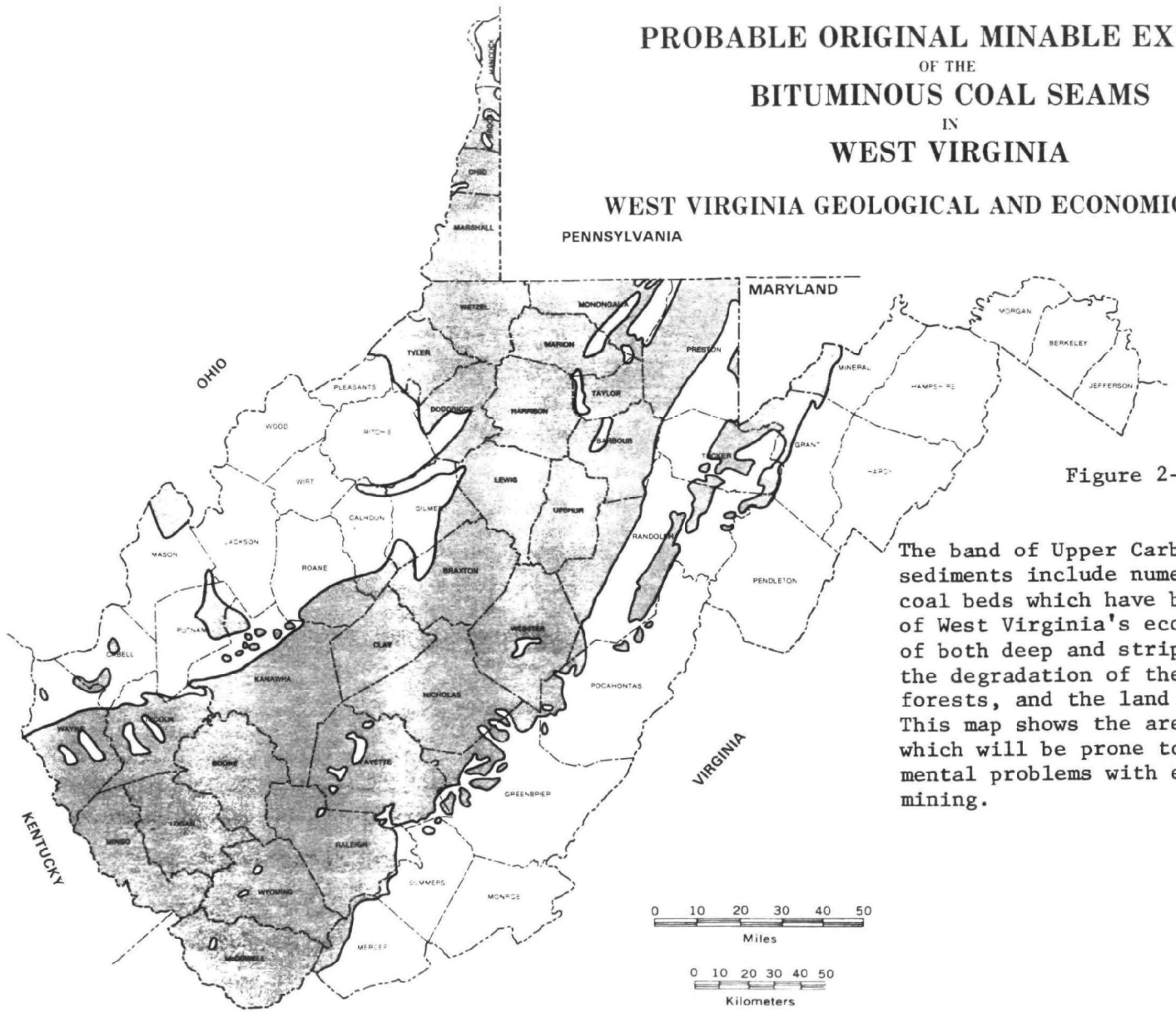


Figure 2-23

The band of Upper Carboniferous aged sediments include numerous bituminous coal beds which have been the mainstay of West Virginia's economy. The effects of both deep and strip mining have been the degradation of the streams, the forests, and the land surface and air. This map shows the areas of the state which will be prone to further environmental problems with expansion of coal mining.

TABLE 2-13

REPRESENTATIVE CLIMATOLOGICAL DATA FOR EIGHT MUNICIPALITIES WIDELY DISTRIBUTED IN WEST VIRGINIA*

AVERAGE AIR TEMPERATURES

(degrees Fahrenheit)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
Bluefield	26	38	45	44	56	65	69	69	66	53	44	34	51
Canaan Valley	19	32	38	39	50	59	64	64	61	47	39	29	45
Charleston	28	40	47	49	59	69	74	75	73	57	47	37	55
Harpers Ferry	26	37	47	51	61	72	76	76	73	59	48	35	55
Huntington	30	42	49	50	60	70	75	75	73	58	47	38	56
Morgantown	23	36	44	45	56	66	72	72	69	55	44	34	51
Parkersburg	28	39	47	48	59	69	75	74	71	57	48	35	54
Wheeling	25	36	43	45	55	67	72	73	70	56	44	33	52

TOTAL RAINFALL

(inches)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
Beckley	1.85	4.41	3.36	2.87	3.20	5.70	5.64	2.23	1.83	4.51	2.21	4.38	42.19
Clarksburg	1.78	4.03	4.63	3.86	3.03	4.52	4.61	3 67	2 04	3.48	2.92	4.05	42.60
Martinsburg	2.72	4.64	4.50	4.01	1.93	4.51	5 87	1.43	.86	1.68	3 25	3.37	38.77
Parkersburg	1.95	3.64	4.69	5.40	3.40	5.15	5.76	3.69	.65	4.59	2.97	3.40	45 29
Petersburg	1.68	3.68	2.46	3.52	2.27	3.20	2.94	.97	3.77	1.38	1.05	3.20	30 18
Pickens	3.77	5.20	7.81	8.17	6 42	8 41	9.18	7.37	8.04	8.22	4.39	7.17	84.15
Webster Springs	2.64	3.92	6.43	5.18	5 09	7.53	8.08	5 02	2.40	6.57	2.53	5.04	60.76
Wheeling	1.71	2.87	4.94	7.42	2 69	4.48	5.99	1.40	.97	2.68	2 59	2 07	40.08

TOTAL SNOWFALL

(inches)

	Jan.	Feb.	Mar	Apr	May	June	July	Aug	Sept.	Oct	Nov	Dec.	Ann.
Athens	12 8	14 3	1 5	4 0	T	.0	0	.0	.0	9 5	4 0	11.1	57.2
Canaan Valley	46.0	35 0	13.0	30 0	1.0	.0	.0	.0	.0	2 0	5 0	23.0	155.0
Kearneysville	25.0	35.5	6 0	3 0	.0	.0	.0	.0	.0	4.0	4 0	12.5	86.0
Logan	11.0	3.5	.0	T	.0	.0	.0	.0	.0	T	.0	2.0	16.5
Parkersburg	9.5	11.5	T	1.4	.0	.0	.0	.0	.0	.0	T	7.0	29.4
Moorefield	6.0	29 0	2 0	3 0	.0	.0	.0	.0	.0	.0	.0	9.5	49.3
Pickens	59 5	24 0	26 0	28 0	T	.0	.0	.0	0	4 0	6 0	42 0	189.0
Spruce Knob	57.0	39 0	14 0	31.0	T	.0	.0	.0	.0	2 0	5 0	20 0	168 0

TABLE 2-14

SURFACE COAL MINING PERMITS IN EFFECT AS OF JANUARY 1, 1978
IN WEST VIRGINIA.

COUNTY	NUMBER OF ACTIVE MINES	ACREAGE OF ACTIVE MINES	AVERAGE ACREAGE	NUMBER OF INACTIVE MINES	ACREAGE OF INACTIVE MINES	AVERAGE ACREAGE
Barbour	34	2791.4	82.1	127 (6)*	4629.7	38.3 **
Berkeley	5	1090.5	218.1	2	583.0	291.5
Boone	35	5095.9	145.6	56	7737.7	138.2
Braxton	8	296.5	37.1	8	333.6	41.7
Brooke	7	300.9	43.0	31 (7)*	662.0	27.6 **
Cabell	1	13.0	13.0	--	-----	-----
Clay	5	178.0	35.6	9	261.0	29.0
Fayette	27	4153.0	153.8	81	8273.6	102.1
Gilmer	2	72.0	36.0	7	242.0	34.6
Grant	12	1238.8	103.2	46	2639.9	57.4
Greenbrier	19	2554.0	134.4	49	3476.3	70.9
Hampshire	1	15.0	15.0	--	-----	-----
Hancock	1	120.0	120.0	1	4.0	4.0
Hardy	--	-----	-----	1	16.2	16.2
Harrison	42	1149.2	27.4	181 (11)*	4994.6	29.4 **
Jefferson	2	425.0	212.5	--	-----	-----
Kanawha	42	3871.3	92.2	108	8022.7	74.3
Lewis	21	960.6	45.7	97 (7)*	4826.7	53.6 **
Lincoln	1	105.0	105.0	--	-----	-----
Logan	15	2970.7	198.0	53	6605.3	124.6
McDowell	16	2128.8	133.0	66	6954.1	105.4
Marion	3	85.0	28.3	19 (1)*	392.8	21.8 **
Mason	1	6.9	6.9	1	39.6	39.6
Mercer	3	217.0	72.3	10	564.0	56.4
Mineral	14	1234.7	88.2	43 (2)*	1577.5	38.8 **
Mingo	7	1159.7	165.7	44	5610.7	127.5
Monongalia	16	1036.4	64.8	82 (9)*	2075.1	28.4 **
Morgan	1	300.0	300.0	--	------	-----
Nicholas	52	6712.8	129.1	63	4711.0	74.8
Ohio	--	------	-----	1	9.7	9.7
Pendleton	1	125.0	125.0	1	79.4	79.4
Pocahontas	4	62.0	15.5	2	16.5	8.3
Preston	58	3067.6	52.9	177 (15)*	5193.2	32.1 **
Raleigh	35	2932.1	83.8	69	5776.0	83.7
Randolph	28	2038.2	72.8	61 (4) *	2298.8	40.3 **
Taylor	5	263.0	52.6	25 (1) *	604.6	25.2 **
Tucker	13	944.0	72.6	21	567.0	27.0
Upshur	17	1254.8	73.8	100 (4) *	3067.3	32.0 **
Wayne	--	------	----	1	20.0	20.0
Webster	9	718.9	79.9	51 (2) *	4073.1	83.1 **
Wetzel	1	30.7	30.7	--	------	-----
Wirt	1	120.0	120.0	--	------	-----
Wyoming	13	1908.0	146.8	58	5171.7	89.2
(Unknown)	--	------	-----	8 (8)	------	-----
Totals:	578	53,746.4 acres 84.0 sq.mi.	93.0	1760	102,110.3 acres 159.5 sq.mi.	58.0

*Source: Unpublished data, courtesy Economic Geology Section, West Virginia Geologic and Economic Survey, Morgantown, West Virginia.

TABLE 2-15

RARE AND ENDANGERED PLANT LISTINGS FROM THE PRELIMINARY REPORT DISTRIBUTED BY THE WEST VIRGINIA DEPARTMENT OF NATURAL RESOURCES 1978

Petitioned Federally Threatened Plants

The 12 plants in this category are listed as threatened in the Smithsonian Institution's Report on Endangered and Threatened Plant Species of the United States. Because they are of national significance, we feel these native plants should be given priority consideration. At this time, all listed threatened plants are pending review and therefore do not have any legal state or federal protection status.

Asplenium ebenoides (Polypodiaceae) Walking Spleenwort
Syn. = Asplenosorus ebenoides

In West Virginia, it occurs on shaded ledges, limestone or calcareous sandstone in Fayette, Greenbrier, Jefferson and Pendleton Counties.

Calamagrostis porteri (Poaceae) Porter's Reedgrass

In West Virginia it is known only from Greenbrier, Hardy and Grant Counties.

Carex fraseri (Cyperaceae) Fraser's Sedge
Syn. = Cymophyllus fraseri

In the state it is restricted to coves and north-facing slopes in the mountain counties, Preston southward to McDowell.

Habenaria flava (Orchidaceae) Pale Green Orchid
Syn. = Platanthera flava

Its seven localities are in the mountain counties and counties in the low hills region. The habitat is wet meadows and swampy woods.

Habenaria peramoena (Orchidaceae) Purple Fringeless Orchid
Syn. = Platanthera peramoena

A plant with showy violet-purple flowers, this orchid is widely scattered in the state, but occurs very locally in the mountain counties, except in the eastern sections.

Anemone minima (Ranunculaceae) Dwarf Anemone

It occurs in rich woods in Kanawha, Fayette, McDowell, Mercer and Upshur Counties. April-May.

Heuchera hispida (Saxifragaceae) Rough Heuchera

In West Virginia it is found in three localities, each on calcareous ledges. Its type locality is at Sweet Springs, Monroe County, with other sites in Pocahontas and Harrison Counties.

Saxifraga caroliniana (Saxifragaceae) Carolina Saxifrage

The only state occurrence is in McDowell County in the Big Sandy drainage system.

Prunus alleghaniensis (Rosaceae) Allegheny Sloe

It occurs in woods chiefly on the eastern slopes of the Alleghenies in Monroe, Pendleton, Grant, Hardy, Mineral and Hampshire Counties.

Scutellaria ovata var. pseudoarguta (Lamiaceae) Heart-leaved Skullcap

This herbaceous perennial is endemic to shale barrens in West Virginia. It is only known from two localities in the state, Greenbrier and Pendleton Counties.

Synandra hispidula (Lamiaceae) Guyandotte Beauty

Its total range is rather restricted, locally occurring from western Virginia west through southern West Virginia, northern Kentucky, southern Ohio, Illinois, to eastern Tennessee.

Possibly Extirpated Plants

The plants listed are believed to be extirpated in West Virginia, but they may grow in relative abundance in other parts of North America. The original stations for these species have not been relocated after repeated searches of the specific site and nearby similar habitats.

Dryopteris celsa (Polypodiaceae) Log Fern

A specimen was collected from Preston County in 1918, but this population is believed to be extirpated after several efforts failed to relocate the station.

Zizania aquatica (Poaceae) Wild Rice

A small population of this aquatic grass was reported from Lake Terra Alta in Preston County.

Scheucherzia palustris (Juncaginaceae)

The southernmost record for this aquatic herb is Cranberry Glades in Pocahontas County. Its usual habitat is cool sphagnum bogs in the northern United States and in Canada.

Euphorbia vermiculata (Euphorbiaceae) Hairy Spurge

The only known collection of hairy spurge was from sandy alluvial soil near Point Pleasant in Mason County in 1891.

Gentiana crinita (Gentianaceae) Fringed Gentian

The fringed gentian was formerly abundant on a farm near Lewisburg

in Greenbrier County. This population has been exterminated since 1947, and no other records are known for the state.

Pycanthemum torrei (Lamiaceae) — Torrey's Mountainmint

This species was collected in dry soil near the abandoned mining town of Nuttallburg in Fayette County.

Restricted

Species were determined to be restricted if they met one or more of the following criteria:

1. recognized by knowledgeable botanists as being rare throughout their entire range;
2. endemic to a limited geographic region;
3. endemic to a highly specific habitat; and
4. subject to extirpation either by over-collection or destruction of habitat.

Included in this list are such plants as shale barren endemics, plants which grow on rocky river banks or at high elevations, many orchids, and several plants which are endemic to the central and southern Appalachian Mountains.

Thelpteris simulata (Polypodiaceae) — Bog Fern

Woodsia appalachiana (Polypodiaceae) — Allegheny Cliff Fern
Syn. = W. Scopulina
W. scopulina var appalachiana

Wolffia punctata (Lemnaceae) — Watermeal

Xyris torta (Xyridaceae) — Yellow-eyed Grass

Allium oxyphilum (Liliaceae) — Wild Onion

Clintonia alleghaniensis (Liliaceae) — Harned's Swamp Clintonia

Disporum maculatum (Liliaceae) — Spotted Mandarin

Trillium nivale (Liliaceae) — Snowy Trillium

Aplectrum hyemale (Orchidaceae) — Puttyroot, Adam-and-Eve

Cleistes divaricata (Orchidaceae) — Spreading Pogonia

Corallorhiza wisteriana (Orchidaceae) — Wister's Coralroot

Cypripedium reginae (Orchidaceae) — Showy Lady's Slipper

Habenaria psycodes (Orchidaceae) Syn. = Platanthera psycodes	Small Purple-fringed Orchid
Listera smallii (Orchidaceae)	Kidney-leaved Twayblade
Spiranthes lucida (Orchidaceae)	Shining Ladies Tresses
Triphora trianthophora (Orchidaceae)	Nodding Pogonia
Eriogonum alleni (Polygonaceae)	Yellow Buckwheat
Aconitum reclinatum (Ranunculaceae)	White Monkshood
Clematis albicoma (Ranunculaceae)	White-haired Leatherflower
Delphinium exaltatum (Ranunculaceae)	Tall Larkspur
Thalictrum steeleanum (Ranunculaceae)	Steele's Meadowrue
Cardamine clematitis (Brassicaceae)	Bitter Cress
Parnassis asarifolia (Saxifragaceae)	Kidneyleaf Grass of Parnassus
Parnassia grandifolia (Saxifragaceae)	Largeleaf Grass of Parnassus
Spiraea virginiana (Rosaceae)	Virginia Spiraea
Trifolium virginicum (Fabaceae)	Kate's Mountain Clover
Euphorbia purpurea (Euphorbiaceae)	Glade Spurge
Ilex collina (Aquifoliaceae)	Long-stalked Holly
Pachistima canybi (Celastraceae)	Canby's Mountain Lover
Oenothera argillicola (Onagraceae)	Shale Evening-primrose
Pseudotaenidia montana (Apiaceae)	Mountain Pimpernel
Monotropsis odorata (Pyrolaceae)	Sweet Pinesap
Pieris floribunda (Ericaceae)	Mountain Fetterbush
Convolvulus purshianus (Convolvulaceae) Syn. = Calystegia spithamaea Subsp. purshiana	Shale Bindweed
Phlox buckleyi (Polemoniaceae)	Swordleaf Phlox
Stachys nuttallii (Lamiaceae)	Nuttall's Hedge-nettle
Antennaria virginica (Asteraceae) Syn. = A. neglecta var. argillicola	Shale-barren Pussytoes
Aster linariifolius (Asteraceae)	Stiff Aster

Aster steeleorum (Asteraceae)	Steele's Aster
Marshallia grandiflora (Asteraceae)	Barbara's Buttons
Rudbeckia spathulata (Asteraceae)	Michaux's Coneflower
Senecio antennariifolius (Asteraceae)	Pussytoes Ragwort
Solidago harrisii (Asteraceae)	Shale-barren Goldenrod

ENDEMIC PLANT SPECIES LISTED FOR ORBES REGION
BUT NOT SPECIFIED BY COUNTIES

Woodsia appalachiana - centered in northern West Virginia and southwestern Virginia

Aplectrum hyemale - state records scattered throughout several counties

Paronychia montana - frequent on dry shale barrens along eastern slopes of Alleghenies

Trifolium virginicum - nine counties

Oenothera argillicola - shale barrens on eastern slopes of Alleghenies

Pseudotaenidia montana - eight shale barren counties

Convolvulus purshiances - shale barrens of eastern West Virginia

Antennaria virginica - dry woods, scattered parts of state

Aster linariifolius - rocky, sandy soils along river in mountain counties

Marshallia grandiflora - in counties along western slopes of Alleghanies

Senecio antennarifolia - from shale barrens of eight eastern counties

Cheilanthes castanea - four stations among shale barrens of eastern panhandle

TABLE 2-16

RARE, ENDANGERED, OR OTHERWISE SCIENTIFICALLY UNIQUE
WEST VIRGINIA ANIMAL SPECIES IDENTIFIED BY THE
WV HERITAGE TRUST PROGRAM OF THE DEPARTMENT OF NATURAL RESOURCES *

All species listed, except for those also on the Federal Register list of endangered and threatened species, have the status of Scientific Interest. Scientific Interest species are rare in West Virginia; they have no legal protection. The species listed on the Federal Register have legal protection under the 1973 Endangered Species Act.

Amphibians		
Scaphiopus holbrooki holbrooki		Eastern Spadefoot Toad
Acris crepitans blanchardi		Blanchard's Cricket Frog
Acris crepitans crepitans		Northern Cricket Frog
Ambystoma texanum		Small-mouthed Salamander
Aneides aeneus		Green Salamander
Desmognathus quadramaculatus		Black-bellied Salamander
Eurycea lucifuga		Cave Salamander
Plethodon hoffmani		Valley & Ridge Salamander
Plethodon nettingi nettingi	(e)	Cheat Mt. Salamander
Plethodon punctatus		Cow Knob Salamander
Birds		
Coragyps atratus		Black Vulture
Accipiter gentilis		Goshawk
Aquila chrysaetos		Golden Eagle
Circus cyaneus		Marsh Hawk
Haliaeetus leucocephalus	(E)	Southern Bald Eagle
Pandion haliaetus		Osprey
Falco columbarius		Pigeon Hawk
Falco peregrinus	(E)	Peregrine Falcon
Rallus elegans		King Rail
Rallus limicola		Virginia Rail
Coturnicops noveboracensis		Yellow Rail
Bartramia longicauda		Upland Sandpiper
Capella gallinago		Common Snipe
Cistothorus platensis		Short-billed Marsh Wren
Dendroica kirtlandii	(E)	Kirtland's Warbler
Dendroica potomac		Sutton's Warbler
Limnothlypis swainsonii		Swainson's Warbler
Aimophila aestivalis		Bachman's Sparrow
Chondestes grammacus		Lark Sparrow
Ammospiza henslowii		Henslow's Sparrow
Spiza americana		Dickcissel
Fishes		
Ichthyomyzon unicuspis		Silver Lamprey
Acipenser fulvescens		Lake Sturgeon
Polyodon spathula		Paddlefish
Scaphirhynchus platorynchus		Shovelnose Sturgeon
Hiodon tergisus		Mooneye

Fishes Continued

Clinostomus elongatus		Redside Dace
Exoglossum laurae		Tonguetied Minnow
Exoglossum maxillingua		Cutlips Minnow
Hybopsis gracilis		Flathead Chub
Nocomis platyrhynchus		Bigmouth Chub
Notropis ariommus		Popeye Shiner
Notropis blennius		River Shiner
Notropis buchanani		Ghost Shiner
Notropis scabriceps	(e)	New River Shiner
Phenacobius mirabilis		Suckermouth Minnow
Phenacobius teretulus		Kanawha Minnow
Phoxinus erythrogaster	(e)	Southern Redbelly Dace
Phoxinus oreas		Mountain Redbelly Dace
Semotilus margarita		Pearl Dace
Catostomus catostomus		Longnose Sucker
Cycleptus elongatus		Blue Sucker
Moxostoma carinatum		River Redhorse
Moxostoma duquesnei		Black Redhorse
Etheostoma kanawhae	(e)	Kanawha Darter
Etheostoma longimanum		Longfin Darter
Etheostoma osburni		Finescaled Saddled Darter
Etheostoma tippecanoe		Tippecanoe Darter
Percina copelandi		Channel Darter
Percina oxyrhyncha		Sharpnose Darter

Mammals

Microsorex hoyi		Pygmy Shrew
Sorex palustris		Northern Water Shrew
Condylura cristata		Star-nosed Mole
Scalopus aquaticus		Eastern Mole
Myotis keenii		Keen's Myotis
Myotis leibii		Small-footed Myotis
Myotis lucifugus		Little Brown Bat
Myotis sodalis		Indiana Myotis
Pipistrellus subflavus		Eastern Pipistrelle
Plecotus rafinesquii		Rafinesque's Big-eared Bat
Plecotus townsendii		Townsend's Big-eared Bat
Sylvilagus transitionalis		New England Cottontail
Glaucomys sabrinus		Northern Flying Squirrel
Sciurus niger vulpinus		Eastern Fox Squirrel
Microtus chrotorrhinus		Rock Vole
Microtus ochrogaster		Prairie Vole
Ochrotomys nuttali		Golden Mouse
Reithrodontomys humulis		Eastern Harvest Mouse
Zapus hudsonius		Meadow Jumping Mouse
Erethizon dorsatum		Porcupine
Canis latrans		Coyote
Ursus americanus		Black Bear
Lontra canadensis		River Otter
Martes pennanti		Fisher
Mustela nivalis		Least Weasel
Spilogale putorius		Eastern Spotted Skunk
Felis concolor	(E)	Mountain Lion

Invertebrates

Mollusks

Epioblasma torulosa torulosa	(E)	Tuberculed Blossom Pearly Mussel
Lampsilis orbiculata orbiculata	(E)	Pink Mucket Pearly Mussel
Carychium costatum		Land Snail
Fontigens tartarea		Cave Snail
Hendersonia occulta		Land Snail
Helicodiscus triodus		Land Snail
Paravitrea reesei		Land Snail
Paravitrea seradens		Land Snail
Triodopsis juxtidens		Land Snail
Triodopsis platysayoides	(T)(e)	Flat-spired Three-toothed Land Snail

Arthropods: Insects

Calephelis muticum	Swamp Metalmark
Colias interior	Pink-edged Sulphur
Erora laeta	Early Hairstreak
Euchloe olympia	Olympia Marble White
Euptychia gemma	Gemmed Satyr
Pieris virginiensis	West Virginia White
Speyeria diana	Diana

Arthropods: Crustaceans

Stygonectes spinatus	Spiny Cave Scud
Cambarus chasmodactylus	Crayfish

Reptiles

Chrysemys floridana floridana	Florida Cooter
Chrysemys rubriventris	Red-bellied Turtle
Chrysemys scripta elegans	Red-eared Turtle
Clemmys guttata	Spotted Turtle
Clemmys insculpta	Wood Turtle
Graptemys geographica	Map Turtle
Graptemys pseudogeographic ouachitensis	Ouachita Map Turtle
Clemmys muhlenbergi	Bog Turtle
Trionyx muticus muticus	Midland Smooth Softshell Turtle
Eumeces anthracinus anthracinus	Northern Coal Skink
Eumeces laticeps	Broad-headed Skink
Leiolopisma laterale	Ground Skink
Elaphe guttata guttata	Corn Snake
Lampropeltis getulus getulus	Eastern Kingsnake
Pituophis melanoleucas melanoleucas	Northern Pine Snake
Thamnophis sauritus sauritus	Eastern Ribbon Snake
Virginia valeriae pulchra	Mountain Earth Snake

Addendum

Mammals

Sorex dispar	Long-tailed shrew
Synaptomys cooperi	Southern bog lemming

Fishes

Ichthyomyzon bdellium	Ohio lamprey
Ichthyomyzon greeleyi	Alleghany brook lamprey
Hiodon alosoides	Goldeye
Esox americanus	Grass pickerel
(There may be a native population still in the state)	
Notropis dorsalis	Bigmouth shiner
Notropis galacturus	Whitetail shiner
Pimephales vigilax	Bullhead minnow
Ammocrypta pellucida	Eastern sand darter
Percina crassa roanoka	Piedmont darter
Percina macrocephala	Longhead darter
Percina notogramma	Stripback darter
Percina phoxocephala	Slenderhead darter
Percina sciera	Dusky darter

* Species listed on the Federal Registry of the U.S. Fish and Wildlife Service are indicated by (E) Endangered, (T) Threatened. Those whose occurences in West Virginia are found only in a few locations are identified by (e) endemics and worthy of state protection.

2.6 ENERGY RESOURCE DEVELOPMENT AND ENVIRONMENTAL PROTECTION

2.6.1 INVENTORIES OF NATURAL HABITATS AND ECOSYSTEMS

The kinds of habitats available to the biota vary geologically, edaphically, climatically, biotically and to the extent that they are influenced by man. Common habitat types in West Virginia, as elsewhere, usually derive their names from their gross appearance and/or primary habitat condition or the vegetation type such as forest, bog, meadow, marsh, field, gorge, escarpment, ridge, or valley. Combining the habitat and dominant vegetation type provides a more complete description; for example, a red spruce swamp forest, an oak-hickory upland forest, an elm-ash-maple bottomland forest, a sphagnum-cranberry bog, or a weed-patch. There also serve as names for communities of organisms (Table 2-7 and Fig. 2-1, 2-5, 2-13 and 2-14) more readily recognized by the public. More complex systems of habitat and community nomenclature are preferred for technical works by the scientific community, but they are generally inappropriate for broad-use documents such as ORBES reports.

The full range of natural habitats in any area may be identified by directly viewing the landscape, or by analyses of topographic maps, relief maps, or panoramic photographs. In order of their abundance the natural or neonatural, terrestrial habitats of West Virginia's ORBES region are: forested slopes, rolling uplands, roadside openings, stream bank and riverbank woodlands, mine spoilbanks, brushlands and barrens, swamps and wetlands, cliffs and cliff-top openings. The remaining land surfaces are under cultivation, pasture, or pavement or other special habitat devoid of natural cover. It has been well established that the human interest in, and extrinsic value of, natural features or populations of plants and animals becomes greater as the supply diminishes. The kinds of special habitats suitable for unique native organisms center around special topographic and geologic features such as caves, waterfalls, gorges, mountaintops and rock outcroppings. These features are almost invariably the central attractions of our state parks, national parks, recreation areas, and private vacation retreats. Fortunately these unique natural history areas are now being identified and registered through the activities of several governmental agencies and private naturalist organizations. Those thus far identified are incorporated in this report by county location (Tables 2-17 through 2-21) but experience has shown that the listing must be kept open-ended as additional significant sites are brought to the attention of inventory and survey groups. Numerous natural areas with high potential for priority consideration in natural resource planning are yet to be officially identified in West Virginia.

2.6.2 THE ECOSYSTEM APPROACH TO ENVIRONMENTAL PROTECTION

In order to comprehend the current status of the terrestrial flora and fauna of the ORBES region of West Virginia we must treat the biota as components of dynamic, more or less finite, functional units occupying the contact zone between the atmosphere and the geosphere. These functional units, the ecosystems, encompass all the living (organic) components and the non-living physical components of matter

and energy. Ecosystems are constantly undergoing cyclic and unidirectional changes. They react to environmental impacts from without and to evolutionary and maturation processes within. In a mature forest ecosystem a degree of apparent stability is attained which is not static but a tenuous dynamic equilibrium ready to react to disturbances originating beyond its spatial boundaries. Vegetation is the best integrator and indicator of environmental change or stability. Thus, a vegetation map reveals any similarities of climate, soils, geology, and animal life and characterizes the ecosystems present. The vegetative cover reflects the past onslaughts by man-made and natural catastrophies and the history of natural resource management such as logging, farming, and earth and soil disturbances. Vegetation may serve as an indicator of atmospheric pollution and microclimatic variations. As the primary consumer of sunlight and the sole photosynthetic energy fixer, vegetation determines the kinds of animal life that the ecosystem can support. Conversely modern plant life is dependent for its perpetuation on the insects, mammals, birds and other animal life, as well as the micro-organismal components of the ecosystem. The ecosystem, as an assemblage of interacting organisms and physical forces, is the basic unit of ecology.

2.6.3 NATURAL HISTORY AREAS AND ENVIRONMENTAL PROTECTION

The terminology applied to localities possessing unique or superior natural qualities has varied with different authorities. We have chosen Natural History Areas in order to avoid the widely held concept that Natural Areas must be essentially free of the effects of man.

In this baseline study of the terrestrial ecology of the ORBES Region we have included all recognized sites identified as having representative or unique entities of nature. Loss or degradation of such features would represent a loss of scientific, educational or aesthetic qualities from the impact area in question. The cultural and scientific values of such natural history sites are, of course, very difficult to equate in monetary units, yet they are tied to the laws of supply and demand. The supply of top quality natural history entities is constantly declining since many such items are non-renewable natural resources, including wetland habitats, free flowing streams, scenic vistas, and populations of rare or endangered species.

Each natural history site must be evaluated carefully in its own right and relative to others of its kind. The current amount of use a natural history feature receives is but one factor in the assessment of its value to this and future generations. Notoriety and over-use may in effect degrade the primary feature which qualified the site for perservation. One objective of ORBES at this time is to identify all natural resources and socio-economic forces of West Virginia which should be given consideration in estimating potential environmental impacts. Careful evaluations must follow as potential sitings are identified.

The state of West Virginia, like many other states, has only recently initiated a Heritage Trust Program for the recognition and preservation of outstanding natural and human history features. The West Virginia Heritage Trust program of the Department of Natural Resources has been gathering data on these features, and the data gathered to date is included in Table 2-21. Standaridized descriptions of all recognized sites with a given county, or of all sites of a given type may be obtained as a computer read-out, upon

request, from the West Virginia Department of Natural Resources (Fig. 2-27).

Our assimilation of baseline data for West Virginia natural history sites has relied heavily on information from the Heritage Trust program, but it also employed information from the Appalachian Plateaus Regional Study of the Natural Landmarks Program of the U.S. Department of Interior, the U.S. Forest Service, the Planning Divisions of the Huntington and Pittsburgh offices of the U.S. Corps of Army Engineers, and the West Virginia Chapter of the Nature Conservancy. The location and nature of such significant natural history sites in each of West Virginia's fifty-five counties are presented in Figure 2-24.

Natural History areas, in contrast to point sites with a single dominant feature or population of plant or animal species, are more in keeping with ecological concepts since no feature, physical or biotic, is wholly isolated from its surroundings. The quality of a natural history item such as a waterfall or a colony of orchids is affected by its total environment. It is an integral part of an ecosystem. Practices of natural area preservation have demonstrated the need to include enough area to provide protection for the central feature or theme. To protect a trout stream the entire watershed above the site must be kept free of pollution. Alterations of the environment caused by strip mining are not confined to the acres mined, nor are the benefits of air pollution controls limited to organisms living within a mile or two of the site. A natural area may encompass several square miles, as do many National Wilderness areas and National Parks. Whole counties may be regarded as essentially natural and rich in scenic beauty. In West Virginia several of the mountainous counties within or bordering on the Monongahela National Forest owe much of their astounding natural beauty to their extensive forest acreage (Table 2-4) and extreme topographic relief (Fig. 2-17). Combined, these counties constitute a regional natural area of great current and potential value to the people of the state and nation. Their conversion to industrialized areas would be a great loss to the natural heritage of West Virginia and the Nation. In another sense the perpetuation and expansion of our federal lands systems, will mean that local residents must be expected to forgo the benefits of industrialization and possibly adequate taxes to support good schools and local services. Tax exempt natural areas, national parks, wildernesses and recreation areas are often not desired by those local residents who would welcome tax generating industries and more jobs.

The Act of August 31, 1964,, Public Law No. 88-523, 78 Stat. 701 (codified at 16 U.S.C. § 715s (1976) provides for payments of federal money in lieu of general property taxes, at the rate of 0.75 percent of the current market value of federal lands in the affected counties. Often this exceeds the taxes paid by private and corporate land owners on comparable lands. Such compensation should reduce the opposition to further expansion of National Forests, Parks, Wilderness Areas, etc.

The recent emphasis on protection of natural areas, natural diversity, and rare and endangered species, like zoning, has been challenged by industry, some politicians and segments of the general populace. But, the alternative of not preserving the best and rarest parts of a region's natural heritage is a costly one. The compilation of lists and descriptions of natural history features is necessary in order to make these hard decisions.

TABLE 2-17

AREAS OF SPECIAL NATURAL HISTORY SIGNIFICANCE IN WEST VIRGINIA

At the state level of discrimination, the following areas and features appear important in West Virginia because of their abundant scenic, aesthetic, and natural history values.

1) Most of the lands included within the Monongahela National Forest and adjacent parts of the highland counties; Preston, Tucker, Grant, Randolph, Pocahontas, Pendleton, and Greenbrier.

2) River gorges: Cheat (Preston and Monongalia), Gauley (Nicholas and Fayette), New River (Mercer, Raleigh, Fayette, Kanawha), Bluestone (Raleigh) as wild and scenic rivers.

3) Cave-karst areas (Greenbrier, Pocahontas, Monroe) as recreational attractions and fragile areas.

4) Clean streams wherever they have escaped pollution by mine waste, industrial chemicals, and domestic sewage.

5) The Ohio River and the Kanawha because of their potential to regain high biological productivity if given proper protection.

6) Virgin or over-mature forests with trees exceeding three feet, dbh.

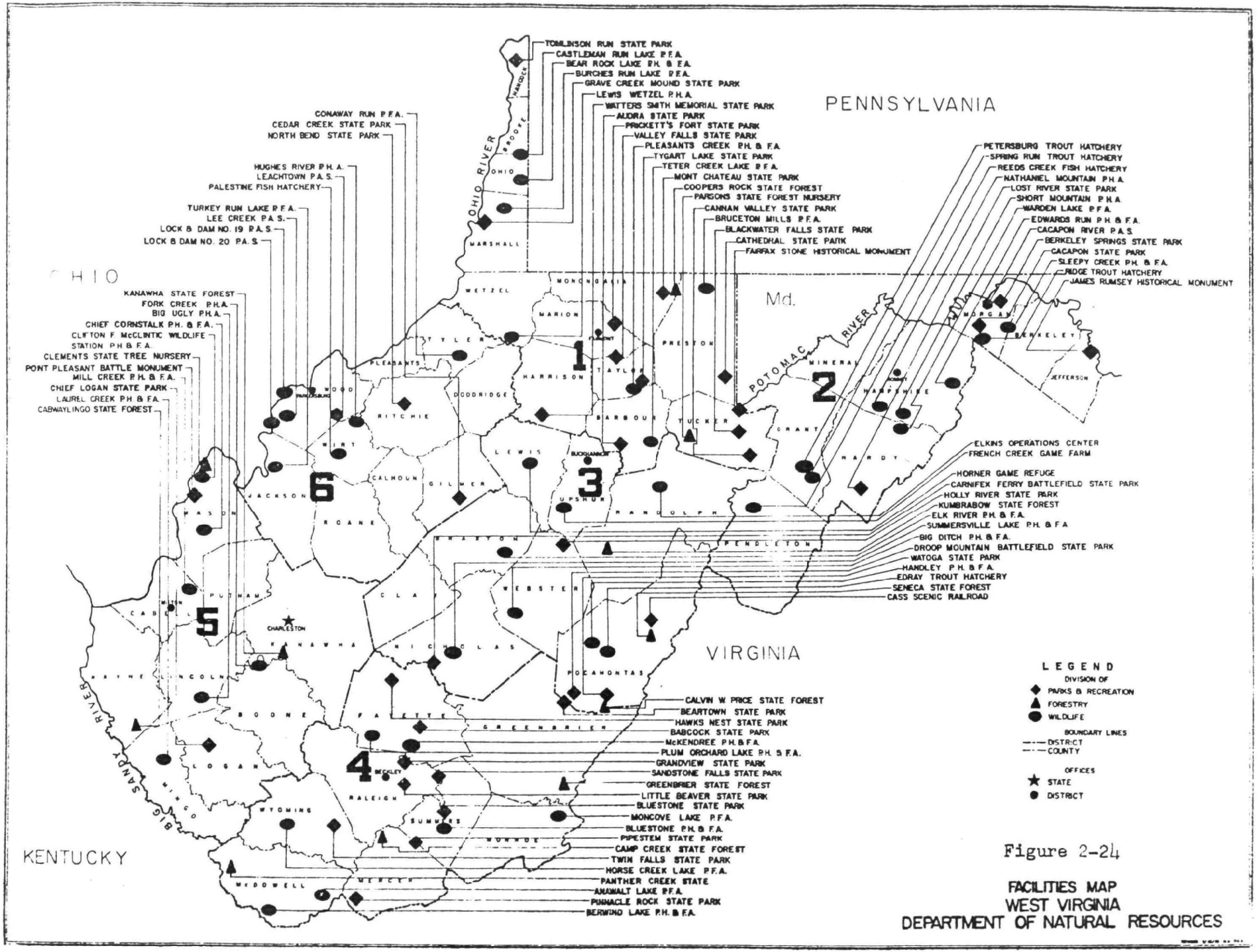
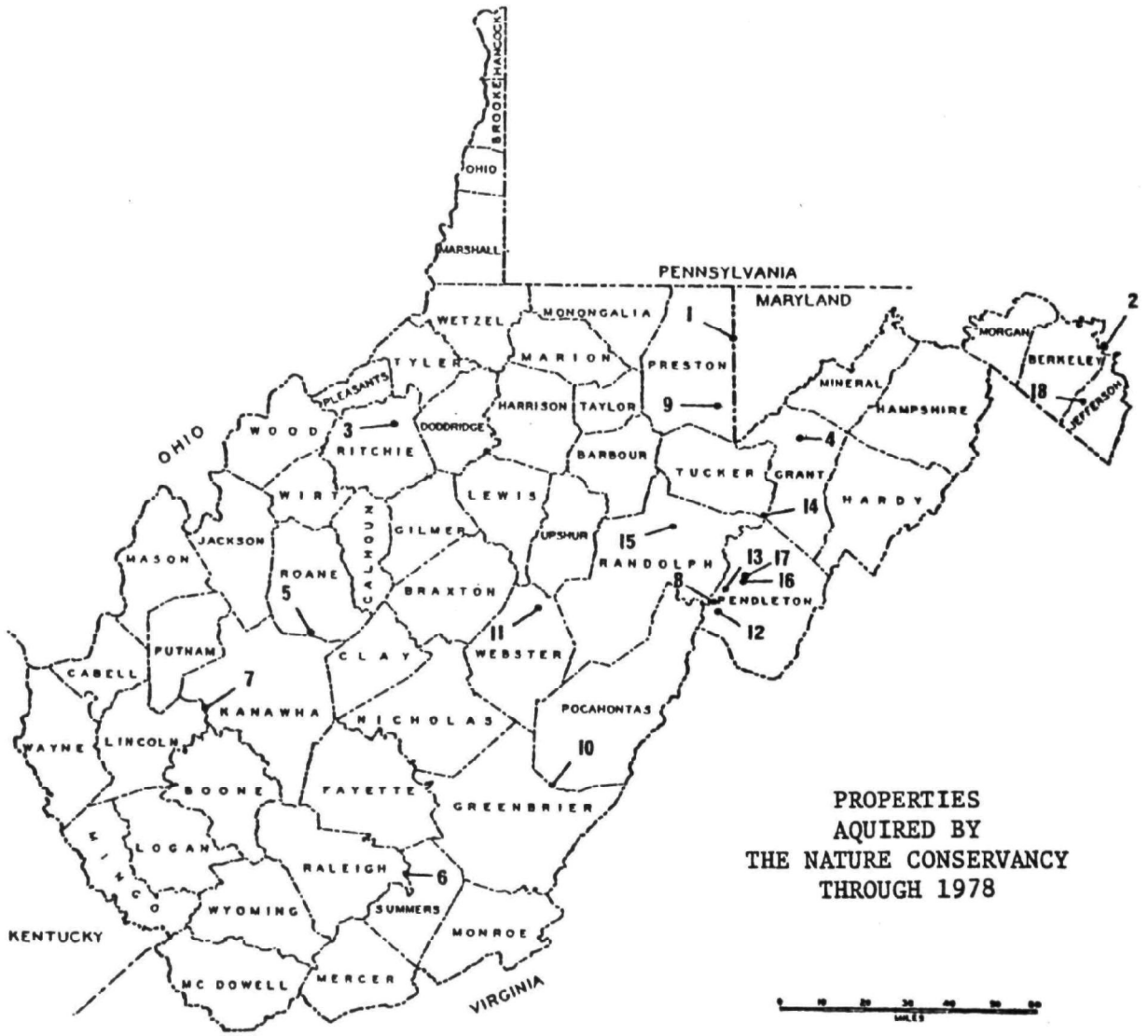


Figure 2-24

FACILITIES MAP
WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES



1. Cranesville Swamp Nature Sanctuary (313 acres)
2. Yankauer Preserve (107 acres)
3. Murphy Preserve (276 acres)
4. Greenland Gap Nature Preserve (255 acres)
5. Hungry Beech Nature Preserve (121 acres)
6. Sandstone Falls (1233 acres)
7. Coal River Tract (735 acres)
8. Woodlands & Whitewater Institute (392 acres)
9. Cathedral State Park Addition (7 acres)
10. Beartown State Park (107 acres)
11. Holly River State Park Addition (104 acres)
12. Fanny Bennett Hemlock Preserve (60 acres)
13. Selmet Spruce Knob Tracts (3977 acres)
14. Dolly Sods, Mineral Rights (15,558 acres)
15. Mullenax Tract (156 acres)
16. Germany Valley - Seneca Rocks Tract (235 acres)
17. Hedrick Tract (221 acres)
18. Leetown Fish Hatchery Addition (86 acres)

Figure 2-25

Map showing the locations of natural areas aquired by the West Virginia chapter of the Nature Conservancy. Eight areas are currently owned by the Nature Conservancy (1-8), three areas have been transferred to the West Virginia Department of Natural Resources (9-11), five areas have been transferred to the U.S. Forest Service (12, 13, 15, 16, 17) and the mineral rights underlying much of the Dolly Sods area (14) were purchased by TNC and later transferred to the Forest Service, and 86 acres of land and waters (18) were purchased and later transferred to the U.S. Fish and Wildlife Service for expansion of the Leetown Fish Hatchery.

REGISTERED NATURAL LANDMARKS OF THE APPALACHIAN PLATEAUS PROVINCE

(by Physiographic Sections)

A. MOHAWK SECTION

1. Moss Island, NY

B. GLACIATED ALLEGHENY PLATEAUS

2. Bear Swamp, NY
3. McLean Bogs, NY
4. Fall Brook Gorge, NY
5. Moss Lake Bog, NY
6. Deer Lick Nature Sanctuary, NY
7. Holden Natural Areas, OH
8. White Pine Bog Forest, OH
9. Arthur B. Williams Memorial Woods, OH
10. Mantua Swamp, OH
11. Tinkers Creek Gorge, OH
12. Brown Lake Bog, OH
13. Lake Lacawac, PA
14. Cranberry Bog, PA
15. Hickory Run Boulder Field, PA
16. The Glens Natural Area, PA
17. Pine Creek Gorge, PA
18. Reynolds Spring and Algerine Swamp Bogs, PA

C. CATSKILL MOUNTAINS

None to date.

D. ALLEGHENY MOUNTAINS

* 19. Ferncliff Peninsula Natural Area, PA
* 20. Cranesville Swamp Nature Sanctuary, WV
* 21. Cathedral Park, WV
* 22. Canaan Valley, WV
* 23. Big Run Bog, WV
* 24. Fisher Spring Run Bog, WV
* 25. Shavers Mountain Spruce-Hemlock Stand, WV
* 26. Gaudineer Scenic Area, WV
* 27. Blister Run Swamp, WV

E. UNGLACIATED ALLEGHENY PLATEAU

* 28. Tionesta Scenic and Research Natural Areas, PA
* 29. Hearts Content Scenic Area, PA
* 30. Cook Forest, PA
* 31. McConnell's Mill State Park, PA
* 32. Clear Fork Gorge, OH
* 33. Dysart Woods, OH
* 34. Cranberry Glades, WV
* 35. Swago Karst Area, WV
* 36. Lost World Caverns, WV
* 37. Greenbrier Caverns, WV
* 38. Greenville Saltpeter Cave, WV

F. CUMBERLAND MOUNTAINS

39. Lilly Cornett Woods, KY

G. CUMBERLAND PLATEAU

40. Red River Gorge, KY
41. Rock Creek Natural Area, KY
42. Cumberland Caverns, TN
43. Conley Hole, TN
44. Crassy Cove Karst Area, TN
45. Piney Falls, TN
46. Big Bone Cave, TN
47. Savage Gulf, TN
48. Dick Cove, TN
49. Shelta Cave, AL
50. Cathedral Caverns, AL
51. Newsome Sinks Karst Area, AL
52. The Dismals, AL

Map of the Appalachian Plateaus study area showing the locations of all Natural Landmarks registered by the U.S. Park Service prior to July, 1976.
(see opposite page)

* Registered Natural Landmarks in ORBES Appalachian area.

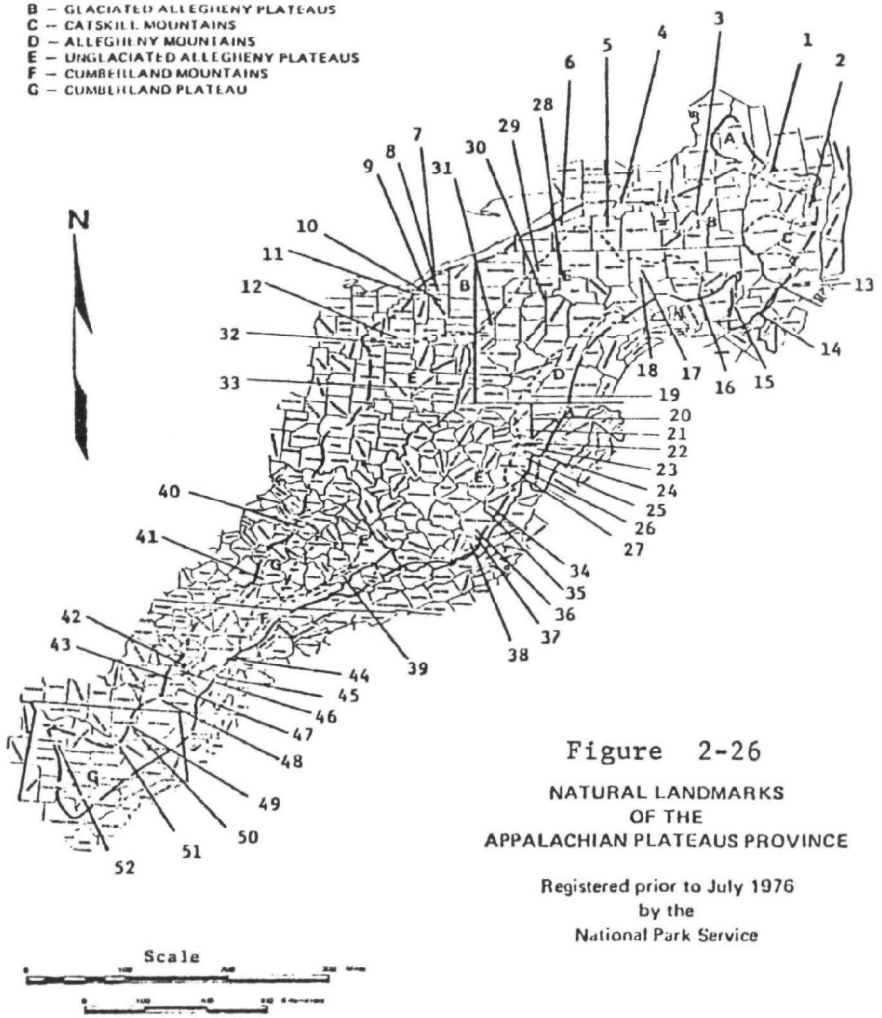


Figure 2-26

NATURAL LANDMARKS OF THE APPALACHIAN PLATEAUS PROVINCE

Registered prior to July 1976 by the National Park Service

Appalachian Plateaus Regional Study - 1976

TABLE 2-18

PROPOSED NATURAL LANDMARKS*
LOCATED IN THE APPALACHIAN PLATEAUS REGION OF ORBES

GLACIATED ALLEGHENY PLATEAU

Eagle Creek State Nature Preserve, Portage Co., OH
Kent Tamarack Bog, Portage Co., OH
Lake Creek Marshes, Crawford Co., PA
Muddy Creek Swamp, Crawford Co., PA
Stumpy Basin, Summit Co., OH
Timken Bog/Stewart Bog, Stark Co., OH
Triangle Lake Bog, Portage Co., OH

ALLEGHENY MOUNTAINS

Allegheny Front/Bear Rocks, Grant Co., WV -151 acres **
Blackwater Falls and Canyon, Tucker Co., WV -7000 acres
Cheat River Gorge/Coopers Rock, Preston Co., WV -3000 acres
Dobbin Slashing, Tucker Co., WV -600 acres
Finzel Swamp Nature Preserve, Garrett Co., MD -500 acres
Mt. Porte Crayon-Roaring Plains, Randolph, Pendleton Co., WV -7000 acres
Spruce Knob, Pendleton Co., WV -75 acres
Swallow Falls State Forest, Garrett Co., MD -500 acres
Tygart Valley, Randolph Co., WV -200 acres (scenic vistas)
Youghiogheny River Gorge, Fayette Co., PA -10,000 acres

UNGLACIATED ALLEGHENY PLATEAU

Allegany State Park, Cattaraugus Co., NY
Allegheny River Island, Warren, Forest Co., PA -700 acres
Beaverkettle Farm, Columbiana Co., OH -2000 acres
Carnifex Ferry State Park, Nicholas Co., WV -100 acres
Carter Caves State Park, Carter Co., KY
Cass Cave, Pocahontas Co., WV -area unknown
Crulls and Thompsons Islands, Warren Co., PA -See Allegheny Mountains
Daily-Hirsch Woods, Ross Co., OH -100 acres
Gauley River Gorge, Fayette, Nicholas Co., WV -5000 acres
Haynes Cave, Monroe Co., WV -area unknown
Hocking Hills State Park, Hocking Co., OH -5000 acres
Kanawha State Forest, Kanawha Co., WV -550 acres
Miller Run Natural Area, Lycoming Co., PA
New River Gorge, Fayette Co., WV
Rock City/Olean, Cattaraugus Co., NY
Rock Run/Lake Katherine Area, Jackson Co., WV-OH -200 acres
Teays Valley, Cabell and Putnam Co., WV-OH -200 acres (scenic vistas)
World's End State Park, Sullivan Co., PA

*Note: This preliminary list shows highly rated natural areas and features which have been proposed for National Natural Landmark designation as additions to the areas registered prior to 1976 by the National Park Service. Information courtesy Appalachian Plateaus Regional Study (Baer, Behling and Little, 1979).

** Acreages of sites are approximations.

TABLE 2-19

WEST VIRGINIA NATURAL HISTORY SITES BY COUNTIES*

Braxton: Elk River Forest, Little Kanawha Back-country.

Brooke: Bethany College Woods.

Cabell: Teays Valley.

Clay: Strange Creek, Tea Table Rock.

Fayette: Fayetteville Hogback and Plateau, Gauley River Gorge, New River Gorge.

Grant: Allegheny Front-Bear Rocks.

Greenbrier: Davis Spring, Gunpowder Ridge, Kates Mountain, Rapp Cave, White Oak-White Pine Stand.

Hancock: Tomlinson Run State Park.

Harrison: Natural Cave.

Jackson: Ohio River Flood-plain Forest, Red Cedar Stand

Kanawha: Kanawha State Forest, Pain Creek Game Refuge.

Lewis: Horner State Game Refuge.

McDowell: Virgin White Oak.

Marion: Valley Falls.

Mercer: Bluestone River Gorge, Pinnacle Rock, Pipestem State Park.

Mineral: Pinnacles, The, Potomac River Gorge.

Monongalia: Cheat River Gorge at Cooper Rock State Park, Core Arboretum, Tibb's Run Preserve

Monroe: Haynes Cave.

Nicholas: Carnifex Ferry State Park, Gauley River Gorge, Open Rocks.

Ohio: Oglebay Park.

Pendleton: Bennett Hemlock Tract, Mt. Porte Crayon-Roaring Plains, Spruce Knob.

Pleasant: Burning Springs Anticline.

Pocahontas: Bald Knob Spruce Stand, Beartown, Blister Swamp, Cass Cave, Droop Mountain Bog, Dunmore Springs, Fossil Coral Reef, Hills Creek Falls, Huntersville Arch, Shaver's Fork, Watoga State Park.

Preston: Big Sandy River Valley, Cheat River Gorge at Cooper's Rock State Park, Cornwall Cave, Virgin Hemlock Stand.

Putnam: Teays Valley.

Raleigh: Flat Top Mountain, Grandview State Park.

Randolph: Brierpatch Mountain, Cheat Mountain, Elk River Sinks, Kumbrabow State Forest, Moore Run, Mt. Porte Crayon-Roaring Plains, Otter Creek Wilderness, Rock Run Sugar Maple Stand, Sinks of Gandy Creek, Tygart Valley.

Ritchie: Burning Springs Anticline, Murphy Preserve, North Bend State Park, Ritchie Mines.

Roane: Hungry Beech Natural Area, Natural Bridge.

Summers: Pipestem State Park, Sandstone Falls.

Taylor: Valley Falls.

Tucker: Blackwater Falls and Canyon, Cave Hollow System, Dobbin Slashing-Allegheny Front, Red Run.

Tyler: Grape Island, Jug, The-Middle Island Creek Loop

Upshur: French Creek Forest.

Webster: Black Fork of Elk Valley, Holly River State Park, Little Kanawha Back Country, Salt Sulphur Springs-Webster Springs.

Wirt: Devil's Tea Table.

Wood: Blennerhassett Island, Burning Springs Anticline.

Wyoming: Virgin White Oak

* These sites represent areas suggested for inclusion in the inventory of natural areas and sites which is a continuing operation by the Heritage Trust Program of the West Virginia Department of Natural Resources. Acreages of the sites are not included since most have not been determined for adequate protective measures.

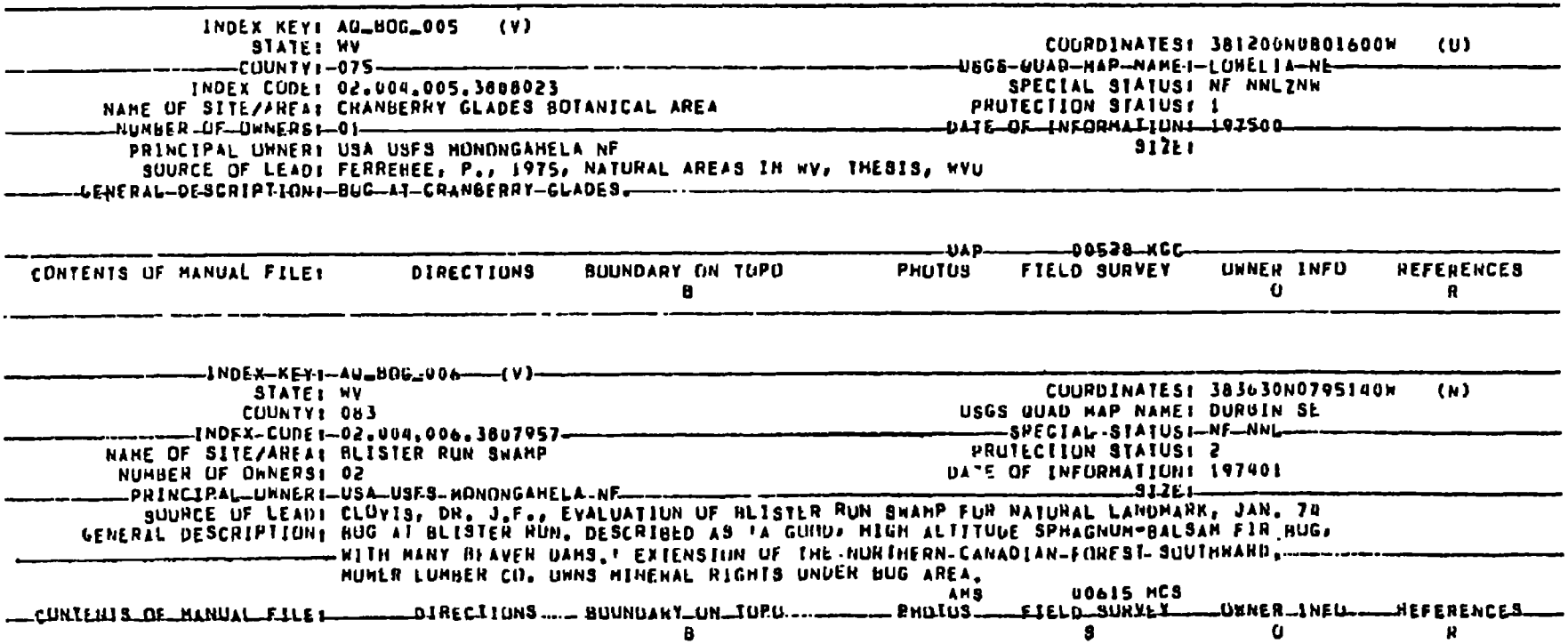


Figure 2-27

A copy of computer read-out supplied by the West Virginia Department of Natural Resources. Its Heritage Trust Program is inventorying all natural history, human history, and outdoor recreation sites. Such information should aid in regional planning and development and environmental impact statement preparation.

TABLE 2-20

INVENTORY OF STATE LANDS IN WEST VIRGINIA

Courtesy
WV Department of Natural Resource
1979

DIVISION OF FORESTRY

	SURFACE
Cabwaylingo State Forest	8,122.57
Calvin W. Price State Forest	9,482.22
Camp Creek State Forest	5,896.99
Clements Tree Nursery	125.71
Coopers Rock State Forest	12,698 35
Fire Tower Sites	57.42
Greenbrier State Forest	5,129.64
Kanawha State Forest	9,051.93
Kumbrabow State Forest	9,430.66
Panther State Forest	7,810.19
Parsons State Forest Nursery	100.00
Romney Storage Building	.75
Seneca State Forest	11,684.06
Yellow Poplar Seed Orchard Research Area	29.40
TOTALS	79,619.906

DIVISION OF WILDLIFE RESOURCES

	SURFACE
Petersburg Trout Hatchery	9.0
Pleasants Creek P.H.& F.A.	3,373.31
Plum Orchard P.H.& F.A.	2,953.33
Back Fork of Elk River P.A.S.	10.00
Cacapon River P A.S.	23.89
Elizabeth P.A.S.	4.61
Hunters Access Site	.17
James R. Jones P.A.S.	2.24
Leachtown P.A.S.	3.80
Lee Creek P.A.S.	3.82
Leon P.A.S.	.26
Palestine P.A.S.	2.4
South Branch of Potomac River P.A.S.	1.77
Morgantown Lock & Dam	5.46
Ohio River P.A.S. Lock & Dam 19	22.93
Ohio River P.A.S. Lock & Dam 20	13.91
Ohio River P.A.S. Lock & Dam 21	5.77
Reeds Creek Fish Hatchery	11.93
Ridge Trout Hatchery	35.21
Shenandoah Wildlife Management Area	4.19
Short Mountain P.H.A.	8,020 47
Sleepy Creek P.H.& F.A.	22,301.42
Spring Run Trout Hatchery	42.03
Stonecoal Reservoir	3,000.00
Stony Creek Rearing Ponds	8.74
Summersville Lake P.H.& F.A.	5,650 00
Summit Point P.H.A.	46 00
Teter Creek Lake P.F.A.	136.64
Turkey Run Lake P.F.A.	64.36
Upper Buffalo Creek P.F.A.	
Upper Decker's Creek Watershed	56 18
Warden Lake P.F.A.	123.19
Westvaco P.H.A.	9,459 85
Widmeyer P.H A.	398 00
TOTALS	184.766 23

DIVISION OF PARKS & RECREATION

	SURFACE
Audra State Park	355.18
Babcock State Park	3,636.78
Beartown State Park	107.42
Beech Fork Lake State Park	
Berkeley Springs State Park	7.00
Blackwater Falls State Park	1,687.96
Bluestone State Park	2,145.01
Cacapon State Park	6,114.91
Canaan Valley State Park	5,809.81
Canyon Rim	3.84
Carnifex Ferry Battlefield State Park	156.37
Cass Scenic Railroad	855.43
Cathedral State Park	133.09
Cedar Creek State Park	2,396.98
Chief Logan State Park	3302.73
Droop Mountain Battlefield State Park	287.90
Fairfax Stone Historical Monument	4.00
Grandview State Park	890.93
Grave Creek Mound State Park	6.92
Hawks Nest State Park	275.84
Holly River State State Park	8101.00
Little Beaver State Park	522.12
Lost River State Park	3,711.61
Mont Chateau State Park	42.16
New River Gorge Scenic Railroad	23.49
North Bend State Park	1,405.05
Pinnacle Rock State Park	244.78
Pipestem State Park	4,023.30
Prickett's Fort State Park	188.47
Point Pleasant Battle Monument	3.62
Rumsey Monument	3.45
Sandstone Falls State Park	71.35
Statts Mill Proposed State Park	119.14
Tomlinson Run State Park	1,397.50
Twin Falls State Park	3,776.28
Tygart Lake State Park	2,133.67
Valley Falls State Park	1,070.00
Watoga State Park	10,105.54
Watters Smith Memorial State Park	530.47
Totals	65,651.207

TABLE 2-21

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
Barbour	Oak-hickory, maple-beech-birch, other hardwood types[1]	135.9	62.8	18,223	0/1	0/0	2/0
Berkeley	Oak-hickory, Virginia and pitch pine, maple-beech-birch, other hardwood types	118.0	58.4	------	out*	0/0	0/0
Boone	Oak-hickory, maple-beech-birch, other hardwood types	264.0	82.5	26,951	0/0	1/0	0/0
Braxton	Oak-hickory, maple-beech-birch, other hardwood types, softwoods	252.0	76.1	856	0/2	1/2	0/0
Brooke	Oak-hickory, other hardwood types, maple-beech-birch	26.6	39.7	4,406	0/0	1/2	0/2
Cabell	Oak-hickory, other hardwoods maple-beech-birch, Virginia pine and other softwoods[2]	131.4	73.4	------	0/0	0/0	1/0
Calhoun	" "	138.5	76.9	------	0/0	0/2	1/0

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
Clay	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and other pines	189.7	86.6	1,071	0/0	1/0	0/0
Doddridge	Oak-hickory, maple-beech-birch, other hardwood types, Virginia pine and other softwoods	150.3	73.7	------	0/0	0/0	0/0
Fayette	Oak-hickory, maple-beech-birch, other hardwood types, Virginia pine and other softwoods	335.7	79.5	22,513	0/3	6/2	12/2
Gilmer	Oak-hickory, Virginia and pitch pine	160.9	74.1	1,260	0/1	2/2	0/0
Grant	Oak-hickory, Virginia and pitch pine, other hardwood types, maple-beech-birch	236.2	77.4	3,603	1/1	0/0	11/1
Greenbrier	Oak-hickory, maple-beech-birch, other hardwoods, other softwoods, Virginia and pitch pine	500.9	76.2	9,473	2/1	1/10	20/3

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
Hampshire	Oak-hickory, Virginia and pitch pine, other hardwoods, maple-beech-birch, other softwoods	319.6	78.1	------	out*	0/0	9/0
Hancock	Oak-hickory, maple-beech-birch, other hardwood types	25.3	47.7	607	0/0	0/4	0/0
Hardy	Oak-hickory, other hardwood types, maple-beech-birch	297.7	79.6	------	out*	0/0	8/0
Harrison	" "	144.8	54.0	29,002	0/1	0/0	1/0
Jackson	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	191.2	64.6	------	0/1	0/1	0/0
Jefferson	Oak-hickory, other hardwood types, Virginia and pitch pine	36.5	27.0	------	out*	0/0	5/0
Kanawha	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine, other softwood types	458.1	78.8	30,800	0/1	2/3	8/1

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
Lewis	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine, other softwood types	167.6	66.8	12,973	0/1	1/0	1/0
Lincoln	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	246.9	88.2	------	0/0	0/3	1/0
Logan	Oak-hickory, maple-beech-birch, other hardwood tvpes, other softwood types	232.6	79.7	10,669	0/1	1/0	2/0
Marion	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	132.2	66.8	720	0/2	1/0	1/1
Marshall	" "	116.5	59.4	------	0/1	1/0	0/0
Mason	Oak-hickory, Virginia and pitch pine, maple-beech-birch, other hardwoods	163.0	59.1	340	0/3	0/0	3/1

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
McDowell	Oak-hickory, maple-beech-birch, other hardwood types, other softwood types	277.0	81.2	16,091	0/1	2/2	6/0
Mercer	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pines and other softwoods	189.2	70.9	6,341	0/3	1/9	4/0
Mineral	Oak-hickory, other hardwood types, Virginia and pitch pine, maple-beech-birch	165.9	78.6	2,009	out*	0/0	5/0
Mingo	Oak-hickory, maple-beech-birch, other hardwood types, other softwood types	222.8	82.2	9,968	0/1	1/0	2/0
Monongalia	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	149.5	63.9	5,392	0/3	1/24	2/4
Monroe	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine, other softwood types	186.0	61.4	------	1/0	1/0	7/3

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
Morgan	Oak-hickory, other hardwood types, Virginia and pitch pines	110.3	74.0	------	out*	0/0	2/0
Nicholas	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pines, other softwood types	337.3	81.3	13,410	1/2	0/5	7/1
Ohio	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	37.4	55.0	------	0/0	1/2	2/0
Pendleton	Other softwood types, oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	301.2	67.7	------	out*	0/1	17/0
Pleasants	Oak-hickory, maple-beech-birch, other hardwood types Virginia and pitch pine	68.4	82.4	------	0/0	0/0	0/1
Pocahontas	Maple-beech-birch, oak-hickory, other hardwood types, spruce-hemlock and other softwood types	503.3	83.5	1,443	4/7	4/28	17/3

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
Preston	Oak-hickory, maple-beech-birch, other hardwood types, hemlock and other softwood types	300.7	73.0	19,156	1/3	2/4	8/1
Putnam	Oak-hickory, Virginia and pitch pine, maple-beech-birch, other hardwood types	156.3	70.1	------	0/0	3/0	0/0
Raleigh	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine, other softwood types	297.4	77.6	17,947	0/2	7/0	4/1
Randolph	Oak-hickory, maple-beech-birch, other hardwood types, hemlock-spruce and other softwood types	569.1	85.8	7,736	2/1	4/14	13/0
Ritchie	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	215.4	74.5	------	0/1	2/6	0/1
Roane	" "	211.4	68.0	------	0/0	0/1	0/1

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
Summers	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine, other softwood types	159.0	69.4	71	0/2	2/0	7/0
Taylor	Oak-hickory, maple-beech-birch, other hardwood types	64.9	59.5	3,290	0/2	0/0	0/0
Tucker	Oak-hickory, maple-beech-birch, other hardwood types, hemlock-hardwoods, other softwood types	210.7	78.0	3,787	2/3	0/67	6/3
Tyler	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	119.3	72.7	------	0/0	0/0	0/0
Upshur	Oak-hickory, maple-beech-birch, other hardwood types	154.0	68.4	5,054	0/2	2/4	6/0
Wayne	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	265.1	82.3	120	0/1	0/4	4/1

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	For-estland (x-1000) Acres	Portion of County Land In Forest (%)	Land Surfaces Mined by 1970 Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)

*Outside of the Ohio River Basin

[1]Other hardwood types - any one of many SAF hardwood forest types (Table 2-) of lesser abundance than those named.

[2]Other softwood types - a Forest Survey category including softwoods (conifers) other than Virginia pine and/or pitch pine, therefore hemlock, spruce, white pine, shortleaf pine, table mountain pine, or red pine, or combinations thereof

[3]Land surfaces mined - represents the sum of acreage from Stanford Research Project (1971) estimates of lands disturbed by surface mining prior to 1970 and the acreage of active surface mines under permit as of January 1978.

TABLE 2-21 cont'd

CHARACTERISTIC FOREST COVER AND SIGNIFICANT NATURAL HISTORY SITES OF COUNTIES SUITABLE FOR POWER PLANT LOCATION OR COAL MINE OPERATION, WEST VIRGINIA

County	Original Vegetation (In descending order of importance)	Forestland (x-1000) Acres	Portion of County Land In Forest (%)	Approx. Surface Areas Mined[3] Acres	Sig. Govt. Lands Nat/ State (#)	Unique Natural Areas Geo./ Bio. (#)	Unique Species Stations Plant/ Animal (#)
Webster	Oak-hickory, maple-beech-borch, other hardwood types, hemlock-hardwood, other softwood types	316.8	89.7	2,657	1/1	2/6	5/2
Wetzel	Oak-hickory, maple-beech-birch, other hardwood types, Virginia and pitch pine	181.9	78.4	------	0/1	0/3	1/2
Wirt	Oak-hickory, Virginia and pitch pine, maple-beech-birch, other hardwood types	123.1	82.6	------	0/0	0/0	2/0
Wood	Oak-hickory, Virginia and pitch pine, maple-beech-birch, other hardwood types	154.7	65.8	------	0/0	1/1	0/0
Wyoming	Oak-hickory, maple-beech-birch, other hardwood types, other softwood types, Virginia and pitch pines	263.5	81.8	10,976	0/1	1/0	5/1

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3. AQUATIC ECOLOGY

3.1 INTRODUCTION

West Virginia is divided into six major drainage areas (Figure 3-1). These areas include the Guyandotte River Basin, the Big Sandy-Tug Fork River Basin, the Little Kanawha River Basin,the Kanawha River Basin, the Monongahela River Basin, and the Potomac River Basin. With the exception of the Potomac River, which drains the eastern portion of the state, these major rivers eventually drain into the Ohio River.

Generally, water quality in West Virginia varies with the geographic location. Acid mine drainage is prevalent throughout the state and greatly affects water quality. Where acid mine drainage is found, surface water generally contains more than 250 ppm of dissolved solids (Doll, Meyer, and Archer, 1963). High sulfate concentrations usually accompany high dissolved solids (sulfate concentrations are generally less than 100 ppm in non-acid drainage areas).

Soft water is commonly found in parts of the Potomac, Cheat, Tygart Valley, Little Kanawha, Gauley, and Elk Rivers. Hard water,i.e. water with a relatively high level of calcium, magnesium, and similar cations, is usually found in areas of high dissolved solids.

Iron concentrations vary significantly in West Virginia streams, with high concentrations occurring in coal mining areas. Many streams in these areas have a characteristic "yellow boy" color produced by oxidized iron.

Manganese concentrations exceed drinking water standards at almost every sampling station in the state. Calcium and magnesium are the principal cations in the state. Levels of sodium and potassium are generally low throughout the state.

Predominant anions in West Virginia waters are sulfate and bicarbonate. Bicarbonate concentrations vary from 0 ppm to over 200 ppm (Doll, Meyer, and Archer, 1963).

Dissolved oxygen content of most West Virginia streams is over 6.0 ppm most of the time; however, in some locations concentrations drop below 6.0 ppm.

The major sources of pollution in West Virginia are coal mining, sewage, and industry. Sewage and acid mine drainage are common throughout most of West Virginia, while the major industrial pollution occurs in the Kanawha River Basin.

Throughout the text of this chapter, water quality analyses of the various streams are compared with water quality standards set by the West Virginia Department of Natural Resources for the state's waterways. These state standards are included at the end of the chapter in Table A-2. Tables of "high quality" streams for each river basin are also included in this chapter. Such streams, designated by the West Virginia Department

of Natural Resources, are defined by that agency as those presently supporting significant or irreplaceable fish, wildlife, and recreational resources.

A compilation of references for West Virginia water resources and aquatic ecology is included at the end of the chapter in Table A-1.

3.2 GUYANDOTTE RIVER BASIN

Basin Description

The Guyandotte River Basin is located in the mountains of southwestern West Virginia. Counties that are located within the drainage basin include Raleigh, Wyoming, Mingo, Logan, Boone, Lincoln, Kanawha Putnam, and Cabell (see Fig. 3-2). The total drainage area is 1,671 square miles. Topography of the basin is generally mountainous except at the lower part of the basin, where the valley is wide. The slope in the upper basin averages 11 feet per mile, but the average drops to 1.8 feet per mile in the lower basin (WV Department of Natural Resources, 1976).

The principal tributaries of the Guyandotte River are the Mud River, with a drainage area of 360 square miles, the Clear Fork, with a drainage area of 129 square miles, and Island Creek, with a drainage area of 103 square miles.

The major water quality problem in the Guyandotte River Basin is the acid mine drainage caused by coal mining, the major industry in the upper half of the basin. A total of 288 miles of streams are considered to be continuously polluted, including the entire 164 mile length of the Guyandotte main stem and 124 tributary miles (Appalachian Regional Commission, 1969). Secondary water quality problems are caused by the lack of sufficient waste treatment facilities in the drainage basin. Table 3-1 shows tributaries, pollutants, and the length of tributaries that are polluted.

Hydrology

The Guyandotte River is a natural flow river having no flood control or low-flow augmentation reservoirs. Table 3-2 presents mean, maximum, and minimum discharges for the water year October 1975 to September 1976 for six locations in the Guyandotte River Basin.

The Guyandotte River at Baileysville has a drainage area of 308 square miles and an average discharge (8 years) of 441 cfs. Briar Creek at Hancock has a drainage area of 7.2 square miles and an average discharge (7 years) of 10.7 cfs. Clear Fork at Clear Fork has a drainage area of 123 square miles. The Guyandotte River at Logan has a drainage area of 836 square miles and an average discharge (14 years) of 1,155 cfs. The Guyandotte River at Branchland has a drainage area of 1,226 square miles and an average discharge (49 years) of 1,613 cfs.

Water Quality

Although much of the basin is polluted with acid mine drainage, the water is normally of good quality. Tables 3-3, 3-4, 3-5, and 3-6 present monthly specific conductivity, pH, temperature, and dissolved

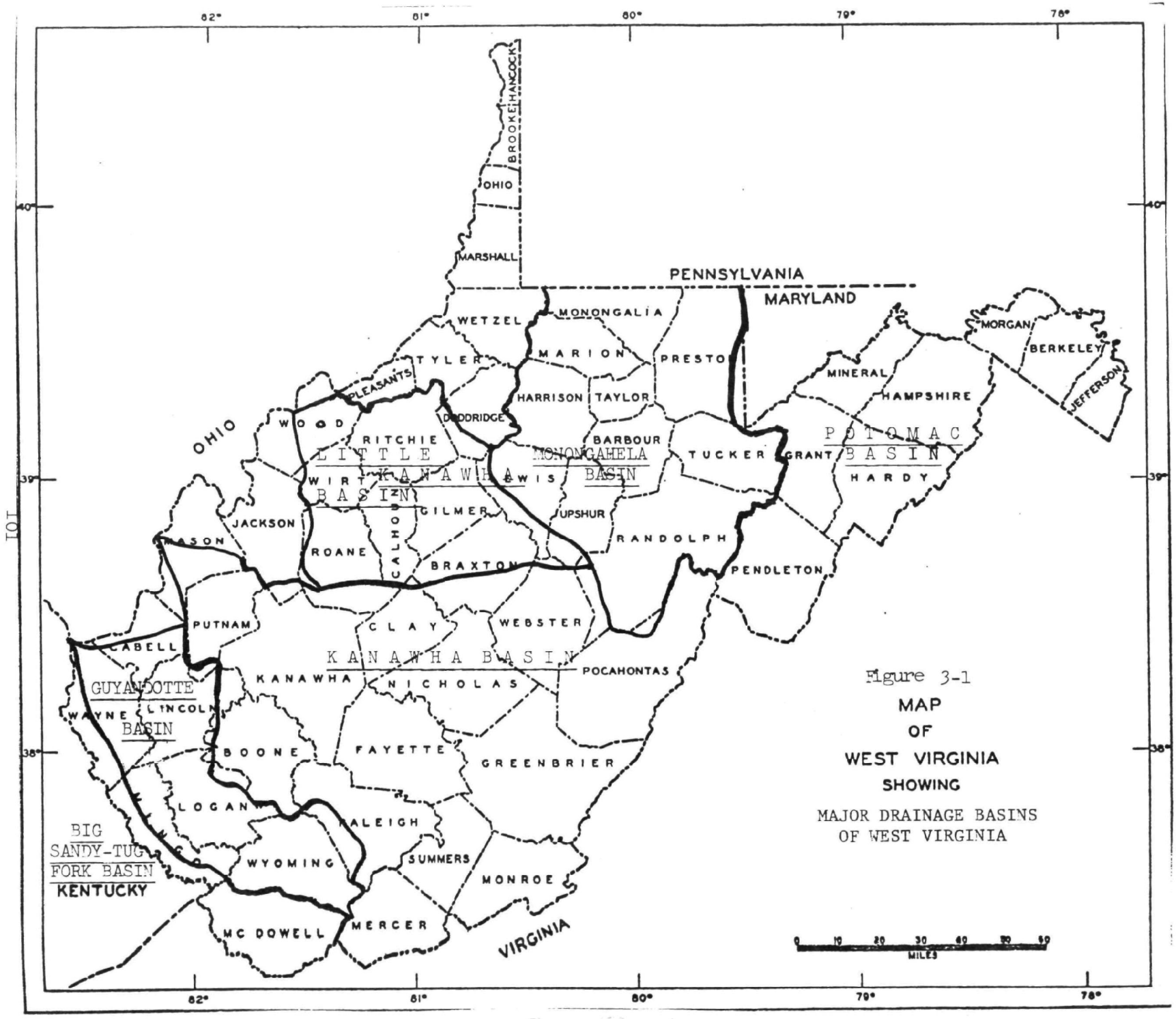


Figure 3-1

MAP
OF
WEST VIRGINIA
SHOWING

MAJOR DRAINAGE BASINS
OF WEST VIRGINIA

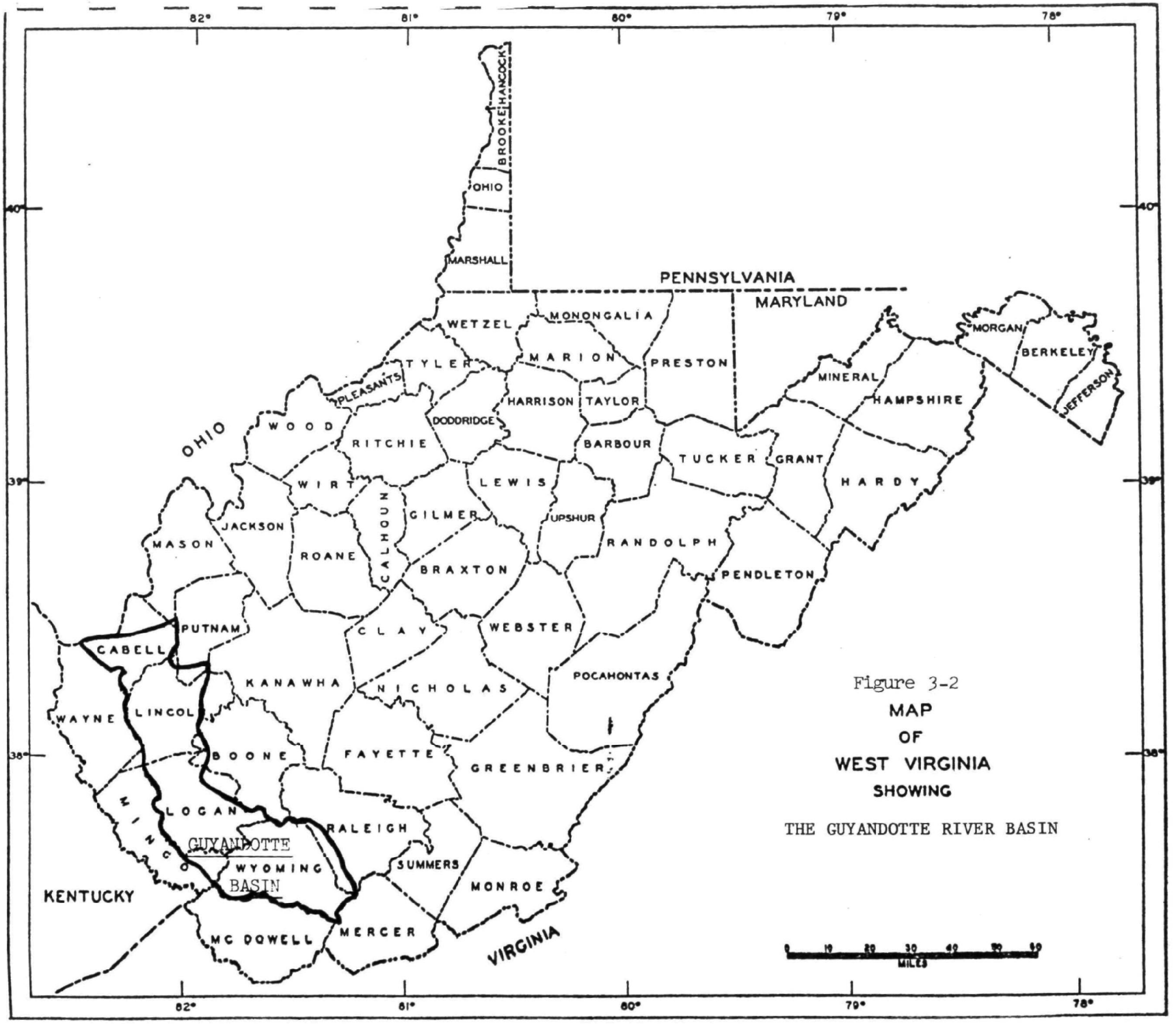


Figure 3-2

MAP

OF

WEST VIRGINIA

SHOWING

THE GUYANDOTTE RIVER BASIN

TABLE 3-1

WATER QUALITY LIMITING STREAMS AND THEIR POLLUTANTS
FOR THE GUYANDOTTE RIVER BASIN
(Dept. of Natural Resources, 1976)

Pollutant	Description	Length (River Miles)
O, MD	Guyandotte Mainstream	155.0
O	Guyandotte Mainstream MP155 to 168	13.0
MD	Mud River MP 0 to 45	0 - 45.0
O, MD	Island Creek	18.5
O	Dingess Creek	7.5
O	Rum Creek	6.9
O, MD	Huff Creek	19.6
O, MD	Clear Fork	28.2
O, MD	Laurel Fork	22.6
O, MD	Toney Fork	5.7
MD	Indian Creek	5.6
O, MD	Barkers Creek	12.0
O, MD	Slab Fork	14.6
MD	Winding Gulf Creek	9.5
O, MD	Stonecoal Creek	9.1
MD	Cub Creek	9.2
MD	Pinnacle Creek	15.2
MD	Cabin Creek	6.7
MD	Tommy Creek	6.1

O = Organic Pollution

MD = Mine Drainage

TABLE 3-2

WATER DISCHARGE RECORDS FOR GUYANDOTTE RIVER BASIN 1975-76
(USGS, 1977)

Location	(cfs) Discharge	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Year
Guyandotte River (Baileysville)	Mean	106	203	163	691	827	502	314	198	175	100	71	92	287
	Max.	222	1070	428	3960	2830	1050	940	642	404	177	191	428	3960
	Min.	80	82	90	180	428	258	140	109	96	59	41	39	39
Briar Creek	Mean	1.4	6.1	3.7	15.5	16.7	10.0	5.1	1.4	0.6	0.5	0.3	0.6	5.2
	Max.	4.7	62.0	29.0	91.0	80.0	34.0	15.0	3.1	1.2	2.8	0.9	3.8	91
	Min.	0.7	1.0	1.0	4.5	6.9	3.8	1.4	0.7	0.4	0.2	0.1	0.1	0.1
Clear Fork	Mean	48	144	101	349	350	191	88	39	29	23	18	26	117
	Max.	218	1050	305	1810	1550	508	260	96	104	87	54	154	1810
	Min.	18	27	39	90	134	75	33	23	14	11	9	9	9
Guyandotte River (Logan)	Mean	322	832	664	2093	2218	1425	777	389	319	197	165	212	801
	Max.	1380	5410	1720	7430	7790	3220	2270	974	639	378	346	1180	7790
	Min.	148	189	271	734	1160	634	325	253	176	118	100	101	100
Guyandotte River (Branchland)	Mean	525	1171	1252	3228	3176	2321	1280	508	390	239	273	288	1221
	Max.	2820	6060	3400	7250	7650	6490	4030	1090	648	450	762	2020	7650
	Min.	199	300	510	1200	1810	949	438	350	214	147	112	117	112
Mud River	Mean	143	230	426	763	451	507	192	119	33	20	40	22	246
	Max.	1680	2510	1920	3260	1950	4660	1360	924	101	146	278	146	4660
	Min.	21	41	100	180	173	87	40	35	8	3	7	5	3

TABLE 3-3

WATER QUALITY FOR GUYANDOTTE RIVER AT BAILEYSVILLE, WV., 1975-76
(USGS, 1977)

Date	Discharge (cfs)	Specific Conductivity (micromhos)	pH (units)	Temperature (°C)	Dissolved Oxygen (mg/l)
Aug. 12, 1975	88	560	8.2	23.0	7.2
Sept. 17	65	470	8.0	18.0	9.7
Sept. 30	84	450	7.5	20.5	7.5
Oct. 22	121	605	7.7	13.0	---
Nov. 25	110	360	8.4	6.0	11.2
Dec. 09	117	700	7.8	7.0	---
Feb. 12, 1976	400	305	8.5	5.0	11.4
Feb. 26	613	200	8.0	12.5	---
Mar. 25	545	249	---	---	---
Apr. 08	367	530	8.4	14.0	---
Apr. 28	125	480	8.0	14.5	9.4
May 19	670	---	---	14.0	---
May 25	163	380	7.6	16.0	8.2
Jun 24	142	460	8.4	22.0	7.8
Jun 30	119	490	7.7	23.0	7.2
Jul. 29	59	605	8.4	24.0	7.2
Aug. 11	64	615	8.6	23.0	9.5
Aug. 25	39	725	8.2	23.5	7.2
Sept. 22	54	490	7.6	15.0	8.2
Oct. 18	157	440	7.9	12.0	8.2
Mean	205	480	8.1	16.1	8.0
Max.	670	725	8.5	24.0	11.4
Min.	39	200	7.5	5.0	7.2

TABLE 3-4

WATER QUALITY FOR GUYANDOTTE RIVER AT LOGAN, WV., 1975-76
(USGS, 1977)

Date	Discharge (cfs)	Specific Conductivity (micromhos)	pH (units)	Temperature (°C)	Dissolved Oxygen (mg/l)
Aug. 13, 1975	214	500	7.2	25.5	8.0
Sept. 30	240	450	8.1	21.0	8.9
Oct. 23	326	600	7.6	14.0	---
Oct. 30	240	520	8.5	14.0	11.6
Nov. 25	444	380	8.1	9.0	10.8
Dec. 04	277	700	7.2	5.0	---
Jan. 08, 1976	1390	340	7.9	2.0	---
Feb. 11	1230	225	7.8	8.0	10.6
Mar. 16	1020	470	7.2	9.0	---
Mar. 26	1600	260	---	12.5	8.8
Apr. 13	575	500	8.2	13.5	---
Apr. 28	370	510	8.3	14.0	10.2
May 12	262	540	7.8	18.0	9.6
May 24	395	350	8.1	22.0	13.8
Jun. 15	650	---	---	24.5	---
Jun. 23	699	480	8.2	20.5	9.2
Jul. 08	392	460	7.6	23.0	7.6
Jul. 28	132	725	8.1	23.5	7.2
Aug. 17	194	600	7.8	24.0	---
Aug. 26	100	760	8.3	26.0	8.1
Sept. 14	124	690	8.1	20.5	---
Sept. 23	120	570	7.7	15.0	8.4
Oct. 19	365	440	7.8	10.0	9.2
Nov. 17	350	385	8.0	4.5	12.4
Mean	488	672	7.9	15.8	9.7
Max.	1600	760	8.5	26.0	13.8
Min.	100	225	7.2	2.0	7.2

TABLE 3-5

WATER QUALITY FOR GUYANDOTTE RIVER AT BRANCHLAND, WV, 1975-76
(USGS, 1977)

Date	Discharge (cfs)	Specific Conductivity (micromhos)	pH (units)	Temperature (°C)	Dissolved Oxygen (mg/l)
Aug. 11, 1975	458	410	7.7	24.0	7.2
Sept. 18	235	540	7.9	20.5	8.1
Sept. 24	2160	261	---	---	---
Sept. 30	345	500	8.0	17.0	9.0
Oct. 10	254	630	7.2	17.5	---
Oct. 28	330	490	8.1	16.0	9.0
Nov. 19	1350	380	7.5	8.0	---
Nov. 28	482	420	8.1	7.5	9.8
Dec. 17	3410	240	7.6	6.0	---
Feb, 04, 1976	2090	200	7.2	3.0	---
Feb. 10	2340	220	8.1	3.0	9.8
Mar. 10	1900	500	---	10.0	---
Mar. 24	3930	200	8.4	13.0	8.3
Apr. 21	585	560	7.2	22.0	---
Apr. 29	315	540	7.2	14.0	9.6
May 26	---	350	7.1	20.0	6.3
Jun·01	369	---	---	22.0	---
Jun. 22	340	460	8.2	21.0	9.2
Jul. 27	105	800	7.6	23.5	8.0
Aug. 24	88	740	8.3	24.0	8.6
Sept. 21	145	670	7.7	19.5	8.5
Oct. 20	392	465	7.8	11.0	9.2
Nov. 18	370	480	8.0	5.0	11.2
Mean	1000	457	7.7	14.9	8.8
Max.	3930	800	8.4	24.0	11.2
Min.	88	200	7.1	3.0	6.3

TABLE 3-6

WATER QUALITY FOR THE MUD RIVER AT MILTON, WV, 1975-76
(USGS, 1977)

Date	Discharge (cfs)	Specific Conductivity (micromhos)	pH (units)	Temperature (^{0}C)	Dissolved Oxygen (mg/l)
Oct. 08, 1975	20	165	7.5	14.0	8.4
Oct. 28	75	124	8.3	13.5	9.1
Nov. 13	2760	122	7.0	12.0	8.9
Nov. 17	226	170	7.4	7.0	---
Nov. 24	74	160	8.4	7.0	8.8
Dec. 17	938	80	6.6	7.0	9.5
Dec. 22	157	160	7.6	1.0	---
Jan. 23, 1976	174	160	7.4	2.0	---
Jan. 30	512	140	---	3.0	---
Feb. 10	282	100	8.3	3.5	10.8
Feb. 19	912	150	7.2	12.0	10.4
Mar. 10	671	180	7.2	7.0	---
Mar. 23	993	120	7.6	10.0	10.1
Apr. 21	59	140	7.3	22.0	---
Apr. 28	49	190	---	12.0	10.2
May 25	68	90	7.2	17.5	8.3
Jun. 04	94	150	6.1	20.0	8.2
Jun. 21	25	180	8.2	21.5	8.8
Jul. 27	4.3	155	6.2	24.0	7.3
Aug. 18	3.4	110	7.4	20.0	---
Aug. 23	14	123	7.2	23.0	8.2
Sept. 20	12	125	7.4	20.0	7.5
Mean	369	141	7.4	12.7	9.0
Max.	2760	190	8.4	24.0	10.8
Min.	3.4	80	6.1	1.0	7.5

oxygen values for four Guyandotte River Basin monitoring stations. None of the values listed for these chemical parameters violate state standards. Hydrogen ion (pH) and dissolved oxygen values are generally good.

Table 3-7 presents a water quality analyses for the Guyandotte River at Branchland. The substance levels are compared for the years 1971 and 1976. Only iron and manganese exceed permissible state levels set for water supplies.

A list of present water quality monitoring stations and their storet numbers is given in Table 3-8.

Aquatic Ecology

Most data for this river basin is not in presentable form. A list of phytoplankton and benthic algae genera is presented in Table 3-9. A total of 50 plankton and genera were found. Chrysophyta contained 19 genera, Cyanophyta 4 genera, Euglenaphyta 5 genera, Chlorophyta 21 genera, and Pyrrehophyta one genera. Chlorophyta contained the most genera. However Chrysophyta, which contained the diatoms, dominated all sampling periods. A list of fish species found in the Guyandotte River Basin is found in Table 3-10. Five endangered or rare fish are found in the Guyandotte Basin (Table 3-11).

High Quality Streams

A list of the nine high quality streams found in the Guyandotte Basin is presented in Table 3-12.

3.3 BIG SANDY-TUG FORK RIVER BASIN

Basin Description

The Big Sandy-Tug Fork Basin lies in the southwestern portion of West Virginia, encompassing also parts of Virginia and Kentucky. Portions of Wayne, Mingo, and McDowell counties are located in the drainage basin (see Fig. 3-3). The Big Sandy-Tug Fork drainage area is 4,280 square miles, of which 1,010 square miles are located in these three West Virginia counites.

The Big Sandy is formed by the confluence of the Levisa Fork and the Tug Fork Rivers at Louisa, Kentucky. The total length of the Tug Fork is 155 miles, while the length of the Levisa Fork, which drains Virginia, is 160 miles. The Big Sandy main stem is 27 miles long. The Tug Fork drains approximately 1,555 square miles, including 937 square miles located in three West Virginia counties.

The principal tributaries and their respective drainage areas are Pigeon Creek, draining 142 square miles, Elkhorn Creek, draining 71 square miles, Clear Fork, draining 25 square miles, and Levisa Fork, draining 2,325 square miles (1,471 square miles in Kentucky and 854 square miles in Virginia).

TABLE 3-7

WATER QUALITY ANALYSES FOR THE GUYANDOTTE RIVER AT BRANCHLAND, WV
(Department of Natural Resources)
(1977)

ANALYSIS (mg/l)	AVERAGE		MAXIMUM		MINIMUM	
	1971	1976	1971	1976	1971	1976
Iron	1.19	1.03	2.60	2.42	.26	.51
Aluminum	----	.54	----	1.7	----	.16
Arsenic	<.01	<.004	<.01	.014	<.01	<.002
Cadmium	<.002	<.009	<.004	.036	<.004	.001
Lead	----	<.06	----	.19	----	<.02
Manganese	.22	.14	.89	.28	.04	.07
Mercury	<.0003	.0003	.0007	.001	<.0002	<.0001
Selenium	----	<.002	----	.004	----	<.001
Silver	<.003	<.004	<.004	.008	<.002	<.002
Zinc	----	.030	----	.092	----	.010
Potassium	2.51	4.45	3.70	8.00	1.40	2.40
Sodium	26	39	46	60	10	13
Fluorides	.08	.11	.10	.19	.07	.05
Phenols	.003	<.002	.007	.005	.001	<.001
Sulfates	111	117	166	223	79	47
Fecal Coliform	943	570	3,200	2,800	100	100

TABLE 3-8

WATER QUALITY MONITORING STATIONS OF THE GUYANDOTTE RIVER BASIN

(Department of Natural Resources 1977)

STORET NO.	STATE NO.	LOCATION
550639	OG-1	Guyandotte River at Fifth Street Bridge.
550473	OG-34	Guyandotte River at Branchland.
550397	OG-65	Guyandotte River at Logan, W. Va. Route 119-A Bridge.
550672	OG-143	Guyandotte River at RR Bridge in Wyoming.
550676	OG-173	Guyandotte River at State Route 16 in Blackeagle.
550641	OGM-0	Mud River at Sec. 26 Bridge, Barboursville.
550657	OG-65-0	Island Creek at State Route 10 in Logan.
550662	OG-68-0	Dingers Run in Stollings.
550663	OG-70-0	Rum Creek at State Route 10.
550665	OG-76-0	Huff Creek at State Route 80.
550495	OG-124-0	Pinnacle Creek, near Pineville.
550674	OG-131-0	Barkers Creek at Tralee.
550675	OG-134-0	Slab Fork at State Route 16 in Mullens.
550668	OGC-0	Clear Fork in Simon.

TABLE 3-9

PHYTOPLANKTON GENERA OF THE GUYANDOTTE RIVER BASIN
(Corp. of Engineers 1976)

Chrysophyta
- Cyclotella
- Melosira
- Achnanthes
- Diatoma
- Synedra
- Gomphonema
- Navicula
- Pinnularia
- Nitzschia
- Surirella
- Rhorcosphenia
- Cocconeis
- Cymbella
- Nedium
- Eunotia
- Gyrosigma
- Meridon
- Stauroneis
- Amphora

Cyanophyta
- Anacystis
- Oscillatoria
- Lyngbrya
- Agmenellum

Euglenophyta
- Trachelomonas
- Cryptomonas
- Euglena
- Lepocinclis
- Phacus

Chlorophyta
- Ankistrodesmus
- Dictyosphaerium
- Cosmarium
- Scenedesmus
- Gonum
- Mongeotia
- Chlamydomonas
- Staurastrum
- Kirchneriella
- Micractinium
- Oocytis
- Tetraedron
- Treubaria
- Actinastrum
- Selanastrum
- Pteromonas
- Crucigenia
- Coelastrum
- Chlorella
- Tetrastrum
- Golenkimia

Pyrrhophyta
- Glenodinium

TABLE 3-10

FISH SPECIES LOCATED IN THE OHIO RIVER DRAINAGE AREA OF WEST VIRGINIA-INCLUDING THE GUYANDOTTE RIVER BASIN (CORP. OF ENGINEERS 1976)

Petromyzontidae
- Lampetra aepyptera - Least brook lamprey
- Lampetra lamottei - American brook lamprey
- Ichthyomyzon unicuspis - Silver lamprey
- Ichthyomyzon bdellium - Ohio lamprey
- Ichthyomyzon greeleyi - Allegheny brook lamprey

Polyodontidae
- Polyodon spathula - Paddlefish

Acipenseridae
- Acipenser fulvencens - Lake sturgeon
- Scaphirhynchus platorynchus - Shovelnose sturgeon

Lepisosteidae
- Lepisosteus osseus - Longnose gar

Amiidae
- Amia calva - Bowfin

Hiodontidae
- Hiodon alosoides - Goldeye
- Hiodon tergisus - Mooneye

Clupeidae
- Alosa chrysochloris - Skipjack herring
- Alsoa pseudoharengus - Alewife
- Dorosoma petenense - Threadfin shad
- Dorosoma cepedianum - Gizzard shad

Salmonidae
- Salmo gairdneri - Rainbow trout
- Salmo trutta - Brown trout
- Salvelinus fontinalis - Brook trout

Esocidae
- Esox masquinongy - Muskellunge
- Esox niger - Chain pickerel
- Esox americanus vermiculatus - Grass pickerel
- Esox lucius - Northern pike
- Esox americanus americanus - Redfin pickerel

Anguillidae
- Anguilla rostrata - American eel

Sciaenidae
- Aplodinotus grunniens - Freshwater drum

TABLE 3-10 CONTINUED

Catostomidae
- Cycleptus elongatus - Blue sucker
- Ictiobus cyprinellus - Bigmouth buffalo
- Ictiobus bubalus - Smallmouth buffalo
- Ictiobus niger - Black buffalo
- Carpiodes carpio - River carpsucker
- Carpiodes cyprinus - Quillback
- Carpiodes velifer - Highfin carpsucker
- Catostomus catostomus - Longnose sucker
- Catostomus commersoni - White sucker
- Hypentelium nigricans - Northern hog sucker
- Minytrema melanops - Spotted sucker
- Moxostoma anisurum - Silver redhorse
- Moxostoma macrolepidotum - Shorthead redhorse
- Moxostoma carinatum - River redhorse
- Moxostoma duquesnei - Black redhorse
- Moxostoma erythrurum - Golden redhorse

Atherinidae
- Labidesthes sicculus - Brook silverside

Cyprinodontidae
- Fundulus diaphanus - Banded killifish

Percopsidae
- Percopsis omiscomaycus - Trout-perch

Cyprinidae
- Campostoma anomalum - Stoneroller
- Carassius auratus - Goldfish
- Chrosomus erythrogaster - Southern redbelly dace
- Clinostomus elongatus - Redside dace
- Clinostomus funduloides - Rosyside dace
- Cyprinus carpio - Carp
- Ericymba buccata - Silverjaw minnow
- Hybopsis aestivalis - Speckled chub
- Hybopsis amblops - Bigeye chub
- Hybopsis dissimilis - Streamline chub
- Hybopsis storeriana - Silver chub
- Nocomis micropogon - River chub
- Notemigonus crysoleucas - Golden shiner
- Notropis ardens - Rosefin shiner
- Notropis ariommus - Popeye shiner
- Notropis atherionoides - Emerald shiner
- Notropis blennius - River shiner
- Notropis buchanani - Ghost shiner
- Notropis cornutus - Common shiner
- Notropis hudsonius - Spottail shiner
- Notropis photogenis - Silver shiner
- Notropis rubellus - Rosyface shiner
- Notropis spilopterus - Spotfin shiner
- Notropis stramineus - Sand shiner
- Notropis umbratilis - Redfin shiner
- Notropis volucellus - Mimic shiner
- Notropis whipplei - Steelcolor shiner
- Phenacobius mirabilis - Suckermouth minnow

TABLE 3-10 CONTINUED

Cyprinidae, cont.
- Pimephales notatus - Bluntnose minnow
- Pimephales promelas - Fathead minnow
- Pimephales vigilax - Bullhead minnow
- Rhinichthys atratulus - Blacknose dace
- Rhinichthys cataractae - Longnose dace
- Semotilus atromaculatus - Creek chub
- Semotilus margarita - Pearl dace

Ictaluridae
- Ictalurus catus - White catfish
- Ictalurus furcatus - Blue catfish
- Ictalurus melas - Black bullhead
- Ictalurus natalis - Yellow bullhead
- Ictalurus nebulosus - Brown bullhead
- Ictalurus punctatus - Channel catfish
- Noturus flavus - Stonecat
- Noturus gyrinus - Tadpole madtom
- Noturus insignis - Margined madtom
- Noturus miurus - Brindled madtom
- Pylodictis olivaris - Flathead catfish

Percidae
- Ammocrypta pellucida - Eastern sand darter
- Etheostoma blennioides - Greenside darter
- Etheostoma caeruleum - Rainbow darter
- Etheostoma camurum - Bluebreast darter
- Etheostoma flabellare - Fantail darter
- Etheostoma nigrum - Johnny darter
- Etheostoma tippecanoe - Tippecanoe darter
- Etheostoma variatum - Variegate darter
- Etheostoma zonale - Banded darter
- Perca flavescens - Yellow perch
- Percina caprodes - Logperch
- Percina copelandi - Channel darter
- Percina macrocaphala - Longhead darter
- Percina maculata - Blackside darter
- Percina oxyrhyncha - Sharpnose darter
- Percina phoxocephala - Slenderhead darter
- Percina sciera - Dusky darter
- Stizostedion canadense - Sauger
- Stizostedion vitreum vitreum - Walleye

Centrarchidae
- Ambloplites rupestris - Rock bass
- Lepomis cyanellus - Green sunfish
- Lepomis gibbosus - Pumpkinseed
- Lepomis gulosus - Warmouth
- Lepomis humilis - Orangespotted sunfish
- Lepomis macrochirus - Bluegill
- Lepomis megalotis - Longear sunfish
- Lepomis microlophus - Redear sunfish

TABLE 3-10 CONTINUED

Centrarchidae
- Micropterus dolomieui - Smallmouth bass
- Micropterus punctulatus - Spotted bass
- Micropterus salmoides - Largemouth bass
- Pomoxis annularis - White crappie
- Pomoxis nigromaculatus - Black crappie

Cottidae
- Cottus bairdi - Mottled sculpin

Percichthyidae
- Morone chrysops - White bass
- Morone saxatilis - Striped bass

TABLE 3-11

RARE OR THREATENED FISH SPECIES OF THE GUYANDOTTE RIVER BASIN

(DEPT. OF NATURAL RESOURCES-HERITAGE PROGRAM 1978)

Ammocrypta pellucida (Eastern Sand Darter)
Mud River - 1 mi. above mouth, Cabell Co.
Mud River at Milton, Cabell Co.

Notropis blennuis (River Shiner)
Mud River, 1 mile above mouth, Cabell Co.
Confluence of Guyandotte & Mud Rivers, Cabell Co.
Guyandotte River at Rt. 10 bridge, Cabell Co.

Percina copelandi (Channel Darter)
Guyandotte River at Tamcliff, Mingo County
Guyandotte River at Justice, Mingo Co.
Guyandotte River at Camp Branch, Logan Co.

Percina phoxocephala (Slenderhead Darter)
Guyandotte River - 3 mi. below Baileyville, Wyoming County.

Phaxinus erythrogaster (Southern Redbelly Dace)
Mud River at Howells Mill, Cabell Co.
Trace Fork, Lincoln County

TABLE 3-12

HIGH QUALITY STREAMS OF GUYANDOTTE RIVER BASIN *
(Dept. of Natural Resources 1974)

Guyandotte River OG

Mud River OGM
Trace Fork OGM-20
Middle Fork OGM-25

Big Ugly Creek OG-38

Laurel Fork OGC-16

Buffalo Creek OG-75

Big Huff Creek OG-76

Indian Creek OG-110

Pinnacle Creek OG-124

* Accompanying symbols refer to West Virginia Dept. of Natural Resource identification designations.

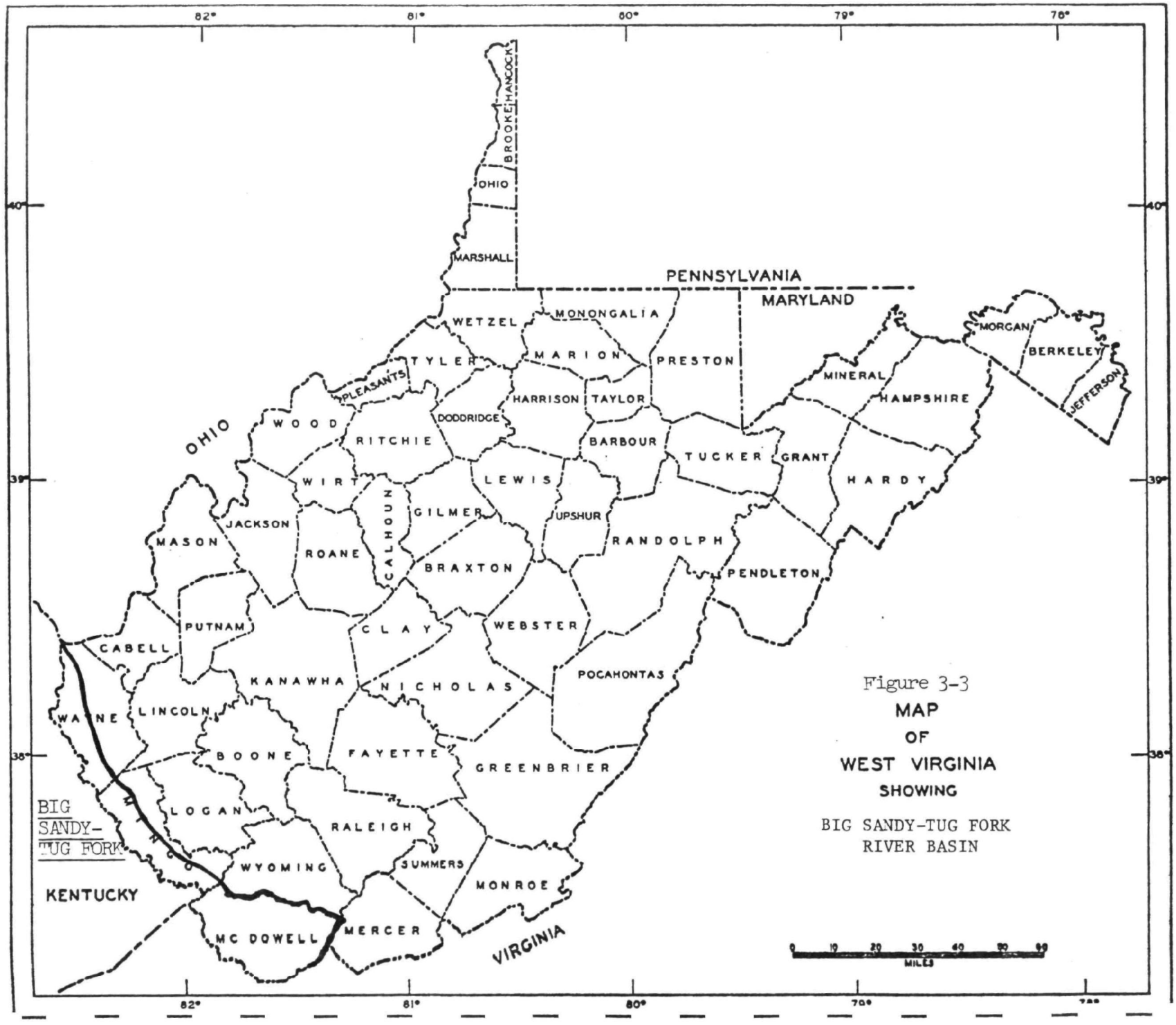


Figure 3-3
MAP
OF
WEST VIRGINIA
SHOWING
BIG SANDY-TUG FORK
RIVER BASIN

The watershed topography is generally rugged, the lower portion of the drainage area is relatively wide and gently sloped.

Major water quality problems in the basin include acid mine drainage and sewage. Acid mine drainage is especially prevalent in the tributaries which lie in McDowell and Mingo Counties. Table 3-13 shows those streams affected by acid mine drainage and organic pollution.

Hydrology

The Big Sandy River is a natural flow river having no flood control or low-flow augmentation reservoirs. Table 3-14 presents mean, maximum, and minimum discharges for the water year 1976 (October 1975 to September 1976) for five locations in the Big Sandy-Tug Fork River Basin.

At Litwar, the first of these five locations, the Tug Fork has a drainage area of 502 square miles and an average discharge (based on 46 years) of 545 cfs. At Williamson it has a drainage area of 932 square miles and and average discharge (9 years) of 1,177 cfs. The Tug Fork near Kermit has a drainage area of 1,185 square miles and an average discharge (42 years) of 1,388 cfs. The Tug Fork at Glenhayes has a drainage area of 1,500 square miles. The Big Sandy River at Louisa has a drainage area of 3,892 square miles and an average discharge (38 years) of 4,425 cfs.

Water Quality

Although five water quality stations were operated by the WV Department of Natual Resources, no data that coincided with the gaging stations was presented, and therefore other water quality data was used. No violations of state water quality standards were found for temperature. The water quality is genrally good in the basin. The pH ranged from a low of 7.2 to a high of 8.4 for 1971, and a low of 7.2 to a high of 7.8 for 1976 (Department of Natural Resources, 1977). Dissolved oxygen and conductivity values are presented in Figures 3-4 and 3-5. No violations of state standards were recorded in the 1970's. Conductivity values generally declined at downstream sampling points, probably due to increases in size and flow.

Table 3-15 shows water quality analyses for the Big Sandy-Tug Fork at Kenova, West Virginia. Iron and manganese levels exceeded state standards. Cadmium and lead also exceeded state standard levels in some cases.

Table 3-16 lists the monitoring stations and their storet numbers for the Big Sandy-Tug Fork River Basin.

Aquatic Ecology

Fish species that may be found in the Big Sandy-Tug Fork Basin are the same as found in the Guyandotte River Basin and are listed in Table 3-10. The Big Sandy-Tug Fork River Basin only has one fish species considered to be rare or threatened. This species, Phaxinus erythrogastor (Southern Redbelly Dace), is found in Lynn Creek (Wayne County) and Buffalo Creek (Wayne County).

TABLE 3-13

WATER QUALITY LIMITING STREAMS AND THEIR POLLUTANTS
OF THE BIG SANDY - TUG FORK RIVER BASIN
(Department of Natural Resources, 1976)

Pollutant	Description	Length of Segment
O, MD	Pigeon Creek	24.9
O, MD	Rock House Creek	9.9
O, MD	Mate Creek	10.6
O, MD	Dry Fork	40.4
O	Bradshaw Creek	5.2
O	Barrenshe Creek	3.9
O, MD	Jacobs Fork	12.3
O, MD	Elkhorn Creek	21.7
O, MD	North Fork of Elkhorn Creek	7.6
MD	Big Sandy-Tug Fork Mainstem	82.0
MD	Beech Creek	6.8
MD	Left Fork	4.2
MD	Panther Creek	7.9
MD	Meathouse Fork	3.8
MD	Long Branch	5.4

O = Organic Pollution; MD = Mine Drainage

TABLE 3-14

WATER DISCHARGE RECORDS FOR THE BIG SANDY-TUG FORK RIVER BASINS (USGS, 1977)

Location	(cfs) Discharge	MONTH												Year
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sep.	
Tug Fork	Mean	201	299	268	829	928	786	645	278	215	131	119	136	403
(Litwar,	Max.	650	1470	550	3640	2650	1520	2440	410	400	300	240	1000	3640
WV)	Min.	110	99	126	340	595	436	285	220	150	75	45	50	45
Tug Fork	Mean.	339	655	527	1829	1827	1565	1051	429	301	228	228	166	762
(William-	Max.	1380	3960	1160	7330	5320	3540	3680	780	568	634	634	450	7330
son, WV)	Min.	199	215	255	620	1000	669	411	315	188	109	109	67	67
Tug Fork	Mean	521	1078	923	2535	2468	1919	1316	475	337	251	217	289	1027
(Kermit,	Max.	2490	7570	2150	9640	7370	4290	4780	876	644	581	518	2800	9640
WV)	Min.	230	323	388	800	1390	858	448	351	214	135	92	95	92
Tug Fork	Mean	---	---	---	---	---	----	1586	549	434	310	355	231	578
(Glen-	Max.	---	---	---	---	---	----	4820	940	1220	609	1100	2110	4820
hayes, WV)	Min.	---	---	---	---	---	----	522	414	234	171	143	132	132
Big Sandy	Mean	1922	3869	3149	8555	7783	6845	4189	1216	1134	863	909	742	3431
(Louisa,	Max.	8000	20500	6430	24900	21500	22600	19100	2190	2860	2260	2220	2690	24900
KY)	Min.	803	1000	1360	3270	4390	3160	1130	790	482	394	396	415	394

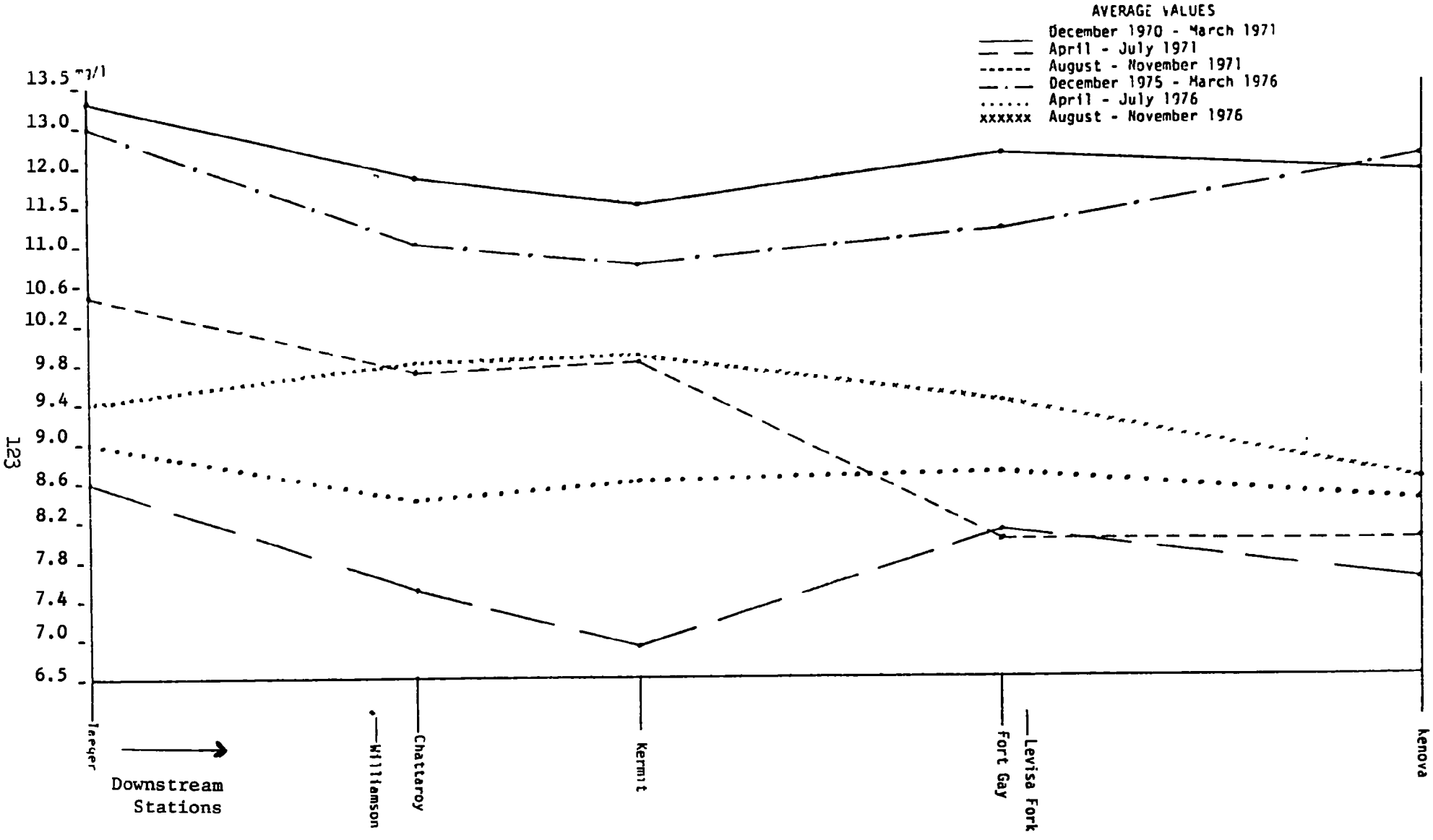


Figure 3-4
Dissolved Oxygen Values for the Big Sandy-Tug Fork River Basin (1971-76) (Department of Natural Resources 1977)

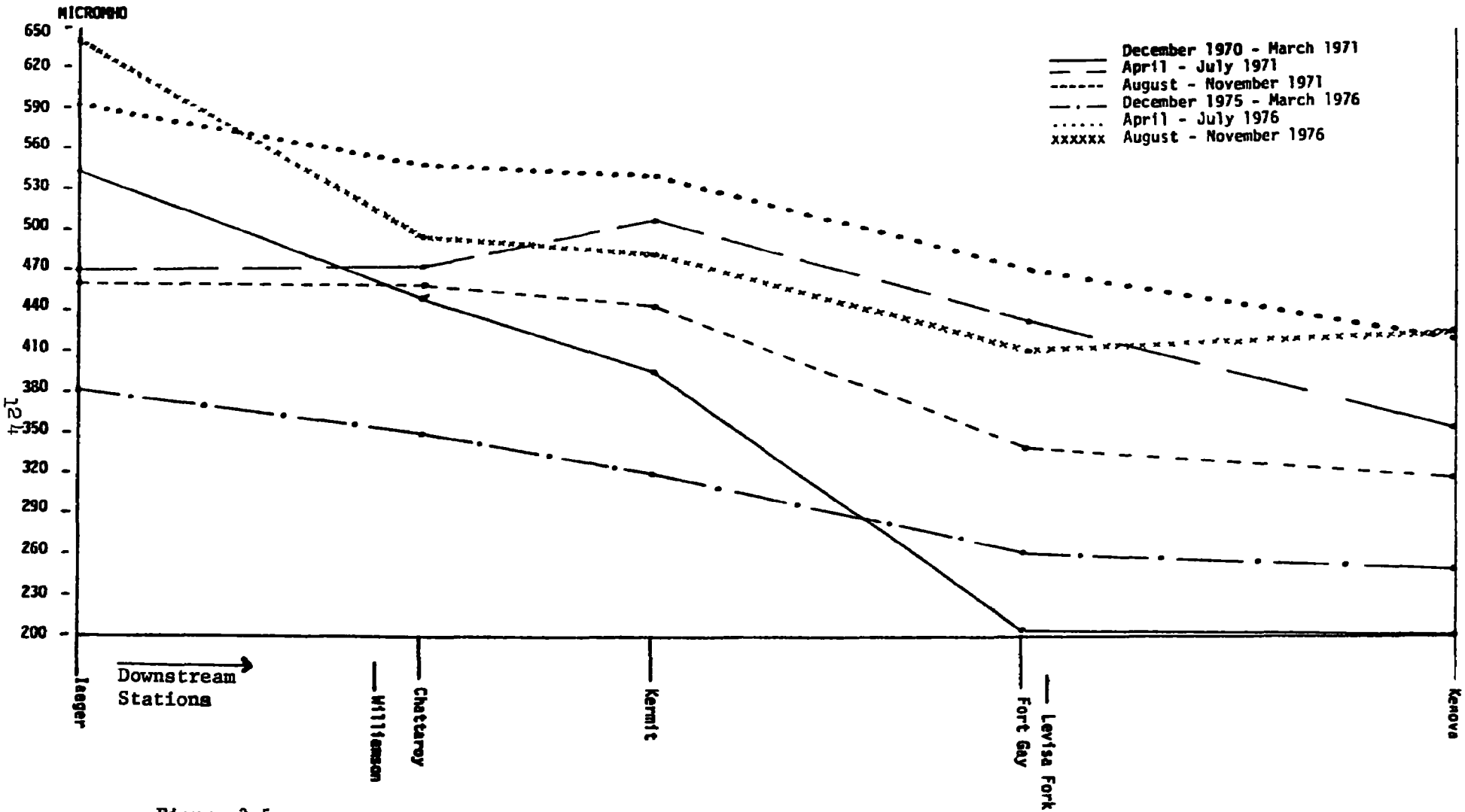


Figure 3-5
Conductivity Values for the Big Sandy-Tug Fork River Basin

(1971-76) (Dept. of Natural Resources 1977)

TABLE 3-15

WATER QUALITY ANALYSES FOR THE BIG SANDY-TUG FORK RIVER AT KENOVA, WV - 1971 & 1976 (DEPT. OF NATURAL RESOURCES 1977)

BIG SANDY-TUG FORK ANALYSES AT KENOVA

ANALYSIS (mg/l)	AVERAGE		MAXIMUM		MINIMUM	
	1971	1976	1971	1976	1971	1976
Iron	.86	6.15	2.10	19.60	.41	0.93
Aluminum	----	2.58	----	8.20	----	0.32
Arsenic	.01	<.004	.01	.007	.01	<.002
Cadmium	.002	<.007	.004	.020	.001	.001
Lead	----	<.105	----	.610	----	<.020
Manganese	.107	.155	.210	.191	.060	.116
Mercury	<.0003	<.0004	.0009	.0007	<.0002	<.0001
Selenium	----	.003	----	.005	----	.001
Silver	<.003	.003	<.004	.004	<.002	<.002
Zinc	----	.034	----	.100	----	.019
Potassium	2.3	4.1	3.5	7.5	1.4	2.8
Sodium	22.9	30.0	38.0	45.0	8.2	11.0
Fluorides	.10	.10	.10	.16	.09	.05
Phenols	<.025	<.002	.093	.004	<.001	<.001
Sulfate	86	84	115	140	51	40
Fecal Coliform (No./100 ml.)	814	<850	3,100	2,200	100	<100

TABLE 3-16

MONITORING STATIONS OF THE BIG SANDY - TUG FORK RIVER BASIN
(DEPT. OF NATURAL RESOURCES 1977)

Storet No.	State No.	Location
550393	BS-1	Big Sandy, Highway Bridge U.S. Rt. 60 near Kenova, WV
550353	BST-0	Tug Fork Tall Bridge State Rt. 37, Fort Gay, WV
550394	BST-19	Tug Fork Tall Bridge, Rt. 52/24 in Kermit, WV
550395	BST-31	Tug Fork Private Bridge off Rt. 25, Chattaroy, WV
550685	BST-24-13	Pigeon Creek above Elk Creek near Delbarton
550689	BST-40-1	Mate Creek at Sec. 9 in North Matewan
550354	BST-70-3	Dry Fork Highway Bridge Rt. 80/2, 3 mi. south of Iaeger, WV
550692	BST-70-M-1	Bradshaw Creek at Bradshaw
550697	BST-70-W-5	Jacob Fork at Sec. 55 in Cucumber
550703	BST-70-U-3	War Creek below Lake Berwind
550698	BST-99-11	Elkhorn Creek at Sec. 52/3 in Vivian

High Quality Streams

A list of high quality streams in the Big Sandy River System is presented in Table 3-17.

3.4 LITTLE KANAWHA RIVER BASIN

Basin Description

The Little Kanawha River Basin lies entirely within the Appalachian Plateau. Its headwaters are located in north cental West Virginia in Upshur County, and it forms a confluence with the Ohio River at Parkersburg. The length of the Little Kanawha River is 169 miles and its drainage area is approximately 2,312 square miles (Department of Natural Resources, 1974).

The entire area of Calhoun, Gilmer, and Ritchie counties lie within the basin, while portions of 9 additional counties form the remaining drainage area (Fig. 3-6). These counties include Wirt (99 percent), Wood (54 percent), Braxton (53 percent), Roane (50 percent), Lewis (38 percent), Doddridge (20 percent), Upshur (17 percent), Webster (3 percent), and Clay (1 percent).

The principal tributaries of the Little Kanawha and their drainage areas are the Hughes River, draining 534 square miles, Reedy Creek, draining 130 square miles, West Fork, draining 247 square miles, Leading Creek, draining 147 square miles, and Steer Creek, draining 209 square miles. (Department of Natual Resources, 1974).

The major water quality problem in the Little Kanawha River Basin is municipal waste, which contributes to an increased concentration of total and fecal coliforms. Oil and gas operations may be another potential problem with this area of the state. A list of degraded streams is presented in Table 3-18.

Hydrology

Six stream gaging stations are located on the Little Kanawha River (United States Geological Survey, 1977). A list of mean, maximum, and minimum flow data is presented in Table 3-19 for the water year 1976.

The Little Kanawha River at Wildcat has a drainage area of 112 square miles. This station is a relatively new station. The Little Kanawha River at Burnsville has a drainage area of 248 square miles. The Little Kanawha River at Glenville has a drainage area of 386 square miles and an average discharge (48 years) of 598 cfs. At Grantsville it has a drainage area of 913 square miles and an average discharge (48 years) of 1,334 cfs. The Little Kanawha River at Rocksdale has a drainage area of 205 square miles and an average discharge (41 years) of 258 cfs. At Palestine it has a drainage area of 1,515 square miles and an average discharge (37 years) of 2,093 cfs.

TABLE 3-17

HIGH QUALITY STREAMS OF THE BIG SANDY-TUG FORK RIVER BASIN*
(Dept. of Natural Resources 1974)

Tug Fork River BST

Pidgeon Creek BST-24
Trace Fork BST-24-K

Panther Creek BST-60

Dry Fork BST-70

Clear Fork BST-76

*Accompanying symbols refer to West Virginia Department of Natural Resources identification designations.

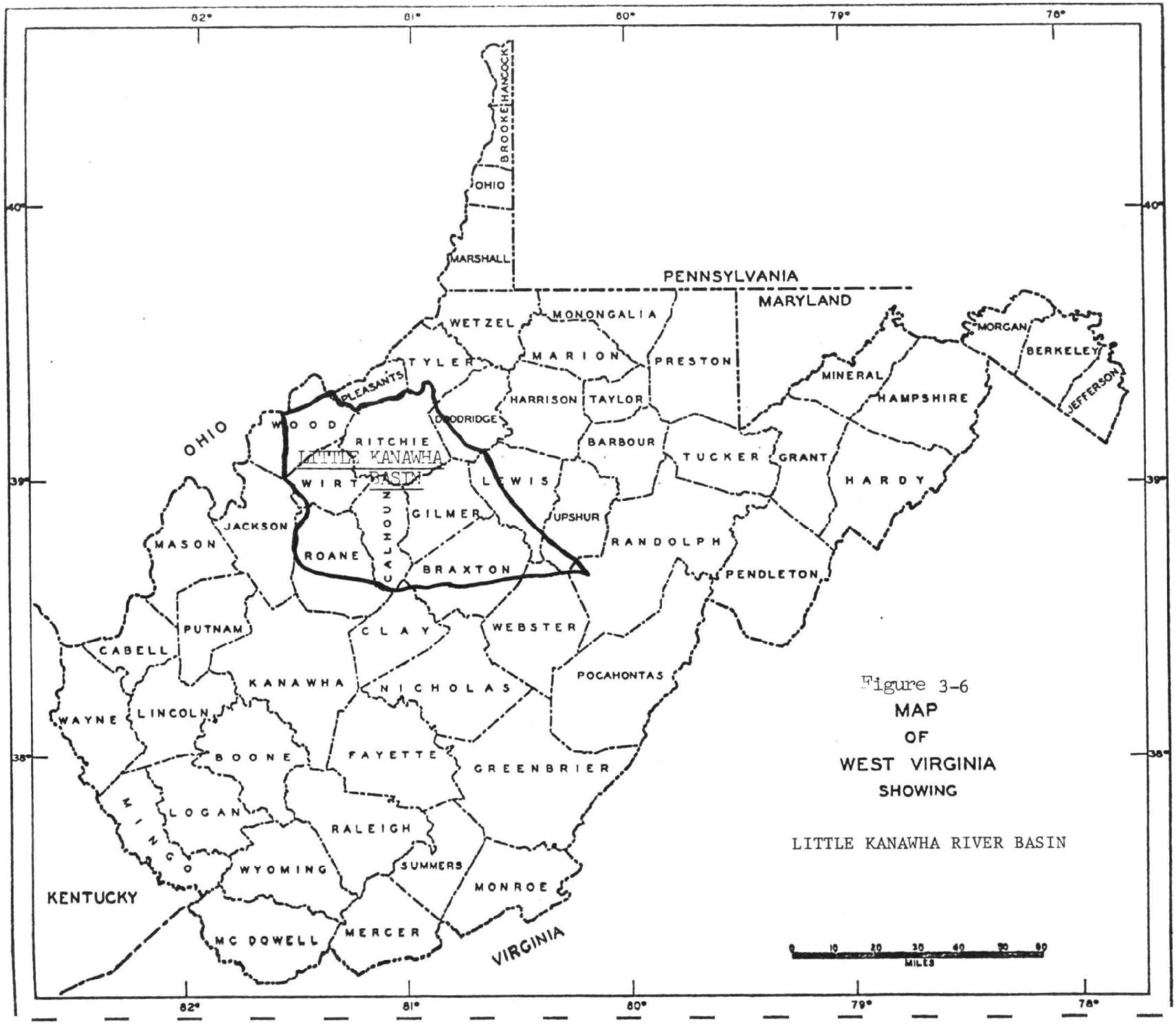


Figure 3-6
MAP
OF
WEST VIRGINIA
SHOWING

LITTLE KANAWHA RIVER BASIN

TABLE 3-18

WATER QUALITY LIMITING STREAMS AND THEIR POLLUTANTS FOR THE LITTLE KANAWHA RIVER BASIN (Dept. of Natural Resources 1976)

Pollutant	Description	Length of Segment
O	Spring Creek	27.1
MD	Sand Fork, Cove Lick, Indian Fork	107.6
MD	S. Fork Hughes River & Middle Fork	16.2
MD	Cedar Creek	35.2
MD	Copen Creek	6.3

O = Organic Pollution

MD = Mine Drainage

TABLE 3-19

DISCHARGE RECORDS OF THE LITTLE KANAWHA RIVER BASIN FOR WATER YEAR 1976 (USGS, 1977)

Location	(cfs) Discharge	MONTH												Year
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sep.	
Little Kanawha River (Wildcat, WV)	Mean	37.6	89.0	223	406	332	252	178	107	57.5	262	18.9	40.0	168
	Max.	266	545	807	2010	1090	1100	740	709	273	2190	60	307	2190
	Min.	10	19	66	113	130	61	38	28	6.3	15	3.6	4.9	3.6
Little Kanawha River (Burnsville WV)	Mean	163	172	467	859	623	535	360	237	96.9	361	40.4	46.7	330
	Max.	948	876	1990	3340	1160	1910	1510	1300	384	2200	128	423	3340
	Min.	21	26	74	74	115	87	62	51	13	27	6.2	7.3	6.2
Little Kanawha River (Glenville WV)	Mean	212	202	689	1308	842	777	521	361	103	549	54.1	62.6	474
	Max.	1550	1170	3900	6170	1940	3710	2500	2400	333	3720	145	410	6170
	Min.	29	42	117	250	281	138	108	67	18	34	15	17	15
Little Kanawha River (Grantsville,WV)	Mean	498	473	1545	2943	1743	1612	982	711	194	970	174	143	997
	Max.	3600	3600	7570	16300	3420	9470	4590	4560	568	6360	321	1120	16300
	Min.	69	92	274	600	631	308	232	132	45	76	33	32	32
West Fork Little Kanawha River (Rocksdale WV)	Mean	4.92	4.95	6.12	7.31	6.32	6.09	5.22	4.83	4.04	4.58	---	---	5.44
	Max.	10.31	8.95	13.73	18.37	10.00	12.10	8.17	7.09	4.58	7.30	---	---	18.37
	Min.	4.06	4.22	4.75	5.32	5.00	4.58	4.37	4.17	3.67	3.79	---	---	3.67
Little Kanawha River (Palestine WV)	Mean	1039	958	2674	5157	2790	2640	1628	1013	465	1599	423	289	1727
	Max.	6990	5890	13600	23900	6500	14300	6660	4810	1470	7170	1780	2330	23900
	Min.	170	179	660	957	1030	508	396	298	97	148	89	51	51

Water Quality

Water quality of the Little Kanawha Basin is genrally good. There were no recorded temperature violations of state standards between 1971 and 1976. The pH readings are good throughout the basin. The average pH value for 1971 was 7.0 with a mixiumum of 7.3 and a minimum of 6.6, while the average in 1976 was also 7.0 with a maximum of 8.1 and a minimum of 6.2.

The state standard for dissolved oxygen was not violated. Average values for 1971 and 1976 were 8.7 mg/l and 9.4 mg/l respectively. (Department of Natural Resources, 1977).

Conductivity levels are on the decline. The average for 1971 was 182 micromhos, whilethe average for 1976 was 176 micromhos.

An analysis of metals and other substances for the Little Kanawha River at Elizabeth, West Virginia for the years 1971 and 1976 is presented in Table 3-20. Iron, manganese, and phenol levels are above accepted state standards.

A list of water quality monitoring stations for the Little Kanawha River is presented in Table 3-21.

Aquatic Ecology

No data on phytoplankton or zooplankton is presently available. A partial list of aquatic invertebrates is presented in Table 3-22. There is no official listing of fish found in the basin; however, the species list would be similar to that found in the Kanawha River Basin (Table 3-39 supra). Also, reference can be made to the fish species list found in the Ohio River Drainage Area in West Virginia (Table 3-10 infra).

Endangered Species

A list of endangered fish species for this basin is presented in Table 3-23. A total of nine species considered threatened by the DNR Heritage Program were found.

High Quality Streams

A list of high quality streams is presented for the Little Kanawha Drainage Basin in Table 3-24.

3.5 KANAWHA RIVER BASIN

Basin Description

The Kanawha River Basin is the largest river basin in West Virginia. Its drainage area encompasses 12,300 square miles and spans the width of West Virginia and portions of Virginia and North Carolina. Portions

TABLE 3-20

WATER QUALITY ANALYSES FOR THE LITTLE KANAWHA RIVER AT ELIZABETH 1971 & 1976 (Dept. of Natural Resources 1977)

ANALYSIS (mg/l)	AVERAGE		MAXIMUM		MINIMUM	
	1971	1976	1971	1976	1971	1976
Iron	.35	.79	.80	1.34	.09	.48
Aluminum	----	.39	----	.80	----	.18
Arsenic	.01	<.003	.01	.006	.01	<.002
Cadmium	.002	<.003	.002	.004	.002	.001
Lead	<.030	<.028	.052	.050	<.020	<.020
Manganese	.072	.115	.130	.240	.030	.061
Mercury	<.0003	<.0004	<.0004	.0009	<.0001	<.0001
Selenium	----	.003	----	.004	----	.001
Silver	<.002	<.002	<.004	.002	<.002	<.002
Zinc	----	.018	----	.030	----	.010
Potassium	1.5	1.9	1.8	2.4	.8	1.4
Sodium	7.6	5.9	15.0	7.0	2.9	4.6
Fluorides	.09	.08	.13	.10	.05	.05
Phenols	<.004	.002	<.010	.003	<.001	.001
Sulfates	22	18	28	21	15	15
Fecal Coliform (No./100 ml.)	567	<100	2,000	100	100	<100

TABLE 3-21

WATER QUALITY MONITORING STATIONS AND THEIR STORET NUMBERS FOR THE LITTLE KANAWHA RIVER BASIN
(Dept. of Natural Resources 1977)

Storet #	State #	Location
550444	LK-1	Little Kanawha River at Parkersburg
550482	LK-23	Little Kanawha River at Elizabeth
550682	LK-31-21	Spring Creek below Nancy Run

TABLE 3-22

PARTIAL LIST OF AQUATIC INVERTEBRATE SPECIES OF THE LITTLE KANAWHA RIVER BASIN (CORPS OF ENGINEERS, 1976)

Perlidae

- Paragnetina media
- Phasganophoracapitata
- Perlesta placida

Isogeninae

- Diploperla duplicata
- Maltrekus hastatus
- Yugus arinus
- Y. bulbosus
- Isoperla bilineata
- I. holochlora
- I. namata
- I. orata
- I. similis
- I. transmarina

Corydalidae

- Corydalus cornutus
- Nigronia serricornis
- N. fasciatus
- Chauliodes pectinicornio

Perlidae

- Perlesta placida
- Acroneuria lycorias
- Eccoptera xanthenes

Heptageniidae

- Stenomema spp
- Stenonema tripunctatum
- Stenonema vicarium

Stream Dwelling Mussels

Unioninae
- Amblema costata

Lampsilinae
- Lampsilis siliguoidea

Anodontinae
- Anodonta grandis

TABLE 3-23

RARE OR THREATENED FISH SPECIES OF THE LITTLE KANAWHA RIVER BASIN

(Dept. of Natural Resources -Heritage Program)
(1978)

Ammocrypta pellucida (Eastern Sand Darter)
Little Kanawha River - 41 mi. above mouth, Wirt Co.
Little Kanawha River - at Calhoun - Gilmer line
Little Kanawha River - at Big Root Run - Calhoun Co.
Little Kanawha River - 44.3 miles above mouth - WIrt County
Hughes River - 8.8 mi. above mouth - Wirt Co.

Clinostomus elongatus (Redside Dace)
Little Kanawha River

Etheostoma Tippecanoe (Tippecanoe Darter)
Throughout Little Kanawha River System

Ichthyomyzon greleyi (Allegheny Brook Lamprey)
Pond Creek near mouth, Wood County

Moxostoma carinatum (River Redhorse)
Throughout Little Kanawha River system

Percina copelandi (Channel Darter)
Little Kanawha River at Sanoma Lowwater Bridge, Wirt Co.

Percina nacro cephala (Long head Darter)
Little Kanawha River at Rt. 5 bridge, Braxton Co.
Bonds Creek, 5 mi. above mouth, Ritchie County

Phaxinus erythrogaster (Southern Redbelly Dace)
Goose Creek at mouth of Short Run, Ritchie Co.

Polyodon spathula (Paddlefish)
Throughout Little Kanawha River Basin in larger pools and lagoons

TABLE 3-24

HIGH QUALITY STREAMS OF THE LITTLE KANAWHA DRAINAGE BASIN
(Dept. of Natural Resources 1974)

LITTLE KANAWHA RIVER SYSTEM

Little Kanawha River LK
- Worthington Creek LK-2
- Tygart Creek LK-6
- Stillwell Creek LK-7
- Walker Creek LK-10
- Hughes River LKH
  - Goose Creek LKH-4
  - South Fork Hughes River LKH-9
    - Indian Creek LKH-9-J
    - Leatherbark Creek LKH-9-M
    - Spruce Creek LKH-9-R
    - Slab Creek LKH-9-W
    - Bone Creek LKH-9-X
    - Middle Fork Hughes River LKH-9-AA
  - North Fork Hughes River LKH-10
    - Devilhole Creek LKH-10-G
    - Bonds Creek LKH-10-R
      - Hushers Run LKH-10-R-1
- Standingstone Creek LK-21
- Tucker Creek LK-23
- Reedy Creek LK-25
  - Right Reedy Creek LK-25-B
  - Middle Fork Reedy Creek (no code)

- West Fork Little Kanawha LKW
  - Henry Fork LKW-15
  - Beech Fork LKW-15-J

- Steer Creek LKS
  - Bear Fork LKS-8
  - Right Fork Steer Creek LKS-9
  - Left Fork LKS-14

- Spring Creek LK-31
- Straight Creek LK-39
- Leading Creek LK-40
- Tanner Creek LK-66
- Cedar Creek LK-72
- Leading Creek LK-75
  - Cove Creek LK-75-K
  - Fink Creek LK-75-N
- Sand Fork LK-86
- Oil Creek LK-94
- Saltlick Creek LK-95
- Right Fork Little Kanawha River LK-115
  - Left Fork Right Fork Little Kanawha LK-115-H

of 21 of West Virginia's 55 counties are located within the drainage area. These include Boone (86.1 square miles), Braxton (55.2), Cabell (3.5), Clay (96.9), Fayette (100), Greenbrier (100), Jackson (15.3), Kanawha (100), Lincoln (11.6), Logan (13.7) Mason (46.8), Mercer (100), Monroe (84.7), Randolph (8.7), Roane (50.3), Summers (100) and Webster (96.4) counties. (Fig. 3-7).

The Kanawha River is formed by the junction of the New River and the Gauley River in southern West Virginia. The total basin length is 190 miles. Six major sub-basins are included in the Kanawha River Basin, including the New River (6,920 square miles), the Greenbrier River (1,500 square miles), the Elk River (1,540 square miles), the Gauley River (1,440 square miles), the Coal River (861 square miles), and the Pocatalico River (238 square miles).

Pollution problems in the Kanawha River Basin are four-fold. High total and fecal coliform levels are present. Chemical industries dump organic wastes into the main stem. The third major contaminent is brine and oil from the oil and gas industry. The fourth facet includes the range of those many pollution problems resulting from coal mining activities. A list of pollutants for the major tributaries is presented in Table 3-25, and a list of polluted minor tributaries is presented in Tables 3-26 and 3-27.

Hydrology

A list of monitoring stations, drainage areas, and average discharges is presented in Table 3-28. Monthly discharges for the 16 gaging stations located throughout the drainage basin are found in Tables 3-29, 3-30 and 3-31.

The Kanawha River main stem has three lock and dam units located at London, Marmet, and Winfield. These structures provide a navigable channel to a point 91 miles above the mouth of the Kanawha.

The Kanawha River Basin also contains four major reservoirs. Of these, Bluestone Lake, Sutton Lake, and Summersville Lake are located in West Virginia. The fourth reservoir, Clayton Lake, is located in Virginia on the New River. These reservoirs are used for flood control, recreation, and low flow regulation. Pertinent data on these reservoirs is presented in Table 3-32.

Water Quality

Generally, the water quality for the main tributaries is good, especially for the New River and the Gauley River. The Kanawha River main stem is especially bad around the Charleston area.

Water temperature has not violated state standards during the 1970's even though installation of the dams has caused changes in natural temperatures (Department of Natural Resources, 1977). Water temperatures are presented in Table 3-33 for six gaging stations.

The dissolved oxygen levels for the basin were above state standards. No violations were recorded in 1971 or 1976. (Fig. 3-8). Seasonally, dissolved oxygen values are associated with stream flow and water tempera-

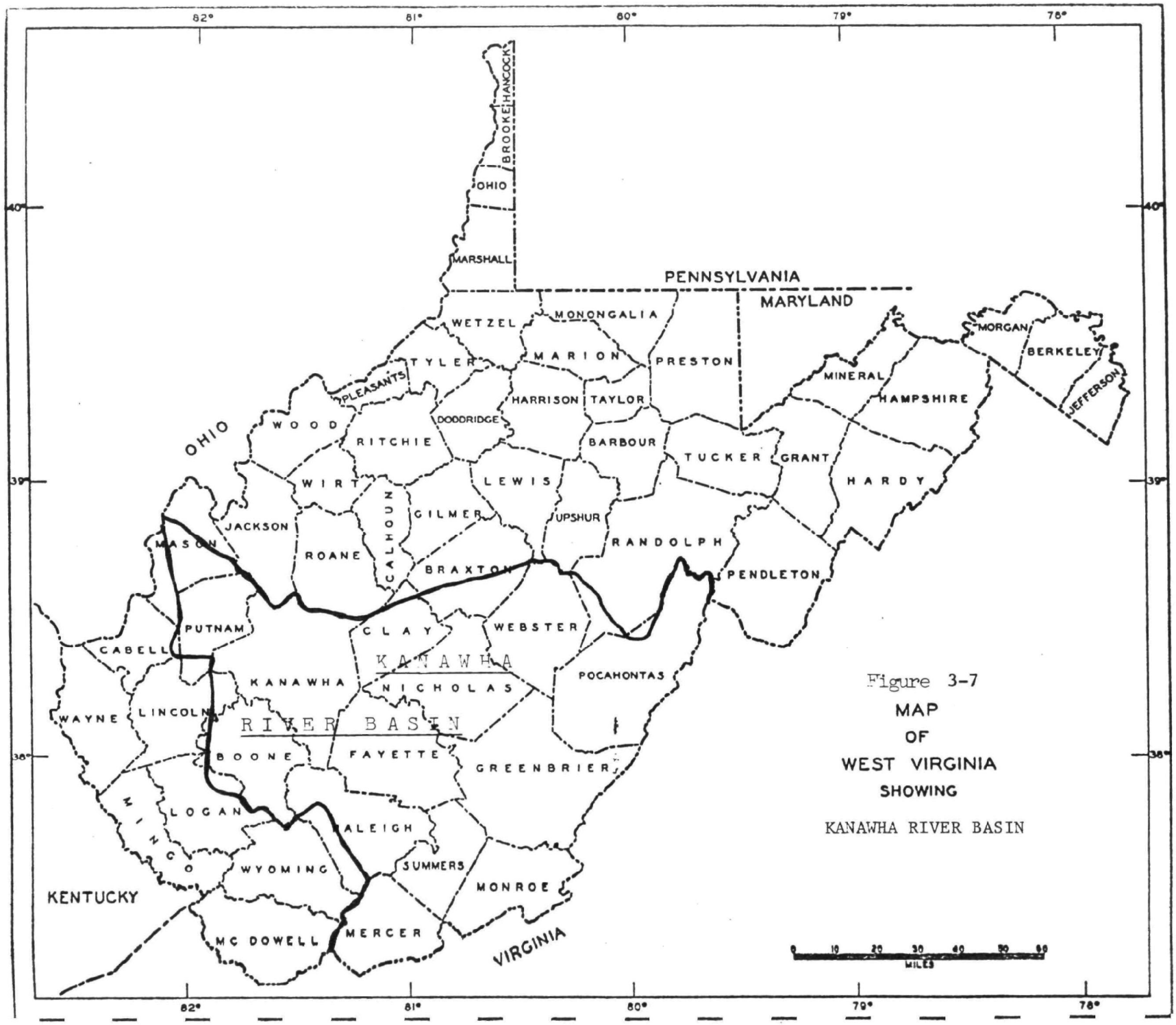


Figure 3-7
MAP
OF
WEST VIRGINIA
SHOWING
KANAWHA RIVER BASIN

TABLE 3-25

WATER QUALITY PROBLEMS OF THE MAJOR TRIBUTARIES
OF THE KANAWHA RIVER BASIN (Dept. of Natural Resources 1975)

Tributary	Problem
Pocatalico River	Sewage, chloride from oil and gas industry
Coal River	Limited acid mine drainage and sewage
Elk River	Sewage, minor oils from oil and gas industries
Gauley River	Limited acid mine drainage, black water and sewage
New River	Sewage on selected tributaries
Greenbrier River	Sewage
Bluestone River	Sewage
East River	Sewage

TABLE 3-26

KANAWHA RIVER BASIN
WATER QUALITY LIMITED SEGMENTS (ORGANICS)
PRIORITY GROUPINGS (W. Va. Dept of Natural Resources 1975)

A Segment	401	Kanawha Mainstem
B	417**	Piney Creek (Beckley Area)
	402	Hurricane Creek
C	415**	Arbuckle Creek
	422	East River (Bluefield Area)
	421	Brush Creek (Princeton Area)
	408	Cabin Creek
	407**	Campbells Creek
	409**	Kelly's Creek
D	403**	Pocatalico
	420	Laurel Creek
	412**	Meadow River
	414**	Marr Branch
	416**	Dunloup Creek
	418**	Greenbrier River
E	411**	Smithers Creek
	406**	Clear Fork
	419	Howards Creek
	405**	Spruce Fork
F	410**	Paint Creek
	413**	Cherry River
	404**	Little Coal River

* Accompanying symbols refer to West Virginia Dept. of Natural Resources identification designation.
** Also affected by potential or actual mine drainage.

TABLE 3-27

KANAWHA RIVER BASIN
MINE DRAINAGE AFFECTED SEGMENTS
PRIORITY GROUPINGS
(Department of Natual Resources 1975)

Group A:	Segment 408	Cabin Creek & Tributaries
	Segment 412	Meadow River & Little Sewell Creek
	Segment 440	Gauley Mainstem
Group B:	Segment 405*	Spruce Fork
	Segment 417*	Piney Creek
	Segment 442	Peters Creek
Group C:	Segment 404*	Little Coal River
	Segment 406*	Clear Fork & Sycamore Creek
	Segment 407*	Campbells Creek
	Segment 410*	Paint Creek
	Segment 413*	Cherry River
	Segment 415*	Arbuckle Creek
	Segment 429	Marsh Fork
Group D:	Segment 403*	Pocatalico River
	Segment 409*	Kelley Creek
	Segment 411*	Smithers Creek
	Segment 416*	Dunloup Creek
	Segment 424	Big Coal River
	Segment 426	Pond Fork
	Segment 427	West Fork
	Segment 428	Spruce Laurel Fork
	Segment 439	Loop Creek
	Segment 441	Twentymile Creek
Group E:	Segment 414*	Marr Branch
	Segment 423	Legg Fork
	Segment 430	Peachtree Creek
	Segment 431	Sandlick Creek
	Segment 434	Blue Creek
	Segment 435	Birch River MP 15-18 & Anthony Creek
	Segment 436	Elk River MP 147.6 to 149 & Bergoo & Leatherwood Creeks
	Segment 438	Hughes Creek
	Segment 444	Big & Little Clear Creeks
	Segment 446	Bluestone Mainstem
	Segment 447	Widemouth Creek
Group F:	Segment 425	Turtle Creek
	Segment 432	Twomile Creek
	Segment 433	Little Sandy & Wills Creek
	Segment 437	Witchers Creek
	Segment 443	Anglins Creek
	Segment 445	Pinch Creek
	Segment 448	Slaughter Creek

*Also Water Quality Limiting because of organics.

TABLE 3-28

MONITORING STATIONS, DRAINAGE AREAS, AND AVERAGE DISCHARGES FOR THE KANAWHA RIVER BASIN (USGS, 1977)

Location:	Drainage Area (sq. mi.)	Average Discharge (cfs)
New River (Bluestone Dam)	4,604	5,485 (47 yrs.)
Greenbrier River (Durbin, WV)	134	252 (33 yrs.)
Greenbrier River (Buckeye, WV)	540	864 (47 yrs.)
Greenbrier River (Alderson, WV)	1,357	1,986 (81 yrs.)
Greenbrier River (Hilldale, WV)	1,625	2,215 (40 yrs.)
Gauley River (Craigsville, WV)	528	1,444 (12 yrs.)
Gauley River (Summersville Dam)	804	2,184 (10 yrs.)
Gauley River (Belva, WV)	1,315	2,691 (48 yrs.)
New River (Hinton, WV)	6,257	7,797 (40 yrs.)
Kanawha River (Kanawha Falls)	8,367	12,510 (99 yrs.)
Elk River (Webster Springs, WV)	268	698 (17 yrs.)
Elk River (Sutton, WV)	543	1,127 (38 yrs.)
Elk River (Frametown, WV)	752	1,552 (18 yrs.)
Elk River (Clay, WV)	994	1,932 (18 yrs.)
Elk River (Queens Shoal, WV)	1,145	2,010 (48 yrs.)
Kanawha River (Charleston, WV)	10,419	14,700 (37 yrs.)

TABLE 3-29

WATER DISCHARGE RECORDS FOR THE NEW AND KANAWHA RIVERS. WATER YEAR 1976 (USGS, 1977)

Location	(cfs) Discharge	MONTH												Year
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sep.	
New River (Bluestone Dam, WV)	Mean	4862	4052	3418	9168	7402	5236	5549	4235	9725	4103	2413	2239	5186
	Max.	27500	9180	5960	28400	11700	10400	19200	11400	33500	7280	3540	4210	33500
	Min.	1520	2090	1740	2980	4900	1310	2580	2200	2420	1770	1490	1460	1310
New River (Hinton, WV)	Mean	5866	5095	4178	13360	10910	7384	6665	4627	10120	4100	2305	2072	6370
	Max.	40100	17400	10100	49100	20300	12200	24200	12300	34600	6990	3530	3860	49100
	Min.	1940	2370	2230	3470	6730	3310	2620	2310	2460	2690	1540	1530	1530
Kanawha River (Kanawha Falls, WV)	Mean	8934	9353	7290	22110	18430	11210	8836	6250	11650	6415	3590	3296	9750
	Max.	49600	28400	16700	81800	31400	19200	30700	14500	37800	10500	7490	6560	81800
	Min.	2700	4530	4320	6290	11600	5580	3640	2980	3260	3910	2280	2420	2280
Kanawha River (Charleston, WV)	Mean	10260	11450	10440	27970	22460	15460	10060	7194	11790	7622	3986	4033	11860
	Max.	43700	31900	20100	99200	36400	35200	34800	17500	37100	17000	8070	10100	99200
	Min.	3930	5670	5730	8280	14700	6930	4200	3380	3490	4430	2330	2680	2330

TABLE 3-30

WATER DISCHARGE RECORDS FOR THE GREENBRIER AND GAULEY RIVERS. WATER YEAR 1976 (USGS, 1977)

Location	(cfs) Discharge	MONTH												Year
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
Greenbrier River (Durbin, WV)	Mean	209	255	236	459	430	289	158	77.9	69.1	117	26.4	26.3	196
	Max.	1970	1120	1250	2310	718	658	442	170	198	450	61	125	2310
	Min.	48	68	105	140	192	101	50	43	30	35	9.0	5.0	14
Greenbrier River (Buckeye, WV)	Mean	797	793	728	1838	1343	975	554	300	333	282	74.5	78.4	674
	Max.	10600	5290	4550	13100	3040	2630	2030	810	1130	1130	236	308	13100
	Min.	114	188	277	432	657	338	140	109	101	72	27	26	26
Greenbrier River (Alderson, WV)	Mean	1504	1434	1112	4195	3016	1947	1185	697	821	481	208	135	1391
	Max.	11800	7400	4770	27500	7700	4770	4620	1970	2440	1320	810	548	27500
	Min.	296	388	476	740	1560	770	346	276	301	258	72	71	71
Greenbrier River (Hilldale, WV)	Mean	1601	1620	1253	4961	3849	2517	1599	857	992	604	255	154	1683
	Max.	14900	8700	5610	25500	8980	5260	5890	2670	2640	1600	950	524	25500
	Min.	344	452	580	820	2090	992	428	344	332	302	86	86	86
Gauley River near Craigsville, WV	Mean	710	1290	1261	2504	2440	1433	894	893	406	977	336	358	1122
	Max.	4830	5970	5240	13000	5050	3770	2810	3580	1490	3840	1830	2790	13000
	Min.	199	360	550	600	880	463	235	273	177	164	60	62	60
Gauley River below Summersville Dam, WV	Mean	2088	2460	1628	3601	3284	1408	203	554	605	1243	711	716	1538
	Max.	5570	5770	3680	12800	7460	5950	1630	2870	2960	3810	1860	1930	12800
	Min.	90	3120	680	700	1330	126	80	112	162	112	224	184	80
Gauley River above Belva, WV	Mean	2297	3109	2196	5598	4803	2303	724	830	859	1514	816	752	2144
	Max.	6800	8020	5070	21700	10300	8000	3190	3670	3250	4950	2900	2430	21700
	Min.	186	1220	944	1100	2140	1000	264	250	234	204	268	173	173

TABLE 3-31

WATER DISCHARGE RECORDS FOR THE ELK RIVER. WATER YEAR 1976 (USGS, 1977)

Location	(cfs) Discharge	MONTH												Year
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	
Elk River Below (Webster Springs WV)	Mean	282	502	600	1178	1184	746	503	366	167	516	114	109	521
	Max.	1570	2420	1480	5910	2950	2180	1870	1490	365	4790	522	564	5910
	Min.	91	132	260	300	450	240	143	143	60	83	26	29	26
Elk River (Sutton, WV)	Mean	750	1090	1040	2121	1916	1349	105	479	274	807	190	336	875
	Max.	1990	2760	2130	4260	3330	3890	540	2870	690	5850	642	1730	5850
	Min.	445	455	390	495	924	292	80	80	77	120	75	75	75
Elk River near (Frame-town, WV)	Mean	903	1341	1516	2924	2446	1900	388	656	370	1126	256	440	1188
	Max.	2270	3350	3040	7460	4340	5120	2180	3690	865	7370	753	2530	7460
	Min.	504	665	632	750	1220	414	143	133	91	174	93	96	91
Elk River (Clay, WV)	Mean	906	1466	1979	3925	2930	2395	667	789	376	1232	287	497	1454
	Max.	2400	3920	4080	14300	4850	6900	3370	4290	891	8090	835	3130	14300
	Min.	452	619	690	850	1390	470	200	170	100	157	95	95	95
Elk River (Queen Shoals WV)	Mean	991	1631	2165	4358	3313	2837	849	915	372	1290	303	520	1628
	Max.	2410	4340	4450	15500	5290	9620	3820	4740	811	7530	811	3140	15500
	Min.	521	731	910	956	1750	610	219	203	99	174	93	93	93

TABLE 3-32

PERTINENT DATA FOR MAJOR RESERVOIRS LOCATED WITHIN THE KANAWHA RIVER BASIN
(Department of Natural Resources 1975)

Reservoir Stream County, State	Year of Storage Commencement	Drainage Area Controlled (Sq. Mi.)	Purposes[a]	Storage (acre-feet)		
				Conservation	Flood Control	Total
Claytor Lake New River Pulaski, Va.	1939	2,382	P, Gen R			224,000
Bluestone Lake New River Summers, W. Va.	1949	4,565	FC, Gen R&F	293,000	338,000	631,000
Sutton Lake Elk River Braxton, W. Va.	1960	537	FC, LFR, Gen R&F	150,000	114,500	265,300
Summersville Lake Gauley River Nicholas, W. Va.	1965	803	FC, LFR, Gen R&F	242,300	171,500	413,800

[a] FC = Flood Control
Gen R&F = General Recreation & Fish & Wildlife
LFR = Low Flow Regulation
P = Power

TABLE 3-33

MONTHLY WATER TEMPERATURES FOR STATIONS IN THE KANAWHA RIVER BASIN WATER YEAR 1976. (USGS, 1977)

Month	STATIONS										
	New River (Bluestone, WV)		Gauley River (Craigsville, WV)		Gauley River (Summersville, WV)		Kanawha River (Kanawha Falls, WV)		Elk River (Webster Springs, WV)		Kanawha River (Winfield, WV)
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
Oct	20°C	16°C	---	---	19.5	16	19	15	17	9	18.5
Nov	16	8	15	4	16.5	8	15	7	15	4.5	12.5
Dec	8.5	2.5	8	1.5	8.5	3.5	8	3	7	0.5	6
Jan	5.5	1.0	---	---	5	1.5	6	1.5	6.5	0	3.5
Feb	9	2.5	---	---	6.5	2	8	2.5	10.5	1	6.5
Mar	13	8.5	13.5	2	11	5.5	13	7	12.5	2.5	11
Apr	20.5	10	22	6	15.5	5	21	10.5	20.5	5.5	16
May	20	16	20	10	11.5	7	21	16	20.5	11	20
Jun	24	18	27.5	16	11.5	8.5	23	19.5	27.5	18	24
Jul	28	22	25.5	17	15	9.5	23	19.5	25.5	19.5	25.5
Aug	26.5	24	27	17	20	15	25.5	22	24.5	19	26
Sep	25.5	20	24	11	21	18	---		22.5	18	24

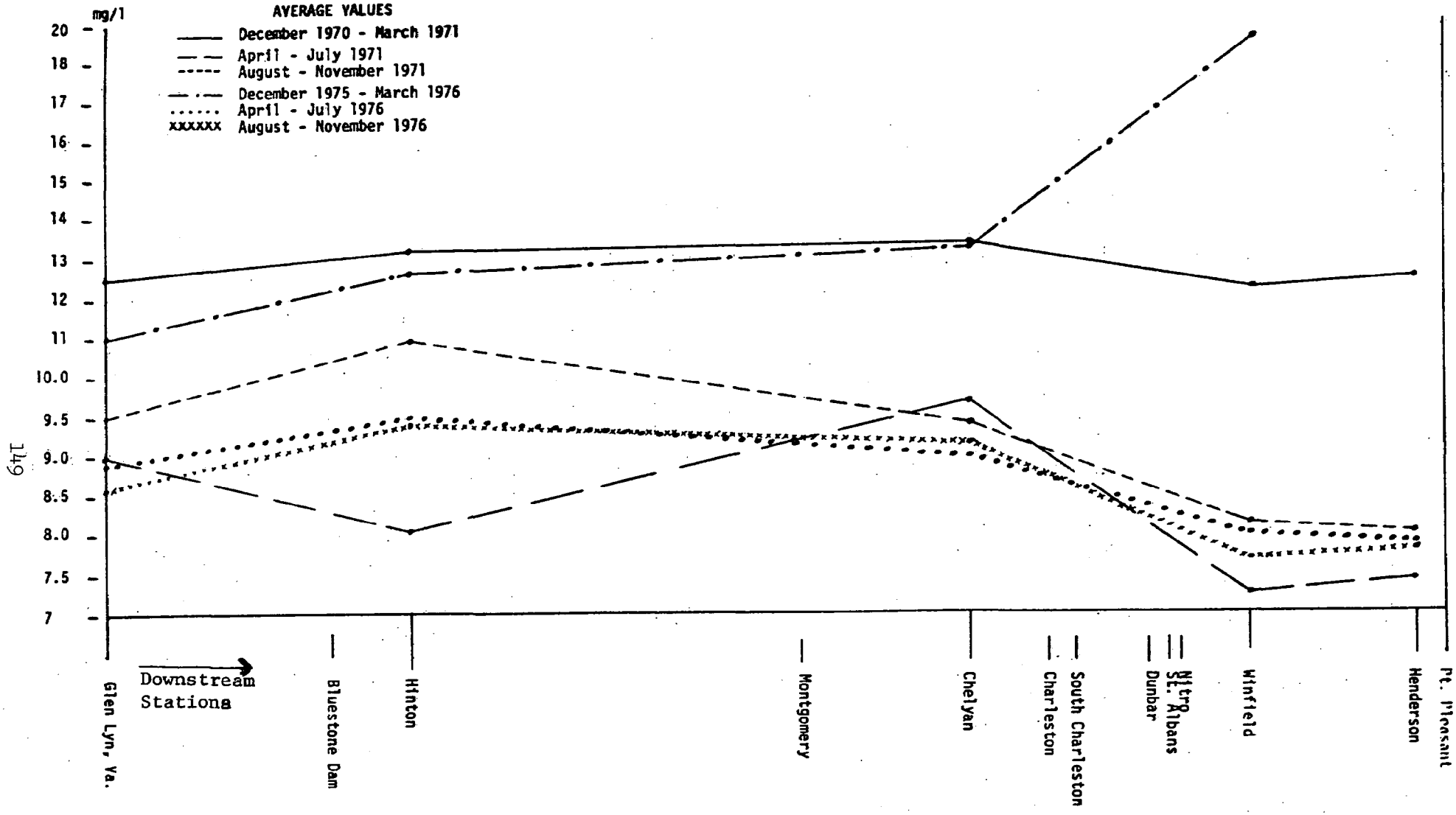


Figure 3- 8
Dissolved Oxygen Values for the Kanawha-New Rivers (1971 and 1976)
Department of Natural Resources 1977

tures, with low values occurring during warmer periods and periods of lower stream flow.

Conductivity levels were found to be high in the lower reaches of the basin due to a higher content of dissolved solids (Fig. 3-9).

Analysis of metal and other substances for the Kanawha River at Winfield are presented in Table 3-34. Iron, manganese, and lead are above accepted standards. Phenols also exceed state standards. Monthly conductivity, pH, temperature and dissolved oxygen values for the Kanawha River at Winfield are presented in Table 3-35.

A list of water quality stations and their storet numbers are given in Table 3-36.

Aquatic Ecology

Forty six genera of algae are found in the Kanawha River (Table 3-37). There are 4 genera of blue greens, 28 genera of green algae, 12 genera of diatoms, 1 genus of dinoflagellates and 1 genus of euglenoids. Green algae and diatoms are the dominant algae in the system.

A partial list of aquatic invertebrate species is presented in Table 3-38. This list includes only some of the Ephemeroptera, Plecoptera, Odonata, and Megaloptera.

Fish species for the Kanawha River (above and below the falls) and the New River are listed in Table 3-39. A total of 95 species were found below the falls, 70 species above the falls and 48 species in the New River (Dames and Moore, 1974). An additional list of fish for the Kanawha River, the Elk River and the New River is presented in Table 3-40.

Endangered Species

A list of rare or threatened fish species and their locations is given in Table 3-41. A total of 15 species were found to be rare or threatened in the Kanawha River drainage area by the DNR-Heritage Program.

High Quality Streams

High quality streams of the Kanawha River Basin are presented in Table 3-42.

3.6 MONONGAHELA RIVER BASIN

Basin Description

The Monongahela River Basin is located on the Allegheny Mountains and the Allegheny Plateau in northern West Virginia. The confluence of the West Fork River and Tygart Valley River at Fairmont forms the Monongahela River. Its drainage area is 7,340 square miles and encompases portions of West Virginia, Pennsylvania and Maryland West Virginia

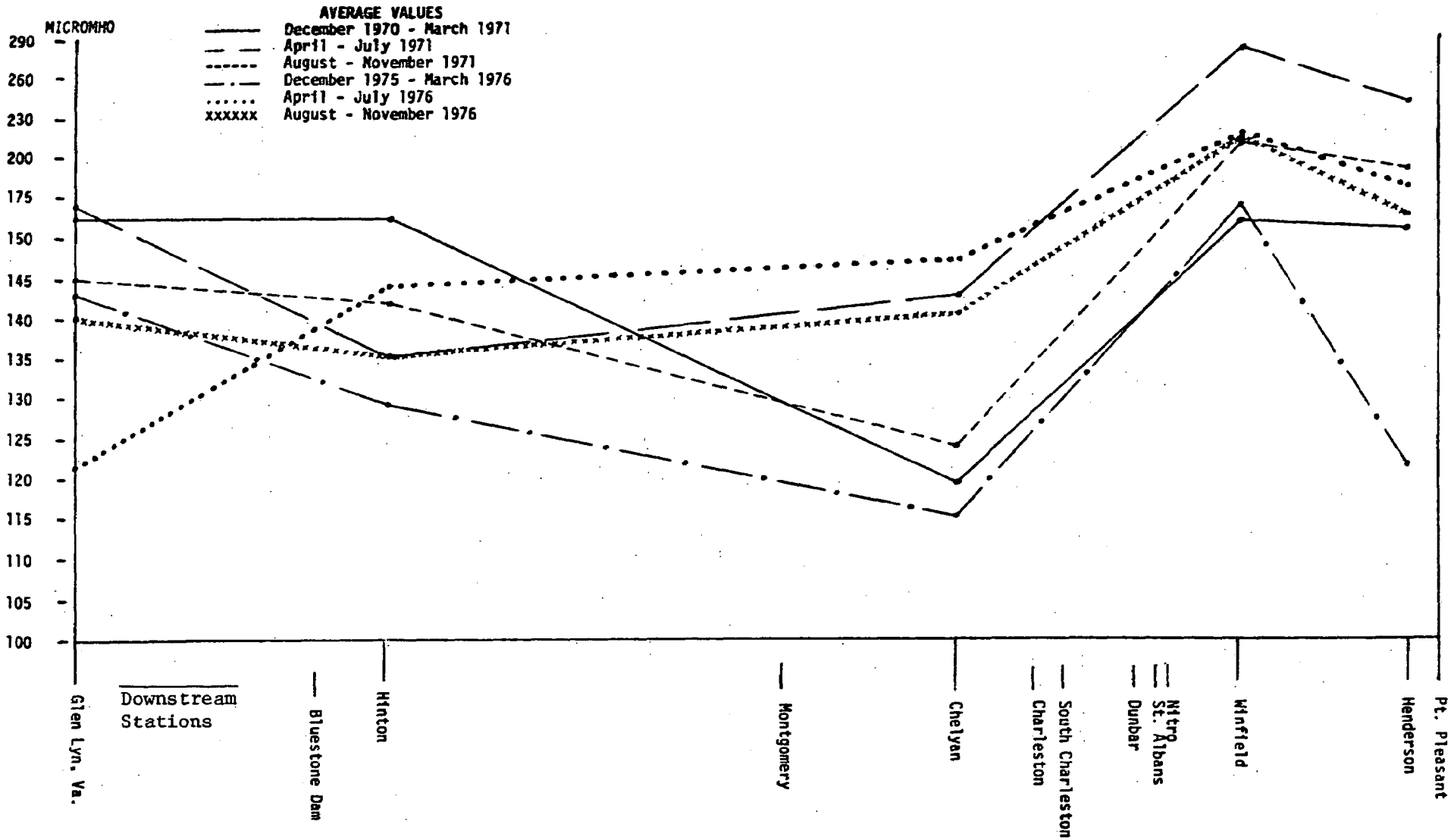


Figure 3-9
Conductivity Values for the Kanawha-New River (1971-1976)
Dept. of Natural Resources, 1977

TABLE 3-34

WATER QUALITY ANALYSES FOR THE KANAWHA RIVER AT WINFIELD, WV.
(1971 & 1976)
(Dept. of Natural Resources 1977)

ANALYSIS (mg/l)	AVERAGE		MAXIMUM		MINIMUM	
	1971	1976	1971	1976	1971	1976
Iron	.51	.64	1.70	.79	.04	.54
Aluminum	----	.39	----	.54	----	.28
Arsenic	<.001	<.002	<.001	<.002	<.001	<.002
Cadmium	.002	<.005	.004	.018	.001	<.001
Lead	----	<.05	----	.15	----	<.02
Manganese	.14	.13	.33	.20	.04	.07
Mercury	.0004	.0003	.001	.001	.0002	.0001
Selenium	----	.002	----	.002	----	.001
Silver	<.003	<.002	<.004	.003	<.002	<.002
Zinc	.022	.028	.022	.060	.022	.010
Potassium	1.4	1.8	1.9	2.0	1.0	1.6
Sodium	11.3	13.5	17.0	26.0	6.0	8.0
Fluorides	.10	.09	.13	.15	.08	.04
Phenols	<.009	<.003	.021	.005	<.001	<.001
Sulfates	36	31	56	53	22	22
Fecal Coliform (No./100 ml)	126	<220	400	600	<10	<100

TABLE 3-35

WATER QUALITY OF KANAWHA RIVER AT THE WINFIELD DAM. WATER YEAR 1976.
(USGS, 1976)

	Discharge (cfs)	Specific Conductivity (micromhos)	pH (units)	Temperature (°C)	Dissolved Oxygen (mg/1)
Nov 07	6560	340	7.5	15.5	8.8
Dec 16	15200	200	7.1	7.5	10.1
Jan 23	9400	360	7.2	1.5	----
Feb 23	27200	200	7.1	6.0	10.9
Mar 23	31100	190	7.5	10.0	9.9
Apr 28	4570	350	---	14.0	9.1
Jun 04	11300	220	7.6	22.0	7.3
Jul 27	7700	---	---	----	----
Aug 18	3160	380	7.5	26.0	----
Sep 23	2780	310	7.6	20.0	6.3
Ave	11897	283	7.4	13.6	7.7
Max	31100	380	7.6	26	10.9
Min	2780	190	7.1	1.5	6.3

TABLE 3-36

WATER QUALITY STATIONS OF THE KANAWHA RIVER BASIN
(Dept. of Natural Resources 1977)

STORET NO.	STATE NO.	LOCATION
550398	K-2	Kanawha River 2 miles above Henderson
550748	K-31	Kanawha River at Winfield Dam
550504	K-46	Kanawha River at St. Albans, Nitro Bridge
550505	K-52	Kanawha River at Dunbar Toll Bridge
550506	K-56	Kanawha River at Patrick St. Br., Rt. 60, Charleston, WV
550474	K-74	Kanawha River at Chelyan
550545	KP-9	Pocatalico River at Lanham
550600	KP-23	Pocatalico River at I-77 Bridge below Sissonville
550476	KC-5	Coal River at Tornado
550638	KC-47-0	Clear Fork at Sec. 1/2 Bridge in Leevale
550626	KC-10-0	Little Coal River at footbridge in Forks of Coal
550630	KC-10-T-0	Spruce Fork at Sec. 119/8 above Madison
550477	KE-27	Elk River at Queen Shoals
550543	K-49-0	Campbells Creek at mouth
550538	K-61-1	Cabin Creek above Chelyan
550541	K-64-0	Kellys Creek at Cedar Grove
550537	K-65-1	Paint Creek 1 mile South of Pratt
550540	K-72-0	Smithers Creek in Smithers
550500	KN-1	New River above mouth of Cove Branch
550478	KN-44	New River above Hinton
510013	KN-60	New River at Glen Lynn, VA
550553	KN-9-2	Marr Branch, Bank Sample below Fayetteville
550722	KN-21-0	Arbuckle Creek at abandoned RR Bridge at mouth
550550	KN-22-0	Dunloup Creek at WV Sec. Route 25 Bridge
550546	KN-26-0	Piney Creek at U.S. 19 Bridge
550480	KNG-6	Greenbrier River at Hilldale
550726	KNG-25-2	Howards Creek near U.S. 60 and I-64
550481	KNG-49	Greenbrier River at Buckeye Bridge
550729	KNG-130	Greenbrier River in Cass
550442	KNB-20	Bluestone River east of Camp Creek
550479	KNB-53	Bluestone River in Bramwell
550617	KNB-12-1	Brush Creek at Sec. 3 Bridge
550443	KNE-1	East River, 2 miles west of Va. State Line
550441	KG-5	Gauley River, Jodie
550557	KG-19-12	Meadow River near Nallen
550608	KG-34-4	Cherry River at W.Va. Route 39 Bridge in Fenwick
550770	K-22-5	Hurricane Creek at Co. 19 Bridge

TABLE 3-37

ALGAE GENERA OF THE KANAWHA RIVER BASIN (DAMES & MOORE, 1974)

	Abundance[a]	Rating[b]
Bluegreen Algae		
Agmenellum	O	36
Anabaena	O	22
Anacystis	O	19
Spirulina	O	37
Green Algae		
Actinastrum	M	40
Ankistrodesmus	M	10
Arthrodesmus	O	N
Chlorella	M	5
Chlorococcum	O	50
Closteridium	O	N
Closteriopsis	O	N
Closterium	M	16
Coelastrum	M	41
Crucigenia	O	60
Dictyosphaerium	O	58
Gloeocystis	O	N
Golenkinia	O	46
Gomphosphaeria	O	N
Micractinium	O	17
Microspora	O	N
Mougeotia	O	N
Nannochloris	A	N
Oocystis	O	35
Pediastrum	O	24
Phytococcus	O	N
Scenedesmus	M	4
Schroederia	O	N

TABLE 3-37 CONTINUED

	Abundance[a]	Rating[b]
Green Algae (cont.)		
Selenastrum	O	57
Sphaerocystis	O	N
Tetradesmus	O	N
Tetraedron	O	N
Tetrastrum	O	N
Diatoms		
Asterionella	O	51
Cyclotella	A	15
Cymbella	O	39
Diatoma	O	44
Fragilaria	O	29
Melosira	M	13
Navicula	M	7
Pinnularia	O	49
Pleuronema	O	N
Stephanodiscus	O	32
Synedra	M	9
Tabellaria	O	N
Dinoflagellates		
Peridinum		
Euglenoids		
Trachelomonas	A	26

[a]Abundance: O = Occasional, M = Moderately Abundant, A = Abundant Relatively

[b]Rating: 1-60, referring to the 60 algal genera most commonly associated with polluted waters; thus, Scenedesmus is the fourth most frequently found pollution-tolerant freshwater algal genus. N = Not in the list of 60 most pollution-tolerant genera.

TABLE 3-38

A PARTIAL LIST OF AQUATIC INVERTEBRATE SPECIES OF THE KANAWHA RIVER BASIN
(TARTAR, 1975)

Ephemeroptera
- Siphlonurus marshalli
- Baetis cingulatus
  - B. flavish
  - B. intercalaris
  - B. propinguus
  - B. rusticans
  - B. vagans
  - Pseudocloeon myrusum
  - P. paryulum
- Heptagenia juno
- Stenonema interpunctatum
  - S. ithaca
  - S. luteum
  - S. pulchellum
  - S. rubrum
  - S. vicaruim
- Ephemerella puneralis
  - E. invaria
  - E. rotunda

Plecoptera
- Pteronarcys dorsata
- Allonarcys beloba
  - A. comstocki
  - A. proteus
- Paragnetina immarginata
  - P. media
- Phasganophora capitata
  - Neopula clymene
- Acrcneuria abnormis
  - A. carolinensis
  - A. evolute
  - A. internata
  - A. lycorias
- Acrcneuria perplexa
- Eccoptura xanthanes
- Perlesta frisoni
  - P. placida
- Perlineila drymo
- Cultus decisus
- Dysloperla duplicata
- Helopicus subvarians
- Isogenoides hansoni
- Malirekus hastatus
- Remenus bilobatus
- Yugus arinus
  - Y. bulbobatus
- Isoperla bilaneata
  - I. burkski
  - I. clio
  - I. dicala
  - I. holochlora
  - I. lata
  - I. namata
  - I. orata
  - I. richardsoni
  - I. similis
  - I. transmarina

Odonata
- Agrion amatum
  - A. maculatum
- Hetaerina americana
  - Lestes dryas
- Argia sedula
  - A. violacea

Megaloptera
- Corydalus cornutus
- Nigronia serricornis
  - N. fasciatus
- Chauliodes pectinicornis
  - C. rastricornis

TABLE 3-39

FISH SPECIES FOR THE KANAWHA RIVER (ABOVE AND BELOW THE FALLS) AND THE NEW RIVER (DAMES & MOORE, 1974)

E = endemic; N = native; NP = probably present native;
NI = regarded as native but possibly introduced; I = introduced;
IP = probably or possibly introduced - regarded as such;
Ma = euryhaline or diadromous; X = fishes listed by Hocutt

	Below Falls[a]	Above Falls[a]	New River[b]
Ichthyomyzon bdellium	N		
Lampetra aepyptera	N		
Polyodon spathula	N		
Lepisosteus osseus	Ma		
Amia calva		I	
Anguilla rostrata	Ma		
Alosa chrysochloris	Ma		
Alosa pseudoharengus			X
Dorosoma cepedianum	Ma		
Dorosoma petenense	I	I	
Salmo gairdneri	I	I	
Salmo trutta	I	I	
Salvelinus fontinalis	IP	N	
Esox masquinongy	N	IP	
Esox niger	I	I	
Campostoma anomalum	N	N	X
Carassius auratus	I		
Chrosomus erythrogaster	N		
Chrosomus oreas		N	
Clinostomus funduloides		N	X
Cyprinus carpio	I	I	X
Ericymba buccata	N	N	
Exoglossum laurae		N	
Exoglossum maxillingua		NI	X
Hybopsis aestivalis	N		
Hybopsis amblops	N		
Hybopsis dissimilis	N	N	
Hybopsis storeriana	N		
Nocomis leptocephalus		N	X
Nocomis micropogon	N		
Nocomis platyrhynchus		E	X
Notemigonus crysoleucas	N		
Notropis albeolus		N	X
Notropis ardens		N	X
Notropis ariommus	N		

TABLE 3-39 CONTINUED

	Below Falls[a]	Above Falls[a]	New River[b]
Notropis atherinoides	N		
Notropis buchanani	N		
Notropis cerasinus		N	
Notropis coccogenis		IP	
Notropis cornutus (=chrysocephalus)	N		X
Notropis galacturus		NI	X
Notropis hudsonius			X
Notropis leuciodus		IP	
Notropis photogenis	N	N	X
Notropis procne			X
Notropis rubellus	N	N	X
Notropis rubricroceus		IP	
Notropis scabriceps		E	
Notropis spilopterus	N	N	X
Notropis stramineus	N	N	
Notropis telescopus		IP	X
Notropis unbratilus	N		
Notropis volucellus	N	N	X
Notropis whipplei	N		
Phenacobius micrabilis	N		
Phenacobius teretulus		E	
Pimephales notatus	N	N	X
Pimephales promelas	IP		X
Pimephales vigilax	N		
Rhinichthys atratulus	N	N	X
Rhinichthys cataractae	N	N	X
Semotilus atromaculatus	N	N	X
Carpiodes carpio	N		
Carpiodes cyprinus	N		
Carpiodes velifer	N		
Catostomus commersoni	N	N	X
Hypentelium nigricans	N	N	X
Ictiobus bubalus	N		
Ictiobus niger	N		
Minytrema melanops	N		
Moxostoma anisurum	N		
Moxostoma carinatum	N		
Moxostoma duquesnei	N		
Moxostoma erythrurum	N		
Moxostoma macrolepidotum	N		
Moxostoma rhothroecum		N	
Ictalurus furcatus	N	IP	
Ictalurus melas		IP	
Ictalutus natalis	N		
Ictalurus nebulosus	N		

TABLE 3-39
CONTINUED

	Below Falls[a]	Above Falls[a]	New River[b]
Ictalurus punctatus	N	NI	X
Noturus insignis		N	X
Noturus miurus	N		
Pylodictis olivaris	N	N	X
Percopsis omiscomaycus	N		
Labidesthes sicculus	N		
Morone chrysops		IP	X
Ambloplites rupestris	N	N	X
Lepomis auritus		IP	X
Lepomis cyanellus	N	IP	X
Lepomis gibbosus	N	IP	X
Lepomis gulosus	N	IP	
Lepomis macrochirus	N	IP	X
Lepomis megalotis	N	I	
Micropterus dolomieui	N	N	X
Micropterus punctulatus	N	NI	X
Micropterus salmoides	N	IP	
Pomoxis annularis	N	IP	X
Pomoxis nigromaculatus	N	IP	X
Ammocrypta pellucida	N		
Etheostoma blennioides	N	N	X
Etheostoma caeruleum	N		X
Etheostoma camurum	N		
Etheostoma flabellare	N	N	X
Etheostoma kanawhae		E	
Etheostoma maculatum	N		
Etheostoma nigrum	N	N	
Etheostoma osburni	N	E	X
Etheostoma tippecanoe	N		
Etheostoma variatum	N		
Etheostoma zonale	N		
Perca flavescens		IP	X
Percina caprodes	N		
Percina copelandi	N		
Percina crassa		NI	X
Percina evides	N		
Percina macrocephala	N		
Percina maculata	N	N	X
Percina oxyrhyncha	N	N	X
Percina sciera	N		
Stizostedion canadense	N		
Stizostedion v. vitreum	NI	N	
Cottus bairdi	N	N	X
Cottus carolinae		E?	X

TABLE 3-40

FISH SPECIES FROM THE KANAWHA, ELK, AND NEW RIVERS (DAMES & MOORE, 1974)

I = thought to have been introduced; IP = probably introduced; M = migratory, moving in and out, not actually permanent residents; N = thought to be native to the drainage system; X = known from above and below the vicinity of Charleston but unrecorded from the Charleston, West Virginia area; P = Present

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
PETROMYZONTIDAE						
Ichthyomyzon bdellium Ohio lamprey	N		N	N	N	
Lampetra aepyptera Least brook lamprey	N		N	N		
POLYODONTIDAE						
Polyodon spathula Paddlefish	N					
LEPISOSTEIDAE						
Lepisosteus osseus Longnose gar	M		M	M		
ANGUILLIDAE						
Anguilla rostrata American eel	M	M	M	M	M	
CLUPEIDAE						
Alosa chrysochloris Skipjack herring	M					
Dorosoma cepedianum Gizzard shad	M	M	M	M		

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Dorosoma petenense Threadfin shad	I					
ESOCIDAE						
Esox masquinongy ohiensis Ohio muskellunge	N					
SALMONIDAE						
Salmo gairdneri Rainbow trout	I					
Salmo trutta Brown trout	I					
Salvelinus fontinalis Brook trout	I	I	I	I	I	
CATOSTOMIDAE						
Carpiodes c. carpio River carpsucker	N					
Carpiodes cyprinus Quillback	N					
Carpiodes velifer Highfin carpsucker	N	N	N	N	N	
Catostomus c. commersoni White sucker	N	N	N	N	N	N
Hypentelium n. nigricans Northern hogsucker	N	N	N	N	N	N
Ictiobus bubalus Smallmouth buffalo	N	N	N	N	N	

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Ictiobus niger Black buffalo	N	N	N	N	N	
Minytrema melanops Spotfin sucker	N					
Moxostoma anisurum Silver redhorse	N	N	N	N	N	
Moxostoma carinatum River redhorse	N					
Moxostoma duquesnei Black redhorse	N	N	N	N	N	
Moxostoma erythrurum Golden redhorse	N	N	N	N	N	
Moxostoma breviceps Shorthead redhorse	N	N	N	N	N	
CYPRINIDAE						
Campostoma a. anomalum Ohio stoneroller	N	N	N	N	N	
Campostoma a. michauxi Appalachian stoneroller						N
Carassius auratus Goldfish	I					
Clinostomus funduloides Rosyside dace						N
Cyprinus carpio Carp	I	I	I	I	I	N

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Ericymba buccata Silverjaw minnow	N	N	N	N	N	IP
Exoglossum maxillingua Cutlips minnow						N
Hybopsis aestivalis hyostoma Speckled chub	N	N	N	N	N	
Hybopsis a. amblops Bigeye chub	N	N	N	N	N	
Hybopsis d. dissimilis Streamline chub	N	N	N	N	N	
Hybopsis storeriana Silver chub	N					
Nocomis leptocephalus Bluehead chub						N
Nocomis micropogon River chub	N	N	N	N	N	
Nocomis platyrhynchus Bigmouth chub						N
Notemigonus crysoleucas Golden shiner	N	N	N	N	N	
Notropis albeolus White shiner						N
Notropis ardens lythrurus Rosefin shiner						N

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Notropis ariommus Popeye shiner	N					
Notropis atherinoides Emerald shiner	N	N	N	N	N	
Notropis blennius[b] River shiner		N				
Notropis buchanani Ghost shiner	X					
Notropis c. cornutus Common shiner	N	N	N	N	N	
Notropis c. chrysocephalus Central common shiner	N	N	N	N	N	N
Notropis galacturus Whitetail shiner						N
Notropis hudsonius ssp. Spottail shiner						P
Notropis photogenis Silver shiner	N	N	N	N	N	N
Notropis p. procne Swallowtail shiner						IP
Notropis rubellus Rosyface shiner	N	N	N	N	N	N
Notropis s. spilopterus Spotfin shiner	N	N	N	N	N	N

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Notropis s. stramineus Sand shiner	N	N	N	N	N	N
Notropis telescopus Telescope shiner						N
Notropis umbratilis cyanocephalus Redfin shiner	N	N	N	N	N	
Notropis v. volucellus Mimic shiner	N	N	N	N	N	N
Notropis v. wickliffi Channel mimic shiner	X					
Notropis whipplei Steelcolor shiner	X					
Phenacobius mirabilis Suckermouth minnow	N					
Phoxinus erythrogaster Redbelly dace	N	N	N	N	N	
Phoxinus oreas Mountain redbelly dace						N
Pimephales notatus Bluntnose minnow	N	N	N	N	N	N

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Pimephales promelas Fathead minnow	I					I
Pimephales vigilax perspicuous Bullhead minnow	N	N	N	N	N	
Rhinichthys atratulus obtusus Blacknose dace	N	N	N	N	N	N
Rhinichthys cataracte Longnose dace	N	N	N	N	N	N
Semotilus a. atromaculatus Creek chub	N	N	N	N	N	N
ICTALURIDAE						
Ictalurus furcatus Blue catfish	N					
Ictalurus n. natalis Yellow bullhead	N	N	N	N	N	
Ictalurus nebulosus Brown bullhead	N					
Ictalurus p. punctatus Channel catfish	N	N	N	N	N	P
Noturus miurus Brindled madtom	N	N	N	N	N	

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Noturus insignis ssp. Marginal madtom						P
Pylodictis olivaris Flathead catfish	N	N	N	N	N	P
PERCOPSIDAE						
Percopsis omiscomaycus Trout perch	N	N	N	N	N	
ATHERINIDAE						
Labidesthes sicculus Brook silversides	N	N	N	N	N	
COTTIDAE						
Cottus b. bairdii Mottled sculpin	N	N	N	N	N	N
Cottus carolinae ssp. Banded sculpin						N
PERCICHTHYIDAE						
Morone chrysops White bass	XI					
CENTRARCHIDAE						
Ambloplites r. rupestris Rockbass	N	N	N	N	N	N
Lepornis auritus Redbreast sunfish						IP

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Lepomis cyanellus Green sunfish	N	N	N	N	N	N
Lempomis gibbosus Pumpkinseed	N					IP
Lepomis gulosus Warmouth	N					
Lepomis macrochirus Bluegill	N	N	N	N	N	N
Lepomis megalotis Longear sunfish	N	N	N	N	N	
Micropterus d. dolomieui Smallmouth bass	N	N	N	N	N	N
Micropterus p. punctulatus Spotted bass	N	N	N	N	N	N
Micropterus salmoides Largemouth bass	N	N	N	N	N	N
Pomoxis annularis White crappie	N					N
Pomoxis nigro-maculatus Black crappie	N	N	N	N	N	

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	Kanawha River Vicinity of Charleston	Elk River Lower	Elk River Middle	Elk River Upper	New River at Glen Lyn[a]
PERCIDAE						
Ammocrypta pellucida Eastern sand darter	N	N	N	N	N	
Etheostoma b. blennioides Greenside darter	N	N	N	N	N	N
Etheostoma caeruleum Rainbow darter	N	N	N	N	N	N
Etheostoma f. flabellare Fantail darter	N	N	N	N	N	N
Etheostoma m. maculatum Spotted darter	N					
Etheostoma n. nigrum Johnny darter	N					
Etheostoma osburni Finescaled saddled darter	N	N	N	N	N	N
Etheostoma tippecanoe Tippecanoe darter	N					
Etheostoma variatum Variegate darter	N	N	N	N	N	
Etheostoma z. zonale Banded darter	N	N	N	N	N	
Percina c. caprodes Logperch	N	N	N	N	N	

TABLE 3-40 CONTINUED

Family Name Scientific Name Common Name	Kanawha River Main Channel	 Vicinity of Charleston	Elk River Lower	 Middle	 Upper	New River at Glen Lyn[a]
Percina copelandi Channel darter	N	N	N	N	N	
Percina crassa roanoka Piedmont darter						I
Percina e. evides Gilt darter	N					
Percina macrocephala Longhead darter	N	N	N	N	N	
Percina m. maculata Blackside darter	N	N	N	N	N	N
Percina oxyrhyncha Sharpnose darter	N	N	N	N	N	N
Percina s. sciera Dusky darter	N					
Stizostedion canadense Sauger	N	N	N	N	N	
Stizostedion v. vitreum Walleye	N	N	N	N	N	
SCIAENIDAE						
Aplodinotus grunniens Freshwater drum	N					

[a] From J. R. Stauffer, Jr., 1975
[b] A new record for the New-Kanawha River system obtained by J. R. Stauffer, Jr., and R. F. Denoncourt

TABLE 3-41

RARE OR THREATENED FISH SPECIES OF THE KANAWHA RIVER BASIN
(Dept. of Natural Resources - Heritage Program 1978)

Etheostoma osburni (Finescaled Saddled Darter)
- Gauley River at Gauley Mills, Webster Co.
- Gauley River at headwaters (Big Run), Webster Co.
- Gauley River - S. of Bolair, Webster Co.
- Cherry River at Holcomb, Nicholas Co.
- Gauley River - just above mouth, Fayette Co.
- Laurel Creek - near Nams Chapel, Greenbriar Co.
- South Fork of Cherry River, Greenbrier Co.
- Gauley River - near Swiss, Nicholas Co.
- Williams River - 3 mi. from Hadley, Pocahontas Co.
- Rosen Run - 1 mile above mouth of Deer Creek, Pocahontas Co.
- Deer Creek - Pocahontas Co.
- Sitlington Creek - at Dunmore, Pocahontas Co.
- Greenbrier River - at Renick, Greenbrier Co.
- Anthony Creek - mouth, Greenbrier Co.
- East Fork of Greenbrier River at Thornwood, Pocahontas Co.
- Greenbrier River - at Alderson, Greenbrier Co.
- Knapp Creek - E. of Marlington, Pocahontas Co.
- Gauley River - at Miller Mill Run; Webster Co.
- North Fork of Cherry River - 2 miles N. of Richwood, Nicholas Co.
- Second Creek near Rt. 219, Monroe Co.
- Turkey Creek - E. of Willow Bend, Monroe Co.
- Indian Creek near Red Sulphur Springs, Monroe Co.
- Briery Run, Greenbrier Co.
- Williams River - just E. of Pocahontas-Webster line
- Stony Creek - Pocahontas Co.
- Greenbrier River - 8 mi. above Bartow, Pocahontas Co.

Exoglossum laurae (Tonguetied Minnow)
- Laurel Creek - at confluence of McMillion Creek, Greenbrier Co.
- South Fork of Cherry Run, Greenbrier Co.
- Williams River, Pocahontas Co.
- N. & S. Fork confluence of Cranberry River, Pocahontas Co.
- Deer Creek - 1.6 mi. W. of Green Bank, Pocahontas Co.
- Sitlington Creek at Rt. 28 bridge, Pocahontas Co.
- Sinking Creek, Greenbrier Co.
- Second Creek - at Greenbrier-Monroe Co. line
- Rich Creek, near Rt. 219, Monroe Co.
- Near mouth of Wolf Creek, Summers Co.
- Above mouth of Spring Creek, Greenbrier Co.
- Indian Creek near confluence of Turkey & Dropping Lick Creeks, Monroe Co.
- Mill Creek near Rt. 12, Greenbrier Co.
- Williams River, W. of headwaters of Stoney Creek, Pocahontas Co.
- Williams River at Bannock Shoals, Pocahontas Co.
- Turkey Creek at Willow Bend, Monroe Co.
- Second Creek - 10.5 mi. above mouth, Monroe Co.
- Milligan Creek at U.S. Rt. 60 crossing, Greenbrier Co.
- Howards Creek at Hart Run, Greenbrier Co.
- Culberson Creek at Fort Connally bridge, Greenbrier Co.

TABLE 3-41 CONTINUED

Ichthyomyzon bdellium (Ohio Lamprey)
Lilly Fork of Buffalo, Clay Co.

Ichthyomyzon unicuapas (Silvery Lamprey)
Elk River at Spread Shoal, Clay Co.

Moxostoma carinatum (Rider Redhorse)
Spruce Fork near mouth of Sparrow Creek, Boone Co.

Notropis buchanani (Ghost Shiner)
Eighteen Mile Creek near Buffalo, Putnam Co.
Kanawha River near mouth Lens Creek, Kanawha Co.
Kanawha River at Kanawha Falls, Fayette Co.
Kanawha River at London Locks, Kanawha Co.

Notropis scabriceps (New River Shiner)
Williams River at Dyer, Webster Co.
Knapp Creek, Pocahontas Co.
Rosen Run, Pocahontas Co.
Deer Creek, Pocahontas Co.
Sidlington Creek near Dunmore, Pocahontas Co.
Anthony Creek at Rt. 92, Neola, Greenbrier Co.
East Fork of Greenbrier River, Pocahontas Co.
West Fork of Greenbrier River at Rt. 250 bridge, Pocahontas Co.
Williams River, Nicholas Co.
New River near Brooks, Summers Co.
Second Creek near Hollywood, Monroe Co.
Spring Creek near mouth, Greenbrier Co.
Williams River near Island Branch, Pocahontas Co.
Greenbrier River, 123.5 mi. above mouth, Pocahontas Co.
Muddlety Creek near Rt. 41, Nicholas Co.
Peters Creek near Drennin, Nicholas Co.
Hungard Creek - Boone Creek, Summers Co.
Lick Creek at Green Sulphur Springs, Summers Co.
Meadow Creek near Claypool, Summers Co.

Percina copelandi (Channel Darter)
Kanawha River near Hangford, Kanawha Co.

Percina macrocephala (Longhead Darter)
Gauley River near Malinda Creek, Nicholas Co.

Percina phoxocephala (Slenderhead Darter)
New River, Fayette Co.

Phenacobius teretulus (Kanawha Minnow)
Laurel Creek near Mamo Chapel, Greenbrier Co.
East Fork of Greenbrier River, Pocahontas Co.
West Fork of Greenbrier River, Pocahontas Co.
Williams River near Dyer, Webster Co.

TABLE 3-41 CONTINUED

Phaxinus erythrogaster (Southern Redbelly Dace)
Howard and Dry Creeks, Greenbrier Co.
Threemile Creek, Mason Co.
Mill Creek at Rt. 62, Mason Co.

Phaxinus oreas (Mt. Redbelly Dace)
East Fork of Greenbrier River, Pocahontas Co.
Buffalo Fork, Pocahontas Co.
Abe's Run, Pocahontas Co.
Buffalo Fork - below Townsend Run, Pocahontas Co.

Pimephales vigilax (Bullhead minnow)
Kanawha River at London Locks, Kanawha Co.

Polyodon spathula (Paddlefish)
Kanawha River at Charleston, Kanawha River
Elk River below Sutton Dam, Braxton Co.
Kanawha River near Fraziers' Bottom P.O., Putnam Co.

TABLE 3-42

HIGH QUALITY STREAMS OF KANAWHA RIVER BASIN
(Dept of Natural Resources 1974)

Kanawha River K
- Threemile Creek K-5
- Tenmile Creek K-10
- Thirteenmile Creek K-12
- Sixteenmile Creek K-14
- Eighteenmile Creek K-16
- Five and Twentymile Creek K-19
- Hurricane Creek K-22

- Pocatalico River KP
  - Left Fork Pocatalico River KP-17
    - Middle Fork Pocatalico River KP-17-B
  - Flat Fork KP-33
- Coal River KC
  - Little Coal River KC-10
    - Spruce Fork KC-10-T
      - Spruce Laurel Fork KC-10-T-11
    - Pond Fork KC-10-U
  - Marsh Fork KC-46
- Elk River KE
  - Little Sandy Creek KE-9
  - Blue Creek KE-14
  - Big Sandy Creek KE-23
  - Laurel Creek KE-37
  - Little Sycamore Creek KE-40
  - Sycamore Creek KE-41
  - Leatherwood Creek KE-46
  - Lilly Fork KE-50-B
  - Beech KE-50-B-8
  - Sand Fork KE-50-F
  - Flat Fork KE-50-i-1
  - Robinson Fork KE-50-0

- Otter Creek KE-64
  - Bogg Fork KE-64-E
- Grove Creek KE-69
- Strange Creek KE-74
- Birch River KE-76
  - Little Birch River KE-76-E
  - Anthony Creek KE-76-N
  - Poplar Creek KE-76-0
  - Strange Creek KE-39
  - Rock Camp Run KE-82
  - Wolf Creek KE-91
- Holly River KE-98
  - Right Fork Holly River KE-98-B
  - Left Fork Holly River KE-98-C
  - Desert Fork KE-98-B-16
  - Old Lick Creek KE-98-C-2
  - Laurel Fork KE-98-C-11
    - Fall Run KE-98-C-14

TABLE 3-42

CONTINUED

Back Fork Elk River KE-111
- Sugar Creek KE-111-K
  - Little Sugar Creek KE-111-K-2

Dry Fork KE-133
Big Run KE-135
Props Run KE-136
Cupp Run KE-138-B
Old Field Run KE-139
Crooked Fork KE-139-B
Slaty Fork KE-140

Loop Creek K-76

Gauley River KG
- Twentymile Creek KG-5
- Otter Creek KG-13-B
- Meadow River KG-19
  - Anglins Creek KG-19-G
  - Wolfpen Creek KG-19-Q-2
  - Big Clear Creek KG-19-U
    - South Fork KG-19-U-2
  - Little Clear Creek KG-19-V
    - Laurel Creek KG-19-V-5
    - Hominy Creek KG-24
    - Deer Creek KG-24-B
- Cherry River KG-34
  - Laurel Creek KG-34-E
  - Little Laurel Creek KG-34-F
  - Improvement Branch KG-34-F-2
  - South Fork Cherry River KG-34-G
  - North Fork Cherry River KG-34-H
- Cranberry River KGC
  - South Fork Cranberry River KGC-23
  - North Fork Cranberry River KGC-24
- Williams River KGW
  - Tea Creek KGW-20

New River KN
- Laurel Creek KN-5
- Mill Creek KN-7
- Wolf Creek KN-10
- Glade Creek Mann Creek KN-17-A
- Piney Creek KN-26
- Glade Creek KN-29
  - Pinch Creek KN-29-E
- Meadow Creek KN-32
- Turkey Creek KN-51-0
- Indian Creek KN-51
  - Laurel Creek of Indian Creek KN-51-i
- East River KN-60
  - Pigeon Creek KN-60-B
- Rich Creek KN-61

TABLE 3-42
CONTINUED

Greenbrier River KNG

- Milligan Creek KNG(S)-1
- Sinking Creek KNG(S)-2
- Culverson Creek KNG(S)-3
- Burns Creek KNG(S)-3-A
- Roaring Creek KNG(S)-3-C-1
- Hills Creek KNG(S)-4
- Wolf Creek KNG-7
- Wolf Creek KNG-18
- Muddy Creek KNG-22
- Second Creek KNG-23
- Anthony Creek KNG-28
  - Meadow Creek KNG-28-P
    - Laurel Run KNG-28-P-1
  - North Fork Anthony Creek KNG-28-Q
- Laurel Run KNG-29
- Spring Creek KNG-30
- Locust Creek KNG-38
- Laurel Run KNG-40
- Beaver Creek KNG-47
- Swago Creek KNG-49
- Knapps Creek KNG-53
  - Brown Creek KNG-53-C
- Stoney Creek KNG-55
- Sitlington Creek KNG-66
- Deer Creek KNG-68
  - North Fork Deer Creek KNG-68-A
- East Fork Greenbrier River KNG-78
  - Little River KNG-78-C
  - Vivemile Run KNG-78-G
  - Mullenax Run KNG-78-C
  - Abes Run KNG-78-L
- West Fork Greenbrier River KNG-79
  - Little River KNG-79-C

Bluestone River KNB

- Mountain Creek KNB-5
- Camp Creek KNB-13
- Mash Fork KNB-13-D

contains 4,150 square miles of this drainage which exists in the counties of Monongalia, Marion, Preston, Harrison, Taylor, Barbour, Tucker, Upshur, Randolph, Lewis, and Pocahontas. (Fig. 3-10).

The principal sub-basins of the Monongahela River Basin are the West Fork, Tygart, and Cheat Rivers. The principal tributaries of the Monongahela River Basin and their drainage areas are presented in Table 3-43. These include the previously mentioned rivers in addition to Dry Fork, Shavers Fork, the Buckhannon River, Big Sandy Creek, Middle Fork River, and the Blackwater River.

Flow augmentation in West Virginia is provided by two reservoirs, Tygart Lake and Lake Lynn (Cheat Lake), and a series of four U.S. Army Corps of Engineers Locks and Dams. These Locks and Dams are located at Opekiska, Hilderbrand, Morgantown, and Point Marion (Pennsylvania). These structures help to maintain river navigation througout the year.

The basin itself is divided into two general regions. The western part of this region is located on the Allegheny Plateau and includes the Monongahela River (main stem), the West Fork River, and the Tygart Valley River. It is characterized by a rolling topography with low stream velocities. The Cheat River Basin lies in the Allegheny Mountains and is characterized by steep gradients and high stream velocities.

Since coal mining is the principal economic activity in the Monongahela River Basin, the major water quality problem is acid mine drainage. A second problem common to the basin is the lack of waste water treatment facilities, which increases the organic, or sewage, load in the system. A list of streams and their pollutants is presented in Table 3-44.

Hydrology

The average discharge of the Monongahela River at Point Marion, Pennsylvania is about 7500 cfs (Department of Natural Resources, 1973). Approximately 60 percent is contributed by the main stem, and about 40 percent comes from the Cheat River. Many smaller streams have no flow during the summer months. The main stem flow is supplemented by release of water from the Tygart Valley River Reservoir.

Water resources consist of approximately 7,400 acres of streams less than one-eighth of a mile wide and ponds greater than 2 acres and less than 40 acres in size. This includes the pools of the three lock and dam structures. Also, Tygart Lake has a normal pool of 3,440 acres, and Cheat Lake has a normal pool level of 1,730 acres.

A list of 17 discharge monitoring stations and their drainage areas in the Monongahela River Basin is presented in Table 3-45. Discharge data for the Tygart Valley River Sub-basin (8 stations), the West Fork River and Sub-basin (4 stations), and the Cheat River Sub-basin (6 stations) is presented in Tables 3-46, 3-47, and 3-48 respectively.

Figure 3-10
MAP
OF
WEST VIRGINIA
SHOWING
MONONGAHELA RIVER BASIN

TABLE 3-43

PRINCIPAL TRIBUTARIES OF THE MONONGAHELA RIVER

(Department of Natural Resources 1973)

River	Sub-Basin	Drainage Area (sq. mi.)
Monongahela River (at WV-PA line)	----------	2715
West Fork	----------	881
Cheat River	----------	1413
Tygart Valley River	----------	1381
Dry Fork (At Hendricks)	Cheat River	345
Shavers Fork (at Parsons)	Cheat River	214
Buckhannon River (at Hall)	Tygart Valley River	277
Big Sandy Creek (Rockville)	Cheat River	200
Middle Fork River	Tygart Valley River	151
Blackwater River	Cheat River	142

TABLE 3-44

WATER QUALITY OF MONONGAHELA RIVER BASIN TRIBUTARIES (Dept. of Natural Resources 1976)

\+ = Organics
* = Mine Drainage

Dept. of Natural Resources

Segment Classifications	Description	Length of Segment River Miles
601+*	Scotts Run	6.8
602+*	Deckers Creek	22.5
603+*	Paw Paw & Little Paw Paw Creeks	13.8
604+*	Buffalo Creek	16.2
605+*	West Fork River	74.3
606+*	Helens Run	4.2
607+*	Salem Fork	9.0
608+*	Simpson Creek	29.1
609+*	Limestone Run	6.5
610+*	Browns Creek	4.5
611+*	Lost Creek	10.3
612+*	Tygart Valley River	156.0
613+*	Buckhannon River & Tribs.	21.8
614*	Cheat River	38.0
615*	Shavers Fork	85.0
616*	Monongahela Mainstem	38.4
617*	Dunkards Creek	14.4
618*	Dents Run	6.2
619*	Indian Creek	5.7
620*	Dunkards Mill	8.2
621*	Pyles Fork	14.2
622*	Booths Creek	16.4
623*	Bingamen Creek	14.2
624*	Jones Creek	6.4
625*	Little Tenmile Creek	7.2
626*	Rockcamp Creek	7.3
627*	Elk Creek & Tribs.	22.4
628*	Isaac Creek	5.6
629*	Skin Creek	10.5
630*	Three Fk., Raccoom, Birds, & Brains Creek	31.6
631*	Sandy and Little Sandy Creeks	13.1
632*	Pecks Run	8.4
633*	Rink Run	8.6
634*	Middle Fork River	15.8
635*	Big and Little Sandy Creeks	19.4
636*	Muddy Creek	13.2
637*	Buffalo Creek	9.6
638*	Blackwater River MP 0 to 12.8	12.8
639*	Rhine Creek	4.8
640*	Snowey Creek	

TABLE 3-45

DISCHARGE AT VARIOUS MONITORING STATIONS IN THE MONONGAHELA RIVER BASIN
(USGS, 1977)

Location	Drainage Area (Sq Mi)	(cfs) Average Discharge
Tygart Valley River (Daily, WV)	187	349 (60 yrs)
Tygart Valley River (Elkins, WV)	272	535 (32 yrs)
Tygart Valley River (Belington, WV)	408	803 (69 yrs)
Middle Fork River (Audra, WV)	149	347 (34 yrs.)
Buckhannon River (Hall, WV)	277	593 (61 yrs)
Tygart Valley River (Philippi, WV)	916	1839 (36 yrs)
Tygart Valley River (Grafton, WV)	1184	2324 (38 yrs)
Tygart Valley River (Colfax, WV)	1366	2610 (37 yrs)
West Fork River (Brownsville, WV)	102	163 (30 yrs.)
West Fork River (Butcherville, WV)	181	300 (61 yrs)
West Fork River (Clarksburg, WV)	384	589 (53 yrs)
West Fork River (Enterprise, WV)	759	1144 (52 yrs)
Blackwater River (Davis, WV)	86.2	196 (55 yrs.)
Shavers Fork (Bemis, WV)	115	330 (6 yrs)
Shavers Fork (Parsons, WV)	214	550 (52 yrs)
Cheat River (Parsons, WV)	718	1679 (63 yrs)
Cheat River (Rowlesburg, WV)	972	2253 (53 yrs)

TABLE 3-46

DISCHARGE RECORDS FOR TYGART VALLEY RIVER SUB-BASIN. WATER YEAR 1976. (USGS-1977)

Location	(cfs) Discharge	MONTH Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
Tygart Valley River near (Dailey,WV)	Mean	1.32	1.72	2.13	3.35	3.24	2.39	1.82	1.36	1.00	1.77	.76	.76	1.80
	Max.	3.44	4.28	3.63	8.87	6.53	4.40	4.03	2.57	1.86	1.48	1.48	1.80	8.87
	Min.	.82	.97	1.34	1.93	2.07	1.39	1.13	1.03	.62	.72	.38	.41	0.38
Tygart Valley River near (Elkins,WV)	Mean	154	279	400	949	972	545	334	149	75.6	376	45.4	42.4	359
	Max.	756	1510	1160	4590	2700	2010	1390	529	236	3270	167	203	4590
	Min.	38	59	122	180	346	137	82	68	15	34	5.6	7.2	5.6
Tygart Valley River (Belington, WV)	Mean	203	441	722	1547	1537	914	592	312	146	581	58.8	65.9	591
	Max.	1050	2250	1910	7240	3870	3670	1360	1110	430	4680	190	310	7240
	Min.	55	91	237	283	558	217	156	127	39	55	18	15	15
Middle Fork River (Audra, WV)	Mean	85.9	190	356	717	673	429	286	189	49.1	395	54.6	29.9	287
	Max.	226	696	725	3000	1810	1730	1190	748	165	3620	215	140	3620
	Min.	.16	47	148	250	260	108	76	66	9.2	10	3.6	4.1	3.6
Buckhannon River (Hall, WV)	Mean	166	267	614	1128	1019	682	461	313	95.3	732	57.8	65.4	466
	Max.	648	942	1680	4250	2240	3300	1790	1470	269	6430	220	476	6430
	Min.	44	75	174	273	405	161	111	93	17	31	8.3	9.0	8.3
Tygart Valley River (Philippi, WV)	Mean	510	960	1604	3724	3428	2178	1453	881	311	1738	192	189	1427
	Max.	2180	3410	4270	13700	8190	9280	5230	3230	908	11900	692	1300	13700
	Min.	149	247	480	960	1440	550	388	302	95	124	46	39	39
Tygart Valley River at Tygart Dam near Grafton, WV)	Mean	1281	1342	2527	4357	4560	2171	1257	589	349	1814	365	356	1742
	Max.	2540	2360	5150	10800	7250	5650	5520	3090	620	9340	740	410	10800
	Min.	650	610	990	858	2030	380	220	140	140	200	254	290	140
Tygart Valley River (Colfax, WV)	Mean	1470	1493	2877	4862	4943	2405	1461	745	438	1954	459	427	1956
	Max.	2680	2690	5560	11200	7540	6090	5610	3260	1310	9390	970	568	11200
	Min.	685	643	1040	1070	2690	504	275	183	173	217	286	349	173

TABLE 3-47

DISCHARGE RECORDS FOR THE WEST FORK RIVER SUB-BASIN WATER YEAR 1976. (USGS, 1977)

Location	(cfs) Discharge	MONTH												Year
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sep.	
West Fork River (Brownsville, WV)	Mean	60.2	63.4	197	327	229	192	121	68.3	18.1	149	9.91	12.3	121
	Max.	504	468	1310	2240	596	1150	744	500	92	1460	27	107	2240
	Min.	9.2	13	41	58	63	32	15	15	2.4	6.7	1.9	1.7	1.7
West Fork River (Butcherville, WV)	Mean	136	119	390	606	435	333	235	114	44.0	302	37.8	72.1	236
	Max.	985	846	2240	3820	1180	1840	1290	910	150	3080	92	282	3820
	Min.	22	25	74	115	129	63	38	26	19	12	14	42	12
West Fork River (Clarksburg WV)	Mean	358	299	806	1310	850	634	471	231	70.8	576	61.7	73.9	479
	Max.	2820	2320	4060	7200	1980	3980	2700	1920	193	5720	239	424	7200
	Min.	56	71	118	257	276	138	90	54	16	19	20	39	16
West Fork River (Enterprise WV)	Mean	682	656	1504	2496	1675	1136	881	449	207	939	158	135	910
	Max.	5040	4530	6830	12200	3020	6050	4200	2470	546	5900	496	578	12200
	Min.	182	158	260	553	610	355	254	164	88	117	74	77	74

TABLE 3-48

DISCHARGE RECORDS FOR THE CHEAT RIVER SUB-BASIN. WATER YEAR 1976. (USGS, 1977).

Location	(cfs) Discharge	MONTH												Year
		Oct.	Nov.	Dec	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	
Blackwater River (Davis,WV)	Mean	144	92.9	140	306	390	208	136	77.3	91.1	63.7	19.1	31.7	141
	Max.	941	250	678	1220	1030	617	527	200	359	222	43	162	1220
	Min.	50	43	57	70	110	70	46	35	24	25	6.8	5.8	5.8
Shavers Fork (Bemis, WV)	Mean	245	250	286	494	585	351	192	203	126	400	66.6	116	276
	Max.	2050	1090	1410	2850	1280	1110	681	715	352	3180	275	768	3180
	Min.	88	84	118	110	190	131	64	70	51	51	15	11	11
Shavers Fork (Parsons, WV)	Mean	310	347	428	786	909	553	345	265	161	388	85.3	122	390
	Max.	1720	1570	1320	4490	2430	1900	1190	893	342	2360	306	643	4490
	Min.	117		202	168	260	211		121	69	61	21	19	19
Cheat River near (Parsons WV)	Mean	1011	998	1276	2637	3109	1859	1129	650	516	893	190	263	1206
	Max.	7230	4360	4760	13300	9010	6690	4100	1900	1870	4880	582	1320	13300
	Min.	283	333	499	600	900	556	366	312	164	186	66	61	61
Cheat River (Rowelsburg, WV)	Mean	1282	1395	2140	3861	4263	2515	1642	979	716	1038	249	285	1691
	Max.	5750	4750	5850	20100	10900	8970	5260	2720	2110	4920	759	1590	20100
	Min.	390	446	819	890	1560	770	515	470	245	245	81	81	81

Water Quality

Water quality in the Monongahela River Basin is generally affected by acid mine drainage, the major problem pollutant. Twenty-two percent of the total stream miles is affected by acid mine drainage. The Environmental Protection Agency estimates 35 percent of the acid load is from non-mining industry, 25 percent from inactive mines, and 40 percent from active mines. Domestic sewage, non-point source pollution, and industrial wastes also contribute to the problem. Generally tributaries located in the upper reaches of the Basin are high quality streams.

Although dams have slowed the natural flow of water in the downstream area, there have been no unusual temperature variations or violations of state standards in the 1970's.

The water quality in the main stem shows improvement regarding acid mine drainage. The average pH was 6.1 with a minimum of 3.3 and a maximum of 8.6 in 1971. The average pH for 1976 was 7.2 with a minimum of 6.8 and a maximum of 7.6. No violations of state standards have been reported in the Monongahela Basin since 1971. In 1971 the average pH value in Morgantown was 5.9, while the average value 7.0 in 1976. Eleven percent of Cheat River samples in 1976 were in violation of state standards (DNR, 1977). Mean levels of pH for various sites in the Monongahela River Basin are shown in Figures 3-11 and 3-12.

Conductivity levels, as shown in Figures 3-13, 3-14, and 3-15 increased from up-river to down-river stations. Monongahela River (main stem) values were higher than those found in the Tygart River and Upper Cheat. Increases in suspended and dissolved solids from mining activities probably caused the higher conductivity values.

Dissolved oxygen levels, as shown in Figures 3-16, 3-17, and 3-18 were within acceptable limits throughout the basin. No violations below the minimum standard of 5 mg/l were reported for the 1970's.

An analysis of Monongahela River water quality at Morgantown is presented in Table 3-49. Iron and manganese are above standard levels, probably due to acid mine drainage. Phenols were also in violation of state standards. Sulfate values at times exceeded acceptable limits. Total and fecal coliforms were also in violation of state standards for 1971 and 1976. This was due primarily to the high influx of domestic sewage.

A list of water quality stations and their storet numbers is presented in Table 3-50.

Aquatic Ecology

A list of phytoplankton species found in a recent study in the Monongahela River Basin is presented in Table 3-51 (Bohme, 1978). The list contains 124 species identified in the Monongahela River Basin from June 1975 to February 1976. An additional list of phytoplankton taxa observed in Tygart Lake in 1973 and 1974 is presented in Table 3-52. A total of 89 taxa was found in this study.

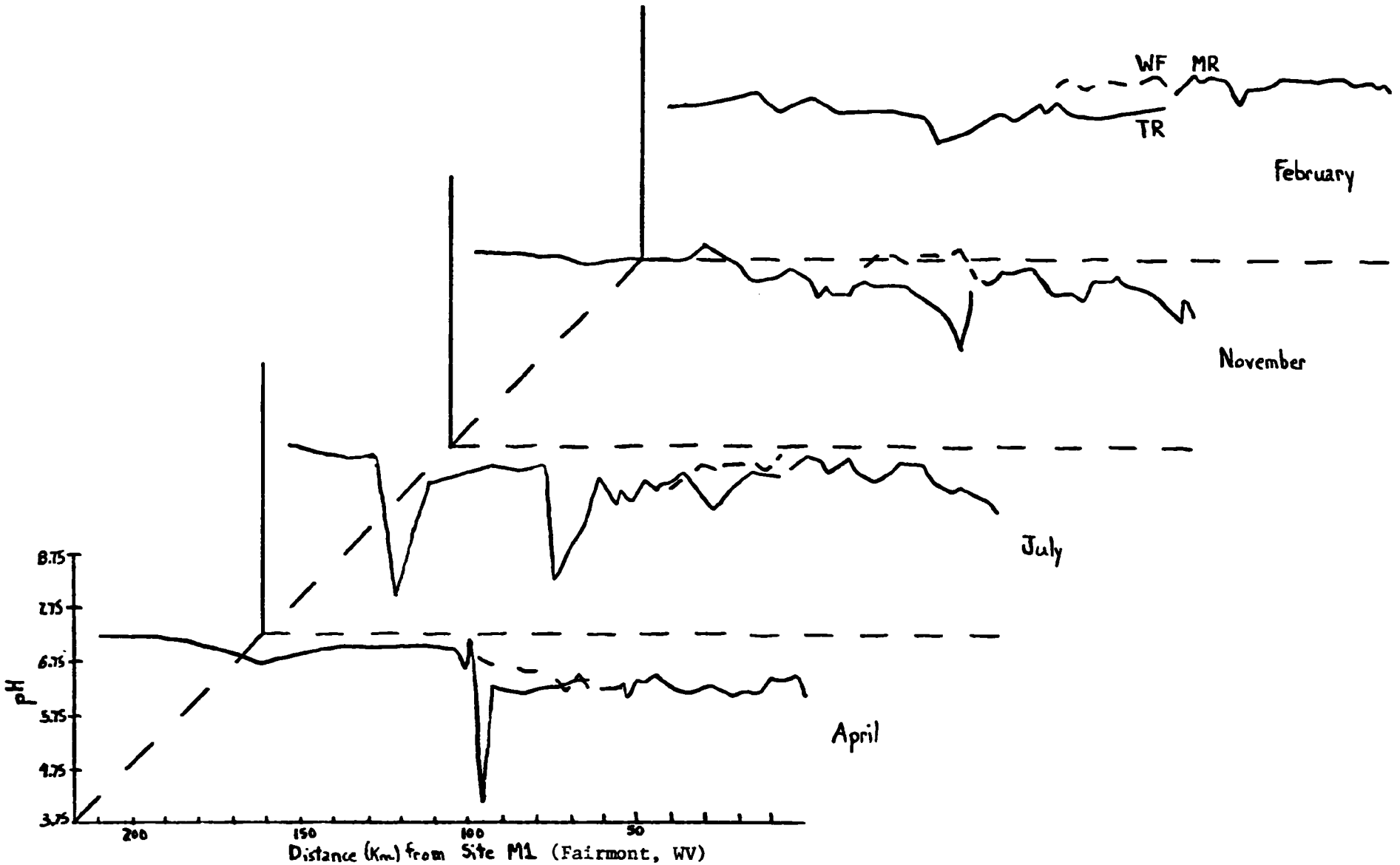


Figure 3-11
Mean Levels of pH Plotted at Each Site (Measured from Site M1 in Km.) on the Monongahela, Tygart Valley, and West Fork Rivers for all Four Sampling Dates - 1974 (Koon, 1977)

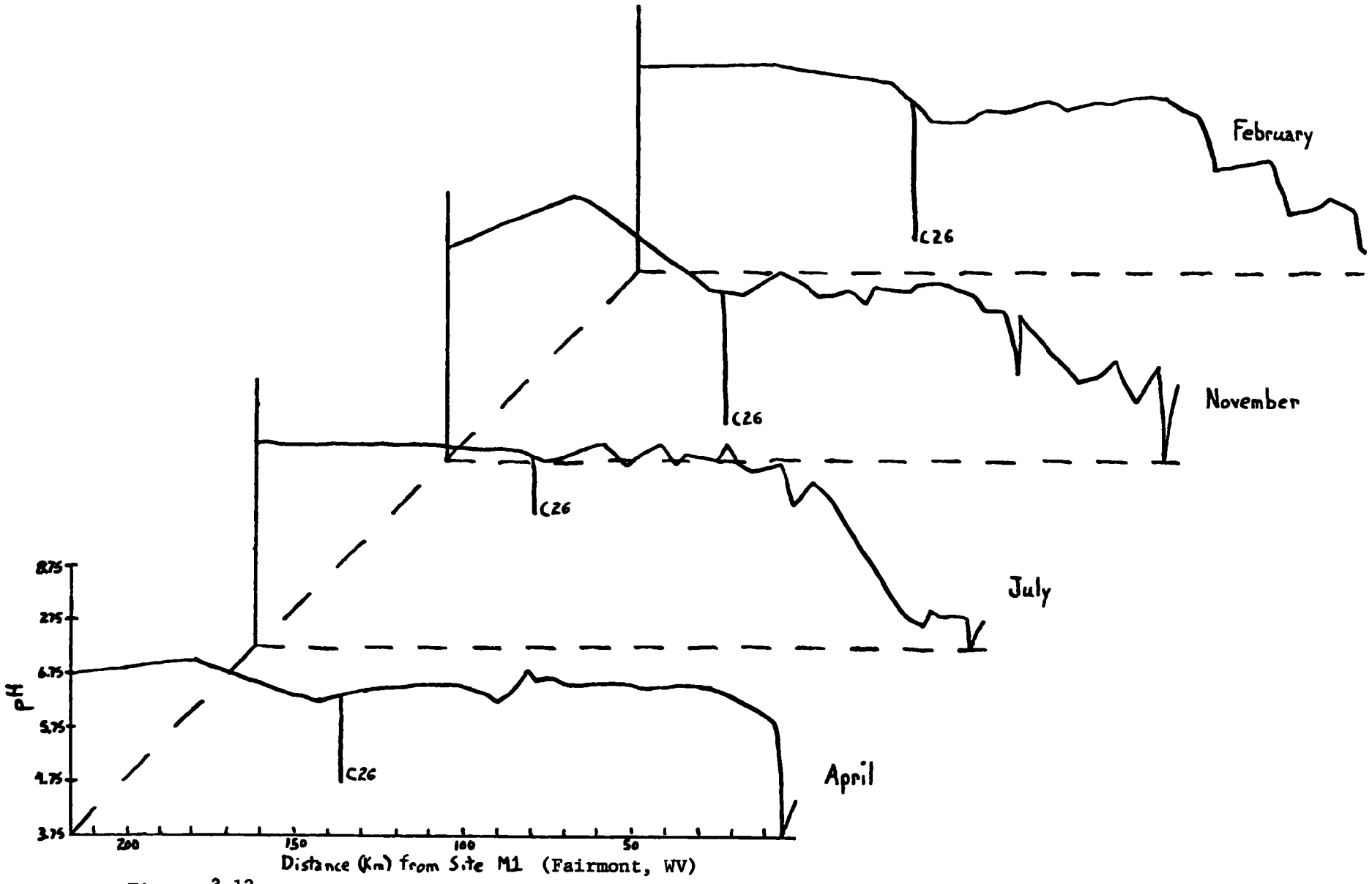


Figure 3-12
Mean Levels of pH Plotted at each Site (Measured from Site M1 in Km.) on the Cheat River for all Four Sampling Dates - 1974 (Koon, 1977)

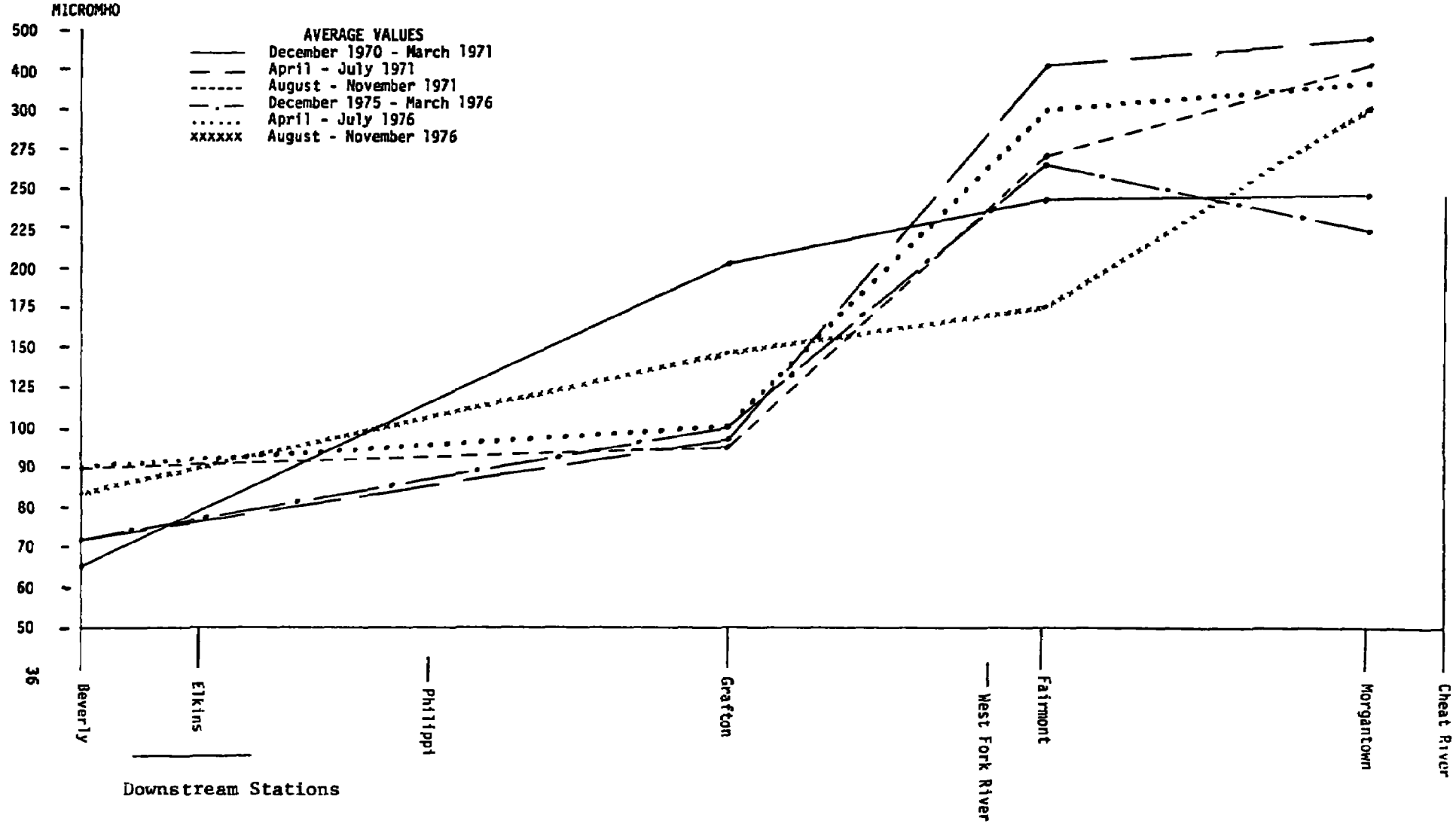


Figure 3-1 3
Conductivity Values for the Monongahela-Tygart Valley Rivers - 1971 & 1976 (DNR-1977)

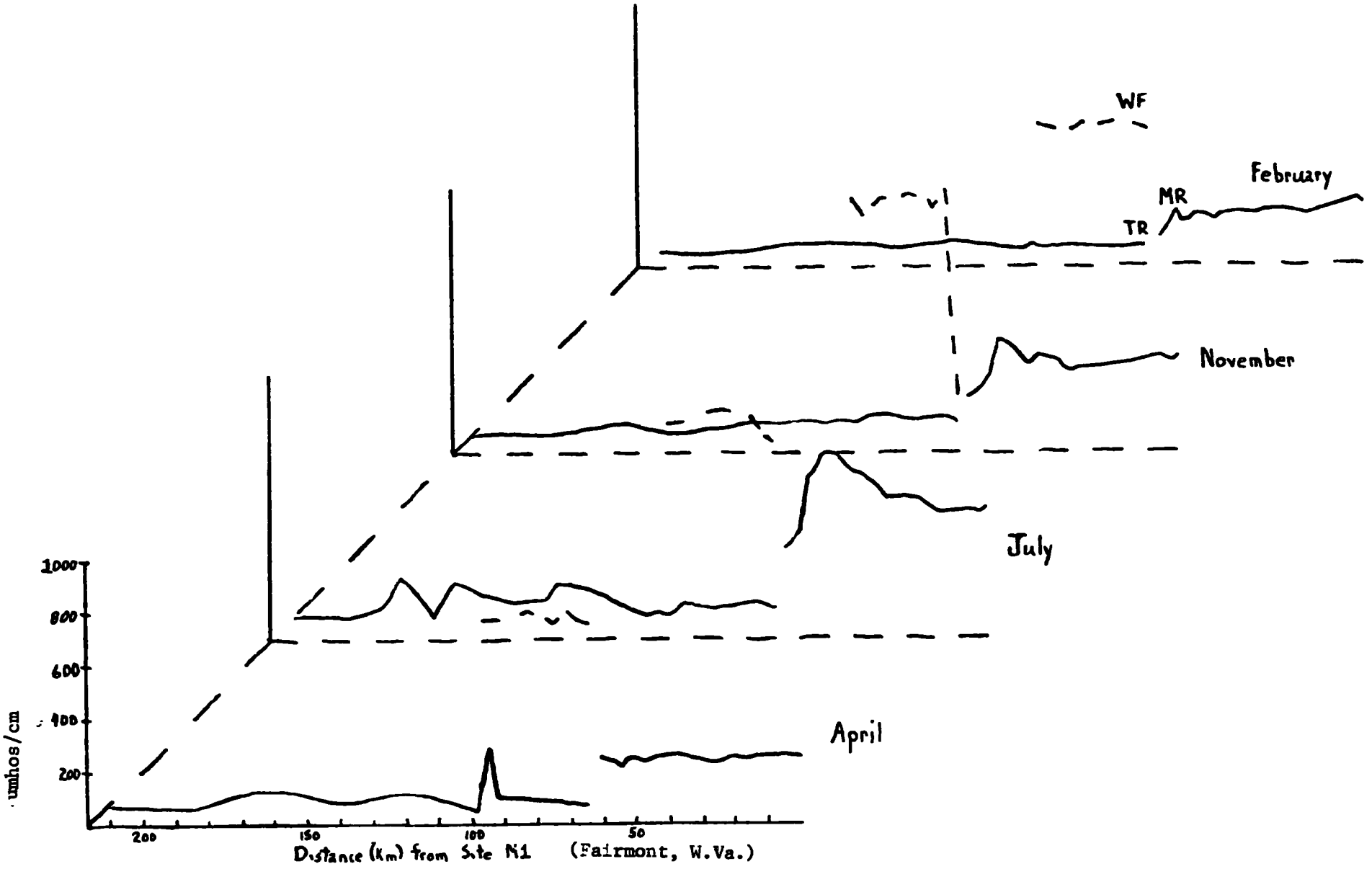


Figure 3-14
Mean Levels of Conductivity, in Umhos, Plotted at Each Site (Measured from Site M1 in Km.) on the Monongahela, Tygart Valley, and West Fork Rivers for all Four Sampling Dates (Koon, 1977)

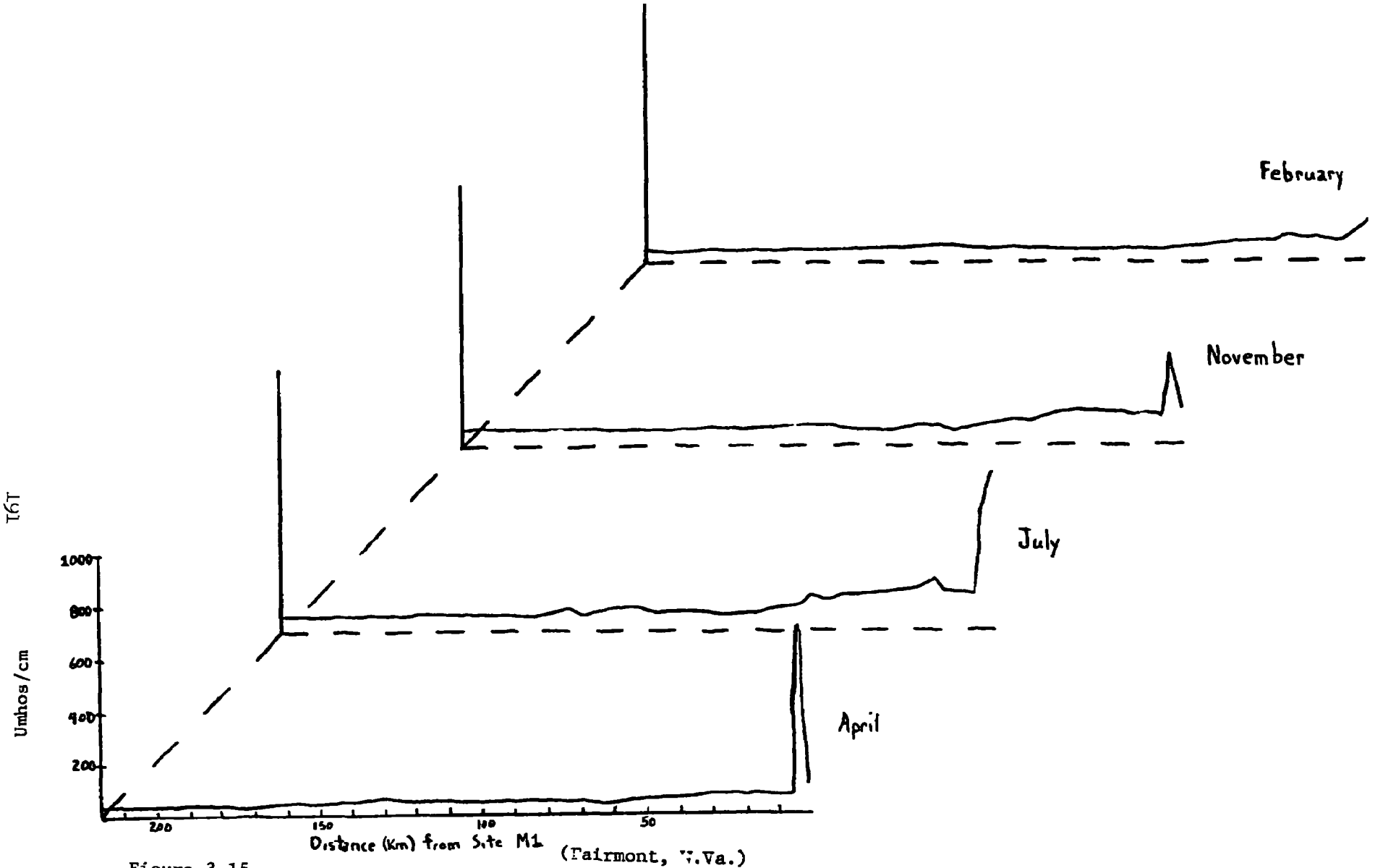


Figure 3-15
Mean Levels of Conductivity, in Umhos, Plotted at Each Site (Measured from Site M1 in Km.) on the Cheat River for all Four Sampling Dates. (Koon, 1977)

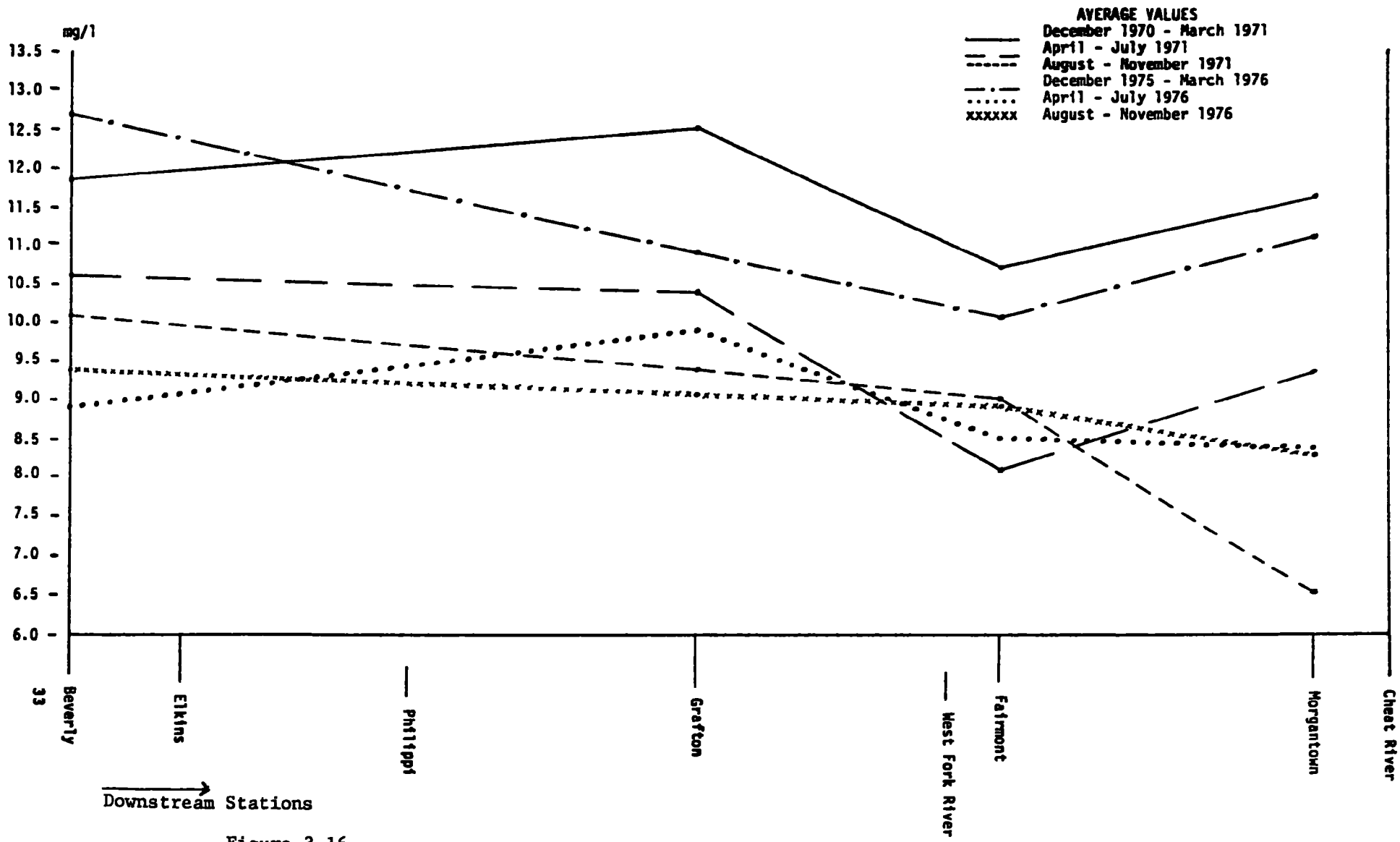


Figure 3-16
Dissolved Oxygen Values for the Monongahela River Basin - 1971 & 1976
Dept. of Natural Resources 1977

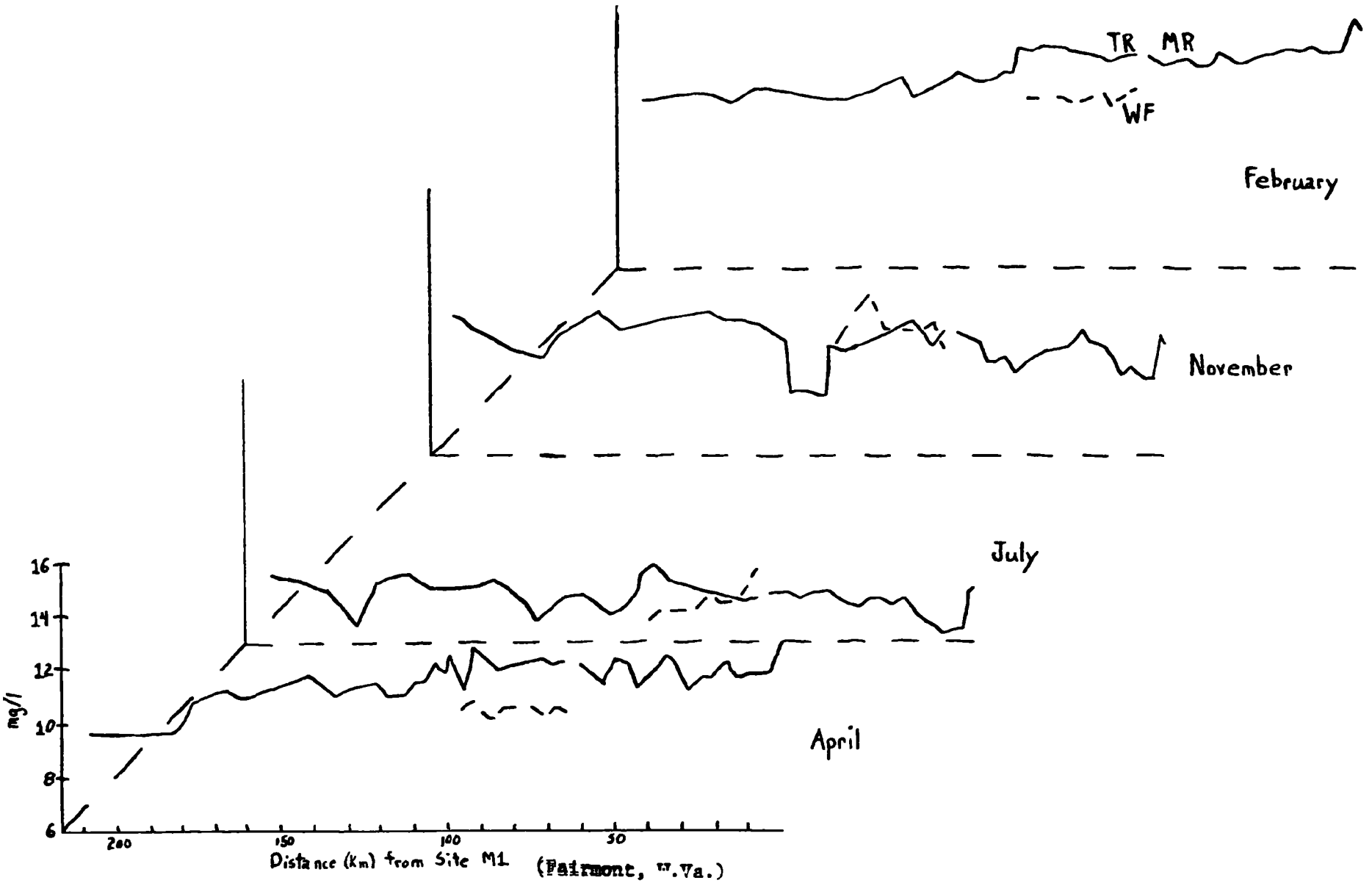


Figure 3-17
Mean Concentrations of Dissolved Oxygen, in Mg./l., Plotted at Each Site (Measured from Site M1 in Km.) on the Monongahela, Tygart Valley, and West Fork Rivers for all Four Sampling Dates (Koon, 1977).

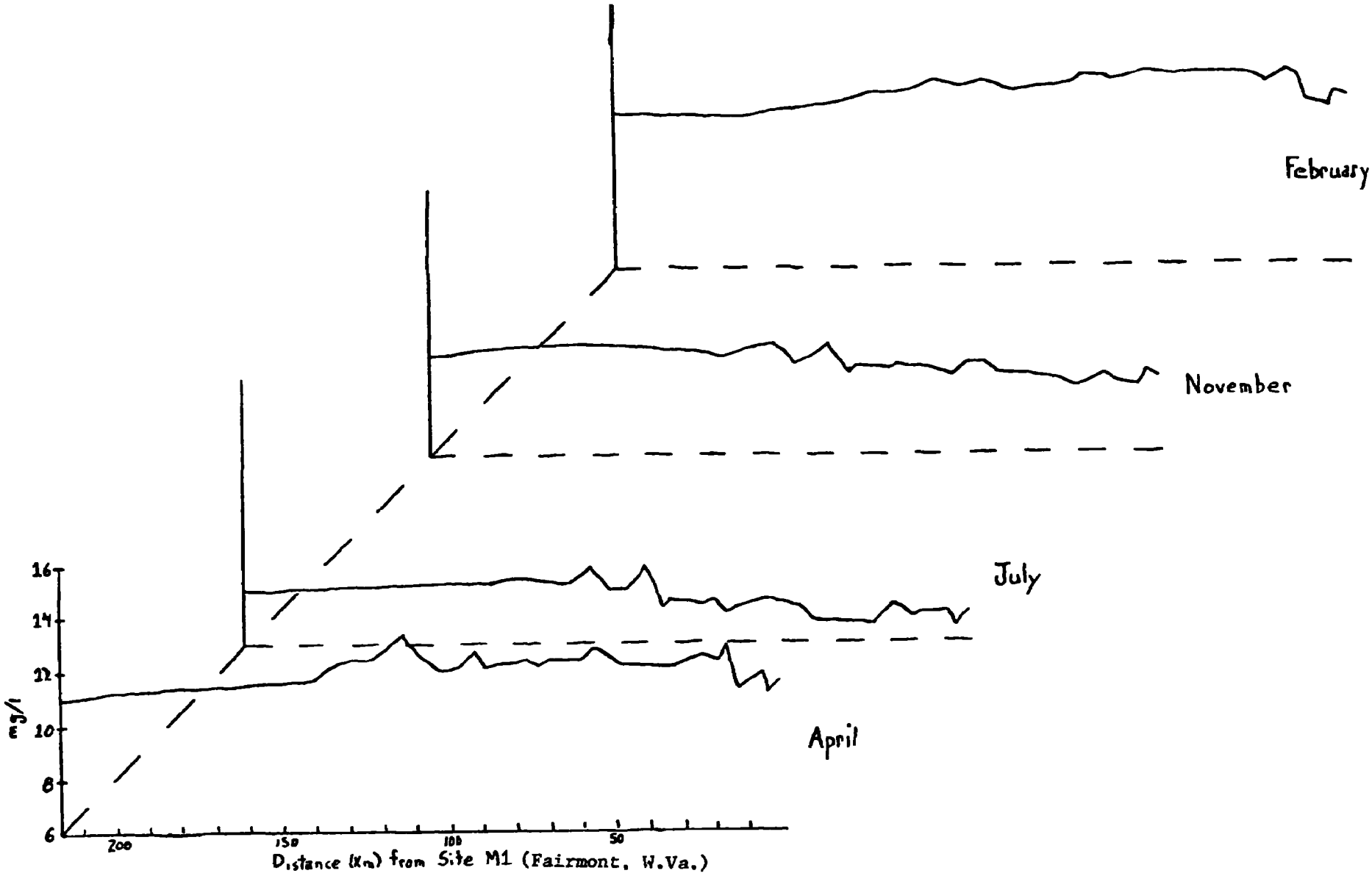


Figure 3-18
Mean Concentrations of Dissolved Oxygen, in Mg./l., Plotted at Each Site (Measured from Site M1 in Km.) on the Cheat River for All Four Sampling Dates. (Koon, 1977)

TABLE 3-49

WATER QUALITY ANALYSES FOR THE MONONGAHELA RIVER AT MORGANTOWN
1971 and 1976
(Dept. of Natural Resources 1977)

ANALYSIS (mg/l)	AVERAGE		MAXIMUM		MINIMUM	
	1971	1976	1971	1976	1971	1976
Iron	1.26	1.32	2.8	4.28	0.2	0.4
Aluminum	----	0.605	----	1.760	----	0.120
Arsenic	0.011	<0.013	0.011	0.030	0.011	<0.002
Cadmium	0.002	<0.006	0.002	0.012	0.002	<0.003
Lead	----	<0.072	----	0.100	----	0.008
Manganese	0.46	0.37	1.00	0.60	0.28	0.22
Mercury	0.0002	<0.0004	0.0004	0.0006	0.0001	<0.0002
Selenium	----	<0.002	----	0.002	----	<0.001
Silver	<0.003	0.007	<0.004	0.010	<0.002	0.005
Zinc	----	0.096	----	0.148	----	0.042
Potassium	1.37	2.81	2.60	6.60	0.70	1.50
Sodium	16.28	16.60	32.00	31.00	6.10	11.00
Fluorides	0.19	0.14	0.48	0.30	0.08	0.09
Phenols	<0.016	<0.026	0.034	0.266	<0.001	<0.001
Sulfates	143	124	300	260	85	49
Fecal Coliform (No./100 ml.)	520	1,408	1,540	8,100	100	<10

TABLE 3-50

WATER QUALITY MONITORING STATIONS OF THE MONONGAHELA RIVER BASIN

(Dept. of Natural Resources 1977)

STORET NO.	STATE NO.	LOCATION
550446	M-6	Monongahela River, 1 mile downstream from Morgantown.
550447	MC-36	Monongahela River in Fairmont.
550483	M-1-20	Dunkard Creek, 4 miles east of Blacksville.
550563	M-6-0	Scotts Run at Sec. 48 Bridge near Osage.
550565	M-8-1	Deckers Creek at St. At. 7 and 92 Bridge in Morgantown.
550568	M-22-4	Paw Paw Creek at Sec. 17 Bridge below Grant Town.
550570	M-23-2	Buffalo Creek at Sec. 250/18 in Chesapeake.
550448	MC-6	Cheat River, Route 73.
550484	MC-30	Cheat River at Albright.
550485	MC-75	Cheat River below Parsons.
550449	MC-12-14	Sandy Creek at Clifton Mills.
550450	MC-60-D-4	Blackwater River at Davis.
550486	MCS-0	Shavers Fork at Parsons.
550451	MT-11	Tygart Valley River in Grafton.
550452	MT-54	Tygart Valley River 2.1 miles upstream from Beverly.
550583	MTB-21	Buckhannon River at Sec. 119/3 Bridge near Buckhannon.
	MTB-31	Buckhannon River at Sago.
550487	MW-7	West Fork River at Enterprise.
550585	MW-4-1	Helens Run at Sec. 15/7 Bridge near Worthington.
550587	MW-13-I-3	Salems Fork at Sec. 50/6 Bridge in Bristol.
550589	MW-15-8	Simpson Creek at Sec. 24/2 (covered) Bridge.
550593	MW-23-1	Browns Creek at Sec. 25 Bridge below Mt. Clare.
550595	MW-26-3	Lost Creek at Sec. 27/4 Bridge at Rider.
550453	MY-1	Snowy Creek at Corinth.
550488	MY-2	Laurel Creek at State Line.

TABLE 3-51

LIST OF PHYTOPLANKTON SPECIES IDENTIFIED FROM THE MONONGAHELA RIVER BASIN JUNE 1975-FEB. 1975 (BOHME, 1978)

Chlorophyta

- Actinastrum hentzschii
- Actinastrum sp.
- Ankistrodesmus convolutus
- Ankistrodesmus falcatus
- Botryococcus sp.
- Carteria sp.
- Cerasterias staurastroides
- Cerasterias sp.
- Characium limneticum
- Characium sp.
- Chlamydomonas globosa
- Chlamydomonas sp.
- Chlorella sp.
- Chlorococcum sp.
- Chladophora sp.
- Closteriopsis longissima
- Closterium dianae
- Closterium sp.
- Cosmarium sp.
- Crucigenia quadrata
- Crucigenia sp.
- Gloeccystis sp.
- Kirchneriella lunaris
- Kirchneriella sp.
- Microspora sp.
- Mougeotia sp.
- Pediastrum duplex
- Pediastrum tetras
- Scenedesmus abundans
- S. armatus
- S. bernardii
- S. bijuga
- S. dimorphus
- S. obliquas
- S. quadracauda
- S. sp.
- Sorastrum americanium
- Staurastrum sp.
- Ulothrix sp.
- Westelle linraris

TABLE 3-51
CONTINUED

Euglenophyta
- Euglena sp.
- Phacus helikoides

Pyrrophyta
- Ceratium hirundinella
- Glenodinium sp.

Cryptophyta
- Chroomonas sp.
- Cryptomonas erosa
- Phacus sp.
- Trachelmonas sp.
- Gymnodinium sp.
- Peridinium sp.
- Cryptomonas sp.

Chrysophyta
- Achnanthes minutissima
- Amphiprora ornata
- Amphiprora sp.
- Amphora sp.
- Cocconeis sp.
- Cyclotella glomerata
- C. meneghiniana
- C. sp.
- Cymbella nariculiformis
- C. tamida
- C. ventricosa
- C. sp.
- Diatoma hiemale
- D. vulgare
- Dinobryon bavaricum
- D. divergens
- D. sertularia
- D. sociale
- D. sp.
- Eunotia cristae
- E. exigua
- E. pectinalis
- E. tenella
- E. sp.
- Fragilaria arcus
- Fragilaria sp.
- Frustulia vulgaris
- Gomphoneis herculana
- Gomphonema acuminatum
- G. acuminatum var coronatum
- G. angustatum
- G. constrictum
- G. olivacrum
- G. parmalum
- G. sp.
- Gyrosigma sp.
- Hantzschia amphioxys
- Melosira various
- Melosira sp.
- Meridon circulare
- Meridon circulare var constricta
- Navicula sp.
- Nitzschia commutata
- N. filiformis
- N. palea
- N. sp.
- Pinnularia globiceps
- P. mesolepta
- P. sp.
- Rhoicosphenia curvata
- Stauroneis sp.
- Surirella argusta
- S. linearis
- S. ovata
- S. saxonica
- S. sp.
- Synedra acus
- S. rumpins
- S. tabulata
- S. ulna
- S. sp.
- Tabellaria sp.
- Tribonema sp.

Cyanophyta
- Anabaena sp.
- Aphanocapsa sp.
- Chroococcus sp.
- Oscillatoria angusta
- O. splendida
- O. tenuis
- O. sp.
- Phormidium sp.
- Spirulina sp.

TABLE 3-52

PHYTOPLANKTON TAXA OBSERVED IN TYGART RIVER LAKE IN 1973 AND 1974
(CORPS OF ENGINEERS, 1976)

CHLOROPHYTA (Green Algae)

Acanthosphaera Zachariasi
Ankistrodesmus falcatus
Ankistrodesmus sp.
Arthrodesmus sp.
Chlamydomonas sp.
Closteriopsis longissima
Closterium leibleinii
Closterium venus
Closterium sp.
Coelastrum microporum
Coelastrum sphaericum
Cosmarium arculars
Cosmarium formosulums
Crucigenia fenestrata
Crucigenia irregularis
Crucigenia rectangularis
Crucigenia tetrapedia
Dictyosphaerium pulchellum
Eudorina elegans
Eremosphaera viridis
Lagerheimia citriformis
Micrasterias sp.
Mougeotia sp.
Ophiocytium biscuspidatum
Pediastrum Boryanum
Pediastrum duplex
Pediastrum obtusum
Pediastrum simplex
Scenedesmus abundans
Scenedesmus Bernardii
Scenedesmus denticulatus
Scenedesmus dimorphus
Scenedesmus opoliensis
Scenedesmus perboratus
Schroederia setigera
Selenastrum gracile
Selenastrum sp.
Spaerocystis sp.
Staurastrum gracile
Staurastrum paradoxum

TABLE 3-52

CHLOROPHYTA (Green Algae)

Acanthosphaera Zachariasi
Ankistrodesmus falcatus
Ankistrodesmus sp.
Arthrodesmus sp.
Chlamydomonas sp.
Closteriopsis longissima
Closterium leibleinii
Closterium venus
Closterium sp.
Coelastrum microporum
Coelastrum sphaericum
Cosmarium arculars
Cosmarium formosulums
Crucigenia fenestrata
Crucigenia irregularis
Crucigenia rectangularis
Crucigenia tetrapedia
Dictyosphaerium pulchellum
Eudorina elegans
Eremosphaera viridis
Lagerheimia citriformis
Micrasterias sp.
Mougeotia sp.
Ophiocytium biscuspidatum
Pediastrum Boryanum
Pediastrum duplex
Pediastrum obtusum
Pediastrum simplex
Scenedesmus abundans
Scenedesmus Bernardi
Scenedesmus denticulatus
Scenedesmus dimorphus
Scenedesmus opoliensis
Scenedesmus perboratus
Schroederia setigera
Selenastrum gracile
Selenastrum sp.
Spaerocystis sp.
Staurastrum gracile
Staurastrum paradoxum

TABLE 3-52 CONTINUED

CHLOROPHYTA (Green Algae)

Stigeoclonium sp.
Tetraedron pusillum
Tetraedron regulare
Treubaria sp.
Ulothrix variabilis

CHRYSOPHYTA (predominately diatoms)

Asterionella formosa
Cyclotella glomerata
Cyclotella meneghiniana
Cymbella sp.
Diatoma sp.
Diatomella sp.
Dinobryon sp.
Epithemia sorex
Fragilaria capucina
Fragilaria crotonensis
Fragilaria sp.
Frustulia rhomboides
Mallomonas sp.
Melosira distans
Melosira granulata
Meridion sp.
Navicula cuspidata
Navicula sp.
Pinnularia sp.
Stephanodiscus sp.
Surirella sp.
Synedra acus
Synedra fasciculata
Tabellaria sp.

EUGLENOPHYTA

Trachelomonas sp.

PYRRHOPHYTA

Ceratium hirundinella
Cryptomonas sp.
Peridinium cinctum
Peridinium inconspicuum
Peridinium limbatum

TABLE 3-52 CONTINUED

CYANOPHYTA

Anabaena sp.
Chroococcus sp.
Coelosphaerium sp.
Lyngbya sp.
Oscillatoria sp.
Spirulina sp.

In addition some flagellates, pennate diatoms, desmids and filamentous types of algae were observed in the samples which were not identified to the genus level.

A list of zooplankton taxa collected in the Monongahela River in 1975 is presented in Table 3-53. A total of 9 species was found. A similar list is presented in Table 3-54 for zooplankton found in Cheat Lake.

Benthic invertebrate data for the Monongahela (main stem), Cheat River, West Fork River, and Tygart Valley River is presented in Tables 3-55, 3-56, 3-57, and 3-58. A list of benthic invertebrate for 51 sampling locations is also presented in Table 3-59.

Fish species for the Monongahela River (main stem) are listed in Tables 3-60 and 3-61. Preston (1974) reported that 27 species of fish were found in the main stem (Table 3-60), while the West Virginia Department of Natural Resources and Environmental Protection Agency found 33 fish species present in the Monongahela (main stem) (Table 3-61). A list of fish and their relative locations in the Cheat River Basin is found in Table 3-62. Only three fish appear to be widespread throughout the basin.

Rare and Threatened Fish

The Department of Natural Resources Heritage Program considers three species of fish present within the basin to be rare or threatened. The fish and their locations are given in Table 3-63.

High Quality Streams

A list of high quality streams for the Monongahela River Basin is presented in Table 3-64. Streams are listed by sub-basins. Most of the high quality streams are found in the upper reaches of the basin.

TABLE 3-53

ZOOPLANKTON TAXA COLLECTED AT MONONGAHELA RIVER STATIONS DURING APRIL, 1975

(CORPS OF ENGINEERS, 1976)

Name of Organism	Sampling Stations[a]		
	M-1	M-2	M-3
Rotifera			
Brachionus sp.	X	X	X
Euchlanis sp.		X	
Filinia longiseta	X		
Keratella cochlearis	X	X	
Rotaria sp.			X
			X
Cladocera			
Bosmina sp.		X	
Chydorus sp.	X	X	
Copepoda			
Nauplius	X	X	X
Calanoid copepodite	X		

[a]Samples were collected at the same locations as phytoplankton samples.

TABLE 3-54

PLANKTON IDENTIFIED IN CHEAT LAKE (BIBLE, 1972)

*Taxa not observed more than twice.

Cyanophyta

- Spirulina sp.*

Chlorophyta

- Gleocystis sp.
- Tetraspora sp.*
- Kirchineriella sp.*
- Pediastrum sp.*
- Scenedesmus sp.*
- Tetrastrum sp.*
- Closterium sp.*
- Ulothrix sp.*

Chyrsophyta

- Dinobryon divergens

Pyrrophyta

- Gymnodinium sp.
- Peridinium sp.
- Ceratium sp.

Bacillariophyceae

- Tabellaria sp.*
- Synedra sp.
- Denticula sp.*
- Navicula sp.*
- Cymbella sp.

Protozoa

- Difflugia sp.*

Rotifera

- Polyarthra sp.
- Keratella cochlearis
- Brachionus cf. urceolaris
- Lecane sp.*

Cladocera

- Leptodora kindtii*
- Diaphanasoma sp.*
- Daphnia parvula
- Ceriodaphnia sp.
- Bosmina longirostris

Copepoda

- Diaptomus sp.
- Mesocylops edax
- Nauplius

TABLE 3-55

BENTHIC INVERTEBRATES OF THE MONONGAHELA RIVER MAINSTEM (PRESTON, 1972)

Caddisflies
- Hydropsychidae
- Psychomyiidae

Stoneflies
- Peilidae

Mayflies
- Baetidae
- Heptageniidae

Hellgrammites
- Corydalidae

Alderflies
- Sialidae

Biting Midges
- Cenatopogonidae

Dragonflies
- Libellulidae

Beetle Larvae
- Elmidae
- Dytiscidae
- Psephenidae

Crayfish
- Astacidae

Amphipoda

Fingernail Clams
- Sphaeriidae

Snails
- Pulmonata

Flatworms
- Planariidae

Moths
- Pyralidae

Midge Flies
- Tendipeclidae

Crane Flies
- Tipulidae

Dance Flies
- Enpididae

Leeches
- Glossiphoniidae

Aquatic Worms
- Oligochaeta

TABLE 3-56

BENTHIC INVERTEBRATES OF THE CHEAT RIVER (PRESTON, 1972)

Caddisflies
- Hydropsychidae
- Helicapsychidae
- Hydroptilidae
- Leptoceridae
- Limnephilidae
- Philopotamidae
- Psychomyiidae
- Rhyacophilidae

Stoneflies
- Nemouridae
- Perlidae
- Perlodidae

Mayflies
- Baetidae
- Ephemeridae
- Heptageniidae

Biting Midges
- Ceratopagonidae

Hellgrammites
- Corydalidae

Alderflies
- Sialidae

Gill Snails
- Etenobranchiata

Dragonflies
- Libellulidae

Beetle Larvae
- Elmidae
- Dytiscidae
- Dryopidae
- Psephenidae

Moths
- Pyralidae

Crayfish
- Aetacidae

Fingernail Clams
- Sphaesidae

Snails
- Pulmonata

Snipe Flies
- Rhagionidae

Midge Flies
- Tendipedidae

Crane Flies
- Tipulidae

Black Flies
- Simuliidae

Aquatic Worms
- Oligochaeta

TABLE 3-57

BENTHIC INVERTEBRATES OF THE WEST FORK RIVER (PRESTON, 1972)

Caddisflies
- Hydropeychidae
- Psychomyiidae
- Hydrotilidae

Stoneflies
- Nemouridae

Mayflies
- Baetidae
- Ephemeridae
- Heptageniidae

Hellgrammites
- Corydalidae

Alderflies
- Sialidae

Biting Midges
- Ceratopogonidae

Beetle Larvae
- Elmidae
- Psephenidae

Crayfish
- Astacidae

Sawbugs
- Asellidae

Fingernail Clams
- Sphaeriidae

Midge Flies
- Tendipedidae

Crane Flies
- Tipullidae

Black Flies
- Simuliidae

Aquatic Worms
- Oligochaeta

TABLE 3-58

BENTHIC INVERTEBRATES OF THE TYGART VALLEY RIVER (PRESTON, 1972)

Caddisflies
- Hydiopsychidae
- Hydroptilidae
- Philopotanidae
- Rhyacophilidae

Stoneflies
- Nemouridae
- Perlidae

Mayflies
- Raetidae
- Ephemeiidae
- Heptagenlidae

Hellgramites
- Corydalidae

Alderflies
- Sialidae

Gill Snails
- Ctenobianchiata

Dragonflies
- Libellulidae

Water Strider
- Veliidae

Beetle Larvae
- Elmidae
- Psephenidae

Crayfish
- Astacidae
- Amphipoda

Fingernail Clams
- Sphaeriidae

Snails
- Pulmonata

Horse Flies
- Tabanidae

Midge Flies
- Tendipedidae

Crane Flies
- Tipulidae

Black Flies
- Simuliidae

Aquatic Worms
- Oligochaeta

TABLE 3-59

BENTHIC INVERTEBRATES OF THE MONONGAHELA RIVER BASIN
(Army Corp of Engineers, 1976)

Aaron Creek - (Monongalia)
- Plecoptera (Stonefly)
  - Perlidae

Big Run - (Randolph)
- Plecoptera (Stonefly)
  - Pteronarcidae
  - Perlidae
- Ephemeroptera (Mayfly)
  - Ephemerellidae
  - Polymitarcidae
  - Leptophelibiidae
  - Heptageniidae

Big Sandy Creek -(Preston)
- Plecoptera (Stonefly)
  - Perlidae
- Trichoptera (Caddisfly)
  - Hydeopsychidae
  - Helicopsychidae
  - Hychoptilidae
  - Leptoceridae
  - Limnephilidae
  - Rhyacophilidae
- Ephemeroptera (Mayfly)
  - Baetidae
  - Ephemeiidae
  - Heptaginidae
- Megatoptera (Alderfly)
  - Sialidae
- Coleoptera (Beetle)
  - Elnidae
  - Dryopidae
  - Psephenidae

Big Sandy Creek - (Preston)
- Diptera
  - Tendipedidae
  - Tipulidae
- Decapoda (Crayfish)
- Sphaeriidae (Clam)

Black Fork - (Randolph)
- Megaloptera
- Sialidae (Alderfly)
- Diptera
- Tendipedidae (Midgefly)

Blackwater River - (Tucker)
- Plecoptera (Stonefly)
  - Nemouridae
  - Leuctridae
  - Perlidae
  - Megaloptera
  - Carydalidae
- Trichoptera (Caddisfly)
  - Rhyacophilidae
  - Hydropsychidae
  - Limnephilidae
  - Diptera

Booth's Creek - (Marion)
- Megaloptera
  - Carydalidae
- Diptera
  - Tendipedidae
- Trichoptera (Caddisfly)
  - Psychomyridae
  - Philopotsmidae
  - Limnephilidae
- Ephemeroptera (Mayfly)
  - Baetidae
  - Heptageniidae
- Petecypoda (Clam)
  - Sphaeriidae

Buckhannon River - (Upshur)
- Diptera
- Tendipedidae (Midgefly)
- Tipulidae (Cranefly)
- Simuliidae (Blackfly)
- Ephemeroptera (Mayfly)
  - Baetidae
  - Ephemeiidae
  - Heptageniidae
- Plecoptera (Stonefly)
  - Nemouridae
  - Perlidae
- Trichoptera (Claddisfly)
  - Hydropsychidae

Buffalo Creek - (Preston)
- Plecoptera (Stonefly)
  - Capniidae

TABLE 3-59 CONTINUED

Cheat River - (Preston)
- Plecoptera (Stonefly)
  - Capniidae
  - Nemouridae
  - Perlodidae
- Ephemeroptera (Mayfly)
  - Baetidae

Cherry Fork - (Lewis)
- Trichoptera (Caddisfly)
  - Rhyocophilidae
  - Limnephilidae
  - Lepidaslomatidae
  - Hydropsychidae
  - Philoptamidae
- Plecoptera (Stonefly)
  - Perlidae
  - Pteronarcidae
  - Ephemeroptera
  - Heptageniidae
  - Odonata
- Gomphidae (Dragonfly)

Cherry Fork - (Randolph)
- Plecoptera (Stonefly)
  - Capniidae

Dry Fork - (Randolph)
- Trichoptera (Caddisfly)
  - Hydropsychidae
  - Philopolamidae
  - Psychomoyiidae
- Ephemeroptera (Mayfly)
  - Baetidae
  - Heptageniidae
  - Megaloptera
- Carydalidae (Hellgrammite)
- Caleoptera (Beetle)
  - Elmidae
  - Psephenidae
  - Diptera
- Rhagionidae (Snipefly)
- Tendipedidae (Midgefly)
- Tipulidae (Cranefly)

Dent's Run - (Monongalia)
- Plecoptera (Stonefly)
  - Perlodidae
  - Perlidae

Deckers Creek - (Monongalia)
- Megaloptera
- Sialidae (Alderfly)
- Coleoptera (Beetle)
  - Dytiscidae
  - Diptera

Deckers Creek, cont.
- Tendipedidae (Midgefly)

Dunkard's Creek - (Monongalia)
- Trichoptera (Caddisfly)
  - Hydropsychidae
- Ephemeroptera (Mayfly)
  - Baetidae
  - Heptageniidae
  - Diptera
- Ceratopogonidae (Biting Midge)
- Tendipedidae (Midgefly)
- Empididae (Dancefly)

Elk Creek - (Harrison)
- Plecoptera (Stonefly)
  - Perlodidae
- Trichoptera (Caddisfly)
  - Hydroptilidae
- Ephemeroptera (Mayfly)
  - Baetidae
  - Megaloptera
- Sialidae (Alderfly)
- Coleoptera (Beetle)
  - Psephinidae
  - Diptera
- Tendipedidae (Midgefly)
- Tipulidae (Cranefly)

Elkwater - (Randolph)
- Plecoptera (Stonefly)
  - Capniidae

Gandy Creek - (Randolph)
- Plecoptera (Stonefly)
  - Taeneopterygidae
  - Peltopereida
- Pteronarcidae (Stonefly)
  - Pereodidae
  - Perlidae
- Ephemeroptera (Mayfly)
  - Baetiscidae

Gandy Creek - (Randolph)
- Ephemerellidae
- Heptageniidae
- Caenidae
- Megaloptera
- Corydalidae
- Trichoptera (Caddisfly)
  - Rhyacophilidae
  - Hydropsychidae
  - Hydroptilidae

Gandy Creek - (Randolph)
- Limnephilidae
- Philopotamidae

TABLE 3-59

(CONTINUED

Glady Fork - (Randolph)
- Plecoptera (Stonefly)
  - Pteronarcidae
- Ephemeroptera (Mayfly)
  - Ephemerellidae
  - Megaloptera
  - Corydalidae
- Trichoptera (Caddisfly)
  - Rhyacophilidae

Grants Branch - (Randolph)
- Trichoptera (Caddisfly)
  - Rhyacophilidae

Laurel Fork - (Randolph)
- Plecoptera (Stonefly)
  - Pteronaicidae
  - Perlodidae
  - Perlidae
- Ephemeroptera (Mayfly)
  - Ephemerelidae
  - Heptageniidae
- Trichoptera (Caddisflies)
  - Rhyacophilidae

Laurel Shoal Run - (Barbour)
- Plecoptera (Stonefly)
  - Perlidae
- Ephemeroptera (Mayfly)
  - Heptageniidae
- Trichoptera (Caddisfly)
  - Hydropsychidae
  - Limnephilidae
  - Odonata
- Aeschnidae (Dragonfly)

Leading Creek - (Lewis)
- Perladidae
- Perlidae
- Ephemeroptera (Mayfly)
  - Ephemerellidae
  - Heptageneniidae
- Trichoptera (Caddisfly)
  - Hydropsychidae

Leading Creek - (Randolph)
- Megaloptera
- Corydalidae

Little Kanawha River - (Upshur)
- Ephemeroptera (Mayfly)
  - Heptaginiidae
  - Siphlonuridas
  - Ephemiridae
- Plecoptera (Stonefly)
  - Perlidae
- Trichoptera (Caddisfly)
  - Limnephilidae
  - Megaloptus
  - Carydalidae
  - Odonata
- Cardulegasteridae (Dragonfly)

Little Sandy Creek - (Preston)
- Plecoptera (Stonefly)
  - Capniidae
  - Megaloptera
  - Corydalidae

McGee Run - (Randolph)
- Ephemeroptera (Mayfly)
  - Heptageniidae

Middle Fork - (Upshur)
- Plecoptera (Stonefly)
  - Leuchridae
  - Perlidae
  - Megaloptera
  - Corydalidae

Mill Creek - (Randolph)
- Plecoptera (Stonefly)
  - Perlidae
- Ephemeroptera (Mayfly)
  - Heptageniidae
  - Magaloptera
  - Corydalidae

Monongahela River - (Monongalia)
- Odonata
- Libellulidae (Dragonfly)
  - Diptera
- Tendipididae (Midgefly)

North Fork - (Pendleton)
- Ephemeroptera (Mayfly)
- Heptageniidae

TABLE 3-59

(CONTINUED)

Otter Creek - (Randolph)
- Plecoptera (Stonefly)
  - Pteronarcidae
  - Perlodidae
  - Perlidae
  - Peltoperlidae
- Trichoptera (Caddisfly)
  - Rhyacophilidae

Polk Creek - (Lewis)
- Trichoptera (Caddisfly)
  - Hydropsychidae
- Ephemeroptera (Mayfly)
  - Baetidae
  - Heptageniidae
- Coleoptera (Beetle)
  - Elmidae
  - Diptera
- Tendipedidae (Midgefly)
- Tipulidae (Cranefly)

Prickett's Creek - (Marion)
- Plecoptera (Stonefly)
  - Perlodidae
  - Perlidae

Red Creek - (Tucker)
- Plecoptera (Stonefly)
  - Nemouridae
  - Leuctridae
  - Pteronarcidae
  - Perlidae
  - Peltoperlidae
- Ephemeroptera (Mayfly)
  - Baetiscidae
  - Ephmmuellidae
  - Megaloptera
  - Corydabidae
- Trichoptera (Caddisfly)
  - Lepidostomatidae

Roaring Creek - (Preston)
- Plecoptera (Stonefly)
  - Pteronarcidae
  - Perlodidae

Sand Fork - (Lewis)
- Megaloptera
- Corydalidae

Seneca - (Randolph)
- Plecoptera (Stonefly)
  - Nemouridae
  - Capniidae
  - Perlodidae

Shaver's Fork - (Randolph)
- Plecoptera (Stonefly)
  - Capniidae
  - Pteronaicidae
  - Perlodidae
  - Perbidae

Shaver's Fork - (Randolph)
- Ephemeroptera (Mayfly)
  - Ephemeridae
  - Ephemerellidae
  - Polymitaricidae
  - Leptophlebiidae
  - Baetidae
  - Heptageniidae
  - Megaloptera
  - Carydalidae

Shaver's Fork - (Randolph)
- Trichoptera (Caddisfly)
  - Rhyacophilidae
  - Brachycentridae

Simpson Creek - (Harrison)
- Diptera
- Tendipedida (Midgefly)

Stony Run - (Randolph)
- Phemeroptera (Mayfly)
  - Heptageniidae

Ten-Mile Creek - (Harrison)
- Ephemeroptera (Mayfly)
  - Heptageniidae
  - Diptera
- Tendipedidae (Midgefly)

Two-Lick Creek - (Harrison)
- Megoloptera
- Carydalidae
- Sialidae (Alderfly)
- Ephemeroptera (Mayfly)
  - Heptageniidae
  - Caenidae
- Trichoptera (Caddisfly)
  - Hydropsychidae

TABLE 3-59

(CONTINUED)

Tygart Valley River - (Randolph)
- Plecoptera (Stonefly)
  - Capniidae
  - Taeniopterygidas
  - Perlodidae
  - Perbidae
  - Nemouridae
- Ephemeroptera (Mayfly)
  - Ephemerellidae
  - Polymitarcidae
  - Baetidae
  - Heptageniidae

Tygart Valley River - (Randolph)
- Siphlonuiidae
- Megaloptera
- Corydalidae
- Trichoptera (Caddisfly)
  - Rhyacophilidae
  - Hydrospychidae
  - Phryganeidae
  - Odonata
- Gomphidae (Dragonfly)

West Fork River - (Lewis)
- Ephemeroptera (Mayfly)
  - Ephemeridae
  - Heptageniidae
- Coleoptera (Beetle)
  - Diptera
- Tendipididae (Midgefly)
- Decapoda (Crayfish)
  - Isopoda
- Asellidae (Sambug)
  - Pelecypoda
  - Sphaeriidae

TABLE 3-60

FISH SPECIES OF THE MONONGAHELA RIVER (MAIN STEM)
(PRESTON, 1974)

Scientific names of fishes listed in this report:

Gizzard shad, Dorosoma cepedianum (Lesueur)

Goldfish, Carassius auratus (Linnaeus)

Carp, Cyprinus carpio (Linnaeus)

Golden shiner, Notemigonus crysoleucas (Mitchill)

Emerald shiner, Notropis atherinoides Rafinesque

Spotfin shiner, Notropis spilopterus (Cope)

Sand shiner, Notropis stramineus (Cope)

Mimic shiner, Notropis volucellus (Cope)

Bluntnose minnow, Pimephales notatus (Rafinesque)

Fathead minnow, Pimephales promelas (Rafinesque)

White sucker, Catostomus commersoni (Lacepede)

Golden redhorse, Moxostoma erythrurum (Rafinesque)

White catfish, Ictalurus catus (Linnaeus)

Yellow bullhead, Ictalurus natalis (Lesueur)

Brown bullhead, Ictalurus nebulosus (Lesueur)

Channel catfish, Ictalurus punctatus (Rafinesque)

Banded killifish, Fundulus diaphanus (Lesueur)

Rock bass, Ambloplites rupestris (Rafinesque)

Green sunfish, Lepomis cyanellus Rafinesque

Pumpkinseed sunfish, Lepomis gibbosus (Linnaeus)

Orangespotted sunfish, Lepomis humilis (Girord)

Bluegill, Lepomis macrochirus Rafinesque

Smallmouth bass, Micropterus dolomieui Lacepede

Largemouth bass, Micropterus salmoides (Lacepede)

White crappie, Pomoxis annularis Rafinesque

Black crappie, Pomoxis nigromaculatus (Lesueur)

TABLE 3-61

FISH SPECIES COLLECTED IN LOCK AREAS ON THE MONONGAHELA RIVER

Family Species	Common Name	West Virginia DNR[a]		EPA, Region III[b]	
		Opekiska Lock	Morgantown Lock	Maxwell Lock	Lock No. 2
Lepisosteidae					
Lepisosteus osseus	Longnose gar		X		
Clupeidae					
Dorosoma cepedianum	Gizzard shad			X	X
Cyprinidae					
Carassius auratus	Goldfish			X	X
Cyprinus carpio	Carp	X	X	X	X
Notemigonus crysoleucas	Golden shiner	X	X		X
Notropis atherinoides	Emerald shiner	X		X	X
Notropis spilopterus	Spotfin shiner				X
Notropis stramineus	Sand shiner			X	X
Notropis volucellus	Mimic shiner	X			X
Notropis whippelei	Steelcolor shiner	X			
Pimephales notatus	Bluntnose minnow	X	X		X
Pimephales promelas	Fathead minnow				X
Catostomidae					
Carpiodes carpio	River carpsucker	X			
Catostomus commersoni	White sucker				X
Moxostoma erythrurum	Golden redhorse			X	
Ictaluridae					
Ictalurus catus	White catfish			X	
Ictalurus natalis	Yellow bullhead	X	X		X
Ictalurus nebulosus	Brown bullhead	X	X	X	X
Ictalurus punctatus	Channel catfish	X	X	X	X

TABLE 3-61

CONTINUED

Family Species	Common Name	West Virginia DNR[a] Opekiska Lock	West Virginia DNR[a] Morgantown Lock	EPA, Region III[b] Maxwell Lock	EPA, Region III[b] Lock No. 2
Cyprinodontidae					
Fundulus diaphanus	Banded killifish				X
Centrarchidae					
Ambloplites rupestris	Rock bass			X	X
Lepomis cyanellus	Green sunfish		X	X	X
Lepomis gibbosus	Pumpkinseed	X	X	X	X
Lepomis humilis	Orangespotted sunfish			X	
Lepomis macrochirus	Bluegill	X	X	X	X
Lepomis cyanellus x *macrochirus*	Sunfish hybrid			X	
Lepomis cyanellus x *gibbosus*	Sunfish hybrid			X	
Micropterus dolomieui	Smallmouth bass		X	X	
Micropterus punctulatus	Spotted bass	X			
Micropterus salmoides	Largemouth bass	X	X	X	X
Pomoxis annularis	White crappie	X	X		
Pomoxis nigromaculatus	Black crappie	X	X	X	
Percidae					
Percina caprodes	Logperch		X		

[a]Collected by the Division of Fish and Wildlife, West Virginia Department of Natural Resources during September, 1973 (Jernejcic, 1974).

[b]Collected by the Wheeling Field Office, EPA Region III during 1967-73 (Preston, 1974).

TABLE 3-62

FISH SPECIES OF CHEAT RIVER DRAINAGE BASIN AND THEIR RELATIVE LOCATION
(CORE, 1959)

A. Wide spread
   1) white sucker
   2) hog sucker
   3) creek chub

B. Cheat Lake Area
   1) catfish
   2) carp
   3) white crappie
   4) large mouth-bass
   5) blue gills
   6) sunfish

C. South of Rowlesburg
   1) green sunfish
   2) small mouth-bass

D. South of Parsons
   1) trout
   2) rosylace minnow
   3) spottail shiner
   4) blacknose dace
   5) longnose dace
   6) darters

E. Big Sandy-Blackwater River (clean)
   1) trout
   2) sand shiner
   3) red side dace
   4) sand minnow
   5) common shiner
   6) white crappie

F. Cleans Waters of Upper Cheat Watershed
   1) redhorses
   2) trout
   3) minnows
   4) green sunfish
   5) small mouth-bass
   6) sculpins

G. Middle Tributaries
   1) stone catfish

TABLE 3-63

RARE OR THREATENED FISH SPECIES OF MONONGAHELA RIVER BASIN

(Dept. of Natural Resources - Heritage Program 1978)

Catostomus catostomus (Longnose Sucker)
Right Fork of Middle Fork of Valley River at Queens, Upshur Co.

Clinostomus elongatus (Redside Dace)
Booths Creek - near Weirton Mine, Monongahela Co.
Blackwater River - above falls, Tucker Co.
Big Sandy - above Bruceton Mills, Preston Co.
White day Creek, Marion-Taylor line

Notropus blennius (River Shiner)
Buffalo Creek near Barrackville, Marion Co.

TABLE 3-64

HIGH QUALITY STREAMS OF THE MONONGAHELA RIVER BASIN

(Department of Natural Resources 1974)

MONONGAHELA RIVER SYSTEM

Monongahela River M

Cheat River MC
- Morgan Run MC-2
  - Darnell Run MC-2-A-1
  - Blaney Hollow MC-2-B
- Quarry Run MC-6
- Big Sandy Creek MC-12
  - Little Sandy Creek MC-12-B
  - Beaver Creek MC-12-B-1
- Laurel Run MC-15
- Muddy Creek MC-17
- Roaring Creek MC-18
- Elsey Run MC-20
- Saltlick Creek MC-32
  - Spruce Fork MC-32-B
- Buffalo Creek MC-33
  - Little Buffalo Creek MC-33-D
- Wolf Creek MC-32
- Clover Run MC-51
- Horseshoe Run MC-54
  - Maxwell Run MC-54-C
- Slip Hill Mill Run MC-56
- Dry Fork MC-60
  - Black Fork (no code)
  - Elklick Run MC-60-C
  - Blackwater River MC-60-D
    - Little Blackwater River MC-60-D-8
  - Otter Creek MC-60-F
  - Glady Fork MC-60-K
    - Three Springs MC-60-K-1
    - East Fork Glady Fork MC-60-K-17
  - Big Run MC-60-L
  - Laurel Fork MC-60-N
  - Camp Five Run MC-60-N-10
  - Red Creek MC-60-O
  - Gandy Creek MC-60-T

TABLE 3-64

CONTINUED

Cheat River (Cont'd)

- Shavers Fork MCS
  - Little Black Fork MCS-13
- Dunkard Creek M-1
  - West Virginia Fork of Dunkard Creek M-1-F
- Cobun Creek M-9
- Whiteday Creek M-16
- Pricketts Creek M-10
- Paw-Paw Creek M-22
- Buffalo Creek M-23

Tygart River MT

- Wickwire Run MT-8
- Three Forks Creek MT-12
- Pleasants Creek MT-15
- Teter Creek MT-23
  - Brushy Fork MT-23-C
  - Mill Run MT-23-F
- Laurel Run MT-24
- Leading Creek MT-43
- Chenoweth Creek MT-45
- Files Creek MT-50
- Mill Creek MT-64
- Beckys Creek MT-68
- Elkwater Fork MT-74
- Stewart Run MT-75
- Big Run MT-81

- Buckhannon River MTB
  - French Creek MTB-18
  - Tenmile Creek MTB-25
  - Panther Creek MTB-27
  - Right Fork Buckhannon MTB-31
    - Left Fork Right Fork Buckhannon MTB-31-F
  - Left Fork Buckhannon MTB-32

- Middle Fork River MTM
  - Right Fork Middle Fork River MTM-21

- West Fork River MW
  - Booths Creek MW-2
  - Corbin Branch MW-2-E
  - Tenmile Creek MW-13
    - Little Tenmile Creek MW-13-B

TABLE 3-64

CONTINUED

Tygart River (cont'd)

Elk Creek MW-21
Hackers Creek MW-31
Freemans Creek MW-36
Stonecoal Creek MW-38
Right Fork MW-38-G
Skin Creek MW-46

3-A-1

A PARTIAL ANNOTATED REFERENCE LIST OF WEST VIRGINIA WATER RESOURCES (EXCLUDING THE POTOMAC RIVER DRAINAGE AREA)

Appalachian Regional Commission. 1969. Acid Mine Drainage in Appalachia. Appalachian Regional Commission. Washington, D.C.

Sources and occurrence of acid mine drainage. Abatement and control techniques. Impact of drainage on industry, navigation, recreation, and stream ecology. Data presented in tables and graphs. No water quality or biological data. Maps included. 6 references.

Baloch, M.S., E.N. Henry, and W.H. Dickerson. 1969. Stream Flow Characteristics of the Greenbrier River. Department of Natural Resources. Charleston, West Virginia

Includes basin description, flow characteristics, hydrology, availability of surface water data, and a list of stream gaging stations. Gives stream flow data in figures and tables for six stations located in the basin. Information includes maximum and minimum 1 day, 7 day, and 30 day flows. No water quality or biological data present. No references.

Baloch, M.S. 1972. Lakes of West Virginia. West Virginia Department of Natural Resources. Charleston, WV

A description of locks and dams, lakes and ponds located in West Virginia. Data includes name, county, drainage basin, location, use, surface area and owners. Brief discussions on uses and different classes in each category. Maps. No references.

Baloch, M.S., E.N. Henry and J.C. Burchinal. 1973. Comprehensive Survey of the Monongahela River Basin. Volume 1. Inventory Department of Natural Resources. Charleston, WV

Basin description with regards to topography, tributaries, climate, resources, navigation, transportation, archeological, cultural and historical aspects, economics, recreation, land use, geology, water quality and groundwater. Flow records. Maximum, minimum and average for 60's for 17 stations. Parameters varied. No biological data. Maps included. 35 references.

Baloch, M.S., E.N. Henry, and W.H. Dickerson. 1973. Streamflow Characteristics of the Monongahela River Basin. Department of Natural Resources. Charleston, WV

Includes basin description, stream gazetteer, climate, and hydrology. Drainage areas for tributaries presented. Precipitation data. Discharge data presented for 13 stations. Flow curves are presented for approximately stations. No references.

Benson, A. 1975. Investigation of Acid Mine Pollution Effects On Reservoir Fishery Populations. Completion Report Contract Number 14-16-0005-3034. Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, and U.S. Department of the Interior.

Water quality and fish data for Tygart River and Lake. Drainage area description. Surface water quality data for selected stations from the years 1960-1964. Morphometric data for Tygart Lake. Water quality data for 1967 (temperature, dissolved oxygen, pH, cold acidity, hot acidity, total iron, and hardness.) Species list and standing crop (fish) for various stations. 17 references.

Bible, J.L. 1972. An Analysis of the Plankton Community in an Acid Mine Drainage Polluted Reservoir and Two Less Acid Embayments. M.S. Thesis. West Virginia University. Morgantown, WV

Comparison of plankton communities and its relation to water quality in Cheat Lake. Phytoplankton genus list. Zooplankton species list. Zooplankton biomass data, chemical data, plankton abundance and biomass for 4 sample sites taken on 9 dates. Samples taken for alternate meters. 8 chemical parameters. Literature review. 61 references. Map.

Biesecker, J.E. and J.R. George. 1966. Stream Quality in Appalachia as Related to Coal Mine Drainage, 1965. U.S. Geological Survey. Washington, D.C.

Stream quality reconnaissance for 318 locations in May 1965. Examines influence of coal mine drainage on water quality. Maps included. Some generalized water quality data. Data for the 318 stations include discharge, pH, temperature, dissolved oxygen, acidity, aluminum, iron, manganese, bicarbonate, sulfate, chloride, phosphate, nitrate, calcium, conductivity and color. No biological data. 19 references.

Butz, B.P. et al. 1974. Ohio River Basin Cooling Study. Environmental Protection Agency. Cincinnati, Ohio.

History of the Ohio River region to include water quality, biota, and electrical power generation (history and present). Biological aspects of cooling water use. River temperature models and evaluation. Thermal plumes in the rivers. Discussions of plankton, benthic invertebrates and fish. Fish species list. 184 references.

Center for Aquatic Biology. 1972. Water Quality Study - Davis Power Project. Eastern Michigan University. Ypsilanti, Michigan.

Description of the Canaan Valley and the upper basin. Water quality sampling stations (31) and their description. 14 water quality parameters measured in two series of diurnal samples. Parameters measured every hour or every other hour. Sediment analyses. Data discussed but not present formally. Biological data collected included

phytoplankton, zooplankton, and benthic invertebrates, but was not presented. Fish population was discussed. Maps. No references.

Chang, M., R. Lee, and W.H. Dickerson. 1976. Adequacy of Hydrologic Data for Application in West Virginia. Water Research Institute. Morgantown, West Virginia.

General topography, topoclimate, snowfally, precipitation, stream flow, and water balance of West Virginia. Data presented in maps and tables. Discussion of data adequacy for each category. 84 references. Section on data sources by category.

Corbett, R.G. and W.P. Stilson. 1974. Selected Water Quality Data - Lake Lynn (Cheat Lake) West Virginia. Water Research Institute Report #2. Morgantown, WV

Monthly water quality data (9-67/1-69) for total iron, manganese, dissolved oxygen, pH, and temperature. No biological data. No references.

Core, E.L. 1959. Biological Investigations of Cheat Lake. Unpublished Manuscript. West Virginia University. Morgantown, WV

History and description of Cheat Lake. Summary of other work. Limited water quality data (historical). Phytoplankton list. Macrophyte list, zooplankton list. Check list and location of fish in basin and lake. Water pollution discussion. Maps. 10 references.

Dames & Moore. 1975. Assessment of the Impacts of PL-92500 on the Kanawha River Basin. Volume 182 (Preliminary draft). National Water Quality Commission, Washington, D.C.

An assessment of the Kanawha River Basin by dividing the basin into three main parts: Kanawha River (mainstem), New River and Elk River. Basin description. Water quantity description. Waste treatment inventory. Industrial inventory. Land use assessments. Water quality predictions using a model. Socio-economic conditions. Overviews concerning mining, non-point source pollution, construction, silviculture, and agriculture. Species lists for algae and fish. Discussion of invertebrates. No chemical data. Maps included. 75 references.

Dames & Moore. 1975. Assessment of the Impacts of PL 92-500 on the Ohio River Basin for the National Commission on Water Quality - A Baseline Overview and Recommendations for Analytical Study. National Water Quality Commission. Washington, D.C.

General overview of the entire basin to include hydrology, climatology, water quality, pollution loading, topography and historical development. Basin is divided into subbasins for analyses. Point and non-point sources of pollution. Economic and social overviews. Methodology of the model development. Water quality and biological data presented in discussion format. Maps included. 8 references.

Dames & Moore. 1975. Assessment of the Impacts of PL92-500 on the Ohio River Basin for the National Commission on Water Quality. Volume 2 (Chapters 1,2, & 3).

Cost/technology of pollution analyses of the Ohio River Basin. Inventory of major municipal direct dischargers to the Ohio River between MP 265.6 and MP 531.3. Inventories of minor municipal dischargers, major industrial and minor industrial dischargers. Land use in Ohio River sub-basins. Some water quality data relating to municipal and industrial discharges. No biological data. Maps included. 37 references.

Dames & Moore. 1975. Assessment of the Impacts of PL92-500 on the Ohio River Basin for the National Commission on Water Quality. Volume 2 (Chapter 4). National Water Quality Commission. Washington, D.C.

General basin description. Climatic and hydrologic characteristics. Description of water quantity and quality. Discussion of water quality pollutants. Flow data for various stations. Water quality data for various stations (maximum, minimum, average for 1962-1974). Projected water quality for 1983 for various chemical parameters. Fish species list and biomass data. Projected data for various abatement scenarios. Benthic invertebrate list and species diversity. Algae species list, maps included, 93 references.

Davis, J.J. 1978. Algal Assays, Chlorophyll A Concentration, and Trophic Status of Seven West Virginia Impoundments. M.S. Thesis. West Virginia University, Morgantown, WV

Morphometric data for the impoundments examined. Some chemical data to include conductivity, pH, total phosphate, nitrate and chlorophyll A. Algal assays were used to assess trophic status. Literature review. 39 references.

DePaulo, J.R. and M.S. Baloch. 1969. Comprehensive Water Resources Study of the Greenbrier River Sub-Basin. Volume I - Inventory. Department of Natural Resources. Charleston, WV

Discusses water resources and quality in the Greenbrier River Basin. Sections on hydrology, runoff, water quality, mine drainage, waste discharge and water supply. Also has stream gazetteer, basin industries, geology, land use, recreation, impoundments, dams, waste water facilities, industrial and municipal and potential sites for development. Little or no biological data. Water quality record for three years (monthly values, 60-63) for five stations. Parameters include flow, temperature, dissolved oxygen, pH, BOD, hardness, alkalinity, turidity, chlorides, TS, TDS, TSS and coliforms. Maps included. 78 references.

Doll, W.L., G. Meyer, and R.J. Archer. 1963. Water Resources of West Virginia. U.S. Geological Survey. Charleston, WV

Presents general overview and hydrology of the six main river basins

of West Virginia. Discussion includes hydrology, flood frequency, water quality, water use, ground water, geology, pollution and future water utilization. Table discussing significance of dissolved mineral constituents and properties of water. Some water quality data present for 1961 for each basin. Maps. 29 references.

Edens, D.L. 1975. A Comparative Study of Nutrients and Water Quality In Cheat Lake Tributaries. M.S. Thesis. West Virginia University. Morgantown, West Virginia.

Examines nutrient and chemical loadings of Cheat Lake by 8 tributaries. Monthly sampling from 1973 to 1974. Slope and stream profiles of tributaries. Discharge data. Chemical parameters include pH, alkalinity, acidity, iron, sulfate, conductivity, silica, phosphate and nitrate. No biological data. Literature review. Maps. 82 references.

Environmental Protection Agency. 1963. Conference on the Matter of Pollution of the Interstate Waters of the Monongahela River and its Tributaries. Volume I. Environmental Protection Agency. Washington, D.C.

Problems and assets in the Basin. Effects of acid mine drainage on water quality. Listing of wells (200 gpm) in the Monongahela River Basin. Stream gaging stations in the Monongahela River Basin. Water quality data for selected stations (1955-56). Chemical analyses of surface waters of different sub-basins. Industrial waste inventories. Public water surveyors. Active mines inventories. Maps included. No references.

Environmental Protection Agency. 1963. Conference on the Matter of Pollution of the Interstate Waters of the Monongahela River and Its Tributaries. Volume II. Environmental Protection Agency. Washington, D.C.

Some water quality data. Status of industries other than coal. Status of municipal waste treatment. Statements of 7 conferences.

Environmental Protection Agency. 1963. Conference on the Matter of Pollution of the Interstate Waters of the Monongahela River and Its Tributaries. Volume III. Environmental Protection Agency, Washington, D.C.

9 statements by conference attendees. Additional water quality data for selected stations. Inventory of industries within the Basin. Some graphs and figures pertaining to plankton and bacteria for the various sub-basins.

Environmental Protection Agency. 1971. Proceedings on the Conference in the Matter of Pollution of the Interstate Waters of the Monongahela River and its Tributaries - Pennsylvania, West Virginia, Maryland (Second Session). Environmental Protection Agency. Washington, D.C.

Characteristics of the Monongahela River Basin with regards to topo-

graphy, hydrology, geology, mining, and coal deposits. Stream quality as affected by mine drainage (includes stream length, streams affected by basin). Mine drainage source inventory and pollution control. State laws and programs. Limited water quality data by drainage basin (65-66) characteristic of the various sub-basin. No biological data. No references.

Environmental Protection Agency. 1973. Water Quality Assessment for the Kanawha River Basin (North Carolina, Virginia, West Virginia). Environmental Protection Agency. Wheeling, WV

Basin description. Sub-basin water quality situtations to include New River, Kanawha River mainstem and their tributaries. Factors affecting water quality. Water quality trends. Maps included. 6 references.

Environmental Protection Agency. 1975. Report on Bluestone Lake, Monroe County, WV. Environmental Protection Agency. Corvallis, Oregon.

Discusses nutrient sources and concentrations for Bluestone Lake. Lake basin characteristics presented. Selected chemical and physical data for 1973. Chlorophyll A values and phytoplankton list. Maps included. 6 references.

Environmenal Protection Agency. 1975. Report on Lake Lynn. Monongahela County, West Virginia. Environmental Protection Agency. Corvallis, Oregon.

Discusses nutrient sources and concentrations for Cheat Lake. Lake basin characteristics presented. Selected chemical and physical data for 1973. Chlorophyll A values and phytoplankton list. Maps included. 6 references.

Environmental Protection Agency. 1975. Report on Summersville Lake, Nicholas County, WV. Environmental Protection Agency, Corvallis, Oregon.

Discusses nutrient sources and concentrations for Summersville Lake. Lake basin characteristics presented. Selected chemical and physical data for 1973. Chlorophyll A values and phytoplankton list. Maps included. 6 references.

Environmental Protection Agency. 1975. Report on Tygart Lake, Barbour County, West Virginia. Environmental Protection Agency. Corvallis, Oregon.

Discusses nutrient sources and concentrations for Tygart Lake. Lake basin characteristics presented. Selected chemical and physical data for 1973. Chlorophyll A values and phytoplankton list. Maps included. 6 references.

Friel, E.A., B.H. Wilmoth, P.E. Ward, and J.W. Work. 1967. Water Resources of the Monongahela River Basin - West Virginia. Department of Natural Resources, Charleston, West Virginia.

Geology, topography, and drainage, climate and vegetation is presented. Surface water discharge data to include flow, channel characteristics, flood frequency, low flow and flow duration. Surface water quality includes pH, hardness, sulfate, D.O., dissolved solids, temperature and sediment. Ground water occurrence and water use is presented. Miscellaneous water quality data for early '60's is presented. No biological data. Maps included. 66 references.

Gibbs and Hill, Inc. 1974. Development of an Overall Economic/Environmental Plan for the Monongahela River Basin. Appalachian Regional Commission. Washington, D.C.

Evaluation of the economic development impact of acid mine drainage and other pollution abatement problems. Discusses water and air pollution in the Monongahela River Basin. Gives state water quality standards. Some water chemistry data to include acidity and acid load for different streams. Land problems. Air quality in relation to power plants, heating, transportation and coal refuse piles. No biological data. Maps included. 111 references.

Gorman, J.W. 1957. An Annual Twenty-Four Hour Limnological Study of Cheat Reservoir. Monongalia County, West Virginia. M.S. Thesis. West Virginia University. Morgantown, WV

Monthly diurnal determinations for temperature, dissolved oxygen, pH and alkalinity during Nov. 1955-Oct. 1956. Data presented in figures. Tributary discussion. 22 references. No biological data.

Hegener, W.D. 1967. An Evaluation of Primary Productivity In the Monongahela River. M.S. Thesis. West Virginia University. Morgantown, WV.

Examines rate of primary productivity and how sewage and acid mine drainage affects it. Limited chemical data to include dissolved oxygen (daily depth profile - 12 hours for two days), acidity, PO_4, NO_3, pH, temperature, and secchi disk reading. Primary production rate. No biological data. No maps. 13 references.

Koon, J.M. 1977, Chemical Water Quality of the Monongahela River Basin in West Virginia (1974-1975). M.S. Thesis. West Virginia University. Morgantown, WV

Basin description. Literature review. Quaterly water quality data from 85 sites in the Monongahela River Basin. Includes statistical analyses for 19 chemical parameters. Identifies similar areas within the basin and compares results to past studies. Data presented in figures. No biological data. Maps included. 53 references.

Mathes, Jr., M.V. 1977. Drainage Areas of the Guyandotte River Basin, West Virginia. U.S. Geological Survey Open-File Report 77-801. Charleston, WV.

Report lists in tabular form 435 drainage areas of the Guyandotte River.

Data includes stream, site, drainage area, river mile, county, quadrangle, latitude and longitude. No references.

Meta Systems, Inc. 1969. A Program For Simulation of Acid Mine Drainage In A River Basin. Appalachian Regional Commission. Washington, D.C.

Model to evaluate acid mine drainage and pollution abatement in the Monongahela River Basin. The model considers streamflows, waste loads, stream standards, and other relevant data. No biological data. Maps included. No references.

Michael Baker, Jr. Inc. 1975. Investigation of Mining Related Pollution Reduction Activities and Economic Incentives in the Monongahela River Basin. Appalachian Regional Commission, Washington, D.C.

Economic potential for coal waste utilization. Prospects of reclaiming and revegetating mined lands. Inventory of coal refuse banks. Location of limestone mining operations in the Monongahela River Basin. No water quality or biological data. Some water quality data from mine pumps. 297 references.

Ohio River Basin Commission. 1975. Monongahela River Basin Water and Related Land Resources Study Report and Environmental Impact Statement - Maryland, West Virginia, Pennsylvania. Ohio River Basin Commission. Cincinnati, Ohio.

Environmental and economic studies and summaries. Recommended plans for flood control, water supply, power, historic, recreation, transportation, and water quality. Basin description and maps. Land use assessment. Selected stream flow data. Major industrial and municipal dischargers. Active mine dischargers. Maps. No biological data or references.

Preston, H.R. 1972. Benthic Biology - Monongahela River Basin - Pennsylvania, West Virginia, Maryland. Federal Water Pollution Control Administration. Wheeling Field Station. Wheeling, WV.

Brief basin description. 225 sampling stations located in the four main drainage areas of the Monongahela River Basin. Station descriptions with benthic fauna predominance. Percentage composition for tolerance groups for the subbasins. Family list. No water quality data. Maps included. No references.

Preston, H.R. 1974. Fish Population Studies of the Monongahela River. Environmental Protection Agency. Wheeling, WV.

A report dealing with fish population studies of the Monongahela River. Results evaluated in relation to water quality. Sampling summaries for Maxwell Lock and Lock #2 (number of fish, weight and number of species). Species list. 12 references.

Robinson, J.M. 1977. The Water Quality of The Monongahela River Basin in West Virginia (1974-1976). M.S. Thesis. West Virginia University. Morgantown, WV.

Statistical analyses of 27 chemical and physical parameters for the years 1974-1976. Chemically similar areas are presented. Chemical factors which affect general water quality. Effect of season on water quality. Relationships among chemical and physical parameters. 54 references.

Sack, W.A., C.R. Jenkins, B.R. Chambers, and R.W. Lange. 1976. Modeling of Acid Mine Drainage and Other Pollutants in the Monongahela River Basin Under Low Flow Conditions. Department of Natural Resources. Charleston, West Virginia.

General basin and subbasin description. Predicted water quality for 20 drainage areas. Water quality model and calibration for the Basin. No water quality or biological data. Maps and figures included. 15 references.

Schwartz, F.J. 1957. The Cheat River Basin - Past, Present, and Future. Unpublished Report. West Virginia University. Morgantown, WV.

Discussion of Cheat River Basin - past and present. Includes precipitation, discharge, floods, climate, soils, geology, and water utilization. Water quality data to include annual 24 hour cycles for several stations. Parameters include pH, oxygen, per cent saturation, and temperature. Some data on sedimentation rate. Light data. Fish species list and composition. No maps. 239 references.

Sotak, M.J. 1968. Fish Distribution and Acid Mine Pollution in the Monongahela River Main Stem of West Virginia. M.S. Thesis. West Virginia University, Morgantown, WV.

Study of fish distribution and water quality for a 29 mile section of the Monongahela River in 1965-66. Parameters included pH, acidity, hardness, iron, turbidity, and temperature. Water quality data. Fish distribution data. Chemical data expressed as ranges. No maps or other biological data. Seasonal comparisons. 15 references.

Tarter, D.C. 1976. Limnology in West Virginia. Marshall University. Huntington, WV.

Benthic invertebrate keys and species lists. County distribution of benthic genera and families. Maps included. Fish species list. No water quality data. Over 100 references. Good benthic invertebrate data.

Taylor, W.W. 1975. Zooplankton, Zoobenthos, and Brook Silverside Food in Moncove Lake, West Virginia. M.S. Thesis. West Virginia University. Morgantown, WV.

Lake description. Statistical comparison of biological data. Literature review. Benthic organisms and their numbers. Seasonal changes for certain organisms. Stomach analyses of Brook Silversides. No water quality data. 59 references.

Tsai, J.C.H. and J.C. Burchinal. 1963. An Annotated Bibliography of Water Resource Papers Pertaining to the State of West Virginia. West Virginia Center for Appalachian Studies. West Virginia University.

An updated bibliography concerning water resources in West Virginia. It contains 645 references or that material published prior to April, 1962. 21 different bibliographic lists were used in the preparation of this publication.

U.S. Army Corps of Engineers. 1966. Ohio River Comprehensive Survey. Appendix C. Hydrology. U.S. Army Corps of Engineers. Cincinnati, Ohio.

Basin description. Climate and meteorology. Hydrology to include gaging stations, runoff (average annual, maximum and average daily), floods of record, low flow, stream regulation and surface water availability. Sedimentation data. Data presented for basin in Table and graph forms. 34 references.

U.S. Army Corps of Engineers. 1966. Ohio River Basin Comprehensive Survey. Appendix G. Fish and Wildlife Resources. U.S. Army Corps of Engineers. Cincinnati, Ohio.

Basin description to include topography, geography, geology, climate, hydrology, industry, and population. Basin fish and wildlife populations and resources to include fisheries (stream, reservoir, pond and lake), commercial fisheries, farm and forest game, furbearers, and migratory birds. Projected demands for hunting and fishing. No references.

U.S. Army Corps of Engineers. 1966. Ohio River Basin Comprehensive Survey. Appendix H. Outdoor Recreation. U.S. Army Corps of Engineers. Cincinnati, Ohio.

Provides recreation inventories including federal, state, and local areas for those states located within the Basin. Projected recreation demands for future years. Evaluations done by sub-basins. No water quality or biological data. Inventory includes aquatic recreation areas. Maps included. No references.

U.S. Army Corps of Engineers. 1966. Ohio River Base Comprehensive Survey. Appendix I - Electric Power. U.S. Army Corps of Engineers. Cincinnati, OH.

Description of power market and its requirements. Future capacity and

underdeveloped hydroelectric sources. Water requirements for electric generation. Stream flow for selected locations. Location of utility plants within the basin. Maps included. No water quality data or references.

U.S. Army Engineer Division. 1967. Ohio River Basin Comprehensive Survey - Appendix D: Water Supply and Water Pollution Control. Federal Water Pollution Control Administration. Cincinnati, Ohio.

General summary description of the Ohio River Basin to include economy, water requirements, and water quality control. Water quality control discussed in terms of muncipal and industrial wastes, acid mine drainage, chloride pollution, fish kills, heat pollution and corrective measures. Discusses 13 sub-basins individually. Maps included. References as footnotes.

U.S. Army Corps of Engineers. 1968. Ohio River Basin. Comprehensive Survey. Appendix M - Flood Control. U.S. Army Corps of Engineers. Cincinnati, Ohio.

Description of flood control and solutions for the Ohio River Basin. Basin is broken down into 22 subbasins with a description of flood control problems for each. Inventory of flood damage data and flood damage methodology. Maps. No references.

U.S. Army Corps of Engineers. 1968. Ohio River Basin Comprehensive Survey. Appendix E - Groundwater. U.S. Army Corps of Engineers. Cincinnati, Ohio.

Hydrogeologic and physiographic setting of the Basin. General ground water characteristics. Use and management of groundwater resources. Reports on 12 sub-basin drainage areas to include hydrologic and chemical characteristics. No water quality or biological data. Maps included for each sub-basin. 164 references.

U.S. Army Corps of Engineers. 1968. Ohio River Basin Comprehensive Study. Appendix K: Development Program Formulation. U.S. Army Corps of Engineers. Cincinnati, Ohio.

Development program with regards to streamflow control, hydroelectric power, navigation, outdoor recreation, sport fishing, hunting and land resources. Development program done by sub-basins. Tables with watersheds and their storage capacities. Maps included. No water quality and biological data. No references.

U.S. Army Corps of Engineers. 1968. Ohio River Basin Comprehensive Survey. Appendix L: Navigation. U.S. Army Corps of Engineers. Cincinnati, Ohio.

Development of the Ohio River Basin navigational system. Present

development of selected sub-basins. Demands for water transportation for selected sub-basins. Problems and potential solutions. Freight transportation data. Coal shipments. Development plans. Maps. No references. No water quality data.

U.S. Army Corps of Engineers. 1969. Development of Water Resources in Appalachia. Appendix C. The Incidence and Formation of Mine Drainage Pollution. U.S. Army Corps of Engineers. Cincinnati, Ohio.

Discussion of incidence and formation of acid mine drainage. Acid mine drainage examined in major river sub-basins in Appalachia. Water quality data to include flow and 7 chemical parameters for several stations in each sub-basin. Maps included. No biological data. 64 references. Also contains an annotated bibliography (67 references). Contains another 174 references.

U.S. Army Corps of Engineers. 1971. Final Environmental Statement - Burnsville Lake, Little Kanawha River, West Virginia. U.S. Army Corps of Engineers. Huntington, WV.

Comments to draft impact statement to construct a dam on the Little Kanawha. No water quality or biological data. No references. No maps.

U.S. Army Corps of Engineers. 1971. Stonewall Jackson Lake - West Fork River, West Virginia - Final Environmental Statement. U.S. Army Corps of Engineers. Pittsburgh, PA.

Environmental setting and environmental impact of the area. Some flow data. No water quality or biological data. Terrestrial data. Mainly comments of the draft statement.

U.S. Army Corps of Engineers. 1972. Final Environmental Statement - Willow Island Locks and Dam, Ohio River, Ohio and West Virginia. U.S. Army Corps of Engineers. Huntington, WV

Comments to the draft impact statement. Some temperature data. Pollution impacts. No water quality or biological data. No references. Maps.

U.S. Army Corps of Engineers. 1975. An Evaluation of the Effects of Mainstem Navigation Dams on the Water Quality of the Upper Ohio River. U.S. Army Corps of Engineers. Pittsburgh, PA.

Evaluates the effect of Ohio River Basin navigational dams on water quality (especially D.O.). A total of 21 chemical and physical parameters were monitored. Phytoplankton and chlorophyll also included. Summary table of chemical parameters for six months (1974) giving mean, maximum and minimum. Fish species list. Phytoplankton data discussed. Graphs. Map and description of each Lock and Dam structure. 15 references.

U.S. Army Corps of Engineers. 1975. Monongahela River (Pennsylvania and West Virginia) - Draft Environmental Statement On The Operation and Maintenance of the Navigation System. U.S. Army Corps of Engineers. Pittsburgh, PA

Project description for 9 locks. Hydrology to include basin characteristics, streamflow, water use, groundwater characteristics and quality. Water quality. Aquatic biology to include plankton, macrophytes, invertebrates and fish, climatology, soils, vegetation, wildlife, geology, socio-economic characteristics. Archaeological and historical characteristics. Flow data. Ground water quality data. Storet water quality data. Species lists for wildlife, fish, birds, plankton, macrophytes, and benthic invertebrates. Some density measurements for benthic invertebrates and birds. Sediment analysis for selected areas. Maps included. 158 references.

U.S. Army Corps of Engineers. 1975. Monongahela River - Final Environmental Statement on the Operation and Maintenance of the Navigation System. U.S. Army Corps of Engineers. Pittsburgh, PA.

Discussion of navigational system, existing environmental setting to include water quality, aquatic ecology, hydrology, geology, terrestrial ecology, soils, socio-economic characteristics and archaeological characteristics. Environmental impact of proposed actions and also alternatives to proposed actions. Discharge data. Sediment analyses. Zooplankton species list. Phytoplankton generic list. Heavy metals data. Some water quality data. Fish species list. Maps included. 190 references.

U.S. Army Corps of Engineers. 1976. Monongahela River Navigation Projects Annual Water Quality Report - 1976. U.S. Army Corps of Engineers. Pittsburgh, PA.

Description of the basin. Recommendations for new and existing projects. Pertinent data and maps of navigational projects. Discussion of 17 chemical and physical parameters and 3 biological parameters. Some chemical data for 10 parameters. Results of 1975 sediment sampling. Species lists for phytoplankton, aquatic macrophytes, and fish. 25 references.

U.S. Army Corps of Engineers. 1976. Tygart River Lake Water Quality Report. U.S. Army Corps of Engineers. Pittsburgh, PA.

General characterization of Tygart River Lake. Tygart River Basin description. Discusses water quality through tables and figures. Evaluations of thermal characteristics, dissolved oxygen, acid mine drainage, and heavy metals. Some water quality data for 9 chemical parameters (73-74). Phytoplankton species list. Some discussion of macroinvertebrates and fish. Maps included. 12 references.

U.S. Army Corps of Engineers and Marshall University. 1976. West Virginia Benthological Survey. U.S. Army Corps of Engineers. Huntington, WV.

Basin descriptions and maps for the major river basins of West Virginia. Summary data for benthic invertebrates and their locations. Maps included. No water quality data. 39 references.

U.S. Army Corps of Engineers. 1977. Water Resources Development in West Virginia - 1977. U.S. Army Corps of Engineers. Cincinnati, Ohio

Water resources planning and development in West Virginia. Project list by basins. Maps included. No water quality and biological data. No references.

U.S. Geological Survey. 1968. Water Resources Data for West Virginia - 1967. U.S. Geological Survey. Charleston, WV.

Discharge data for 108 gaging stations in West Virginia for 1967. Data includes location, drainage area, average discharge, extremes and daily discharge records for Oct. 1966-Sept. 1967. Also includes chemical and physical data for 17 sampling stations. No biological data. No references.

U.S. Geological Survey. 1969. Water Resources Data for West Virginia - 1968. U.S. Geological Survey. Charleston, WV.

Discharge data for 108 gaging stations in West Virginia for 1968. Data includes location, drainage area, average discharges, extremes and daily discharge records for Oct. 1967-Sept. 1968. Also includes some chemical and physical data for 24 sampling stations. No biological data. No references.

U.S. Geological Survey. 1973. Water Resources Data for West Virginia. U.S. Geological Survey. Charleston, WV.

Discharge records for 126 gaging stations located throughout West Virginia (includes daily discharge, average discharge, drainage area, location and extremes.) Water quality data for selected stations. No biological data. Map of stations included. No references.

U.S. Geological Survey. 1977. Water Resources Data for West Virginia - Water Year 1976. U.S. Geological Survey. Charleston, WV.

Discharge records for 125 gaging stations (daily records). Water quality to include temperature, pH, conductivity, dissolved oxygen and suspended solids for 44 gaging stations. Other water quality data for selected stations. Ground water data for the counties. Maps included. Biological data include species lists for selected stations (also some chlorophyll data). Records also include drainage areas, average flows and extremes for the period of record. No references.

U.S. Soil Conservation Service. 1976. West Virginia Watershed Progress Report. U.S. Soil Conservation Service. Morgantown, WV.

Summary and status of watershed modifications for the state of West Virginia in 1975. Brief description for each watershed which includes location, size, sponsor, problem, land treatment and structure measures. No water quality or biological data.

Volkmar, R.D. 1972. Phytoplankton Primary Production in Cheat Lake. M.S. Thesis. West Virginia University. Morgantown, WV.

Examines the influence of mineral activity on primary production in Cheat Lake. Chemical data for three stations. 6 chemical parameters measured at various depths. Temperature, light and primary productivity profiles for the different stations. No other biological data besides productivity. Literature review. 44 references.

West Virginia Department of Natural Resources. 1969. New River Flow Study. Department of Natural Resources. Charleston, WV

Examines New River flow from Bluestone Reservoir to Sandstone Falls and its relationship to recreation. Discharge data. No water quality data. Benthic invertebrate listing and count data. Benthic invertebrate listing and count data. Benthic invertebrate drift data. No other biological data. No maps. 1 reference.

West Virginia Department of Natural Resources. 1971 West Virginia Water Quality Network - 1967. W. Va. Department of Natural Resources. Charleston, West Virginia.

Bimonthly water quality data for 64 sampling stations are presented. Data only encompasses the latter part of the year (July-December, 1967) and is only one sample per station. Parameters include appearance, D.O., B.O.D., acidity, alkalinity, chlorides, pH, coliform, color, conductivity, hardness, flourides, iron, lead, nitrates, phenol, potassium, sodium, temperature, TDS, TSS, sulfates, odor, turbidity, and per cent saturation of D.O. No biological data. No references.

West Virginia Department of Natural Resources, 1973. Comprehensive Survey of the Greenbrier River Basin. Volume II. Economic Base Study. W.Va. Department of Natural Resources. Charleston, West Virginia.

Basin description, land use assessments in relation to forestry and agriculture, general discussion of water resources developments and recreational resources. No water quality or biological data. 34 references.

West Virginia Department of Natural Resources. 1974. Economic Base Study of the Monongahela River. Volume II-B. West Virginia Department of Natural Resources. Charleston, WV.

General basin description. Basin economy structure. Selected population characteristics. Employment by counties. Agriculture-Forestry. Land use. Mining and manufacturing. No water quality or biological data. 32 references. Maps included.

West Virginia Department of Natural Resources. 1974. Economic Base Study of the Monongahela River. Volume II-B. West Virginia Department of Natural Resources. Charleston, WV.

General basin description. Basin economy structure. Selected population characteristics. Employment by counties. Agriculture-Forestry. Land use. Mining and manufacturing. No water quality or biological data; 32 references; maps included.

West Virginia Department of Natural Resources. 1974. West Virginia High Quality Streams. West Virginia Department of Natural Resources. Charleston, WV.

Listing of high quality streams by basin and sub-basin and also by county. Listing of county game and fish biologists. Quality stream criteria. Addresses of Soil Conservation Service District Conservationists.

West Virginia Department of Natural Resources. 1975. Basin Water Quality Management Plan for the Kanawha River Basin. West Virginia Department of Natural Resources. Charleston, WV.

Basin description. Segment listing. Municipal and industrial discharge inventories. NPDES permits. Land use policies and non-point pollution. Maps included. Some storet data regarding water quality violations. No biological data. No references.

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Big Sandy-Tug Fork River Basin. W.Va. Department of Natural Resources. Charleston, WV.

Includes basin description, water quality problems, municipal discharge impacts, industrial discharge inventories, NPDES permits, land use assessments and non-point pollution assessments. Monitoring stations are listed for the basin. Tributaries are broken down into problem segments. Limited water quality data (only water quality violations for the period of 71-74). No biological data. Maps included. No references.

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Guyandotte River Basin. W. Va. Department of Natural Resources. Charleston, WV.

Includes basin description, water quality problems, municipal discharge impacts, industrial discharge inventories, NPDES permits, land use assessments and non-point pollution. Monitoring stations are listed

for the basin. Tributaries are broken down into problem segments. Limited water quality data (only water quality violations for the period of 71-74 are given). No biological data. Maps included. No references.

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Little Kanawha River Basin. W. Va. Department of Natural Resources. Charleston, WV.

Gives general overview of the Basin, municipal discharge impacts, industrial discharge inventories, land use policies, NPDES permits, non-point pollution, and monitoring and surveillance activities. Water quality data limited to violations of state standards for '71-'74. No biological data. Tributaries broken down into problem segments. Maps included. No references.

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Monongahela River Basin. West Virginia Department of Natural Resources. Charleston, WV.

General basin description and overview. Water quality violations (70-74). Municipal and industrial discharge inventories. NPDES permits. Land use policies. Non-point pollution. 201 & 208 plans. Monitoring plans. Stream segment analysis. Maps included. Some storet data on water quality violations. No general water quality data and no biological data. No references.

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Ohio River Basin. W. Va. Department of Natural Resources. Charleston, WV.

General basin description. Segment listing with pollutants and water quality violations. Municipal discharge inventory and impact. Industrial discharge inventory and impact. NPDES permits and data. Land use assessments. Non-point pollution. Maps included. Limited water quality data. No biological data.

West Virginia Department of Natural Resources. 1976. Comprehensive Survey of the Monongahela River. Volume III. Problems, Needs, and Alternative Solutions. W. Va. Department of Natural Resources. Charleston, WV.

Basin description with brief discussions on hydrology, mineral resources, land use, water resources and fish and wildlife resources. Problems such as erosion, acid mine drainage, sewage, floodwater damage, water distribution and supply are discussed in greater detail. Present and future needs and potentials and alternative solutions are discussed. No water quality data. No biological data. Data covering water storage and potential of different watersheds is included. Maps.

West Virginia Department of Natural Resources. 1976. Comprehensive Survey of the Monongahela River Basin. Volume IV: Selected Plan Elements. W. Va. Department of Natural Resources. Charleston, WV.

Presents selected plan elements and recommends programs, projects and measures. Description of the basin. Section on natural and scenic resources. Also section on unresolved conflicts. Data presented in tables. No water quality or biological data. Map included. No references.

West Virginia Department of Natural Resources. 1977. Basin Water Quality Management Plan for the Monongahela River Basin. W. Va. Department of Natural Resources. Charleston, WV.

Addendum to plan published in 1976. Report on the public hearing held in Morgantown, West Virginia, June 24, 1976. No water quality or biological data. No references.

West Virginia Department of Natural Resources. 1977. West Virginia Water Quality Status Assessment 1971-1976. W. Va. Department of Natural Resources. Charleston, WV.

General description of seven main drainage basins in West Virginia. Water quality data average for '71 and '76 for one station per drainage basin. Graphs for conductivity, dissolved oxygen, pH, suspended solids, nitrate-nitrogen, biochemical oxygen demand and total coliforms. General basin problems (also reported fish kills). West Virginia water quality stations. Stream gazateer. Streams affected by acid mine drainage. Limited water quality data. No biological data except for Ohio River fish data (species, numbers and biomass for lock areas). 12 references.

Wheeling Field Station. 1968. Stream Pollution by Coal Mine Drainage - Upper Ohio River Basin. Federal Water Pollution Control Administration. Wheeling Field Station. Wheeling, WV.

History of acid mine drainage. Formation and chemistry of acid mine drainage. Abatement measures. Mine drainage problems in the Allegheny River, Monongahela River, Beaver River, Muskingum River, Hocking River, Little Kanawha River, Kanawha River, Scioto River, Guyandotte River, Big Sandy River and Ohio River (Mainstem). Maps included. Some water quality data for the forementioned basins. No biological data. 25 references.

Wojcik, B. and L. Butler. 1977. Aquatic Insects as Indicators of Stream Environmental Quality in Northern West Virginia. West Virginia University Agricultural and Forestry Experiment Station Bulletin 653T. Morgantown, West Virginia.

Survey of 17 stations on 9 northern West Virginia streams during June 1972-May 1973. Chemical and physical data to include pH, total iron, total acid, hardness and velocity (means and standard deviations

for year). Qualitative and quantitative data for aquatic insects. Environmental categories and indicator insects. 15 references.

AQUATIC ECOLOGY REFERENCES

Appalachian Regional Commission. 1969. Acid Mine Drainage in Appalachia. Appalachian Regional Comission. Washington, D. C.

Bible, J. L. 1972. An Analysis of the Plankton Community in an Acid Mine Drainage Polluted Reservoir and Two Less Acid Embayments. M.S. Thesis, West Virginia University, Morgantown, WV

Bohme, L. 1978. Phytoplankton of the Monongahela River Basin - West Virginia. In Preparation. West Virginia University, Morgantown, West Virginia.

Core, E. L. 1959. Biological Investigations of Cheat Lake. Unpublished Manuscript. West Virginia University, Morgantown, WV

Dames & Moore. 1975. Assessment of the Impacts of PL 92-500 on the Kanawha River Basin. Volume 182 (Preliminary Draft). National Water Quality Commission. Washington, D.C.

Doll, W. L., G. Meyer, and R. J. Archer. 1963. Water Resources of West Virginia. U.S. Geological Survey. Charleston, WV

Koon, J. M. 1977. Chemical Water Quality of the Monongahela River Basin in West Virginia (1974-1975). M.S. Thesis. West Virginia University, Morgantown, WV

Preston, H. R. 1972. Benthic Biology - Monongahela River Basin - Pennsylvania, West Virginia, Maryland. Federal Water Pollution Control Administration. Wheeling Field Station. Wheeling, WV

Preston, H. R. 1974. Fish Population Studies of the Monongahela River. Environmental Protection Agency. Wheeling, WV

Tartar, D. C. 1975. Limnology in West Virginia. Marshall University. Huntington, WV

U.S. Army Corps of Engineers. 1975. Monongahela River (Pennsylvania and West Virginia) - Draft Environmental Statement on the Operation and Maintenance of the Navigation System. U.S. Army Corps of Engineers. Pittsburgh, PA

U.S. Army Corps of Engineers. 1976. Tygart Lake Water Quality Report. U.S. Army Corps of Engineers. Pittsburgh, PA

U.S. Army Corps of Engineers and Marshall University. 1976. West Virginia Benthological Survey. U.S. Army Corps of Engineers. Huntington, WV

U.S. Geological Survey. 1977. Water Resources Data for West Virginia - Water Year 1976. U.S. Geological Survey. Charleston, WV

West Virginia Department of Natural Resources. 1974. Comprehensive Survey of of the Little Kanawha River Basin. Volume I - Inventory. W. Va. Department of Natural Resources. Charleston, WV

West Virginia Department of Natural Resources. 1974. West Virginia High Quality Streams. W. Va. Department of Natural Resources. Charleston, WV

West Virginia Department of Natural Resources. 1975. Basin Water Quality Management Plan for the Kanawha River Basin. W. Va. Department of Natural Resources. Charleston, WV

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Big Sandy-Tug Fork River Basin. W. Va. Department of Natural Resources. Charleston, WV

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Guyandotte River Basin. W. Va. Department of Natural Resources. Charleston, WV

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Little Kanawha River Basin. W. Va. Department of Natural Resources. Charleston, WV

West Virginia Department of Natural Resources. 1976. Basin Water Quality Management Plan for the Monongahela River Basin. W. Va. Department of Natural Resources. Charleston, WV

West Virginia Department of Natural Resources. 1977. West Virginia Water Quality Status Assessment 1971-1976. W. Va. Department of Natural Resources. Charleston, WV

West Virginia Department of Natural Resources-Heritage Program. 1978. Endangered or Threatened Fish Species and Their Locations. Unpublished data. DNR-Heritage Program. Charleston, WV.

WEST VIRGINIA WATER QUALITY STANDARDS[1]

Parameter	Standard
Arsenic	0.01 mg/l
Barium	0.50 mg/l
Cadnium	0.01 mg/l
Chlorides	100 mg/l
Chromium (Hexavalent)	0.05 mg/l
Coliform[2]	1000
Cyanide	0.025 mg/l
Dissolved Oxygen[3]	5.0 mg/l
Fecal Coliform[4]	200
Fluorides	1.0 mg/l
Lead	0.05 mg/l
Nitrates	45 mg/l
pH[5]	6-8.5
Phenols	1.0 ppb
Selenium	0.01 mg/l
Silver	0.05 mg/l
Temperature[6]	73-87°F
Threshold Odor No.	8 at 40°C
Toxic Substances	1/10 (96 hour TLm)

Source: "Administrative Regulations of the State of West Virginia for Water Quality criteria on inter state and intrastate streams" Dept. of Natural Resources, 1974.

1. Applicable for all flows greater than or equal to the 7-consecutive day drought flow with a 10 year return frequency.
2. Monthly average 1000/100 ml; Maximum daily 2400/100 ml.
3. D.O. minimum of 6 mg/l in trout streams

4. 30 day geometric mean 200/100 ml; Maximum for 10% of the samples 400/100 ml
5. Acid mine drainage streams: minimum p^H 5.5.
6. 87°F maximum May-Nov; 73°F maximum Dec.-April trout waters: Oct-April 50°F, Sept. & May 58°F, June-Aug. 66 Daily maximum

CLIMATE AND GEOLOGY

4.1 CLIMATE

West Virginia's climatic divisions and weather stations are shown in Figure 4-1. The greatest controlling factor on the state's climate is its mountainous topography. Figure 4-2 illustrates this topography and Figures 4-3 and 4-4 show the climatic response in terms of mean annual snowfall and total precipitation. Mean annual precipitation ranges from 30 to 38 inches in the eastern panhandle to 50 to 70 inches in the central and northern mountains, and varies from 38 to 50 inches elsewhere. The pattern of mean annual snowfall is much more contrasted. Annual snowfall ranges from 20 inches along the lower Ohio River Basin to well over 100 inches in the central and northern mountains. Figure 4-5 shows the average number of days per year with depth of snow cover of one inch or more. It should be noted that caution should be used in interpolating the climatic maps, especially in the more mountainous areas where the constantly changing terrain, slope direction, and elevation make generalized maps less accurate.

West Virginia's latitudinal position places the state in the humid continental climatic zone. This zone is characterized by evenly distributed precipitation throughout four clearly defined seasons of nearly equal length. There is a slight peak of monthly mean precipitation in July (Fig. 4-6) and a noticeably drier period in October (Fig. 4-7). Figure 4-8 illustrates the number of days with 0.01 inch or more of precipitation, which in the northern and central mountains nears one half of the days annually. A degree of extreme drought occurs on the average once in every ten years throughout many locations in the state. Figure 4-9 shows the drought index probability by climatic divisions.

Climate in West Virginia is characterized also by large temperature contrasts between summer and winter (Fig. 4-10 to 4-16). Figures 4-17 and 4-18 show the annual cooling and heating degree days using $65^{\circ}F$ as a base temperature. For each day the number of heating degree days is the number of degrees the average temperature for the day is below $65^{\circ}F$. Likewise the number of cooling degree days is the number of degrees by which the mean daily temperature exceeds $65^{\circ}F$. The freezing index is presented in Figure 4-19. This is defined as the greatest continuous accumulation of freezing degree-days. For each day the number of freezing degree-days is the difference between $32^{\circ}F$ and the daily mean temperature when the latter is below $32^{\circ}F$. Pan evaporation is highest in July, as is illustrated by Figure 4-20. Potential evapotranspiration is also shown in Figure 4-21.

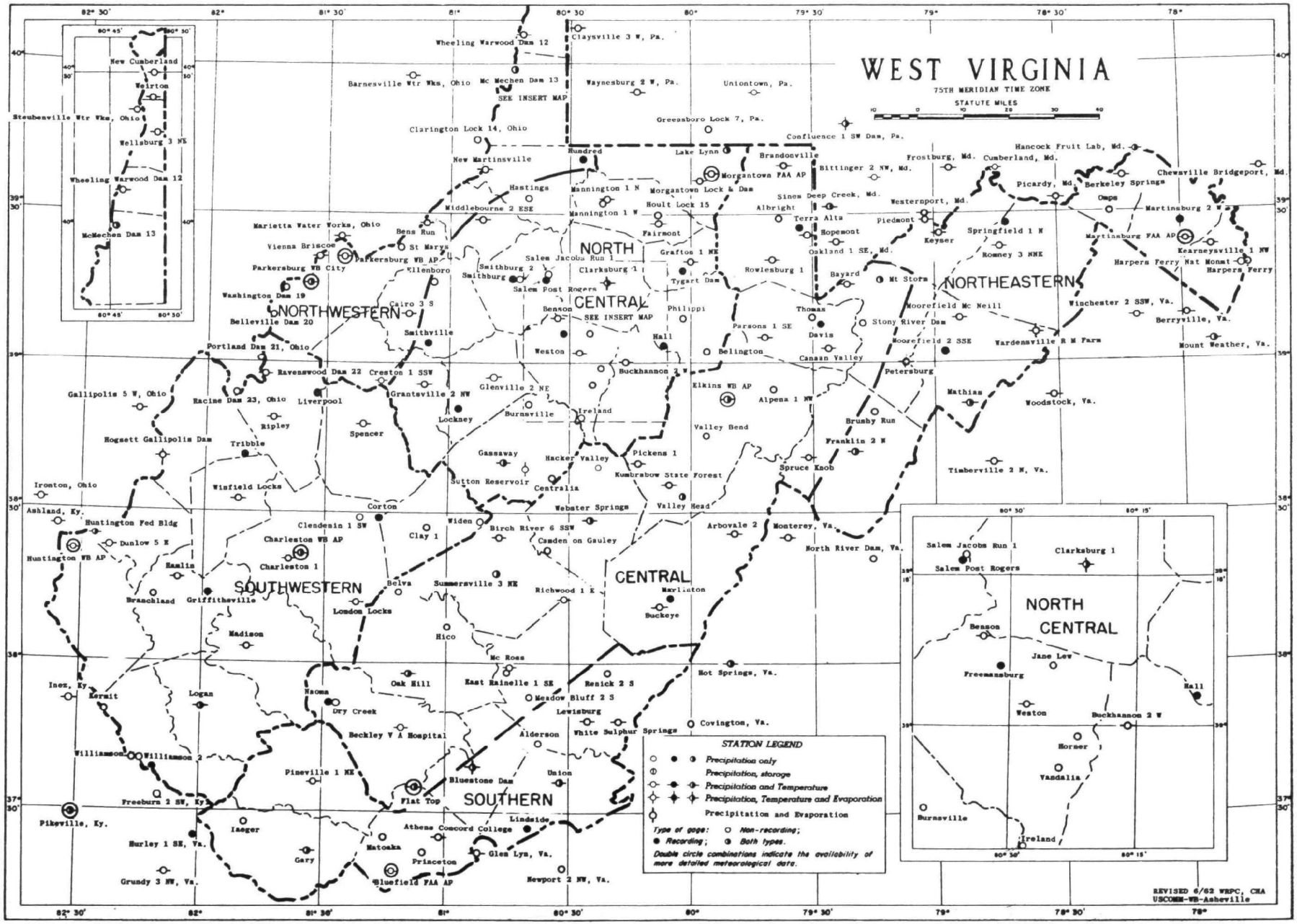
The greater part of the precipitation in the summer is the result of thunderstorm activity, with 40 to 50 thunderstorm days occuring annually at most locations (Fig. 4-22). The thunderstorms frequently contain intense rainfall, cloud to ground lightning and strong gusty winds, and present the danger of flash flooding. Large scale flooding is most likely from December to April when saturated ground and snow cover in association with long rainy periods produce a widespread and voluminous runoff. Large scale flooding also may occur during the late spring to early fall as remnants of tropical storms or hurricanes move inland. Tornadoes are not common in West Virginia, but as is shown in Figure 4-23, about two observed tornadoes per year are expected.

The average monthly wind speeds for four locations are shown in Figure 4-24.

In general, high average wind speeds over a long period of time are most frequent from late fall to early spring, while high peak wind gusts are more common during late spring to early fall.

West Virginia is located within the poorest air pollution dispersion region of the Eastern United States. As is shown by Figure 4-25, more than 40 forecast-days of high meterological potential for air pollution are expected in the southwestern part of the state (Kanawha Valley). A combination of low mixing height and nearly calm wind speeds leads to these pollution occurrences.

Figure 4-1 Climatic divisions and weather station location map. (Reference 8).



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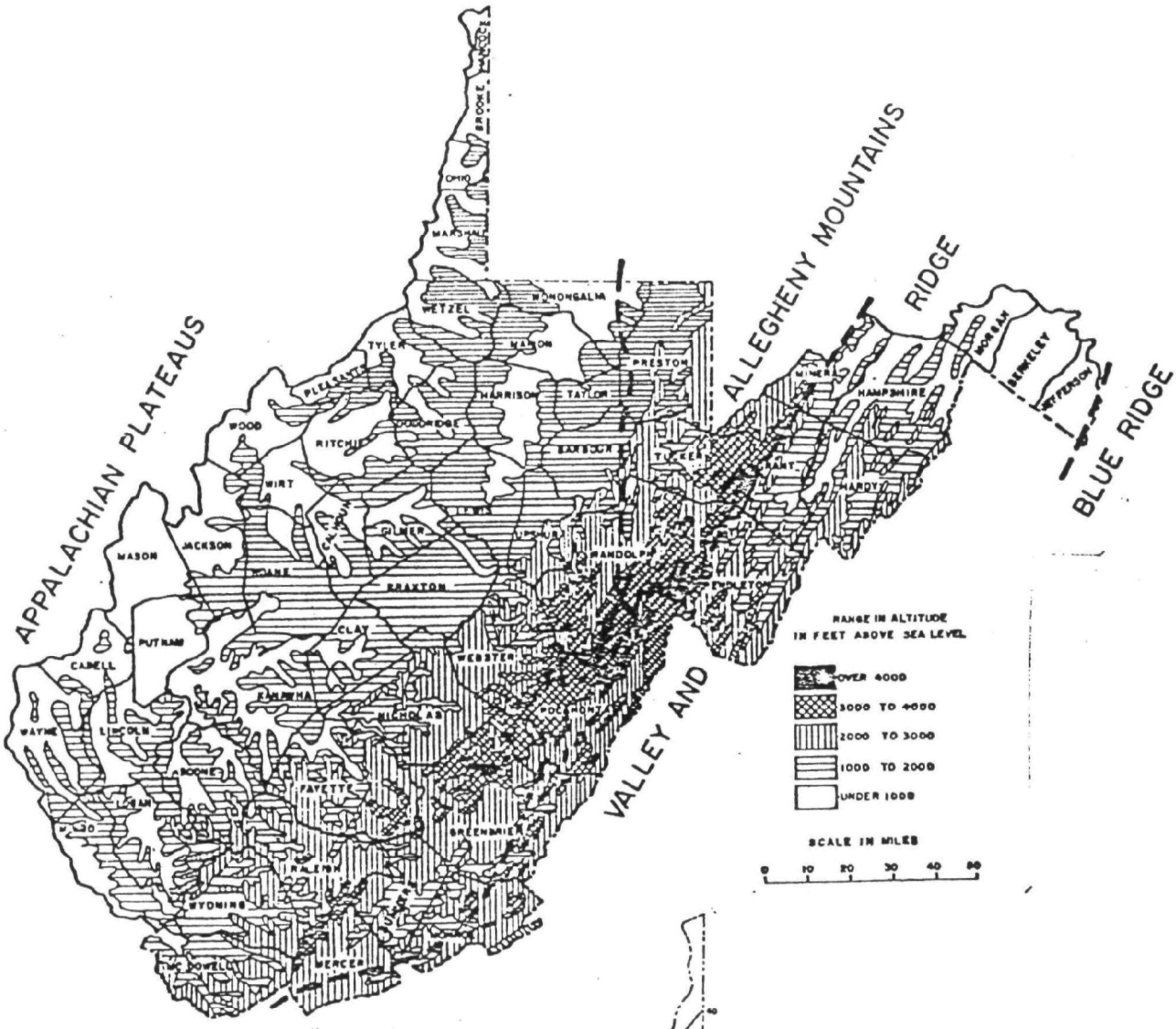

Figure 4-2
Topographic Map of West Virginia.
(West Virginia Geological and Economic Survey).

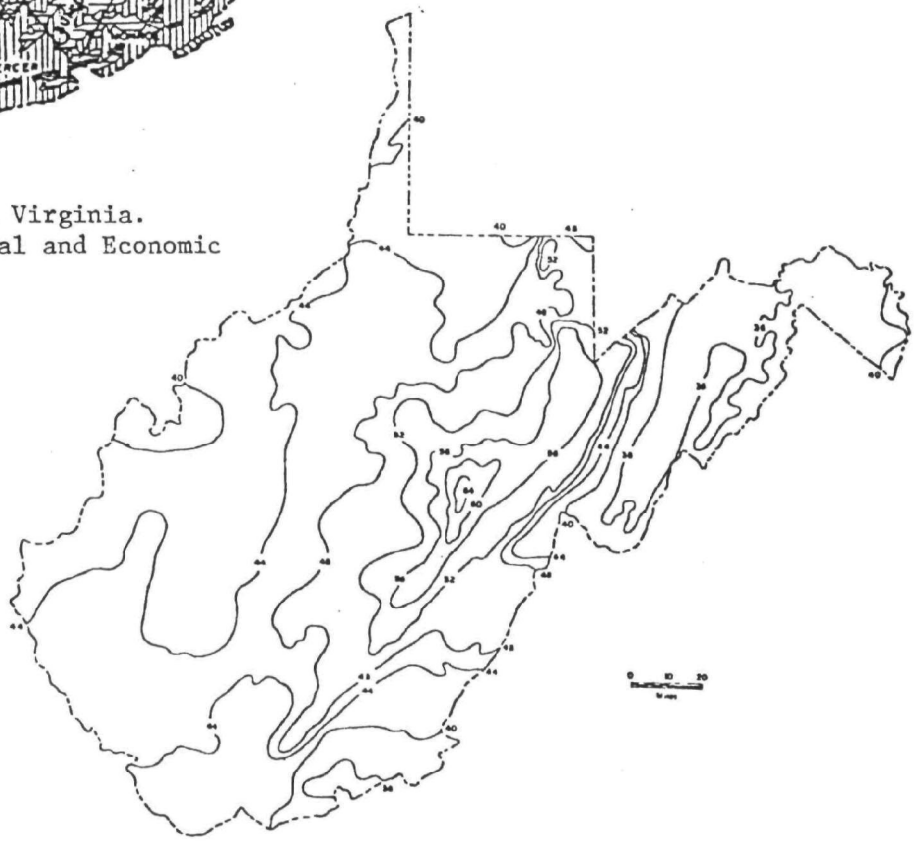

Figure 4-3
Mean annual precipitation (inches). Based on period 1948-1972. (Reference 1)

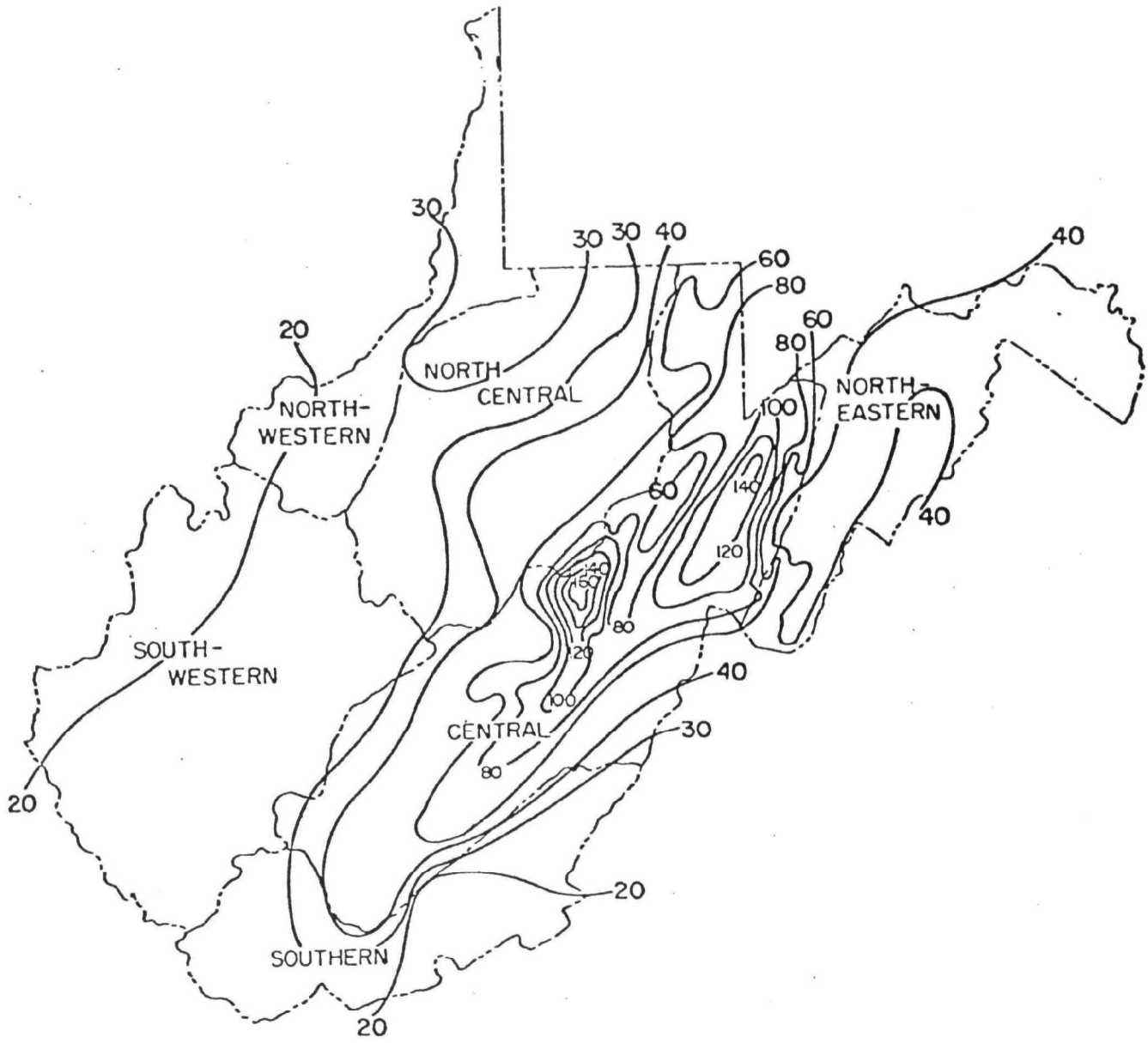

Figure 4-4
Mean annual snowfall (inches). Based on period 1931-60. (Reference 8)

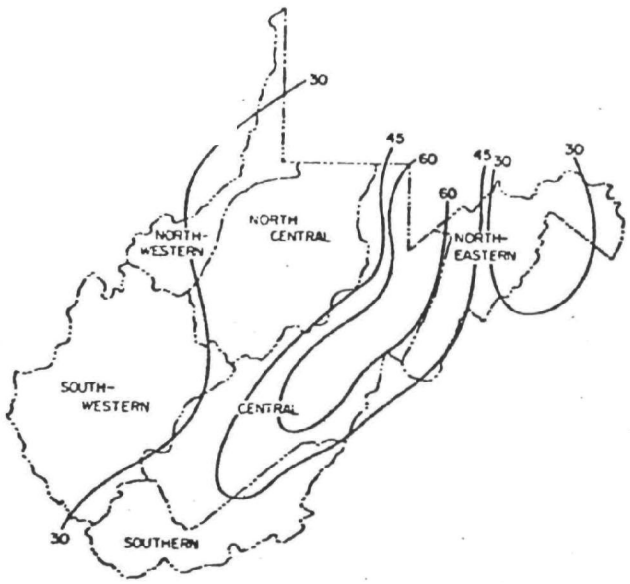

Figure 4-5
Snow cover map. Average number of days per year, depth of snow cover is one inch or more. (Reference 8)

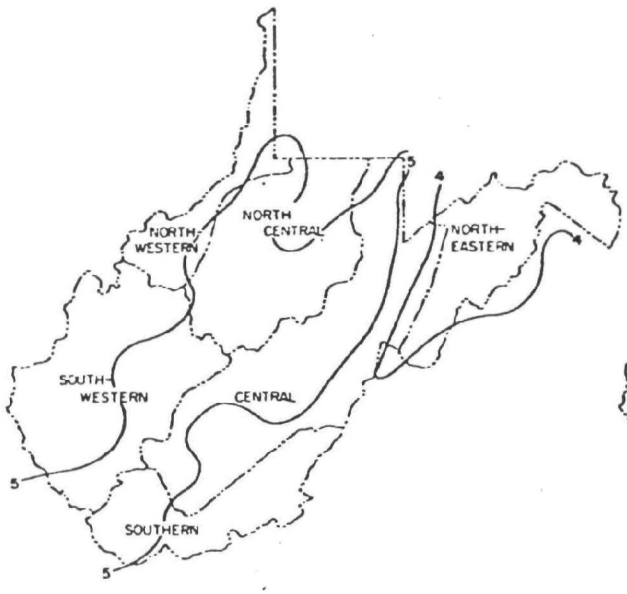

Figure 4-6
Mean July Rainfall (inches). Based on period 1931-60. (Reference 8)

Figure 4-7
Mean October rainfall (inches). Based on period 1931-60. (Reference 8)

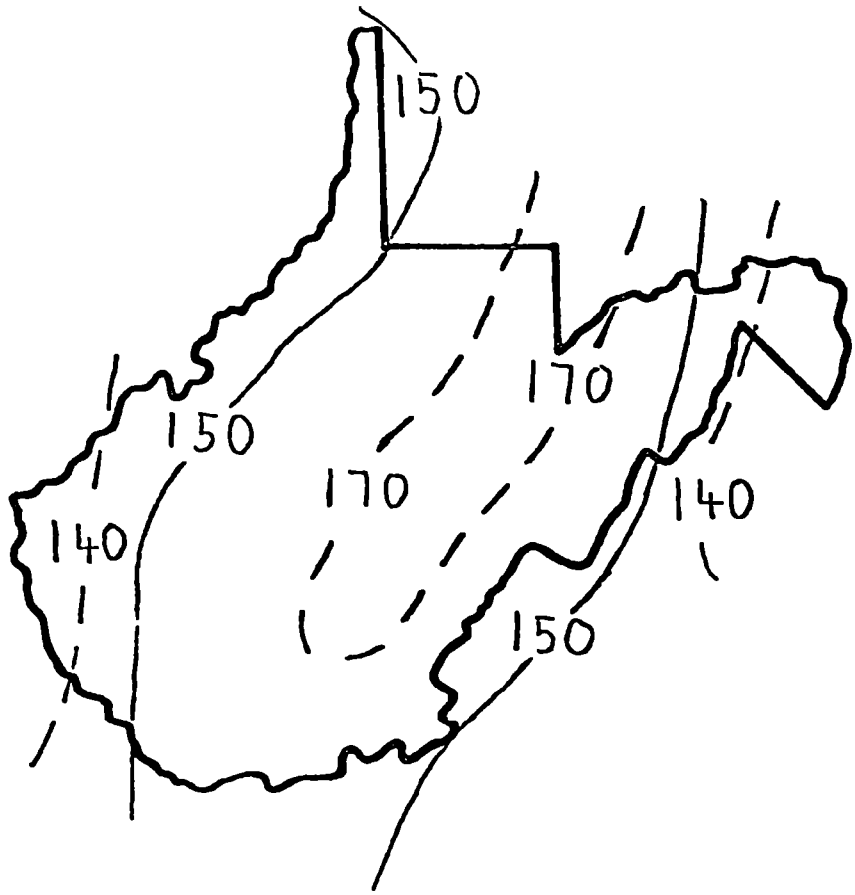

Figure 4-8
Mean annual number of days with 0.01 inch or more of precipitation. (Reference 5)

Climatic Division	Recurrence Interval (Return Period) in Years				
	2	5	10	25	50
Northwester	−1.29	−2.94	−4.19	−5.84	−7.09
North Central	−1.28	−2.97	−4.23	−5.91	−7.18
Southwestern	−1.24	−2.85	−4.06	−5.67	−6.88
Central	−1.34	−2.97	−4.20	−5.83	−7.07
Southern	−1.33	−2.79	−3.89	−5.35	−6.45
Northeastern	−1.16	−2.97	−4.34	−6.15	−7.52

DROUGHT CATEGORIES: 0.49 to −0.49 : Near Normal; −0.50 to −0.99 : Incipient Drought; −1.00 to −1.99 : Mild Drought; −2.00 to −2.99 : Moderate Drought; −3.00 to −3.99 : Severe Drought ; ≤ −4.00 : Extreme Drought

Figure 4-9
West Virginia drought index probabilities. (Reference 8)

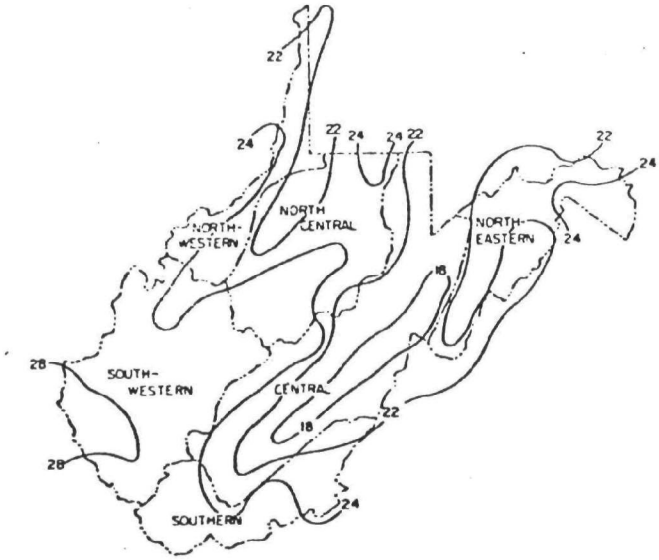

Figure 4-10
Mean January minimum temperatures (°F), based on period 1931-60. (Reference 8)

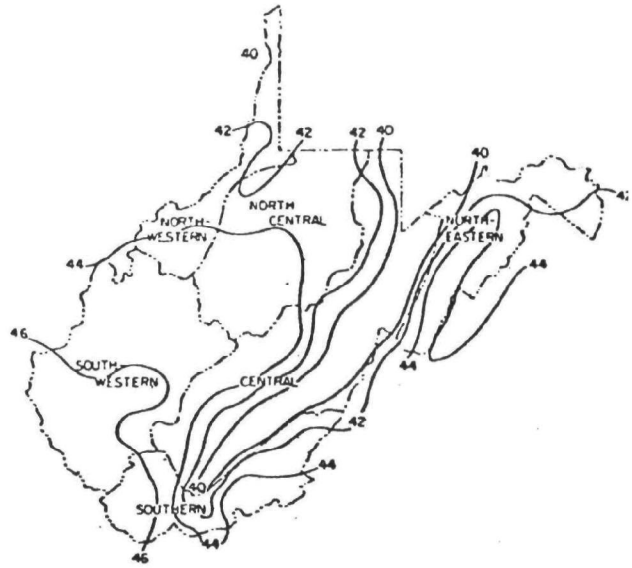

Figure 4-11
Mean January maximum temperatures (°F), based on period 1931-60. (Reference 8)

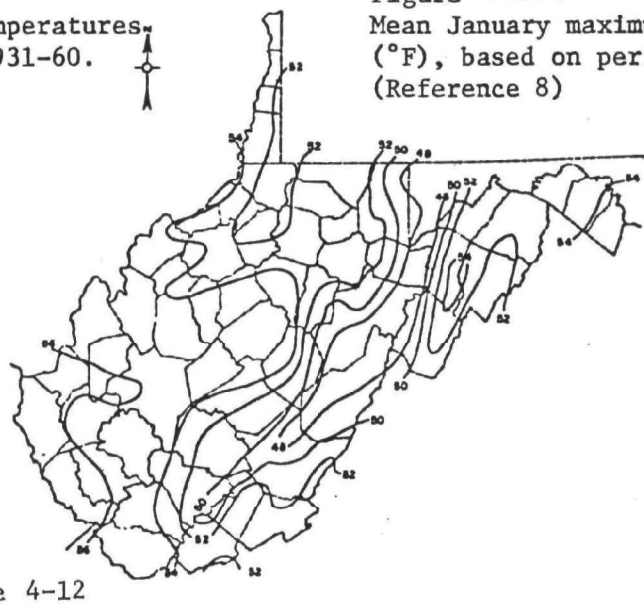

Figure 4-12
Mean annual temperatures, based on period 1931-60. (Reference 8)

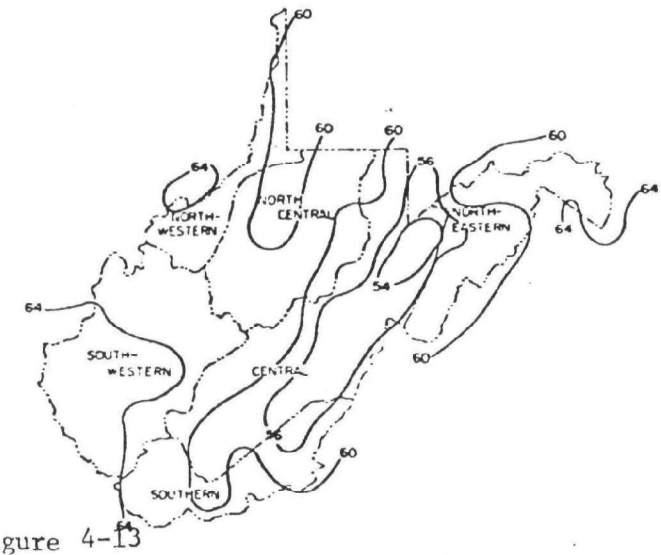

Figure 4-13
Mean July minimum temperatures (°F), based on period 1931-60. (Reference 8)

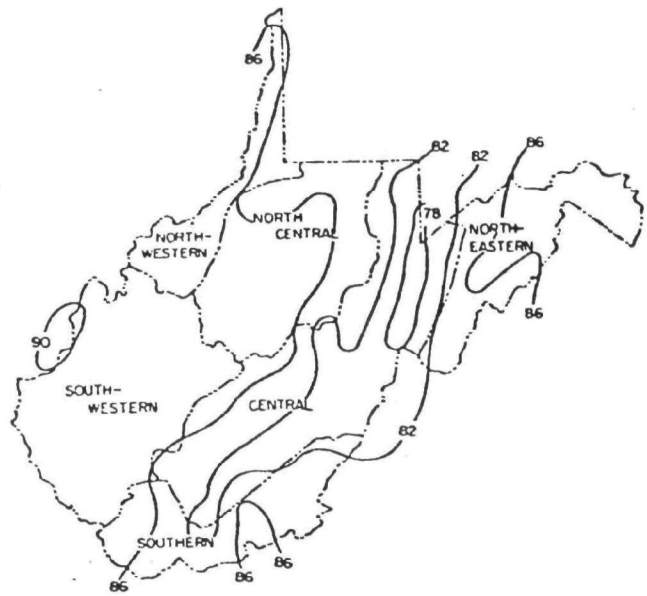

Figure 4-14
Mean July maximum temperatures (°F), based on period 1931-60. (Reference 8)

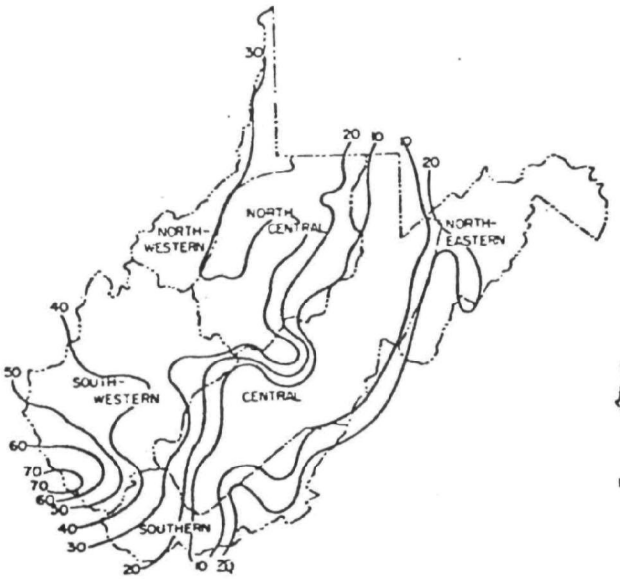

Figure 4-15
Average number of days annually with temperatures 90°F or above. Based on period 1931-60. (Reference 8)

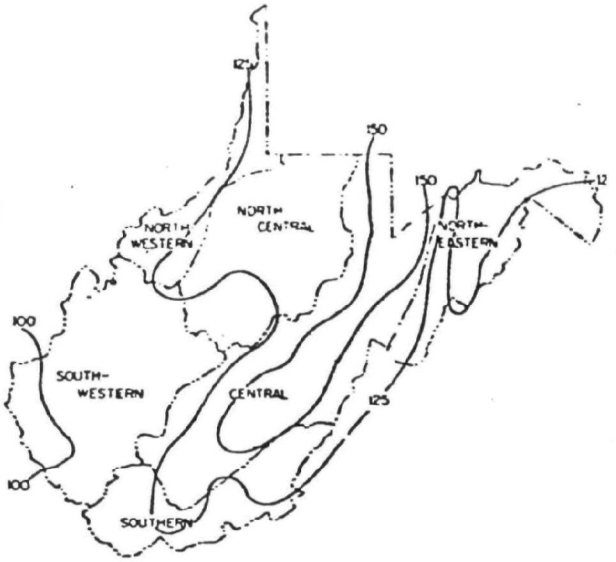

Figure 4-16
Average number of days annually with temperatures 32°F or below. Based on period 1931-60. (Reference 8)

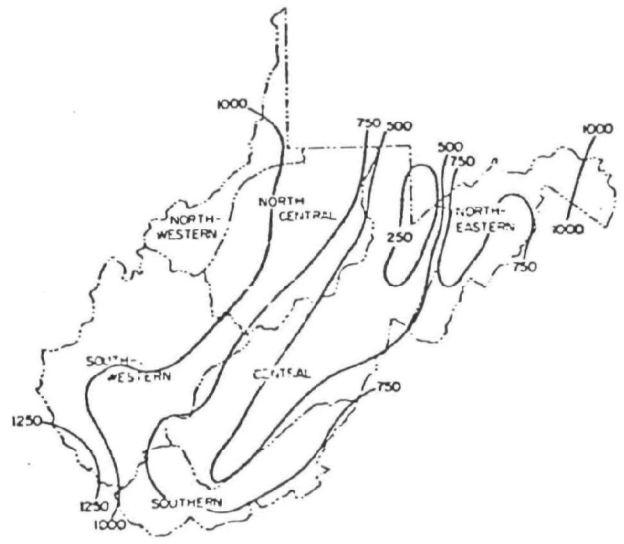

Figure 4-17
Average annual cooling-degree days. (Base 65°F). (Reference 8)

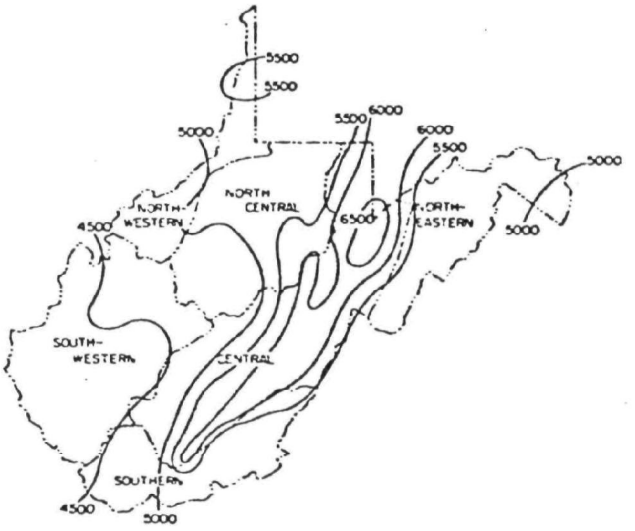

Figure 4-18
Average annual heating-degree days. (Base 65°F). (Reference 8)

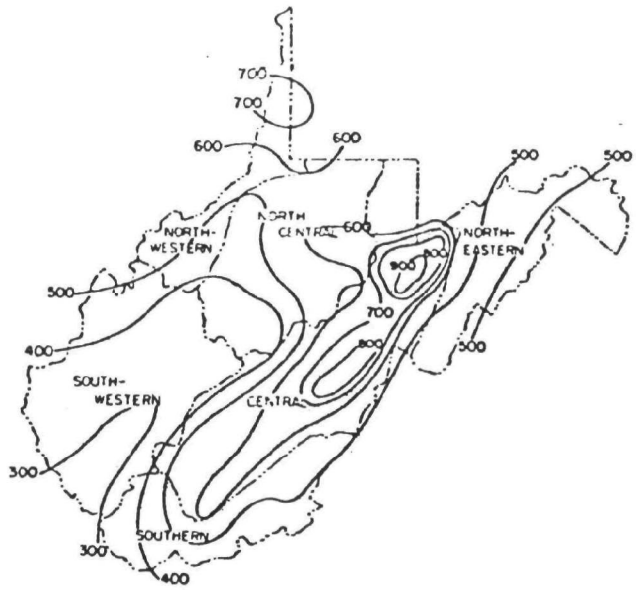

Figure 4-19
Freezing index in accumulated degree-days. (Base 32°F). Based on period 1930-64. (Reference 8)

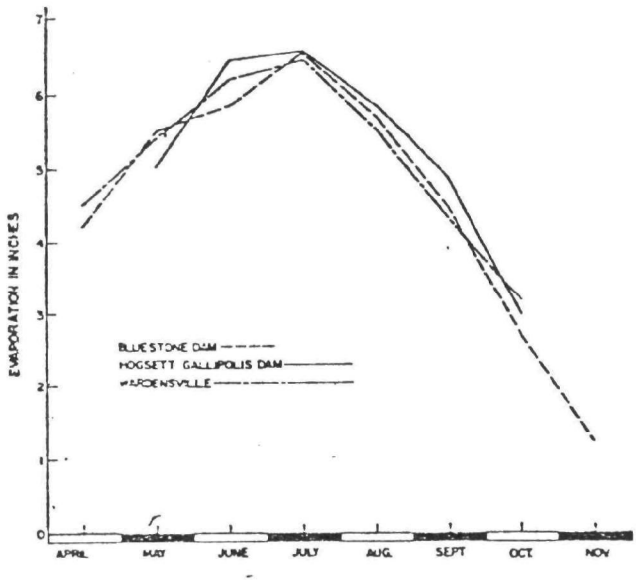

Figure 4-20
Average monthly pan evaporation from three locations in West Virginia. Based on period 1948-65. (Reference 8)

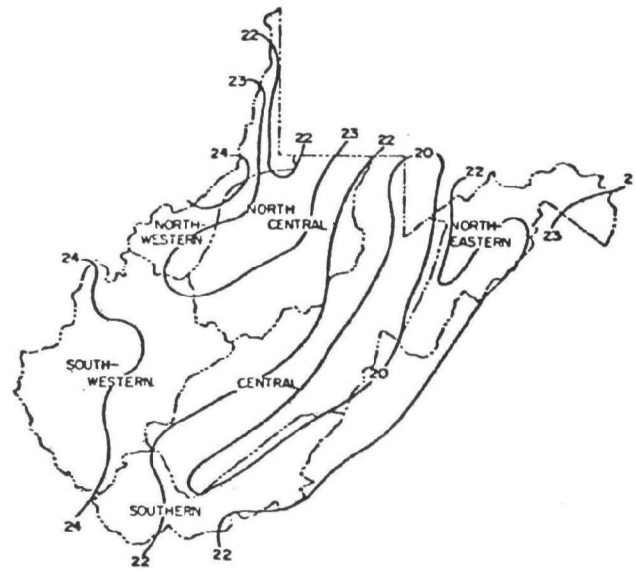

Figure 4-21
Potential evapotranspiration (inches) during growing season (May to October). Based on period 1931-60. (Reference 8)

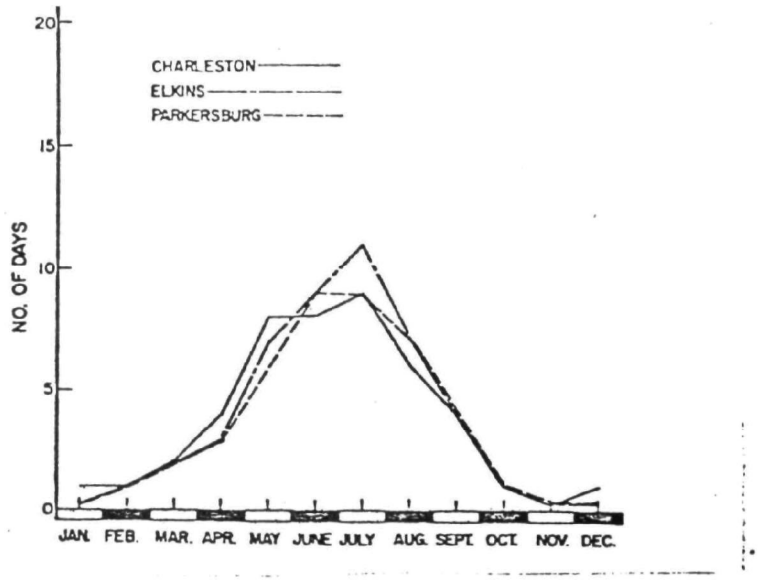

Figure 4-22
Average number of thunderstorm days per month for three West Virginia cities. (Reference 8)

West Virginia Tornado Information (1956-75)

Total number of tornadoes, 1956-75	40
Average number per year	2
Greatest number in any one year	6 - 1974
Least number in any one year	0 - 1960
Mean number per 10,000 sq. mi. per year	0.83
Total days with tornadoes, 1956-75	32
Average number of days with tornadoes per year	2
Total deathes from tornadoes, 1956-75	1
Average deaths per year	0
Mean deaths per 10,000 sq. mi. per year	0

Figure 4-23
West Virginia tornado statistics, based on period 1956-75.
(Reference 4)

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4.2 PHYSIOGRAPHY

The total land area of West Virginia is 24,283 square miles. The state lies between 37° 12' 7.8' and 40° 38' 17.1' North latitude and between 77° 43' 11.2' and 82° 38' 48.3' West Longitude, yielding extreme dimensions of 237 miles from north to south and 265.5 miles from east to west. Most of the state boundary is irregular, being defined by natural features. West Virginia's average elevation of 1500' above sea level is the greatest of any state east of the Mississippi River. The elevation ranges from 227 feet at Harpers Ferry to 4862 feet on the summit of Spruce Knob. Although this is not alpine relief, the land generally has a rugged character. It is well drained with no large natural lakes. Of the total state area, 20,600 square miles are drained by the Potomac River (eastern panhandle) and 80 square miles are drained by the James River (Monroe County).

The physiographic provinces of West Virginia are shown in Figure 4-26. The Allegheny Front, a prominent escarpment, separates the northwesterly dipping topography and dendritic drainage network to the northwest, from the alternate ridge and valley topography and trellis drainage network to the southeast. It runs approximately from Keyser, past Green Bank and White Sulphur Springs, to Bluefield. The Appalachian Plateau and Allegheny Mountain Provinces are found northwest of the Allegheny Front, and the Ridge and Valley, Great Appalachian Valley and Blue Ridge Provinces are found to the southeast of the Allegheny Front.

The greater portion of the state lies within the Appalachian Plateau Province which is entirely drained by the Ohio River System. This area is characterized by a dendritically dissected plateau, consisting of low to moderately prominent rolling hills of nearly the same elevation in any one area. The mean elevation increases from the Ohio River towards the southeast. Local relief of 200 to 500 feet is common in the northeastern part of the province, while it exceeds 1000 feet in some localities in the southeastern portion.

The Allegheny Mountain Province is contained in the north central section of the state. All but Grant County, which is drained by the Potomac River, is drained by the Ohio River System. The topography varies widely over this province with many high points exceeding 4,000 feet. Local relief of several hundred to several thousand feet is found across the area. South of the Dry Fork River it is characterized by well defined mountain crests running northeast-southwest, interspaced by parallel, elevated mountain stream valleys. North of the Dry Fork River the topography is more continuous, unbroken highland, consisting mainly of hilly plateaus running from 2,000 to 4,000 feet above sea level. The highland areas generally gain elevation from northwest to southeast.

The Ridge and Valley Province occupies the extreme southeastern part of the state, drained mainly by the Ohio River System, and the major part of the eastern panhandle, drained by the Potomac River. This area is characterized by prominent steep-crested or slightly rounded mountain ridges oriented in a northeast-southwest direction. The dendritic streams flow parallel to the mountains in narrow to broad valleys, occasionally cutting gaps perpendicular

to the mountain crests. The relief is greatest along the Allegheny Front and in Pendleton County, where local relief of 1500 to 3000 feet is found. Elsewhere, relief of 500 to 2000 feet is common between the ridge crests and valley bottom land.

In the extreme eastern panhandle, the Great Appalachian Valley Province (Shenandoah Valley) passes through Berkeley and Jefferson Counties. This section drains into the Potomac River and consists of a broad limestone valley dominated by karst topography. Bordering it to the east along extreme eastern Jefferson County is the Blue Ridge Province. This is part of a long continuous mountain chain which, in this area, has a maximum relief of about 1200 feet.

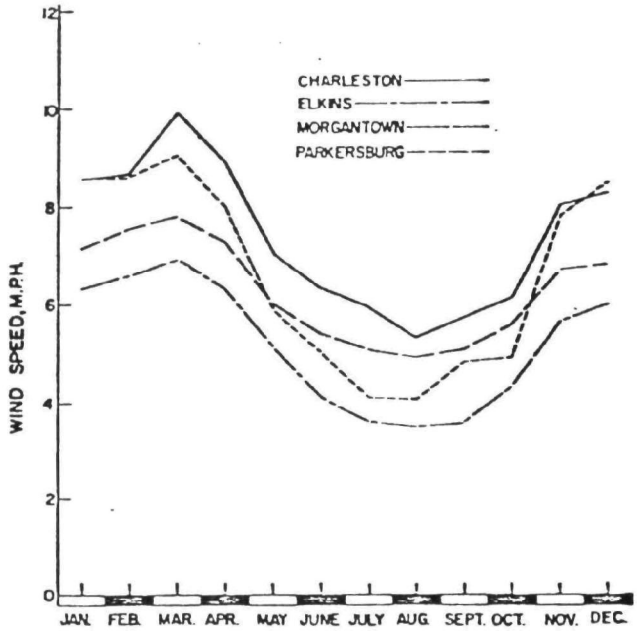


Figure 4-24
Average monthly wind speeds (miles per hour) at four locations in West Virginia. (Reference 8)

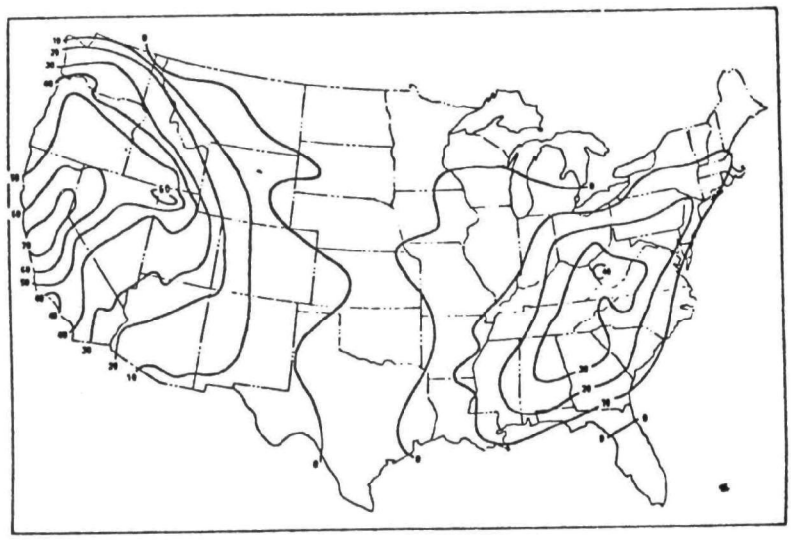


Figure 4-25
Isopleths of total number of forcast-days of high meteorological potential for air pollution expected in a 5-year period. Based on period August 1, 1960 to April 3, 1970. (Reference 3)

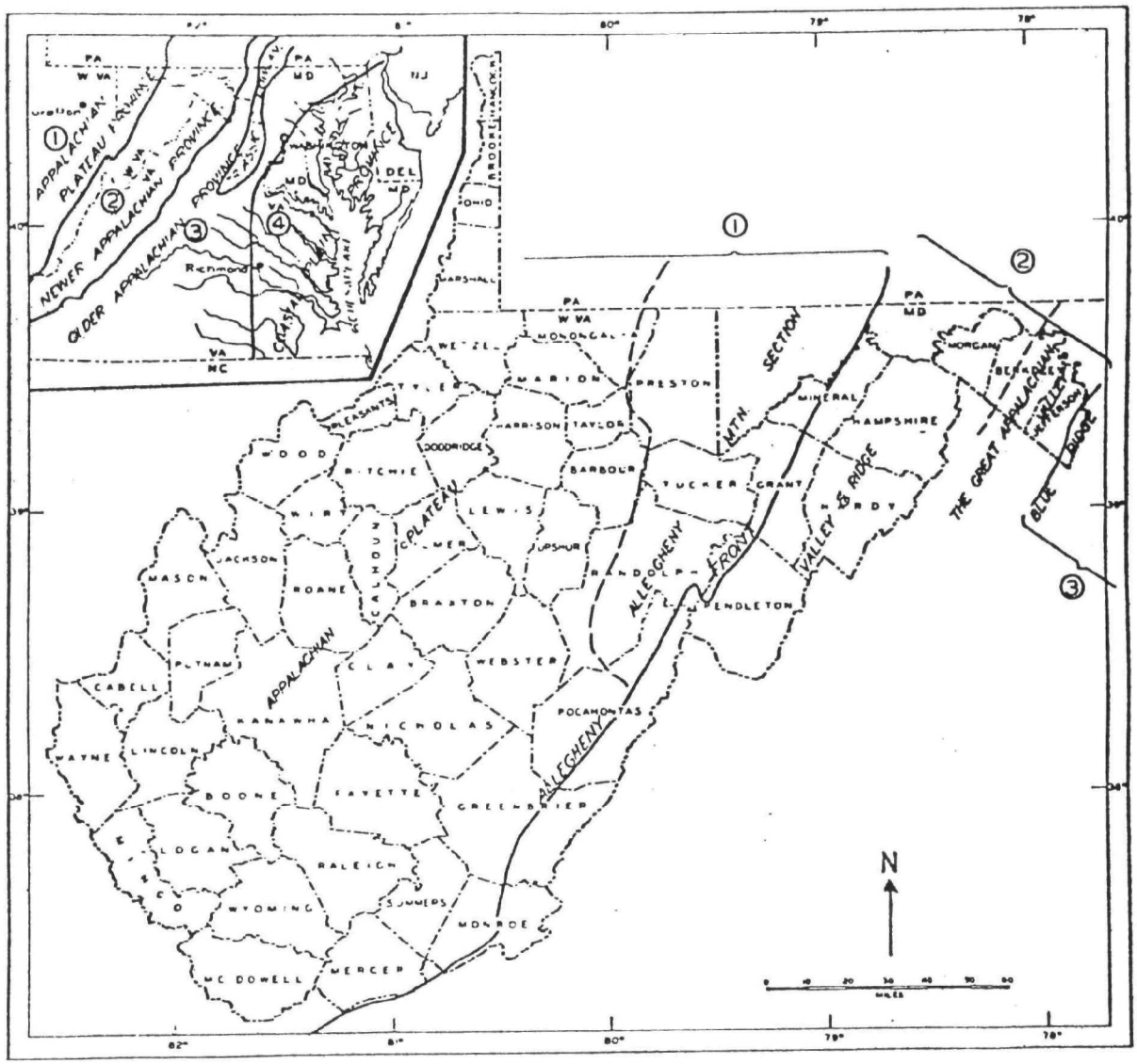


Figure 4-26 Physiographic Provinces of West Virginia (West Virginia Geologic and Economic Survey).

4.3 GROUNDWATER

West Virginia can be divided into six ground-water regions based on the principal type of rock (lithology) and on the geologic structure which is present. The regions are shown in Figure 4-27, and a brief description of each is given below.

Region I. Limestone which has been severely folded and faulted. The highest variability in the ground-water yield and quality occurs in this region.

Region II. Severely folded sandstone and shale. This area is characterized by high variability in the ground-water yield and quality.

Region III. Moderately folded sandstone, shale and coal. The region contains primary, secondary and artesian aquifers. The water generally becomes saltier with depth.

Region IV. Nearly horizontal sandstone with shale and coal. The area contains both primary and secondary aquifers. The water generally becomes saltier with depth.

Region V. Nearly horizontal shales with sandstone and coal. This region contains primary and secondary aquifers. The water generally becomes saltier with depth.

Region VI. Alluvial sands and gravels. Aquifers are found mainly along the Ohio and Kanawha River valleys. Some large capacity wells are present.

The yield of a well is a function of many variables, including the volume of water entering an aquifer, lithology, amount of fracturing, efficiency and size of the well and pump, depth of the well, and the proximity of other wells. Figure 4-28 illustrates the generalized distribution of reported yields from existing small-diameter drilled water wells in West Virginia. The map shows that the northwestern part of the state has generally low well yields, and the central and southern sections have somewhat higher well yields, and the eastern part has highly variable well yields.

The most widespread problems in the quality of ground water in West Virginia are due to five principal contaminants: compounds of iron, compounds of sulfur, compounds of chlorine, hardness due to calcium and magnesium compounds, and bacteria. Table 4-1 shows average concentrations in ground water of those substances which are most likely to occur in the state's major geological units. These ground-water contaminants may be due to natural sources or to industrial and human wastes. Many contaminants become concentrated in the ground-water and reside in the sub-surface system for a long time. The single most widespread ground-water problem in West Virginia is the presence of compounds of iron and sulfur which usually occur together and are derived from the same source. These compounds are produced by the solution of iron and sulfur minerals, particularly iron pyrite, which occur in the aquifer, and by the leaching of iron-rich wastes in recharge areas. The iron compounds cause objectionable taste, staining of clothing and porcelain, and damage to water-carrying pipes. The objectionable sulfur compounds range from foul-smelling hydrogen sulfide to highly corrosive sulfuric acid and hardness-causing sulfates. Most of the chloride content of the water originates in deep saline waters and reaches the surface area as a result of excessive pumping, natural upward movement, and as a result of improper methods of production of oil and gas. A considerable amount of chloride

results from the run-off from roads which have been treated with sodium or calcium chloride for de-icing. Water hardness, resulting principally from the solution of calcium and magnesium carbonates as the bicarbonates, causes increased soap consumption and other difficulties in laundering and steam generation. In certain areas, a serious problem may result from contamination by bacteria from human and animal wastes.

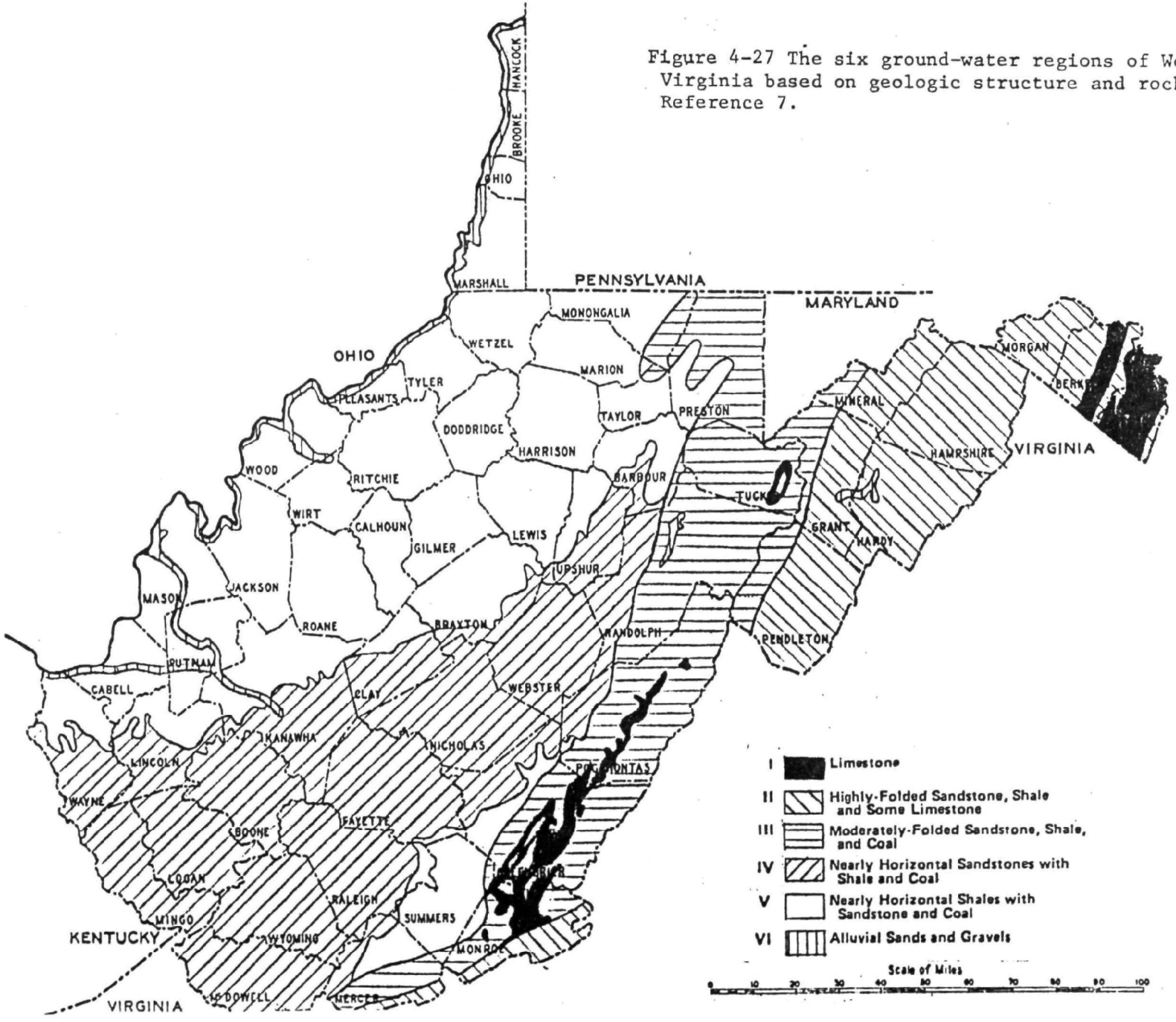
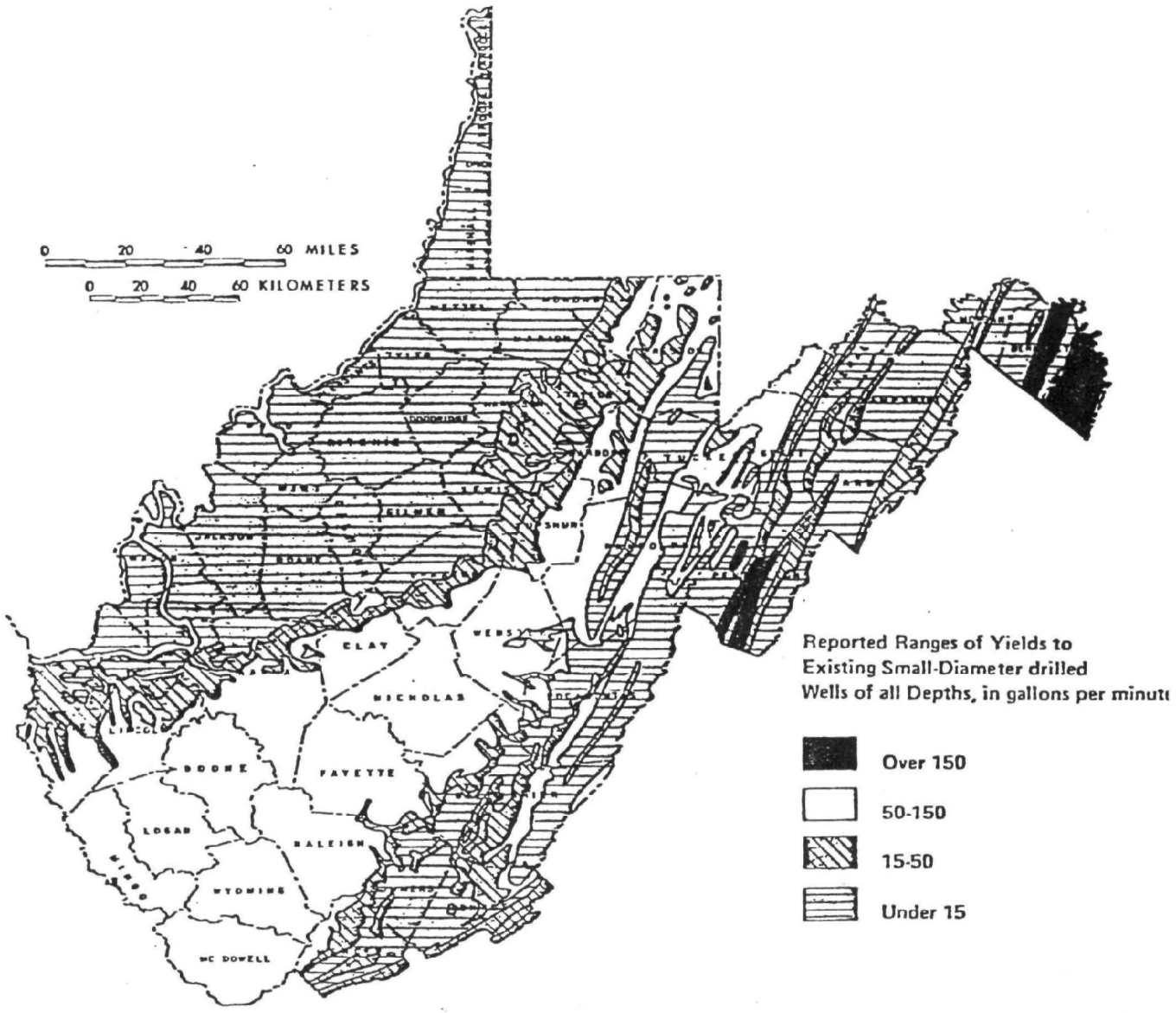


Figure 4-27 The six ground-water regions of West Virginia based on geologic structure and rock lithology. Reference 7.



Based On: Cooperative Work by the West Virginia Geological and Economic Survey and the U. S. Geological Survey and on the State Geological Map.

Figure 4-28 Generalized distribution of reported yields from existing small-diameter drilled water wells in West Virginia.

Geologic Unit	RANGES OF AVERAGE CONCENTRATIONS			
	Chloride (mg/l)	Iron (mg/l)	Hardness (mg/l)	pH (units)
Dunkard	16- 83	0.2-0.6	110-130	7.5-7.6
Monongahela	6- 70	0.2-0.5	95-125	7.1-7.6
Conemaugh	5- 58	0.1-0.9	90-102	7.0-7.4
Allegheny	4- 50	1.0-1.6	60- 80	6.4-6.7
Pottsville	4- 38	1.0-3.0	46- 82	6.5-6.6
Mississippian	2- 24	0.01-1.5	70- 94	6.7-6.8
Devonian	10-100	0.4-0.6	63-246	6.8-7.2
Silurian	5.9	1.3	127	7.8
Ordovician	28.	1.9	275	7.3
Cambrian	4.0	0.2	61	7.2

Sources: .Ground-water data from cooperative program between the West Virginia Geological and Economic Survey and the U. S. Geological Survey.

Table 4-1 Average concentrations, in ground water, of those substances which are most likely to occur in West Virginia's major geological units.

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4.4 GEOLOGIC HAZARDS

Every county in West Virginia is subject to the hazard of flooding and landslides. Both are tied closely to short term climatic variations, geology and human activity. Major large scale flooding is most common in the late winter and early spring. Flash flooding may occur following any intense rainfall, most likely from late winter to early fall. Tributaries are especially susceptible to flash flooding, while a more gradual rise in the flood water occurs along the larger rivers.

Damage from landslides greatly exceeds the ten million dollars reported annually in West Virginia. Figure 4-29 shows the distribution of highway landslides from 1959 to 1975. Two thirds of the state has slopes ranging from 10% to 40% that are within the range of landslide prone areas. Table 4-2 shows the percentages slope grades by county. The West Virginia Geological Survey has published 28 maps of landslide conditions around seven urban areas (Fig. 4-30). Types of landslides which occur in West Virginia include creep, slump, earthflows, mudflows, debris,flows, and debris avalanches. Common slope modifications made by man which may cause landslides in unstable slope areas include the cutting away of the toe of the slope, placing fill material and buildings at the top of the slope, altering surface water or ground water conditions in unstable areas, and trees and other vegetative cover.

Figure 4-29 Distribution of 1,418 highway landslides from 1959 to 1975 (after W.Va. Dept. of Highways).

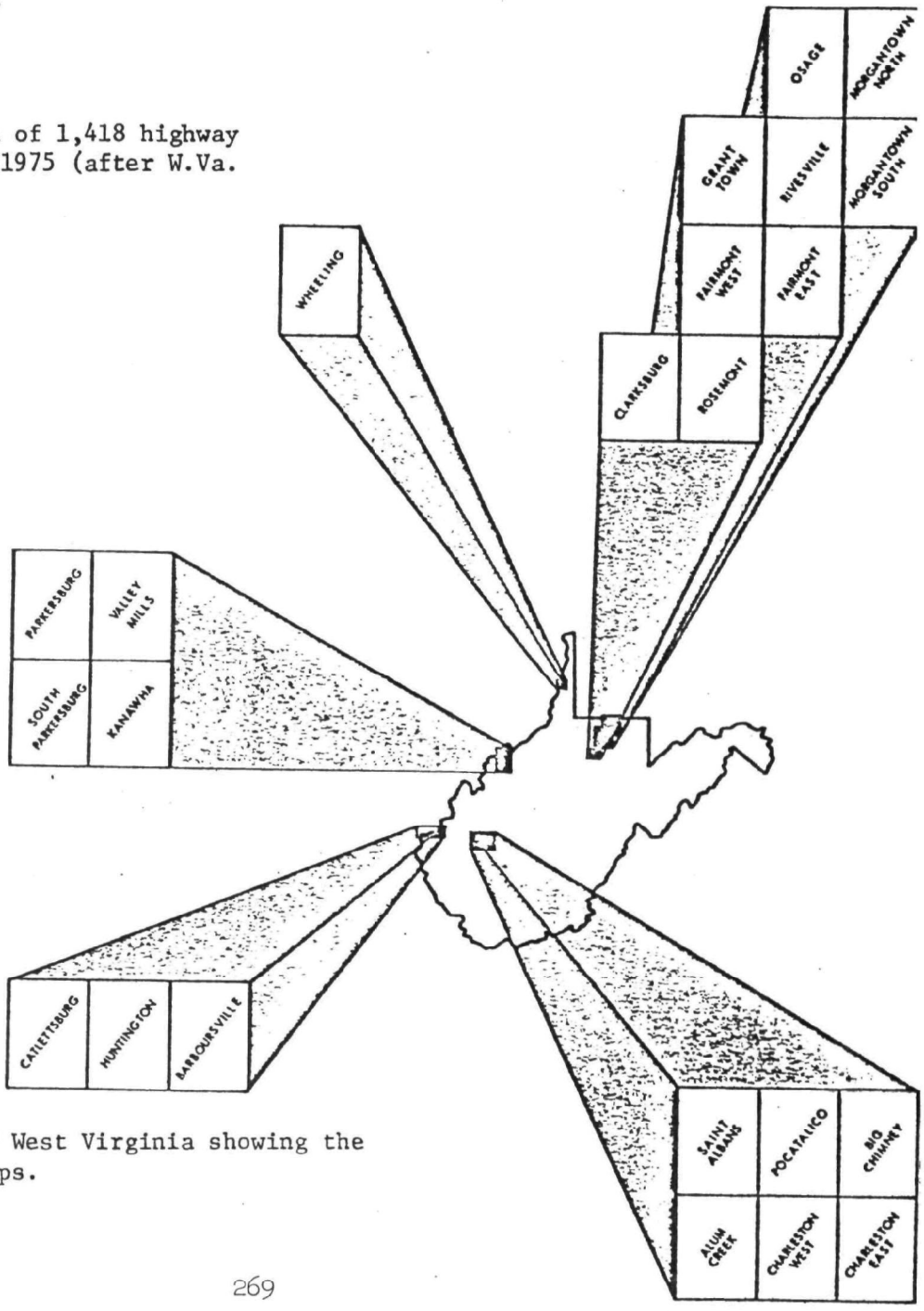


Figure 4-30 Index map of West Virginia showing the location of landslide maps.

#	County Name	Level*	10	20	30	40	50	60	70	C_s
01	Barbour	98.2	86.4	44.5	16.6	3.4	0.4	0.0	0.0	0.56
02	Berkeley	88.9	46.9	13.5	4.8	2.3	1.1	0.2	0.0	1.90
03	Boone	100.0	99.4	95.1	82.5	59.4	33.3	13.3	3.8	0.16
04	Braxton	99.6	97.8	88.7	61.0	25.8	6.5	2.2	0.8	0.31
05	Brooke	94.3	77.9	46.6	22.9	5.2	0.0	0.0	0.0	0.25
05	Cabell	92.8	87.2	76.5	46.5	12.7	1.5	0.0	0.0	-0.61
07	Calhoun	99.6	98.2	90.7	73.0	38.6	13.5	2.1	0.0	0.21
08	Clay	99.7	98.4	89.9	63.4	27.9	9.1	3.1	1.0	0.56
09	Doddridge	100.0	99.2	92.6	92.6	62.1	23.3	2.8	0.2	-0.06
10	Fayette	99.4	88.5	56.9	37.3	23.4	11.5	5.6	2.3	-0.87
11	Gilmer	100.0	98.3	88.9	65.5	30.1	7.2	1.5	0.0	-0.04
12	Grant	96.6	72.3	40.9	21.0	7.2	1.7	1.0	0.5	1.00
13	Greenbrier	97.8	84.2	52.4	24.1	8.5	2.3	0.4	0.0	0.58
14	Hanpshire	98.1	74.3	30.0	9.5	2.9	1.0	0.1	0.0	1.25
15	Hancock	95.2	76.6	41.1	17.7	7.5	2.1	0.6	0.0	0.86
16	Hardy	97.3	82.2	51.8	24.6	8.0	2.2	0.5	0.2	0.70
17	Harrison	99.0	94.1	72.0	32.4	6.3	0.8	0.1	0.0	0.01
18	Jackson	96.7	90.1	66.4	25.4	3.9	0.2	0.0	0.0	-0.27
19	Jefferson	81.0	21.9	5.4	1.7	1.2	0.7	0.1	0.0	3.28
20	Kanawha	98.2	96.0	88.3	65.0	37.9	17.7	7.9	3.2	0.53
21	Lewis	99.5	97.1	85.5	50.9	14.1	1.4	0.0	0.0	-0.29
22	Lincoln	99.8	98.8	92.8	71.4	30.3	7.1	1.4	0.2	-0.04
23	Logan	99.3	98.5	96.7	89.9	73.6	48.6	23.3	7.1	-0.40
24	McDowell	100.0	99.4	94.2	74.0	43.9	20.2	8.8	2.7	0.45
25	Marion	98.7	92.6	70.3	41.8	12.1	1.5	0.1	0.0	-0.05
26	Marshall	98.7	94.1	79.8	44.0	19.3	5.9	0.7	0.1	0.27
27	Mason	96.3	86.0	61.4	23.0	4.9	0.5	0.2	0.1	0.09
28	Mercer	99.2	89.9	52.4	19.1	5.7	1.7	0.7	0.4	1.11
29	Mineral	97.1	78.2	38.0	15.5	7.3	1.9	0.3	0.1	1.08
30	Mingo	99.8	99.1	96.7	91.4	77.1	48.8	19.5	4.5	0.64
31	Monongalia	99.2	92.5	64.9	30.5	8.7	1.7	0.8	0.1	0.50
32	Monroe	99.2	83.7	46.7	19.4	6.5	1.9	0.4	0.3	0.90
33	Morgan	97.7	81.5	46.3	17.0	5.9	3.1	1.8	1.3	1.58
34	Nicholas	99.5	89.0	55.9	29.4	14.3	6.2	2.1	0.5	1.05
35	Ohio	98.1	91.6	69.0	31.0	0.3	0.0	0.0	0.0	0.04
36	Pendleton	99.7	91.4	67.3	38.6	16.9	6.1	2.0	0.5	0.61
37	Pleasants	95.4	91.6	72.0	43.1	11.8	2.6	0.7	0.0	-0.10
38	Pocahontas	98.2	90.6	65.6	31.6	8.3	1.7	0.3	0.1	0.26
39	Preston	99.0	81.0	45.4	20.6	8.4	4.0	1.1	0.2	1.24
40	Putnam	99.1	92.7	78.6	47.5	10.5	0.5	0.0	0.0	-0.54
41	Raleigh	99.0	87.0	62.8	38.3	23.6	13.5	5.9	2.2	0.87
42	Randolph	98.4	91.5	62.8	28.8	8.7	1.7	0.0	0.0	0.33
43	Ritchie	98.9	98.2	83.7	44.9	11.3	1.4	0.7	0.2	0.36
44	Roane	98.8	98.3	83.7	42.7	12.6	2.6	0.2	0.0	0.36
45	Summers	98.3	86.9	58.5	21.0	5.7	2.4	1.1	0.3	0.72
46	Taylor	97.0	89.9	61.8	19.3	5.4	2.4	0.9	0.0	0.70
47	Tucker	95.0	71.0	49.0	27.1	8.7	2.3	0.8	0.7	0.78
48	Tyler	99.2	92.8	71.6	32.5	10.1	1.6	0.0	0.0	0.13
49	Upshur	99.1	89.0	52.3	18.4	5.6	1.4	0.0	0.0	0.70
50	Wayne	99.6	96.4	88.3	62.5	27.2	7.9	2.1	0.1	-0.02
51	Webster	99.4	94.5	76.5	52.1	25.7	9.3	1.7	0.2	0.13
52	Wetzel	99.2	98.0	93.0	70.9	31.7	8.3	1.4	0.4	-0.25
53	Wirt	98.7	95.9	80.8	38.4	10.7	2.0	0.2	0.0	-0.03
54	Wood	93.8	83.8	54.4	14.3	1.8	0.2	0.0	0.0	-0.20
55	Wyoming	100.0	99.6	91.6	64.9	32.9	15.3	6.7	2.1	0.90

*The slope of "level" land is less than 2.5 percent.

Table 4-2 Percentage of Land Area by counties in West Virginia with slope inclination greater than the indicated slope.

4.5 GEOLOGY AND SOILS

A summary of the geology of West Virginia is presented on a county by county basis in section 4.6 in this chapter. The following is a brief description of the headings listed for each county.

Geologic Structure:

A brief description of the structure contour pattern across each county is given under this heading. This includes the direction and degree of regional dip where it exists, orientation, shape and names of major folds (anticlines and synclines), and location and names of major faults. In general, the rock strata west of the Allegheny Front have a slight regional dip to the northwest, interrupted by occasional, nearly symmetrical folds which trend northeast-southwest. East of the Allegheny Front the rock strata have been much more severly folded and may be vertical, overturned or faulted. The fold arcs generally parallel the mountain crest in a northeast-southwest direction.

Exposures:

Surface rocks are listed according to group or formation and age of deposition. They are listed in descending order, youngest to oldest or by pattern of occurrence, where a discernable pattern occurs. As shown on the Geologic Map of West Virginia (Fig. 4-31), the age of the rocks increases from west to east. All surface rocks are sedimentary, except in extreme eastern Jefferson County, where a metamorphic greenstone is found.

The generalized geologic columns for the four sections of West Virginia are shown in Figures 4-32 and 4-33. The following is a brief description of the principal surface rock units in descending order.

Quaternary System

Represented by clays, gravels and sand beds present along the river and creek valleys, and by river-terrace deposits now resting many feet above the present streams.

Permian System or Pennsylvanian

Dunkard Group: Non-marine cyclic sequences of sandstone, siltstone, red and gray shales, limestone and coal.

Pennsylvanian System

Monongahela Group: Non-marine cyclic sequences of sandstone, siltstone, red and gray shales, limestone and coal.

Conemaugh Group: Cyclic sequences of red and gray shale, siltstone with thin limestones and coal.

Allegheny Formation: Cyclic sequences of sandstone, siltstone, shale, limestone and coal.

Pottsville Group:

Kanawha Formation: Sandstones, Massive conglomeratic sandstones, sandy shales, fire clays, thin limestones, and coals.

New River Formation: Same as Kanawha.

Pocahontas Formation: Sandstone, shales and coals.

Mississippian System

Mauch Chunk Group: Red, green and medium gray shale, and sandstone, with a few thin limestones.

Greenbrier Group: Predominantly limestone, layers of dark calcareous shale, some red shale and some sandy zones present.

Maccrady Formation: Predominantly red shale and mudstone, partly calcareous.

Pocono Group: Predominantly hard, gray, massive sandstone with some shale.

Devonian System

Hampshire Formation: Non-marine shales and fine micaceous sandstones, mostly red to brownish gray, including siltstone, sandstone and conglomerate.

Chemung Group: Gray to brown siltstone, and sandstone with shale and conglomerate interbeds, mainly marine and sparingly fossiliferous, boundaries gradational.

Brallier Formation: Predominantly olive-gray to dark, thickly laminated marine shale and siltstone, mainly non-fossiliferous.

Harrell Shale: Dark gray to black, thinly laminated to fissile shale. Calcareous shale and limestone lenses near base.

Mahantango Formation: Predominantly a dark gray shale with sandstone lenses.

Marcellus Formation: Distinct black fissile shale.

Huntersville Chert: Mostly a highly silicified black shale which contains many beds that have been brecciated, and recemented with amorphous silica.

Needmore Shale: Generally a very dark shale.

Oriskany Sandstone: Principally coarse grained sandstone with some chert beds.

Helderberg Group: Essentially limestone, part cherty.

Silurian System

Tonoloway Formation: Thinly laminated, interbedded, argillaceous limestone and calcareous shale.

Wills Creek Formation: Predominantly shale with sandstone interbeds.

Bloomsburg Facies: Red shale.

Williamsport Formation: Sandstone.

McKenzie Formation: Dark Calcareous shales and thin-bedded fossiliferous limestones.

Clinton Group:

Rochester Shale: Dark gray shale with thin limestone lenses.

Keefer Sandstone: Thin sheet sandstone.

Rose Hill Formation: Mostly shale with thin red sandstone lenses.

Tuscarora Sandstone: Mostly a clean white sandstone.

Ordovician System

Juniata Formation: Non-marine red to reddish brown sandstone with some shale.

Oswego Formation: Gray to gray-brown, non-fossiliferous, arkosic sandstone.

Martinsburg Formation: Predominantly black to dark gray shale with some sandstone interbeds.

Trenton Group: Dark gray shale and dark gray limestone with bentonite beds.

Black River Group: Predominately limestone with some dolomite and chert with thin bentonite beds.

St. Paul Group: Predominately limestone with some dolomite and chert. Nearly pure limestone at base.

Beekmantown Group: Predominately limestone and dolomite with some sandstone.

Cambrian System

Conococheague Formation: Limestone and dolomite with sandstone and shale layers.

Elbook Formation: Predominately limestone.

Waynesboro Formation: Predominately green shale with streaks of impure sandstone and some dolomite.

Tomstown Dolomite: Mainly dolomite, nearly pure at top.

Antietam Formation: Predominately sandstone.

Cambrian or Precambrian

Harpers Formation: Sandy shale with varying degrees of metamorphism.

Weverton-Loudoun Formation: Predominately an arkosic course-grained sandstone.

Catoctin Formation: Greenstone or schist.

Minable Coal Seams:

The minable coal seams are listed in descending order. Minable coals of economic importance are only found west of the Allegheny Front. Figure 4-34 shows the original extent of the minable coals. The West Virginia Geological and Economic Survey coal maps (Fig.4-35 through 4-39) provide additional information on rank, fixed carbon, sulfur content, ash content, BTU heating value and age of coals.

Limestone Resources:

Limestone groups, formations or members which outcrop in the county and are suitable for quarrying are listed. Figure 4-40 shows the major limestone outcrop areas.

Sandstone Resources:

A listing is given of the sandstone members which outcrop in the county and are suitable for quarrying.

Salt Resources:

A statement is made as to whether the county is underlain by natural salt brine and rock salt. Where it can be determined, the major rock members containing the salt brine are listed. Figure 4-40 shows the areas that are likely underlain by rock salt and natural brine.

Oil and Gas Deposits

A significant amount of gas and some oil is recovered yearly in the western part of West Virginia. Figure 4-41 shows the oil and gas fields in West Virginia as of 1971.

Soil Limitations:

A summary of the limitations and hazards associated with the various soils is presented for the counties with modern soil publications completed. Figure 4-42 shows the progress of soil mapping on a county to county basis. It should be noted that the Upshur soil unit, wherever it occurs, is a serious landslide risk. Brooke, Brookside, Clarksburg, Ernest, Gilpin, Leadvale Markland, Meckesville, Shelocta, Vandlia, Westmoreland, Wharton, and Zoar soils also have a slippage potential on moderate to steep slopes. Erosional problems are likely with most soils left in unprotected areas. It is not uncommon for bedrock to be exposed or located at a shallow depth below the surface.

Seismic Risk:

The seismic risk is given according to zone designation. As shown on the earthquake location map, Figure 4-43, southeastern and extreme eastern West Virginia fall within Zone 2, while the remainder of the state falls within Zone 1. If an area is located within Zone 1, minor damage is expected. If an area is located within Zone 2, moderate damage is expected. The higher risk in the eastern part of the state is caused primarily by the earthquake activity in the Blue Ridge Mountains.

Major Rivers:

A listing is given of the counties' largest rivers, the type of drainage network and the ultimate drainage.

Comments:

Miscellaneous items are provided, including published landslide maps, salient geological features, occurrence of limestone caverns, major impoundments, registered national landmarks (RNL), and the Nature Conservancy's natural areas (TNC).

Boxed Information:

The boxed section consists of a presentation of the physiographic province or provinces of the county; highest and lowest points above sea level; a breakdown of the land area into flood plains, slopes and uplands; and meteorological station location and measurement capabilities (P - precipitation, T - temperature, and E - evaporation).

The percentage of slopes given in the land area column is the percentage of the land area with slope inclination greater than 10%. Table 4-2 presents the percentage of land area by counties with slope inclination greater than 2.5, 10, 20, 40, 50, 60, 70 percent. The percentage of flood plains was determined by estimating the area of Quaternary deposits terraces. Uplands are the remaining areas of less than 10% slope, without Quaternary deposits and with significantly higher elevations than the major streams and rivers.

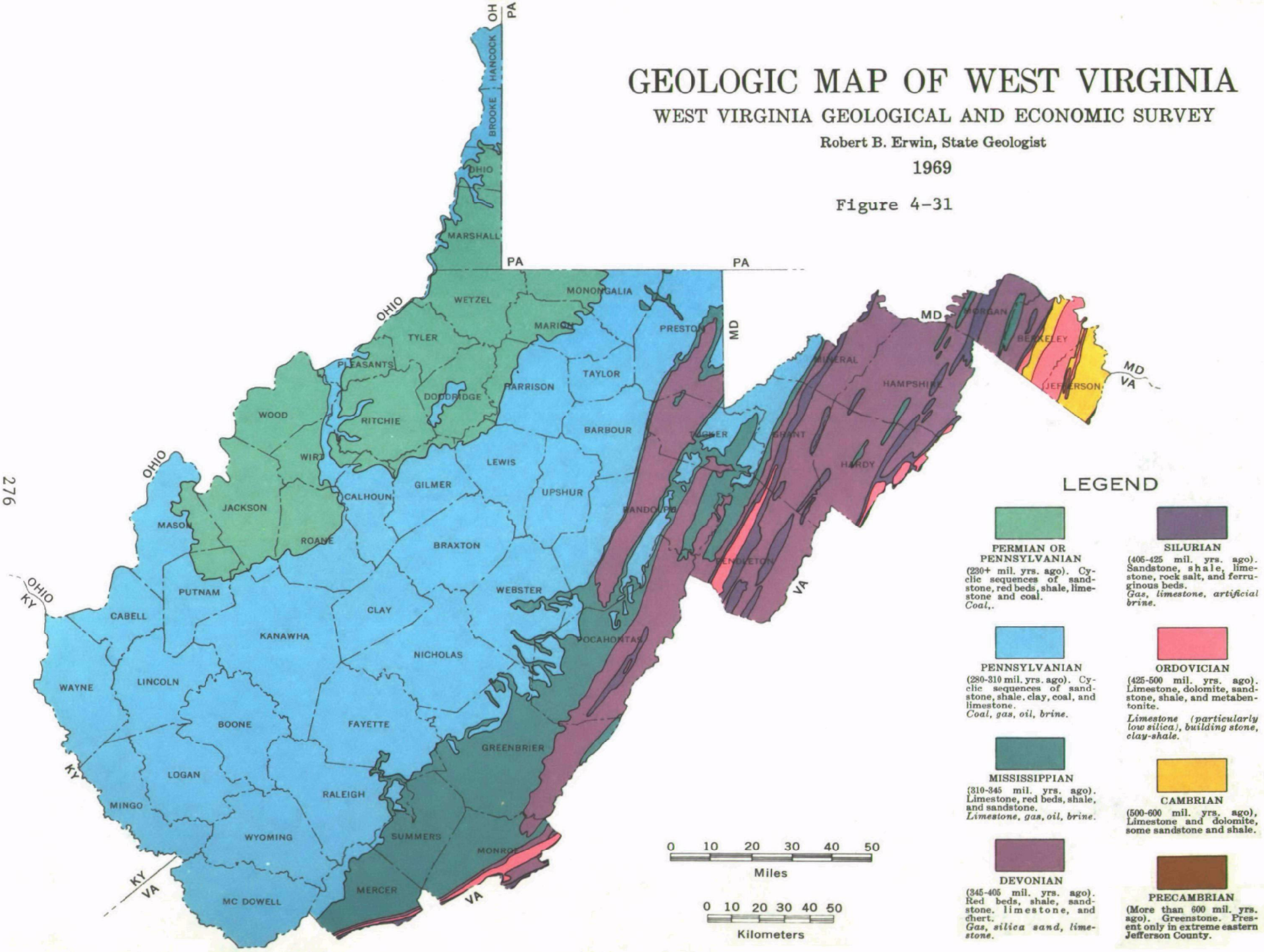
GEOLOGIC MAP OF WEST VIRGINIA

WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

Robert B. Erwin, State Geologist

1969

Figure 4-31



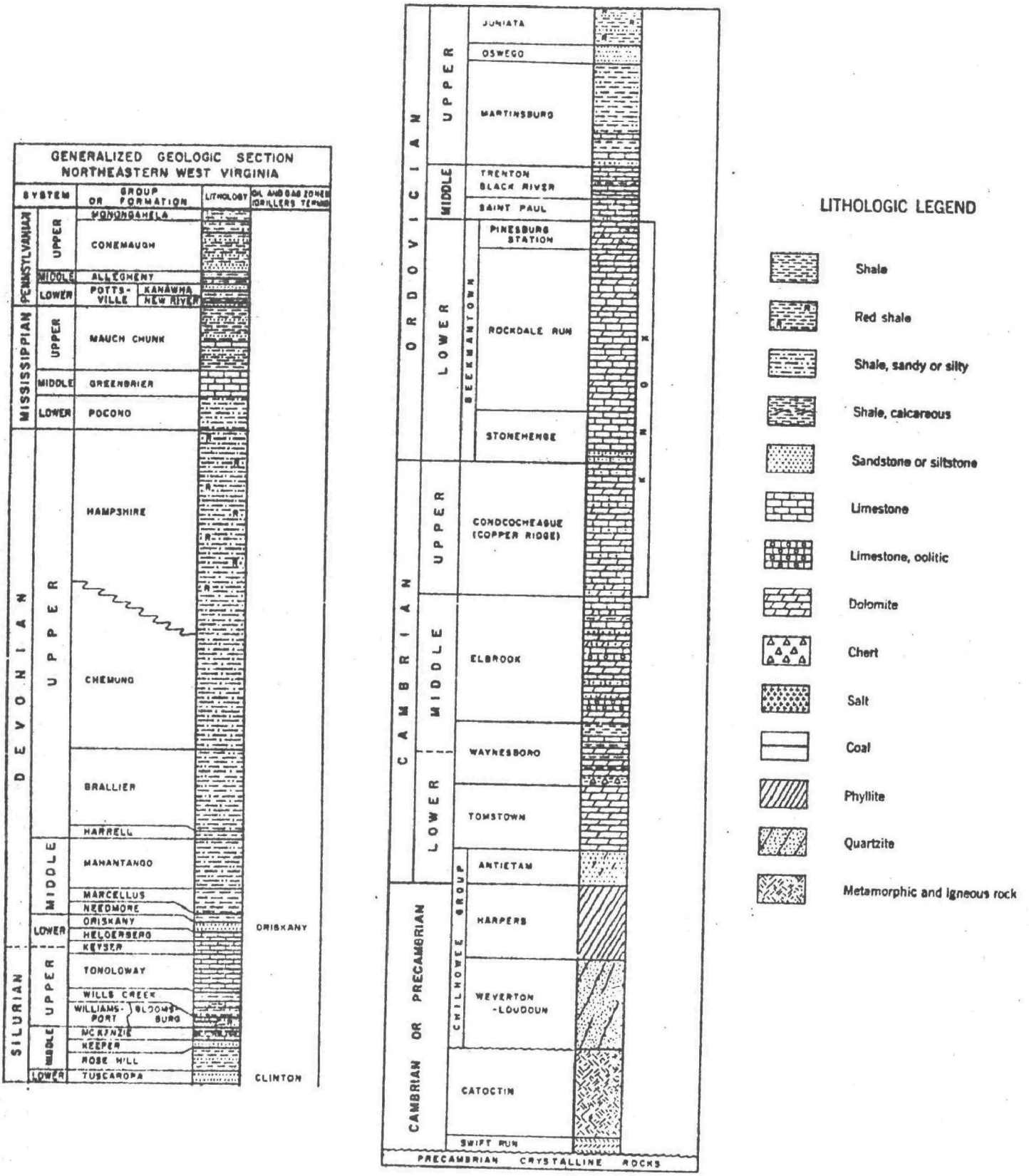


Figure 4-32

1968 State Geologic Map

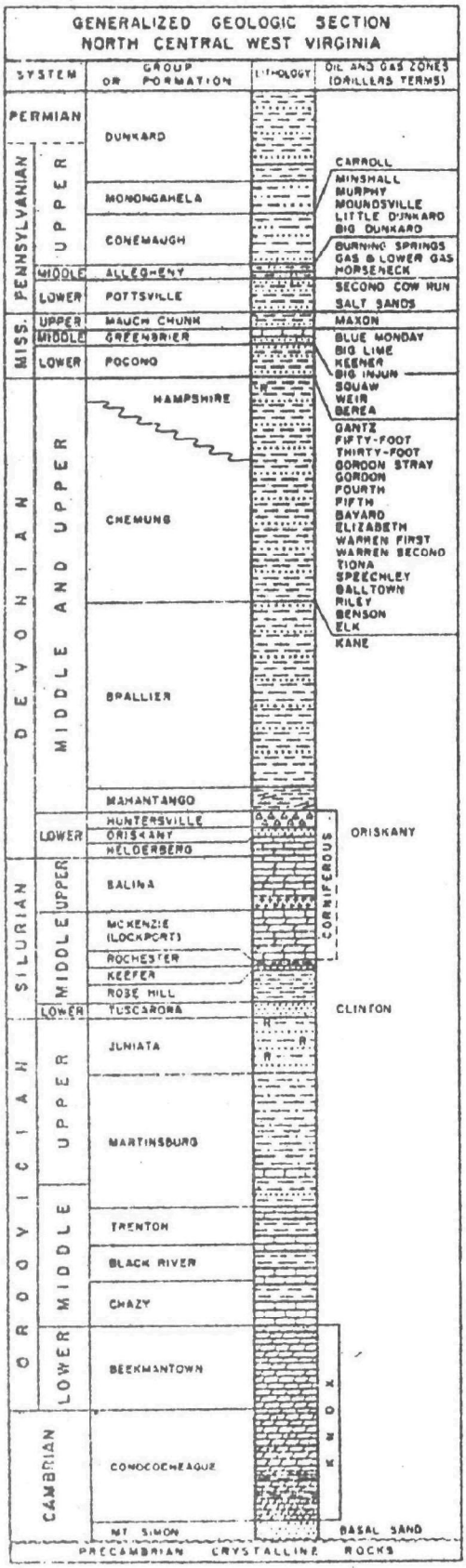
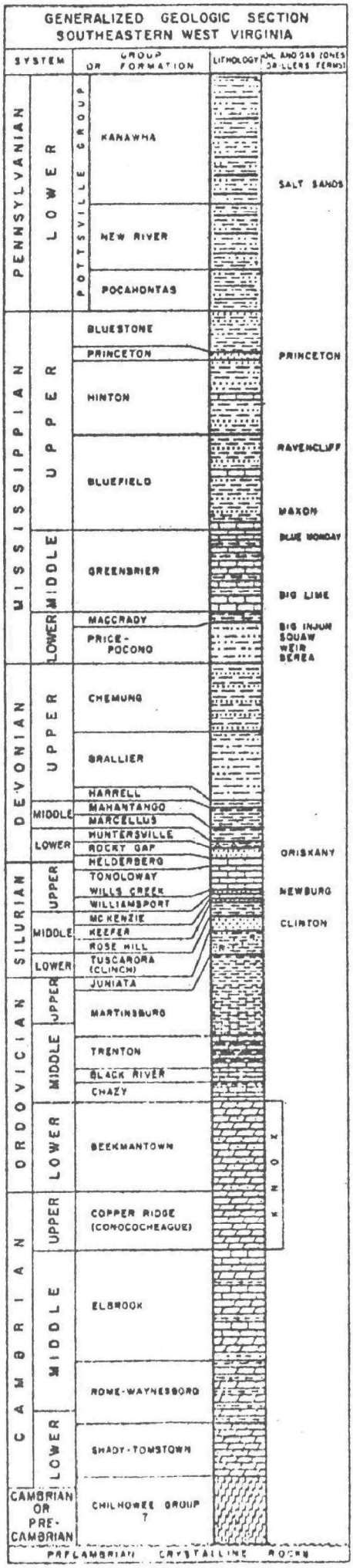
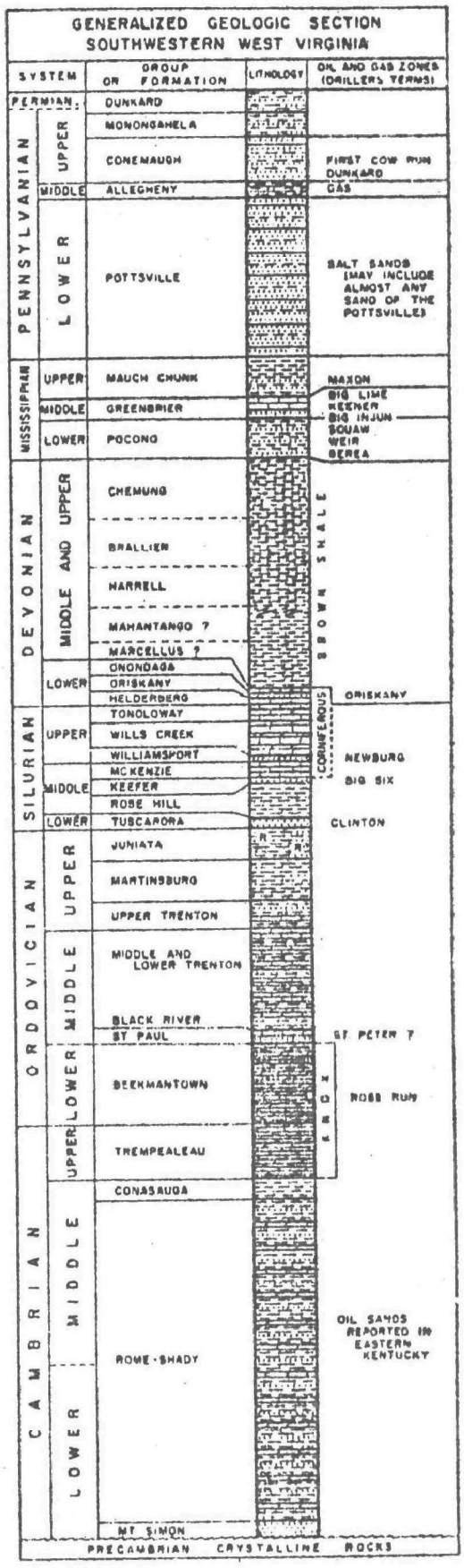


Figure 4-33





1968 State Geologic Map

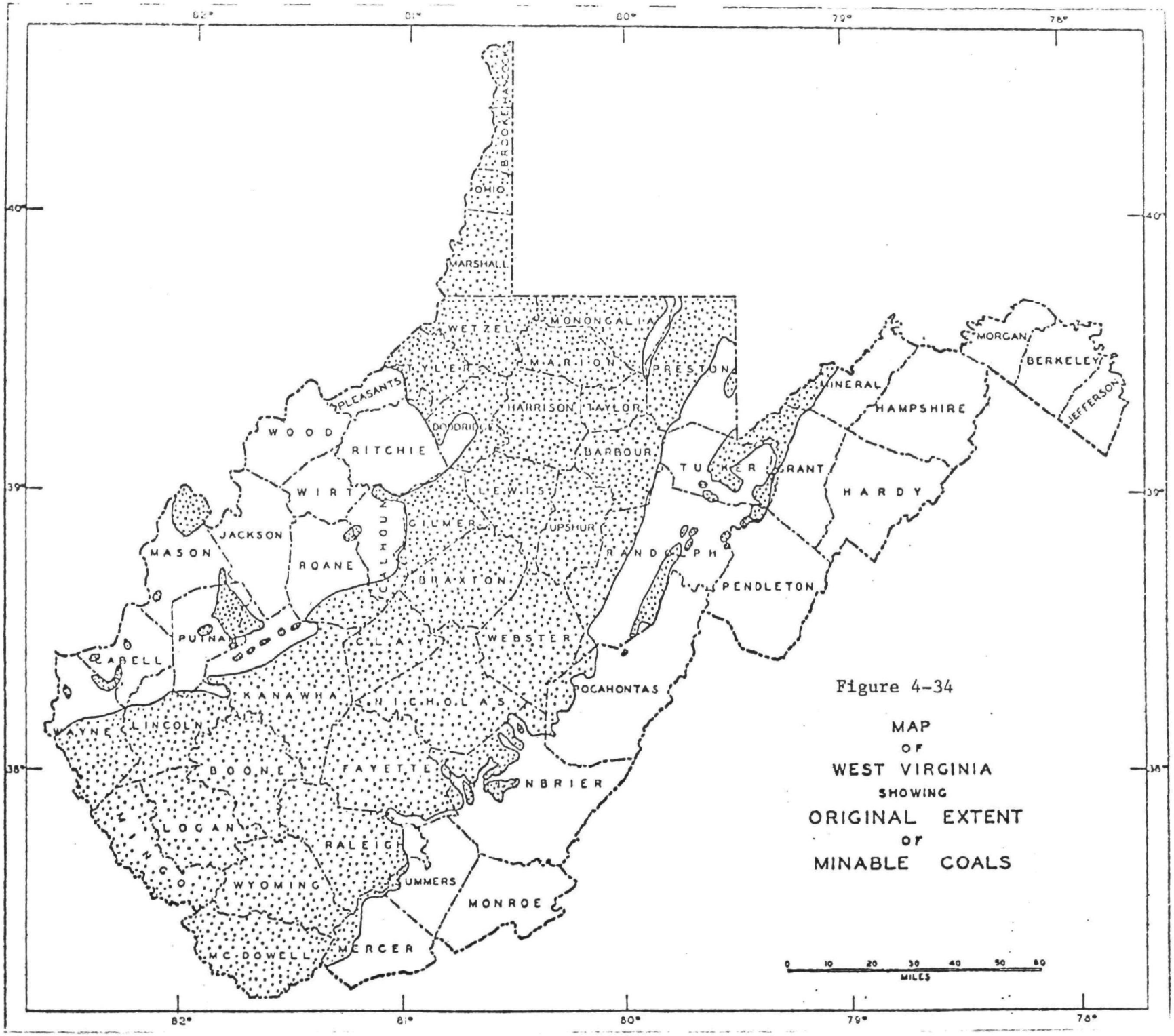


Figure 4-34

MAP
OF
WEST VIRGINIA
SHOWING
ORIGINAL EXTENT
OF
MINABLE COALS

GENERALIZED GEOLOGIC MAP
OF THE
COAL FIELDS
OF
WEST VIRGINIA
WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

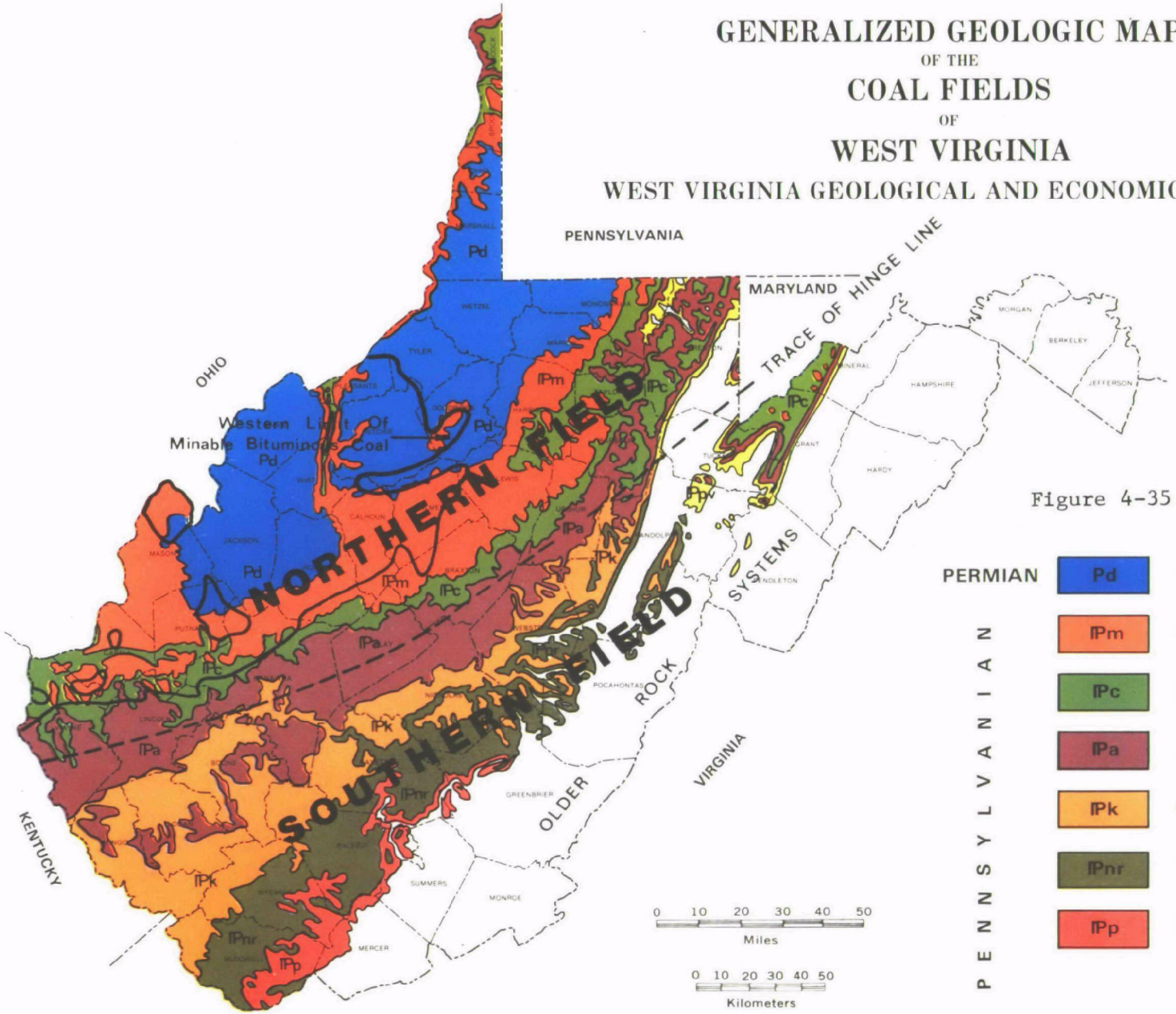


Figure 4-35

PENNSYLVANIAN

PERMIAN	Pd	Dunkard Group
	IPm	Monongahela Group
	IPc	Conemaugh Group
	IPa	Allegheny Formation
	IPk	Kanawha Formation
	IPnr	New River Formation
	IPp	Pocahontas Formation
	IPpv	Pottsville Group, undivided.

COAL RANK AND FIXED CARBON
OF
WEST VIRGINIA COALS

WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

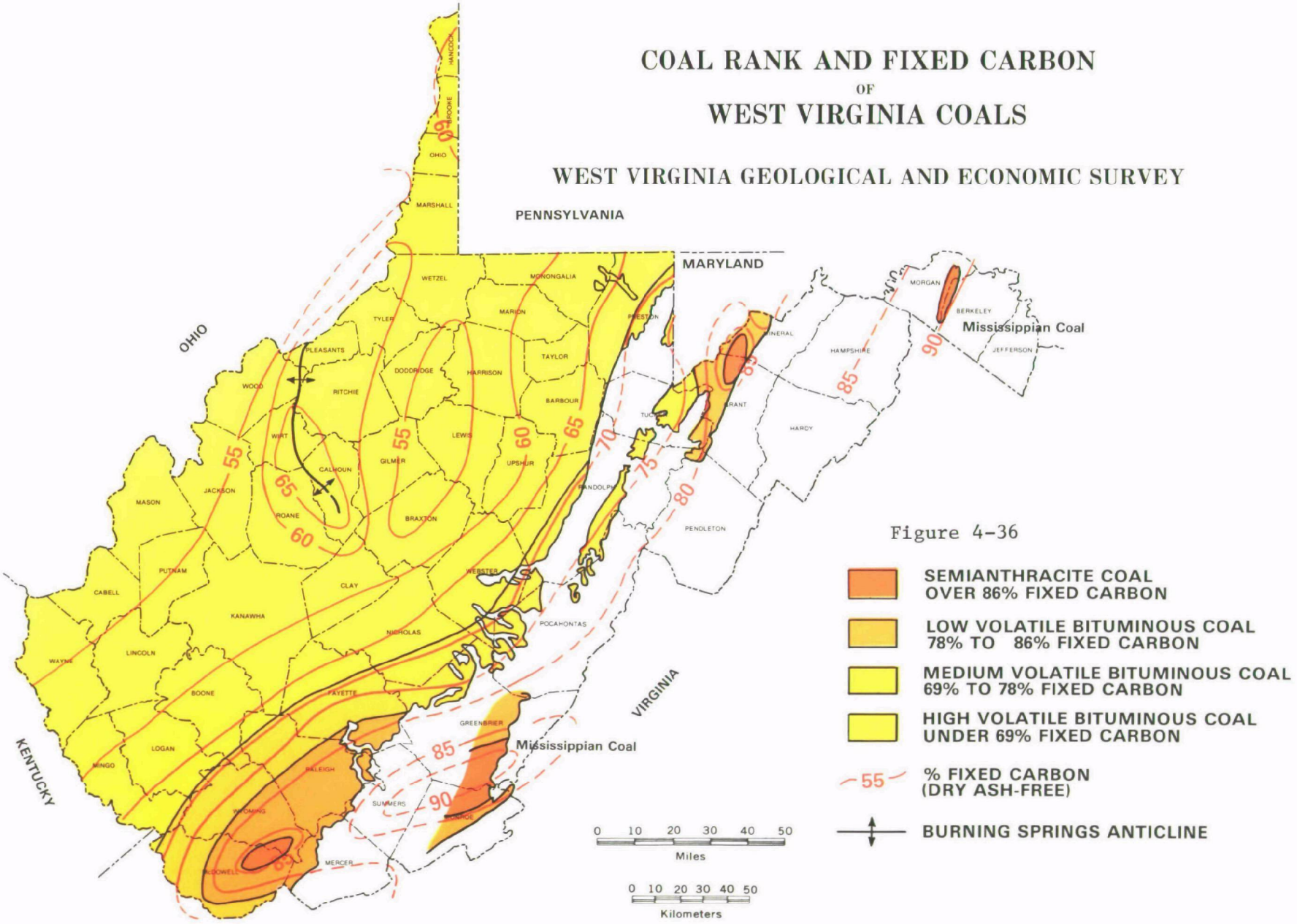


Figure 4-36

- SEMIANTHRACITE COAL OVER 86% FIXED CARBON
- LOW VOLATILE BITUMINOUS COAL 78% TO 86% FIXED CARBON
- MEDIUM VOLATILE BITUMINOUS COAL 69% TO 78% FIXED CARBON
- HIGH VOLATILE BITUMINOUS COAL UNDER 69% FIXED CARBON
- 55 % FIXED CARBON (DRY ASH-FREE)
- BURNING SPRINGS ANTICLINE

GENERALIZED SULFUR CONTENT
OF THE
BITUMINOUS COALS
OF
WEST VIRGINIA

WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

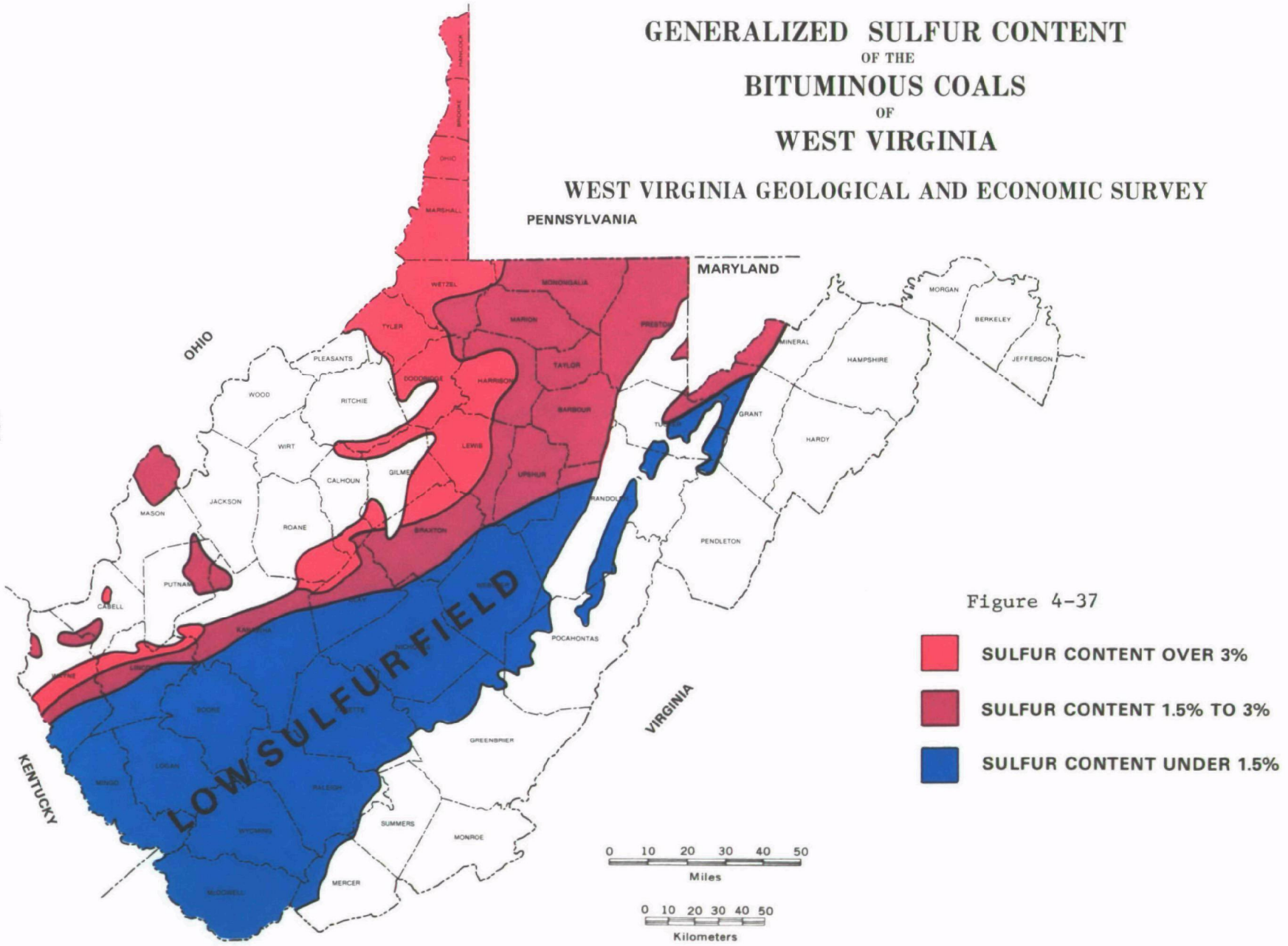


Figure 4-37

SULFUR CONTENT OVER 3%

SULFUR CONTENT 1.5% TO 3%

SULFUR CONTENT UNDER 1.5%

GENERALIZED ASH CONTENT
OF THE
BITUMINOUS COALS
OF
WEST VIRGINIA

WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

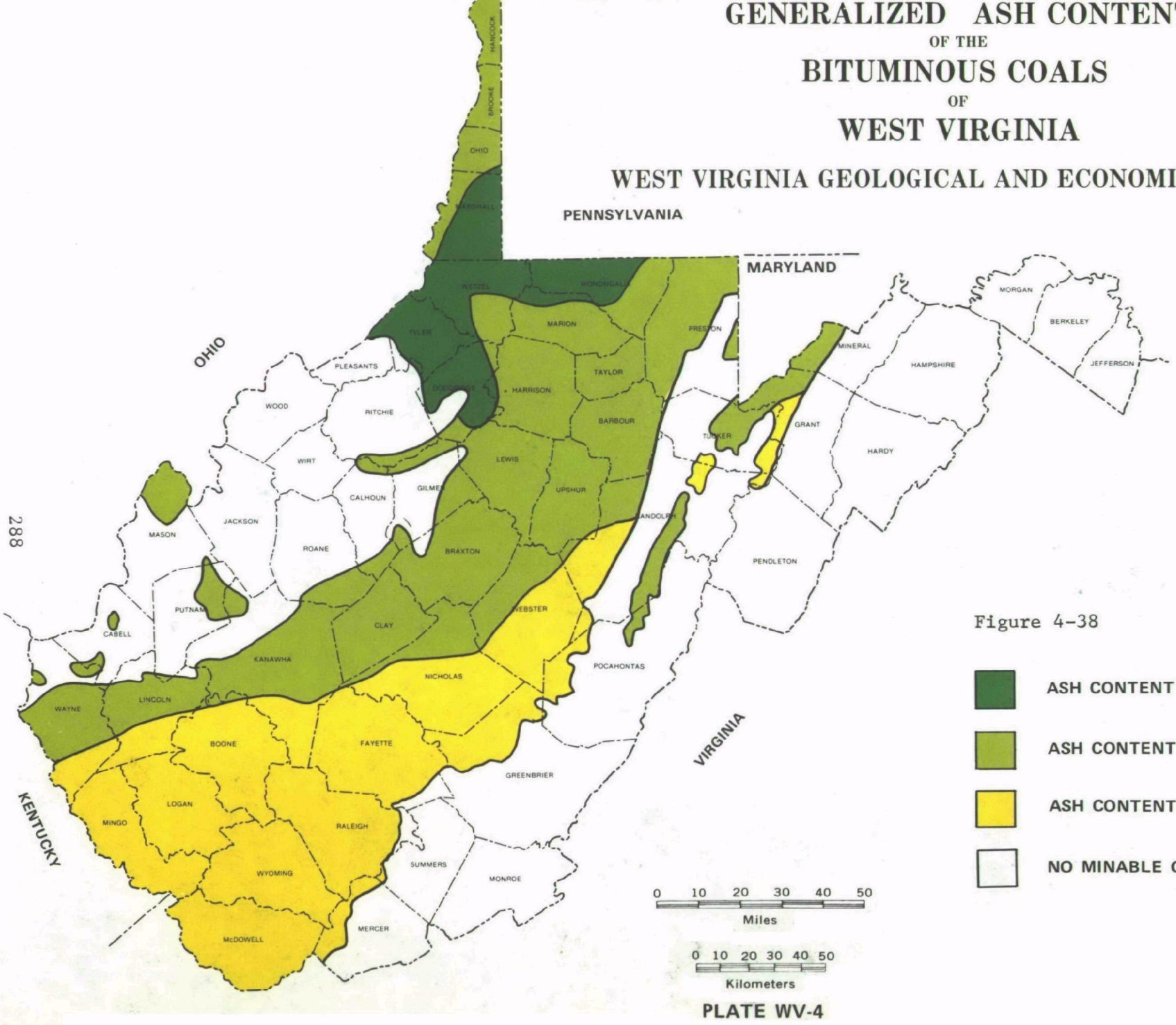


Figure 4-38

ASH CONTENT OVER 12%

ASH CONTENT 6% TO 12%

ASH CONTENT UNDER 6%

NO MINABLE COAL

PLATE WV-4

GENERALIZED BTU HEATING VALUE
OF THE
BITUMINOUS COALS OF WEST VIRGINIA

WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

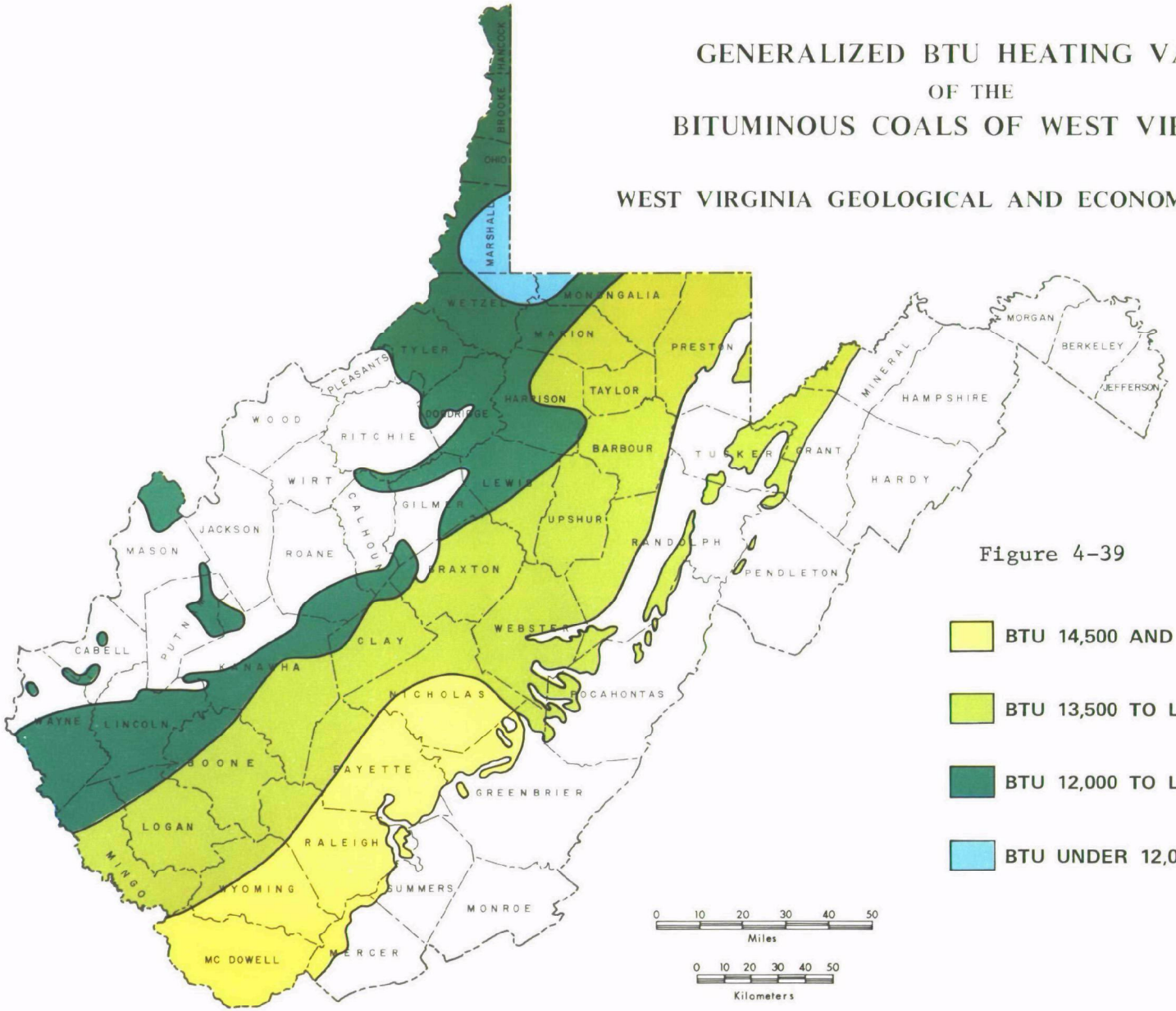


Figure 4-39

- BTU 14,500 AND OVER
- BTU 13,500 TO LESS THAN 14,500
- BTU 12,000 TO LESS THAN 13,500
- BTU UNDER 12,000

LIMESTONE OUTCROPS
AND
PROBABLE AREA UNDERLAIN BY ROCK SALT AND NATURAL BRINE
IN
WEST VIRGINIA

WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

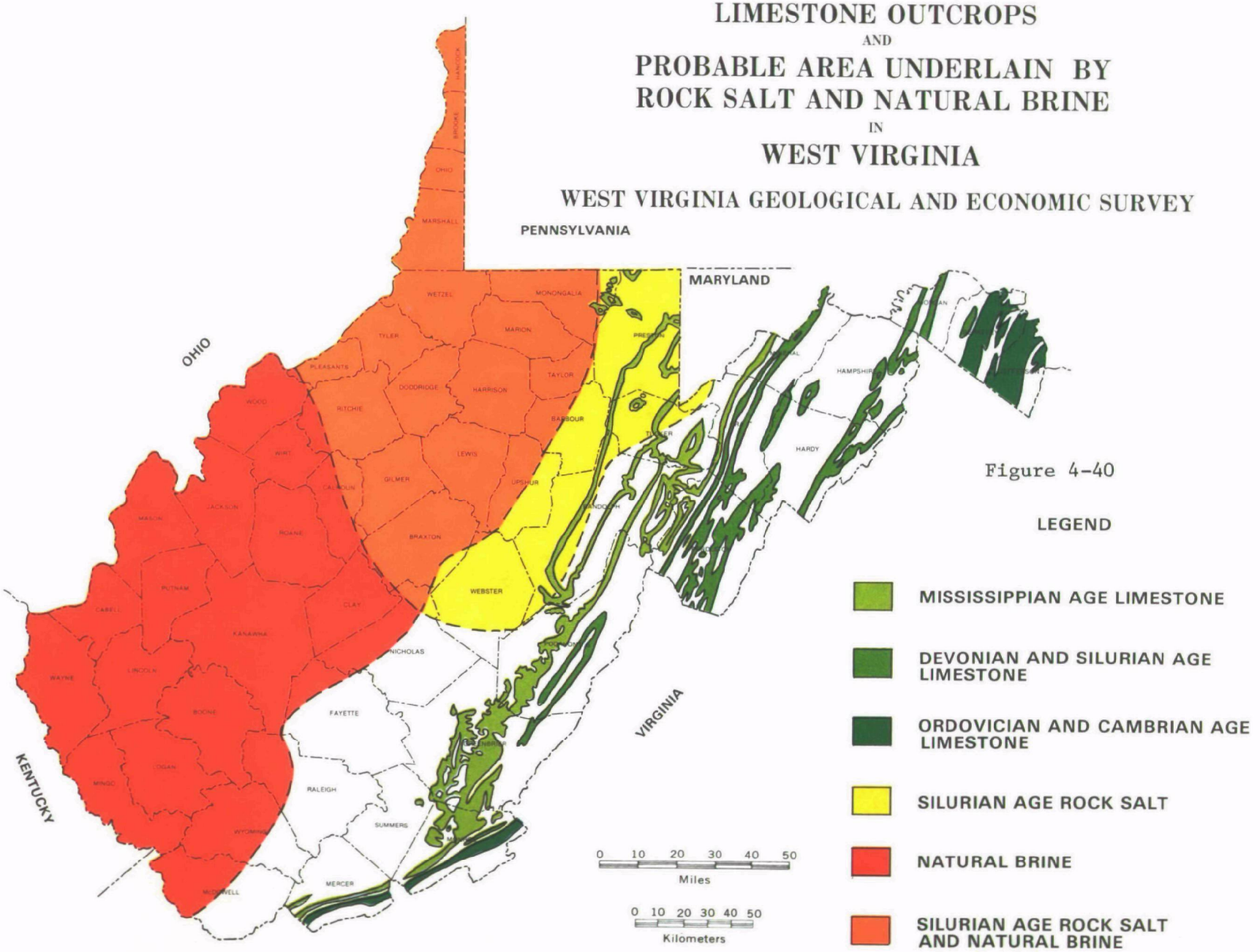
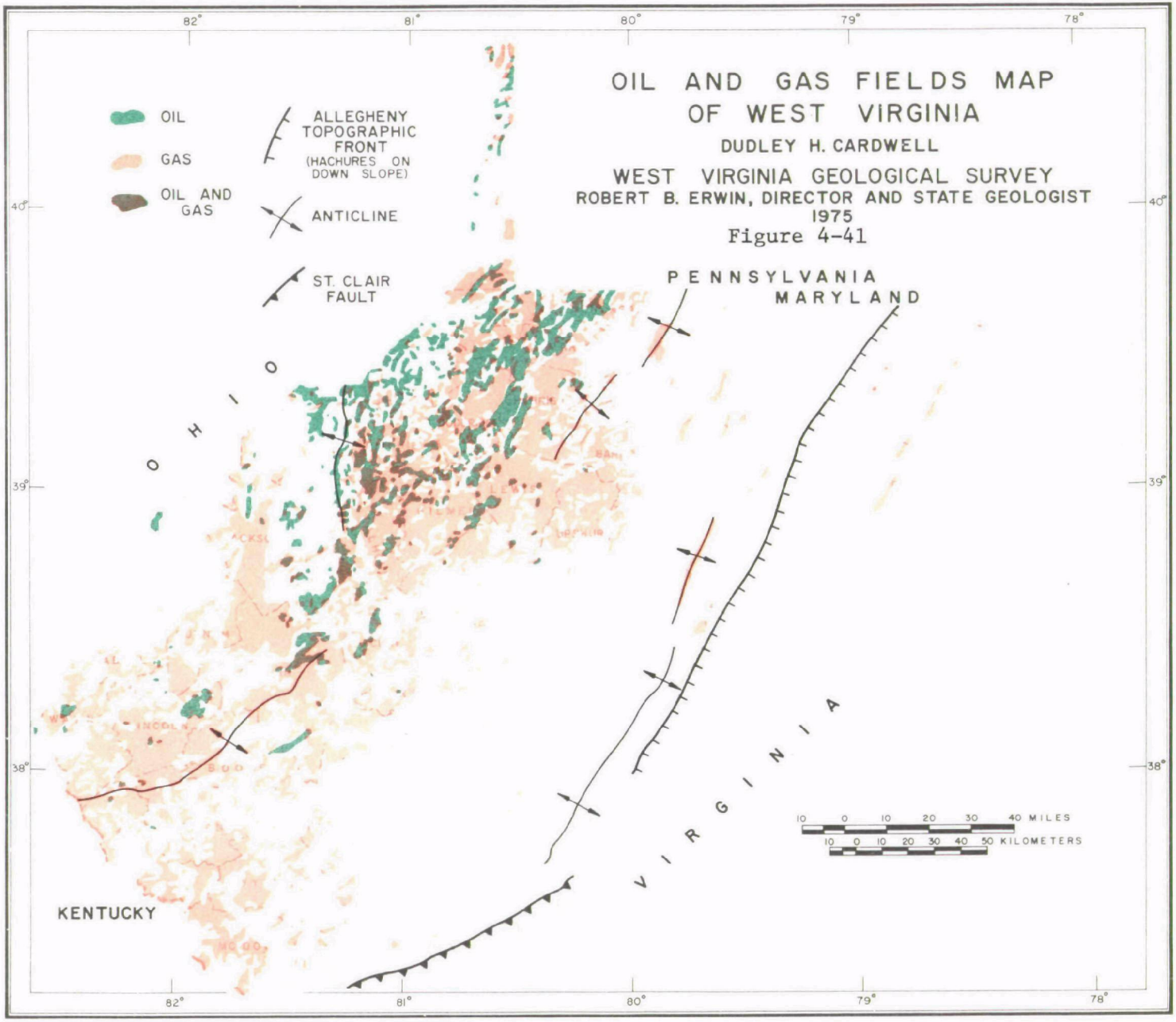
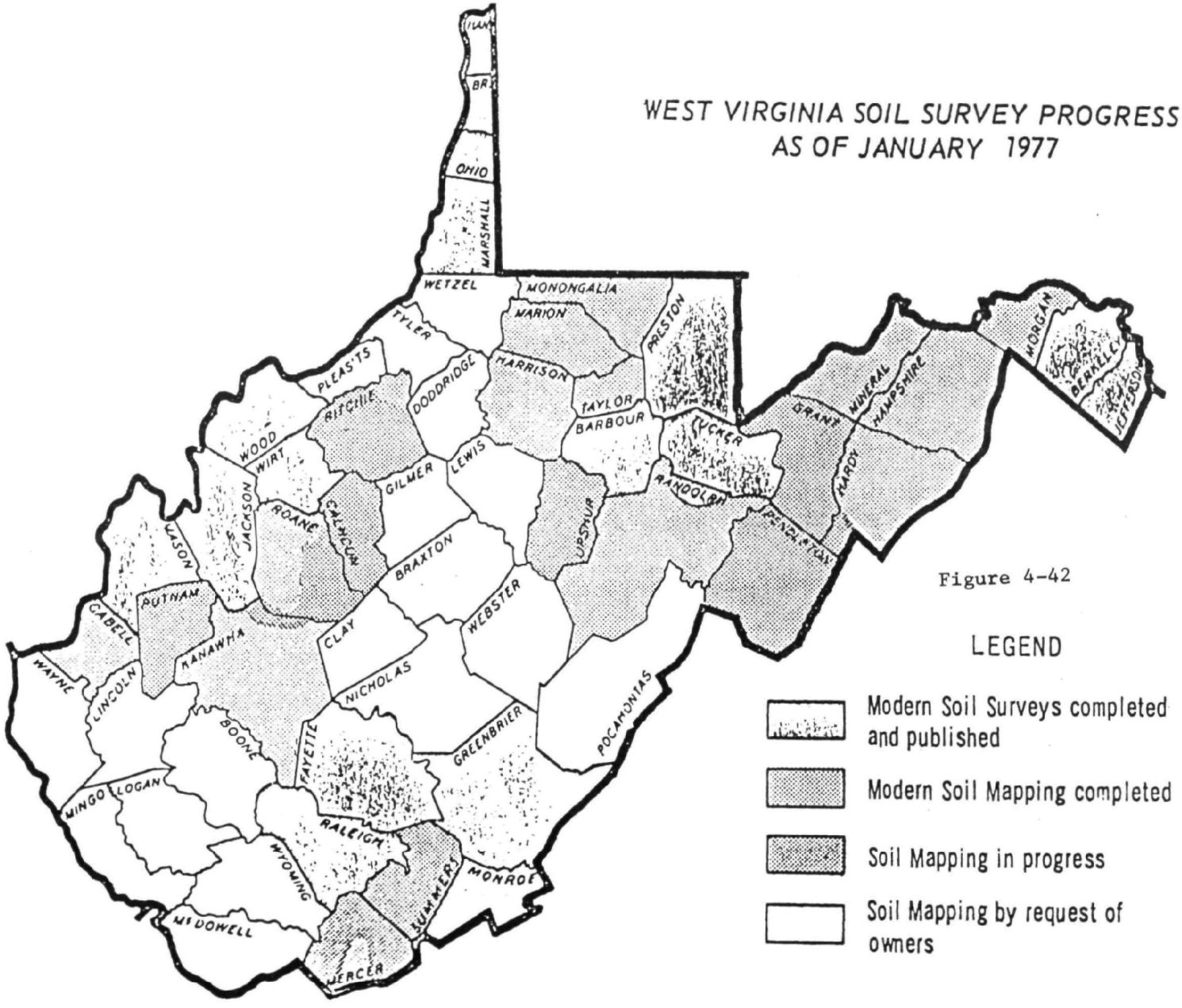


Figure 4-40

LEGEND

- MISSISSIPPIAN AGE LIMESTONE
- DEVONIAN AND SILURIAN AGE LIMESTONE
- ORDOVICIAN AND CAMBRIAN AGE LIMESTONE
- SILURIAN AGE ROCK SALT
- NATURAL BRINE
- SILURIAN AGE ROCK SALT AND NATURAL BRINE


OIL AND GAS FIELDS MAP
OF WEST VIRGINIA
DUDLEY H. CARDWELL
WEST VIRGINIA GEOLOGICAL SURVEY
ROBERT B. ERWIN, DIRECTOR AND STATE GEOLOGIST
1975
Figure 4-41
OIL
GAS
OIL AND GAS
ALLEGHENY TOPOGRAPHIC FRONT
(HACHURES ON DOWN SLOPE)
ANTICLINE
ST. CLAIR FAULT
PENNSYLVANIA
MARYLAND
OHIO
VIRGINIA
KENTUCKY
82°
81°
80°
79°
78°
40°
39°
38°
10 0 10 20 30 40 MILES
10 0 10 20 30 40 50 KILOMETERS


WEST VIRGINIA SOIL SURVEY PROGRESS
AS OF JANUARY 1977
HAN
BR
OHIO
MARSHALL
WETZEL
MONONGALIA
MARION
TYLER
PRESTON
PLEAS'TS
RITCHIE
DODDRIDGE
HARRISON
TAYLOR
BARBOUR
TUCKER
GRANT
MINERAL
HAMPSHIRE
MORGAN
BERKELEY
JEFFERSON
WOOD
WIRT
LEWIS
GILMER
CALHOUN
ROANE
JACKSON
UPSHUR
RANDOLPH
HARDY
PENDLETON
WASON
PUTNAM
BRAXTON
WEBSTER
CABELL
KANAWHA
CLAY
WAYNE
LINCOLN
NICHOLAS
POCAHONTAS
BOONE
FAYETTE
GREENBRIER
WYOMING
LOGAN
MINGO
RALEIGH
SUMMERS
MONROE
MCDOWELL
MERCER
Figure 4-42
LEGEND
Modern Soil Surveys completed and published
Modern Soil Mapping completed
Soil Mapping in progress
Soil Mapping by request of owners

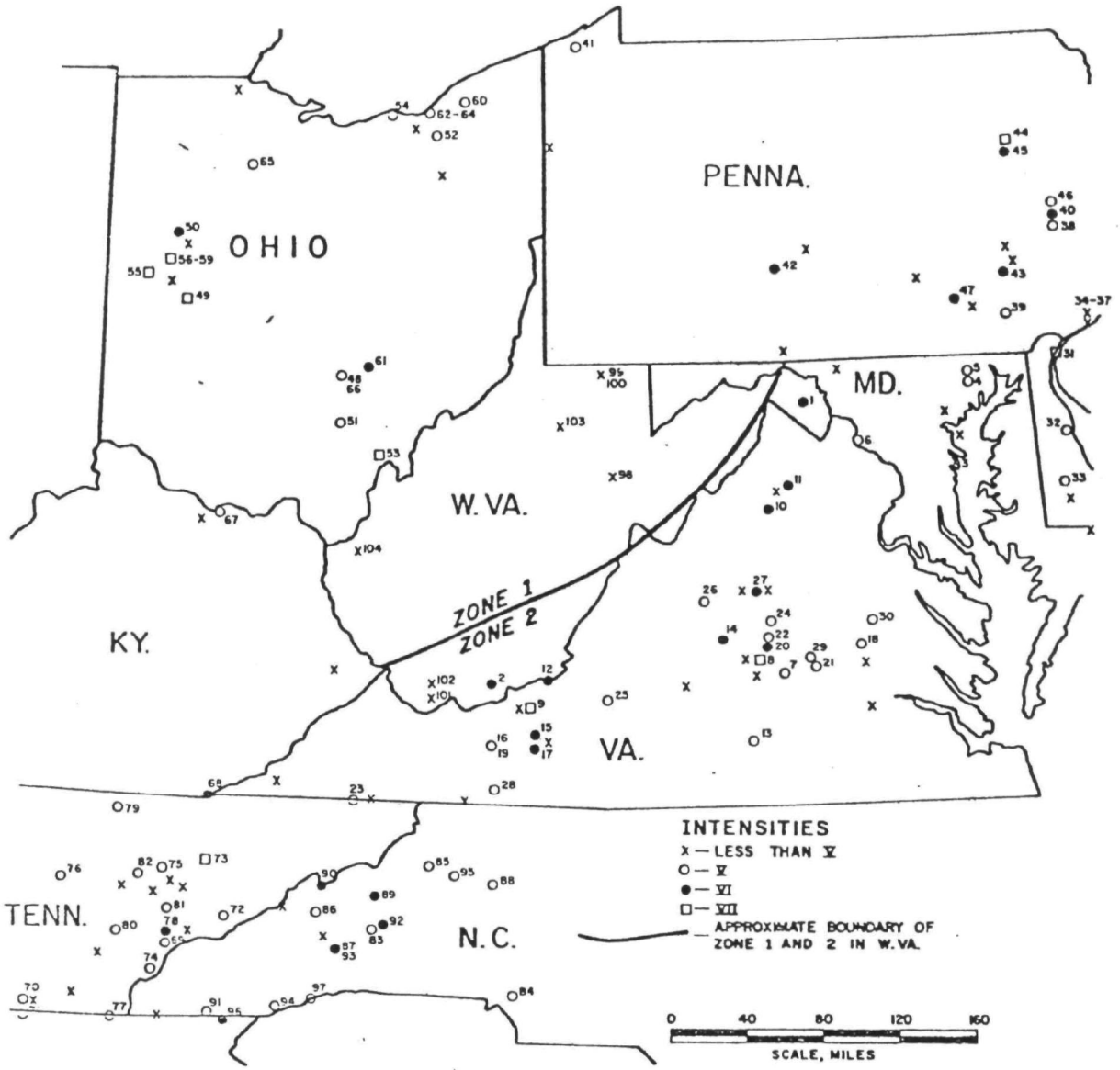


Figure 4-43 Earthquakes of the Central Appalachians from 1758 to 1970, showing approximate boundary of zone 1 and zone 2 in W. Va. Minor damage is expected in zone 1 and moderate damage is expected in zone 2.

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4.6 COUNTY DESCRIPTIONS

BARBOUR COUNTY 54 001

Geologic Structure: Regional dip to the northwest, gradual in west, very abrupt in extreme east, interrupted by several synclinal basins which trend northeast-southwest. Major features: Hiram Anticline and Belington Syncline.

Exposures: Dominated by the Monongahela Group, Conemaugh Group, Allegheny Formation (Pennsylvanian), with a small amount of the Dunkard Group (Permian). Alluvium (Quaternary) is found along the streams. Exposed along the extreme eastern border are the Mauch Chunk Group, Greenbrier Group and Pocono Group (Mississippian); Hampshire Formation and Chemung Group (Devonian).

Minable Coal Seams: Redstone and Pittsburgh Coal of the Monongahela Group; Elk Lick and Bakerstown Coal of the Conemaugh Group; Upper Freeport, Upper Kittanning, Middle and Lower Kittanning and Clarion of the Allegheny Formation; Upper Mercer, Winifrede and Sewell Coal of the Pottsville Group.

Limestone Resources: Uniontown, Sewickley and Redstone of the Monongahela Group; Clarksburg, Orlando and Elk Lick of the Conemaugh Group; Johnstown of the Allegheny Formation; Greenbrier Limestone.

Sandstone Resources: Upper Sewickley and Lower Sewickley of the Monongahela Group; Lower Pittsburgh, Connellsville, Lower Connellsville, Morgantown, Grafton, Saltsburg, Buffalo, Upper Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport and East Lynn of the Allegheny Formation; Homewood, Upper Connoquenessing and Lower Connoquenessing of the Pottsville Group.

Salt Resources: Underlain by natural salt brine in west; whole county underlain by rock salt of Silurian Age.

Soil Limitations: Alluvial Land, Atkins, Lindside, Melvin, Philo and Pope soils are subject to flooding. Brinkerton, Cookport and Monongahela are soils of low permeability and contain a seasonal high water table. Calvin and Belmont are stony soils on very steep slopes subject to erosion. Clarksburg, Ernest, Upshur and Westmoreland occur on moderate to steep slopes, contain zones of low permeability and are subject to the hazard of slipping.

Seismic Risk: Zone 1

Major Rivers: Tygart Valley River, Buckhannon River, Middle River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Tygart Lake

Physiographic Province	Relief	Est. Land Area (%)	Meteorological Stations
Appalachian Plateau (Allegheny Mountain - extreme east)	3300' 1000'	Flood Plains 2 Slopes 86 Uplands 12	Philippi (P) Hall (P) Belington (P,T)

Ref: Beverage et al., 1968; Lessing, 1974; McCue et al., 1939; Price et al. 1937; Reger et al., 1918; WVU Agri. Exp. Sta., 1970.

BERKELEY COUNTY 54 003

Geologic Structure: Berkeley County is located within the intensely folded Appalachian Mountain Region. The structure consists of overthrust folds with large faults, and in the limestone valley the folds are sharp, close together, with numerous fault-planes and overthrust faults. Ferrel Ridge Anticline and North Mountain Faulted Anticline parallel the mountain ridges in a northeast-southwest direction.

Exposures: The surface rocks consist of the Pocono Group (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Mahantango Formation, Marcellus Shale, Oriskany Sandstone, Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek Formation, Bloomsburg Red Shale, McKenzie Formation, Clinton Group, Tuscarora Sandstone (Silurian); Juniata, Martinsburg Formations, Black River, St. Paul Limestones, Beekmantown Group (Ordovician); Conococheague, Elbrook and Waynesboro Formations (Cambrian); with Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: A small amount of coal in the Meadow Branch area.

Limestone Resources: Limestones of (Group or Formation) Helderberg (Devonian); Tonoloway, Wills Creek (Silurian); Black River, St. Paul, Beekmantown (Ordovician); Conococheague, Elbrook and Waynesboro (Cambrian).

Sandstone Resources: Pocono Sandstones; Oriskany Sandstone; Sandstones in the Devonian Shales; Keefer Sandstone of the McKenzie Formation; and Tuscarora Sandstone.

Soil Limitations: Alluvial Land, Atkins, Huntington, Lindside, Melvin, Philo and Pope soils are subject to flooding. Blairton, Buchanan, Captina, Monongahela, Pickaway, Sees and Tygart are terrace soils with slow permeability and a seasonal high water table. Leadvale has a slipping hazard. Carbo, Chilhowie, Corydon and Duffield overlie solution passages; Frankstone, Frederick, Hagerstown, Murrill, Pickaway and Sees overlie cavernous limestone.

Seismic Risk: Zone 2

Major Rivers: Potomac River
Drainage Network: Trellis
Ultimate Drainage: Potomac River

Comments: Shenandoah Valley; Some caves; Yankauer Preserve (TNC)

Physiographic Province	Relief	Est. Land Area (%)	Meteorological Stations
West - Ridge and Valley East - Great Appalachian Valley	2220' 310'	Flood Plains 4 Slopes 50 Uplands 46	Martinsburg FAA AP (P, T, E) Martinsburg 2 (P)

Ref: Gorman et al., 1966; Grimsley, 1916; Lessing, 1974; McCue et al., 1939; WVU Agri. Exp. Sta., 1970.

BOONE COUNTY 54 005

Geologic Structure: Boone County is traversed by the large Warfield Anticline which passes through the area in a northeast and southwest direction. About one-third of the area lies north and the remaining two-thirds lie south of this anticline. Paralleling the Warfield Anticline, about five miles to the southeast, is the Coalburg Syncline which is the largest trough in southern West Virginia.

Exposures: The Conemaugh Group (Pennsylvanian) is exposed in a few scattered locations. The surface rocks are dominated by the Allegheny Formation and Kanawha Formation (Pennsylvanian), with Alluvium (Quaternary) along the streams.

Minable Coal Seams: Lower Kittanning of the Allegheny Formation; Stockton-Lewiston, Coalburg, Winifrede, Chilton, Hernshaw, Williamson, Cedar Grove, Alma, Campbell Creek (No. 2 Gas), Powellton and Eagle Coals of the Kanawha Formation.

Limestone Resources: Boone County contains very little limestone.

Sandstone Resources: Upper Freeport and East Lynn of the Allegheny Formation; Homewood, Coalburg, Lower Coalburg, Upper Winifrede, Lower Winifrede, Upper Chilton, Lower Chilton, Hernshaw, Naugatuck, Williamson, Upper Cedar Grove, Middle Cedar Grove, Lower Cedar Grove, Logan, Malden, Brownstown, Matewan, Eagle and Decota of the Pottsville Group.

Salt Resources: Underlain by natural salt brine, especially brine of the Salt Sands (Pottsville Group) and Maxton Sand (Mauch Chunk Group).

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Coal River and Little Coal River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	3375'	Flood Plains	3	Madison (P,T)
	595'	Slopes	95	
		Uplands	2	

Ref: Krebs et al., 1915; Lessing, 1974; Price et al., 1937, WVU Agri. Exp. Sta., 1970.

BRAXTON COUNTY 54 007

Geologic Structure: There is a gradual regional dip (at a very small angle to the horizontal) from the southeast margin of the area to the northwest border. There are several slight interruptions by low anticlines and shallow synclines. These trend northeast and southwest. The pitch of the steepest structural slope is barely perceptible to the eye.

Exposures: The surface rocks, in a generally northwest to southeast pattern, are the Dunkard Group (Permian); Monongahela Group, Conemaugh Group, Allegheny Formation and the Kanawha Formation (Pennsylvanian); along with Alluvium (Quaternary) along the stream channels.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Bakerstown Coal of the Conemaugh Group; Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning and Lower Kittanning Coals of the Allegheny Formation; Stockton-Lewiston, Cedar Grove, Eagle and Sewell Coals of the Pottsville Group.

Limestone Resources: Sewickley and Redstone Limestones of the Monongahela Group; Clarksburg, Orlando, Elk Lick, Ewing and Sutton Limestones of the Conemaugh Group; Upper Freeport Limestone of the Allegheny Formation.

Sandstone Resources: Mannington and Waynesburg of the Dunkard Group; Gilboy, Uniontown, Arnoldsburg, Upper Sewickley, Lower Sewickley, Cedarville, and Weston of the Monongahela Group; Lower Pittsburgh, Connellsville, Lower Connellsville, Morgantown, Grafton, Jane Lew, Saltsburg, Buffalo, Upper Mahoning, Middle Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport, Upper East Lynn, East Lynn and Kittanning of the Allegheny Formation; Homewood, Coalburg, Lower Coalburg, Upper Winifrede, Upper Cedar Grove, Peerless, Eagle and Decota of the Kanawha Formation.

Salt Resources: Underlain by natural salt brine, including brine of the Pocono Group. Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Elk River and Little Kanawha River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Burnsville Lake; Sutton Lake

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	2160'	Flood Plains	2	Burnsville (P)
	760'	Slopes	98	Centralia 2 NNW (P)
		Uplands	0	Gassaway (P,T)
				Sutton Rsvr.(P,E)

Ref: Hennen et al., 1917; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

BROOKE COUNTY 54 009

Geologic Structure: Basically flat lying with a slight regional dip to the northwest, interrupted by the minor Mingo Syncline, which crosses the area in a northeast-southwest direction.

Exposures: The surface rocks consist of the Dunkard Group (Permian), Monongahela Group and Conemaugh Group (Pennsylvanian), with Alluvium (Quaternary) along the streams and the Ohio River.

Minable Coal Seams: Washington Coal of the Dunkard Group; Waynesburg, Upper Sewickley, Redstone and Pittsburgh Coals of the Monongahela Group; Bakerstown, Brush Creek and Mahoning Coals of the Conemaugh Group; Lower Freeport, Middle Kittanning, Lower Kittanning and Clarion Coals of the Allegheny Formation.

Limestone Resources: Washington and Elk Grove Limestones of the Dunkard Group; Benwood, Sewickley and Redstone Limestones of the Monongahela Group; Ames and Cambridge Limestones of the Conemaugh Group.

Sandstone Resources: Mahoning of the Conemaugh Group; Freeport and Kittanning of the Allegheny Formation.

Salt Resources: Underlain by natural salt brine, occurring especially in the Salt Sands of the Pottsville Group. Also rock salt of the Silurian Age is present.

Soil Limitations: Atkins, Chagrin, Chavies, Dunning, Huntington, and Linside soils are subject to flooding. Ernest and Monongahela are footslope soils with slow permeability and a seasonal high water table. Brooke and Upshur soils are a serious landslide hazard. Brookside, Clarksburg, Ernest, Gilpin, Westmoreland and Wharton have a moderate landslide risk.

Seismic Risk: Zone 1

Major Rivers: Ohio River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Remnants of glacial Lake Monongahela

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1377'	Flood Plains	4	New Cumberland (P,T)
	657'	Slopes	78	Weirton (P,T)
		Uplands	18	

Ref: Ellyson et al., 1974; Lessing, 1974; McCue et al., 1939; Price et al., 1937; White, 1910; WVU Agri. Exp. Sta., 1970.

CABELL COUNTY 54 011

Geologic Structure: The Appalachian basin (Parkersburg Syncline) passes through the central part of the county from northeast to southwest. The strata dip slightly to the east on the west side of the syncline and to the southeast on the east side.

Exposures: The surface rocks consist of the Dunkard Group (Permian): Monongahela Group and Conemaugh Group (Pennsylvanian); with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Little Pittsburgh of the Conemaugh Group; Lower Kittanning Coal of the Allegheny Formation.

Limestone Resources: Very little limestone occurs in Cabell County.

Sandstone Resources: Waynesburg of the Dunkard Group; Gilboy, Uniontown, Arnoldsburg, and Upper Pittsburgh of the Monongahela Group; Lower Pittsburgh, Connellsville, Morgantown, Grafton, Saltsburg, Buffalo and Mahoning of the Conemaugh Group; Upper Freeport and Lower Freeport of the Allegheny Formation.

Salt Resources: Underlain by natural salt brine, especially brine of the Salt Sands (Pottsville Group), Maxon Sand (Mauch Chunk Group) and Big Injun Sand (Pocono Group).

Soil Limitations: Modern soil mapping completed but not published.

Seismic Risk: Zone 1

Major Rivers: Ohio River and Guyandot River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Huntington and Barboursville Landslide Quadrangles; Ancient Teays Valley.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1165'	Flood Plains	10	Huntington Fed. Bldg.(P,T)
	494'	Slopes	87	
		Uplands	3	

Ref: Krebs et al., 1913; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

CALHOUN COUNTY 54 013

Geologic Structure: The county lies near the center of the Appalachian basin, entirely on the eastern side of its deepest portion. The strata dip slightly to the southeast, interrupted by several minor anticlines (Big Moses, Burning Springs, Arches Fork, Chestnut Ridge), and several minor synclines (Burchfield, Robinson, Richardson Basin), trending in a northeast-southwest direction.

Exposures: The surface rocks are the Dunkard Group (Permian); Monongahela and, exposed in the south, the Conemaugh Group (Pennsylvanian); with Alluvium (Quaternary) along the stream channels.

Minable Coal Seams: Waynesburg Coal of the Dunkard Group; Pittsburgh Coal of the Monongahela Group; Campbell Creek Coal of the Pottsville Group.

Limestone Resources: No outcrop of workable thickness occurs.

Sandstone Resources: Hundred, Upper Marietta, Lower Marietta, Mannington and Waynesburg of the Dunkard Group; Uniontown, Arnoldsburg and Sewickley of the Monongahela Group; Lower Pittsburgh, Connellsville, Morgantown, and Buffalo of the Conemaugh Group.

Salt Resources: Underlain by natural salt brine, especially brine of the Salt Sands (Pottsville Group), and Maxton Sand (Mauch Chunk Group). Rock Salt of Silurian Age probable in the northeast portion of the county.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Little Kanawha River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1560' 630'	Flood Plains Slopes Uplands	2 98 0	Grantsville 2 NW (P,T)

Ref: Hennen, 1911; Lessing, 1914; Price et al., 1937; WVU Exp. St., 1970.

CLAY COUNTY 54 015

Geologic Structure: There is a gradual regional dip at a very low angle with the horizontal from the southeast margin of the area to the northwest border, with several slight interruptions by low anticlines and shallow synclines which trend northeast-southwest. The pitch over the steepest structural slope is barely perceptible to the eye.

Exposures: The rocks at the surface consist of the Monongahela Group, Conemaugh Group, Allegheny Formation and the Kanawha Formation (Pennsylvanian); with Alluvium (Quaternary) along the streams.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Bakerstown Coal of the Conemaugh Group; Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning and Clarion Coals of the Allegheny Formation; Stockton-Lewiston, Coalburg, Winifrede, Cedar Grove, Eagle and Sewell Coals of the Pottsville Group.

Limestone Resources: Sewickley and Redstone Limestones of the Monongahela Group; Clarksburg, Orlando, Elk Lick, Ewing and Sutton Limestones of the Conemaugh Group.

Sandstone Resources: Upper Sewickley, Lower Sewickley, Cedarville and Weston of the Monongahela Group; Lower Pittsburgh, Connellsville, Lower Connellsville, Morgantown, Grafton, Jane Lew, Saltsburg, Buffalo, Upper Mahoning, Middle Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport, Upper East Lynn and Kittanning of the Allegheny Formation; Homewood, Coalburg, Lower Coalburg, Upper Winifrede, Lower Winifrede, Upper Cedar Grove, Peerless and Eagle of the Kanawha Formation.

Salt Resources: Underlain by natural salt brine, including the Salt Sands of the Pottsville Group.

Soil Limitations: Modern soil mapping not complete.

Seismic Risk: Zone 1

Major Rivers: Elk River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1875'	Flood Plains	2	Clay 1 (P)
	605'	Slopes	98	Widen (P)
		Uplands	0	

Ref: Hennen, 1917; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

DODDRIDGE COUNTY 54 017

Geologic Structure: Nearly flat-lying strata, with a slight dip to the northwest. The county is traversed by a number of minor anticlines and synclines, trending southwest and northeast.

Exposures: The exposures are dominated by the Dunkard Group (Permian). Also present is the Monongahela Group (Pennsylvanian), and Alluvium (Quaternary) along the streams.

Minable Coal Seams: Washington Coal of the Dunkard Group; Uniontown and Pittsburgh Coals of the Monongahela Group; Harlem Coal of the Conemaugh Group; and Upper Kittanning Coal of the Allegheny Formation.

Limestone Resources: Uniontown Limestone of the Pennsylvanian System.

Sandstone Resources: Nineveh, Jollytown, Hundred, Upper Marietta, Lower Marietta, Mannington and Waynesburg of the Dunkard Group; Gilboy, Uniontown, Arnoldsburg and Upper Sewickley of the Monongahela Group.

Salt Resources: Underlain by natural salt brine, expecially brine of the Salt Sands (Pottsville Group), Maxton Sand (Mauch Chunk Group), and Big Injun Sand (Pocono Group). Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Middle Island Creek
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1600' 725'	Flood Plains Slopes Uplands	1 99 0	Smithburg (P) West Union (P,T)

Ref: Hennen, 1912; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

FAYETTE COUNTY 54 019

Geologic Structure: The strata have only been slightly disturbed, showing a low angle regional dip from the southeast to the northwest boundary; accentuated slightly by the Mann Mountain, Ravens Eye and Boggs Knob Anticlines and depressed by the Clifftop, Lawton and Springdale Synclines, trending in a northeast-southwest direction.

Exposures: The exposures in a very generalized northwest to southeast pattern consist of the Allegheny Formation, Kanawha Formation, New River Formation and Pocahontas Formation (Pennsylvanian); Mauch Chunk Group (Mississippian); Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: Middle Kittanning and Lower Kittanning of the Allegheny Formation; Stockton-Lewiston, Coalburg, Winifrede, Chilton, Cedar Grove, Alma, Peerless, Campbell Creek (No. 2 Gas), Powellton, Eagle, Little Eagle, Glenalum Tunnel, Gilbert and Douglas of the Kanawha Formation; Sewell and Fire Creek of the New River Formation; No. 6 and No. 3 Pocahontas of the Pocahontas Formation.

Limestone Resources: Limestones of the Kanawha Formation. No significant surface limestone resources in Fayette County.

Sandstone Resources: Upper East Lynn and East Lynn of the Allegheny Formation; Homewood, Upper Coalburg, Lower Coalburg, Winifrede, Lower Winifrede, Upper Chilton, Williamson, Upper Cedar, Peerless, Monitor, Brownstone, Eagle, Decota, Lower War Eagle, Upper Gilbert, Lower Gilbert, Dotson and Lower Dotson of the Kanawha Formation; Upper Nuttall, Lower Nuttall, Harvey Conglomerate, Guyandot, Lower Guyandot, Welch, Upper Raleigh, Lower Raleigh, Quinnimont, and Pineville of the New River Group; Flattop Mountain, Pierpont and Upper Pocahontas of the Pocahontas Formation; Princeton Conglomerate of the Mauch Chunk Group.

Salt Resources: Underlain in northwest portion of county by natural salt brine.

Soil Limitations: Alluvial Land, Atkins, Gravelly alluvial land, Landes, Philo and Pope soils are subject to flooding. Ashton and Chavies are subject to infrequent flooding. Monongahela is a terrace soil with slow permeability and a seasonal high water table. Cookport is an upland soil with slow permeability. Meckesville, Shelocta and Wharton are subject to the hazard of slippage.

Seismic Risk: Zone 1 northwest, Zone 2 southeast

Major Rivers: Kanawha River, New River, Gauley River and Meadow River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: New River Gorge

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	3375'	Flood Plains	2	Hico (P)
	598'	Slopes	88	Oak Hill (P,T)
		Uplands	10	

Ref: Gorman et al., 1975; Hennen, 1919; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

GILMER COUNTY 54 021

Geologic Structure: There is a slight regional dip from the southeast to the northwest, accentuated by Chestnut Ridge Anticline and interrupted by the Grassland Syncline (which trend northeast-southwest). The pitch of the rocks is nowhere excessive, being usually hardly perceptible to the eye.

Exposures: The rocks exposed at the surface include only the Dunkard Group (Permian); Monongahela Group and Conemaugh Group (Pennsylvanian). Alluvium (Quaternary) is found along the streams.

Minable Coal Seams: Washington Coal of the Dunkard Group; Pittsburgh Coal of the Monongahela Group; Bakerstown Coal of the Conemaugh Group.

Limestone Resources: Redstone Limestone of the Monongahela Group.

Sandstone Resources: Rush Run, Jollytown, Lower Marietta, Mannington and Waynesburg of the Dunkard Group; Gilboy, Uniontown, Arnoldsburg, Upper Sewickley, Cedarville and Weston of the Monongahela Group; Lower Pittsburgh, Connellsville and Lower Connellsville of the Conemaugh Group.

Salt Resources: Underlain by natural salt brine, especially brines of the Salt Sands (Pottsville Group), Maxton Sand (Mauch Chunk Group) and Big Injun Sand (Pocono Group). Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 1

Major Rivers: Little Kanawha River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1600'	Flood Plains	2	Glenville (P,T)
	690'	Slopes	98	Lockney (P)
		Uplands	0	

Ref: Lessing, 1974, McCue et al., 1939; Price et al., 1937; Reger, 1916; WVU Agri. Exp. Sta., 1970.

GRANT COUNTY 54 023

Geologic Structure: West of Allegheny Front: An area of gentle, symmetrical folds which trend northeast - southwest; of comparatively slight disturbance, and as a whole, may be considered as one broad basin with minor structural relief and nearly horizontal strata. From west to east the folds are: North Potomac (Georges Creek) Syncline, Blackwater Anticline and Stony River Syncline. East of Allegheny Front: Orogenic disturbance has been comparatively severe. The rocks have been greatly folded, tilted, being vertical in some localities and elsewhere are overturned and faulted. Numerous anticlines (Patterson Creek Mountain, Evitts Mountain, Wills Mountain, Laurel Dale, Welton, Cave Mountain, Royal Glen, Elkhorn Mountain, Sawmill, Peacock Cave, and Hopeville) and Synclines (Elliber, Bean Cove, Bedford, Laurel Dale, Middle Mountain, Kessel, Hiser, Blue Rock, Sawmill, Corners, Hopeville, and Deep Spring) lie parallel to the mountain ranges in a northeast-southwest direction.

Exposures: West of the Allegheny Front: Monongahela, Conemaugh Groups, Allegheny Formation and Pottsville Group (Pennsylvanian). East of Allegheny Front: Mauch Chunk, Greenbrier, Pocono Groups (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Harrell Shale, Mahantango Formation, Marcellus Shale, Oriskany Sandstone, Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek Formation, Bloomsburg Shale, McKenzie Formation, Clinton Group, Tuscarora Sandstone (Silurian); Juniata, Oswego, Martinsburg Formations (Ordovician), Alluvium (Quaternary) occurs both east and west of the Front.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Little Pittsburg, Elk Lick, Harlem and Bakerstown Coals of the Conemaugh Group; Upper Freeport Coal of the Allegheny Formation.

Limestone Resources: Limestones of the Greenbrier Group (Mississippian); Helderberg Group (Devonian); Tonoloway, Wills Creek and McKenzie Formations (Silurian).

Sandstone Resources: Sewickley of the Monongahela Group; Connellsville, Lower Connellsville, Morgantown, Upper Grafton, Grafton, Saltsburg, Buffalo, and Upper Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport and East Lynn of the Allegheny; Homewood, Upper Connoquenessing, Lower Connoquenessing, Guyandot and Sharon of the Pottsville group; Ridgeley of the Oriskany Sandstone, Williamsport of the Bloomsburg Shale, Iron Sandstone of the Clinton Group and Tuscarora Sandstone.

Iron Ore: Found mainly in the Oriskany Sandstone and in the Clinton Group.

Salt Resources: Likely rock salt of Silurian Age in extreme N.E. corner.

Soil Limitations: Modern soil mapping is not complete.

Seismic Risk: Zone 1

Major Rivers: North Fork South Branch Potomac River, South Branch Potomac River, North Branch Potomac River, Patterson Creek and Stony River.

Drainage Network: Trellis

Ultimate Drainage: Potomac River

GRANT COUNTY. CONT.

Comments: Allegheny Front; some caves; Stony River Reservoir; Mt. Storm Lake; Greenland Gap (TNC)

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
West - Allegheny Mtn.	4150'	Flood Plains	5	Bayard (P,T)
East - Valley and Ridge	850'	Slopes	72	Petersburg (P,T)
		Uplands	23	Mt. Storm (P)
				Stony River Dam (P)

Ref: Lessing, 1974; McCue et al., 1939; Price et al., 1937; Reger, 1924; WVU Agri. Exp. Sta., 1970.

GREENBRIER COUNTY 54 025

Geologic Structure: Western: The rocks have been only slightly disturbed leaving the strata nearly horizontal, interrupted by several anticlines (Webster Springs and Boggs Knob) and several synclines (Kovan and Springdale) which trend northeast-southwest.. Central and Eastern: The rocks have suffered greater deformation leaving them tilted, vertical, occasionally overturned and sometimes faulted. The anticlines (Alderson, Williamsburg, Sinks Grove, Maple Grove, Browns Mountain, Neola and Glace) and Synclines (Creamery, Muddy Creek Mountain, Caldwell, Hurricane Ridge, Stony River, Meadow Creek, Kates Mountain and Tuckahoe) parallel the mountain crests in a northeast-southwest direction. Major fault: Burr Foult located along the west side of Beaver Lick Mountain.

Exposures: Kanawha, New River, Pocahontas Formations (Pennsylvanian); Mauch Chunk, Greenbrier, Maccrady, Pocono Groups (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Harrell Shale, Marcellus Shale, Oriskany Sandstone and Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek, McKenzie Formation, Clinton Group, Tuscarora Sandstone (Silurian); Juniata (Ordovician); with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Sewell, Little Raleigh, Beckley and Fire Creek Coals of the New River Formation; No. 7 Pocahontas, No. 6 Pocahontas and No. 3 Pocahontas of the Pocahontas Formation.

Limestone Resources: Avis, Reynolds and Glenray Limestone of the Mauch Chunk Group; Alderson, Union, Pickaway, Taggard, Patton, Sinks Grove and Hillsdale Limestones of the Greenbrier Group; Helderberg, Salina and Niagara Limestones of the Devonian and Silurian Systems.

Sandstone Resources: Numerous sandstones occur mainly of the Pottsville, Mauch Chunk, Pocono, Chemung Groups, Brallier Formation, Oriskany Sandstone, Clinton Group and Tuscarora Sandstone.

Iron Ore: The Oriskany Sandstone and Clinton Group.

Manganese: Mainly limited to the Helderberg Group.

Soil Limitations: Alluvial Land, Atkins, Chavies, Huntington, Lindside, Philo, and Pope are subject to flooding. Albrights, Andover, Buchanan, Clarksburg, Ernest, Monongahela and Purdy are terrace or lower slope soils with slow permeability and a seasonal high water table. Cookport, Pickaway, Nolo and Sees are upland soils with slow permeability. Frankstown, Frederick, Murrill, Pickaway and Sees contain sink holes and overlie cavernous limestone. Clarksburg, Ernest and Westmoreland have the hazard of soil slippage.

Seismic Risk: Mostly in Zone 2 (Zone 1 - northwest)

Major Rivers: Greenbrier River, Anthony Creek - Trellis Network
Meadow River - Dendritic Network
Ultimate Drainage: Ohio River

Comments: Numerous caves; Lost World Caverns (RNL)

GREENBRIER COUNTY CONT.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Applachian Plateau - west	4372'	Flood Plains	7	East Rainelle 3 NNE (P)
		Slopes	84	Lewisburg 2 SSW (P,T)
Ridge and Valley - east	1520'	Uplands	9	McRoss (P,T)
				Renick 2 S (P)
				White Sulphur Spgs. (P,T)

REF: Gorman et al., 1972; Lessing, 1974; McCue et al., 1939; Price et al., 1939; WVU Agri. Exp. Sta., 1970.

HAMPSHIRE COUNTY 54 027

Geologic Structure: Hampshire county lies within the folded Appalachian region. In general the structure consists of one great syncline with numerous anticlines and synclines impressed upon it. The anticlines (North Mountain, Cacapon Mountain, Whip Cove, and Broad Top), and synclines (Meadow Branch, Sideling Hill, Spring Gap Mountain, Town Hill and Clearville) lie parallel to the mountain ranges in a northeast-southwest direction.

Exposures: The surface rocks consist of Pocono Group (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Harrell Shale, Mahantango Formation, Marcellus Shale, Oriskany Sandstone, Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek Formation, Bloomsburg Shale, McKenzie Formation, Clinton Group, Tuscarora Sandstone (Silurian); Juniata, Oswego and Martinsburg Formations (Ordovician); Alluvium (Quaternary) along the streams and rivers.

Mineable Coal Seams: There is no coal in Hampshire County.

Limestone Resources: Limestones of the Helderberg Group, Tonoloway, Wills Creek and McKenzie Formations.

Sandstone Resources: Purslane and Rockwell Sandstones of the Pocono Group; Hendricks of the Chemung Group; Sandstones of the Brallier Formation; Ridgeley of the Oriskany Sandstone; Williamsport of the Bloomsburg Shale; Iron Sandstone of the Clinton Group; and the Tuscarora Sandstone.

Iron Ore: Limited mainly to the Oriskany Sandstone and Clinton Group.

Salt Resources: No salt resources in Hampshire County.

Soil Limitations: Modern soil mapping is completed but soil survey not published.

Seismic Risk: Zone 1, west; Zone 2, east.

Major Rivers: Potomac River, South Branch Potomac River, North Branch Potomac River, Cacapon River, North River, Little Cacapon River.

Drainage Network: Trellis
Ultimate Drainage: Potomac River
Comments: A few caves

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Valley and Ridge	2870'	Flood Plains	5	Romney 3 NNE (P,T)
	520'	Slopes	74	
		Uplands	21	

Ref: Lessing, 1974; McCue et al., 1939; Tilton et al., 1927; WVU Agri. Exp. Sta., 1970.

HANCOCK COUNTY 54 029

Geologic Structure: Basically flat lying with a slight regional dip to the northwest, interrupted by the minor New Cumberland Anticline, passing across the area in a northeast-southwest direction.

Exposures: Dominated by the Conemaugh Group (Pennsylvanian) with lesser exposures of the Monongahela Group and Allegheny Formation (Pennsylvanian), along with Alluvium (Quaternary) along the streams and Ohio River.

Minable Coal Seams: Washington Coal of the Dunkard Group; Waynesburg, Upper Sewickley, Redstone and Pittsburgh Coals of the Monongahela Group; Bakerstown, Brush Creek and Mahoning Coals of the Conemaugh Group; Lower Freeport, Middle Kittanning, Lower Kittanning, and Clarion Coals of the Allegheny Formation.

Limestone Resources: Washington and Elk Grove Limestones of the Dunkard Group; Benwood, Sewickley and Redstone Limestones of the Monongahela Group; Ames and Cambridge Limestones of the Conemaugh Group.

Sandstone Resources: Pittsburgh of the Monongahela Group; Connellsville, Morgantown and Saltsburg of the Conemaugh Group.

Salt Resources: Underlain by natural salt brine, occurring especially in the Salt Sands of the Pottsville Group. Also rock salt of the Silurian Age is present.

Soil Limitations: Atkins, Chagrin, Chavies, Dunning, Huntington and Linside soils are subject to flooding. Ernest and Monongahela are footslope soils with slow permeability and a seasonal high water table. Brooke and Upshur soils are a serious landslide hazard. Brookside, Clarksburg, Ernest, Gilpin, Westmoreland and Wharton have a moderate landslide risk.

Seismic Risk: Zone 1

Major Rivers: Ohio River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Remnants of glacial Lake Monongahela

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1337'	Flood Plains	3	Wellsburg (P,T)
	666'	Slopes	77	
		Uplands	20	

Ref: Ellyson et al., 1974; Lessing, 1974; McCue et al., 1939; Price et al., 1937; White, 1910; WVU Agri. Exp. Sta., 1970.

HARDY COUNTY 54 031

Geologic Structure: Hardy lies within the folded Appalachian region. In general the structure becomes more complex toward the east. In the east the deformation has been severe with the rocks being unsymmetrically folded, vertical, overturned and faulted. In the west the folds are narrower, shorter, more numerous and symmetrical with smaller dip. The anticlines (Elkhorn Mountain, Broad Top, Kessel, Patterson Creek Mountain, Sawmill Ridge, Sugar Knob, Crab Run, Anderson Ridge, Adams Run, Whip Cove, Hanging Rock and Baker Mountain) and Synclines (Whip Cove, Middle Mountain, Town Hill, Clearville, West Mountain, Sideling Hill, Meadow Branch, Wardensville and Sandy Ridge) lie parallel to the mountain ranges in a northeast-southwest direction.

Exposures: The surface rocks consist of the Pocono Group (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Harrell Shale, Mahantango Formation, Marcellus Shale, Oriskany Sandstone, Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek Formation, Bloomsburg Shale, McKenzie Formation, Clinton Group, Tuscarora Sandstone (Silurian); Juniata, Oswego, Martinsburg Formations (Ordovician); Alluvium (Quaternary) along the streams & rivers.

Minable Coal Seams: There is no coal in Hardy County.

Limestone Resources: Limestones of the Helderberg Group, Tonoloway, Wills Creek and McKenzie Formation.

Sandstone Resources: Purslane and Rockwell Sandstones of the Pocono Group; Hendricks of the Chemung Group; Sandstones of the Brallier Formation; Ridgeley of the Oriskany Sandstone; Williamsport of the Bloomsburg Shale; Iron Sandstone of the Clinton Group; and the Tuscarora Sandstone.

Iron Ore: Limited mainly to the Oriskany Sandstone and Clinton Group.

Soil Limitations: Modern soil mapping is completed but soil survey not published.

Seismic Risk: Zone 1 west, Zone 2 east.

Major Rivers: South Fork South Branch Potomac River, South Branch Potomac River, Lost River, Cacapon River.

Drainage Network: Trellis

Ultimate Drainage: Potomac River

Comments: Some caves

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Valley and Ridge	3320'	Flood Plains	7	Mathias (P,T)
	725'	Slopes	82	Moorefield 2 SSE (P)
		Uplands	11	Moorefield McNeill (P,T)
				Wardensville RM Farm (P,T, E)

Ref: Lessing, 1974; McCue et al., 1939; Tilton et al., 1927; WVU Agri. Exp. Sta., 1970.

HARRISON COUNTY 54 033

Geologic Structure: Nearly flat-lying, with a slight regional dip to the northwest. The county is traversed by a number of minor anticlines and synclines which have a northeast and southwest trend.

Exposures: The rocks at the surface are: The Dunkard Group (Permian), Monongahela Group and Conemaugh Group (Pennsylvanian), along with Alluvium (Quaternary) along the streams.

Minable Coal Seams: Washington Coal of the Dunkard Group; Uniontown, Pittsburgh and Redstone Coals of the Monongahela Group; Harlem Coal of the Conemaugh Group; Upper Kittanning Coal of the Allegheny Formation.

Limestone Resources: Clarksburg, Redstone and Benwood Limestones of the Pennsylvanian System.

Sandstone Resources: Nineveh, Jollytown, Hundred, Upper Marietta, Lower Marietta, Mannington and Waynesburg of the Dunkard Group; Gilboy, Uniontown, Arnoldsburg, Upper Sewickley and Lower Sewickley of the Monongahela Group; Lower Pittsburgh, Connellsville, Morgantown, Grafton, Saltsburg and Buffalo of the Conemaugh Group.

Salt Resources: Underlain by natural salt brines, including the Salt Sands of the Pottsville Group. Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is complete but soil survey not published.

Seismic Risk: Zone 1

Major Rivers: West Fork River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Clarksburg, Rosemont, and Fairmont West Landslide Quadrangles; Remnants of glacial Lake Monongahela.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1800'	Flood Plains	3	Benson (P,T)
	880'	Slopes	94	Clarksburg 1 (P,T,E)
		Uplands	3	

Ref: Hennen, 1912; Lessing, 1974, McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

JACKSON COUNTY 54 035

Geologic Structure: This area occupies the middle or deepest portion of the Appalachian basin. The strata have a slight regional dip towards the middle of the basin (Parkersburg Syncline) which passes through about the center of the county in a northeast to southwest direction. The Flat Fork Anticline passes through the southeastern part of the county.

Exposures: Dominated by the Dunkard Group (Permian) with the Monongahela Group (Pennsylvanian) exposed in the extreme south, and Alluvium (Quaternary) along the streams and the Ohio River.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Lower Freeport Coal of the Allegheny Formation.

Limestone Resources: Nineveh Limestone of the Dunkard Group.

Sandstone Resources: Gilmore, Nineveh, Burton, Fish Creek, Rush Run, Jollytown, Hundred, Upper Marietta and Lower Marietta Sandstones of the Dunkard Group.

Salt Resources: Underlain by natural salt brines, especially the Salt Sands of the Pottsville Group.

Soil Limitations: Melvin and Moshannon soils are subject to frequent flooding; Huntington, Lindside, and Senecaville have occasional flooding; Ashton and Hackers are infrequently flooded. Chilo, Ginat, Markland, McGary, Purdy, Sciotoville, Senecaville and Tyler are terrace soils with slow permeability and moderate to poor drainage. Monongahela, Tilsit, Wharton, and Zoar have moderate to low permeability with gentle slopes. Muskingum - Upshur soils are a serious landslide hazard on slopes over 20%; Upshur, Upshur-Muskingum, Vandalia and Westmoreland have a high landslide risk and Brooke is moderately susceptible to landslides.

Seismic Risk: Zone 1

Major Rivers: Ohio River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1260' 525'	Flood Plains Slopes Uplands	5 90 5	Liverpool (P), Ripley (P, T) Portland Dam 21 (P) Racine Dam 23 (P) Ravenswood Dam 22 (P,T)

Ref: Hatfield et al., 1973; Krebs, 1911; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

JEFFERSON COUNTY 54 037

Geologic Structure: Jefferson County is located in the intensely folded Appalachian Mountain Region. The limestones of the Great Valley are thrown into a series of compressed folds, with numerous faults, and the strata are often overthrust. The Blue Ridge is an area of extensive overthrust faulting, with a development of minor synclines on its flanks.

Exposures: The exposures in a pattern west to east consist of the Martinsburg Formation, Black River, St. Paul Limestones, Beekmantown Group (Ordovician); Conococheague, Elbrook and Waynesboro Formations, Tomstown Dolomite, Antietam, Harpers Shale, Weverton-Loudoun Formations (Cambrian); Volcanic and Crystalline Rocks (Precambrian); with Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: There is no minable coal in Jefferson County.

Limestone Resources: Limestones of (Group or Formation) Black River, St. Paul, Beekmantown (Ordovician); Conococheague, Elbrook, Waynesboro, and Tomstown (Cambrian).

Dolomite: Dolomites of the St. Paul Group, Beekmantown Group and Tomstown Formation.

Sandstone Resources: No significant sandstone resources.

Soil Limitations: Alluvial Land, Alluvial Land Marl Substratum, Huntington, Landes, Lindside and Melvin are subject to flooding. Ashton is subject to infrequent flooding. Monongahela and Blairton are soils with slow permeability and a seasonal high water table. Benevola, Frankstown, Hagerstown and Frederick contain limestone outcrops. Chilhowie, Chilhowie-Opequon, Dueffields, Frankstown, Hagerstown, Hagerstown-Frederick, Huntington and Lindside overlie solution channels.

Seismic Risk: Zone 2

Major Rivers: Potomac River and Shenandoah River
Drainage Network: Trellis
Ultimate Drainage: Potomac River

Comments: Blue Ridge Mountains; Shenandoah Valley, Some caves

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
West - Great Appalachian Valley	1720'	Floodplains	2	Harpers Ferry (P,T)
East - Blue Ridge	247'	Slopes	22	Kearneysville (P,T)
		Uplands	76	

Ref: Gorman et al., 1961, Grimsley, 1916; Lessing, 1974; McCue et al., 1939; WVU Agri. Exp. Sta., 1970.

KANAWHA COUNTY 54 039

Geologic Structure: Kanawha County is on the eastern flank of the Great Appalachian Basin. The strata are very much twisted and distorted, with a gentle regional dip toward the northwest in the north and central sections, and a more rapid dip toward the northwest in the southern section. Anticlines: Byrnside, Milliken, Warfield, Winifrede, Hansford, Wake Forest. Synclines: Saint Albans, Guthrie, Jarrett, Coalburg, Hundley, Quincy, Robinson, Miami.

Exposures: The Dunkard Group (Permian) is exposed only in the extreme northwest; the Monongahela Group and Conemaugh Group (Pennsylvanian) are exposed mainly in the north; the Allegheny Formation and Kanawha Formation (Pennsylvanian) are found at the surface in the southern and central sections; Alluvium (Quaternary) exists along the streams and rivers.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Little Pittsburgh, Little Clarksburg, Elk Lick, Harlem and Bakerstown Coals of the Conemaugh Group; Middle and Lower Kittanning Coals of the Allegheny Formation; Stockton-Lewiston, Coalburg, Winifrede, Cedar Grove, Peerless, Campbell Creek, Powellton, Eagle and Little Eagle Coals of the Kanawha Formation.

Limestone Resources: Thin limestone seams of the Monongahela and Conemaugh Groups.

Sandstone Resources: Uniontown, Arnoldsburg, Sewickley, and Upper Pittsburgh of the Monongahela Group; Lower Pittsburgh, Connellsville, Morgantown, Grafton, Saltsburg and Buffalo of the Conemaugh Group; Upper Freeport and East Lynn of the Allegheny Formation; Homewood, Coalburg, Upper Winifrede, Lower Winifrede, Chilton, Malden, Peerless, Lower Peerless, Eagle and Decota of the Pottsville Group.

Salt Resources: Underlain by natural salt brine, especially the brines of the Salt Sands (Pottsville Group), Maxton Sand (Mauch Chunk Group), Big Injun Sand (Pocono Group) and Oriskany Sandstone.

Soil Limitations: Modern soil mapping completed but not published.

Seismic Risk: Zone 1

Major Rivers: Kanawha River and Elk River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Saint Albans, Pocatalico, Big Chimney, Alum Creek, Charleston West, and Charleston East Landslide Quadrangles; Upper Falls of Coal River (TNC).

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	2850'	Flood Plains	4	Charleston 1 (P,T)
	542'	Slopes	96	Charleston WB AP (P,T)
		Uplands	0	Clendenin 1 SW (P)
				Corton, London Locks (P,T)

Ref: Krebs et al., 1914; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970

LEWIS COUNTY 54 041

Geologic Structure: There is a gradual regional dip from the southeast to the northwest, accentuated by Chestnut Ridge Anticline and interrupted by the Grassland Syncline, which trend northeast-southwest. The pitch of the rocks is nowhere excessive, usually it is hardly perceptible to the eye.

Exposures: The surface rocks are dominated by the Dunkard Group (Permian); Monongahela Group, Conemaugh Group (Pennsylvanian). Exposed only in the extreme southern panhandle of the county are the Allegheny Formation and Pottsville Group (Pennsylvanian). Alluvium (Quaternary) is found along the streams.

Minable Coal Seams: Washington Coal of the Dunkard Group; Redstone and Pittsburgh Coal of the Monongahela Group; Elk Lick and Bakerstown Coal of the Conemaugh Group; Upper Freeport, Upper Kittanning and Lower Kittanning of the Allegheny Formation; Upper Mercer Coal of the Pottsville Group.

Limestone Resources: Redstone Limestone of the Monongahela Group.

Sandstone Resources: Rush Run, Jollytown, Lower Marietta, Mannington and Waynesburg of the Dunkard Group; Gilboy, Uniontown, Arnoldsburg, Upper Sewickley and Weston of the Monongahela Group; Lower Pittsburgh, Connellsville, Lower Connellsville, Morgantown, Grafton, Jane Lew, Saltsburg, Buffalo and Mahoning of the Conemaugh Group.

Salt Resources: Underlain by natural salt brine, especially brines of the Salt Sands (Pottsville Group), and Big Injun Sand (Pocono Group). Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 1

Major Rivers: West Fork River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Remnants of glacial Lake Monongahela

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1950'	Flood Plains	3	Freemansburg (P)
	760'	Slopes	97	Horner, Ireland (P)
		Uplands	0	Jane Lew (P)
				Weston (P,T)

Ref: Lessing, 1974; McCue et al., 1939; Price et al., 1937; Reger, 1916; WVU Agri. Exp. Sta., 1970.

LINCOLN COUNTY 54 043

Geologic Structure: This area lies on the western side of the Appalachian basin. The strata dip slightly toward the northwest, interrupted by the Branchland Anticline and the Ferrellsburg and Griffithsville Synclines, which trend in a northeast-southwest direction.

Exposures: The exposures, in a very general north to south pattern, consist of the Monongahela Group, Conemaugh Group, Allegheny Formation and Kanawha Formation (Pennsylvanian); with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Upper Freeport and Lower Kittanning Coals of the Allegheny Formation; Stockton-Lewiston, Coalburg, Winifrede, and Campbell Creek Coals of the Pottsville Group.

Limestone Resources: Very little limestone occurs in Lincoln County.

Sandstone Resources: Upper Pittsburgh of the Monongahela Group; Lower Pittsburgh, Connellsville, Morgantown, Grafton, Saltsburg, Buffalo and Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport and East Lynn of the Allegheny Formation; Homewood, Coalburg, Upper Winifrede, Lower Winifrede and Malden of the Pottsville Group.

Salt Resources: Underlain by natural salt brine, especially brine of the Salt Sands (Pottsville Group), and Big Injun Sand (Pocono Group).

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 1

Major Rivers: Guyandot River and Coal River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Alum Creek Landslide Quadrangle

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1500'	Flood Plains	1	Branchland (P)
	535'	Slopes	99	Griffithsville (P)
		Uplands	0	Hamlin (P,T)

Ref: Krebs et al., 1913; Lessing, 1974, Price et al., 1937; WVU Agri. Exp. Sta., 1970.

LOGAN COUNTY 54 045

Geologic Structure: There is a gradual regional dip of the rocks from the southeast to northwest, interrupted by occasional anticlines (Warfield is the most important anticline) and corresponding synclines (Coalburg is the most important syncline). The pitch of the rocks is nowhere excessive, usually is hardly perceptible to the eye.

Exposures: The surface rocks are of the Allegheny Formation and Kanawha Formation (Pennsylvanian). The New River Formation (Pennsylvanian) is found along some of the stream valleys. Alluvium (Quaternary) is located along the streams.

Minable Coal Seams: Lower Kittanning Coal of the Allegheny Formation; Stockton-Lewiston, Coalburg, Buffalo Creek, Winifrede, Chilton "A", Chilton, Dingess, Williamson, Cedar Grove, Lower Cedar Grove, Alma, Campbell Creek (No. 2 Gas), Eagle, Bens Creek, Cedar, Lower War Eagle and Glenalum Tunnel Coals of the Kanawha Formation.

Limestone Resources: Logan County contains little limestone reserves.

Sandstone Resources: East Lynn and Lower Clarion of the Allegheny Formation; Homewood, Upper Coalburg, Lower Coalburg, Upper Winifrede, Lower Winifrede, Upper Chilton, Lower Chilton, Hernshaw, Williamson, Upper Cedar Grove, Middle Cedar Grove, Lower Cedar Grove, Logan, Peerless, Brownstown, Matewan, Eagle, Bens Creek, Grapevine, Upper Gilbert and Lower Gilbert of the Kanawha Formation; Wharncliffe of the New River Formation.

Salt Resources: Underlain by natural salt brine, especially the Salt Sands of the Pottsville Group.

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 1

Major Rivers: Guyandot River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	2750' 600'	Flood Plains Slopes Uplands	1 99 0	Logan (P,T)

Ref: Hennen et al., 1914; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

MARION COUNTY 54 047

Geologic Structure: The strata are essentially flat-lying with a regional dip to the northwest. The county is traversed in a northeast-southwest direction by a number of minor folds, with the most prominent being the Chestnut Ridge Anticline along the Taylor-Marion County line.

Exposures: The exposures basically from west to east: Dunkard Group (Permian); Monongahela Group, Allegheny Formation and Pottsville Group, Conemaugh Group (Pennsylvanian); with Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: Washington Coal of the Dunkard Group; Waynesburg, Sewickley and Pittsburgh Coal of the Monongahela Group; Upper Freeport and Upper and Lower Kittanning Coal of the Conemaugh Group; Upper Mercer Coal of the Pottsville Group.

Limestone Resources: Uniontown, Benwood and Sewickley of the Monongahela Group; Upper Pittsburgh, Lower Pittsburgh, Clarksburg and Elk Lick of the Conemaugh Group; Upper Freeport and Lower Freeport of the Allegheny Formation.

Sandstone Resources: Proctor, St. Cloud, Gilmore, Taylor, Nineveh, Burton, Fish Creek, Rush Run, Jollytown, Hundred, Upper Marietta, Lower Marietta, Washington, Mannington and Waynesburg of the Dunkard Group; Gilboy, Arnoldsburg, Upper Sewickley, Lower Sewickley and Upper Pittsburgh of the Monongahela Group; Lower Pittsburgh, Connellsville, Lower Connellsville, Morgantown, Grafton, Saltsburg, Buffalo and Mahoning of the Conemaugh Group; Upper Freeport and Lower Freeport of the Allegheny Formation; Homewood and Upper Connoquenessing of the Pottsville Group.

Salt Resources: Underlain by natural salt brine, including the brines of the Salt Sands (Pottsville Group) and Big Injun Sand (Pocono Group). Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is completed but soil survey is not published.

Seismic Risk: Zone 1

Major Rivers: Monongahela River, Tygart Valley River and West Fork River.
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Remnants of Glacial Lake Monongahela

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	2003' 847'	Flood Plains Slopes Uplands	3 93 4	Fairmont (P,T) Hoult Lock 15 (P) Mannington 1 N (P,T) Mannington 1 W (P)

Ref: Hennen et al., 1913; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

MARSHALL COUNTY 54 049

Geologic Structure: This area occupies the deepest portion of the Appalachian basin. The strata are basically flat lying with a slight regional dip to the northwest, interrupted by several low folds (which trend in a northeast-southwest direction) with the most prominent being the Nineveh Syncline.

Exposures: Dominated by the Dunkard Group (Permian) and the Monongahela Group (Pennsylvanian) with some of the Conemaugh Group (Pennsylvanian), and Alluvium (Quaternary) along the streams and Ohio River.

Minable Coal Seams: Washington Coal of the Dunkard Group; Waynesburg, Uniontown, Sewickley and Pittsburgh Coals of the Monongahela Group.

Limestone Resources: Nineveh and Washington Limestones of the Dunkard Group; Benwood, Sewickley and Redstone Limestones of the Monongahela Group.

Sandstone Resources: Several sandstones of the Dunkard and Monongahela Groups.

Salt Resources: Underlain by natural salt brine, occurring especially in the Salt Sands of the Pottsville Group. Also rock salt of Silurian Age is present.

Soil Limitations: Melvin is frequently flooded, Lindside and Huntington are occasionally flooded and Ashton is infrequently flooded. Captina, Monongahela, Robertsville and Wyatt are soils on terraces above the flood plain which are of low permeability and moderate to poor drainage. Guernsey and Holston are soils on gentle to steep slopes with slow permeability. Gilpin-Upshur soils are a serious landslide hazard on slopes over 20%, Clarksburg has a high landslide risk, and Brooke and Brookside are moderately susceptible to landslides.

Seismic Risk: Zone 1

Major Rivers: Ohio River and Wheeling Creek
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Wheeling Landslide Quadrangle; Remnants of glacial Lake Monongahela.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1590'	Flood Plains	4	Clarington Lock 14 (P)
	591'	Slopes	94	McMechen Dam 13 (P)
		Uplands	2	Moundsville (P,T)

Ref: Beverage et al., 1960; Hennen, 1909; Lessing, 1974; McCue et al., 1939, Price et al., 1937; WVU Agri. Exp. Sta., 1970.

MASON COUNTY 54 051

Geologic Structure: This area occupies the middle or deepest portion of the Appalachian basin. The strata have a very gentle regional dip to the east towards the middle of the basin (Parkersburg Syncline) which passes through the southeastern portion of the county.

Exposures: The Dunkard Group (Permian) and Monongahela Group (Pennsylvanian) with Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: Pittsburgh and Little Pittsburgh of the Monongahela Group; Lower Freeport of the Allegheny Formation.

Limestone Resources: No significant limestone reserves.

Sandstone Resources: Gilmore, Nineveh, Burton, Fish Creek, Rush Run, Jollytown, Hundred, Upper Marietta and Lower Marietta Sandstones of the Dunkard Group.

Salt Resources: Underlain by natural salt brines, especially the Salt Sands of the Pottsville Group and the Big Injun Sand of the Pocono Group.

Soil Limitations: Melvin and Moshannon soils are subject to frequent flooding; Huntington, Lindside, and Senecaville have occasional flooding; Ashton and Hackers are infrequently flooded. Chilo, Ginat, Markland, McGary, Purdy, Sciotoville, Senecaville and Tyler are terrace soils with slow permeability and moderate to poor drainage. Monongahela, Tilsit, Wharton and Zoar have moderate to low permeability with gentle slopes. Muskingum-Upshur soils are a serious landslide hazard on slopes over 20%; Upshur, Upshur-Muskingum, Vandalia, and Westmoreland have a high landslide risk and Brooke is moderately susceptible to landslides.

Seismic Risk: Zone 1

Major Rivers: Ohio River and Kanawha River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1070'	Flood Plains	12	Hognett Gallipolis
	510'	Slopes	86	Dam (P,T,E)
		Uplands	2	Point Pleasant (P,E)
				Tribble (P)

Ref: Gorman et al., 1961; Krebs, 1911; Lessing, 1974; Price et al, 1937; WVU Agri. Exp. Sta., 1970.

MCDOWELL COUNTY 54 053

Geologic Structure: The strata have been only slightly folded or disturbed from their original position of deposition. There is a gradual regional dip at a very low angle with the horizontal from the southeast margin of the area to the northwest edge, interrupted in the southeast by Dry Fork Anticline which is an arch of considerable magnitude. This area also contains two minor folds, the Bradshaw Anticline and Bradshaw Syncline.

Exposures: In a very general northwest to southeast pattern, the surface rocks consist of the Kanawha, New River, and Pocahontas Formations (Pennsylvanian); Mauch Chunk Group (Mississippian); with Alluvium (Quaternary) along the streams.

Minable Coal Seams: Cedar Grove, Lower Cedar Grove, Alma, Campbell Creek (No. 2 Gas), Powellton, Matewan, Eagle, Bens Creek, Little Eagle, Cedar, Lower War Eagle, Glenalum Tunnel and Gilbert of the Kanawha Formation; Douglas, Lower Douglas, Iaeger, Sewell "B", Sewell, Welch, Beckley, Fire Creek, and No. 9 Pocahontas of the New River Formation; No. 7 Pocahontas, No. 6 Pocahontas, No. 5 Pocahontas, No. 4 Pocahontas and No. 3 Pocahontas Coals from the Pocahontas Formation.

Limestone Resources: McDowell County has very small limestone reserves.

Sandstone Resources: Many hard sandstones of the Kanawha, New River and Pocahontas Formations and Mauch Chunk Group furnish an inexhaustible supply for construction and building purposes.

Salt Resources: Likely underlain by natural brine in the western portion of the county.

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 2

Major Rivers: Tug Fork
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	3400'	Flood Plains	1	Gary (P,T)
	875'	Slopes	99	Iaeger (P)
		Uplands	0	

Ref: Hennen, 1915; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

MERCER COUNTY 54 055

Geologic Structure: North: Area of gentle and rather symmetrical folds of relatively slight disturbance, with the strata dipping slightly toward the northwest. Major features are the Dunn Anticline and Bellepoint Syncline. South: Severe folding with large reverse faults. The structural features largely control the direction (approximately N 70° E), shape and height of the mountains. Anticlines: Dry Fork, Abbs Valley. Synclines: Pocahontas, Hurricane Ridge. Faults: Boissevain, Graham, St. Clair Fault (immense overthrust).

Exposures: The Silurian and Ordovician rocks are brought to the surface by the St. Clair Fault along the southern edge of the county. The surface rocks are: New River and Pocahontas Formations (Pennsylvanian); Mauch Chunk, Greenbrier Groups, Maccrady Formation and Pocono Group (Mississippian); Helderberg Group (Devonian); Clinton Group, Tuscarora Sandstone (Silurian); Juniata, Oswego, Martinsburg Formations, Martinsburg, Trenton, Black River, Chazy and Beekmantown Groups (Ordovician); Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: Sewell, Beckley, Fire Creek and No. 8 Pocahontas Coals of the New River Formation; No. 6 Pocahontas, No. 3 Pocahontas, and No. 2 Pocahontas Coals of the Pocahontas Formation.

Limestone Resources: Avis Limestone of the Hinton Formation; Raines Corner, Reynolds and Glenray Limestones of the Bluefield Formation; Limestones of the Greenbrier Group; Limestones of the Martinsburg Formation; Black River and Beekmantown Limestones of the Ordovician System.

Sandstone Resources: Pineville of the New River Formation; Flattop Mountain, Pierpont, Upper Pocahontas and Keystone of the Pocahontas Formation; Upper Belcher, Glady Fork, Princeton; Falls Mills, Tallery, Hackett, Upper Bellepoint, Stony Gap, Clayton, Graham, Bertha, Bradshaw and Indian Mills of the Mauch Chunk Group; Logan Broad Ford and Berea of the Pocono Group; Oriskany Sandstone; Keefer and Iron Sandstone of the Clinton Group; and Tuscarora Sandstone.

Salt Resources: No salt resources in Mercer County

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 2

Major Rivers: Bluestone River and East River
Drainage Network: Dendritic (Bluestone) and Trellis (East)
Ultimate Drainage: Ohio River

Comments: Some caves.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau, majority of county	4020'	Flood Plains	2	Athens Conconrd College (P,T); Bluefield FAA AP (P,T); Flat Top (P,T) Matoaka (P)
Ridge and Valley, extreme southeast	1450'	Slopes	90	
		Uplands	8	

Ref: Lessing, 1974; McCue et al., 1939; Reger et al., 1926; WVU Agri. Exp. Sta., 1970.

MINERAL COUNTY 54 057

Geologic Structure: West of Allegheny Front: An area of gentle, symmetrical folds (which trend northeast-southwest) of comparatively slight disturbance, and as a whole may be considered as one broad basin with minor structural relief and nearly horizontal strata. From west to east the folds are: North Potomac (Georges Creek) Syncline, Blackwater Anticline, and Stony River Syncline. East of Allegheny Front: Orogenic disturbance has been comparatively severe. The rocks have been greatly folded, tilted, being vertical in some localities and elsewhere are overturned and faulted. Numerous anticlines (Martin Mountain, Tussey Mountain, Evitts Mountain, Wills Mountain, Noswad, Elliber, and Laurel Dale) lie parallel to the mountain ranges in a northeast-southwest direction.

Exposures: West of Allegheny Front: Monongahela, Conemaugh Groups, Allegheny Formation, and Pottsville Group (Pennsylvanian). East of Allegheny Front: Mauch Chunk, Greenbrier, Pocono Groups (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Harrell Shale, Mahantango Formation, Marcellus Shale, Oriskany Sandstone, Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek Formation, Bloomsburg Shale, McKenzie Formation, Clinton Group, Tuscarora Sandstone (Silurian); Juniata Formation (Ordovician); Alluvium (Quaternary) occurs both east and west of the Front.

Minable Coal Seams: Sewickley, Redstone, Pittsburgh Coals of the Monongahela Group; Little Clarksburg, Elk Lick, Harlem, Upper Bakerstown, Bakerstown, Mahoning Coals of the Conemaugh Group; Upper Freeport, Upper Kittanning, Lower Kittanning Coals of the Allegheny Formation.

Limestone Resources: Limestones of the Greenbrier Group (Msssissippian); Helderberg Group (Devonian); Tonoloway, Wills Creek and McKenzie Formations (Silurian).

Sandstone Resources: Sewickley of the Monongahela Group; Connellsville, Lower Connellsville, Morgantown, Upper Grafton, Grafton, Saltsburg, Buffalo, and Upper Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport and East Lynn of the Allegheny; Homewood, Upper Connoquenessing, Lower Connoquenessing, Guyandot and Sharon of the Pottsville Group; Ridgeley of the Oriskany Sandstone; Williamsport of the Bloomsburg Shale, Iron Sandstone of the Clinton Group, and Tuscarora Sandstone.

Iron Ore: Found mainly in the Oriskany Sandstone and in the Clinton Group.

Salt Resources: No salt resources in Mineral County.

Soil Limitations: Modern soil mapping is complete but soil survey not published.

Seismic Risk: Zone 1

Major Rivers: North Branch Potomac River, New Creek and Patterson Creek.
Drainage Network: Trellis
Ultimate Drainage: Potomac River

Comments: Allegheny Front; a few caves

MINERAL COUNTY CONT.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
West - Allegheny Mtn.	3250'	Flood Plains	7	Keyser (P,T)
East - Valley & Ridge	545'	Slopes	78	Piedmont (P)
		Uplands	15	

Ref: Lessing, 1974; McCue et al., 1939; Reger, 1924; WVU Agri. Exp. Sta., 1970.

MINGO COUNTY 54 059

Geologic Structure: There is a gradual regional dip of the strata from the southeast to northwest, interrupted by occasional anticlines (Warfield is the most important anticline) and corresponding synclines (Coalburg is the most important syncline). The pitch of the rocks is nowhere excessive, usually it is hardly perceptible to the eye.

Exposures: The surface rocks are of the Allegheny Formation and Kanawha Formation (Pennsylvanian). The New River Formation (Pennsylvanian) is found along some of the stream valleys. Alluvium (Quaternary) is located along the streams.

Minable Coal Seams: Lower Kittanning Coal of the Allegheny Formation; Stockton-Lewiston, Coalburg, Buffalo Creek, Winifrede, Chilton "A", Chilton, (No. 2 Gas), Eagle, Bens Creek, Cedar, Lower War Eagle and Glenalum Tunnel Coals of the Kanawha Formation.

Limestone Resources: Mingo County contains little limestone reserves.

Sandstone Resources: East Lynn of the Allegheny Formation; Homewood, Upper Coalburg, Lower Coalburg, Upper Winifrede, Lower Winifrede, Upper Chilton, Lower Chilton, Hernshaw, Naugatuck, Williamson, Upper Cedar Grove, Middle Cedar Grove, Lower Cedar Grove, Logan, Peerless, Brownstown, Matewan, Eagle, Bens Creek, Grapevine, Upper Gilbert and Lower Gilbert of the Kanawha Formation; Wharncliffe of the New River Formation.

Salt Resources: Underlain by natural salt brine.

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Mainly Zone 1, Zone 2 in extreme south.

Major Rivers: Tug Fork of the Big Sandy River and Guyandot River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	2450'	Flood Plains	1	Kermit (P)
	585'	Slopes	99	Williamson (P,T)
		Uplands	0	

Ref: Hennen et al., 1914; Lessing, 1974; Price et al., 1937; WVU Agr. Exp. Sta., 1970.

MONONGALIA COUNTY 54 061

Geologic Structure: The strata are essentially flat lying with a regional dip to the northwest. The county is traversed in a northeast-southwest direction by a number of minor folds, with a prominent arch, Chestnut Ridge Anticline, along the Monongalia-Preston County line.

Exposures: From west to east, the exposures are, basically: Dunkard Group (Permian); Monongahela Group, Conemaugh Group, Allegheny Formation, Pottsville Group (Pennsylvanian); Mauch Chunk Group, Greenbrier Group and Pocono Group (Mississippian); along with Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: Washington Coal of the Dunkard Group; Waynesburg, Sewickley, Redstone and Pittsburgh Coals of the Monongahela Group; Upper Freeport and Upper Kittanning Coals of the Conemaugh Group; Upper Mercer Coal of the Pottsville Group.

Limestone Resources: Greenbrier Limestone of the Greenbrier Group; Elk Lick, Upper and Lower Pittsburgh, Clarksburgh and Waynesburgh Limestones of the Pennsylvanian System.

Sandstone Resources: Proctor, St. Cloud, Gilmore, Taylor, Nineveh, Burton, Fish Creek, Brush Run, Jollytown, Hundred, Upper Marietta, Lower Marietta, Washington, Mannington and Waynesburg of the Dunkard Group; Gilboy, Arnoldsburg, Upper Sewickley, Lower Sewickley and Upper Pittsburgh of the Monongahela Group; Lower Pittsburgh, Connellsville, Lower Connellsville, Morgantown, Grafton, Saltsburg, Buffalo and Mahoning of the Conemaugh Group; Upper Freeport and Lower Freeport of the Allegheny Formation; Homewood, Upper Connoquenessing and Lower Connoquenessing of the Pottsville Group.

Salt Resources: Underlain by natural salt brine, including brines of the Salt Sands (Pottsville Group) and Big Injun Sand (Pocono Group). Also underlain by rock salt of Silurian Age.

Soil Limitations: Chagrin, Holly, Kanawha, Lobdel, Lobdel-Holly, and Pope Variant are subject to flooding. Durmont, Guernsey and Wharton are ridge top soils with slow permeability and seasonally high water table. Buchanon, Ernest, and Clarksburg are lower slope soils, and Monongahela and Zoar are terrace soils with slow permeability and a seasonal high water table. Gilpin-Culleaka-Upshur and Upshur are subject to the hazard of slippage.

Seismic Risk: Zone 1

Major Rivers: Monongahela River and Cheat River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Remnants of glacial Lake Monongahela; Cheat River Gorge; Lake Lynn; a few caves.

MONONGALIA COUNTY, CONT.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau - Major Part	2600'	Flood Plains	3	Morgantown FAA AP (P,T)
	793'	Slopes	93	Morgantown L & D (P,T)
Appalachian Mountain - along Preston Line		Uplands	4	Lake Lynn (P)

Ref: Hennen et al., 1913; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

MONROE COUNTY 54 063

Geologic Structure: Northwest: An area of gentle and rather symmetrical folds trending northwest-southeast, of relatively slight disturbance, with the strata dipping slightly toward the northwest. Anticlines: Alderson, Mt. Pleasant, Abbs Valley. Synclines: Creamery, Laurel Creek, Knobs. Southeast: Severe folding with large reverse faults and overturned folds. The structural features control the shape, height and direction of the mountains. The trend of the folds changes from approximately N 30°E to N 70°E in this county. Anticlines: Sinks Grove, Maple Grove, Hillsdale, Highland, Harts Run, Glace, Nigger Mountain, Fork Mountain, Back Valley, Crosier. Synclines: Patton, Hurricane Ridge, Dorr, Hollywood, Kates Mountain, Pedro, Wolf Hills, North Fork, Ray.

Exposures: The Silurian and Ordovician rocks are brought to the surface by the St. Clair and Sugar Grove Faults in the Southeast. The surface rocks are: (Group or Formation) Hinton, Bluefield, Greenbrier, Maccrady, Pocono (Mississippian); Chemung, Brallier, Harrel Shael, Mahantango, Marcellus Shale, Oriskany Sandstone, Helderberg (Devonian); Clinton, Tuscarora Sandstone (Silurian); Juniata, Oswego, Martinsburg, Trenton, Black River, Chazy, and Beekmantown (Ordovician); with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Monroe County contains no minable coals.

Limestone Resources: Avis Limestone of the Hinton Formation: Raines Corner, Reynolds and Glenray Limestone of the Bluefield Formation; Limestones of the Greenbrier Group; Limestones of the Martinsburg Formations; Black River and Beekmantown Limestones of the Ordovician System.

Sandstone Resources: Falls Mills, Tallery, Hackett, Upper Bellepoint and Stony Gap of the Hinton Formation; Clayton, Graham, Bertha, Bradshaw and Indian Mills of the Bluefield Formation; Logan, Broad Ford and Berea of the Pocono Group; Oriskany Sandstone; Keefer and Iron Sandstone of the Clinton Group; and the Tuscarora Sandstone.

Iron Ore: In the Oriskany Sandstone and Clinton Group in southern part of county.

Soil Limitations: Alluvial Land, Atkins, Huntington, Lindside, Melvin, Philo and Pope soils are subject to frequent flooding. Captina, Clarksburg, Landisburg, Leadvale, Monongahela and Robertsville are terrace or lower slope soils with slow permeability and a seasonal high water table. Guthrie, Pickaway and Tilst are upland soils with slow permeability. Chilhowie-Tumbez, Duffield, Dunmore, Frederick, Frederick-Bodine, Frederick-Dunmore and Murrill contain sinkholes and overlie cavernous limestone.

Seismic Risk: Zone 2.

Major Rivers: Greenbrier River and New River.
Drainage Network: Dendritic
Ultimate Drainage: Ohio River, James River (80 sq. miles)

Comments: Numerous Caves; Greenbrier Caverns (RNL); Greenville Saltpeter Cave (RNL)

MONROE COUNTY, CONT.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	4050'	Flood Plains	2	Bluestone Dam (P,T,E)
west	1450'	Slopes	84	Lindside (P)
Ridge and Valley		Uplands	14	Union (P,T)
east				

Ref: Gorman et al., 1965; Lessing, 1974; McCue et al., 1939; Reger et al., 1926; WVU Agri. Exp. Sta., 1970.

MORGAN COUNTY 54 065

Geologic Structure: Morgan County is located within the intensely folded Appalachian Mountain region. The county is dominated by well-defined, fairly smooth folds, with a fair degree of symmetry. Cacapon Mountain Anticline and Meadow Branch Syncline run parallel to the mountain ridges in a northeast-southwest direction.

Exposures: The surface rocks consist of the Pocono Group (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Mahantango Formation, Marcellus Shale, Oriskany Sandstone, Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek Formation, Bloomsburg Red Shale, McKenzie Formation, Clinton Group and Tuscarora Sandstone (Silurian); with Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: There is a small amount of coal in the Meadow Branch area.

Limestone Resources: Limestones of Helderberg Group (Devonian); Tonoloway Formation and Wills Creek Formation (Silurian).

Sandstone Resources: Pocono Sandstones; Oriskany Sandstone; Sandstones in the Devonian Shales; Keefer Sandstone of the McKenzie Formation; and Tuscarora Sandstone.

Soil Limitations: Modern soil mapping is completed but the soil survey is not published.

Seismic Risk: Zone 2

Major Rivers: Potomac River and Cacapon River
Drainage Network: Trellis
Ultimate Drainage: Potomac River

Comments: One cave.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Valley and Ridge	2320'	Flood Plains	3	Berkeley Springs (P,T)
	380'	Slopes	82	Omps (P,T)
		Uplands	15	

Ref: Grimsley et al, 1916; Lessing, 1974; McCue et al., 1939; WVU Agri. Exp. Sta., 1970.

NICHOLAS COUNTY 54 067

Geologic Structure: Mainly a broad monocline showing a gradual northwestward dip of the rocks away from Greenbrier, Pocahontas and Webster Counties, where, in the former two, distortion has been much more severe. The general dip in Nicholas County is interrupted by two slight anticlines (Mann Mountain and Enon) and their corresponding shallow synclines (Lockwood and Clifftop) in the west, and by another anticline (Webster Springs) which cuts across the extreme eastern part of the county. The folds trend northeast and southwest.

Exposures: The general outcrop pattern, from northwest to southeast, consists of the Conemaugh Group, Allegheny Formation, Kanawha Formation, and New River Formation (Pennsylvanian); Mauch Chunk Group (Mississippian); along with Alluvium (Quaternary) associated with the streams.

Minable Coal Seams: Lower Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning and Clarion Coals of the Allegheny Formation; Stockton-Lewiston, Coalburg, Winifrede, Chilton, Alma, Peerless, Campbell Creek (No. 2 Gas), Eagle, Little Eagle and Gilbert of the Kanawha Group; Sewell and Fire Creek of the New River Formation.

Limestone Resources: The surface rocks of Nicholas County contain no limestone of any consequence.

Sandstone Resources: Upper Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport, Upper East Lynn and East Lynn of the Allegheny Formation; Homewood, Upper Coalburg, Lower Coalburg, Upper Winifrede, Upper Chilton, Lower Chilton, Hernshaw, Upper Cedar Grove, Peerless, Monitor, Brownstown, Eagle, Decota, Lower Gilbert, Dotson and Lower Dotson of the Kanawha Formation; Lower Nuttall, Harvey, Guyandot, Lower Guyandot and Upper Raleigh of the New River Formation; Princeton Conglomerate of the Mauch Chunk Group.

Salt Resources: Underlain by natural salt brines in northwest, including brine of the Big Injun Sand (Pocono). Also underlain by rock salt of Silurian Age in extreme north.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Gauley River, Cherry River, Cranberry River and Meadow River.
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: A few caves; Summersville Lake

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	3850'	Flood Plains	3	Birch River 6 SSW (P,T)
	675'	Slopes	89	Richwood (P,T)
		Uplands	8	Summersville (P)

Ref: Lessing, 1974; McCue et al., 1939; Price et al., 1937; Reger, 1921; WVU Agri. Exp. Sta., 1970.

OHIO COUNTY 54 069

Geologic Structure: Basically flat lying with a slight regional dip to the northwest, interrupted by the minor Loudenville (Finney) Syncline, passing through the area in a northeast-southwest direction.

Exposures: Dominated by the Dunkard Group (Permian) and the Monongahela Group (Pennsylvanian), with some of the Conemaugh Group (Pennsylvanian), and Alluvium (Quaternary) along the streams and the Ohio River.

Minable Coal Seams: Washington Coal of the Dunkard Group; Waynesburg, Upper Sewickley, Redstone and Pittsburgh Coals of the Monongahela Group; Bakerstown, Brush Creek and Mahoning Coals of the Conemaugh Group; Lower Freeport, Middle Kittanning, Lower Kittanning, and Clarion Coals of the Allegheny Formation.

Limestone Resources: Washington and Elk Grove Limestones of the Dunkard Group; Benwood, Sewickley, Redstone of the Monongahela Group; Ames and Cambridge Limestones of the Conemaugh Group.

Sandstone Resources: Fish Creek and Waynesburg of the Dunkard Group; Sewickley and Pittsburgh of the Monongahela Group; Lower Pittsburgh, Connellsville and Morgantown of the Conemaugh Group.

Salt Resources: Underlain by natural salt brine, occurring especially in the Salt Sands of the Pottsville Group. Also rock salt of the Silurian Age is present.

Soil Limitations: Atkins, Chagrin, Chavies, Dunning, Huntington and Linside soils are subject to flooding. Ernest and Monongahela are footslope soils with slow permeability and a seasonal high water table. Brooke and Upshur soils are a serious landslide hazard and Brookside, Clarksburg, Ernest, Gilpin, Westmoreland and Wharton have a moderate landslide risk.

Seismic Risk: Zone 1

Major Rivers: Ohio River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Wheeling Landslide Quadrangle; Remnants of glacial Lake Monongahela.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1440'	Flood Plains	3	Wheeling Warwood Dam
	610'	Slopes	92	12 (P,T)
		Uplands	5	

Ref: Ellyson et al., Lessing, 1974; McCue et al., 1939; Price et al., 1937; White, 1910; WVU Agri. Exp. Sta., 1970.

PENDLETON COUNTY 54 071

Geologic Structure: The structure as a whole may be described as being composed of two great synclinal areas (trending northeast to southwest), one on the east (Shenandoah Mountain Synclinal area) and one on the west (Stony River Synclinal area), with a third great area between them that includes numerous anticlines and synclines. Of these, the Wills Mountain Anticline and Middle Mountain Syncline are the most pronounced. Major reverse faulting occurs in some areas along the eastern limb of the Wills Mountain Anticline.

Exposures: Older Rocks are exposed in anticlinal areas. The surface rocks in descending order are: Alluvium (Quaternary); Pottsville Group (Pennsylvanian); Mauch Chunk, Greenbrier, Pocono Groups (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Harrel Shale, Mahantango Formation, Marcellus Shale, Oriskany Sandstone, Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek Formation, McKenzie Formation, Clinton Group, Tuscarora Sandstone (Silurian); Juniata Formation, Oswego Formation, Martinsburg Shale, Trenton Group, Black River Group, St. Paul Group (Ordovician); a patch of igneous rocks near the Virginia State line.

Minable Coal Seams: Thin seams in the Mauch Chunk and Pottsville Groups.

Limestone Resources: Great beds of limestone in the Tonoloway Formation and Helderberg and Greenbrier Groups; smaller beds in the Clinton Group, McKenzie and Wills Creek Formations and in the Chemung and Mauch Chunk Groups.

Sandstone Resources: Purslane of the Pocono Group; Sandstones of the Hampshire Formation, Chemung Group and Brallier Formation; Oriskany Sandstone; and Tuscarora Sandstone.

Iron Ore: Iron Ore of the Clinton Group and Oriskany Sandstone.

Salt Resources: There are no salt resources in Pendleton County.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1, west; Zone 2, east.

Major Rivers: South Branch Potomac River, North Fork South Branch Potomac River, South Fork South Branch Potomac River.

Drainage Network: Trellis

Ultimate Drainage: Potomac River

Comments: Spruce Knob-Seneca Rocks National Recreation Area; Numerous Caves; Germany Valley (RNL); Fanny Bennett Hemlock Forest (TNC); Selmet-Spruce Knob Tracts (TNC): Hendrick Tract (TNC); Spruce Knob-Seneca Rocks NRA (TNC).

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Ridge and Valley - most of county	4862'	Flood Plains	4	Brushy Run (P)
Allegheny Mountain - Northeast	1155'	Slopes	91	Franklin 2 NE (P,T)
		Uplands	5	Spruce Knob (P,T)

Ref: Lessing, 1974; McCue et al., 1939; Tilton et al., 1927; WVU Agri. Exp. Sta., 1970.

PLEASANTS COUNTY 54 073

Geologic Structure: This area is located just west of the deepest portion of the Appalachian basin. The strata have a very gentle regional dip to the southeast, towards the Parkersburg Syncline which is the middle of the basin and is located east of the county. The Burning Springs Anticline (which trends north-south) is located in the western portion of the county.

Exposures: Dominated by the Dunkard Group (Permian) with the Monongahela Group and Conemaugh Group (Pennsylvanian) being exposed along Middle Island Creek & French Creek and in the southwest portion of the county. A few areas of the Allegheny Formation (Pennsylvanian) are also located in the southwest. There is Alluvium (Quaternary) along the streams and the Ohio River.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Lower Freeport, Upper Freeport, Middle Kittanning and Lower Kittanning Coals of the Allegheny Formation.

Limestone Resources: There are no significant limestone deposits in Pleasants County.

Sandstone Resources: Marietta and Waynesburg Sandstones of the Dunkard Group.

Salt Resources: Underlain by natural salt brine, especially brines of the Salt Sands (Pottsville Group), Maxton Sand (Mauch Chunk Group), and Big Injun Sand (Pocono Group). Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Ohio River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1232'	Flood Plains	8	St. Marys (P)
	587'	Slopes	92	
		Uplands	0	

Ref: Lessing, 1974; Price et al., 1937; White, 1910; WVU Agri. Exp. Sta., 1970.

POCAHONTAS COUNTY 54 075

Geologic Structure: West of Greenbrier River: The strata have a general regional dip to the west and form the eastern limb of the Kovan Syncline. The dip is interrupted in the central portion by the Deer Park Anticline and the North Potomac (Georges Creek) Syncline, which trend northeast and southwest. East of Greenbrier River: The anticlines and synclines are, from west to east: Blackwater Anticline, Browns Mountain Anticline, Job Syncline, Horton Anticline and Stony River Syncline. These are bold features in a northeast and southwest trend which largely control the direction, shape and height of the mountains and exert considerable influence on the drainage basins.

Exposures: West of Greenbrier River: Kanawha and New River Formations (Pennsylvanian); Bluestone, Princeton, Hinton and Bluefield Formations, Greenbrier Limestone, Maccrady Formation and Pocono Group (Mississippian); and Alluvium (Quaternary). East of Greenbrier River: Pocono Group (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation, Harrell Shale, Mahantango Formation, Marcellus Shale, Oriskany Sandstone, Helderberg Group (Devonian); Tonoloway Limestone, Wills Creek Formation, McKenzie Formation, Clinton Group and Tuscarora Sandstone (Silurian); and Juniata Group (Ordovician).

Minable Coal Seams: Gilbert Coal of the Kanawha Formation; Iaeger and Sewell Coals of the New River Formation.

Limestone Resources: Reynolds and Glenray Limestones of the Mauch Chunk Group; Alderson, Union, Pickaway, Taggard, Patton, Sinks Grove and Hillsdale Limestones of the Greenbrier Group; Helderberg Limestone of the Devonian System; Tonoloway, Wills Creek and McKenzie Limestones of the Silurian System.

Sandstone Resources: Lower Gilbert and Dotson of the Kanawha Formation; Upper Nuttall, Lower Nuttall, Guyandot, Lower Guyandot, Upper Raleigh, Quinnimont and Pineville of the New River Formation; Princeton of the Princeton Formation; Goodwyn and Stony Gap of the Hinton Formation; Big Spruce Knob, Bradshaw, Droop and Edray of the Bluefield Formation; Broad Ford and Berea of the Pocono Group; Sandstones of the Hampshire Formation; Valley Head and Elkins of the Chemung Group; Sandstones of the Brallier Formation; Ridgeley Sandstone of the Oriskany Sandstone; Keefer and Iron Sandstone of the Clinton Group; and Tuscarora Sandstone.

Iron Ore: Iron ore of the Oriskany Sandstone and of the Clinton Group.

Soil Limitations: Modern soil mapping is not complete.

Seismic Risk: Zone 1, north; Zone 2, south.

Major Rivers: Greenbrier River
Drainage Network: Trellis
Ultimate Drainage: Ohio River

Comments: Numerous caves; Cranberry Glades (RNL); Gaudineer Scenic Aoea (RNL); Swago Run Karst Area (RNL); Beartown State Park (TNC)

Pocahontas County, cont.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau, SW	4842'	Flood Plains	3	Arborvale 2 (P,T)
Allegheny Mountain, NW	1952'	Slopes	91	Buckeye (P,T)
Valley and Ridge, E		Uplands	6	Marlington (P)

Ref: Lessing, 1974; McCue et al., 1937; Price, 1929; WVU Agri. Exp. Sta., 1970.

PRESTON COUNTY 54 077

Geologic Structure: The rocks are folded and distorted, with the folds being roughly parallel to the mountain ranges which lie in a northeast-southwest direction. Prominent anticlines: Chestnut Ridge, Preston and Briery Mountain. Prominent synclines: Ligonier, Kingwood and Mount Carmel.

Exposures: The Monongahela Group, Conemaugh Gaoup, Allegheny Formation and Pottsville Group (Pennsylvanian); Mauch Chunk Group, Greenbrier Group and Pocono Group (Mississippian); Hampshire Formation and Chemung Group (Devonian); with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Elk Lick, Harlem and Bakerstown Coal of the Conemaugh Group; Upper Freeport, Lower Freeport, Upper Kittanning, Lower Kittanning and Clarion Coal of the Allegheny Formation; Winifrede Coal of the Pottsville Group.

Limestone Resources: Elk Lick and Pine Creek of the Conemaugh Group; Upper Freeport and Lower Freeport of the Allegheny Formation and Greenbrier Limestones of the Greenbrier Group.

Sandstone Resources: Connellsville, Morgantown, Grafton, Saltsburg, Buffalo, and Mahoning of the Conemaugh Group; Lower Freeport and Clarion of the Allegheny Formation; Homewood, Upper Connoquenessing and Lower Connoquenessing of the Pottsville Group; and Rowelsburg of the Chemung Group.

Salt Resources: Likely underlain by rock salt of Silurian Age.

Iron Ore: Found in the Conemaugh, Allegheny, Pottsville and Mauch Chunk rocks, noneconomic deposits which consist mostly of lean carbonates.

Soil Limitations: Atkins, Elkins, Melvin, Mixed Alluvial Land, Philo and Pope soils are subject to flooding. Brinkerton, Cavode, Ernest, Lickdale, Monongahela and Tyler are terrace or lower hill soils with slow permeability and seasonal high water table. Cookport and Wharton are upland soils with slow permeability. Upshur has a high landslide hazard potential.

Seismic Risk: Zone 1

Major Rivers: Cheat River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Cheat River Gorge; a few caves; Cranesville Swamp (TNC,RNL); Cathedral State Park (TNC)

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Allegheny Mountain (Appalachian Plateau in extreme southwest)	3380' 875'	Flood Plains Slopes Uplands	1 81 18	Albright, Terra Alta (P) Brandonville (P,T), Hopemont (P,T), Rowlesburg (P,T)

Ref: Hennen et al., 1914; Lessing, 1974; McCue et al., 1939; Patton et al., 1959 Price et al., 1937; WVU Agri. Exp. Sta., 1970.

PUTNAM COUNTY 54 079

Geologic Structure: This area occupies the middle or deepest portion of the Appalachian basin. The strata dip slightly to the north or northwest toward the middle of the basin (Parkersburg Syncline), which passes through the northwestern portion of the county. An arch in the rocks, Byrnside Anticline, extends through a portion of the southern part of the county.

Exposures: The surface rocks, in a very general north to south pattern, consist of the Dunkard Group (Permian); Monongahela Group and Conemaugh Group (Pennsylvanian); with Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Little Pittsburgh of the Conemaugh Group; and Lower Freeport Coal of the Allegheny Formation.

Limestone Resources: No significant limestone reserves.

Sandstone Resources: Gilmore, Nineveh, Burton, Fish Creek, Rush Run, Jollytown, Hundred, Upper Marietta, and Lower Marietta of the Dunkard Group.

Salt Resources: Underlain by natural brine, including brines of the Salt Sands (Pottsville Group), and Big Injun Sand (Pocono Group).

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 1

Major Rivers: Ohio River and Kanawha River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Saint Albans and Pocatalico Landslide Quadrangles; Ancient Teays Valley.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1232'	Flood Plains	7	Winfield Locks (P,T)
	513'	Slopes	93	
		Uplands	0	

Ref: Krebs, 1911; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

RALEIGH COUNTY 54 081

Geologic Structure: Raleigh County is east of the Coalburg Syncline. The strata dip gradually in a southeast to northwest direction. No decided synclines or basins exist within the area. There are a few small ones that occur occasionally (which trend northeast-southwest). Minor Anticlines: Pineville, Mullens and Dry Fork. Minor Synclines: Pineville, Mullens and Weyanoke.

Exposures: The surface rocks, in a very general northwest to southeast pattern consist of the Allegheny Kanawha, New River and Pocahontas Formations (Pennsylvanian); the Mauch Chunk Group (Mississippian); and Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Stockton-Lewiston, Coalburg, Winifrede, Hernshaw, Cedar Grove, Alma, Campbell Creek (No. 2 Gas); Powellton, Matewan, Eagle, Little Eagle, Lower War Eagle, Glenalum Tunnel and Gilbert Coals of the Kanawha Formation; Douglas, Lower Douglas, Laeger, Lower Laeger, Castle, Welch, Little Raleigh, Beckley, Fire Creek, No. 8 Pocahontas of the New River Formation; No. 7 Pocahontas, No. 6 Pocahontas, No. 5 Pocahontas, No. 4 Pocahontas, No. 3 Pocahontas and No. 2 Pocahontas of the Pocahontas Formation.

Limestone Resources: There are no important limestone reserves in Raleigh County.

Sandstone Resources: East Lynn Sandstone of the Allegheny Formation; Homewood, Upper Coalburg, Lower Coalburg, Upper Winifrede, Lower Winifrede, Upper Chilton, Lower Chilton, Hernshaw, Naugatuck, Williamson, Upper Cedar Grove, Middle Cedar Grove, Lower Cedar Grove, Monitor, Peerless, Brownstown, Matewan, Eagle, Decota, Grapevine, Lower War Eagle, Upper Gilbert and Lower Gilbert of the Kanawha Formation; Nuttall, Lower Nuttall, Panther, Upper Laeger, Middle Laeger, Lower Laeger, Harvey Conglomerate, Guyandot, Lower Guyandot, Welch, Upper Raleigh, Lower Raleigh, Quinnimont and Pineville of the New River Formation; Flattop Mountain, Pierpont, Eckman, Upper Pocahontas, Lower Pocahontas, Vivian and Keystone of the Pocahontas Formation.

Salt Resources: Underlain by natural salt brine in the northwestern part of the county.

Soil Limitations: Alluvial Land, Atkins, Gravelly alluvial land, Landes, Philo and Pope soils are subject to flooding. Ashton and Chavies are subject to infrequent flooding. Monongahela is a terrace soil with slow permeability and a seasonal high water table. Cookport is an upland soil with slow permeability. Meckesville, Shelocta and Wharton are subject to the hazard of slippage.

Seismic Risk: Mostly Zone 2, Zone 1 in extreme northwest

Major Rivers: New River

Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: New River Gorge

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	3566'	Flood Plains	2	Beckley VA Hosp. (P,T)
	820'	Slopes	87	Beckley WB AP (P,T)
		Uplands	11	Dry Creek (P)
				Naoma (P)

Ref: Gorman et al., 1975; Krebs et al., 1916; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

RANDOLPH COUNTY 54 083

Geologic Structure: West: A gradual regional dip to the north parallel to the axis of structural folds and a sharp uplift to the east along Rich Mountain. East: More severely folded than west, with fold axis nearly parallel to the crest of the mountain ranges, northeast-southwest. Anticlines and Synclines (west to east): Hiram Anticline, Belington Syncline, Deer Park Anticline, North Potomac (Georges Creek) Syncline, Blackwater Anticline, Job Syncline, Horton Anticline, Stoney River Anticline.

Exposures: Exposures in descending order: Alluvium (Quaternary); Conemaugh Group, Allegheny, Kanawha and New River Formations (Pennsylvanian); Mauch Chunk Group, Greenbrier Limestone, Maccrady Formation and Pocono Group (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation and Harrell Shale (Devonian).

Minable Coal Seams: Bakerstown of the Conemaugh Group; Upper Freeport, Upper Kittanning, Lower and Middle Kittanning and Clarion of the Allegheny Formation; Upper Mercer, Stockton-Lewiston, Winefrede, Campbell Creek, Eagle, Gilbert, Iaeger, Castle, Sewell, Welch and Fire Creek of the Pottsville Group.

Limestone Resources: Reynolds and Glenray Limestones of the Mauch Chunk Group; Alderson, Union, Pickaway, Taggard, Patton and Sinks Grove Limestones of the Greenbrier Group.

Sandstone Resources: Upper Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport and Upper East Lynn of the Allegheny Formation; Homewood, Upper Connoquenessing, Lower Connoquenessing, Upper Cedar Grove, Peerless, Monitor, Brownstown, Eagle, Decota and Lower Gilbert of the Kanawha Formation; Upper Nuttall, Lower Nuttall, Harvey, Guyandot, Lower Guyandot and Upper Raleigh of the New River Formation; Princeton, Stony Gap and Webster Springs of the Mauch Chunk Group; Hendricks of the Chemung Group.

Salt Resources: Likely underlain by rock salt of Silurian Age in the western part of the County.

Soil Limitations: Modern soil mapping is completed but soil survey not published.

Seismic Risk: Zone 1

Major Rivers: Middle Fork River, Buckhannon River, Tygart Valley River, Shavers Fork of Cheat River, Dry Fork of Cheat River.

Drainage Network: Dendritic (Middle Fork and Buckhannon)
Trellis (Tygart Valley, Shavers Fork and Dry Fork)
Ultimate Drainage: Ohio River

Comments: Many caves; Blister Run Swamp (RNL); Gaudineer Scenic Area (RNL); Shavers Mountain Spruce-Hemlock Stand (RNL)

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau - western	4760'	Flood Plains	6	Alpena 1 NW (P)
Allegheny Mountain - central and eastern	1750'	Slopes	92	Elkins WB AP (P,T)
Valley and Ridge - extreme southeast		Uplands	2	Pickens (P,T)
				Valley Bend (P)
				Valley Head (P)

Ref: Lessing, 1974; McCue et al., 1939; Price et al., 1937; Reger, 1931; WVU Agri. Exp. Sta., 1970.

RITCHIE COUNTY 54 085

Geologic Structure: This area occupies the middle or deepest portion of the Appalachian basin. The strata have a very gentle regional dip towards the middle of the basin (Parkersburg Syncline), which passes through the northwestern portion of the county from the southwest to northeast. The Burning Springs Anticline trends north - south along the Wood-Ritchie County Line.

Exposures: Dominated by the Dunkard Group (Permian), with the Monongahela Group and Conemaugh Group (Pennsylvanian) exposed along the tributaries of the Hughes River and along the western border. A few areas of the Allegheny Formation (Pennsylvanian) are located along the extreme western border. Alluvium (Quaternary) occurs along the streams.

Minable Coal Seams: Washington Coal of the Dunkard Group; Pittsburgh Coal of the Monongahela Group.

Limestone Resources: There are no significant limestone deposits.

Sandstone Resources: Marietta and Waynesburg Sandstones of the Dunkard Group.

Salt Resources: Underlain by natural salt brine, including brine of the Salt Sands (Pottsville Group), Maxton Sand (Mauch Chunk Group), and Big Injun Sand (Pocono Group). Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Hughes River System
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Murphy Preserve (TNC)

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1380'	Flood Plains	2	Cairo 3 S (P)
	605'	Slopes	98	Ellenboro (P)
		Uplands	0	Smithville (P)

Ref: Lessing, 1974; McCue et al., 1939; Price et al., 1937; White, 1910, WVU Agri. Exp. Sta., 1970.

ROANE COUNTY 54 087

Geologic Structure: The county lies near the center of the Appalachian basin, almost entirely to the east of the deepest portion. The rocks dip slightly to the southeast, interrupted by several minor anticlines (Flat Rock, Arches Fork, Burning Springs, Chestnut Ridge) and several minor synclines (Spencer and Robinson).

Exposures: The general pattern of surface rocks from northwest to southeast consists of the Dunkard Group (Permian); Monongahela Group and Conemaugh Group (Pennsylvanian); with Alluvium (Quaternary) along the streams.

Minable Coal Seams: Bakerstown and Brush Creek Coals of the Conemaugh Group; Lower Freeport and Lower Kittanning of the Allegheny Formation; Stockton-Lewiston and Campbell Creek Coals of the Pottsville Group; Waynesburg Coal of the Dunkard Group; and Pittsburgh Coal of the Monongahela Group.

Limestone Resources: No outcrop of workable thickness occurs.

Sandstone Resources: Hundred, Upper Marietta, Lower Marietta, Mannington and Waynesburg of the Dunkard Group; Uniontown, Aronoldsburg and Sewickley of the Monongahela Group; Lower Pittsburgh, Connellsville, Morgantown and Buffalo of the Conemaugh Group.

Salt Resources: Underlain by natural salt brine, especially brine of the Salt Sands (Pottsville Group), and Oriskany Sandstone.

Soil Limitations: Modern soil mapping completed but not published.

Seismic Risk: Zone 1

Major Rivers: West Fork of Little Kanawha River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Hungry Beech Natural Area (TNC)

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachinan Plateau	1500'	Flood Plains	2	Spencer (P,T)
	615'	Slopes	98	
		Uplands	0	

Ref: Hennen, 1911; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

SUMMERS COUNTY 54 089

Geologic Structure: This is an area of gentle and rather symmetrical folds (trending northeast - southwest), of relatively slight disturbance, and as a whole may be considered as one broad monocline (strata dipping toward the northwest) in which minor structural relief has developed. Anticlines: Boggs Knob, Dunn, Alderson and Abbs Valley. Synclines: Springdale, Bellepoint and Creamery. Fault: Talcott (slight).

Exposures: The surface rocks generally become older from northwest to southeast. They consist of the New River and Pocahontas Formations (Pennsylvanian); Bluestone, Princeton, Hinton and Bluefield Formations and the Greenbrier Group (Mississippian); Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: No. 6 Pocahontas and No. 3 Pocahontas of the Pocahontas formation.

Limestone Resources: Avis Limestone of the Hinton Formation; Raines Corner, Reynolds and Glenray Limestones of the Bluefield Formation; Limestones of the Greenbrier Group; and Limestones of the Martinsburg Formation.

Sandstone Resources: Pineville of the New River Formation; Flattop Mountain, Pierpont, Upper Pocahontas and Keystone of the Pocahontas Formation; Upper Belcher and Glady Fork of the Bluestone Formation; Princeton of the Princeton Formation; Falls Mills, Tallery, Hackett, Upper Bellpoint and Stony Gap of the Hinton Formation; Clayton, Graham, Bertha, Bradshaw and Indian Mills of the Bluefield Formation.

Salt Resources: There are no salt resources in Summers County.

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 2.

Major Rivers: New River, Greenbrier River and Bluestone River.
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Bluestone Lake

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	3945' 1240'	Flood Plains Slopes Uplands	3 87 10	Bluestone Dam (P,T,E)

Ref: Lessing, 1974; McCue et al., 1939; Reger et al., 1926; WVU Agri. Exp. Sta., 1970.

TAYLOR COUNTY 54 091

Geologic Structure: The strata are essentially flat-lying with a regional dip to the northwest. The county is traversed in a northeast-southwest direction by a number of minor folds, with the most prominent, by far, being the Chestnut Ridge Anticline in the western part of the county.

Exposures: The surface rocks are dominated by the Conemaugh Group (Pennsylvanian). Also present are the Monongahela Group, Allegheny Formation and Pottsville Group (Pennsylvanian), with Alluvium (Quaternary) along the streams and rivers.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Upper Freeport and Upper and Lower Kittanning Coal of the Conmaugh Group; Upper Mercer Coal of the Pottsville Group.

Limestone Resources: Sewickley of the Monongahela Group; Upper Pittsburgh, Clarksburg and Elk Lick of the Conemaugh Group; Upper Freeport and Lower Freeport of the Allegheny Formation.

Sandstone Resources: Lower Pittsburgh, Connellsville, Lower Connellsville, Morgantown, Grafton, Saltsburg, Buffalo and Mahoning of the Conemaugh Group; Upper Freeport and Lower Freeport of the Allegheny Formation; Homewood of the Pottsville Group.

Salt Resources: Underlain by natural salt brine and by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is complete, but soil survey not published.

Seismic Risk: Zone 1

Major Rivers: Tygart Valley River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Remnants of glacial Lake Monongahela: Tygart Lake

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	2003'	Flood Plains	3	Tygart Dam (P)
	895'	Slopes	90	
		Uplands	7	

Ref: Hennen et al., 1913; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

TUCKER COUNTY 54 093

Geologic Structure: West: A region of extreme and sharp folding. Many of the folds are discontinuous, their traceable length being a few miles only, interrupted by monoclines, followed in turn by other short isolated folds. The folds trend northeast-southwest. East: The folds are very broad and on the whole, symmetrical. Their axes extend entirely across the county, generally in a northeast-southwest direction. Anticlines: Texas, Etam, St. George, Eglon, Drift Run, Deer Park, Blackwater. Synclines: Pifer Mountain, Hannahsville, St. George, Leadmine, North Potomac.

Exposures: The Monongahela Group, Conemaugh Group, Allegheny Group, Pottsville Group (Pennsylvanian); Mauch Chunk Group, Greenbrier Group, Pocono Group (Mississippian); Hampshire Formation, Chemung Group, Brallier Formation (Devonian); with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Little Pittsburgh, Bakerstown of the Conemaugh Group; Upper Freeport of the Allegheny Formation; Sewell Coal of the Pottsville Group.

Limestone Resources: Hinton Limestone of the Mauch Chunk Group; Greenbrier Limestone of the Greenbrier Group.

Sandstone Resources: Upper Grafton, Grafton, Jane Lew, Saltsburg, Buffalo, Upper Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport and Kittanning of the Allegheny Formation; Homewood, Upper Connoquenessing, Lower Gilbert, Upper and Lower Nuttall, Upper and Lower Guyandot and Upper Raleigh of the Pottsville Group; Princeton Conglomerate of the Mauch Chunk Group.

Salt Resources: Western portion of county likely underlain by rock salt of Silurian Age.

Soil Limitations: Alluvial Land, Atkins, Barbour, Philo, Pope, Sequatchie and strong alluvial land are subject to flooding. Brinkerton, Cookport, Lickdale and Nolo are upland or plateau soils with slow permeability and a seasonal high water table. Albrights and Blayo are lower slope soils and Monongahela, Purdy and Tyler are terrace soils with slow permeability and a high water table. Belmont overlies solution channels. Ernest and Meckesville are subject to the hazard of slippage on steep slopes.

Seismic Risk: Zone 1

Major Rivers: Cheat River, Shavers Fork of Cheat River, Dry Fork of Cheat River, Blackwater River.

Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Allegheny Front and Blackwater Canyon; Some caves; Big Run Bog (RNL); Fisher Spring Bog (RNL); Canaan Valley (RNL); Dolly Sods Mineral Rights (TNC).

TUCKER COUNTY, CONT.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Allegheny Mountain	4420'	Flood Plains	4	Canaan Valley (P,T)
	1450'	Slopes	71	Parsons (P,T)
		Uplands	25	Davis, Thomas (P)

Ref: Lessing, 1974; Losche et al., 1967; McCue et al, 1939; Price et al., 1937; Reger, 1923; WVU Agri. Exp. Sta., 1970.

TYLER COUNTY 54 095

Geologic Structure: This area occupies the center or deepest portion of the Appalachian Basin (Parkersburg Syncline). From the trough of the basin the strata have a gentle rise both to the northwest and southeast. This rise is interrupted by several low folds, the most prominent being the Big Moses Anticline.

Exposures: The exposures consist of the Dunkard Group (Permian) and the Monongahela Group (Pennsylvanian), with Alluvium (Quaternary) exposed along the streams and Ohio River.

Minable Coal Seams: Washington Coal of the Dunkard Group; Waynesburg and Uniontown Coals of the Monongahela Group.

Limestone Resources: There are no significant limestone reserves.

Sandstone Resources: Fish Creek, Hundred, Upper Marietta, Lower Marietta and Mannington of the Dunkard Group; Gilboy of the Monongahela Group.

Salt Resources: Underlain by natural salt brine, including brines of the Salt Sands (Pottsville Group), Maxton Sand (Mauch Chunk Group), and Big Injun Sand (Pocono Group). Also underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Ohio River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1500'	Flood Plains	4	Bens Run 1 SSE (P,T)
	580'	Slopes	93	Middlebourne 2 ESE (P,T)
		Uplands	3	New Matamoris Dam 16 (P)

Ref: Hennen, 1909; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

UPSHUR COUNTY 54 097

Geologic Structure: The prevailing structural feature is a long, gentle monocline, giving the rocks a gradual regional dip northwest away from the mountains of Randolph County, interrupted by only two shallow synclines. These trend northeast -southwest and enter the northwestern part of the county.

Exposures: From northwest to southeast: Dunkard Group (Permian); Pottsville Group, Allegheny Formation, Conemaugh Group and Monongahela Group (Pennsylvanian); with scattered Alluvium (Quaternary) along the streams.

Minable Coal Seams: Redstone and Pittsburgh of the Monongahela Group; Elk Lick of the Conemaugh Group; Upper Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning, and Clarion of the Allegheny Formation; Upper Mercer, Stockton-Lewiston, Winifrede, Peerless and Eagle of the Kanawha Formation; Iaeger, Castle and Sewell of the New River Formation.

Limestone Resources: Uniontown, Sewickley and Redstone of the Monongahela Group; Clarksburg, Orlando and Elk Lick of the Conemaugh Group; and Johnstown of the Allegheny Formation.

Sandstone Resources: Upper Sewickley and Lower Sewickley of the Monongahela Group; Lower Pittsburgh, Connellsville, Lower Connellsville, Morgantown, Grafton, Saltsburg, Buffalo, Upper Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport and East Lynn of the Allegheny Formation; Homewood, Upper Connoquenessing of the Pottsville Group.

Salt Resources: Underlain by natural salt brine in west, and entire county underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping is not completed.

Seismic Risk: Zone 1

Major Rivers: Buckhannon River and Middle Fork River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments:

Physiographic Province	Relief	Est. Land Area (%)	Meteorological Stations
Appalachian Plateau	3050' 1038'	Flood Plains 4 Slopes 89 Uplands 7	Buckhannon 2 W (P,T)

Ref: Lessing, 1974; McCue et al., 1939; Price et al., 1937; Reger et al., 1918; WVU Agri, Exp. Sta., 1970.

WAYNE COUNTY 54 099

Geologic Structure: The deepest portion of the Appalachian basin (Parkersburg Syncline) passes through the northern part of the county from east to west. The strata in the northern fifth of the county dip slightly to the southeast and the strata in the southern four-fifths dip to the northwest. The Doane Anticline and Queens Ridge Syncline pass through the southeastern part of the county.

Exposures: The exposures, in a very general north to south pattern, consist of the Monongahela Group, Conemaugh Group, Allegheny Formation and Kanawha Formation (Pennsylvanian), with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Little Pittsburgh and Elk Lick Coals of the Conemaugh Group; Upper Freeport and Lower Kittanning Coals of the Allegheny Formation; Stockton-Lewiston, Coalburg, Winifrede and Campbell Creek Coals of the Pottsville Group.

Limestone Resources: Very little limestone occurs in Wayne County.

Sandstone Resources: Upper Pittsburgh of the Monongahela Group; Lower Pittsburgh, Connellsville, Morgantown, Grafton, Saltsburg, Buffalo and Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport and East Lynn of the Allegheny Formation; Homewood, Coalburg, Upper Winifrede, Lower Winifrede and Malden of the Pottsville Group.

Salt Resources: Underlain by natural salt brine, including brine of the Salt Sands (Pottsville Group), and Big Injun Sand (Pocono Group).

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 1

Major Rivers: Ohio River, Big Sandy River, Tug Fork River, Twelve Pole Creek
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Catlettsburg and Huntington Landslide Quadrangles; Ancient Teays Valley; East Lynn Lake.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1500'	Flood Plains	4	Dunlow 5 E (P,T)
	490'	Slopes	96	Huntington WB AP (P,T)
		Uplands	0	Wayne 2 (P)

Ref: Krebs et al., 1913; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

WEBSTER COUNTY 54 101

Geologic Structure: The structure is a long monocline showing a gradual southeastward dip of the strata away from Randolph, Pocahontas and Greenbrier Counties where distortion of the strata has been much more severe, interrupted by one slight anticline (Webster Springs Anticline) and its corresponding shallow syncline (Kovan Syncline), both of which reach almost across the county in an approximate north-south direction.

Exposures: Very generally, the rocks at the surface are younger in the northwest than the rocks in the southeast. Included are the Conemaugh Group, Allegheny Formation, New River Formation, Kanawha Formation (Pennsylvanian); Mauch Chunk Group and Greenbrier Group (Mississippian); with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Upper Freeport, Upper Kittanning, Middle Kittanning and Lower Kittanning of the Allegheny Formation; Upper Mercer, Stockton-Lewiston, Coalburg, Winifrede, Chilton, Cedar Grove, Alma, Campbell Creek, Eagle, Lower War Eagle and Gilbert of the Kanawha Formation; Iaeger, Sewell, Welch and Fire Creek of the New River Formation.

Limestone Resources: Hinton Limestone of the Mauch Chunk Group and Greenbrier Limestone of the Greenbrier Group.

Sandstone Resources: Upper Mahoning and Lower Mahoning of the Conemaugh Group; Upper Freeport, Lower Freeport, Upper East Lynn and East Lynn of the Allegheny Formation; Homewood, Upper Coalburg, Upper Winifrede, Lower Winifrede, Upper Chilton, Lower Chilton, Upper Cedar Grove, Peerless, Monitor, Brownstown, Eagle, Decota, Grapevine, Lower Gilbert, Dotson and Lower Dotson of the Kanawha Formation; Upper Nuttall, Lower Nuttall, Harvey, Guyandot, Lower Guyandot, Welch and Upper Raleigh of the Pottsville Group; Princeton and Webster Springs of the Mauch Chunk Group.

Salt Resources: Underlain by rock salt of Silurian Age, except in extreme southern portion of county.

Soil Limitations: Modern soil mapping has not been completed.

Seismic Risk: Zone 1

Major Rivers: Cranberry River, Williams River, Gauley River, Elk River and Holly River

Drainage Network: Dendritic

Ultimate Drainage: Ohio River

Comments: Potato Knob, Holly River State Park (TNC)

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	4200'	Flood Plains	2	Camden on Gauley (P)
	940'	Slopes	95	Hacker Valley (P)
		Uplands	3	Webster Springs 1 E (P,T)

Ref: Lessing, 1974; McCue et al., 1939; Price et al., 1937; Reger, 1920; WVU Agri. Exp. Sta., 1970.

WETZEL COUNTY 54 103

Geologic Structure: This area occupies the center of the deepest portion of the Appalachian Basin (Parkersburg Syncline). Towards the middle of the basin the strata have a gentle regional dip both to the northwest and southeast which is interrupted by several low folds. These trend northeast-southwest. The most prominent are the Big Moses Anticline and the Nineveh Syncline.

Exposures: The exposures consist of the Dunkard Group (Permian), and Monongahela and Conemaugh Groups (Pennsylvanian), with Alluvium (Quaternary) along the streams and the Ohio River.

Minable Coal Seams: Washington Coal of the Dunkard Group; Waynesburg, Uniontown, Sewickley and Pittsburgh Coals of the Monongahela Group.

Limestone Resources: Nineveh and Washington Limestones of the Dunkard Group.

Sandstone Resources: Fish Creek, Hundred, Upper Marietta, Marietta and Mannington of the Dunkard Group; Gilboy of the Monongahela Group.

Salt Resources: Underlain by natural salt brines, including the Salt Sands of the Pottsville Group. Underlain by rock salt of Silurian Age.

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Zone 1

Major Rivers: Ohio River and Fishing Creek
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Remnants of glacial Lake Monongahela.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1650'	Flood Plains	2	Duffy Dam 15 (P)
	588'	Slopes	98	Hastings (P)
		Uplands	0	Hundred (P)
				New Martinsville (P,T)

Ref: Hennen, 1909; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

WIRT COUNTY 54 105

Geologic Structure: The county lies near the center of the Appalachian basin, almost entirely on the eastern side of its deepest portion. The rocks dip slightly to the southeast, interrupted by several anticlines (Burning Springs and Big Moses) and by a minor syncline (Middlebourne).

Exposures: The surface rocks mainly consist of the Dunkard Group (Permian), with the Monongahela Group, Conemaugh Group and Allegheny Group (Pennsylvanian) exposed along the crest of the Burning Springs Anticline. Alluvium (Quaternary) occurs along the streams.

Minable Coal Seams: Waynesburg Coal of the Dunkard Group; Pittsburgh Coal of the Monongahela Group.

Limestone Resources: Middle Rockport, Lower Rockport and Nineveh Limestones of the Dunkard Group.

Sandstone Resources: Hundred, Upper Marietta, Lower Marietta, Mannington and Waynesburg of the Dunkard Group; Uniontown, Arnoldsburg and Sewickley of the Monongahela Group; Lower Pittsburgh, Connellsville, Morgantown and Buffalo of the Conemaugh Group.

Salt Resources: Underlain by natural salt brine, especially brine of the Salt Sands (Pottsville Group), Maxon Sand (Mauch Chunk Group), and Oriskany Sandstone.

Soil Limitations: Ashton, Harkers, Huntington, Lindside, Melvin, Moshannon and Senecaville soils are subject to flooding. Cataco, Ginat, Markland, McGary, Monongahela, Sciotoville, Tygart and Zoar are terrace soils with slow permeability and a seasonal high water table. Brooke, Upshur and Vandalia soils have a high landslide potential, and Markland and Zoar have a moderate landslide risk where they occur on steep slopes.

Seismic Risk: Zone 1

Major Rivers: Little Kanawha River and Hughes River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Kanawha Landslide Quadrangle

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1325' 589'	Flood Plains Slopes Uplands	4 96 0	Creston 1 SSW (P,T)

Ref: Ellyson et al., 1970; Hennen, 1911; Lessing, 1974; McCue et al., 1939; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

WOOD COUNTY 54 107

Geologic Structure: This area is located just to the west of the deepest portion of the Appalachian basin. The strata have a very gentle regional dip to the southeast, towards the Parkersburg Syncline, which is the middle of the basin and is located in the southeastern portion of the county. The Burning Springs Anticline trends north - south along the Wood - Ritchie County line.

Exposures: Dominated by the Dunkard Group (Permian), with the Monongahela Group, Conemaugh Group and Allegheny Formation (Pennsylvanian) being exposed along the eastern boundary. A significant amount of Alluvium (Quaternary) exists along the Ohio and Little Kanawha Rivers.

Minable Coal Seams: Pittsburgh Coal of the Monongahela Group; Lower Freeport, Upper Freeport, Middle Kittanning and Lower Kittanning Coals of the Allegheny Formation.

Limestone Resources: No significant limestone deposits.

Sandstone Resources: Nineveh, Marietta and Waynesburg of the Dunkard Group.

Salt Resources: Underlain by natural salt brine, especially the brines of the Maxton Sand (Mauch Chunk Group) and Big Injun Sand (Pocono Group).

Soil Limitations: Ashton, Hackers, Huntington, Lindside, Melvin, Moshannon, and Senecaville soils are subject to flooding. Cataco, Ginat, Markland, McGary, Monongahela, Sciotoville, Tygart & Zoar are terrace soils with slow permeability and a seasonal high water table. Brooke, Upshur and Vandalia have a high landslide potential. Markland and Zoar have a moderate landslide risk where they occur on steep slopes.

Seismic Risk: Zone 1

Major Rivers: Ohio River and Little Kanawha River
Drainage Network: Dendritic
Ultimate Drainage: Ohio River

Comments: Parkersburg, Valley Mills, South Parkersburg, and Kanawha Landslide Quadrangles.

Physiographic Province	Relief	Est. Land Area (%)		Meteorological Stations
Appalachian Plateau	1204'	Flood Plains	10	Belleville Dam 20 (P)
	563'	Slopes	84	Parkersburg FAA AP (P,T)
		Uplands	6	Parkersburg WB City (P,T)
				Washington Dam 19 (P)

Ref: Ellyson et al., 1970; Lessing, 1974; Price et al., 1937; White, 1910; WVU Agri. Exp. Sta., 1970.

WYOMING COUNTY 54 109

Geologic Structure: The strata have been only slightly folded or disturbed from their original position of deposition. There is a gradual regional dip at a very low angle with the horizontal from the southeast margin of the area to the northwest edge, interrupted by two low anticlines (Pineville and Mullens) and two low synclines (Pineville and Mullens) which trend northeast-southwest across the area.

Exposures: In a very general northwest to southeast pattern, the surface rocks consist of the Allegheny, Kanawha, New River and Pocahontas Formations (Pennsylvanian); with Alluvium (Quaternary) along the rivers and streams.

Minable Coal Seams: Lower Kittanning of the Allegheny Formation; Stockton-Lewiston, Coalburg, Winifrede, Chilton, Williamson, Cedar Grove, Lower Cedar Grove, Alma, Campbell Creek, Powellton, Matewan, Eagle, Bens Creek, Little Eagle, Cedar, Lower War Eagle, Glenalum Tunnel, Gilbert of the Kanawha Formation; Douglas, Lower Douglas, Iaeger, Sewell "B", Sewell, Welch, Beckley, Fire Creek and No. 9 Pocahontas of the New River Formation; No. 7 Pocahontas, No. 6 Pocahontas, No. 5 Pocahontas, No. 4 Pocahontas and No. 3 Pocahontas Coals of the Pocahontas Formation.

Limestone Resources: Wyoming County has negligible limestone resources.

Sandstone Resources: Many hard sandstones of the Kanawha, New River and Pocahontas Formations furnish an inexhaustible supply for construction and building purposes.

Salt Resources: Likely underlain by natural brine in the western portion of the county.

Soil Limitations: Modern soil mapping not completed.

Seismic Risk: Mainly within Zone 2.

Major Rivers: Guyandot River
Drainage Network: Dendritic
Ultimate Drainage: Ohio RIver

Comments:

Physiographic Province	Relief	Est. Land Area (%)	Meteorological Stations
Appalachian Plateau	3536' 900'	Flood Plains 1 Slopes 99 Uplands 0	Kopperston (P,T) Pineville (P,T)

Ref: Hennen, 1915; Lessing, 1974; Price et al., 1937; WVU Agri. Exp. Sta., 1970.

5. SOCIOECONOMIC BASELINE

5.1 INTRODUCTION

Phase I of the Ohio River Basin Energy Study included, among other things, the completion of a socioeconomic data base and a descriptive analysis of the socioeconomic characteristics of the original study region which included portions of Illinois, Indiana, and Ohio, and all of Kentucky. At the onset of Phase II portions of Pennsylvania and West Virginia were added to the study area. Consequently, data collection and analysis efforts were necessary to update the baseline information already completed for the four original ORBES states. The purpose of this report is to provide background information on West Virginia which, when coupled with the efforts of the researchers at the University of Pittsburgh, will complete the socioeconomic baseline for the entire Phase II ORBES region.

One of the functions of the ORBES socioeconomic baseline is to provide a data bank for use by the Core Team and support researchers in their impact analyses. The socioeconomic impact models and analysis, the siting analysis, and support research on induced migration have all required data stored as part of this baseline information. As the study progresses further demands may be made of this data bank. A second and equally important function of the baseline is to provide a socioeconomic profile of the study region. This profile, by identifying the current trends in population, income and housing, can give some insight as to the areas which would be the least and most affected by the development of energy facilities. This report provides information that fulfills both functions of the baseline as it relates to the ORBES portions of West Virginia.

5.2 ORBES-WEST VIRGINIA DATA COLLECTION

The ORBES portion of West Virginia contains forty-eight of the total fifty-five counties in the state (See Fig. 5-1). The seven counties not included in ORBES make up the eastern panhandle of the state and were left out of the study region mainly because: 1) they are not part of the primary coal field that runs through western Pennsylvania, West Virginia, Ohio and western Kentucky, and 2) they are not within the boundaries of the Ohio River Basin. These counties are Berkeley, Hampshire, Hardy, Jefferson, Mineral, Morgan, and Pendleton counties.

The basic unit used in the data collection is the county. County level data is the most abundant and consistent of any geographical unit below the state level. Altogether there are 425 counties in the Phase II ORBES region. There is great variation in land area and population among these counties so it is advisable to be cautious when comparing the characteristics of one against another.

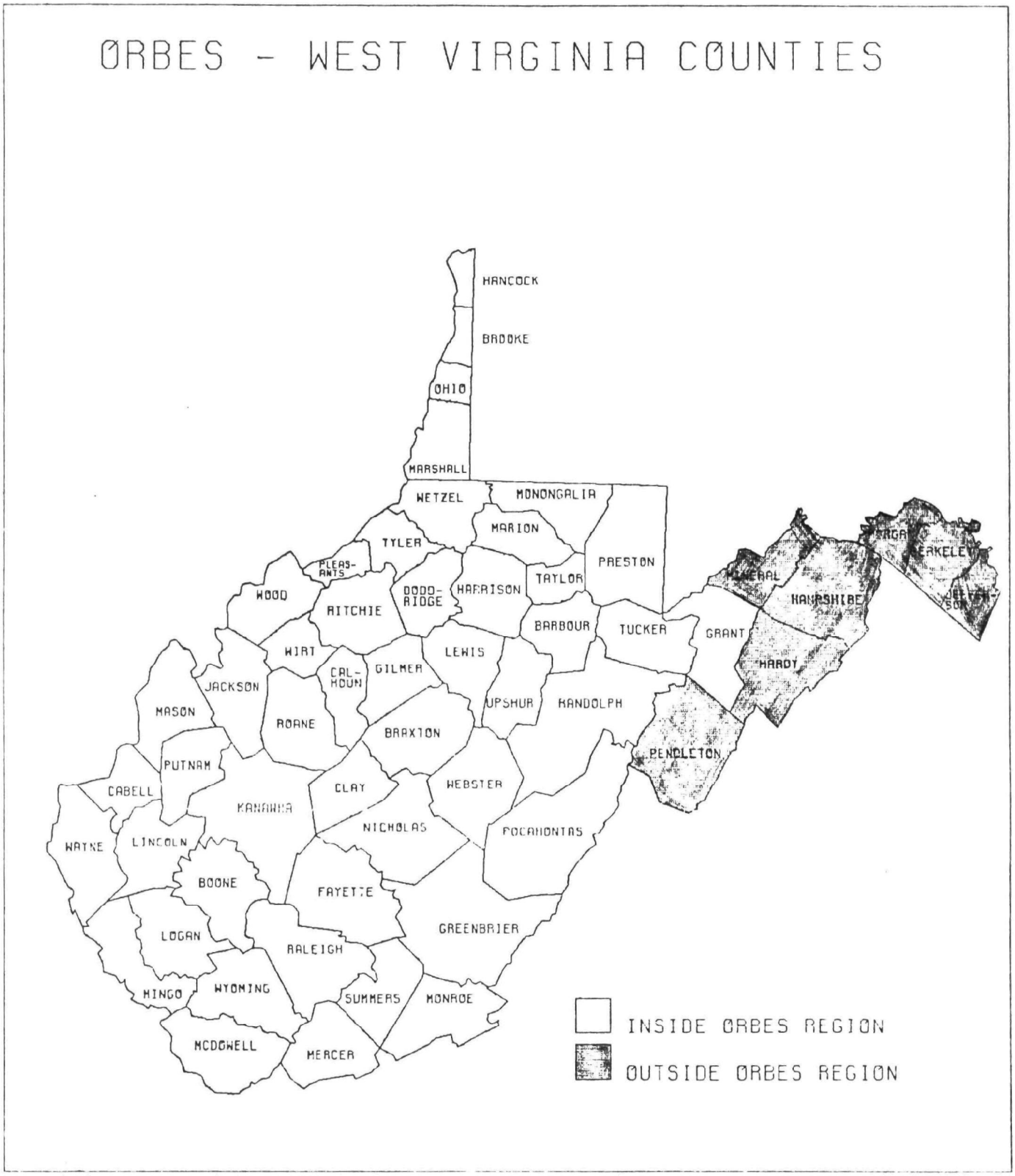

Figure 5-1 ORBES Counties

The most significant socioeconomic impacts due to the construction of a large scale energy facility will occur locally, including nearby communities and surrounding area. For example, the housing stock of nearby towns and villages and the local demand for public services by in-migrants may be affected. Changes in the property tax base will occur, in most instances, only at the local tax district level. For the purpose of examining these local impacts, community or sub-county level data is ideal. However, the availability, comparability and accessibility of data at this level precludes the collection of this information for the entire ORBES region. As part of the ORBES Study, case study sites were chosen to enable Core Team members to investigate local impacts for a selected number of planned energy facility sites. Some data sources which could be used for this local analysis are included in the Appendix as Table 5-A-1.

The time period chosen for the baseline by the Core Team was 1975. The majority of Census data, however, is recorded for 1970. These data make up the foundation of the baseline. Additional information for time periods ranging from 1960 to 1977 was also collected. A list of the data sources, data items and time periods covered is presented on Table 5-1.

The following sections describe the demographic, income, housing, labor force, mining, agriculture and tax base characteristics of ORBES-West Virginia. A final section includes implications for socioeconomic impact analysis. Baseline information is presented in tabular and map form throughout the report. Detailed information and an annotated bibliography are provided in the Appendix.

5.3 DEMOGRAPHIC CHARACTERISTICS

The population trends for the six ORBES states over the period 1960 to 1975 are presented on Table 5-2. The relatively small population of the ORBES-West Virginia suffered the greatest space absolute and percentage decline over the 1960-1970 period. However, the following five years provided a reversal of that trend with a percentage increase greater than any other state except Kentucky. It should be noted that in absolute numbers the increase was small in comparison. The county level data (See Table 5-3 and Fig. 5-2 and 5-3) show that with this reversal in population growth there was also a significant geographical shift in the growth counties. In the earlier period, 1960-1970, the industrial counties, specifically those along the Ohio River, grew in population while most of the other counties either remained stable or lost population. The latter period, 1970-1975, illustrates the shift of population to the mining and more rural counties. This trend of urban to rural migration was observed throughout ORBES during this period and was probably enhanced in West Virginia by the renewed interest in coal as an energy source.

The largest cities in the state, Huntington (68,811), Charleston (67,348), Wheeling (44,369), Parkersburg (38,882) and Morgantown (30,318), are small in comparison to other major cities in the ORBES region, e.g. Pittsburgh (458,651), Louisville (335,954), Indianapolis (714,878) or Cincinnati (412,564). Five Standard Metropolitan Statistical Areas

Table 5-1

Data Items Collected for ORBES-West Virginia Baseline
by Source and Time Period

Data Item	Source	Time Period
Population		
Total county	1960 Census of Population	1960
	1970 Census of Population	1970
	Current Population Reports, P-25	1975(est.)
Five year age groups	1970 Census of Population	1970
Urban/Rural	1970 Census of Population	1970
White/Non-white	1970 Census of Population	1970
Housing		
Total no. of units:	1970 Census of Housing	1970
Year built		
Water source		
Sewage systems		
Gross rent		
Plumbing facilities		
Persons per room		
Vacancy		
Heating source		
Labor Force/Employment		
Labor force-male/ female	1960 Census of Population	1960
	1970 Census of Population	1970
Occupations (31)	1970 Census of Population	1970
Employment (39)	1970 Census of Population	1970
Income		
Mean, median family income	1970 Census of Population	1970
Per capita income	Current Population Reports,P-25	1969,1974
Coal Mining		
Production by type	Annual Dept. of Mines Report	1976
Employment by type	Annual Dept. of Mines Report	1976
Agriculture		
Acres in farms	1974 Census of Agriculture	1969,1974
Number of operators	1974 Census of Agriculture	1969,1974
Value of Products	1974 Census of Agriculture	1969,1974
Property Valuations		
Assessed valuations	Study of Property Values As they Relate to Levies...	1975,1977

Table 5-2

Population Trends of ORBES States
1960-1975

ORBES-State	1960	1970	1975*	% Change 60-70	% Change 70-75
Illinois	3,185,622	3,365,111	3,419,656	5.63%	1.62%
Indiana	3,583,098	4,001,836	4,097,337	11.69	2.39
Kentucky	3,039,156	3,220,711	3,387,860	5.97	5.19
Ohio	6,651,496	7,353,377	7,518,120	10.55	2.24
Pennsylvania	3,677,787	3,634,132	3,589,600	-1.19	-1.23
West Virginia	1,748,129	1,627,359	1,671,715	-6.91	2.73
ORBES	21,885,288	23,202,526	23,684,288	6.02	2.08

Sources: U.S. Department of Commerce, Bureau of the Census, 1960 City County Data Book.
U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.
U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25, May 1977.

Notes: * These are estimates and not actual amounts.

Table 5-3

Population Characteristics, ORBES-West Virginia Counties

County	1960 Population	1970 Population	1975* Population	% Change 60-70	% Change 70-75
Barbour	15,474	14,030	15,402	-9.33	9.78
Boone	28,764	25,118	27,858	-12.68	10.91
Braxton	15,152	12,666	12,964	-16.41	2.35
Brooke	28,940	29,685	31,049	2.57	4.59
Cabell	108,202	106,918	103,654	-1.19	-3.05
Calhoun	7,948	7,046	7,588	-11.35	7.69
Clay	11,942	9,330	9,702	-21.87	3.99
Doddridge	6,970	6,389	6,575	-8.34	2.91
Fayette	61,731	49,322	52,426	-20.10	6.29
Gilmer	8,050	7,782	7,806	-3.33	.31
Grant	8,304	8,607	8,712	3.65	1.22
Greenbrier	34,446	32,090	32,928	-6.84	2.61
Hancock	39,615	39,749	40,126	.34	.95
Harrison	77,856	73,028	75,103	-6.20	2.84
Jackson	18,541	20,903	22,144	12.74	5.94
Kanawha	252,925	229,515	225,037	-9.26	-1.95
Lewis	19,711	17,847	20,166	-9.46	12.99
Lincoln	20,267	18,912	20,251	-6.69	7.08
Logan	61,570	46,269	47,026	-24.85	1.64
McDowell	71,359	50,666	51,651	-29.00	1.96
Marion	63,717	61,356	62,805	-3.71	2.36
Marshall	38,041	37,598	38,841	-1.16	3.31
Mason	24,459	24,306	25,254	-.63	3.90
Mercer	68,206	63,208	65,379	-7.33	3.43
Mingo	39,742	32,780	34,628	-17.52	5.64
Monongalia	55,617	63,714	67,116	14.56	5.34
Monroe	11,584	11,262	11,644	-2.69	3.30
Nicholas	25,414	22,522	24,659	-11.38	9.49
Ohio	68,437	64,197	60,283	-6.20	-6.10
Pleasants	7,124	7,274	7,717	2.11	6.09
Pocahontas	10,136	8,870	8,637	-12.49	-2.63
Preston	27,233	25,455	26,844	-6.53	5.46
Putnam	23,561	27,625	30,927	17.25	11.95
Raleigh	77,826	70,080	77,046	-9.95	9.94
Randolph	26,349	24,596	25,934	-6.65	5.44
Ritchie	10,877	10,145	10,274	-6.73	1.27
Roane	15,720	14,111	14,740	-10.24	4.46
Summers	15,640	13,213	13,504	-15.52	2.20
Taylor	15,010	13,878	15,188	-7.54	9.44
Tucker	7,750	7,447	7,578	-3.91	1.76
Tyler	10,026	9,929	9,979	-.97	.50
Upshur	18,292	19,092	21,006	4.37	10.03
Wayne	38,977	37,581	38,357	-3.58	2.06
Webster	13,719	9,809	10,382	-28.50	5.84
Wetzel	19,347	20,314	20,370	5.00	.28
Wirt	4,391	4,154	4,523	-5.40	8.88
Wood	78,331	86,818	87,449	10.83	.73
Wyoming	34,836	30,095	32,473	-13.61	7.90

Notes: * These are estimates.

Sources: U.S. Department of Commerce, Bureau of the Census, 1960 City County Data Book.
U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.
U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25, May 1977.

Table 5-4

Miscellaneous Demographic Characteristics, ORBES-West Virginia Counties

1970

County	% White	% Aged 0-15	% Aged 65+	Dependency Ratio	% Rural
Barbour	98.69	25.40	14.44	66.21	78.60
Boone	98.74	29.41	10.09	65.27	100.00
Braxton	99.21	26.80	14.99	71.79	100.00
Brooke	98.97	28.00	9.32	59.54	50.21
Cabell	95.63	23.99	12.16	56.63	32.95
Calhoun	99.89	27.21	14.24	70.77	100.00
Clay	99.91	32.30	11.62	78.33	100.00
Doddridge	99.75	27.02	16.50	77.03	100.00
Fayette	89.18	27.00	12.51	65.33	86.79
Gilmer	99.70	24.16	13.25	59.76	100.00
Grant	98.30	29.43	11.46	69.16	100.00
Greenbrier	94.79	27.02	12.79	66.14	100.00
Hancock	96.51	28.97	8.27	59.33	34.43
Harrison	98.39	25.30	13.06	62.22	52.33
Jackson	99.92	31.64	9.05	68.59	64.20
Kanawha	94.07	26.46	9.42	55.95	31.56
Lewis	99.29	23.92	16.57	68.04	58.97
Lincoln	99.92	31.00	10.83	71.91	100.00
Logan	93.79	30.64	9.07	65.85	84.54
McDowell	81.92	31.68	8.97	68.49	91.81
Marion	96.08	24.02	13.08	58.99	53.00
Marshall	99.22	27.12	10.93	61.42	48.92
Mason	98.73	29.22	10.45	65.75	74.81
Mercer	91.47	25.93	11.64	60.20	63.33
Mingo	95.75	32.51	9.73	73.14	82.21
Monongalia	97.74	21.68	9.26	44.79	45.83
Monroe	95.25	24.22	14.55	63.31	100.00
Nicholas	99.96	30.49	10.23	68.69	83.63
Ohio	96.64	23.42	15.09	62.64	14.23
Pleasants	99.45	30.95	10.54	70.91	100.00
Pocahontas	98.41	25.78	15.49	70.28	100.00
Preston	99.56	29.05	12.51	71.13	89.98
Putnam	99.90	29.67	8.38	61.42	82.60
Raleigh	89.84	27.17	11.41	62.82	71.63
Randolph	99.03	25.83	12.40	64.58	65.31
Ritchie	99.83	26.28	17.24	77.05	100.00
Roane	99.41	24.46	15.29	65.97	100.00
Summers	95.63	25.57	15.28	69.07	65.92
Taylor	98.82	25.76	14.99	68.77	53.65
Tucker	99.69	25.72	14.45	69.98	100.00
Tyler	99.84	29.11	13.72	74.90	83.67
Upshur	99.66	25.34	12.88	61.87	61.97
Wayne	99.82	29.38	9.80	64.44	64.55
Webster	99.91	29.41	12.60	72.45	100.00
Wetzel	99.91	29.33	11.51	69.04	55.32
Wirt	99.86	28.65	14.88	77.07	100.00
Wood	99.02	29.13	9.97	64.20	32.62
Wyoming	98.29	32.31	6.59	63.68	90.14

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

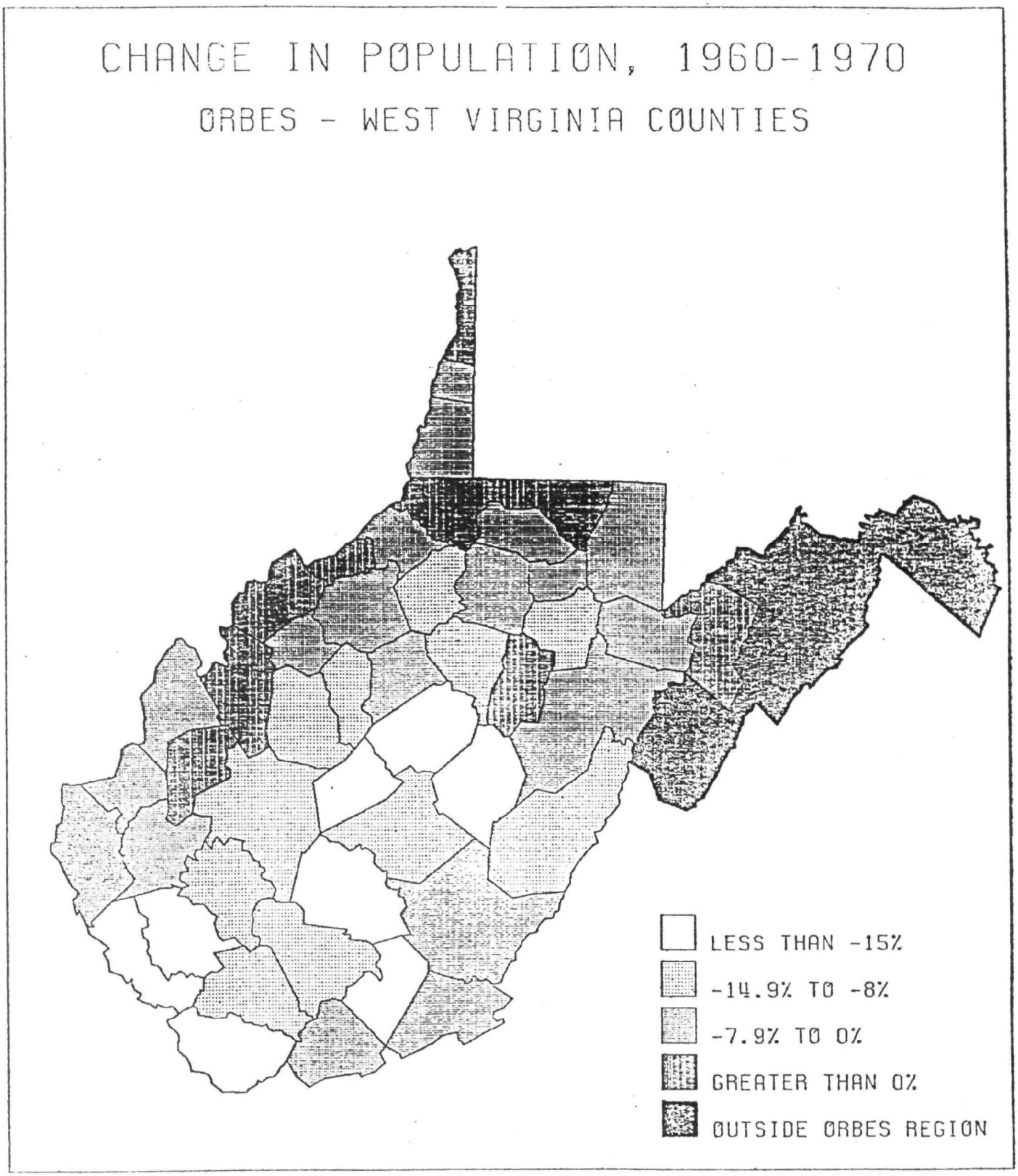

Figure 5-2

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

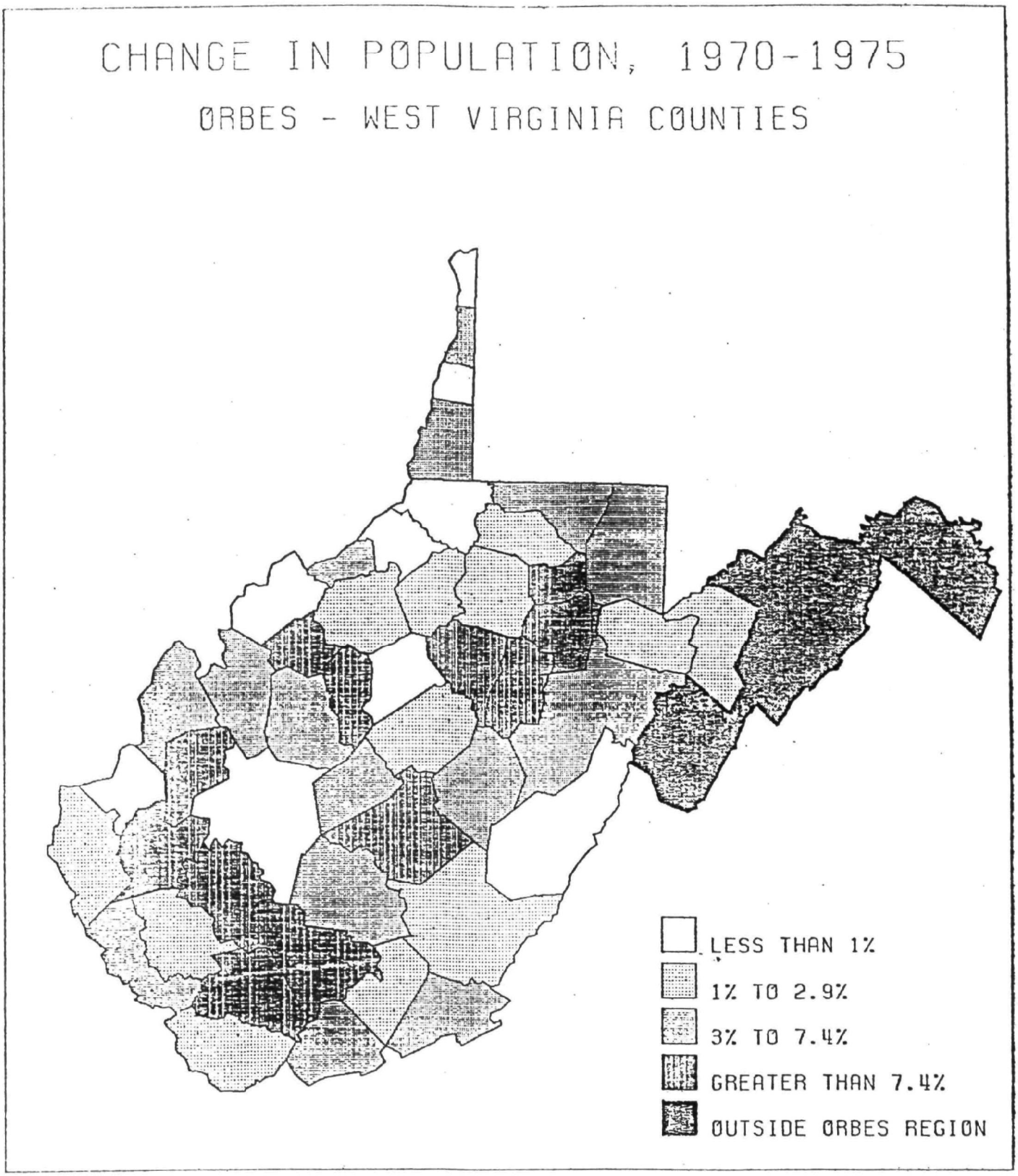

Figure 5-3 Change in Population, 1970-1975

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.
U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25, May 1977.

(SMSA) involve West Virginia counties: Huntington-Ashland, Charleston, Stubenville-Weirton, Wheeling, and Parkersburg-Marietta (See Fig. 5-4).

Other demographic characteristics of the ORBES-West Virginia population are provided on Table 5-4. As one might expect, the majority of the counties, more than 55%, are greater than 75% rural (See Fig. 5-5). Only three counties have non-white populations of 10 percent or more, with the majority of counties, almost 65%, containing 2 percent or less non-white populations.

The dependency ratio is an indicator of the age structure of a given population. This ratio is equal to the dependents of the population (those over 64 and under 15 years of age) divided by the working age population (those between 15 and 64 years of age) times 100. In general, these dependents demand more of the public service sector in terms of education, health and welfare services. At the same time, their input into the public sector in terms of tax revenues from income, property and sales taxes is generally very small. Therefore a high dependency ratio can mean a disproportionate demand for public services compared to a county of equal size and lower or average dependency ratio. It is worthwile to note that the counties with a high dependency ratio (greater than 70.0) are all very rural in character, e.g. Braxton, Calhoun, Clay, Doddridge, Lincoln, Mingo, Pleasants, Pocahontas, Preston, Ritchie, Tyler, Webster and Wirt Counties. Further examination of income and housing characteristics will show these same counties have low incomes and poor housing conditions. A map of counties according to their dependency ratio is provided as Figure 5-6.

5.4 INCOME CHARACTERISTICS

Per capita income levels vary substantially among the counties in ORBES. The cost of living also varies substantially across the ORBES region. Comparison of per capita income levels therefore can be somewhat misleading. Still, the extreme values can be indicative of relatively poor or wealthy populations. The 1974 per capita income for ORBES-West Virginia was $3,250. On Table 5-5 per capita income levels are shown for all the ORBES states, 1969 and 1974. Only Kentucky maintains a lower per capita income than West Virginia. The income levels of both states are less than seventy-five percent of Illinois' income level for 1974. A more dramatic comparison would be between individual counties. For example, an extreme case might be Gilmer County, West Virginia at $2,289 per capita income in 1974 compared with Piatt County, Illinois at $5,523 per capita, 1974.

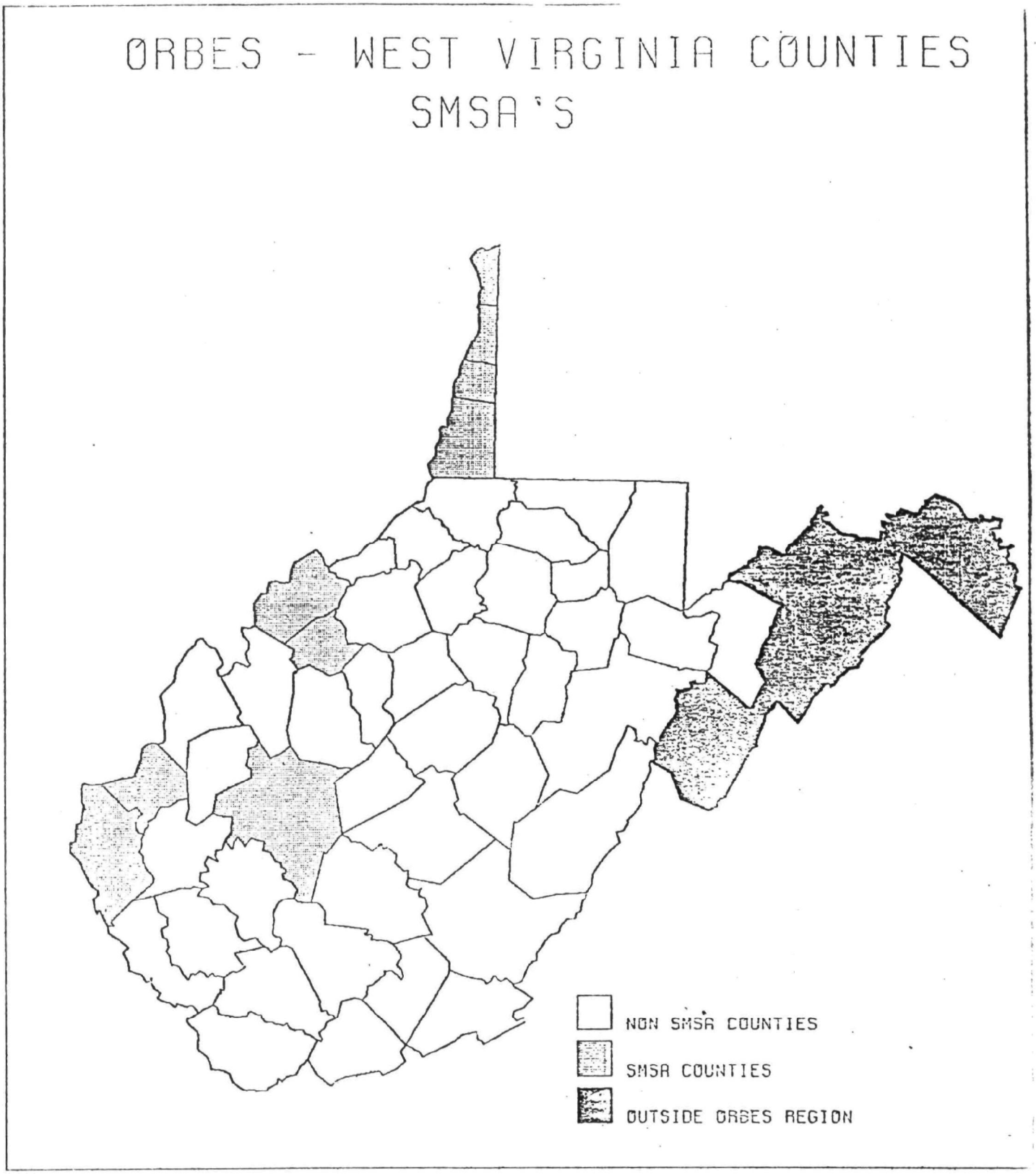

Figure 5-4 ORBES-West Virginia Counties SMSA's

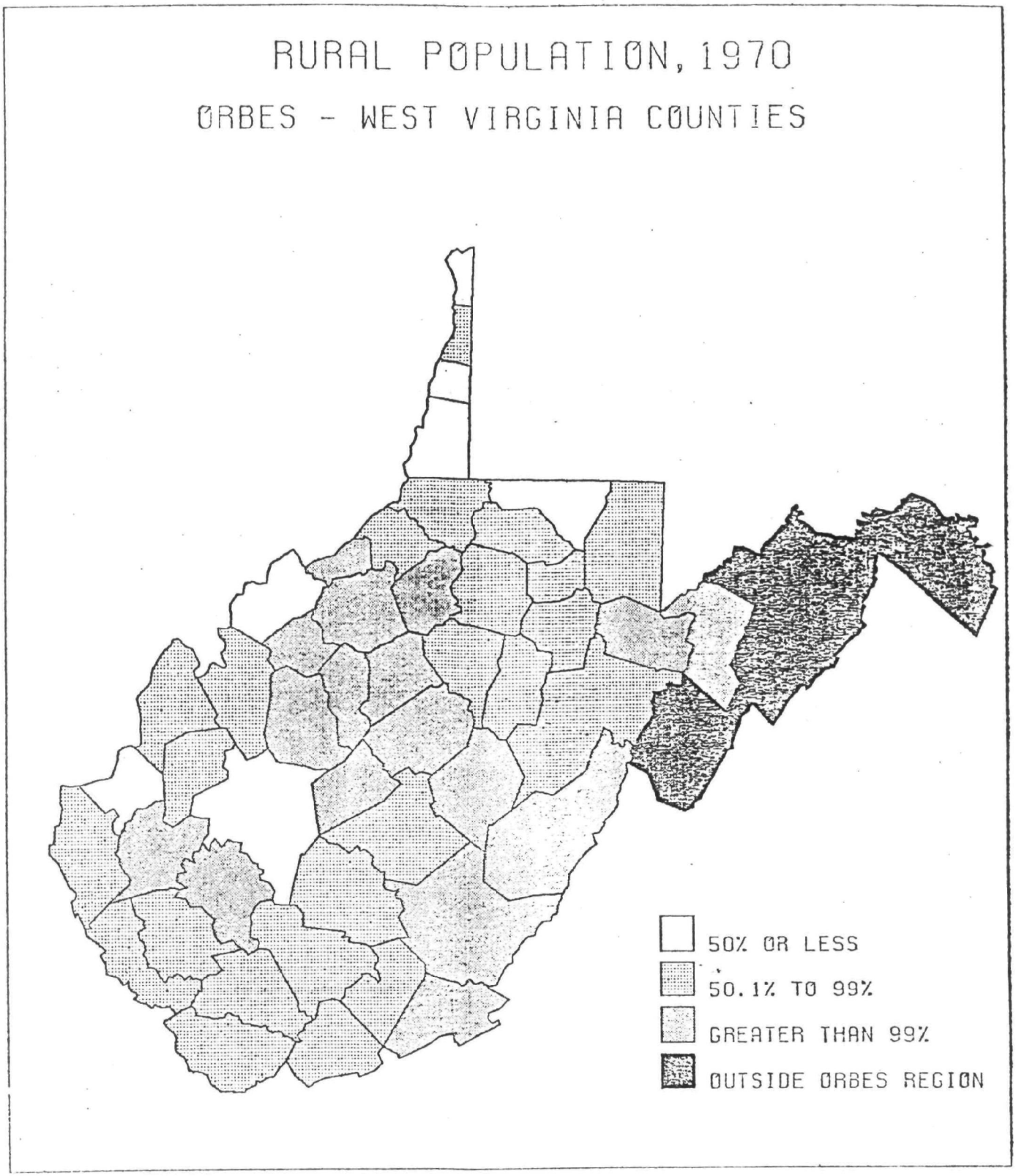

Figure 5-5 Rural Population, 1970

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

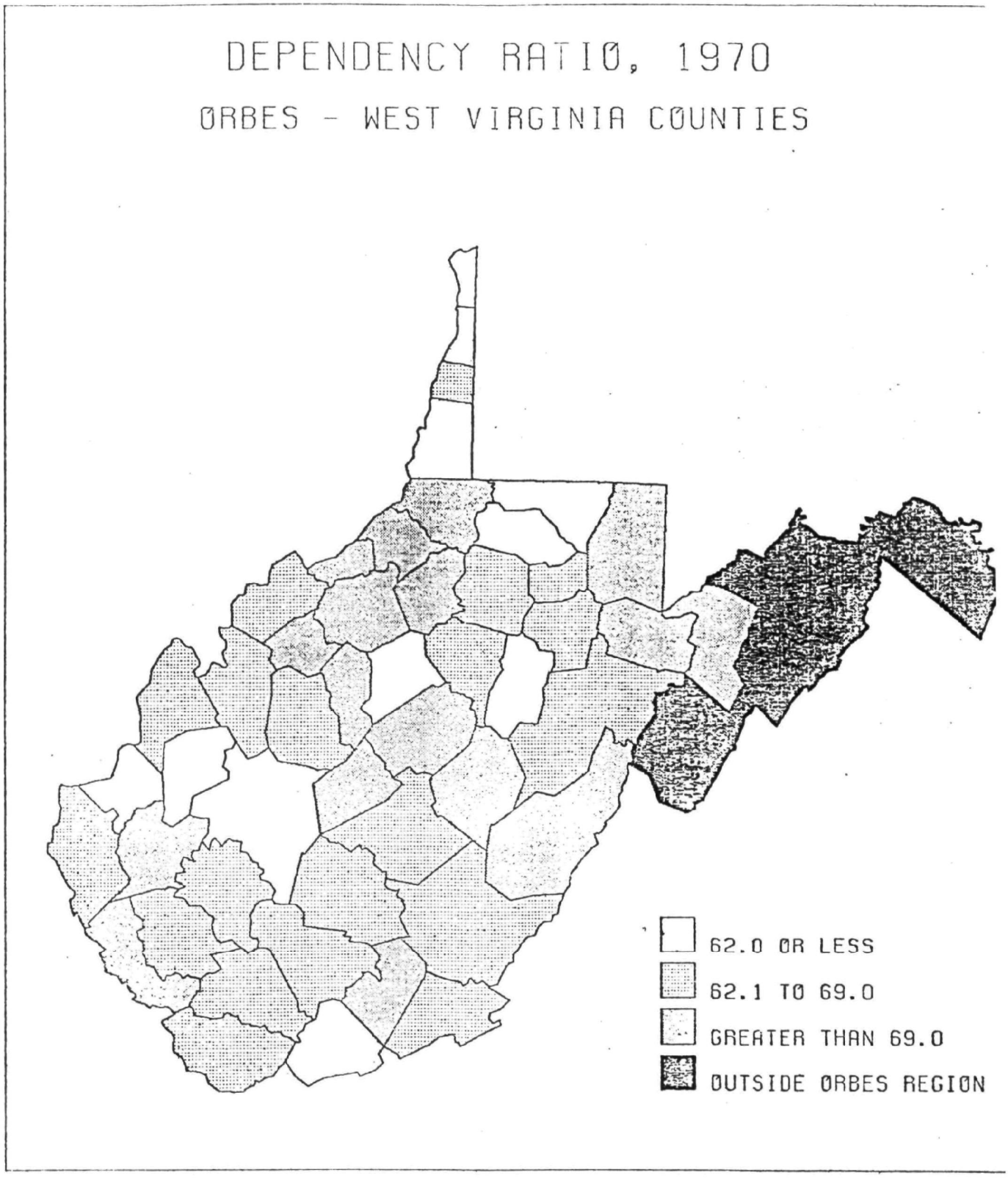

Figure 5-6 Dependency Ratio, 1970

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

Table 5-5

Per Capita Incomes for ORBES States
1969 and 1974

State	1969	1974
Illinois	$2,675	$4,345
Indiana	2,772	4,086
Kentucky	1,982	3,098
Ohio	2,688	3,904
Pennsylvania	2,532	3,822
West Virginia	2,068	3,250

Source: U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25, May, 1977.

Income characteristics at the county level are presented on Table 5-6. The highest mean family income is in Hancock County, the site of Weirton, and part of the Steubenville-Weirton SMSA. The highest percentage of families below the poverty level is 41.32% in Gilmer County. The poverty level used to compute this statistic is a national standard set according to family size. The low dependency ratio and associated low numbers of population below 15 years of age for Gilmer County indicate a large working age population. In spite of this, the income levels are very low and many families are below the poverty level. One possible explanation for this situation could be high unemployment or under-employment. A map of the geographical distribution of counties according to the percentage of families below the poverty level is shown as Figure 5-7.

Table 5-6

Income Characteristics, ORBES-West Virginia Counties
1969-1974

County	1970 # Families	1970 $\bar{x}$ Family Income	1969 Per Capita Income	1974 Per Capita Income	% Fam. Below Poverty
Barbour	3,623	$5,324	$1,785	$2,877	25.86
Boone	6,548	4,502	1,874	3,261	18.98
Braxton	3,380	9,296	1,936	2,880	20.15
Brooke	7,891	8,109	2,821	4,543	8.63
Cabell	28,187	8,109	2,770	4,127	2.42
Calhoun	1,939	4,504	1,659	2,573	37.08
Clay	2,243	4,179	1,297	2,287	39.63
Doddridge	1,587	5,896	1,714	2,589	23.38
Fayette	12,594	6,034	1,908	3,081	23.59
Gilmer	1,641	4,485	1,497	2,289	41.32
Grant	2,256	5,320	1,863	2,955	28.01
Greenbrier	7,687	6,016	2,056	3,281	23.05
Hancock	10,363	10,380	3,055	4,833	5.87
Harrison	19,735	7,717	2,518	3,839	13.19
Jackson	5,480	7,959	2,225	3,570	17.03
Kanawha	61,661	8,669	2,826	4,329	13.01
Lewis	4,327	5,919	1,865	2,915	22.28
Lincoln	4,893	5,058	1,611	2,601	37.97
Logan	11,574	7,077	1,998	3,459	23.01
McDowell	12,542	5,868	1,746	3,071	29.29
Marion	16,632	7,807	2,465	3,670	12.56
Marshall	9,863	8,492	2,537	3,859	10.45
Mason	6,276	6,768	2,007	3,134	23.10
Mercer	16,565	6,945	2,340	3,670	18.00
Mingo	8,016	5,127	1,606	2,889	36.46
Monongalia	15,251	7,758	2,461	3,695	13.12
Monroe	2,859	5,516	1,726	2,513	29.21
Nicholas	5,850	6,623	1,920	3,132	25.25
Ohio	15,733	8,770	2,922	4,392	10.53
Pleasants	1,795	8,235	2,308	3,510	14.87
Pocahontas	2,290	5,089	1,734	2,813	27.16
Preston	6,702	5,626	1,824	3,113	26.65
Putnam	7,752	8,159	2,365	3,748	13.72
Raleigh	18,426	6,737	2,135	3,565	19.56
Randolph	6,212	5,870	1,916	3,017	24.00
Ritchie	3,271	5,681	1,836	2,760	21.43
Roane	3,605	5,517	1,754	2,767	27.13
Summers	3,240	5,130	1,763	2,751	35.74
Taylor	3,440	5,130	2,090	3,208	33.66
Tucker	3,752	6,644	1,769	2,836	18.92
Tyler	1,942	5,243	2,204	3,191	24.87
Upshur	4,718	6,228	1,943	3,097	23.76
Wayne	10,209	7,033	2,150	3,246	21.07
Webster	2,488	4,288	1,504	2,531	39.07
Wetzel	5,480	8,185	2,520	3,617	16.88
Wirt	1,076	5,688	1,811	2,694	28.90
Wood	23,006	8,766	2,740	4,090	9.73
Wyoming	7,560	7,284	1,908	3,066	21.90

Sources: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.
U. S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25, May 1977.

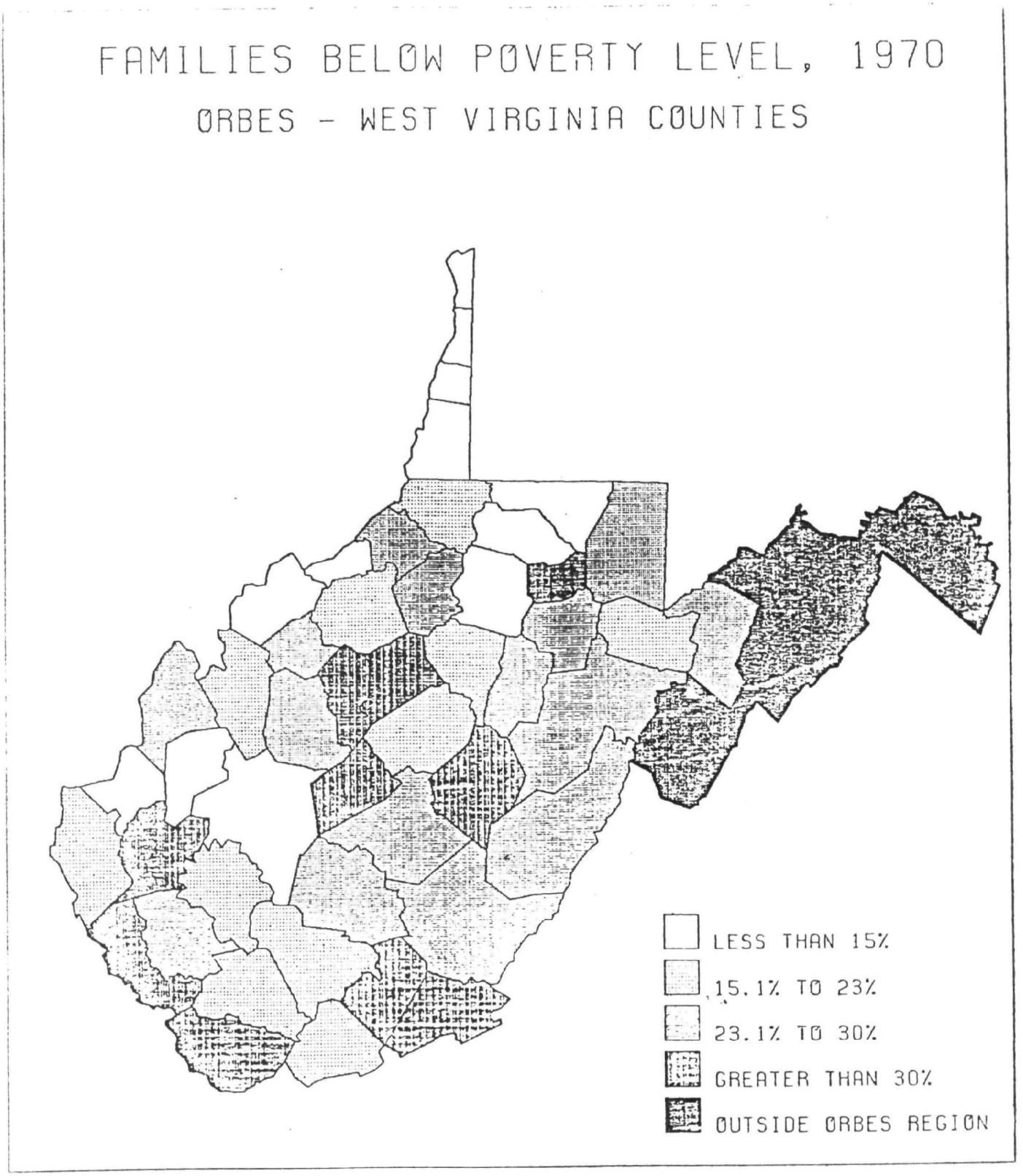

Figure 5-7 Families Below the Poverty Level, 1970

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

5.5 HOUSING CHARACTERISTICS

Indicators of the condition of housing stock are the percentage of units with public water or sewer systems, the percentage that lack some plumbing facilities, the percentage that are crowded or vacant, the source of heat and the vintage of the units. County data for these variables are presented on Tables 5-7 and 5-8. The vintage of the housing stock is shown by two different variables: the percentage of housing units built between 1960 and 1970 and those built before 1940. One might expect that the 1960-1970 period would have been a very slow period for home building in West Virginia since many counties, and the state as a whole, were experiencing a declining population. Most of the counties support this expectation. Several counties (Jackson, Monongalia, and Putnam), however, did experience population growth during this period (See Section 5.3) and their share of housing built during the 1960-1970 decade is substantially greater than any of the other counties in the state.

Public sewer and water systems are not very abundant in many of the ORBES-West Virginia counties mainly because of their small populations and rural character. It is not economical to service a widely dispersed, very small population. For example, Calhoun, Clay and Doddridge counties each have 3,200 or less housing units and the largest town in the three counties has a population of 1,093; all are 100% rural. The taxes necessary to support sewer and water services for all of the households in these counties may be a prohibitive burden. Housing in the larger counties is enhanced by the availability of these important services.

The number of housing units lacking plumbing facilities is indicated on Table 5-7 as a percentage figure. Again, high percentages appear in the smaller rural areas such as Braxton, Calhoun, Clay, Lincoln, McDowell, Webster and Wirt Counties where the rate is greater than 40% (See Fig. 5-8).

The vacancy rate (see Table 5-8) measures the percentage of year round housing units that were vacant at the time the Census was taken. These units could be vacant for sale, for rent, or for some reason other than seasonal housing. High vacancy rates appear to be the case for many of the same counties noted above - those lacking some plumbing facilities. Poor housing conditions along with a decade of declining population could be responsible for these high rates. Exceptions to this might be Roane and Monongalia counties, neither of which have relatively high rates of housing units lacking some plumbing facilities.

Another indicator of housing conditions is the amount of crowding of the percentage of housing units with greater than 1.5 persons per room. This indicator shows only a small number of units under these circumstances. In general, these figures are expected to be at least this low. The highest percentages are for Lincoln, Logan, McDowell and Wyoming counties - all over 5%.

Table 5-7

Housing Characteristics, ORBES-West Virginia Counties
1970

County	Total Housing Units	% Built Before 1940	% Built 1960 to 1970	% With Public Water	% With Public Sewers	% Lack Some Plumbing
Barbour	5,039	65.43%	13.14%	35.42%	30.48%	38.56%
Boone	8,123	49.85	13.11	32.08	25.70	26.10
Braxton	4,663	63.61	13.90	32.45	23.38	41.65
Brooke	10,038	46.75	15.69	71.61	52.16	5.30
Cabell	37,944	55.99	16.57	86.42	86.42	6.36
Calhoun	2,479	57.64	14.36	18.64	13.67	41.11
Clay	3,200	49.28	14.91	18.19	9.28	51.72
Doddridge	2,508	70.93	10.93	20.97	19.46	36.40
Fayette	16,881	62.60	7.32	68.46	41.75	24.49
Gilmer	2,643	62.66	15.74	28.94	25.69	35.26
Grant	2,933	51.65	22.20	34.91	31.50	29.19
Greenbrier	11,503	53.37	15.84	55.83	31.91	24.38
Hancock	12,479	41.69	18.02	82.92	75.91	3.62
Harrison	26,032	67.37	10.98	79.06	63.33	9.52
Jackson	6,898	42.08	28.20	37.82	36.14	22.76
Kanawha	78,837	43.23	16.28	87.17	66.53	6.98
Lewis	5,838	71.53	11.44	47.52	40.20	20.55
Lincoln	5,969	42.25	18.98	25.92	15.21	41.36
Logan	13,902	64.57	9.24	78.25	36.93	24.42
McDowell	15,572	70.58	6.92	67.44	39.61	40.43
Marion	22,179	67.61	11.56	87.58	66.01	8.25
Marshall	12,338	61.50	15.91	78.21	64.91	9.19
Mason	8,193	41.61	19.79	53.75	42.26	24.86
Mercer	21,701	51.97	13.69	69.95	52.96	17.37
Mingo	17,678	64.07	7.99	93.36	76.30	18.40
Monongalia	7,961	25.52	59.52	15.22	10.40	29.19
Monroe	3,800	53.47	15.18	31.89	21.79	37.76
Nicholas	7,379	43.87	19.14	37.31	28.87	27.24
Ohio	22,374	70.23	9.83	92.44	84.91	3.85
Pleasants	2,272	61.27	15.76	50.44	48.42	18.53
Pocahontas	3,421	60.01	18.39	27.68	22.07	37.09
Preston	8,516	63.77	14.07	31.18	31.05	29.91
Putnam	9,081	35.95	31.17	58.50	27.71	18.36
Raleigh	23,425	48.96	13.11	80.08	40.37	18.24
Randolph	8,472	63.47	14.45	59.58	44.32	24.54
Ritchie	3,756	73.70	10.14	37.75	35.09	25.32
Roane	4,993	63.69	14.72	29.86	23.47	28.16
Summers	5,023	64.28	11.05	38.44	36.05	35.22
Taylor	5,073	75.56	8.42	57.70	44.88	21.94
Tucker	2,715	72.38	16.46	64.75	60.41	21.62
Tyler	3,511	69.10	14.73	45.97	43.01	20.85
Upshur	6,532	54.19	18.20	43.26	36.65	26.75
Wayne	12,331	42.80	21.95	57.46	42.87	22.46
Webster	3,568	48.99	11.35	31.53	16.59	48.96
Wetzel	7,033	58.60	18.98	57.14	51.19	16.98
Wirt	1,642	58.10	20.04	23.63	16.20	40.93
Wood	29,539	46.44	22.70	83.94	70.96	6.24
Wyoming	8,834	38.75	15.56	50.59	31.29	29.38

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Housing.

Table 5-8

Housing Characteristics, ORBES-West Virginia Counties
1970 (Part 2)

County	% Vacant	% With > 1.5 PPR*	% Heat With Gas	% Heat With Oil	% Heat With Coal	Gross Rent
Barbour	13.87%	1.85%	33.18%	9.01%	38.62%	$65
Boone	6.73	3.50	71.80	3.10	12.30	52
Braxton	14.03	2.85	48.40	4.18	23.61	60
Brooke	2.82	1.47	61.26	10.68	13.83	88
Cabell	6.01	1.30	85.95	.91	.62	79
Calhoun	12.18	3.27	78.30	1.65	5.57	57
Clay	17.44	4.03	42.56	.62	27.87	41
Doddridge	18.26	2.43	85.05	15.15	1.91	51
Fayette	9.71	2.86	57.34	4.34	22.14	58
Gilmer	13.24	2.76	82.94	0.00	4.09	60
Grant	11.05	2.25	4.98	47.02	21.89	73
Greenbrier	11.26	1.90	28.24	25.54	27.03	65
Hancock	3.30	.99	73.68	10.93	6.43	94
Harrison	6.69	1.35	90.53	.47	1.05	71
Jackson	10.28	1.17	61.58	2.93	6.34	88
Kanawha	5.49	1.60	87.10	.49	1.50	82
Lewis	8.50	1.13	87.38	0.00	4.52	62
Lincoln	8.36	5.91	75.19	.99	6.33	51
Logan	8.03	5.47	72.92	2.09	13.85	58
McDowell	7.17	5.72	4.84	14.78	66.20	45
Marion	6.55	1.17	85.84	.82	3.28	69
Marshall	4.49	.82	73.97	7.70	4.87	76
Mason	9.52	2.15	37.73	24.46	10.84	71
Mercer	6.54	2.17	34.87	14.09	33.62	70
Mingo	4.15	3.56	22.40	2.87	22.30	50
Monongalia	16.54	3.79		10.99	24.72	98
Monroe	11.87	2.29	17.13	31.42	26.55	55
Nicholas	8.82	2.34	41.79	14.77	27.75	63
Ohio	5.30	1.03	84.79	2.81	2.60	74
Pleasants	6.82	2.73	86.93	1.10	.84	76
Pocahontas	17.39	1.93	3.01	40.89	31.28	54
Preston	9.97	2.79	13.46	16.87	54.00	54
Putnam	7.91	1.86	66.12	6.44	3.69	75
Raleigh	6.43	3.01	63.84	5.04	18.98	64
Randolph	11.39	2.17	38.63	7.58	31.54	74
Ritchie	10.62	2.02	80.83	0.00	.59	63
Roane	13.44	1.74	76.93	.48	1.96	65
Summers	14.27	2.59	35.60	17.86	25.92	51
Taylor	9.44	1.89	68.05	5.14	15.51	53
Tucker	10.79	1.03	42.39	7.07	28.25	57
Tyler	10.57	1.48	78.61	4.02	1.14	65
Upshur	11.02	2.36	57.69	2.24	16.81	81
Wayne	7.01	3.27	79.13	1.19	8.63	71
Webster	15.89	3.45	5.86	16.54	48.46	47
Wetzel	8.56	1.58	84.26	3.91	2.96	78
Wirt	19.43	2.98	54.51	4.26	6.52	67
Wood	6.05	.90	87.80	.71	1.22	86
Wyoming	4.86	5.15	51.98	6.19	30.84	54

Note: * Persons per room.

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Housing.

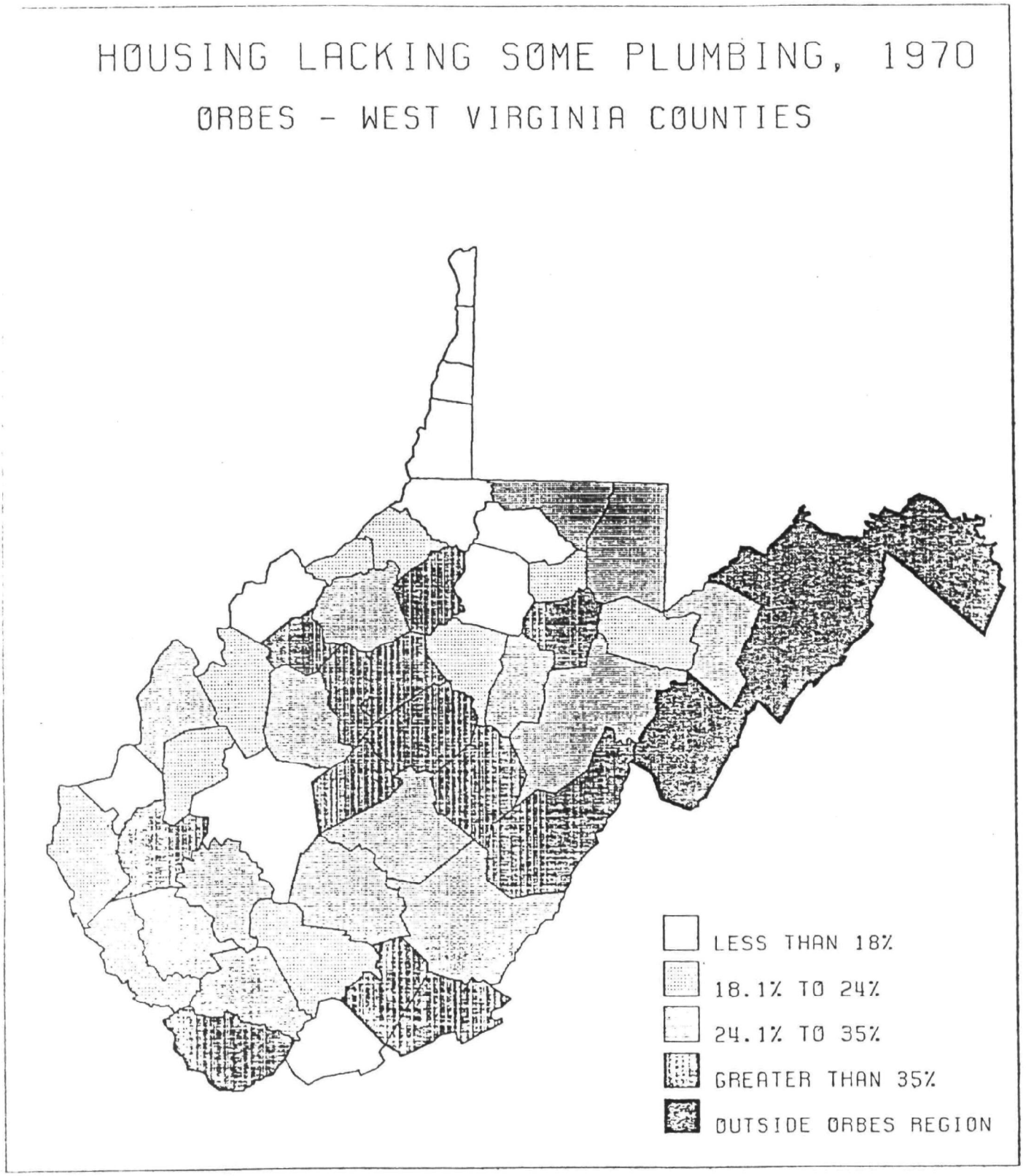

Figure 5-8 Housing Lacking Some Plumbing, 1970

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Housing.

The major heating sources used for home heating are shown on Table 5-8. Several coal using counties stand out: McDowell, Preston, and Webster counties (See Fig. 5-9). These are rural coal-producing counties. Oil is used in many homes in Grant and Pocahontas counties. Gas seems to be the major source of house heating, especially in the more populous counties.

Average rent values for ORBES-West Virginia counties range from $41 per month in Clay County to $98 in Monongalia County (site of Morgantown and West Virginia University). The mean rent for renter occupied housing units for ORBES-West Virginia is $66 compared to $93 for ORBES-Indiana, $92 for ORBES-Ohio, $86 for ORBES-Illinois, $79 for ORBES-Pennsylvania, and $65 for Kentucky.

5.6 LABOR FORCE AND EMPLOYMENT CHARACTERISTICS

Labor force data for 1960 and 1970 are presented on Table 5-9. The decline in population during this period was obviously accompanied by a decline in the labor force as exhibited by the fact that 28 out of 48 ORBES-West Virginia counties experienced such a decrease. Although not explicitly listed on Table 5-9, there is a noticeable increase in both the absolute numbers and percentage of women in the labor force over this decade. This coincides with a national trend toward higher female labor force participation rates.

Occupational data for 1970 are provided on Table 5-10 and 5-11. The largest occupational groups are craftsmen, foremen and kindred workers and operatives except transport. High numbers of clerical, professional and service workers are concentrated in the more populous counties of Cabell, Kanawha and Monongalia. Farm workers are a very small group in the state and make up 500 or more workers only in Greenbrier County.

Employment figures for ORBES-West Virginia are shown on Table 5-12. The major employer groups are manufacturing, services, retail and wholesale trade, and mining. Maps depicting the geographical distribution of counties with varying numbers of employees in manufacturing, services, and mining are shown as Figures 5-10, 5-11, and 5-12 respectively. The major manufacturing counties are along the Ohio, Kanawha and Monongahela Rivers. The counties with large numbers of employees in the service industries are those with the largest populations. According to the 1970 Census data, the major mining counties (based on employment) are Fayette, Kanawha, Logan, McDowell, Marion, Raleigh, and Wyoming. These counties, with the exception of Marion, form a large cluster in the southern portion of the state.

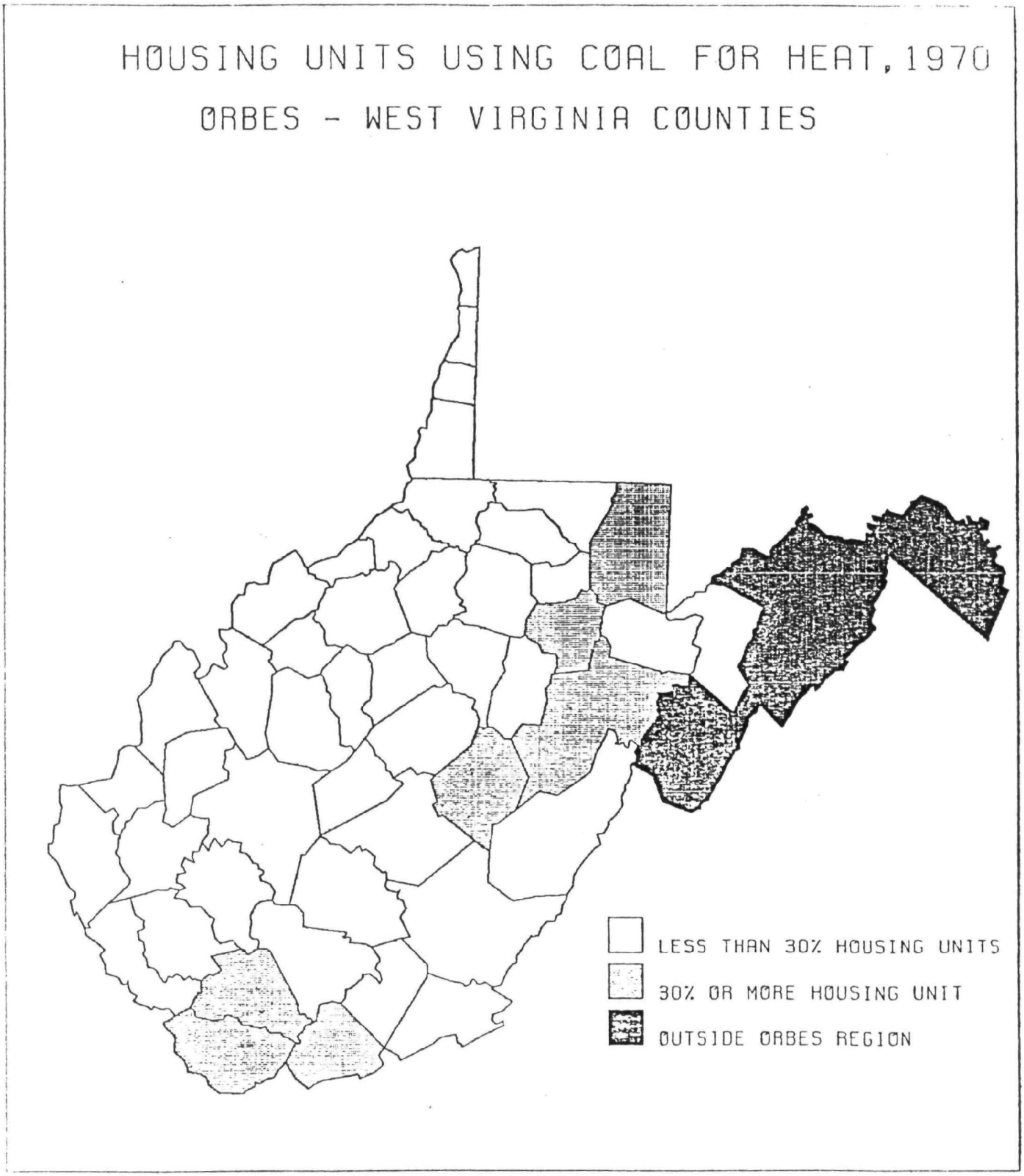

Figure 5-9 Housing Units Using Coal for Heat, 1970

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Housing.

Table 5-9

Labor Force Characteristics, ORBES-West Virginia Counties
1960-1970

Counties	1960 Total Labor Force	1960 Male Labor Force	1960 Female Labor Force	1970 Total Labor Force	1970 Male Labor Force	1970 Female Labor Force
Barbour	4,367	3,280	1,087	4,458	2,943	1,515
Boone	7,132	5,805	1,327	6,686	4,939	1,747
Braxton	3,811	3,083	728	3,162	2,255	907
Brooke	10,372	7,665	2,707	11,017	7,686	3,331
Cabell	39,884	26,682	13,202	39,788	25,186	14,602
Calhoun	2,357	1,697	660	1,877	1,299	578
Clay	2,498	2,016	482	1,968	1,542	426
Doddridge	2,032	1,483	549	1,904	1,352	552
Fayette	15,854	11,922	3,932	12,553	8,811	3,742
Gilmer	2,241	1,735	506	2,357	1,496	861
Grant	2,607	2,052	555	2,953	2,083	870
Greenbrier	10,961	8,056	2,905	10,620	7,219	3,401
Hancock	14,343	10,800	3,543	14,599	10,214	4,385
Harrison	27,550	19,147	8,403	25,844	17,331	8,513
Jackson	5,602	4,538	1,064	6,780	4,955	1,825
Kanawha	88,408	62,239	26,169	85,642	55,538	30,104
Lewis	6,054	4,129	1,925	5,534	3,425	2,109
Lincoln	4,234	3,383	851	4,554	3,276	1,278
Logan	15,554	11,852	3,702	12,160	8,398	3,762
McDowell	17,078	13,440	3,638	11,971	8,649	3,322
Marion	22,599	15,661	6,938	21,887	14,116	7,771
Marshall	12,924	9,370	3,554	13,885	9,358	4,527
Mason	7,687	5,904	1,783	7,576	5,506	2,070
Mercer	20,886	14,558	6,328	21,288	13,831	7,457
Mingo	8,564	6,697	1,867	7,365	5,256	2,109
Monongalia	19,362	13,340	6,022	22,907	14,491	8,416
Monroe	3,590	2,761	829	3,445	2,349	1,096
Nicholas	6,811	5,422	1,389	6,573	4,683	1,890
Ohio	26,953	17,870	9,083	25,235	15,557	9,678
Pleasants	2,340	1,680	660	2,331	1,568	763
Pocahontas	3,066	2,413	653	2,552	1,869	683
Preston	7,951	6,210	1,741	7,915	5,475	2,440
Putnam	6,892	5,631	1,261	9,013	6,758	2,255
Raleigh	21,684	15,482	6,202	20,327	13,723	6,604
Randolph	8,068	5,817	2,251	8,152	5,415	2,737
Ritchie	3,366	2,568	798	3,164	2,122	1,042
Roane	4,528	3,287	1,241	3,910	2,610	1,300
Summers	4,057	3,043	1,014	3,501	2,466	1,035
Taylor	4,368	3,180	1,188	4,599	2,980	1,619
Tucker	2,280	1,664	616	2,411	1,645	766
Tyler	2,994	2,275	719	3,035	2,191	844
Upshur	5,339	3,908	1,431	6,158	4,046	2,112
Wayne	11,258	8,241	3,017	11,935	8,273	3,662
Webster	3,251	2,549	702	2,380	1,727	653
Wetzel	5,915	4,549	1,366	6,425	4,725	1,700
Wirt	1,398	1,100	298	1,260	936	324
Wood	28,534	19,574	8,960	32,271	21,466	10,805
Wyoming	8,354	6,875	1,479	7,754	6,200	1,554

Sources: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.
U. S. Department of Commerce, Bureau of the Census, 1960 City County Data Book.

Table 5-10

Occupational Characteristics, ORBES-West Virginia Counties
1970 (Part 1)

Counties	Professional Technical & Kindred	Managers Except Farm	Sales Workers	Clerical & Kindred	Craftsmen Foremen & Kindred
Barbour	426	303	161	4,300	680
Boone	471	545	276	598	1,273
Braxton	292	285	172	316	582
Brooke	1,112	625	595	1,344	2,194
Cabell	6,085	3,462	3,097	6,027	5,427
Calhoun	179	171	92	144	225
Clay	101	153	77	120	311
Doddridge	91	68	86	174	420
Fayette	1,360	891	700	1,549	2,107
Gilmer	334	187	78	235	258
Grant	230	197	109	212	471
Greenbrier	983	864	555	1,277	1,667
Hancock	1,408	725	697	1,854	3,123
Harrison	2,845	2,159	1,833	3,616	4,100
Jackson	770	521	310	738	1,239
Kanawha	12,945	7,964	5,900	15,920	12,961
Lewis	464	365	249	648	918
Lincoln	423	247	144	368	969
Logan	1,242	1,045	703	1,674	2,118
McDowell	1,103	801	579	1,163	2,105
Marion	974	1,400	1,233	2,695	4,016
Marshall	1,183	669	673	1,537	2,710
Mason	702	476	274	738	1,468
Mercer	2,505	1,762	1,539	2,977	3,415
Mingo	834	617	358	877	1,275
Monongalia	4,794	1,706	1,087	3,235	2,945
Monroe	327	181	74	269	512
Nicholas	567	427	236	605	1,099
Ohio	3,284	2,015	2,245	4,027	3,451
Pleasants	292	171	102	292	479
Pocahontas	255	168	95	204	405
Preston	671	427	253	733	1,384
Putnam	840	576	358	1,132	2,184
Raleigh	2,283	1,514	1,365	2,550	3,608
Randolph	861	826	408	1,053	1,197
Ritchie	192	162	123	206	610
Roane	426	316	164	424	467
Summers	299	318	138	393	523
Taylor	393	345	240	523	810
Tucker	222	187	84	290	337
Tyler	291	204	115	274	595
Upshur	851	411	372	715	790
Wayne	1,145	720	754	1,560	1,940
Webster	196	155	103	173	307
Wetzel	793	370	171	617	1,217
Wirt	83	88	55	150	229
Wood	4,323	2,482	2,104	4,828	5,517
Wyoming	624	569	309	593	1,826

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

Table 5-11

Occupational Characteristics, ORBES-West Virginia Counties
1970 (Part 2)

Counties	Operatives Except Transport	Transportation Equipment Operatives	Laborers Except Farm	Farm Workers	Service Workers
Barbour	795	184	247	191	730
Boone	1,369	492	450	7	684
Braxton	314	215	300	71	280
Brooke	1,997	550	871	61	1,292
Cabell	4,975	1,456	1,994	198	5,118
Calhoun	355	64	208	32	217
Clay	392	135	172	33	170
Doddridge	329	106	195	129	175
Fayette	2,122	741	823	94	1,444
Gilmer	330	98	106	97	462
Grant	486	204	332	236	308
Greenbrier	1,252	471	713	544	1,635
Hancock	2,680	591	1,246	92	1,793
Harrison	4,139	1,289	1,331	344	2,948
Jackson	1,084	424	419	150	592
Kanawha	8,271	3,835	3,833	150	10,348
Lewis	1,033	233	225	198	927
Lincoln	782	275	437	75	410
Logan	2,183	941	511	24	1,145
McDowell	2,466	939	779	30	1,121
Marion	5,076	1,002	1,188	63	2,494
Marshall	3,038	546	905	270	1,693
Mason	1,305	280	543	278	1,010
Mercer	2,752	1,274	1,129	142	2,735
Mingo	1,137	491	596	25	767
Monongalia	2,802	840	1,103	155	3,274
Monroe	570	205	284	367	343
Nicholas	1,506	454	438	97	616
Ohio	2,929	1,003	1,211	164	3,981
Pleasants	272	105	164	26	301
Pocahontas	327	144	266	153	307
Preston	1,459	564	730	281	1,033
Putnam	1,387	550	652	84	911
Raleigh	2,994	1,314	966	146	2,414
Randolph	1,064	417	545	150	1,173
Ritchie	774	134	202	84	252
Roane	750	183	267	85	490
Summers	228	320	258	124	491
Taylor	700	305	301	87	616
Tucker	436	104	255	54	340
Tyler	665	115	260	80	353
Upshur	981	333	417	131	800
Wayne	2,241	674	935	121	1,186
Webster	503	176	190	56	300
Wetzel	1,227	254	507	37	824
Wirt	273	61	95	24	142
Wood	5,489	1,362	1,340	218	3,828
Wyoming	1,745	642	572	16	597

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

In terms of population size, there are many West Virginia counties with fewer than 15,000 people. They are often within 60 miles of an SMSA county, but, as noted in Section 5.3, the cities involved in these SMSA's are quite small. The terrain and the highway system here make commuting distances shorter for the same time span than those in relatively flat Ohio and Indiana.

The Census data on Table 5-12 show that construction employment was over 2,000 in Kanawha (Charleston) and Cabell (Huntington) counties only. A large power plant can require as many as 3,500 workers at peak construction (e.g. the Rockport Plant in southern Indiana, 2600 MW). Kanawha and Cabell counties are located in the southwest portion of the state and would be unable to supply (via commuting) the skilled labor to the far corners of the state. Significant migration of workers with their families may be required for power sites located greater than 60 miles from these SMSA's. The trend in population growth since 1970 (See Section 5.3) may indicate an improvement in the supply of skilled labor for the rural and non-SMSA counties for 1975 but the data is not available to verify this.

Though the vacancy rate is high in some counties, the condition of the housing stock in terms of availability of plumbing facilities and public sewer and water services may make these vacant units unattractive to in-migrants. If the demand for housing increases beyond the capacity of the existing housing stock that has these services, new mobile homes may appear and housing prices may increase forcing local residents (not working at the plant at increased wage rates) to vacate and move into substandard housing.

Local incomes are very low compared to a construction worker's salary. The effect of the added income from in-migrant construction workers to these small rural counties will mean increased sales and services but also increased scarcity of goods and services and higher prices. Though the mean income level for the county as a whole may increase, those on fixed incomes will remain at those incomes and may be at a marked disadvantage in terms of competition for local goods, housing, etc.

From the section on coal mining it was evident that there remains considerable coal reserves in the state. Extensive development of these resources will also have socioeconomic impacts with regard to in-migrants and their demand on public and private services and housing. Existing coal activities are predominately carried out in some of the larger counties where conditions are not so rural or incomes low. However, there are some very small counties involved in coal production and some more small counties with considerable reserves. The impacts of coal development may be substantial in these counties.

Agricultural lands make up a very small portion of ORBES-West Virginia. The displacement of croplands or pasturelands would most liekly be very small and probably avoidable.

Table 5-12

Employment Characteristics, ORBES-West Virginia Counties
1970

Counties	Agric.	Mining	Constr.	Manuf.	Services & Bankg.	Trade	Transp. & Util.
Barbour	221	742	360	484	1,493	621	226
Boone	38	2,175	332	456	1,546	1,170	448
Braxton	77	131	563	413	770	583	290
Brooke	93	280	485	4,898	2,664	1,631	590
Cabell	284	265	2,462	9,834	13,182	8,209	3,639
Calhoun	32	128	209	486	544	173	115
Clay	37	326	122	338	393	341	107
Doddridge	136	119	257	391	399	272	199
Fayette	113	2,545	676	1,795	3,726	2,086	890
Gilmer	102	203	127	341	1,005	266	147
Grant	268	155	251	815	651	458	187
Greenbrier	638	832	955	1,350	3,716	1,850	620
Hancock	117	99	523	7,819	3,156	1,800	695
Harrison	407	2,092	1,594	5,767	7,121	5,655	1,968
Jackson	169	158	689	2,397	1,154	983	291
Kanawha	307	3,799	7,053	15,692	29,654	18,281	7,341
Lewis	204	332	395	1,162	2,052	876	503
Lincoln	121	372	604	932	1,084	596	421
Logan	53	3,796	475	826	3,525	2,141	770
McDowell	71	4,783	298	461	3,012	1,897	564
Marion	1,210	2,992	1,169	5,622	5,761	3,735	1,729
Marshall	338	1,016	827	4,872	3,138	2,114	919
Mason	331	182	673	1,989	1,967	1,007	925
Mercer	234	1,678	1,272	2,909	6,923	4,834	2,380
Mingo	45	1,691	337	464	2,177	1,520	743
Monongalia	245	1,998	1,390	2,602	11,108	3,485	1,113
Monroe	3,830	360	316	957	924	328	166
Nicholas	178	1,931	376	782	1,450	985	343
Ohio	229	825	1,328	5,103	9,011	6,171	1,643
Pleasants	34	0	224	729	708	305	204
Pocahontas	204	70	209	554	865	312	110
Preston	329	994	634	1,786	2,098	1,058	636
Putnam	129	96	1,200	2,757	2,048	1,516	928
Raleigh	215	4,584	1,139	1,398	6,534	4,047	1,237
Randolph	268	405	610	1,414	2,579	1,688	730
Ritchie	95	191	364	994	484	405	210
Roane	104	177	362	888	1,230	603	208
Summers	138	111	182	251	1,118	507	785
Taylor	92	178	218	931	1,313	874	714
Tucker	96	82	195	715	775	297	149
Tyler	80	65	252	1,310	769	333	143
Upshur	148	442	435	1,241	2,023	1,181	331
Wayne	193	167	1,017	3,504	2,910	2,174	1,311
Webster	73	456	136	393	597	325	179
Wetzel	48	322	498	2,615	1,400	728	406
Wirt	24	36	120	497	262	145	68
Wood	317	228	2,288	11,667	8,975	6,129	1,887
Wyoming	40	3,305	359	548	1,624	1,089	528

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

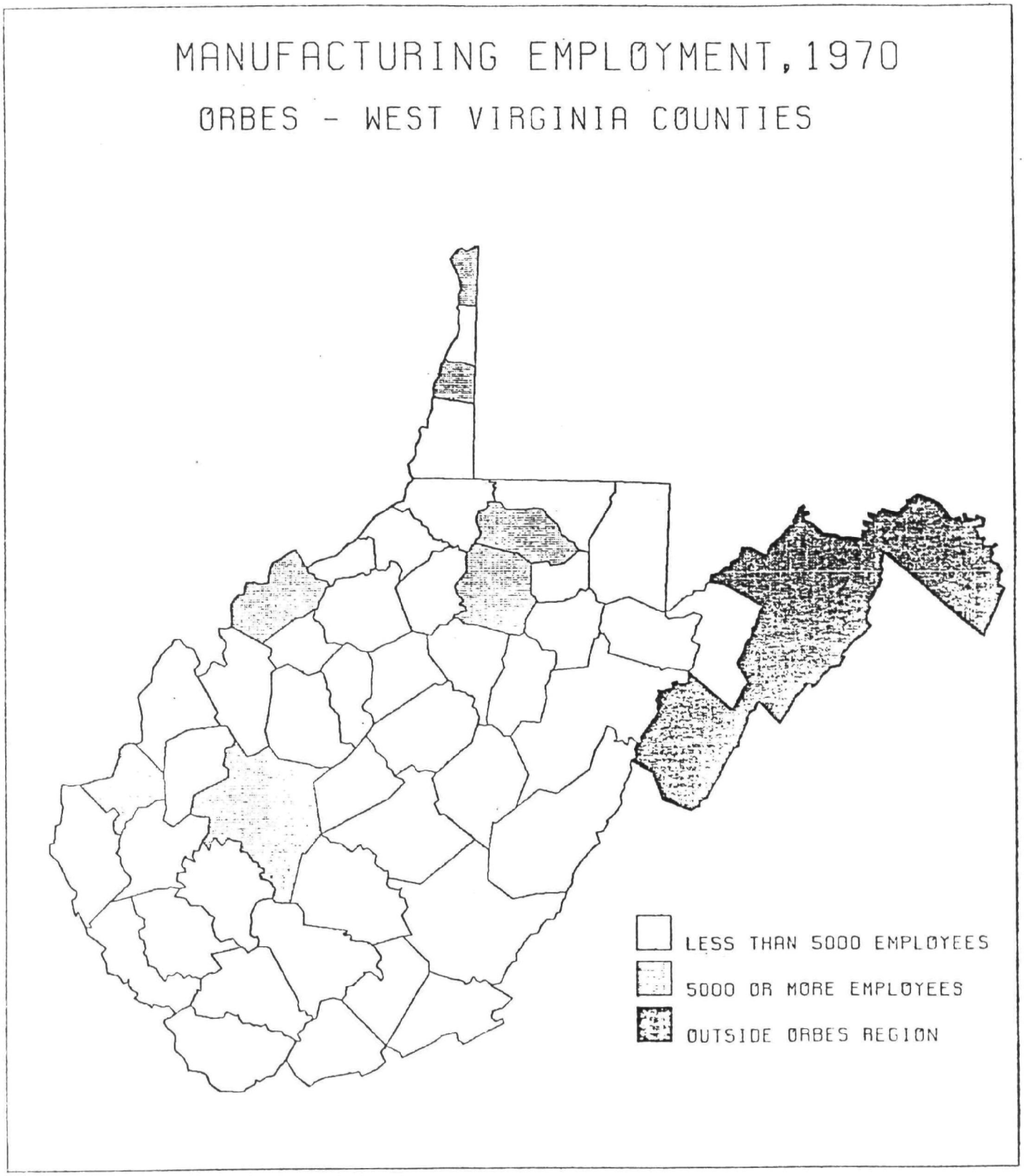

Figure 5-10 Manufacturing Employment, 1970

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

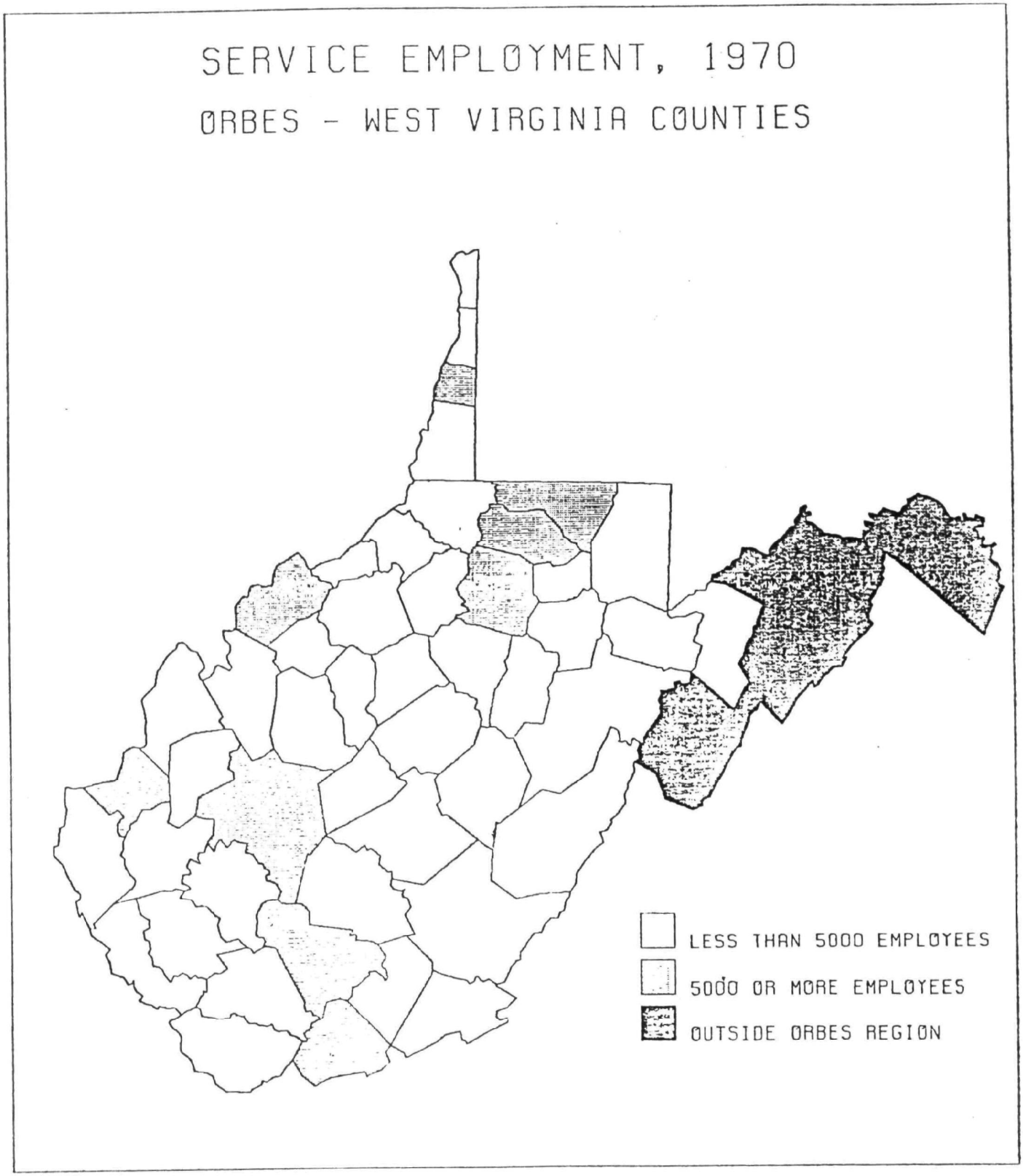

Figure 5-11 Service Employment, 1970

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

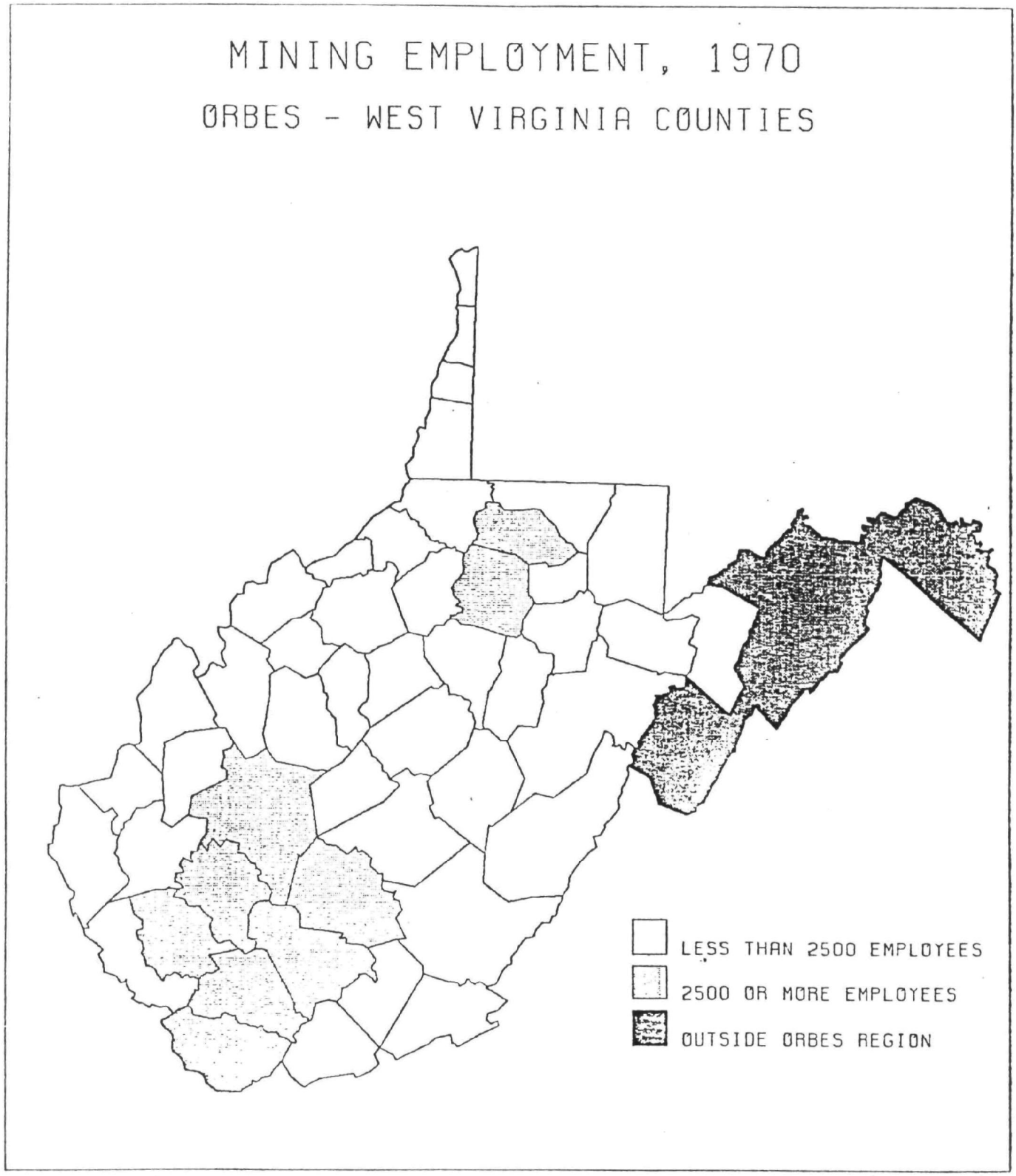

Figure 5-12 Mining Employment, 1970

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

5.7 COAL MINING

The subject of coal mining is examined in some depth in the Geology Section of the West Virginia Baseline Report. However, since coal mining is such an important part of the state's economy and because this activity is so closely tied to the development of power generation facilities it is appropriate that it be included as part of this report as well. Increased coal production and the expansion of coal mines will require new workers, induce migration and place demands on public services just as the construction of power plants will. All but fourteen of the ORBES-West Virginia counties produced some coal in 1976 (See Table 5-13). Employment in these coal counties is sometimes larger than for any other (e.g., Boone, Fayette, Logan, Nicholas, and Wyoming). A map portraying the various coal counties according to their production levels is presented as Figure 5-13.

Referring back to Sections 5-3 and 5-5, Demographic and Housing Characteristics, Table 5-14 was compiled to show some of these characteristics for the major coal counties. The mean population for this group (49,007) was somewhat higher than that for ORBES-West Virginia (33,902) as was the 1974 per capita income ($3385 compared with $4250). The dependency ratio was lower for this group than for the state (63.29 compared with 66.35). The main reason for this seems to be the inclusion of Kanawha and Monongalia counties in this group. Both have very low dependency ratios and high per capita incomes; Kanawha County is the largest in population of any ORBES-West Virginia county.

A list of recoverable reserves was taken directly from the State of West Virginia, Department of Mines Annual Report, 1976 and is presented as Table 5-15.

5.8 AGRICULTURE

Agriculture in West Virginia is sparse because of the hilly terrain. Farming is declining here just as it is across the country. Acreage in farms, 1969 and 1974, is shown on Table 5-16. Only in two counties, Fayette and Nicholas, did farming acreage increase over this five year period. Even here the absolute number of acres involved is very small. Figure 5-14 shows the distribution of farming counties. The largest farming counties appear to be scattered primarily along the borders; some even in the 'hilly' part of the state.

Table 5-13

Coal Production and Employment, ORBES-West Virginia Counties
1976

Counties	Total Tons	Underground Tons	Surface Mining Tons	Employment Underground	Employment Surface
Barbour	2,997,290	950,046	2,047,244	696	737
Boone	10,468,942	8,263,056	2,204,986	5,053	676
Braxton	177,435	29,132	148,303	27	87
Brooke	875,166	748,228	126,938	344	31
Cabell					
Calhoun					
Clay	62,731	40,497	22,234	29	5
Doddridge					
Fayette	3,186,924	2,259,810	927,114	1,649	502
Gilmer	44,670	28,289	16,381	26	12
Grant	1,600,887	1,299,251	301,636	780	62
Greenbrier	1,029,437	504,707	524,730	241	490
Hancock					
Harrison	5,161,463	3,950,524	1,210,939	1,105	561
Jackson					
Kanawha	7,684,902	5,412,582	2,272,320	3,378	554
Lewis	382,252	41,493	340,759	8	158
Lincoln	172,414	172,414		91	
Logan	8,612,153	7,113,887	1,498,266	4,567	475
McDowell	10,463,144	9,516,678	946,466	6,979	346
Marion	5,701,851	5,615,695	86,156	2,846	21
Marshall	5,131,175	5,131,175		2,362	
Mason	45,550	45,550		49	
Mercer	805,521	784,804	20,717	567	16
Mingo	4,434,673	3,796,526	638,147	1,916	379
Monongalia	10,575,252	9,649,969	925,283	3,221	195
Monroe					
Nicholas	5,230,669	3,964,981	1,265,688	2,572	441
Ohio	1,501,590	1,501,590		939	
Pleasants	778	778		1	
Pocahontas					
Preston	2,479,950	971,007	1,508,943	309	440
Putnam					
Raleigh	6,827,818	5,730,110	1,097,708	4,662	633
Randolph	1,077,093	404,388	672,705	297	217
Ritchie					
Roane					
Summers	3,531	3,531		5	
Taylor	227,227		227,227		93
Tucker	364,706		364,706		56
Tyler					
Upshur	1,402,719	949,022	453,697	341	321
Wayne	494,250	494,250		189	
Webster	516,294	213,145	303,149	120	176
Wetzel					
Wirt					
Wood					
Wyoming	8,695,399	8,224,163	471,236	6,402	248
Total	108,434,956	87,811,278	20,623,678	51,771	7,932

Source: State of West Virginia, Department of Mines Annual Report, 1976.

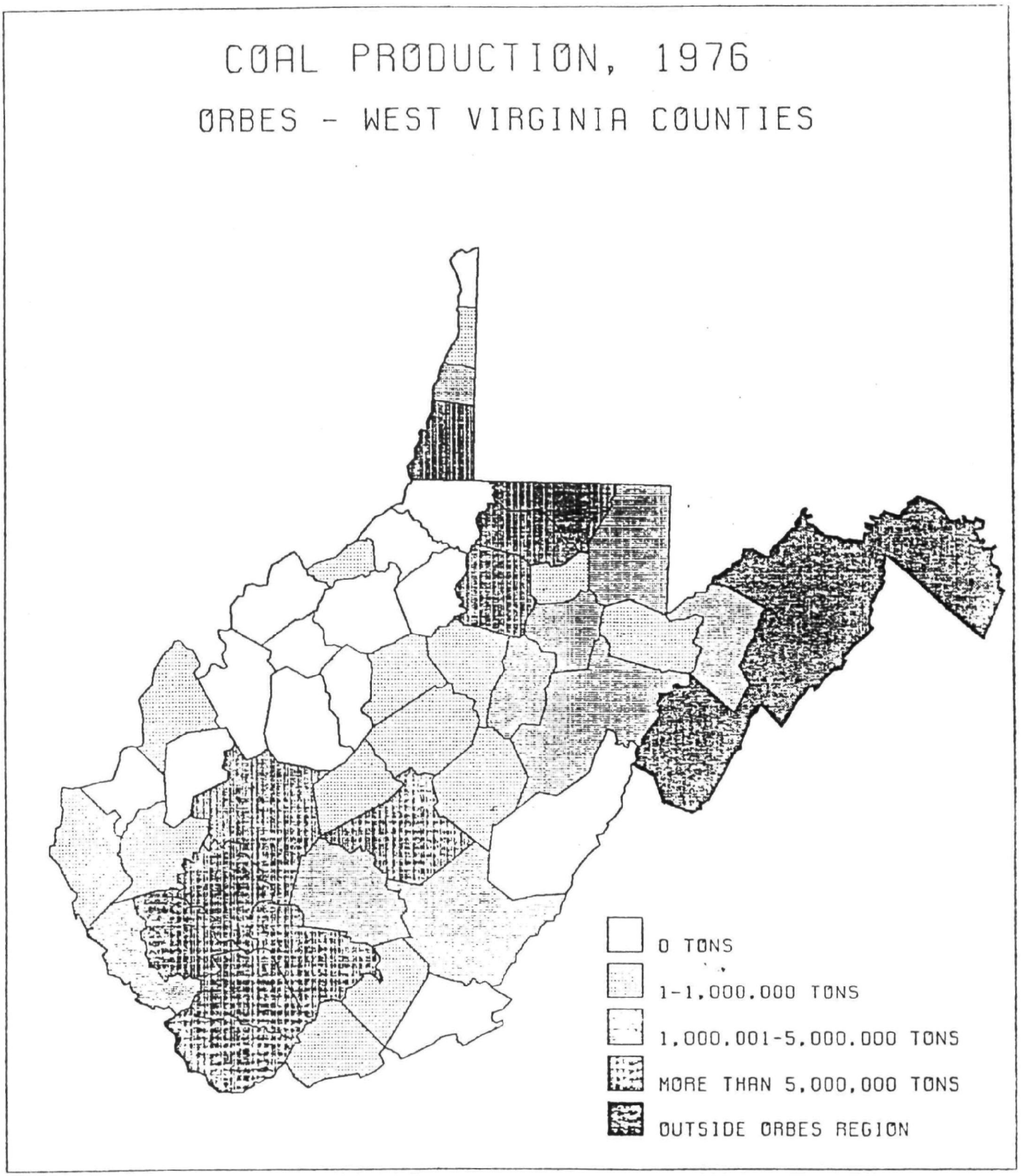

Figure 5-13 Coal Production, 1976

Source: State of West Virginia, Department of Mines Annual Report, 1976.

Table 5-14

Selected Demographic and Housing Characteristics
Major Coal Counties, ORBES-West Virginia
1970

Counties	1970 Population	Dependency Ratio (1970)	% Housing Lacking Plumbing	% Families Below Poverty	1974 Per Capita Income
Barbour	14,030	66.21	38.56	25.86	$2877
Boone	25,118	65.27	26.10	18.98	3261
Fayette	49,322	65.33	24.49	23.59	3081
Grant	8,607	69.16	29.19	28.01	2955
Greenbrier	32,090	66.14	24.38	23.05	3281
Harrison	73,028	62.22	9.52	13.19	3839
Kanawha	229,515	55.95	6.98	13.01	4329
Logan	46,269	65.85	24.42	23.01	3459
McDowell	50,666	68.49	40.43	29.29	3071
Marion	61,356	58.99	8.25	12.56	3670
Marshall	37,598	61.42	9.19	10.45	3859
Mingo	32,780	73.14	18.40	36.46	2889
Monongalia	63,714	44.79	29.19	13.12	3695
Nicholas	22,522	68.69	27.24	25.25	3182
Ohio	64,197	62.64	3.85	10.53	4392
Preston	25,455	71.13	29.91	26.65	3113
Raleigh	70,080	62.82	18.24	19.56	3565
Randolph	24,596	64.58	24.54	24.00	3017
Upshur	19,092	61.87	26.75	23.76	3097
Wyoming	30,095	63.68	29.38	21.90	3066
Mean	49,007	63.92	22.45	21.11	3324

Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.
U.S. Department of Commerce, Bureau of the Census, 1970 Census of Housing.

Table 5-15 WEST VIRGINIA COAL RESERVES

COUNTIES	ORIGINAL MINEABLE RESERVES* SHORT TONS	REPORTED PRODUCTION 1883-1976 *** (INCLUSIVE) SHORT TONS	ESTIMATED LOSS IN MINING ** SHORT TONS	ESTIMATED RECOVERABLE RESERVE SHORT TONS
Barbour.....	3,585,619,298	166,832,615	166,832,615	1,625,977,034
Berkeley.....	-	246	246	-
Boone.....	8,142,970,465	328,336,482	218,890,988	4,557,445,797
Braxton.....	2,323,332,633	9,456,581	9,456,581	1,152,209,736
Brooke.....	360,000,000	89,735,875	89,735,875	90,264,125
Cabell.....	44,167,156	-	-	22,083,578
Calhoun.....	251,017,114	-	-	125,508,557
Clay.....	3,237,869,854	43,454,443	28,969,628	1,899,267,470
Doddridge.....	1,119,317,757	2,790	1,860	671,587,864
Fayette.....	4,420,505,039	710,505,254	473,670,169	1,941,797,770
Gilmer.....	1,019,245,455	12,959,614	12,959,614	496,663,114
Grant.....	969,014,155	31,597,672	21,065,115	549,810,821
Greenbrier....	1,220,293,321	75,345,385	50,230,257	656,830,607
Hancock.....	500,000,000	3,340,986	3,340,986	246,659,014
Harrison.....	2,172,730,581	461,613,172	461,613,172	624,752,119
Kanawha.....	5,901,324,612	582,886,000	388,590,667	2,957,908,767
Lewis.....	2,776,037,160	15,699,175	15,699,175	1,372,319,405
Lincoln.....	1,770,813,665	4,541,976	3,027,984	1,057,946,223
Logan.....	8,149,879,105	1,015,146,755	676,764,506	3,874,780,706
Marion.....	4,317,089,326	602,616,004	602,616,004	1,555,928,659
Marshall.....	4,448,857,374	124,530,856	124,530,856	2,099,897,831
Mason.....	339,976,480	17,547,265	17,547,265	152,440,975
McDowell.....	5,340,598,171	1,364,715,670	909,810,447	1,839,643,232
Mercer.....	506,829,312	199,656,559	133,104,373	104,441,028
Mineral.....	809,834,066	34,609,144	34,609,144	370,307,889
Mingo.....	6,332,263,181	324,800,936	216,533,957	3,474,556,973
Monongalia....	3,748,630,971	491,590,829	491,590,829	1,382,724,657
Nicholas.....	6,172,807,449	171,911,351	114,607,567	3,531,773,119
Ohio.....	910,000,000	109,895,834	109,895,834	345,104,166
Pleasants.....	-	82,429	54,953	-
Pocahontas....	508,644,743	5,336,236	3,557,491	299,850,610
Preston.....	3,212,323,508	133,844,480	133,844,480	1,472,317,274
Putnam.....	433,090,336	21,620,592	14,413,728	238,233,610
Raleigh.....	4,283,368,262	685,227,490	456,818,327	1,884,793,467
Randolph.....	4,183,643,819	67,551,974	45,034,649	2,442,634,318
Roane.....	674,768,793	-	-	404,861,276
Summers.....	18,678,528	349,717	233,145	10,857,400
Taylor.....	1,327,767,239	48,940,185	48,940,185	614,493,435
Tucker.....	486,964,209	58,919,929	58,919,929	184,562,176
Tyler.....	948,133,232	-	-	474,066,616
Upshur.....	3,554,551,754	42,602,445	42,602,445	1,734,673,432
Wayne.....	1,471,495,778	10,059,966	6,706,644	872,837,501
Webster.....	6,305,536,510	41,661,209	27,774,139	3,741,660,697
Wetzel.....	3,321,923,236	93,425	93,425	1,660,868,193
Wirt.....	22,302,720	-	-	11,151,360
Wyoming.....	5,061,292,844	382,432,297	254,954,865	2,654,343,409
Small Mines...	-	25,028,400	25,028,400	-50,000,000
TOTALS.....	116,705,415,231	8,517,080,247	6,494,672,249	57,433,286,010

*Estimate by W. Va. Geological Survey using One Foot as the Minimum Mineable Thickness.
**Loss resulting from the Undermining of a Coal Bed not included.
***Includes 1975 Delinquent Production.

Table 5-16

Agricultural Characteristics, ORBES-West Virginia
1969 and 1974

Counties	1974 Acres In Farms	1969 Acres In Farms	1974 Total Farm Operators	1974 Total Value Ag. Products*
Barbour	83,810	96,071	460	1,662
Boone	4,552	10,900	55	108
Braxton	72,352	97,173	336	890
Brooke	12,100	167,900	55	686
Cabell	44,279	65,386	419	1,182
Calhoun	43,468	53,899	180	336
Clay	12,216	18,798	74	124
Doddridge	54,536	72,022	237	415
Fayette	22,374	21,883	201	655
Gilmer	53,185	62,775	208	580
Grant	135,387	158,706	384	4,535
Greenbrier	183,602	212,016	718	7,253
Hancock	8,192	9,618	62	349
Harrison	89,080	114,159	503	2,523
Jackson	107,818	138,951	608	1,891
Kanawha	18,962	23,946	171	326
Lewis	90,102	126,621	365	2,435
Lincoln	37,086	54,397	319	815
Logan	2,363	4,652	20	122
McDowell	1,866	na	8	116
Marion	38,649	43,964	297	749
Marshall	71,594	102,996	450	2,022
Mason	113,824	154,468	647	7,445
Mercer	54,421	63,318	325	1,332
Mingo	555	1,203	8	7
Monongalia	48,105	60,032	335	1,070
Monroe	134,887	161,655	649	4,988
Nicholas	38,732	37,649	296	1,002
Ohio	22,812	28,936	148	2,377
Pleasants	13,783	20,142	87	274
Pocahontas	136,881	154,128	438	2,107
Preston	127,696	149,412	629	5,470
Putnam	58,514	81,570	475	1,514
Raleigh	30,715	46,872	276	1,429
Randolph	134,667	181,109	388	2,492
Ritchie	74,317	89,045	316	985
Roane	86,336	123,313	430	1,060
Summers	45,360	60,713	295	1,107
Taylor	41,221	45,737	255	1,730
Tucker	36,426	54,353	156	656
Tyler	43,314	49,331	211	995
Upshur	56,631	79,749	344	1,166
Wayne	27,186	45,375	180	916
Webster	12,807	13,380	100	136
Wetzel	42,930	57,399	228	406
Wirt	33,350	45,445	172	795
Wood	62,349	70,958	438	3,333
Wyoming	4,233	7,162	43	69

Source: U.S. Department of Commerce, Bureau of the Census, 1974 Census of Agriculture.

Note: * In thousands of dollars.

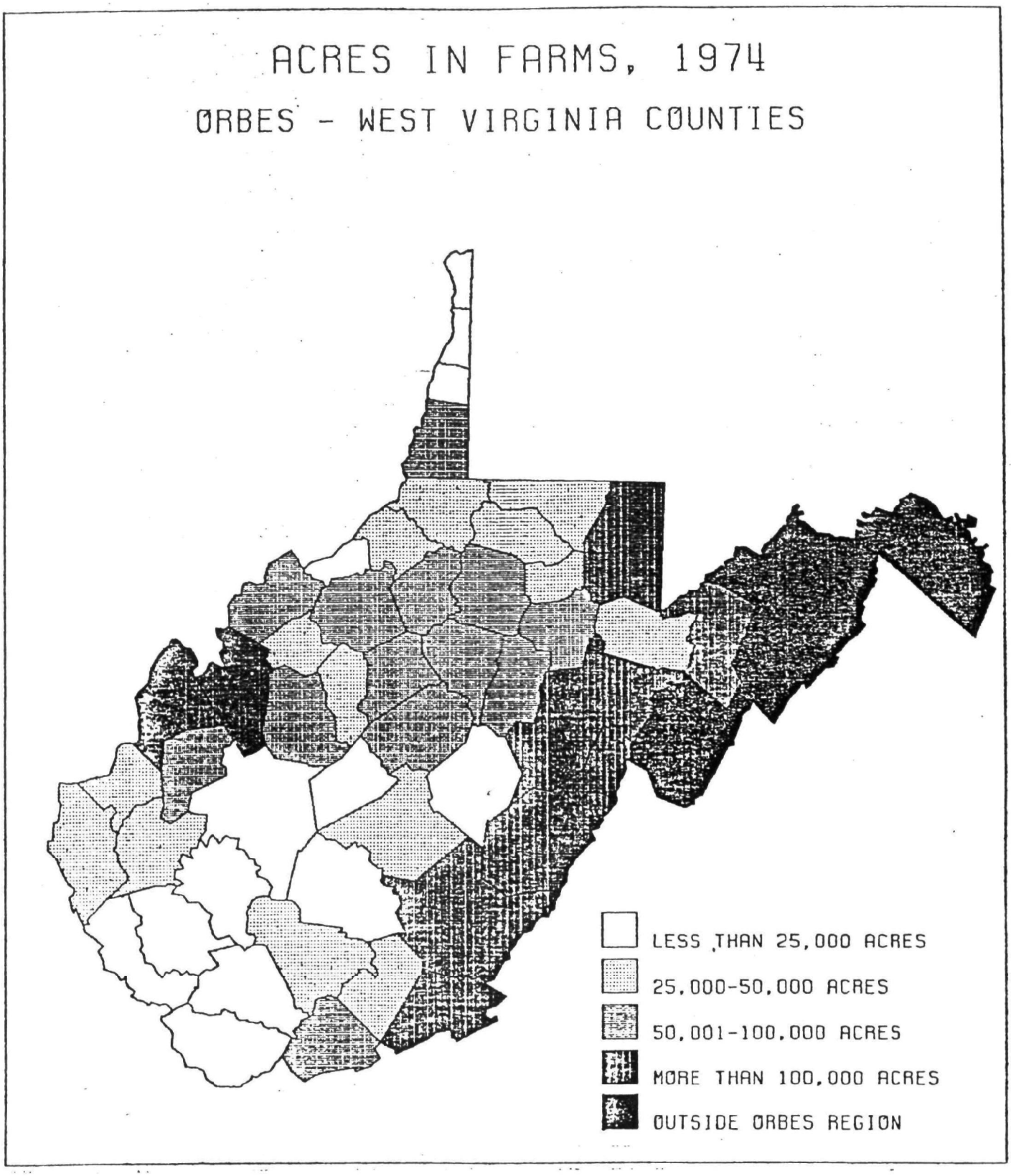

Figure 5-14 Acres in Farms, 1974

Source: U.S. Department of Commerce, Bureau of the Census, 1974 Census of Agriculture.

5.9 PROPERTY VALUATIONS

One of the most important benefits from energy development is the associated increase in the tax base and local tax revenues. An energy facility that is privately financed must pay property taxes. On Table 5-17 assessed valuations for both utility and non-utility property is presented for 1975 and 1977. In general, the utility valuation will be proportional to the size of the population of the county. The site of a major public utility, such as a power plant, will have a much larger valuation, however, For example, in 1975 Grant County had an assessed valuation for utility property that was more than double its non-utility valuation. A large power plant, the Mt. Storm Plant owned by Virginia Electric and Power Company, is sited in this county with the third unit to be in operation in 1975. It would be safe to assume that the major portion of the utility valuation is due to this power plant.

5.10 IMPLICATIONS FOR SOCIOECONOMIC IMPACT ANALYSIS

The socioeconomic impacts of energy development occur primarily during the construction phase of the plant. These impacts may involve:

- Displacement of families, homes, cropland, forestland, etc.
- Increased employment opportunities for residents
- Influx of in-migrants and their associated demands on housing and public services
- Increased burden on public school system
- Increased tax base from plant and new housing
- Increased local government expenditures and personnel needs
- Increased local traffic and noise
- Increased retail trade and services to in-migrants and plant
- Higher prices on locally available goods, services and housing.

The extent to which these effects are felt locally depend on the population size of the county, the county population growth rate, the distance to the nearest metropolitan center, the number of construction workers in the county, the construction time to build the plant and the facility size in megawatts.* In general, the smaller, more remote counties will be affected the most. These counties usually have fewer public services available, low incomes, few skilled workers and a small tax base.

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* Richard S. Krannich, "A Comparative Analysis of Factors Influencing the Socioeconomic Impacts of Electric Generating Facilities," Paper presented at the 71st Annual Meeting of the Air Pollution Control Association, Houston, Texas, June 1978.

Table 5-17

Total Assessed Valuation, Utility and Non-Utility Property
ORBES-West Virginia - 1975,1977

Counties	1975 Non-Utility Valuation	1975 Public Utility Valuation	1977 Non-Utility Valuation	1977 Public Utility Valuation
Barbour	$ 46,719,825	$ 8,771,500	$ 62,841,405	$ 11,710,200
Boone	104,806,350	22,454,500	127,724,925	26,491,400
Braxton	41,406,835	13,914,500	45,433,505	15,739,000
Brooke	128,151,265	12,026,600	138,561,615	14,068,800
Cabell	493,759,620	58,860,800	563,216,610	67,593,200
Calhoun	26,816,640	8,261,600	31,748,450	11,316,800
Clay	31,893,450	9,252,700	40,496,370	10,789,100
Doddridge	14,819,640	15,850,100	25,052,870	20,622,800
Fayette	157,327,937	49,995,600	197,744,539	55,847,500
Gilmer	30,063,200	15,731,700	42,216,430	19,664,700
Grant	35,494,860	84,994,800	43,092,991	83,177,500
Greenbrier	118,563,525	35,470,300	150,410,350	38,424,800
Hancock	na	na	266,241,900	16,648,400
Harrison	311,604,761	100,267,800	359,826,050	112,705,000
Jackson	119,851,260	22,107,800	148,176,070	24,783,700
Kanawha	1,165,654,190	201,283,400	1,318,006,058	224,391,100
Lewis	56,924,680	35,957,500	65,936,350	40,456,500
Lincoln	30,526,300	25,589,000	36,211,255	28,545,700
Logan	115,168,400	29,569,800	147,605,150	34,456,500
McDowell	129,798,140	47,422,500	165,691,970	53,069,800
Marion	259,192,473	38,533,400	288,429,604	44,699,300
Marshall	265,914,740	37,048,100	304,637,340	39,557,700
Mason	92,245,093	25,509,500	100,984,550	32,444,100
Mercer	187,082,240	52,277,700	236,514,090	59,295,800
Mingo	69,401,700	39,324,600	85,197,800	44,704,100
Monongalia	256,297,125	55,401,500	304,254,300	56,981,200
Monroe	31,653,600	9,848,600	40,124,200	10,885,400
Nicholas	86,119,900	12,313,400	109,858,950	14,684,400
Ohio	297,768,225	20,532,100	323,801,762	23,983,000
Pleasants	28,571,770	13,556,100	45,722,510	19,291,900
Pocahontas	37,162,130	8,760,000	43,890,160	9,892,000
Preston	76,422,007	33,449,500	107,959,883	38,213,700
Putnam	152,007,720	76,687,700	183,971,630	79,096,900
Raleigh	213,996,950	44,473,200	274,943,050	53,388,200
Randolph	71,431,010	23,635,100	84,843,450	25,528,100
Ritchie	34,453,090	11,031,500	45,876,380	13,853,800
Roane	50,848,880	15,921,200	59,164,179	19,922,000
Summers	31,518,540	20,280,000	33,782,860	21,713,900
Taylor	45,180,910	12,294,300	52,731,930	13,737,800
Tucker	22,459,620	4,689,200	27,009,270	5,565,500
Tyler	35,022,000	7,106,000	38,291,300	10,525,200
Upshur	63,799,280	16,665,100	75,786,750	18,703,400
Wayne	90,522,840	52,263,800	102,839,480	56,162,600
Webster	32,811,890	6,075,200	68,771,510	7,016,700
Wetzel	58,328,030	36,768,200	64,089,850	35,291,300
Wirt	16,338,170	3,055,100	24,851,645	3,734,400
Wood	399,514,110	35,159,300	434,713,260	39,940,100
Wyoming	93,452,870	33,781,900	129,123,340	38,057,400

Source: West Virginia State Tax Commission, Study of Property Valuations as They Relate to Levies Laid for the Support of Schools in West Virginia for the Assessment Year 1975 and 1977.

Information on the tax base and county government revenues and expenditures would be most useful when investigating the local impacts of power development. For this report, only tax base information is provided. Data sources for the expenditures and revenues may be obtained at the county auditor's office. From the tax base information the impacts of public utilities are evident; what are not evident are the revenues generated and the expenditures incurred by the public utility property and the indirect effects associated with it.

After reviewing some of the demographic, income and housing data for the ORBES-West Virginia, seven counties were identified that exhibit some of the conditions which indicate that they could be severely impacted by the development of a large scale energy facility within their boundaries (See Table 5-18).

With the exception of Lincoln County these counties form a cluster in the center of the state. Clay, Lincoln and Webster are major coal counties. All have small populations, a high percentage of dependents and low income families with poorly served housing stock. The only advantage that some of these counties have is their proximity to Kanawha County (Charleston). The construction of large power plants within any of these counties could have major impacts on housing and public services. The extent of these impacts would depend on the characteristics of the energy facility, the available skilled labor force and other local conditions. A detailed review of these characteristics would be necessary in order to predict the impacts of a particular energy plant on a specific county.

Table 5-18

Selected Characteristics, Seven ORBES-West Virginia Counties - 1970,1975

Counties	1975 Population	1970 Dep. Ratio	1970 $\bar{x}$ Family Income	1970 % Fam. Below Poverty	1970 % Housing Public Sewer	1970 % Housing Lack Some Plumbing
Calhoun	7,588	70.77	$4504	37.08	13.67	41.11
Clay	9,702	78.33	4179	39.63	9.28	51.72
Doddridge	6,575	77.03	5896	23.38	19.46	36.40
Gilmer	7,806	59.76	4485	41.32	25.69	35.26
Lincoln	20,251	71.91	5058	37.97	15.21	41.36
Webster	10,382	72.45	4288	39.07	16.59	48.96
Wirt	4,523	77.07	5688	28.90	16.20	40.93

Sources: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.
U.S. Department of Commerce, Bureau of the Census, 1970 Census of Housing.
U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25, May 1977.

5.11 SUMMARY

This socioeconomic baseline report provides the ORBES Core Team with 1) a socioeconomic data bank for ORBES-West Virginia, and 2) a socioeconomic profile of the state. The data bank consists of the data presented in tabular form throughout the report. The socioeconomic profile consists of the written interpretation of these data. The profile provides information that illustrates the demographic, income, housing, and employment characteristics of ORBES-West Virginia.

ORBES-West Virginia contains 48 of the state's 55 counties. Most are very small in population size; many are rural and poor. The trend in population growth since 1970 has increased relative to the preceding decade. Still, ORBES-West Virginia is the smallest of the ORBES states. Employment is provided mainly by manufacturing, services and mining industries.

Implications for impact analysis are presented as a final section. It is noted that the extent of the impacts associated with the development of large scale energy facilities can be a function of many things, e.g. the size of the energy facility, the available skilled labor force, the existing infrastructure such as sewer and water services, the availability of housing. Based on the information provided as part of this data bank several counties were identified which could be severely impacted by the construction of a power plant and the in-migration of construction workers.

Business and Occupation Tax: Coal Distribution Tax and Severance Tax Listing. (1975 to present). Research Division, West Virginia State Tax Department. Unpublished.

Seventy-five percent of the coal severance tax is distributed by the West Virginia Tax Department and is returned to coal producing counties. The remaining twenty-five percent of the coal severance tax is distributed by the West Virginia Department of the Treasury. The tax is returned to all counties, muncipalities (corporated and unincorporated); the share is based on population.

Consumer Sales Tax. Research Division State Tax Department. Unpublished.

Table by county of percent and total taxes with ranking for all counties.

County Study Data Book - Measures of Social Change in West Virginia, 1940-1974. Agricultural and Forestry Experiment Station; Office of Research and Development.

This publication is an aggregation of statistics by county for the years 1940, 1950, 1960, 1965, 1970, 1971, 1972, and 1973. The statistics were collected from the U.S. Department of Census, West Virginia Department of Welfare, the West Virginia Department of Employment Security, West Virginia State Superintendent of Schools, the U.S. Department of Interior Minerals Yearbook, and the West Virginia State Road Commission. The following categories are included in this publication: population and vital statistics, government, welfare, education, health, agriculture, transportation and roads, and economic activity.

Directory of Mines. West Virginia Department of Mines - annually to present.

Directory of employment, production and injuries by coal company for underground, surface and auger mine by county areas.

Employment and Earnings Trends - Annual Summary. West Virginia Department of Employment Security. (Annually to present).

Total labor force, employment and unemployment 1970 through 1976; non-agricultural wage and salary employment, 1948 through 1959, 1960 through 1976; female employment, 1970 through 1976; gross hours and earnings of production workers, 1958 through 1976. These tables are statewide by industries according to the Standard Industrial Code Manual. The total labor force, employment and unemployment estimates are as defined by the West Virginia Department of Employment Security as stated under the West Virginia Labor Force Estimates: Small Labor Areas annotation.

Employment Wages. West Virginia Department of Employment Security, Research and Statistics section (1970 to present).

These employment figures include only such employment as covered by the West Virginia Unemployment Compensation Law. Each county is reviewed by industry in terms of average employment (according to the Standard Industrial Classification Manual), total wages, average annual wage and average weekly wage.

Health Manpower and Inpatient Facilities in West Virginia, 1974. West Virginia Regional Medical Program, Office of Research and Evaluation.

This publication reviews health manpower estimates by planning areas (11 in total) to include general practitioners, specialists, nurses and supporting health technologists. Inpatient facility data, by planning areas, reviews hospitals, skilled nursing facilities and personal care homes in terms of number of beds and services. One can disaggregate the health facility data to county areas. The manpower estimates cannot be disaggregated to county areas.

Index to Surface Mining. West Virginia Geological and Economic Survey. Quarterly updates.

An index to surface mine operations listed by county giving such information as: permit number, extracted mineral resource and quadrangle location.

Projections of 1985: Industry and Occupation. West Virginia Department of Employment Security, Occupational Employment Statistics Unit.

Summary report of long-term outlook for West Virginia industry and employment. The information is for the total state and compares employment by occupation for the years 1970 and 1974 with projection to 1985.

School Dollar: An analysis of Public Financing and Related Statistics in West Virginia, (1965 - present). State Board of School Finance.

Each category of expenditures or taxes is reported at county level. The following are included in the report: federal aid, per pupil receipts, expenditure by pupil, expenditure (actual or total), levy rates and tax receipts.

Study of Property Valuations, as They Relate to Levies Laid for the Support of Schools in West Virginia. Report of the State Tax Commissioner. (Annually to present).

County statistics by class of assessed valuation general taxes, appraisal totals, ratio of assessed to appraised and taxes generated.

Suitability of West Virginia Coals to Coal-conversion Processes. Coal-geology Bulletin No. 1. West Virginia Geological and Economic Survey.

Relation of coal properties to coal-conversion processes by factors of coal combustion, low BTU gasification, high BTU gasification; liquefaction, and carbonization. These relationships are represented in map form with accompanying conclusions and recommendations and final plant sitings.

Welfare Statistics. West Virginia Department of Welfare, Division of Audits and Accounts, (1936 to present).

The information in this report is collected by welfare areas. This may be a single county or several aggregated counties. It is not possible to disaggregate the multiple county areas in this report. Statistics by welfare area included are number of cases, expenditures, total medical services, and total administration.

West Virginia Agricultural Statistics, Annual Report. (1969 to present.) In cooperation with the U.S. Department of Agriculture: Statistical Reporting Service.

Summary statistics by county for: crops, dairy, and poultry. Other summary statistics at the aggregated state level are: prices received, prices paid, farm labor, wage rates and farm income.

West Virginia Coal Facts. West Virginia Coal Association (1970-1975).

Usable statistics are county level coal employment and coal wage summaries as compared to total employment and total wages. County summaries include total number of mines, production and employment for underground and surface-auger mining. Each county is ranked in production and the major coal companies are listed with their respective production and employment figures. Coal Facts is a Coal Industry publication, published by the West Virginia Coal Association, a trade association which represents the state's underground mining industry.

West Virginia Department of Agriculture, Annual Report. (1970 to present). Annual publication July to June.

Summary statistics by entity for total state for: animal licensing, consumer protection, crops, fiscal expenditures, lab services, meat inspection, plant pest control, rural resources and soil conservation.

West Virginia Department of Employment Security, Labor Supply Survey. No date on any pamphlet.

Survey of selected cities with surrounding areas and selected counties. Statistics of areas by age, sex, employment education as

Labor Supply Survey, cont.

related to employment and sex, employment as related to sex, age, transportation arrangements and distance from job.

West Virginia Department of Education Annual Report of the State Superintendent of Schools. Annual publication July to June (1969 to present).

Aggregated reports of total state by education department divisions: organization, vocational services, planning services, financial, and action divisions.

West Virginia Department of Education: Education Statistical Summary. Annual Report (Volume II and Volume III) - July to June, (1970 to present).

Volume II - Statistical data by county or entity on personnel, pupils, transportation, school plan and facilities, miscellaneous and private and parochial schools.

Volume III - Financial report of current expenditures by county for administrative, health operation, maintenance of plants, student outlays, food services, community services, debt service fund, bond construction fund and total expenditures for all funds.

West Virginia Department of Health, Vital Statistics. Annually published.

Birth, death and marriage statistics by counties and planning regions along with total state population statistics by age, population density, and birth and death rates.

West Virginia Department of Mines Annual Report. (annually to present).

Summary of production; distribution, employment injuries, method of production, employment fatalities, violations, closings and inspections for whole state. The county information includes method of production, employment (number of companies, number of employees, total man days worked, tons mined per day and tons mined per man per year), reserves and permit numbers for all companies and mines.

West Virginia Economic Profile. 1977 only. By Office of the Governor.

Total state statistics in map form for: transportation systems, business and industry, educational facilities, natural resources, industrial parks by county statistics in table form for: population, labor force, income, economic indicators. This is a public relations pamphlet with the above statistics and also text on the following: economic trends, state finance, recreation, taxes, industrial financing, regional development, services of the economic development division, and other state agencies.

West Virginia Hospital Patient Flow: 1976 Community and Hospital Profiles. Office of Health Services Research, West Virginia University Department of Community Medicine in cooperation with the West Virginia Hospital Association. (1968, 1972, 1976).

Survey data in table form of influx and outflow to area hospitals including out-of-state facilities and out-of-state influx. Specific concentration was made on hospital profiles (instate and out-of-state) and community profiles. These profiles include patient characteristics and hospital characteristics.

West Virginia Labor Force Estimates: Small Labor Areas. West Virginia Department of Employment Security. Research and Statistics Section, annual averages (1971-1974), biannual averages 1974.

Total employment, labor force and unemployment, estimates for labor market areas (cities and surrounding areas). Total employment estimates are on a place of residence basis. Labor force estimates are a sum of employed and unemployed persons by place of residence. The total unemployment rate is the ratio of the number unemployed to the number in the labor force. These are defined by the W.Va. Department of Employment Security.

West Virginia Labor Force: Annual Averages 1970-1975. Hours and earnings 1972 - 1975. West Virginia Department of Employment Security, Research and Statistics Division.

Labor force, employment and unemployment estimates are as defined by the West Virginia Department of Employment Security. This publication deals with specific West Virginia standard statistical areas: Charleston, Huntington, Ashland-Ironton, Parkersburg-Marietta, Wheeling. Statistic definitions are as stated in the West Virginia Labor Force Estimates: Small Labor Areas annotation.

West Virginia Physicians, 1974: Current Distribution, Recent Changes, and Projected Needs for Selected Specialties. West Virginia Regional Medical Program, Office of Research and Evaluation.

This publication is divided into 4 categories. The first is the general distribution of physicians by specialty, county and planning area and age. The second is changes: 1972 to 1974. This section reviews changes in number of physicians by selected specialties, by licensing, and ratios per 10,000 of the general population. The third section reviews the characteristics of and projected needs for selected specialties and sections. Four reviews all residencies and internships: January 1974. There are visual representations of all ratios of population versus specialty.

5-A-2

LAND USE (IN ACRES) - 1970

Boone County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (sq. mile)
244	740	1	383	7	24	1	320	12	37104	1488	603
245	224	1	405	4	16	1	91	3008	50842	3750	853
246	163	0	510	3	9	100	1325	1	38273	2111	631
247	187	5	103	7	28	3	25	1	89	359	7
248	378	0	286	5	19	61	114	368	23217	1231	382
249	202	0	186	1	6	1	23	765	27104	1184	442
250	119	1	219	3	20	1	23	1317	17689	1703	303
251	317	1	401	4	14	1	708	0	26394	1446	435
252	580	0	485	7	27	0	114	521	49338	1734	798
253	538	0	412	5	23	5000	457	6	28343	10441	606
TOTAL	3448	9	3390	46	186	9169	3200	5999	298393	25447	5060

Braxton County

578	265	302	804	6	30	0	11648	0	28225	13055	645
579	337	0	603	8	13	0	7104	10	23157	8075	488
580	435	22	1149	15	98	0	13568	0	41993	15287	895
581	88	21	97	20	86	5	0	0	451	317	12
582	421	13	845	15	14	112	15040	0	35924	16460	881
583	400	23	583	136	140	1856	3648	0	8638	6786	241
584	213	0	625	4	11	11884	5280	0	22079	22017	685
585	326	0	1119	7	19	0	17408	0	38081	18879	890
586	381	35	529	23	23	1	5696	10	22486	6698	456
TOTAL	2866	416	6354	234	434	13858	83392	20	225034	107574	5197

Brooke County

1074	388	169	232	5	33	0	512	35	2338	1374	58
1075	228	0	168	0	1	1115	6656	0	7256	8168	241
1076	46	0	19	0	69	9	1	0	240	144	6
1077	202	0	199	0	2	0	3840	70	8807	4313	205
1078	58	22	46	19	30	10	0	0	7	185	3
1079	152	0	114	6	13	4	0	0	351	289	10
1081	218	0	118	0	23	0	1088	14	3851	1461	83
1082	687	26	241	0	1	150	1024	82	7773	2211	156
1083	110	74	86	22	13	22	0	2	311	329	10
1086	174	206	209	0	53	0	384	0	4350	1026	84
1087	193	484	89	47	59	6	0	0	274	878	18
1088	38	0	160	0	1	0	0	0	3065	199	51
TOTAL	2494	981	1681	99	298	1316	13505	203	38623	20577	925

LAND USE (IN ACRES) - 1970

CABELL COUNTY

STZ #	RESIDENTIAL	MANUFACTURING	TRANSPORTATION	TRADE	SERVICES	CULTURAL	AGRICULTURE	MINERAL EXTRACTION	UNDEVELOPED	DEVELOPED	TOTAL LAND AREA (sq. Mi.)
310	248	0	391	4	71	0	3758	0	16264	4472	324
311	213	0	278	5	18	50	1615	0	8701	2179	170
312	435	10	1189	4	90	6	8512	0	26346	10646	578
315	57	10	137	52	54	1	0	1	72	312	6
316	0	0	5	0	21	0	0	0	38	26	1
317	11	126	51	15	24	0	14	0	143	241	6
318	130	11	114	34	30	6	10	0	113	325	7
319	146	1	55	5	10	1	0	0	102	218	5
320	137	3	123	6	8	3	0	0	424	280	11
321	101	36	118	11	8	25	0	4	337	303	10
322	200	22	162	26	41	6	1	3	307	461	12
323	52	3	62	24	10	0	0	1	104	152	4
324	1	57	17	0	0	8	0	0	45	83	2
325	177	1	103	6	12	7	0	0	14	306	5
326	230	3	122	25	24	1	0	0	107	405	6
327	298	1	143	9	44	84	1	0	316	580	14
328	103	139	50	1	8	1	0	1	209	303	8
329	153	1	118	1	4	0	0	0	611	277	17
330	190	1	59	0	2	93	0	1	422	346	12
331	264	1	90	0	98	0	0	1	58	454	8
332	175	1	64	8	142	1	0	4	117	395	8
333	10	17	124	21	33	0	0	0	51	205	4
340	201	1	124	8	8	2	0	0	40	344	6
341	340	1	226	23	30	221	257	0	822	1098	30
342	435	1	412	5	22	206	1226	0	12925	2307	238
343	260	5	334	5	85	138	1024	0	5175	1861	110
344	506	5	261	24	29	11	970	0	5746	1806	118
345	352	1	270	6	21	9	714	0	7523	1373	139
358	122	0	222	3	12	15	3190	0	6164	3564	152
359	351	0	453	2	60	0	2276	0	18746	3142	342
360	267	6	195	3	45	22	906	0	1116	1444	40
361	306	0	662	4	50	0	5466	0	23240	6488	468
TOTAL	6471	464	6734	340	1114	917	30350	16	136602	46406	2860

CALHOUN COUNTY

573	520	188	786	136	465	7	5345	0	40361	7447	747
574	1229	452	1526	576	605	2708	20713	0	57951	27809	1340
575	196	9	44	17	42	2	0	0	10	310	5
576	609	231	924	306	391	6	6904	0	36065	9371	710
TOTAL	2554	880	6280	1035	1503	2723	32962	0	134391	44937	2802

LAND USE (IN ACRES) - 1970

Clay County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
514	234	1	452	2	14	3	2565	0	25139	3271	444
515	559	1	778	4	37	0	3338	1	35256	4718	895
516	983	4	1128	22	56	0	5310	1	35686	7504	675
517	380	1	817	3	19	2	4606	1	57711	5629	993
518	362	1	593	2	13	0	3479	0	24562	4450	459
TOTAL	2518	8	3768	33	139	5	19298	3	19058	25772	3466

Dodridge County

704	286	0	752	4	13	1	6793	0	35139	7849	672
705	162	0	789	3	15	1	10623	0	51303	11593	983
706	74	7	64	5	9	2	4	0	155	165	5
707	476	2	1070	5	21	1	12476	0	43134	14051	893
708	230	3	588	3	10	1	10746	0	30860	11581	662
TOTAL	1228	12	3263	20	68	6	40642	0	160591	45239	3216

Fayette County

255	160	0	641	3	9	2955	3027	0	21621	6795	444
256	90	0	111	0	5	0	465	0	7073	671	121
257	117	1	707	1	14	0	1218	434	35716	2492	597
258	180	1	387	0	17	0	2800	0	19655	3285	360
259	20	0	279	1	2	0	269	939	11418	1510	202
260	112	3	92	7	10	6	1	10	1103	241	21
261	133	2	218	1	6	0	234	0	5358	594	93
262	260	0	516	4	10	0	207	487	28020	1484	461
263	47	0	48	0	1	0	1	0	927	97	16
264	163	5	99	20	22	18	1	0	376	328	11
265	78	2	57	7	13	1	0	0	354	158	8
266	139	0	215	2	6	0	323	0	12755	685	210
267	322	1	316	5	8	1550	236	903	8171	3341	133
268	171	3	889	0	12	277	3180	639	47501	5171	823
269	0	0	30	0	0	2515	0	0	163	2549	58
270	106	1	113	1	3	0	856	0	6816	1120	124
271	150	0	211	1	10	0	63	697	19412	1132	321
272	93	1	215	2	3	375	2557	45	16421	3291	308
273	104	1	77	3	17	12	0	1	873	215	17
274	544	0	276	2	4	0	2876	0	11914	3702	244
275	157	1	772	7	19	585	2215	3845	25615	7601	519
276	36	1	49	9	15	1	0	0	145	111	4
277	49	2	58	5	1	3	0	0	330	118	7
278	128	100	144	8	5	0	1024	1658	2501	3067	87
279	106	1	135	1	5	0	896	0	1736	1144	45
280	160	2	180	10	12	367	0	0	3877	731	72

LAND USE (IN ACRES) - 1970

Fayette County Continued

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
281	127	0	298	5	4	0	2579	0	9239	3013	193
282	107	1	127	1	3	0	2304	0	10065	2543	197
283	139	2	227	6	9	0	275	201	6181	859	110
284	115	0	392	10	6	0	120	170	21523	813	345
285	118	0	485	0	6	0	4218	0	27813	4827	510
TOTAL	4231	131	8364	122	257	9669	31985	10029	361772	64788	6665

Gilmer County

588	211	3	763	5	17	1	3202	5	62679	4207	1045
589	183	0	490	1	6	2034	2432	6	32166	5152	583
590	265	17	602	4	17	1	11392	53	33499	12351	716
601	111	4	58	6	395	1	138	2	309	715	16
602	289	0	1084	5	11	1	25344	43	41281	26777	1064
TOTAL	1059	24	2997	21	446	2038	42508	109	169934	49202	3424

Grant County

TOTAL	1394	62	2357	230	509	1685	57000	732	241951	63969	4780

Greenbrier County

816	555	11	803	83	28	55	17168	4	81453	18707	1565
817	170	14	62	24	312	15	1088	1	362	1686	32
818	230	28	438	79	139	1569	8016	718	111215	11217	1913
819	439	9	1054	44	30	46	30728	9	48521	32359	1270
186	159	1	504	1	38	0	4312	278	21715	5253	422
187	292	2	578	18	25	0	5712	18	42691	6645	774
188	207	1	123	13	74	12	1	0	145	431	9
189	110	1	238	8	20	0	5592	0	8111	5969	220
190	209	7	125	32	106	101	3	0	313	583	14
192	0	0	94	0	0	5062	0	0	10460	5156	244
201	120	1	712	1	73	0	34075	13	27405	34955	975
202	174	3	1095	5	39	0	16720	0	31500	18036	774
203	326	3	97	43	60	24	3	1	83	957	10
204	12	0	63	1	4	0	128	0	688	208	14
205	200	57	211	50	43	30	1164	1	6884	1756	135
206	131	5	315	2	39	0	3664	5	16575	4161	324
207	72	0	358	0	48	0	6104	8	14594	6950	331
208	36	0	248	0	8	0	7464	0	13492	7756	332

LAND USE (IN ACRES) - 1970

Greenbrier County Continued

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
209	101	0	785	1	70	96	25248	75	22072	26376	757
210	56	0	459	1	27	1176	13104	0	100505	14823	1802
211	187	2	579	4	79	0	3562	18	36593	4431	641
212	26	0	172	0	4	0	1	463	59174	666	938
213	53	1	422	0	23	0	6963	26	28352	7488	560
214	2	0	218	0	4	0	1164	0	59732	1388	955
TOTAL	2473	84	7396	180	784	6501	134984	906	501284	153308	10228

Hampshire County

943	155	0	532	3	16	3	8872	0	33174	9581	668
944	204	1	425	5	15	8876	9384	0	29541	18910	757
945	390	1	947	6	39	8020	26796	0	38236	36199	1163
946	341	3	841	4	31	9108	12704	0	63548	23032	1355
947	163	8	81	22	45	4	12	0	305	335	10
948	374	5	625	4	17	3	12192	0	29655	13220	673
949	305	0	682	5	39	3	25324	0	39312	26358	1026
950	103	1	360	2	8	398	4517	0	43126	5389	758
TOTAL	2035	19	4493	51	210	26415	99801	0	277497	133024	6414

Hancock County

1090	163	0	338	1	197	53	2048	0	5648	2800	132
1092	80	5	361	0	13	1399	2392	0	7014	4250	176
1101	289	251	113	17	103	185	0	0	706	958	26
1102	133	295	101	17	22	0	0	0	8	568	9
1103	377	1	247	14	35	0	0	0	1310	674	31
1104	302	1	257	7	30	167	0	0	1156	764	30
1105	209	371	164	14	55	50	0	0	865	863	27
1113	87	2	113	4	16	7	128	0	219	357	9
1114	125	13	264	1	83	420	2400	0	7958	3306	176
1115	68	32	127	0	5	0	576	0	2648	808	54
1116	134	2	314	0	0	79	3608	0	7031	4137	174
1117	2	0	33	0	2	304	128	0	107	469	5
1118	57	7	41	1	15	0	0	0	199	121	5
1119	93	18	80	9	6	14	0	0	356	220	5
1120	580	95	128	1	37	0	220	0	91	1061	18
TOTAL	2699	1093	2681	266	86	619	2678	11500	35316	21356	885

LAND USE (IN ACRES) - 1970

Hardy County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
821	401	2	657	2	19	60	20288	0	82507	21429	1624
822	271	1	617	3	30	23570	14720	0	33092	39612	1136
823	337	25	69	18	23	2	2	0	35	477	6
824	271	1	427	3	11	2	16896	0	45237	17611	982
825	630	3	1179	6	44	37449	20480	0	68542	59751	2005
TABLE	1910	32	2949	32	127	61484	72386	0	229413	138920	5755

Harrison County

721	93	0	299	0	18	0	3724	1478	10580	5612	253
722	73	0	312	3	8	270	5004	3168	5498	8838	224
723	131	0	338	15	25	0	7924	1338	4693	9771	226
724	98	0	503	5	26	0	6900	2746	15258	10278	399
725	42	0	175	2	6	0	4404	352	6219	4981	175
726	122	0	262	0	12	700	2601	2886	4489	6583	173
727	79	2	157	77	12	0	356	563	1762	1246	47
728	129	0	251	2	10	0	2252	1549	4575	4193	137
729	109	30	110	2	9	6	571	70	373	907	20
730	62	0	131	0	14	0	4084	141	3248	4432	120
731	80	98	22	3	6	11	57	211	1752	488	35
732	122	9	76	9	23	60	0	0	533	259	13
733	233	25	186	6	18	38	0	0	326	506	13
734	10	0	15	1	26	50	0	0	26	102	2
735	175	10	151	7	19	0	0	0	86	362	7
736	94	1	81	4	8	39	33	141	559	401	15
739	95	21	145	8	11	0	0	0	1192	280	23
740	198	40	217	56	137	0	0	0	212	648	15
741	124	13	131	1	3	0	0	0	368	272	10
752	30	0	65	1	1	0	0	0	1119	97	19
753	171	0	63	1	18	29	0	0	166	282	7
754	38	6	29	8	4	0	0	0	107	85	3
755	142	2	91	4	9	0	0	0	456	248	11
756	136	1	65	5	71	8	0	0	354	286	10
757	43	0	27	0	10	0	656	211	333	547	20
758	16	1	55	0	0	0	2160	352	360	2684	46
759	0	0	413	0	0	0	0	0	99	413	8
760	61	0	91	0	0	0	1420	0	348	1572	30
761	158	6	423	3	27	0	6080	0	9111	6697	247
762	129	0	329	27	19	0	4504	2042	4342	7050	178
763	103	0	413	0	12	0	6680	1126	15026	8334	365
764	123	0	279	19	30	2	2672	1197	5790	4322	158
765	91	15	109	10	16	0	5080	586	2525	6307	138
766	166	1	706	3	34	4	6296	1126	13552	8236	342
767	48	0	76	11	13	5	78	0	25	231	4
768	59	0	137	0	3	0	812	0	781	1011	28
769	49	0	211	0	6	0	4760	845	4177	5871	157
770	87	0	200	8	10	8	4056	282	2817	4651	112
771	119	15	172	10	12	61	0	0	571	389	15
772	89	0	254	0	27	48	4184	774	10048	5376	241
773	166	0	257	13	12	3	4604	282	3111	5337	132
TABLE	4093	296	8024	324	725	1342	91952	23866	136764	130625	447

LAND USE (IN ACRES) - 1970

Jackson County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
548	346	1	1162	6	13	142	3904	0	46394	5574	812
549	327	132	1457	25	10	156	5304	0	46189	11411	900
550	410	2	820	18	98	119	12184	10	18147	13661	497
551	201	12	33	27	62	31	44	1	1253	411	26
552	37	3	25	1	40	0	28	0	122	134	4
554	247	0	1008	0	6	17	16408	0	30442	17686	752
555	144	389	497	18	48	75	6888	9	7542	7738	245
556	155	1	385	6	4	0	3020	0	7309	3571	170
557	264	1	518	13	51	10	7160	1	21806	8018	466
558	62	4	39	9	28	15	0	0	35	157	3
559	184	60	94	23	16	3	31	0	933	411	21
561	171	0	737	2	18	0	6233	0	21639	7161	450
562	143	0	478	0	3	69	7804	10	18429	8507	374
TOTAL	2691	605	7253	148	397	637	72678	31	217640	84440	4720

Jefferson County

986	280	32	237	14	2	2	12284	0	1997	12851	232
987	1004	7	282	14	13	3	13308	0	1497	14631	252
988	391	0	151	3	0	2262	6775	0	6866	5582	257
989	266	1	192	36	74	3	11638	0	1742	12210	218
990	119	1	121	0	0	0	4688	0	639	4929	87
991	23	0	34	163	0	128	1415	0	29	1763	28
1001	392	0	118	0	0	0	3906	0	320	4416	74
1002	237	22	111	0	22	0	4900	0	1620	5292	108
1003	657	0	139	0	0	3135	100	0	3585	4031	115
1004	531	0	325	0	7	1	11624	0	1336	12488	216
1005	216	4	146	22	18	6	9	1	26	422	7
1006	82	20	121	6	13	15	1	0	318	258	9
1010	120	14	408	56	35	71	12464	696	2392	13864	254
1011	237	1	88	2	10	2	6	0	38	346	6
1012	102	4	46	2	3	2	10	0	151	169	5
1013	52	0	274	5	2	0	12747	0	2920	13080	250
1014	54	1	33	7	22	9	2	0	0	128	2
TOTAL	4763	107	2826	330	221	5639	95877	697	25476	11046	2124

LAND USE (IN ACRES) - 1970

Kanawha County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
374	136	2	380	0	3	0	489	624	22174	1634	372
375	53	0	331	0	2	0	401	487	21510	1274	356
376	175	1	271	13	8	1	305	276	13542	1050	228
377	187	0	426	15	19	1	0	500	17540	1148	292
378	114	0	290	5	7	0	237	484	10811	1137	182
379	57	0	234	2	2	1	186	1	4125	483	72
380	128	0	49	1	28	1	0	1	304	208	8
381	136	0	331	0	7	1	354	173	10582	1002	181
382	56	1	102	4	4	4	0	1	3028	172	50
383	221	1	310	2	5	123	1640	0	6514	2302	144
384	332	2	406	20	42	4	2145	0	8569	2951	180
385	172	1	416	4	11	1	3910	0	23645	4515	440
386	452	5	510	3	7	220	2565	1	20173	3763	374
387	105	3	106	21	11	8	0	3	639	257	14
388	136	23	121	19	22	27	2	1	481	351	13
389	155	2	105	5	2	3	0	0	240	272	8
401	78	0	101	0	1	0	427	0	2401	607	47
402	65	2	68	40	7	6	0	0	68	188	4
403	161	1	105	6	14	1	0	0	32	268	5
404	179	1	110	63	23	64	0	0	72	440	8
405	245	0	146	12	8	0	0	0	165	411	9
406	248	4	260	6	14	4	0	0	2024	536	40
411	342	3	157	30	58	86	0	0	92	676	12
412	50	355	50	10	10	4	0	0	33	479	8
413	398	15	202	28	21	8	0	0	96	672	12
414	40	165	37	6	1	0	0	0	7	249	4
420	46	6	165	58	34	6	1	1	3	317	5
421	133	17	105	42	16	5	0	2	0	320	5
422	57	1	78	4	28	2	1	0	21	171	3
423	439	1	225	4	191	3	0	0	1313	863	34
424	46	20	154	12	15	4	0	1	4	252	4
425	438	3	211	34	25	2	0	1	438	714	18
426	179	1	54	3	4	1	0	0	846	242	17
427	107	2	75	18	33	14	0	0	7	249	4
428	628	0	163	3	3	2	0	1	352	800	18
429	0	0	45	2	0	2	0	0	15	49	1
430	896	33	317	26	65	18	1	1	307	1357	26
431	257	20	249	129	32	6	0	1	10	694	11
432	383	1	120	3	2	109	0	1	533	619	18
433	177	0	55	2	1	0	0	0	597	235	13
434	374	0	133	7	12	61	0	0	53	587	10
435	76	27	109	81	5	19	0	0	3	317	5
436	241	3	74	1	11	0	0	0	1014	330	21
464	39	0	803	2	3	0	0	0	113	847	15
465	288	15	173	33	43	21	1	0	2	574	9
466	82	1	91	7	3	0	0	0	456	184	10
467	30	500	152	2	138	60	0	0	718	882	25
471	75	0	182	1	3	0	123	0	3456	384	60
472	192	0	111	2	1	1	0	0	1741	307	32
473	184	1	140	1	1	1	0	0	2232	328	40
476	36	1	57	0	2	0	187	0	1809	283	26
477	43	1	24	1	0	0	63	0	764	132	14
478	86	0	82	0	0	0	59	0	2205	227	38
479	117	1	229	0	2	5	1450	0	9716	1804	180

LAND USE (IN ACRES) - 1970

Kanawha County Continued

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
480	164	1	251	5	2	0	468	0	7813	891	136
481	219	1	234	14	61	4	243	1	1575	777	43
482	110	138	218	13	8	0	0	0	3609	487	64
483	131	0	342	7	12	2	0	624	15586	1118	261
484	230	15	66	1	3	5	0	0	4032	320	66
485	72	0	62	5	15	0	0	1	101	155	4
486	35	0	56	0	5	8	120	0	32	224	4
487	46	0	298	14	2	0	693	52	8239	1105	146
488	56	0	230	1	25	14	2541	185	12308	3052	240
489	66	1	234	0	1	0	596	3	25947	901	482
490	184	0	243	0	2	0	766	0	6485	1195	120
501	217	0	814	0	1	25	4513	0	25726	5570	489
502	419	0	676	2	2	2	2107	1	16247	3209	304
503	131	0	643	1	49	0	4304	1	20727	5129	404
504	112	0	146	5	2	6	246	0	2427	517	46
505	123	0	227	1	1	677	550	0	9365	1579	171
506	137	1	157	1	1	0	727	1	3519	1025	71
507	212	0	383	0	1	0	1679	0	20061	2275	345
508	153	0	261	1	0	0	720	1	12948	1196	221
509	92	3	784	0	1	0	2874	2	45204	3756	765
510	176	0	492	2	12	0	4291	1	19282	4574	379
511	179	20	399	1	23	4	1407	6	9993	2039	188
512	228	1	726	6	37	1	3168	1	17080	4168	332
391	1	0	37	0	1	6597	0	0	1031	6636	120
TOTAL	13563	1423	17979	873	1277	8258	46620	3441	491132	93431	9134

Lewis County

710	309	8	903	0	153	1	16272	0	25490	17646	674
711	674	22	1328	70	529	273	25587	788	45929	29271	1175
712	570	0	583	41	63	1	11600	744	15806	13602	522
713	847	0	918	78	114	0	16144	263	43716	16364	970
714	220	6	128	14	66	11	0	1	130	446	9
715	171	3	105	6	82	0	2	0	143	369	8
718	433	18	328	206	118	524	6120	4903	2710	12650	240
719	391	93	425	5	228	6	13968	631	4245	15947	315
TOTAL	3615	150	4718	420	1353	816	89693	7530	142169	108295	3913

Lincoln County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
235	197	1	493	2	13	0	1880	0	29670	2586	504
236	138	3	524	0	13	5700	3357	0	37305	9735	735
237	345	2	543	2	21	0	2261	1	26777	3175	469
238	465	0	706	0	15	0	4463	0	48307	5849	844
239	433	10	317	10	23	0	2527	2	20998	3322	380
240	397	0	424	2	14	0	3017	0	28530	3854	506
241	148	1	119	5	10	0	719	0	5398	1002	100
242	772	17	792	11	20	1	7022	3	44700	8638	833
TOTAL	2895	34	3918	32	129	5701	25246	6	241745	37961	4370

Logan County

85	147	0	337	3	20	0	476	6	28003	989	453
86	109	12	229	3	12	120	211	410	20014	1106	330
87	99	0	111	2	9	0	185	7	14755	413	237
88	48	2	184	1	25	0	106	1	9617	367	156
104	189	0	169	1	14	0	317	481	14317	1171	242
89	99	3	50	4	23	1	0	0	268	180	7
90	98	0	86	1	11	0	132	68	10228	396	166
101	214	1	210	1	13	0	0	51	13334	490	216
102	196	9	163	2	13	0	211	1	11549	595	196
103	130	0	197	2	13	0	211	348	10875	901	184
105	74	0	123	1	7	0	0	190	14581	395	234
106	48	6	66	0	3	256	159	1	7909	539	132
107	328	6	184	4	18	256	0	301	5047	1097	96
108	0	0	1	0	27	0	0	0	0	28	1
109	190	31	63	22	14	1	0	1	574	322	14
111	110	18	181	6	9	0	106	1	14033	431	226
112	94	0	269	2	36	0	159	59	25109	619	402
113	148	5	124	9	4	1769	211	1	1249	2271	55
114	81	0	115	1	9	0	132	1	6061	339	100
115	108	0	391	1	17	0	159	1	33883	677	540
116	104	0	126	1	4	1024	159	1	6005	1419	116
117	178	40	327	4	18	0	608	1	19496	1176	323
118	77	0	45	3	30	1	0	1	227	157	6
119	89	0	204	3	5	0	158	1	7604	460	126
TOTAL	2958	133	3955	77	354	3429	3700	1933	275133	1634	4558

LAND USE (IN ACRES) - 1970

McDowell County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
2	202	0	444	9	11	7810	668	21	37555	9165	730
3	39	25	64	4	24	1	100	55	712	312	16
4	252	0	562	12	41	0	888	292	40641	2047	667
5	229	0	412	7	12	0	128	23	34133	811	546
6	158	0	255	2	10	2	300	1	27624	728	443
7	95	0	76	6	29	0	0	0	562	206	12
8	216	1	579	8	25	108	462	528	52473	1927	850
9	89	4	71	1	4	0	128	13	7690	310	125
10	242	0	370	1	29	60	462	1373	38231	2537	637
11	131	2	70	5	31	0	0	1	592	240	13
12	67	1	95	1	25	4	0	1	702	194	14
15	117	0	256	1	11	0	236	9	19146	630	309
16	105	4	278	3	10	4	191	57	11124	652	184
17	59	0	115	0	4	0	0	413	7729	591	130
18	65	2	90	4	12	0	64	15	2180	252	38
19	106	0	163	3	15	0	236	105	12492	628	209
20	95	0	181	2	13	0	0	60	9505	351	154
21	147	0	281	4	13	309	236	859	18055	1849	311
TOTAL	2414	39	4362	73	319	8298	4099	3826	321146	23430	5384

Marion County

852	98	0	309	0	0	1	4516	3	16813	4927	335
853	114	0	359	0	1	68	7240	6	15636	7788	366
854	101	7	212	1	11	120	2007	6	3679	2465	96
855	121	9	190	9	1	1	2294	2	4093	2627	105
856	214	0	251	27	18	4	3584	1	3965	4059	126
857	347	0	324	0	7	835	4014	1	8808	5528	224
858	342	0	563	3	13	64	6236	4	14151	7225	334
859	160	0	393	0	40	1	2756	14	16116	3404	305
860	46	32	49	7	20	6	0	1	95	161	4
861	102	0	68	2	40	0	1	0	235	213	7
862	271	1	329	3	2	4	2580	19	9338	3209	196
863	203	33	262	0	62	60	1362	0	2754	1582	74
864	110	2	50	5	29	4	2	0	246	202	7
865	3	1	42	8	7	0	0	1	2	62	1
866	165	1	99	10	14	0	0	0	351	289	10
867	0	0	7	0	48	0	0	0	9	55	1
868	420	48	209	62	60	0	0	1	608	800	22
869	170	6	80	8	20	0	0	0	612	284	14
870	217	24	168	24	19	0	0	0	316	452	12
871	61	227	112	12	3	0	0	0	289	415	11
872	127	2	148	12	11	0	0	0	596	300	14
882	483	49	433	24	79	64	2079	0	3189	3211	100
883	78	83	113	0	1	124	645	0	1452	1044	39
884	254	32	254	2	17	4	860	2	4591	1425	94
885	577	16	318	14	30	4	2437	16	7980	3412	178
886	476	42	415	2	20	1	3154	1	8689	4111	200
887	293	0	193	2	11	1	2222	10	6676	2732	147
888	251	5	133	1	10	1	1935	14	4914	2350	114
TOTAL	5804	620	6083	238	594	1367	49964	102	135900	64772	3136

LAND USE (IN ACRES) - 1970

Marshall County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
1016	164	306	701	0	84	11400	10150	18	15705	22823	602
1017	229	0	859	3	1	0	11826	37	39499	12955	820
1018	167	542	260	0	1	253	3511	7	3547	5141	142
1019	254	3	540	3	1	0	10616	0	18343	11417	465
1020	101	4	160	29	30	11	0	36	333	371	11
1021	259	1	112	9	26	41	165	0	219	613	13
1022	124	21	75	1	20	1	0	0	142	242	6
1023	121	24	112	10	8	11	2	0	352	288	10
1029	456	271	286	18	2	41	6984	11	6523	8069	228
1030	126	0	305	0	1	0	12199	0	9129	12631	340
1031	85	0	238	10	5	9	0	0	165	347	8
1032	430	0	225	0	2	275	6705	9	5410	7646	204
1033	157	0	303	0	1	106	5312	0	8041	9879	280
1034	55	1	58	1	2	1	22	0	436	140	5
1035	71	147	115	5	1	1	0	0	620	340	15
TOTAL	2799	1320	4349	89	185	12150	71892	118	108864	92902	3153

Mason County

535	344	1	785	12	23	40	13509	422	17376	15136	508
536	480	400	1157	3	13	10573	24463	0	26783	37089	998
537	477	0	1331	0	22	3	17088	393	35518	19314	863
538	426	396	589	10	31	7	12633	0	19892	14092	531
539	49	2	74	21	10	108	0	0	440	264	11
540	352	28	155	10	168	2	876	0	1737	1891	52
544	752	1	1290	10	19	202	15564	0	33170	17838	797
545	501	1	321	11	33	78	3651	143	6653	4739	178
546	673	250	974	28	23	356	7302	20	11366	9626	328
592	124	33	385	0	1503	2484	3792	0	3903	8321	191
TOTAL	4178	1112	7061	105	1845	13853	98878	978	157238	128010	4457

Mercer County

23	5	2	10	15	3	0	0	1	28	36	1
24	65	17	287	36	31	2	0	0	906	438	21
25	123	0	198	7	11	3	0	1	873	343	19
26	4	2	14	5	5	0	0	0	34	30	1
27	194	5	249	34	60	268	0	0	406	810	19
36	629	38	553	6	18	0	5328	0	16516	6572	367
37	307	1	107	2	3	0	0	0	2524	420	46
38	279	1	100	10	22	8	1	0	27	421	7
39	124	2	83	15	5	5	0	0	150	234	6
40	227	2	135	29	20	2	0	0	32	415	7
47	344	4	240	3	3	0	1600	0	1774	2194	62
48	360	1	250	5	13	60	1876	0	6011	2565	134
49	341	6	598	9	10	0	2836	0	10792	3800	228

LAND USE (IN ACRES) - 1970

Mercer County Continued

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
50	318	1	758	4	18	0	5660	0	29201	6959	565
51	330	1	897	6	106	448	13534	0	36134	15322	804
52	394	1	1629	10	155	6409	12828	54	57284	21180	1226
53	681	1	1360	16	90	260	3908	306	39648	6622	726
TOTAL	4725	85	7468	212	573	7465	47471	362	202941	68361	4239

Mineral County

928	216	8	537	3	17	21	6792	332	25994	7526	530
929	320	3	387	6	38	1	6072	8	20045	6835	420
930	195	0	477	4	13	1	10034	0	28556	10724	620
931	144	13	106	3	10	5	392	1	5214	674	92
932	150	14	87	6	9	1	4	1	112	272	6
933	239	0	224	2	32	0	6	1	264	504	12
937	363	128	403	3	6	420	10137	0	32828	11460	692
938	195	425	186	1	3	1	3242	3	9768	4056	216
939	332	1	396	2	8	13	5666	0	20582	6618	425
940	218	0	237	2	3	1	2415	0	11396	2876	223
941	353	1	216	3	32	2	463	0	3026	1070	64
TOTAL	2725	593	3256	35	171	466	45423	346	158185	53015	3300

Mingo County

60	95	23	177	24	25	14	0	0	602	358	15
61	25	0	140	2	2	0	0	0	663	169	13
66	109	0	81	6	38	0	33	0	2228	267	35
67	201	0	212	28	49	0	54	260	7558	804	130
68	132	0	138	3	2	0	43	780	5273	1058	100
69	18	0	56	4	6	0	3	2	1191	89	20
70	202	0	107	5	6	0	11	520	4499	851	84
71	334	0	419	3	28	8	303	1170	28781	2265	485
72	115	65	214	100	51	0	33	1365	9500	1943	179
73	134	0	402	0	3	0	57	1560	20490	2196	354
74	172	4	237	7	103	0	155	1495	12187	2213	228
75	142	0	172	0	2	0	0	455	12349	771	205
76	162	0	183	0	1	0	130	575	11861	1451	208
77	49	25	71	84	66	0	210	1105	2742	1610	68
78	122	0	186	2	1	3	108	0	13530	422	218
79	231	0	341	12	24	4261	141	0	18142	5010	362
80	136	0	163	3	8	0	97	195	13158	602	215
81	78	6	288	39	23	0	282	65	24122	781	389
82	92	0	153	0	0	3030	76	0	17513	3351	326
83	368	6	410	2	8	0	184	0	37422	978	600
TOTAL	2917	129	4150	324	446	7316	2000	9947	243811	27229	4235

LAND USE (IN ACRES) - 1970

Monongalia County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mile)
890	202	1	784	6	53	2	2816	0	32296	3864	565
891	5	0	0	0	0	7990	1	0	0	7996	124
892	204	103	140	2	18	2	0	0	427	469	14
893	351	16	205	28	43	61	0	5	507	709	19
901	480	0	968	92	83	0	7384	39	29994	9046	613
902	746	1	809	11	34	0	10941	221	17164	12763	468
903	178	0	540	22	8	1	2572	0	11143	3321	226
904	551	10	570	11	16	0	3648	53	28549	4859	522
905	439	5	340	21	31	5	4352	0	10551	5193	246
906	421	1	675	59	48	7	5144	151	15382	6506	342
907	263	16	248	41	20	54	0	10	564	652	19
912	458	2	757	35	88	52	1536	0	6224	2928	143
913	662	0	310	0	19	0	2816	2	8031	3809	185
914	198	0	258	17	16	132	1280	0	8189	1901	158
908	92	24	81	30	76	1	1	1	14	306	5
909	274	37	50	26	437	8	0	0	128	832	15
910	8	1	32	7	491	0	0	0	101	539	10
911	228	12	84	14	10	13	0	0	727	361	17
TOTAL	5760	229	6851	422	1491	8328	42491	482	169991	66054	3688

Monroe County

55	101	0	557	3	725	270	14020	0	65220	15676	1264
56	465	4	1020	23	97	16	47563	0	31452	49188	1260
57	357	1	512	7	12	5	6985	0	22649	7879	477
58	873	1	1399	18	118	18	40269	0	68472	42696	1737
TOTAL	1796	6	3488	51	952	309	108837	0	187793	115439	4738

Morgan County

952	81	1	93	1	28	3	192	0	817	399	19
953	352	5	610	1	20	1	3080	0	44891	4069	765
954	0	0	16	0	0	6294	0	0	26	6310	99
955	502	0	761	1	48	4	11772	0	39264	13088	818
956	503	409	313	8	36	7	1210	460	6910	2946	154
957	308	1	494	6	21	5751	6124	0	16581	12705	458
TOTAL	1746	416	2287	17	153	12060	22378	460	108489	39517	2313

Nicholas County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Square Miles)
287	488	195	338	13	43	0	1956	732	31691	3765	554
288	561	17	386	14	72	156	5038	640	56924	6884	957
289	439	39	468	8	105	2727	9683	0	29155	13469	666
290	601	4	522	18	33	0	3946	1535	48701	6659	865
301	484	36	473	45	70	126	4958	1798	54986	7990	984
302	197	13	101	16	30	19	0	200	1152	576	27
303	466	3	269	11	39	2	7463	2349	28310	10602	608
304	483	30	336	26	72	26002	2428	281	9574	29658	613
305	91	3	107	2	7	12	0	0	482	222	11
306	71	50	59	14	23	7	9	0	215	233	7
307	887	19	379	52	157	6	8435	2486	24443	12421	576
308	370	0	331	5	113	0	1079	0	40323	1898	660
TOTAL	5138	409	3769	236	764	29057	44995	10021	325956	94377	6568

Ohio County

1038	175	5	114	5	3	1	0	0	17	303	5
1039	232	1	94	5	5	39	0	0	8	376	6
1040	189	36	146	30	20	12	0	0	271	433	11
1041	151	1	127	30	34	6	0	0	1123	349	23
1042	68	30	81	3	19	13	0	0	426	214	10
1043	115	2	108	3	14	9	0	0	69	251	5
1044	69	39	64	20	16	0	0	0	241	207	7
1045	114	1	58	4	112	210	0	0	141	499	10
1046	139	2	153	16	75	70	0	0	249	455	11
1047	163	12	120	10	70	14	0	0	251	389	10
1048	816	36	178	9	10	0	0	0	2023	1049	48
1049	381	40	257	29	12	18	0	0	223	737	15
1063	762	0	80	1	1	0	1920	0	116	2764	45
1064	330	0	251	1	1	308	4736	0	4165	5627	153
1065	217	4	203	15	18	0	128	0	1655	585	35
1066	318	0	177	4	6	0	1728	0	1159	2233	53
1067	703	0	246	11	449	0	3008	0	4351	4417	137
1068	296	0	216	11	10	133	5888	0	5286	6554	185
1069	699	0	183	10	1	110	2048	0	2069	3051	80
1070	704	0	303	20	572	0	4114	0	4271	5713	156
1071	307	0	192	2	1	0	1152	60	1870	1714	56
1072	0	0	117	0	0	0	0	0	459	117	9
1091	0	0	5	0	0	1275	0	0	0	1280	20
TOTAL	6947	209	3473	239	1449	2218	24722	60	30443	39317	1090

Pendleton County

630	306	1	520	2	2	6	19303	0	128468	20140	2322
631	462	12	1328	5	67	41664	24004	1	16809	67543	1318
632	68	43	37	5	27	26	2	1	303	209	8
633	334	1	982	6	17	24626	36000	0	40370	61966	1599
634	322	0	756	4	69	14	23691	0	85352	24856	1722
TOTAL	1492	57	3623	22	182	66366	103000	2	271302	174714	6969

LAND USE (IN ACRES) - 1970

Pleasants County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
827	352	94	529	17	32	1582	1533	0	19285	4139	366
828	243	0	510	4	16	21	2972	1	19145	3767	358
829	155	42	82	23	30	57	0	0	315	389	11
830	247	0	733	0	67	286	5163	0	32640	6496	611
TOTAL	997	136	1854	44	145	1946	9668	1	71385	14791	1346

Pocahontas County

528	287	6	998	29	48	12838	19713	0	61249	33919	1487
529	4	0	133	0	0	19539	0	0	5540	19676	394
530	129	18	470	1	20	0	8780	0	69046	9418	1226
531	330	19	1249	7	10	784	31545	7	116321	33951	2348
532	298	6	829	26	2644	230	18680	0	83975	22713	1667
533	171	160	800	60	21	90	6630	0	80708	7932	1385
591	111	3	439	13	116	1900	8005	0	46949	10587	899
593	181	31	73	31	22	0	1	10	937	349	20
TOTAL	1511	243	4991	167	2881	35381	93354	17	464725	138545	9426

Preston County

916	540	0	1574	2	22	0	12746	211	45513	15095	947
917	247	8	188	1	4	5	101	0	214	554	12
918	430	2	1427	3	85	19996	12443	0	29358	34386	996
919	401	1	1004	2	117	0	6904	1056	18547	9485	438
920	853	11	1389	6	161	0	10385	1830	22613	14635	582
921	289	33	458	19	60	24	57	3	81	943	16
922	566	1	1780	4	372	2823	19652	10	48136	25208	1146
923	138	8	150	2	21	10	235	10	194	574	12
924	1050	51	1216	7	138	800	7110	493	26639	10865	586
925	356	1	1184	0	5	1005	17469	10	34626	20030	854
926	470	4	1393	3	137	6592	14224	10	37954	22833	950
TOTAL	5340	120	11763	49	1122	31255	101325	3633	263875	154608	6539

Putnam County

363	304	39	989	22	38	731	6938	0	36827	9061	717
364	281	8	101	18	34	1	7	20	170	470	10
365	316	0	281	6	10	379	2724	0	6652	3716	162
366	556	9	1077	3	16	22	4150	49	13574	5882	304
367	339	0	288	47	19	666	1424	0	7329	2783	158
368	324	4	676	13	14	1	8857	0	25887	9889	559
369	117	3	207	15	54	618	1733	255	7750	3002	168
370	257	16	237	3	9	1	682	0	10187	1205	178
371	735	14	1263	28	62	537	10774	0	38555	13413	812
372	290	0	544	20	40	147	7558	0	17897	8599	414
390	80	425	1	18	6	60	2	294	630	886	24
TOTAL	3599	578	5664	193	302	3163	44849	618	165458	58906	3506

LAND USE (IN ACRES) - 1970

Raleigh County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
137	264	0	428	2	16	1	1388	568	33045	2667	558
138	307	0	386	5	24	1	1271	483	19027	2477	336
139	391	1	599	7	65	196	6684	991	20762	8934	464
140	81	0	401	0	6	1	7153	0	33062	7642	636
141	280	0	390	0	11	1	937	725	23640	2344	406
142	87	1	48	7	18	2	0	0	93	163	4
143	172	1	145	0	7	1	736	1	2521	1063	56
144	664	10	552	9	32	388	4140	7	15958	5802	340
145	212	8	145	1	9	1	1807	2	5495	2185	120
146	870	0	154	10	13	61	961	1	1450	2070	55
147	284	0	499	2	27	300	7689	1	16414	8802	354
148	450	0	438	8	8	1	3002	1	9404	3908	208
149	170	6	74	50	37	1	0	1	173	339	8
150	231	4	126	35	32	7	0	1	76	436	8
151	219	0	122	6	15	121	0	0	93	483	9
152	333	4	129	20	73	11	0	0	134	570	11
153	320	2	137	43	27	11	1	1	34	542	9
154	176	15	105	10	4	1	0	0	137	311	7
155	248	1	143	34	6	30	1	1	240	464	11
163	526	4	401	9	135	1	1372	1	10671	2449	205
164	9	0	1448	0	0	1	134	0	1864	1592	54
165	43	0	124	0	0	1	2735	1	11816	2904	230
166	358	6	632	3	33	1	8358	998	49003	10389	928
167	202	0	391	0	18	1	4475	1786	34279	6873	643
168	120	0	231	0	0	1	1671	65	5336	2088	116
169	425	51	99	53	12	1	469	0	1834	1110	46
170	0	0	22	0	0	0	0	0	234	22	4
171	239	5	188	4	13	1	335	1	3566	786	68
172	356	0	193	3	111	1	1071	1	7224	1736	140
173	0	0	17	0	0	878	0	0	865	895	28
TOTAL	8037	119	8767	321	752	2023	56390	5637	308450	82046	6102

Randolph County

614	286	0	662	0	22	6	7320	19	79941	8315	1379
615	297	2	669	2	2018	9443	5800	73	72640	18304	1421
616	171	8	783	0	25	1	8563	73	85800	9624	1491
617	355	10	406	3	26	1	8080	2	33741	8883	666
618	302	1	788	9	17	5	6975	6	40473	8103	759
619	641	14	1285	35	15	1034	15469	0	43011	18493	961
620	468	2	1277	1	34	170	15330	16	175534	17298	3013
621	329	10	104	16	85	9	0	1	342	554	14
622	114	179	73	14	19	4	0	0	109	403	8
623	176	10	95	4	62	0	0	0	293	347	10
627	312	5	383	15	30	105	6767	70	12793	7687	320
628	208	0	383	3	31	5	10151	1	16188	10782	421
TOTAL	305	241	6908	102	2384	10783	84455	261	560865	108793	10463

LAND USE (IN ACRES) - 1970

Ritchie County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
686	418	3	1516	10	24	1398	27586	85	74816	31040	1654
687	305	1	837	9	19	3	16589	0	37341	17763	861
688	265	2	1256	4	26	1524	17516	71	53127	20665	1153
689	152	5	54	6	22	1	0	3	717	243	15
690	345	4	449	3	18	62	8773	0	14365	9654	375
701	162	15	82	8	25	6	0	1	725	299	16
702	144	0	395	2	5	1	12730	4	17337	13281	478
TOTAL	3072	51	7867	72	238	5734	142618	281	340162	159334	7803

Roane County

564	612	12	1086	37	85	12	23700	0	26872	25544	819
565	499	6	1305	9	58	10	18975	0	37826	20862	917
566	654	6	1623	78	34	12	22510	0	57067	24917	1281
567	621	24	1005	78	40	67	1702	0	59631	3537	987
568	2	0	1	0	125	0	0	0	0	128	2
569	156	8	94	19	14	7	13	15	122	326	7
571	648	6	1151	46	35	13	12946	0	39491	14845	849
TOTAL	3192	62	6265	267	391	121	79846	15	221009	90159	4862

Summers County

175	217	0	461	10	14	16047	6726	0	11213	23475	542
176	628	6	890	5	10	8636	12831	0	27490	23006	789
177	632	23	861	12	16	2304	9463	0	33345	13311	729
178	72	1	67	2	1	0	0	0	241	143	6
179	847	4	683	5	263	222	4414	0	29146	6438	556
180	136	21	249	14	24	10	0	0	826	454	20
183	259	22	835	25	20	65	10098	0	30596	11324	655
184	628	0	277	2	7	70	5324	0	17346	6308	370
191	0	0	0	0	0	704	0	0	0	704	11
TOTAL	3419	77	4323	75	355	28058	48856	544	150203	85163	3678

Taylor County

775	105	0	92	0	1	0	1694	544	2684	2436	80
776	291	0	160	10	44	0	1942	1349	8108	3796	186
777	89	0	183	1	0	0	2519	0	3608	2792	100
778	18	0	61	0	0	3621	356	0	3560	4056	119
779	116	0	229	0	2	0	4729	0	7468	5076	196
780	306	0	572	1	1960	730	11506	638	17759	15713	523
781	227	20	191	133	26	0	0	0	555	597	18
782	83	18	64	21	4	0	0	0	194	190	6
785	71	0	285	1	3	0	6959	0	6889	7319	222
786	111	0	330	0	2	320	8654	0	11185	9417	322
TOTAL	1417	38	2167	167	2042	4671	38359	2531	62010	51392	1772

LAND USE (IN ACRES) - 1970

Tucker County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
808	332	69	458	10	34	5	2631	1	33580	3540	580
809	117	0	617	0	5	7863	9010	0	71348	17612	1390
810	92	0	713	0	4	40	5205	0	34778	6054	638
811	144	17	275	1	16	106	2519	0	13754	3078	263
812	82	0	353	5	7	14	112	21	18350	594	296
813	59	2	196	2	6	1	112	4	26370	382	418
814	134	0	533	1	9	2	2911	4	36835	3594	632
TOTAL	960	88	3145	19	81	3031	22500	30	235015	34854	4217

Tyler County

832	200	0	485	1	7	0	10047	0	25100	10740	560
833	383	2	1062	1	24	363	14775	0	46110	16610	980
834	158	15	580	3	9	0	16942	0	2901	17707	322
835	50	3	36	3	69	0	30	0	193	191	6
836	98	48	202	8	16	130	0	400	186	902	17
837	456	17	921	3	8	0	9950	0	34582	11255	716
TOTAL	1345	85	3286	19	133	493	51644	400	109072	57405	2601

Upshur County

604	488	13	1694	17	33	525	15076	10	53440	17856	1114
605	1	0	0	0	35	10	0	0	18	46	1
606	230	15	160	33	12	17	1	2	234	470	11
607	56	27	88	12	15	0	0	5	437	203	10
609	303	18	826	25	11	8	8536	281	21288	10008	489
610	142	56	500	18	6	132	8602	186	10582	9642	316
611	325	10	709	118	33	64	5826	40	23977	7127	486
612	953	33	1611	6	20	536	14954	50	53619	18163	1122
TOTAL	2498	172	5588	229	165	1292	52997	574	163595	63515	3549

LAND USE (IN ACRES) - 1970

Wayne County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
216	258	10	798	0	39	8036	5865	50	42096	15056	893
217	535	15	1373	1	108	0	21360	113	61410	23505	1327
218	272	0	800	1	50	24985	8822	0	34318	34930	1082
219	244	0	633	0	40	0	7819	125	24547	8861	522
220	163	48	66	6	37	7	0	2	119	329	7
221	486	0	1027	1	63	257	15664	50	42228	17548	934
222	103	0	113	0	0	1	1775	0	2680	1992	73
223	154	0	225	0	6	0	2545	67	3403	2997	100
224	173	185	244	1	15	10	756	0	2776	1384	65
225	6	16	745	0	0	0	132	0	509	899	22
226	105	3	123	0	234	427	341	21	1565	1251	44
227	109	0	109	0	0	126	578	0	2022	922	46
228	94	3	88	1	1	0	0	0	1605	187	28
229	103	12	119	11	3	16	0	21	355	285	10
230	79	56	78	4	34	0	0	0	69	251	5
231	51	9	94	2	6	0	0	0	350	162	8
232	4	0	43	0	0	27	4	0	114	78	3
233	268	12	129	5	10	0	20	75	121	519	10
TOTAL	3207	366	6807	33	646	33892	65681	524	220287	111156	5179

Webster County

520	39	2	394	2	0	38240	0	22	24789	38699	992
521	969	99	798	83	41	2140	10050	45	61295	14225	1180
522	93	5	44	7	46	11	8	0	1258	214	23
523	277	2	227	14	57	17000	190	31	26298	17798	689
524	514	3	652	5	12	0	2161	0	78509	3347	1279
525	149	35	447	9	9	0	436	29	33318	1114	538
526	182	46	730	6	38	7677	525	0	47336	9304	885
TOTAL	2223	192	3292	126	203	65068	13470	127	27243	84701	5586

Wetzel County

839	391	0	723	12	53	1492	4964	0	25389	7635	516
840	413	4	1151	5	31	9714	4810	17	50031	16145	1034
841	195	26	103	12	17	12	16	0	195	381	9
843	85	0	124	2	20	1	839	0	3217	1071	67
844	151	4	96	20	7	0	0	0	746	278	16
845	302	36	214	71	34	200	0	16	279	873	18
848	483	376	1181	0	22	15	5558	0	50541	7635	909
849	215	0	789	1	5	0	4978	0	36380	5988	662
850	1078	0	471	21	60	10	2331	38	19908	4009	374
TOTAL	3313	446	4852	144	249	11444	23496	71	186686	44015	36005

LAND USE (IN ACRES) - 1970

Wirt County

STZ#	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
682	618	19	1389	26	190	221	24874	0	60919	27337	1379
683	266	2	34	9	14	8	11	1	39	345	6
684	461	0	833	5	91	8903	8779	1	42309	19073	959
TOTAL	1345	21	2256	40	295	9132	33664	2	103267	46755	2355

Wood County

636	183	0	609	2	7	10	11346	0	18691	12157	482
637	111	0	785	0	5	0	8046	5	21640	8952	478
638	146	0	360	0	2	0	7903	0	13029	8411	335
639	238	0	447	0	3	0	10247	1	9160	10936	314
640	13	482	49	10	5	0	508	0	789	1067	29
641	113	0	73	0	1	0	960	0	3205	1147	68
642	281	1	417	31	25	120	4685	0	4680	5560	160
643	115	0	49	0	9	0	56	0	1627	229	29
644	145	22	104	7	39	0	0	2	65	319	6
645	100	20	163	8	11	0	0	0	594	302	14
646	19	107	37	1	5	0	1	0	86	170	4
647	558	6	43	19	3	0	0	2	9	631	10
648	141	16	55	11	13	0	0	4	16	240	4
649	194	0	72	15	15	1	1	0	214	298	8
650	227	1	120	19	8	175	0	0	282	550	13
651	318	13	101	26	36	0	1	2	271	497	12
652	277	3	274	12	15	0	0	3	696	584	20
653	265	1	71	12	20	163	0	1	619	533	18
654	118	30	282	8	2	120	226	14	11936	800	199
655	129	17	110	5	15	7	0	0	613	283	14
656	280	64	91	23	117	16	0	2	303	593	14
657	348	3	96	31	62	17	0	1	1106	558	25
668	0	164	17	0	1	0	113	0	345	295	10
669	288	4	427	26	22	0	2427	0	4038	3194	113
670	271	0	446	0	2	12	6548	27	10998	7306	286
671	18	1	710	8	120	0	0	0	1127	857	31
677	247	0	412	0	17	120	4455	9	5552	5264	169
678	171	3	505	1	8	6	6830	33	16571	7557	377
679	220	1	711	2	35	0	6604	41	26626	7614	535
TOTAL	5534	959	7636	277	623	767	70961	147	154888	86904	3778

LAND USE (IN ACRES) - 1970

Wyoming County

STZ #	Residential	Manufacturing	Transportation	Trade	Services	Cultural	Agriculture	Mineral Extraction	Undeveloped	Developed	Total Land Area (Sq. Mi.)
121	463	13	384	4	28	0	1320	12	30800	2224	516
122	282	0	312	13	35	23	1016	108	18179	1789	312
123	230	9	431	37	53	19	0	22	35167	801	562
124	671	5	721	3	36	8	5488	1343	44205	8275	820
125	196	0	161	0	18	3	694	137	11975	1209	206
126	494	23	270	54	15	65	2249	182	19688	3352	360
127	1196	0	641	34	59	8	1438	0	32912	3376	567
128	266	18	186	3	0	0	510	11	14750	994	246
129	110	7	57	14	19	34	0	0	783	241	16
130	38	0	31	1	9	0	0	0	113	79	3
131	127	9	76	43	40	20	0	1	452	316	12
132	274	0	271	5	43	3780	1546	6	18779	5925	386
133	422	0	377	13	13	6	0	94	20067	925	328
134	246	2	199	0	0	0	497	0	21594	934	352
135	364	0	171	5	18	36	1242	116	22816	1952	387
TOTAL	5379	86	4278	229	386	4002	160015	2032	292295	32392	5073

Note: STZ is a standard traffic zone.

Source: West Virginia Department of Highways, Statewide Traffic Assignment Model Study, n.d.

STZ#	Barbour County	Classification	Subclassification	Ownership
801	BROADDUS	1	2	1
51	ANIMALFOSSILS	2	1	1
58	C.WARSALTPETERCAVE	2	1	2
56	HAYNESSALTPETERCAV	2	1	2
801	COVEREDBRIDGE	2	1	1
802	AUDRA	3	1	1
802	AUDRASTATEPARK	3	2	1
788	TWINLAKES	3	2	2
803	HERSHEYHUDKINS	3	2	2
803	HUDKINSCAMP	3	2	2
803	TETERCREEKLAKE	3	2	1
805	PLEASANTCREEK	3	2	1
790	BARBOURCOUNTRYCLUB	3	4	2
803	CAMPBARBOUR	3	7	1
789	BELINGTONINDPARK	5	1	2
802	COADETACHMENT	6	1	1
801	COCHOUSEPHILIPPI	6	5	1
789	BELINGTONBRANCH	6	6	1
801	PHILIPPIPUBLIC	6	6	1
789	BELINGTON	7	1	1
801	PHILIPPI	7	1	1
806	KASSON	7	1	1
802	PHILLIPBARBOUR	7	2	1
801	ALDERSON-BROADDUS	7	3	2
802	SIMPSONAIRPORT	8	4	2
801	PHILIPPI	9	1	1
801	PHILIPPI	10	1	2
789	BELINGTON	10	2	2
802	PHILIPPI	10	2	2

STZ#	Berkeley County	Classification	Subclassification	Ownership
981	MARTINSBURGVAHOSP	1	1	2
971	MARTINSBURGCITY	1	2	1
971	KINGSDAUGHTERS	1	2	1
967	NORBORNECENTER	1	3	2
965	SNODGRASSTAVERN	2	1	2
971	BOYDVILLE	2	1	2
971	ADAMSTEPHENHOUSE	2	1	2
965	SLEEPYCREEKPHFA	3	2	1
984	FALLINGWATERS	3	2	2
984	YOGIBEARSJELLYSTON	3	2	2
966	WOODBRIERGOLFCOURS	3	4	1
982	MARTINSBURGGOLFCLU	3	4	2
964	CAMPFRAME	3	7	1
974	MARTINSBURGPLAZA	4	2	2
967	BERKELEYPLAZA	4	2	2
961	BERKELEYINDUSTRIAL	5	1	2
974	SCHMIDTBAKINGCO	5	2	2
971	SHEPPARDSTIENCO	5	2	2

STZ#	Berkeley County continued	Classification	Subclassification	Ownership
973	ROYCEHOISERYMILLS	5	2	2
962	PETINC	5	3	2
961	CORNINGGLASS	5	3	2
984	DUPONT	5	3	2
971	NATIONALFRUIT	5	3	2
974	PERFECTIONGARMENT	5	3	2
971	MARTINMARIETTA	5	3	2
966	GENERALMOTORS	5	3	2
967	COCDETACHMENT	6	1	1
971	NGUNITMARTINSBURG	6	2	1
972	WEPMANMARTINSBURG	6	3	2
972	WESMANMARTINSBURG	6	3	2
971	COCHOUSEMBURG	6	5	1
966	NAYLORMEMORIAL	6	6	1
971	MARTINSBURGPUBLIC	6	6	1
984	NOBERKELEYBRANCH	6	6	1
967	MARTINSBURGNORTH	7	1	1
971	MARTINSBURGSOUTH	7	1	1
962	MUSSELMAN	7	2	1
966	HEDGESVILLE	7	2	1
971	MARTINSBURG	7	2	1
966	J.RUMSEYVOC-TECHCE	7	4	1
972	MARTINSBURG	8	2	2
970	O'BOYLETANKLINES	8	3	2
971	WHITTINGTONTRANSFE	8	3	2
972	COOKMOTORLINES	8	3	2
982	CONSOLIDATEDFRTWAY	8	3	2
984	RUDECARRIERCORP	8	3	2
961	MARTINSBURGMUNICIP	8	4	1
971	MARTINSBURG	9	3	1
969	WHEATLAND	10	2	2
969	WINDE-WALD	10	2	2
971	GATEWAYINN	10	2	2
972	MARTINSBURG MOTEL	10	2	2
984	MOTEL81	10	2	2
961	PIKESIDE	10	2	2
957	HOLIDAYINN	10	2	2
967	SHADYREST	10	2	2
969	FLAGG	10	2	2
959	RON-DE	10	2	2

STZ#	Marion County continued	Classification	Subclassification	Ownership

Marshall County

STZ#				
1021	MOUNDSVILLEGENERAL	1	2	1
1023	REYNOLDSMEMORIAL	1	2	1
1034	MCCONAUGHEYHOME	1	3	2
1020	GRAVECREEKMOUND	2	1	1
1020	GRAVECREEKMOUND	3	1	1
1018	QUIETRESTCAMPING	3	2	2
1029	MOUNDSVILLECCCLUB	3	4	2
1020	MOUNDSVILLEPLAZA	4	2	2
1035	COOK'SPLAZA	4	2	2
1032	GARVINSJERSEY,INC.	5	2	2
1035	WHEELINGSTEEL	5	3	2
1023	MARXCO	5	3	2
1023	TRIANGLECONDUITCO	5	3	2
1016	PITTSBURGHPLATEGLA	5	3	2
1016	MOBAYCHEMICAL	5	3	2
1018	ALLIEDCHEMICAL	5	3	2
1022	FOSTORIAGLASS	5	3	2
1022	U.S.STAMPINGCO	5	3	2
1020	COADETACHMENT	6	1	1
1021	NGUNITMOUNDSVILLE	6	2	1
1020	WEIFAMMOUNDSVILLE	6	3	2
1020	COCHOUSEMOUNDSVILL	6	5	1
1021	MIRACLEVALLEYREGIO	6	6	1
1031	MCMECHENPUBLICBRAN	6	6	1
1034	CAMERONPUBLICBRANC	6	6	1
848	SAINTJOSEPH	7	1	2
1020	MOUNDSVILLE	7	1	1
1020	STFRANCISXAVIER	7	1	2
1031	STJAMESANDJOHN	7	1	2
1032	SHERRARD	7	1	1
1032	OURLADYOFPEACE	7	1	2
1035	UNION	7	1	1
1023	JOHNMARSHALL	7	2	1
1031	BISHOPDONAHUE	7	2	2
1034	CAMERON	7	2	1
1021	KITTLEPAULING&SUPP	8	3	2
1023	GLENDALEAIRPARK	8	4	2
1016	ALLIEDCHEMICAL	8	5	2
1016	HANNACOAL	8	5	2
1016	P.P.G.CHEMICALS	8	5	2
1016	MOBAYCHEMICALS	8	5	2
1020	VALLEYCAMPCOAL	8	5	2

STZ#	Marshall County continued	Classification	Subclassification	Ownership
1035	HANNACOAL	8	5	2
1035	WHEELINGPITTSTEEL	8	5	2
1035	BENWOOD	9	1	1
1031	MCMECHEN	9	1	1
1020	MOUNDSVILLE	9	3	1
1018	TERRACE	10	2	2
1021	WRIGHT	10	2	2
1023	HAVEN	10	2	2
1023	REILLEYARMS	10	2	2
1029	MOUND	10	2	2
1020	GRAVECREEKMOUND	11	1	1

Mason County

STZ#				
540	PLEASANTVALLEY	1	2	1
592	LAKINSTATE	1	4	1
539	POINTPSGROUND	2	1	1
539	PTPLEASANTMONUMENT	3	1	1
535	ASHTONRIVERVIEWCAM	3	2	2
536	JERRYSRUNCAMPINGAR	3	2	2
536	CHIEFCORNSTALKPHA	3	2	1
538	SHADYWATERSRESORT	3	2	2
592	MCCLINTICWILDLIFE	3	2	1
592	HIDDENVALLEYCOCLUB	3	4	2
536	MASONCOUNTYYOUTH	3	7	1
538	STAUFFERCHEMICAL	5	2	2
540	WVAMALLEABLEIRON	5	2	2
546	FOOTEMINERALCO.	5	3	2
536	GOODYEARTIRE	5	3	2
539	COBDETACHMENT	6	1	1
592	NGUNITPTPLEASANT	6	2	1
539	COCHOUSEPTPLEASANT	6	5	1
540	MASONCOPUBLIC	6	6	1
545	MASONCOUNTYPUBLIC	6	6	1
546	NEWHAVENPUBLIC	6	6	1
544	POINTPLEASANT	7	1	1
535	HANNAN	7	2	1
540	POINTPLEASANT	7	2	1
545	WAHAMA	7	2	1
544	MASONCOVOC-TECHCEN	7	4	1
592	MASONCOAIRPORT	8	4	1
537	UNIONCARBIDE	8	5	2
545	LIEVINGCOAL	8	5	2
545	RIVERCOAL	8	5	2
546	OHIOPOWER	8	5	2
539	POINTPLEASANT	9	2	1
539	LOWESMOTOR	10	2	2
592	REDCARPETINN	10	2	2

STZ#	Boone County	Classification	Subclassification	Ownership
248	BOONEMEMORIAL	1	2	1
253	FORKCREEKPHA	3	2	1
246	RIVERVIEWCCUNTRYCL	3	4	2
248	WALHONDE	3	4	1
250	CODDETACHMENT	6	1	1
251	COBDETACHMENT	6	1	1
247	COCHOUSEMADISON	6	5	1
247	BOONE-MADISONPUB	6	6	1
244	RAMAGE	7	1	1
244	JEFFERYSPENSER	7	1	1
245	WHARTON	7	1	1
247	MADISONDANVILLE	7	1	1
248	VANEL	7	1	1
250	WHITESVILLE	7	1	1
251	LORYJULIAN	7	1	1
252	COMFORT	7	1	1
252	SETH	7	1	1
253	ASHFORDRUMBLE	7	1	1
253	NELLIS	7	1	1
253	PEYTONA	7	1	1
247	SCOTT	7	2	1
248	VAN	7	2	1
252	SHERMAN	7	2	1
247	BOONECOVOC-TECHCEN	7	4	1
247	MADISON	10	1	2
244	WILLIAMS	10	2	2
247	HOMESTEAD	10	2	2
251	ROSEDALE	10	2	2
251	RANDRMOTEL	10	2	2

STZ#	Braxton County	Classification	Subclassification	Ownership
581	GASSAWAY	1	2	1
213	C.WARSALTPETERCAVE	2	1	1
186	SLOTHFOSSILBONES	2	1	2
209	GRISTMILLHIGGIBOTH	2	1	2
593	BEERUN	3	2	1
584	BAKERRUN-MILLCREEK	3	2	1
584	BROCKRUN	3	2	1
584	KANAWHARUN	3	2	1
583	BRAXTONCOUNTY	3	7	1
583	COADETACHMENT	6	1	1
582	NGUNITGASSAWAY	6	2	1
583	WSGBAMSUTTON	6	3	2
583	COCHOUSESUTTON	6	5	1
581	GASSAWAYPUBLIC	6	6	1
583	SUTTONPUBLIC	6	6	1
581	GASSAWAY	7	1	1
583	SUTTON	7	1	1

STZ#	Braxton County continued	Classification	Subclassification	Ownership
596	BURNSVILLE	7	1	1
583	BRAXTONCOUNTY	7	2	1
581	LINCOLN	10	1	2
583	MIDWAY	10	1	2
583	SUTTONAIRPORT	8	4	1
580	TRAVELERSINN	10	2	2
583	ELKMOTORCOURT	10	2	2
583	LAURELCOURT	10	2	2
586	MOTEL79	10	2	2

Brooke County

1079	WELLSBURGEYE-EAR	1	2	1
1074	JONESNURSINGHOME	1	3	2
1083	BROOKEHAVENINC	1	3	2
1076	OLDMAIN.BETHANYCOL	2	1	2
1077	A.CAMPBELLMANSION	2	1	2
1077	PEACEPOINTCAMPGROU	3	2	2
1077	BROOKEHILLSPARK	3	2	1
1081	HIGHLANDSPRSGOLFCO	3	4	1
1082	VILLAGEGREENGOLFCO	3	4	2
1079	WVAPULPANDPAPERCO	5	2	2
1087	FORTSTEUBENMETAL	5	2	2
1078	MAMMOTHPLASTICS	5	2	2
1078	CRESCENTGLASS	5	2	2
1088	COLLIERSTEELCORP	5	2	2
1087	SIGNODECORP	5	2	2
1087	CONTINENTALCANCO	5	2	2
1078	MURPHYFABRICATION	5	2	2
1078	EAGLECO	5	3	2
1074	WHEELINGSTEEL	5	3	2
1086	WHEELINGSTEEL	5	3	2
1086	KOPPERS	5	3	2
1078	COADETACHMENT	6	1	1
1076	WVBCFMBETHANY	6	3	2
1079	COCHOUSEWELLSBURG	6	5	1
1078	BROOKECOPUBLIC	6	6	1
1083	HOOVERSONHTSBRANCH	6	6	1
1074	BEECHBOTTOMMIDDLE	7	1	1
1076	BETHANYMIDDLE	7	1	1
1079	WELLSBURGMIDDLE	7	1	1
1079	STJOHNWELLSBURG	7	1	2
1083	FOLLANSBEEMIDDLE	7	1	1
1083	STANTHONY	7	1	2
1087	EDGEWOODMIDDLE	7	1	1
1082	BROOKECOUNTY	7	2	1
1076	BETHANYCOLLEGE	7	3	2
1074	DONSWARTTRUCKINGCO	8	3	2
1087	P.L.HIGGINSTRUCKIN	8	3	2
1076	GRESHAMHOUSE	10	1	2
1074	DONSWART	8	5	2
1081	WEIRTONICEANDCOAL	8	5	2
1086	WHEELINGSTEEL	8	5	2

STZ#	Brooke County continued	Classification	Subclassification	Ownership
1086	KOPPERS	8	5	2
1087	WEIRTONICEANDCOAL	8	5	2
1078	WELLSBURG	9	1	1
1083	FOLLANSBEE	9	1	1
1087	WEIRTON	9	1	1
1074	MIDTOWN	10	2	2
1083	WASHINGTONTRAIL	10	2	2
1077	BETHANYCOLLWOODS	11	1	2

Cabell County

315	HUNTINGTONHOSPITAL	1	2	1
326	ORTHOPEDICHTGN	1	2	1
326	DOCTORSMEMORIAL	1	2	2
319	SAINTMARYHOSPITALL	1	2	1
323	GUTHRIEMEMORIAL	1	2	2
326	CABELLHTGNHOSPITAL	1	2	1
312	HORRISMEMORIAL	1	3	2
319	PLEASANTVIEWMANOR	1	3	2
319	CUSTODIALCARE	1	3	2
323	FAIRHAVENRESTHOME	1	3	2
325	BRUMFIELDSCARE	1	3	2
326	HILLVIEWNURSING	1	3	2
326	GOLDENYEARSCUST	1	3	2
327	HUNTINGTON STATE	1	4	1
343	BARBOURSVILLESTATE	1	4	1
315	B&ORAILROADDEPOT	2	1	2
316	OLDMAIN.MARSHALL	2	1	1
360	COLLINSTRAILERPARK	3	2	2
221	SUGARWOODGOLF&COUN	3	4	1
341	GUYANGOLF&COUNTRYC	3	4	2
342	GLENBRIERCOUNTRYCL	3	4	1
342	RIVIERACOUNTRYCLUB	3	4	2
343	KNOBHILLGOLFCOURSE	3	4	2
343	ORCHARDHILLSCOUNTR	3	4	2
344	DAVISCREEKCAMP	3	7	1
325	FAIRFIELDSTADIUM	3	8	1
326	FAIRFIELDPLAZA	4	2	2
344	EASTERNHEIGHTS	4	2	2
342	KYLEFIELDINDPARK	5	1	2
319	HUNTINGTONINDPARK	5	1	2
317	LOGANPACKINGCO	5	2	2
321	MAIDENFORM	5	2	2
360	BLENKOGLASS	5	2	2
322	DELAVALTURBINE	5	2	2
323	ARMSTRONGCO.	5	2	2
322	HEINERSBAKERY	5	2	2
315	HTGNPUBLISHING	5	3	2
317	ACFINDUSTRIES	5	3	2
319	PERRYNORVELLCO	5	3	2
324	OWENSILLINOISGLASS	5	3	2

STZ#	Cabell County continued	Classification	Subclassification	Ownership
328	KEPRGLASSCOMPANY	5	3	2
317	CONNORSSTEELCO.	5	3	2
328	INTNICKELCORP	5	3	2
322	ENSIGNELECTRICCO	5	3	2
324	HOUDAILLEINDUSTRY	5	3	2
333	CHEMTRONCORP	5	3	2
315	HUNTINGTONIND	5	3	2
344	COBDETACHMENT	6	1	1
322	NGUNITHUNTINGTON	6	2	1
315	WGNTAMHUNTINGTON	6	3	2
315	WKEEAMHUNTINGTON	6	3	2
315	WKEEFMHUNTINGTON	6	3	2
316	WMULAMHUNTINGTON	6	3	1
322	WWHYAMHUNTINGTON	6	3	2
315	WHTNTVHUNTINGTON	6	4	2
316	WMULTVHUNTINGTON	6	4	1
315	COCHOUSEHUNTINGTON	6	5	1
315	CABELLCOPUBLIC	6	6	1
322	HUNTINGTONWESTBRAN	6	6	1
327	GALLAHERVILLAGEBRA	6	6	1
343	BARBOURSVILLEBRANC	6	6	1
360	MILTONBRANCH	6	6	1
310	SALTROCK	7	1	1
312	ONA	7	1	1
315	OLEY	7	1	1
315	SAINTJOSEPH	7	1	2
318	ENSLOW	7	1	1
321	SACREDHEART	7	1	2
322	WEST	7	1	1
326	HTGNHOSPITAL	7	1	1
327	LINCOLN	7	1	1
331	OURLADYOFFATIMA	7	1	2
332	BEVERLYHILLS	7	1	1
340	CAMPACK	7	1	1
342	COXLANDING	7	1	1
343	BARBOURSVILLE	7	1	1
360	MILTON	7	1	1
315	STJOSEPH	7	2	2
318	HUNTINGTONEAST	7	2	1
325	HUNTINGTON	7	2	1
343	BARBOURSVILLE	7	2	1
360	MILTON	7	2	1
316	MARSHALL	7	3	1
318	CABELLCOVOC-TECHCE	7	4	1
315	HUNTINGTON	8	1	2
315	HUNTINGTON	8	2	2
315	REFRIGERATEDEXPRES	8	3	2
317	COMMERCIALMOTORFRT	8	3	2
317	RUSSELLTRANSFER	8	3	2
317	YELLOWFREIGHTSYSTU	8	3	2
321	COOKMOTORLINE	8	3	2
321	POINTEXPRESS	8	3	2
322	O.K.TRUCKING	8	3	2
327	CHAPMANTRUCKINGCO	8	3	2

STZ#	Cabell County continued	Classification	Subclassification	Ownership
329	C.I.WHITTENTRANSFE	8	3	2
331	SMITHTRANSFER	8	3	2
341	CASEDRIVEWAY	8	3	2
344	CARROLLTRUCKINGCO	8	3	2
359	WILSONFREIGHT	8	3	2
342	NEWLONAIRPORT	8	4	1
317	TRI-STATEMATERIALS	8	5	2
319	OHIORIVERCO	8	5	2
323	AMHERSTINDUSTRIES	8	5	2
315	HUNTINGTON	9	5	1
315	FIFTHAVENUE	10	1	2
315	FREDERICK	10	1	2
315	HUNTINGTON	10	1	2
315	JONES	10	1	2
340	BILTMORE	10	1	2
315	HOLIDAYINNDOWNTOWN	10	2	2
315	UPTOWNERINN	10	2	2
322	TOURIST	10	2	2
341	GATEWAYINN	10	2	2
341	QUALITYCOURTS	10	2	2
344	HOLIDAYINNEAST	10	2	2
344	STONELODGE	10	2	2

Calhoun County

575	CALHOUNGENERAL	1	2	1
574	J.D.J.ACRES	3	2	2
576	CALHOUNJRODDFELLOW	3	2	2
574	RIVERSIDEGOLFCLUB	3	4	2
574	B.F.GOODRICHCO.	5	3	2
576	COBDETACHMENT	6	1	1
575	COCHOUSEGRANTSVILL	6	5	1
575	CALHOUNCOPUBLIC	6	6	1
573	MINNORA	7	1	1
574	ARNOLDSBURG	7	1	1
576	BROOKSVILLE	7	1	1
575	CALHOUN	7	2	1
575	CALHOUN-GILMERVOC-	7	4	1
574	HOUCHINS	10	2	2
575	RIVERSIDE	10	2	2

STZ#	Clay County	Classification	Subclassification	Ownership
516	BRADLEYFIELD	3	7	1
516	COBDETACHMENT	6	1	1
515	COCHOUSECLAY	6	5	1
516	CLAYCOPUBLIC	6	6	1
514	HEWHITE	7	1	1
515	BROWNEL	7	1	1
515	LIZEMORE	7	1	1
516	CLAY	7	1	1
516	VALLEYFORK	7	1	1
516	CLAY	7	2	1
516	HENRYCLAY	10	1	2

Doddridge County

704	COADETACHMENT	6	1	1
706	COCHOUSEWESTUNION	6	5	1
706	DODDRIDGECOPUBLIC	6	6	1
704	GREENWOOD	7	1	1
704	SUMMERS	7	1	1
705	MIDDLEISLAND	7	1	1
706	WESTUNION	7	1	1
707	BIGISAAC	7	1	1
707	CARR	7	1	1
707	GREENBRIER	7	1	1
707	SMITHBURG	7	1	1
708	CENTERPOINT	7	1	1
708	SEDALIA	7	1	1
706	DODDRIDGE	7	2	1
704	GREENWOOD	10	2	2

STZ#	Fayette County	Classification	Subclassification	Ownership
264	OAKHILLHOSPITAL	1	2	2
276	MONTGOMERYGENERAL	1	2	1
266	HILLTOPHOME	1	3	2
273	CHRISTIANHOME	1	3	2
269	BABCOCK	3	1	1
280	HAWKSNEST	3	1	1
255	PLUMORCHARDPHA	3	2	1
266	SLEEPYHOLLOWCAMPGR	3	2	2
269	BABCOCKSTATEPARK	3	2	1
281	PATTYHILLCAMPGROUN	3	2	2
284	NEWRIVERCAMPGROUND	3	2	2
205	RAINELLEGOLFCLUB	3	4	2
267	WHITEOAKCOUNTRYCLU	3	4	2
294	HAWKSNESTCOUNTRYCL	3	4	2
272	CAMPBECKWITH	3	7	1
275	WASHINGTONCARVER	3	7	1
267	FAYETTEPLATEAUPARK	5	1	2
278	UNIONCARBIDE	5	3	2
264	LONGAIRDOXCORP	5	3	2
264	CODDETACHMENT	6	1	1
280	CODDETACHMENT	6	1	1
264	NGUNITOAKHILL	6	2	1
278	NGUNITMONTGOMERY	6	2	1
266	WOAYAMOAKHILL	6	3	2
266	WOAYFMOAKHILL	6	3	2
266	WOAYTVOAKHILL	6	4	2
273	COCHOUSEF*VILLE	6	5	1
260	MTHOPECOMMUNITYBRA	6	6	1
264	OAKHILLBRANCH	6	6	1
273	FAYETTECOPUBLIC	6	6	1
260	MOUNTHOPEMIDDLE	7	1	1
261	SCARBRO	7	1	1
262	PAGE	7	1	1
264	COLLINS	7	1	1
265	ROSEDALE	7	1	1
265	OAKHILLCATHOLIC	7	1	2
267	SUMMERLEE	7	1	1
276	MONTGOMERY	7	1	1
277	OAKLAND	7	1	1
278	FALLVIEW	7	1	1
280	ANSTEDMIDDLE	7	1	1
282	CANNELTON	7	1	1
283	GAULEYBRIDGE	7	1	1
284	JODIE	7	1	1
256	MOUNTHOPE	7	2	1
258	MEADOWBRIDGE	7	2	1
264	COLLINS	7	2	1
273	FAYETTEVILLE	7	2	1
275	NUTALL	7	2	1
277	MONTGOMERY	7	2	1
280	ANSTED	7	2	1
283	GAULEYBRIDGE	7	2	1
276	WVATECH	7	3	1

STZ#	Fayette County continued	Classification	Subclassification	Ownership
265	FAYETTEPLATEAUVOC-	7	4	1
257	PRINCE	8	2	2
264	BROWIESSERVICEINC	8	3	2
276	COOKMOTORLINES	8	3	2
274	FAYETTEAIRPORT	8	4	2
280	LEEMASSEYAIRPORT	8	4	2
278	ALLIEDCHEMICAL	8	5	2
278	HUMBLECIL	8	5	2
278	UNIONCARBIDE	8	5	2
264	OAKHILL	9	1	1
264	HILL	10	1	2
284	CONLEY	10	1	2
269	BABCOCK	10	3	1
280	HAWKSNEST	10	3	1
279	GLENFERRISINN	10	2	2
274	YEAGERS	10	2	2
277	ROCKETTE	10	2	2
280	COASTTOCOAST	10	2	2
285	SHIRLEYS	10	2	2
279	KANAWHAFALLS	11	1	1
281	NEWRIVERGORGE	11	1	2

Gilmer County

589	CEDARCREEK	3	1	1
589	CEDARCREEKSTATEPAR	3	2	1
589	HERSMANRECREATION	3	2	2
602	GLENVILLEGOLFCLUB	3	4	2
602	COUNTYRECCENTER	3	7	1
602	KINNEYSHOECORP.	5	2	2
590	COADETACHMENT	6	1	1
601	COCHOUSEGLENVILLE	6	5	1
588	NORMANTOWN	7	1	1
590	SANDFORK	7	1	1
602	TANNER	7	1	1
602	TROY	7	1	1
601	GILMERCOUNTY	7	2	1
601	GLENVILLESTATE	7	3	1
601	PIONEER	10	2	2
601	CONRAD	10	2	2

STZ#	Grant County	Classification	Subclassification	Ownership
816	GRANTMEMORIAL	1	2	1
816	BIGBEND	3	2	1
816	FOXANDOXCAMP	3	2	2
819	ROLLINGACRESCAMPGR	3	2	2
816	CAMPECHO	3	7	1
817	EDINBURGMFG	5	2	2
816	ALLIED/EGRYSYSTEMS	5	2	2
817	COCOETACHMENT	6	1	1
817	COCHOUSEPETERSBURG	6	5	1
817	PETERSBURGPUBLIC	6	6	1
817	PETERSBURG	7	2	1
818	UNION	7	2	1
817	SOBRANCHVOC-TECHCE	7	4	1
816	DETTINBURNTRUCKING	8	3	2
817	SOBRANCHMOTORFREIG	8	3	2
816	PETERSBURGAIRPORT	8	4	1
816	FORTHILL	10	2	2
817	HERMITAGE	10	2	2
817	PARK	10	2	2
817	TOWNHOUSEMOTEL	10	2	2
818	BOB-INNMOTEL	10	2	2
818	MILLSMOTEL	10	2	2
818	MOUNTAINEER	10	2	2
819	LAHMANSHOMESTEAD	10	2	2
819	LITTLEBROWNEAT	11	1	1

Greenbrier County

STZ#	Greenbrier County continued	Classification	Subclassification	Ownership
190	GREENBRIERVALLEY	1	2	2
189	GREENBRIERMANOR	1	3	2
203	GREENBRIERCOURTHOO	2	1	1
203	OLDSTONECHURCH	2	1	2
203	SUPREMECTLIBRARY	2	1	1
187	THEGREENBRIER	2	1	2
203	STUARTMANOR	2	1	2
186	SECONDCREEKCAMPGRO	3	2	2
187	GREENBRIERRIVERCAM	3	2	2
192	GREENBRIERSTFOREST	3	2	1
192	GREENBRIERMOUNTAIN	3	2	2
209	MOUNTAINVIEWFARM	3	2	2
210	YOUNGSCAMPGROUNDS	3	2	2
210	BLUEBEND	3	2	1
210	LAKESHERWOOD	3	2	1
214	SUMMITLAKE	3	2	1
187	THEGREENBRIER	3	4	2
187	THEGREENBRIER	3	4	2
187	THEGREENBRIER	3	4	2
187	VALLEYVIEWCOUNTRYC	3	4	2
202	COUNTYYOUTHCAMP	3	7	1
189	REDOAKSCENTER	4	2	2
187	WSSSHOPPINGCENTER	4	2	2
205	GEORGIAPACIFIC	5	2	2
202	BENDIXCORP.	5	3	2
202	CODDETACHMENT	6	1	1
190	NGUNITRONCEVERTE	6	2	1
189	WRONAMRONCERVTE	6	3	2
203	COCHOUSELEWISBURG	6	5	1
187	WTSULPHURSPRPUBLIC	6	6	1
203	GREENBRIERCOUNTY	6	6	1
205	RAINELLEPUBLIC	6	6	1
187	WHITESULPHUR	7	1	1
188	ALDERSON	7	1	1
190	GREENBRIER	7	1	1
201	SMOOT	7	1	1
203	LEWISBURG	7	1	1
205	RAINELLE	7	1	1
206	RUPERT	7	1	1
209	WILLIAMSBURG	7	1	1
211	CHRICHTON	7	1	1
213	RENICK	7	1	1
203	GREENBRIEREAST	7	2	1
211	GREENBRIERWEST	7	2	1
208	JOHNSONTRUCKINGCO	8	3	2
187	GREENBRIERAIRPORT	8	4	1
189	BOONEFIELD	8	4	2
202	GREENBRIERVALLEY	8	4	1
206	RAINELLEAIRPORT	8	4	1
187	GREENBRIER	10	1	2
187	WESTVIRGINIAN	10	1	2
203	HOTELNEELY	10	1	2
187	ALVON	10	2	2
187	ALLSTATE	10	2	2
187	COLONIALCOURT	10	2	2
187	MOUNTAINBROWLODGE	10	2	2
187	OLDWHITE	10	2	2
187	VILLAGE	10	2	2
190	GATEWAYINN	10	2	2
202	OLDCOLONYINN	10	2	2
202	SUNSETTERRACE	10	2	2
203	FORTSAVANNAH	10	2	2
203	GENERALLEWIS	10	2	2
203	LEWISBURGTOWNHOUSE	10	2	2
205	RAINELLEMOTORLODGE	10	2	2
209	JIMS	10	2	2
209	MTVIEWFARM	10	2	2
186	ORGANCAVEFORMATION	11	1	1
186	GREENBRIERCAVERNS	11	1	2
186	HEDRICKSCAVE	11	1	2
201	MUDDYCREEKCAVE	11	1	2
202	LOSTWORLDCAVERNS	11	1	2
210	NO.FORKANTHONYCRK.	11	1	1

STZ#	Hampshire County	Classification	Subclassification	Ownership
948	HAMPSHIREMEMORIAL	1	2	1
947	KIDWELLRESTHOME	1	3	2
946	COLDSTREAMCAMPGROU	3	2	2
946	COLDSTREAMK.O.A.	3	2	2
944	JUDYSTRAILERCOURT	3	2	2
944	NATHANIELMT.PHFA	3	2	1
944	PARKER'SGROVE	3	2	2
944	WAPOCOMO	3	2	2
945	SHORTMT.PHFA	3	2	1
946	HAWKRECREATIONAREA	3	2	1
946	BAKER'SCAMP	3	2	2
948	MILESONSWALNUTGROV	3	2	2
949	GREENMEADOWSCAMPGR	3	2	2
946	CAPONSPRINGS&FARM	3	4	2
948	KINNEYSHOECORP	5	3	2
947	COCDETACHMENT	6	1	1
947	COCHOUSEROMNEY	6	5	1
946	CAPONBRIDGEPUBLIC	6	6	1
947	HAMPSHIRECOUNTY	6	6	1
946	CAPONBRIDGE	7	1	1
947	ROMNEY	7	1	1
947	HAMPSHIRECOUNTY	7	2	1
947	HAMPSHIRECOVOC-TEC	7	4	1
946	CAPONSPRGSAIRPORT	8	4	1
943	MANORLANDPOST	10	2	2
944	KOOLWINK	10	2	2
946	GREENLANTERN	10	2	2
947	HOUSERS	10	2	2

STZ#	Hancock County	Classification	Subclassification	Ownership
1104	WEIRTONOSTEOPATHIC	1	2	1
1105	WEIRTONGENERAL	1	2	1
1104	WIERTONCONVHOME	1	3	2
1114	OLDCOURTHOUSE	2	1	1
1092	TOMLINSONRUN	3	1	1
1115	KENNEDYPARKMARINA	3	2	2
1101	WILLIAMSCOUNTRYCLU	3	4	2
1104	PLEASANTVALLEYGOLF	3	4	2
1114	WOODVIEWGOLFCOURSE	3	4	1
1117	WATERFORDPARK	3	5	2
1092	TOMLINSONSRUN	3	7	1
1103	PREMIERCENTER	4	2	2
1103	WEIRTONPLAZA	4	2	2
1116	NATIONALCHURCHCO	5	2	2
1092	AIRREDUCTION	5	2	2
1120	OHIOBRASS	5	2	2
1119	CELOTEXCORP.	5	2	2
1115	QUAKERSTATEOIL	5	2	2
1117	GLOBEREFRACTORS	5	3	2
1120	LAUGHLINCHINA	5	3	2

STZ#	Hancock County continued	Classification	Subclassification	Ownership
1119	TAYLORSMITHCOMPANY	5	3	2
1102	NATIONALSTEEL	5	3	2
1102	STARVIGGINDUSTRY	5	3	2
1103	COADETACHMENT	6	1	1
1103	WEIRAMWEIRTON	6	3	2
1113	COCHOUSENEWCUMBER	6	5	1
1101	MARYHWEIRPUBLIC	6	6	1
1113	SWANEYMEMORIAL	6	6	1
1118	NORTHHANCOCKAREA	6	6	1
1101	SAINTPAUL	7	1	2
1101	WEIR	7	1	1
1103	SAINTJOSEPH	7	1	2
1103	SACREDHEARTOFMARY	7	1	2
1113	NEWCUMBERLAND	7	1	1
1118	CHESTER	7	1	1
1120	WELLS	7	1	1
1103	WEIR	7	2	1
1103	MADONNA	7	2	2
1113	OAKGLEN	7	3	1
1103	WVANORTHENCOMM	7	3	1
1088	WEIRTONAIRPORT	8	4	1
1116	HERRONFIELD	8	4	2
1105	NATIONALSTEEL	8	5	2
1115	QUAKERSSTATEOIL	8	5	2
1115	C.F.Y.INC.	8	5	2
1119	CHESTER	9	1	1
1101	WEIRTON	9	3	1
1087	TOWNHOUSE	10	2	2
1101	WEIRTONMOTORINN	10	2	2
1103	WEIRTON	10	2	2
1117	WATERFORDINN	10	2	2
1092	TOMLINSONRUNSP	11	2	1

STZ#	Hardy County	Classification	Subclassification	Ownership
824	FORTPLEASANT	2	1	2
822	LOSTRIVER	3	1	1
825	TROUTPOND	3	2	1
825	WOLFGAP	3	2	1
821	VALLEYVIEW	3	4	1
825	CAMPPINNACLE	3	7	1
823	ROCKINGHAMPCULTRY	5	2	2
823	RAYGOLDMANU	5	2	2
823	COCDETACHMENT	6	1	1
821	WELDAMFISHER	6	3	2
823	COCHOUSEMOOREFIELD	6	5	1
823	HARDYCOPUBLIC	6	6	1
822	MATHIAS	7	2	1
823	MOOREFIELD	7	2	1
825	WARDENSVILLE	7	2	1
825	HARDYCOVOC-TECHCEN	7	4	1
824	MOOREFIELDMUNICIPA	8	4	1
825	SEES	10	1	2
822	LOSTRIVER	10	2	2
823	BEANSTOURIST	10	2	2
823	HARPERSMOTEL	10	2	2
825	TROUTPOND	11	1	1

Harrison County

STZ#	Harrison County	Classification	Subclassification	Ownership
734	CLARKSBURGVAHOSP	1	1	2
727	UNITEDHOSPCENTER	1	2	1
740	UNITEDHOSPITALDOWT	1	2	1
740	LIDACLARKHOME	1	3	2
760	HERITAGEHOME	1	3	2
771	LEVISHINNHOUSE	2	1	2
722	WATTERSSMITHMEM	3	1	1
755	TAYLORSTRAILERPARK	3	2	2
760	GLASSBARNCAMPGROUN	3	2	2
762	SYCAMOREROADCAMPGR	3	2	2
724	BEL-MEADOWCCCLUB	3	4	1
726	CLARKSBURGCOCLUB	3	4	2
726	SUNNYCROFTCOCLUB	3	4	2
726	HIDE-A-WAYGOLFCOUR	3	4	1
731	CRESTVIEWGOLFCOURS	3	4	1
765	BRIDGEPORTCCCLUB	3	4	2
754	HILLSPLAZA	4	2	2
754	HOLIDAYPLAZA	4	2	2
754	TERRACEPLAZA	4	2	2
755	VALLEYHILLSCENTER	4	2	2
759	BENEDUMAIRINDPARK	5	1	2
735	MAIDENFORM	5	2	2
732	HARVEYINDUSTRIES	5	2	2
739	EAGLECONVEXGLASS	5	2	2
727	INGERSOLLRAND	5	2	2
739	HINKLEBROS	5	2	2
739	LOCKHEEDAIRCRAFT	5	2	2
740	ROLLANDGLASS	5	3	2
740	BROCKWAYGLASSCO.	5	3	2
731	UNIONCARBIDE	5	3	2
736	COADETACHMENT	6	1	1
758	COAHEADQUARTERS	6	1	1
727	NGUNITCLARKSBURG	6	2	1
761	NGUNITSALEM	6	2	1
740	WBOYAMCLARKSBURG	6	3	2
740	WHARAMCLARKSBURG	6	3	2
740	WBOYTVCLARKSBURG	6	4	2
740	COCHOUSECLARKSBURG	6	5	1
740	CLARKSBURGPUBLIC	6	6	1
754	BENEDUMCIVICCENTER	6	6	1
771	SHINNSTONPUBLIC	6	6	1
735	SAINTMARY	7	1	2
736	NORWOOD	7	1	1
739	BROADWAY	7	1	1
740	CENTRAL	7	1	1
741	NORTHVIEW	7	1	1
753	ALLSAINTS	7	1	2
754	BRIDGEPORT	7	1	1
756	SALEM	7	1	1
757	SUMMITPARK	7	1	1
764	GORE	7	1	1
766	WALLACE	7	1	1
770	ENTERPRISE	7	1	1
771	SHINNSTON	7	1	1
773	WYATT	7	1	1
722	SOUTHHARRISCN	7	2	1
727	LIBERTY	7	2	1
732	WASHINGTONIRVING	7	2	1
735	NOTREDAME	7	2	2
740	ROOSEVELTWILSON	7	2	1
753	BRIDGEPORT	7	2	1
767	LUMBERPORT	7	2	1
771	SHINNSTON	7	2	1
756	SALEMCOLLEGE	7	3	2
740	KELLYMILLERVOC-TEC	7	4	1
764	UNITEDCAREERCENTER	7	4	1
740	CLARKSBURG	8	1	2
760	HALLSMOTORTRANSIT	8	3	2
731	COOKMOTORLINES	8	3	2
733	BYRONCONST.CO	8	3	2
739	ALLEGHEDYFRTLINES	8	3	2
740	ELMERG.BRAKEING	8	3	2
769	JOHNSONMOTORLINES	8	3	2
759	BENEDUMAIRPORT	8	4	1
754	BRIDGEPORT	9	1	1
756	SALEM	9	1	1
771	SHINNSTON	9	1	1
740	CLARKSBURG	9	3	1

STZ#	Harrison County continued	Classification	Subclassification	Ownership
740	GORE	10	1	2
740	PARSONS	10	1	2
740	SHERATONINN	10	1	2
740	STONEWALLJACKSON	10	1	2
727	TOWNEHOUSEWEST	10	2	2
733	RIVERBEND	10	2	2
736	GREENBRIERMOTOR	10	2	2
739	HOLIDAYINN	10	2	2
752	HEDGES	10	2	2
752	TOWNEHOUSEMOTOREAS	10	2	2
752	TERRACE	10	2	2
755	ROTH	10	2	2
762	SUNCRESTCOURT	10	2	2
764	CUROTZ	10	2	2
768	BARNES	10	2	2

Jackson County

550	JACKSONGENERAL	1	2	1
548	RIPPLINGWATERS	3	2	2
550	ROLLINSLAKE	3	2	2
554	RUBYLAKECAMPGROUND	3	4	2
555	GREENHILLSCOCLUB	3	4	2
549	CEDARLAKESCAMP	3	7	1
559	RAVENSWOODPLAZA	4	2	2
551	MARTINISPORTSWEAR	5	2	2
555	KAISERALUMINUM	5	3	2
550	COBDETACHMENT	6	1	1
558	WMOVAMRAVENSWOOD	6	3	2
551	COCHOUSERIPLEY	6	5	1
551	JACKSONCOPUBLIC	6	6	1
558	RAVENSWOODBRANCH	6	6	1
548	KENNA	7	1	1
550	COTTAGEVILLE	7	1	1
551	RIPLEY	7	1	1
557	GILMORE	7	1	1
551	RIPLEY	7	2	1
559	RAVENSWOOD	7	2	1
557	ARCHA.MOOREJR.VOC-	7	4	1
550	POINTEXPRESS	8	3	2
562	RAVENSWOODAIRPORT	8	4	1
559	RAVENSWOOD	9	1	1
551	RIPLEY	9	1	1
551	ALPINEHOTEL	10	1	2
549	77MOTEL	10	2	2
551	COLONIAL	10	2	2
551	HI-WAY	10	2	2
559	EDGEWOOD	10	2	2
559	WASHINGTON	10	2	2

STZ#	Jefferson County	Classification	Subclassification	Ownership
1006	CHARLESTOWVGENERAL	1	2	1
1002	JEFFERSONMANOR	1	3	2
1005	KNOTTSHOME	1	3	2
1005	JEFFERSONCOURTHOUS	2	1	1
990	CLAYMONTCOURT	2	1	2
1012	STPETERSRCCHURCH	2	1	2
989	TRAVELLERSREST	2	1	2
999	PRATORIO	2	1	2
1014	RUMSEYHALL	2	1	2
1014	SHEPHERDSTOWNHIST.	2	1	2
990	HAREWOOD	2	1	2
1002	HAPPYRETREAT	2	1	2
1010	BEALL-AIR	2	1	2
1012	HISTORICALPARK	2	1	1
1014	RUMSEYMONUMENT	2	1	2
989	SHANG-RA-LA	3	2	2
1003	BLUERIDGEBENDFAMIL	3	2	2
1010	HARPERSFERRYK.O.A.	3	2	2
1010	SLEEPYHOLLOWGOLFCO	3	4	2
991	SHENANDOAHDOWNS	3	5	2
1002	CHARLESTOWNTRACK	3	5	2
1010	SHENANDOAHPLAZA	4	2	2
1010	SHENANDOAHQUARRY	5	2	2
1010	HALLTOWNPAPERCO	5	2	2
1006	DIXIENARCOCO	5	2	2
986	MINNESOTAMINING	5	3	2
1006	POWHATANCO	5	3	2
1002	COCDETACHMENT	6	1	1
1005	WXVAAMCHARLESTOWN	6	3	2
1005	WZFMFMCHARLESTOWN	6	3	2
1005	COCHOUSECHARLESTOW	6	5	1
1005	OLDCHARLESTOWNPUBL	6	6	1
1014	SHEPHERDSTOWNPUBLI	6	6	1
1002	CHARLESTOWN	7	1	1
1012	HARPERSFERRY	7	1	1
1013	SHEPHERDSTOWN	7	1	1
1004	JEFFERSON	7	2	1
1014	SHEPHERDCOLLEGE	7	3	1
1011	HARPERSFERRY	8	2	2
1005	CHARLESTOWN	9	1	1
1011	HILLTOPHOUSE	10	1	2
1002	KRATZ	10	2	2
1002	SHENANDOAH	10	2	2
1002	SPORTSMENMOTOR	10	2	2
1002	TOWNEHOUSEMOTOR	10	2	2
1002	TURF	10	2	2
1010	CLIFFSIDEMOTOR	10	2	2

STZ#	Kanawha County continued	Classification	Subclassification	Ownership
511	ELKVIEW	7	1	1
512	CLENDENIN	7	1	1
380	EASTBANK	7	2	1
388	NITRO	7	2	1
404	SAINTALBANS	7	2	1
413	SOUTHCHARLESTON	7	2	1
420	CHARLESTONCATHOLIC	7	2	2
421	CHARLESTON	7	2	1
430	GEORGEWASHINGTON	7	2	1
434	STONEWALLJACKSON	7	2	1
465	DUNBAR	7	2	1
482	DUPONT	7	2	1
503	SISSONVILLE	7	2	1
512	HERBERTHOOVER	7	2	1
427	MORRISHARVEY	7	3	2
467	WVACGSTUDIES	7	3	1
467	WVASTATE	7	3	1
420	GARNETCAREERCENTER	7	4	1
465	B.FRANKLINCAREER&T	7	4	1
482	CARVERCAREERCENTER	7	4	1
502	CREDEADULTEDCENTER	7	4	1
420	CHARLESTON	8	1	2
430	CHARLESTON	8	2	2
411	GORDONSTRANSPORT	8	3	2
411	SCHWERMANTRUCKING	8	3	2
421	ELKVALLEYMOTOREXPR	8	3	2
421	OKTRUCKINGCOMPANY	8	3	2
431	TOWERLINES	8	3	2
431	COMMERICALCARRIERS	8	3	2
432	ALLEGHENYFREIGHT	8	3	2
435	EAZOREXPRESS	8	3	2
435	JOHNSONMOTORLINES	8	3	2
435	REINHARDTTRANSFER	8	3	2
435	POINTEXPRESS	8	3	2
467	HALLSMOTORTRANSIT	8	3	2
471	CAROLINAFRTCARRIER	8	3	2
471	LEMMONTRANSPORT	8	3	2
471	CHEMICALTANKLINES	8	3	2
491	HOUFFTRANSFER	8	3	2
481	SMITHTRANSFER	8	3	2
481	UNITEDPARCEL	8	3	2
482	FALWELLFASTFRGIGHT	8	3	2
464	KANAWHACOAIRPORT	8	4	1
471	MIDWESTSTEELCORP	8	5	2
376	SO.APPALACHIANCOAL	8	5	2
384	MATERIALSHANDLING	8	5	2
412	PARKCORP	8	5	2
414	FOODMACHINERYCORP	8	5	2
414	UNIONCARBIDE	8	5	2
414	TROJANSTEEL	8	5	2
414	EVANSLEAD	8	5	2
430	KANAWHABLOCK	8	5	2
430	EXXONOIL	8	5	2
431	CAPITALIRON&METAL	8	5	2
467	W.VA.PAVING	8	5	2
467	UNIONCARBIDE	8	5	2
481	AMHERSTINDUSTRIES	8	5	2
482	DUPONT	8	5	2
482	WALKERMACHINERY	8	5	2
483	VALLEYCAMPCCAL	8	5	2
485	KELLEYSCR&NWESTRR	8	5	2
486	APPALACHIANPOWER	8	5	2
488	MONTGOMERYIRON&SCR	8	5	2
488	TEXACO	8	5	2
465	DUNBAR	9	2	1
388	NITRO	9	2	1
402	SAINTALBANS	9	3	1
413	SOUTHCHARLESTON	9	3	1
420	CHARLESTON	9	5	1
420	DANIELBOONE	10	1	2
420	HOLLEY	10	1	2
485	MID-WAY	10	1	2
384	GENES	10	2	2
384	JOHNSMILEYS	10	2	2
384	KANAWHATERRACE	10	2	2
384	RUSTIC	10	2	2
384	48STATES	10	2	2
405	BLAND	10	2	2
405	ELRANCHO	10	2	2
405	MODERN	10	2	2
405	TOWNCOUNTRY	10	2	2
411	LILLIANA	10	2	2
411	OWENS	10	2	2
411	MARVINS	10	2	2
411	WELCH	10	2	2
413	RAMADA	10	2	2
420	HEART-O-TOWN	10	2	2
420	HOLIDAYINNNO1	10	2	2
420	HOLIDAYINNNO2	10	2	2
421	MARVINMIDTOWN	10	2	2
425	IVYTERRACE	10	2	2
427	KANAWHACITYMOTOR	10	2	2
480	GOODS	10	2	2
481	MOUNTAINLODGE	10	2	2
490	YOUNGS	10	2	2
504	PARKMOTEL	10	2	2
504	RIVERIA	10	2	2
511	COOKS	10	2	2
512	JACKSONS	10	2	2
512	STUMPS	10	2	2
391	DWARFANEMOVEBED	11	1	1
413	SOCHARLESTONMOUND	11	1	1

STZ#	Kanawha County	Classification	Subclassification	Ownership
411	H.J.THOMASMEMORIAL	1	2	1
412	SOUTHERNHILLS-PICK	1	2	1
420	KANAWHAVALLEY	1	2	1
420	EYEANDEARCLINIC	1	2	2
420	SAINTFRANCIS	1	2	1
421	CHARLESTONGENERAL	1	2	1
421	MCMILLIANDIVCHARGE	1	2	1
427	CHARLESTONMEMORIAL	1	2	1
431	STAATS	1	2	2
384	RIVERSIDE	1	3	2
421	HARRELLNURSINGHOME	1	3	2
421	HOUSEOFMERCY	1	3	2
421	MTSTATENURSING	1	3	2
425	HIGHLANDHOSPITAL	1	4	2
413	INDIANMOUND	2	1	1
421	CRAIK-PATTONHOUSE	2	1	2
422	STATECAPITALMUSEUM	2	1	1
504	DBOONEROADSIDEPARK	2	1	1
391	KANAWHASTATEFOREST	3	2	1
503	GREENBERRYFARMKOA	3	2	2
383	BIGBENDGOLFCOURSE	3	4	1
396	BERRYHILLSCOCLUB	3	4	2
396	KANAWHACCUNTRYCLUB	3	4	2
404	STALBANSCHIP&PUT	3	4	1
434	CHARLESTONMUNICIPA	3	4	1
467	SHAWNEEGOLFCOURSE	3	4	1
505	COONSKINPARKGOLFCO	3	4	1
501	CAMPVIRGILTATE	3	7	1
421	LAIDLEYFIELD	3	8	1
402	GATEWAYCENTER	4	2	2
402	STALBANSMALL	4	2	2
421	PLAZAEAST	4	2	2
424	K-MARTPLAZA	4	2	2
465	DUNBARPLAZA	4	2	2
412	CHARLESTONORDCENTE	5	1	2
406	PEERLESSINDPARK	5	1	2
431	PURITYBAKERY	5	2	2
421	WVASTEEL	5	2	2
430	TROJANSTEEL	5	2	2
421	KANAWHAMANUFACTOR	5	2	2
509	ELKREFININGCO.	5	2	2
420	TINCHERDENTALLAB	5	2	2
431	VALLEYBELLDAIRY	5	3	2
420	NEWSPAPERAGENCY	5	3	2
414	FMC	5	3	2
482	DUPONT	5	3	2
414	UNIONCARBIDE	5	3	2
412	UNIONCARBIDE	5	3	2
424	LIBBYOWENSFORD	5	3	2
435	TRUETEMPER	5	3	2
467	UNIONCARBIDE	5	3	2
411	COBHEADQUARTERS	6	1	1
411	COBDETACHMENT	6	1	1

STZ#	Kanawha County continued	Classification	Subclassification	Ownership
422	EXECUTIVEOFFICE	6	1	1
476	ACADEMY	6	1	1
481	TURNPIKEDETACHMENT	6	1	1
486	COBDETACHMENT	6	1	1
502	COBDETACHMENT	6	1	1
402	NGUNITSAINTALBANS	6	2	1
464	NGUNITCHARLESTON	6	2	1
465	NGUNITDUNBAR	6	2	1
332	WMONAMMONTGOMERY	6	3	2
402	WKLCAMSAINTALBANS	6	3	2
402	WKLCFMSAINTALBANS	6	3	2
413	WRDSAMSOUTHCHAR	6	3	2
420	WKAZAMCHARLESTON	6	3	2
420	WTIPAMCHARLESTON	6	3	2
420	WXITAMCHARLESTON	6	3	2
420	WKAZFMCHARLESTON	6	3	2
420	WTIOFMCHARLESTON	6	3	2
421	WCHSAMCHARLESTON	6	3	2
421	WBESFMCHARLESTON	6	3	2
425	WCAWAMCHARLESTON	6	3	2
425	WVAFAMCHARLESTON	6	3	2
420	WSAZTVCHARLESTON	6	4	2
421	WCHSTVCHARLESTON	6	4	2
420	COCHOUSECHARLESTON	6	5	1
388	NITRGPUBLICBRANCH	6	6	1
402	STALBANSPUELICBRAN	6	6	1
413	SOCHARLESTONPUBLIC	6	6	1
420	KANAWHACOPUBLIC	6	6	1
465	DUNBARPUBLICBRANCH	6	6	1
380	EASTBANK	7	1	1
384	MCKINLEY	7	1	1
385	WASHINGTON	7	1	1
387	MARMET	7	1	1
388	NITRO	7	1	1
402	FRANCISOFASSISSI	7	1	2
403	SAINTALBANS	7	1	1
406	HAYES	7	1	1
411	SPRINGHILL	7	1	1
413	SOUTHCHARLESTON	7	1	1
420	SACREDHEART	7	1	2
421	ROOSEVELT	7	1	1
421	THOMASJEFFERSON	7	1	1
425	HORACEMANN	7	1	1
425	SAINTAGNES	7	1	2
430	ADAMS	7	1	1
431	LINCOLN	7	1	1
431	SAINTANTHONY	7	1	2
434	WOODROWWILSON	7	1	1
465	DUNBAR	7	1	1
477	ANDREWJACKSON	7	1	1
482	DUPONT	7	1	1
485	CEDARGROVE	7	1	1
503	SISSONVILLE	7	1	1

ST Z#	Lewis County	Classification	Subclassification	Ownership
714	STONEWALLJACKSON	1	2	1
714	MAPLESONVALESCENT	1	3	2
714	WESTONSTATE	1	4	1
718	JACKSON'SMILL	2	1	1
711	WOODLANDGOLFCOURSE	3	4	1
718	JACKSONSMILL	3	7	1
719	LEWISCOUNTYINDPARK	5	1	2
718	COLONIALGLASS	5	2	2
719	LEWISCOUNTYGLASS	5	2	2
714	LOUIEGLASS	5	2	2
711	WESTVIRGINIAGLASS	5	3	2
712	COADETACHMENT	6	1	1
711	NGUNITWESTON	6	2	1
714	WHAWAMWESTON	6	3	2
714	WHAWFMWESTON	6	3	2
714	WDTVTVWESTON	6	4	2
714	COCHOUSEWESTON	6	5	1
714	LEWISBENNETTWARMEM	6	6	1
710	WALKERSVILLE	7	1	1
714	WESTON	7	1	1
719	JANELEW	7	1	1
714	LEWISCOUNTY	7	2	1
711	WATSONTRUCKINGCO	8	3	2
718	LEWISBENNETTFIELD	8	4	1
714	WESTON	9	2	1
711	CARAVAN	10	2	2
719	HOLIDAYHAVEN	10	2	2

ST Z#	Lincoln County	Classification	Subclassification	Ownership
236	BIGUGLYPHA	3	2	1
242	DEEMUREBRACO	5	2	2
242	COBDETACHMENT	6	1	1
242	COCHOUSEHAMLIN	6	5	1
242	HAMLINPUBLIC	6	6	1
236	BIGUGLY	7	1	1
237	BRANCHLAND	7	1	1
237	FEZ	7	1	1
237	MIDKIFF	7	1	1
238	RANGER	7	1	1
239	GRIFFITHSVILLE	7	1	1
239	MARTIN	7	1	1
239	SUMERCO	7	1	1
239	WOODVILLE	7	1	1
240	GARRETSBEND	7	1	1
240	MCCORKLE	7	1	1
240	MIDWAY	7	1	1
241	PLEASANTVIEW	7	1	1
241	WESTHAMLIN	7	1	1

ST Z#	Lincoln County continued	Classification	Subclassification	Ownership
235	HARTS	7	2	1
237	GUYANVALLEY	7	2	1
239	DUVALL	7	2	1
242	HAMLIN	7	2	1
242	LINCOLNCOVOC-TECH	7	4	1
242	MIDKIFFANDSTOWERS	8	3	2
242	HAMLINAIRPORT	8	4	2
242	SEARLSTOURIST	10	2	2

Logan County

86	MANAPPLACHIANREG	1	2	1
101	HOLDENHOSPITAL	1	2	2
107	LOGANGENERAL	1	2	1
109	GUYANVALLEY	1	2	2
113	CHIEFLOGAN	3	1	1
86	TRIADELPHIACOCLUB	3	4	2
119	LOGANCOUNTRYCLUB	3	4	2
117	CHIEFLOGAN	3	7	1
117	GUYANMACHINERY	5	3	2
107	CODDETACHMENT	6	1	1
102	NGUNITLOGAN	6	2	1
114	WLOGAMLOGAN	6	3	2
114	WVOWAMLOGAN	6	3	2
114	WVOWFMLOGAN	6	3	2
109	COCHOUSELOGAN	6	5	1
86	BUFFALOCREEKMEM	6	6	1
109	WOMANSCLUBOFLOGAN	6	6	1
89	MAN	7	1	1
102	OMAR	7	1	1
109	LOGANCENTRAL	7	1	1
109	LOGAN	7	1	1
115	HUGHDINGESS	7	1	1
118	CHAPMANSVILLE	7	1	1
86	MAN	7	2	1
108	LOGAN	7	2	1
112	SHARPLES	7	2	1
118	CHAPMANSVILLE	7	2	1
107	SOWVACOMMCOLLEGE	7	3	1
109	LOGANCOVOC-TECHCEN	7	4	1
88	MCDONALDFIELD	8	4	2
109	LOGAN	9	1	1
107	MOUNTGAY	9	1	1
109	ARACOMA	10	1	2
109	BROWNING	10	1	2
112	CHAMBERS	10	1	2
113	JUSTICE	10	2	2
113	MATHIAS	10	2	2

STZ #	McDowell, County	Classification	Subclassification	Ownership
11	WELCHEMERGENCY	1	2	1
12	DOCTORSMEMORIAL	1	2	2
12	STEVENSCLINIC	1	2	2
2	PANTHERSTATEFOREST	3	2	1
10	GARYCOUNTRYCLUB	3	4	2
2	PANTHERYOUTHCAMP	3	7	1
12	CODDETACHMENT	6	1	1
11	NGUNITWELCH	6	2	1
12	WELCAMWELCH	6	3	2
12	WXEEAMWELCH	6	3	2
11	COCHOUSEWELCH	6	5	1
11	MCDOWELLCOPUBLIC	6	6	1
3	IAEGER	7	1	1
4	BRADSHAW	7	1	1
4	THREEFORKS	7	1	1
6	BARTLEY	7	1	1
7	WAR	7	1	1
8	BERWIND	7	1	1
9	COALWOOD	7	1	1
11	HEMPHILL	7	1	1
15	DAVY	7	1	1
16	KIMBALL	7	1	1
20	ELKHORN	7	1	1
21	ANAWALT	7	1	1
3	IAEGER	7	2	1
7	BIGCREEK	7	2	1
10	GARY	7	2	1
12	WELCH	7	2	1
19	NORTHFORK	7	2	1
12	MCDOWELLCOVOC-TECH	7	4	1
12	CAREEREDCENTER	7	4	1
17	VIVIANMININGCAMPUS	7	4	1
11	WELCH	8	2	2
16	WELCHMUNICIPAL	8	4	1
11	WELCH	9	1	1
5	BEAUTYREST	10	2	2
5	SPRATTMOTOR	10	2	2
11	BELCHER	10	2	2
12	JOHNSON	10	2	2
15	POCAHONTAS	10	2	2
16	BIGFOUR	10	2	2

STZ #	Marion County	Classification	Subclassification	Ownership
869	FAIRMONTGENERAL	1	2	1
870	FAIRMONTEMERGENCY	1	2	1
855	WISHINGWELLHOME	1	3	2
864	STBARBARASMEMORIAL	1	3	2
868	WALNUTGROVEHOME	1	3	2
870	EASTFAIRMONTHOME	1	3	2
885	COVEREDBRIDGE	2	1	1

STZ #	Marion County continued	Classification	Subclassification	Ownership
857	VALLEYFALLS	3	1	1
883	PRICKETTSFORT	3	1	1
855	GREENHILLSCCCLUB	3	4	2
863	FAIRMONTFIELDCLUB	3	4	2
885	CAMPMAR-MAC	3	7	1
856	MIDDLETOWNMALL	4	1	2
868	COUNTRYCLUBSTORES	4	2	2
872	FAIRVIEWPLAZA	4	2	2
871	SHARONSTEEL	5	2	2
863	ELECTRONICCONTROL	5	2	2
871	AANDPTEACO.	5	2	2
868	FAIRMONTPLASTERCO.	5	2	2
862	INTERSTATEENGRS.	5	2	2
882	DECORATORINDUSTRY	5	2	2
865	THOMPSONNEWSPAPER	5	2	2
868	FAIRMONTBOXCO	5	2	2
871	ALCANALUMINUM	5	2	2
868	GALISMANU	5	2	2
871	OWENSILLINOIS	5	2	2
883	WESTINGHOUSE	5	3	2
868	COADETACHMENT	6	1	1
868	NGUNITFAIRMONT	6	2	1
865	WMNNAMFAIRMONT	6	2	1
870	WTCSAMFAIRMONT	6	3	2
865	COCHOUSEFAIRMONT	6	5	1
860	MANNINGTONBRANCH	6	6	1
865	MARIONCOPUBLIC	6	6	1
864	MONOGAH	7	1	1
864	PETERANDPAUL	7	1	2
865	FAIRMONTCATHOLIC	7	1	2
866	MILLER	7	1	1
870	CENTRAL	7	1	1
870	EASTPARK	7	1	1
870	STATESTREET	7	1	1
892	PLEASANTVALLEY	7	1	1
858	FAIRMONTEAST	7	2	1
861	MANNINGTON	7	2	1
864	MONOGAH	7	2	1
868	FAIRMONT	7	2	1
884	FARMINGTON	7	2	1
885	BARRACKSVILLE	7	2	1
886	RIVESVILLE	7	2	1
888	FAIRVIEW	7	2	1
867	FAIRMONTSTATE	7	3	1
866	MARIONCOVOC-TECH	7	4	1
866	FAIRMONT	8	1	2
856	SMITHTRANSFER	8	3	2
871	GENERALDELIVERYINC	8	3	2
871	WSTHOMASTRANSFER	8	3	2
862	FAIRMONTMUNICIPAL	8	4	1
868	MARQUETTECEMENT	8	5	2
886	MONONGALIAPOWER	8	5	2
860	MANNINGTON	9	1	1
865	FAIRMONT	9	4	1
865	BEL-AIR	10	1	2

STZ#	Mercer County	Classification	Subclassification	Ownership
26	STLUKESHOSPITAL	1	2	2
27	BLUEFIELDSANT	1	2	2
38	PRINCETONCOMMUNITY	1	2	1
26	STMARYSNURSINGHOME	1	3	2
27	GREENVALLEYHOME	1	3	2
48	GLENWOODPARKHOME	1	3	2
53	PINNACLEROCK	3	1	1
52	BLUEJAYCAMPINGAREA	3	2	1
27	BLUEFIELDCOCLUB	3	4	2
48	PRINCETONELKSCOCLU	3	4	2
48	GLENWOODPARK	3	7	1
25	BLUEFIELDPLAZA	4	2	2
38	THEPRINCECORP	4	2	2
49	BLUEPRINCEPLAZA	4	2	2
27	BETSYROSSBREAD	5	2	2
27	WVAARMATURE	5	2	2
36	COPPINGERMACHINERY	5	2	2
27	NAT*LELECTRICCOIL	5	2	2
23	DAILYTELEGRAPH	5	2	2
24	BAILEYLUMBER	5	2	2
25	JOYSERVICECENTER	5	2	2
48	MAIDENFORMINC	5	3	2
48	ROCKWELLINT	5	3	2
40	CODDETACHMENT	6	1	1
36	NGUNITBLUEFIELD	6	2	1
38	NGUNITPRINCETON	6	2	1
23	WKOYAMBLUEFIELD	6	3	2
25	WHISAMBLUEFIELD	6	3	2
25	WHISFMBLUEFIELD	6	3	2
47	WAEYAMPRINCETON	6	3	2
25	WHISTVBLUEFIELD	6	4	2
40	COCHOUSEPRINCETON	6	5	1
23	BLUEFIELDPUBLIC	6	6	1
38	PRINCETONPUBLIC	6	6	1
27	CENTRAL	7	1	1
27	FAIRVIEW	7	1	1
38	PRINCETON	7	1	1
48	GLENWOOD	7	1	1
24	PARKUNGRADED	7	2	1
27	BLUEFIELD	7	2	1
38	PRINCETON	7	2	1
50	OAKVALE	7	2	1
51	ATHENS	7	2	1
52	SPANISHBURG	7	2	1
53	BRAMWELL	7	2	1
53	MATOAKA	7	2	1
53	MONTCALM	7	2	1
24	BLUEFIELDSTATE	7	3	1
51	CONCORDCOLLEGE	7	3	1
40	MERCERCOVOC-TECH	7	4	1
26	BLUEFIELD	8	1	2
24	BLUEFIELD	8	2	2
24	CONSOLIDATEDMOTOR	8	3	2
49	OVERNITETRANSPORT	8	3	2
49	POINTEXPRESS	8	3	2
49	SMITHTRANSFER	8	3	2
36	MERCERCOAIRPORT	8	4	1
40	PRINCETON	9	2	1
23	BLUEFIELD	9	3	1
23	WESTVIRGINIA	10	1	2
25	MILNERMATZ	10	1	2
40	VIRGINIAN	10	1	2
40	RIVERIA	10	2	2
39	GATEWAY	10	2	2
40	TOWN-O-TEL	10	2	2
47	EDENROCK	10	2	2
47	HOLIDAYINN	10	2	2
47	PRINCETON	10	2	2
47	TOWNANDCOUNTRY	10	2	2
47	TURNPIKE	10	2	2
48	GREENTREE	10	2	2
49	BELAIR	10	2	2
49	BRIAR	10	2	2
49	HIGHLANDER	10	2	2
49	HOLIDAYINN	10	2	2
49	RAINBOW	10	2	2
49	MIDWAY	10	2	2
51	MTLION	10	2	2
53	PINNACLEROCK	11	1	1

STZ#	Mineral County	Classification	Subclassification	Ownership
932	POTOMACVALLEY	1	2	2
939	FORTASHBY	2	1	1
930	NANCYHANKSMONUMENT	2	1	1
930	NANCYHANKSMEMORIAL	3	2	2
939	ROCK-A-WAYBEACH	3	2	2
930	MILLCREEKCOCLUB	3	4	2
937	CAMPMINCO	3	7	1
937	KEYSERINDUSTRIALPK	5	1	2
932	KEYSERGARMET	5	2	2
938	HERCULESINC.	5	3	2
932	COCDETACHMENT	6	1	1
933	NGUNITKEYSER	6	2	1
937	WKLPFMKEYSER	6	3	2
932	COCHOUSEKEYSER	6	5	1
931	PIEDMONT	6	6	1
932	KEYSERMINERALCOPUB	6	6	1
929	NEWCREEK	7	1	1
930	BURLINGTON	7	1	1
933	SAINTFRANCIS	7	1	2
941	WILEYFORD	7	1	1
928	ELKGARDEN	7	2	1
931	PIEDMONT	7	2	1
932	KEYSER	7	2	1
939	FORTASHBY	7	2	1
941	RIDGELY	7	2	1
933	POTOMACSTATE	7	3	1
932	MINERALCOVOC-TECH	7	4	1
937	SPENCERTRUCKING	8	3	2
929	MILLERFIELD	8	4	1
941	CUMBERLANDMUNICIPA	8	4	1
932	KEYSER	9	2	1
932	MERRYRAY	10	1	2
929	HENDERSON	10	2	2
929	POTOMAC	10	2	2
929	TOLLGATE	10	2	2
930	VALLEY	10	2	2

Mingo County

60	WILLIAMSONMEMORIAL	1	2	2
82	LAURELCREEK	3	2	1
68	RIVERVIEWPARTHREE	3	4	1
68	TUGVALLEYCCCLUB	3	4	2
50	CODDETACHMENT	6	1	1
60	NGUNITWILLIAMSON	6	2	1
60	WBTHAMWILLIAMSON	6	3	2
72	WHJCAMMATEWAN	6	3	2
60	COCHOUSEWILLIAMSON	6	5	1
60	WILLIAMSONPUBLIC	6	6	1
69	MINGOCENTERDELBAR	6	6	1
66	NOLAN	7	1	1
67	CHATTAROY	7	1	1

STZ#	Mingo County continued	Classification	Subclassification	Ownership
71	BEECHCREEK	7	1	1
71	REDJACKET	7	1	1
72	THACKER	7	1	1
60	WILLIAMSON	7	2	1
69	BURCH	7	2	1
72	MAGNOLIA	7	2	1
77	GILBERT	7	2	1
79	LENORE	7	2	1
81	KERMIT	7	2	1
60	SOWVACOMMCOLLEGE	7	3	1
60	MINGOCOVOC-TECH	7	4	1
60	WILLIAMSON	8	2	2
80	POINTEXPRESS	8	3	2
67	MINGOCOAIRPORT	8	4	1
60	WILLIAMSON	9	2	1
60	MOUNTAINEER	10	1	2
60	MUSICK	10	1	2
60	"T"MOTEL	10	2	2
67	PHILLIPS	10	2	2
74	JUSTONIAN	10	2	2

STZ#	Monongalia County	Classification	Subclassification	Ownership
910	MONONGALIAGENERAL	1	2	1
908	MONOGENDOWNTOWNDIV	1	2	1
910	WVUHOSPITAL	1	2	1
911	SUNDALERESTHOME	1	3	2
908	ALEXANDERWADEHOUSE	2	1	2
891	HENRYCLAYFURNACE	2	1	2
908	OLDIRONWORKS	2	1	2
914	MONTCHATEAU	3	1	1
891	COOPERSROCKSTATEFO	3	2	1
914	SANDSPRINGSCAMPING	3	2	2
906	MOUNTAINEERGOLF&CO	3	4	2
906	MEADOWPONDCLUB	3	4	1
912	PINECOUNTRYCLUB	3	4	2
914	LAKEVIEWINN&COCLUB	3	4	2
891	CHESTNUTRIDGE	3	6	1
903	CAMPMUFFLY	3	7	1
908	MOUNTAINEERFIELD	3	8	1
911	MORGANTOWNPLAZA	4	2	2
908	WVANEWSPUB	5	2	2
909	SENACAGLASS	5	2	2
909	BEAUMONTCO	5	2	2
909	MORGANTOWNGLASS	5	2	2
908	GREERLIMESTONE	5	2	2
910	MILANPHARMACEUTICA	5	2	2
903	MORGANTOWNMACHINE	5	2	2
911	DAVISLYNCHGLASS	5	3	2
892	MORGANSHIRTCO	5	3	2
892	STERLINGFAUCET	5	3	2
910	COADETACHMENT	6	1	1
912	NGUNITMORGANTOWN	6	2	1
908	WAJRAMMORGANTOWN	6	3	2
908	WCLGAMMORGANTOWN	6	3	2
908	WAJRFMMORGANTOWN	6	3	2
908	WWVUTVMORGANTOWN	6	4	1
908	COCHOUSEMORGANTOWN	6	5	1
908	MORGANTOWNPUBLIC	6	6	1
892	SABRATON	7	1	1
902	WAITMANBARBE	7	1	1
906	CASSDISTRICT	7	1	1
907	RIVERSIDE	7	1	1
907	WESTOVER	7	1	1
908	MORGANTOWN	7	1	1
908	STFRANCISDESALE	7	1	2
911	SUNCRESTFLATS	7	1	1
912	CHEATLAKE	7	1	1
893	MORGANTOWN	7	2	1
901	CLAYBATELLE	7	2	1
908	UNIVERSITY	7	2	1
910	STFRANCISCENTRAL	7	2	2
908	WVAUNIVERSITY	7	3	1
909	WVAUNIVERSITY	7	3	1
910	WVAUNIVERSITY	7	3	1

STZ#	Monongalia County continued	Classification	Subclassification	Ownership
893	MONONGALIAVOC-TECH	7	4	1
908	MORGANTOWN	8	1	2
892	LEWISTRUCKING	8	3	2
905	CONNERSTRUCKING	8	3	2
912	MORGANTOWNMUNICIPA	8	4	1
902	MORGANTOWNORD.WKS.	8	5	2
902	CHRISTOPHERCOALCO.	8	5	2
906	MONONGALIAPOWER	8	5	2
905	CHRISTOPHERCOALCO.	8	5	2
906	CHRISTOPHERCOALCO.	8	5	2
907	VANCECOALCO	8	5	2
907	WESTOVER	9	2	1
908	MORGANTOWN	9	4	1
914	LAKEVIEWINN	10	1	2
914	MONTCHATEAU	10	3	1
908	MORGAN	10	1	2
907	WESTOVER	10	2	2
908	MID-CITY	10	2	2
908	MORGANTOWN	10	2	2
910	MOUNTAINEER	10	2	2
911	SANDRALEE	10	2	2
911	HOLIDAYINN	10	2	2
912	AIRPORT	10	2	2
912	BABBLINGBROOK	10	2	2
912	HOLIDAY	10	2	2
910	CHINQUAPINOAK	11	1	1

Monroe County

55	ANDREWROWANMEMHOME	1	3	2
55	OLDSWEETSPRINGS	2	1	2
55	MONCOVELAKE	3	2	1
56	B.F.GOODRICHCO	5	3	2
56	CODDETACHMENT	6	1	1
56	COCHOUSEUNION	6	5	1
56	MONROECOPUBLIC	6	6	1
55	GAPMILLS	7	1	1
58	GREENVILLE	7	1	1
56	UNION	7	2	1
58	PETERSTOWN	7	2	1
56	SUNNYSIDETOURIST	10	2	2
56	PENCESTOURIST	10	2	2
58	MONROE	10	2	2
58	UNDERGROUNDPOND	11	1	2

STZ#	Morgan County	Classification	Subclassification	Ownership
956	WARMEMORIAL	1	2	1
956	VALLEYVIEWNURSING	1	3	2
956	CANDOCANAL	2	1	2
956	BERKELEYSPRINGS	2	1	2
954	CACAPON	3	1	1
956	BERKELEYSPRINGS	3	1	1
956	RUMSEYMONUMENT	3	1	1
955	CACAPONSOUTH	3	2	2
955	COOLFONTRECREATION	3	2	2
955	TRI-LAKE	3	2	2
957	KAR-TUR-HOCAMPGROU	3	2	2
957	NOBLESMUSICHALL&CA	3	2	2
956	PITTSGLASSSANDCO	5	3	2
956	COCDETACHMENT	6	1	1
956	WCSTAMBERKELEYSPGS	6	3	2
956	COCHOUSEBSPRINGS	6	5	1
952	PAWPAWPUBLIC	6	6	1
956	MORGANCOPUBLIC	6	6	1
952	PAWPAW	7	2	1
956	BERKELEYSPRINGS	7	2	1
957	POTOMACAIRPARK	8	4	2
954	CACAPON	10	3	1
956	PARKVIEWINN	10	1	2
956	WASHINGTONHOUSE	10	1	2
955	CACAPON	10	2	2
955	MILLERS	10	2	2
955	MOUNTAINSTATE	10	2	2
955	PARKHAVENMOTOR	10	2	2
955	TIMBERRIDGE	10	2	2
955	DANDDMOTEL	10	2	2
956	BERKELEYSPRINGS	10	2	2

STZ#	Nicholas County	Classification	Subclassification	Ownership
305	SACREDHEART	1	2	1
301	SUMMERSVILLEMEMORI	1	2	1
288	CARNIFEXFERRYBATTL	3	1	1
289	BATTLERUNREC.AREA	3	2	1
289	SUMMERSVILLEK.O.A.	3	2	2
304	BIGROCKCAMPGROUND	3	2	1
307	INDIANROCKCAMPGROU	3	2	2
301	NICHOLASCOGOLFASSO	3	4	2
304	CHERRYHILLCOCLUB	3	4	2
301	NICHOLASMEMPARK	3	7	1
290	BOISECASCADE	5	2	2
288	CARROLLSHOECO.	5	2	2
289	BRIGHTOFAMERICA	5	3	2
306	B.F.GOODRICHCO.	5	3	2
301	CODDETACHMENT	6	1	1
305	CODDETACHMENT	6	1	1

STZ#	Nicholas County continued	Classification	Subclassification	Ownership
305	NGUNITRICHWOOD	6	2	1
306	WVARAMRICHWOOD	6	3	2
307	COCHOUSES*VILLE	6	5	1
302	ELIZABETHSTEPHENSO	6	6	1
306	RICHWOODPUBLIC	6	6	1
287	DIXIE	7	1	1
287	OTTERCREEK	7	1	1
288	KESLERSCROSSLANES	7	1	1
288	ZELA	7	1	1
289	MOUNTLOOKOUT	7	1	1
289	MOUNTNEBO	7	1	1
290	FLEGEPRIDGE	7	1	1
290	LEIVASY	7	1	1
290	NEWHOPE	7	1	1
301	GLADECREEK	7	1	1
301	MUDDLETY	7	1	1
303	CANVAS	7	1	1
303	NETTIE	7	1	1
304	FENWICK	7	1	1
306	MILLTOWN	7	1	1
306	RICHWOOD	7	1	1
306	TANNERY	7	1	1
307	BEAVER	7	1	1
307	CRAIGSVILLE	7	1	1
308	BIRCHRIVER	7	1	1
302	NICHOLASCOUNTY	7	2	1
306	PICHWOOD	7	2	1
288	SHELTONTRUCKING	8	3	2
289	SUMMERSVILLEAIRPOR	8	4	2
290	RICHWOODMUNICIPAL	8	4	1
306	RICHWOOD	9	1	1
306	OAKFORD	10	1	2
301	MOUNTAINSTATE	10	2	2
302	LAKESERVICE	10	2	2
302	OXFORDINN	10	2	2
302	SAINTNICHOLASINN	10	2	2
304	MARLWOOD	10	2	2
306	WATERGATEINN	10	2	2
307	MID-TOWN	10	2	2

STZ#	Ohio County	Classification	Subclassification	Ownership
1038	WHEELINGHOSPITAL	1	2	1
1049	OHIOVALLEYGENERAL	1	2	1
1045	GOODSHEPHERDHOME	1	3	2
1040	INDEPENDENCEHALL	2	1	1
1039	SUSPENSIONBRIDGE	2	1	1
1091	MANSIONMUSEUM	2	1	2
1064	DALLASPIKECAMPGROU	3	2	2
1045	WHEELINGPARKGOLFCO	3	4	1
1091	OGLEBAYPARKCRISPIN	3	4	1
1091	OGLEBAYPARKPAR3	3	4	1
1091	OGLEBAYPARKSPEIDEL	3	4	1
1091	WHEELINGCOCLUB	3	4	2
1039	WHEELINGDOWNS	3	5	2
1091	OGLEBYPARK	3	6	1
1091	CAMPRUSSELL	3	7	1
1040	WARWOODCENTER	4	2	2
1047	ELMTERRACEPLAZA	4	2	2
1064	DALLASPIKEI-70	5	1	2
1042	WEIMERPACKING	5	2	2
1040	CONSOLIDATEDCORP	5	2	2
1038	M.MARSHANDSON	5	2	2
1040	CENTREFOUNDRY	5	2	2
1043	WHEELINGCLOSURECO	5	2	2
1049	BLOCHBROSCO	5	3	2
1049	CONTINENTALBAKING	5	3	2
1046	WHEELINGMACHINECO	5	3	2
1040	WHEELINGSTAMPING	5	3	2
1038	WHEELINGSTEEL	5	3	2
1038	OGDENNEWS	5	3	2
1042	BLAWKNOXFOUNDRY	5	3	2
1047	COADETACHMENT	6	1	1
1038	WKWKAMWHEELING	6	3	2
1038	WWVAAMWHEELING	6	3	2
1038	WKWKFMWHEELING	6	3	2
1038	WWVAFMWHEELING	6	3	2
1038	WTRFFMWHEELING	6	3	2
1067	WNEUAMWHEELING	6	3	2
1038	WTRFTVWHEELING	6	4	2
1038	COCHOUSEWHEELING	6	5	1
1038	OHIOCOPUBLIC	6	6	1
1040	WARWOODBRANCH	6	6	1
1038	WASHINGTON	7	1	1
1039	MADISON	7	1	1
1039	BLESSEDTRINITY	7	1	2
1040	CORPUSCHRISTI	7	1	2
1041	WOODSDALE	7	1	1
1043	CLAY	7	1	1
1043	CATHEDRALGRADE	7	1	2
1044	SAINTMICHAELS	7	1	2
1047	BRIDGESTREET	7	1	1
1047	STVINCENTDEPAUL	7	1	2
1049	RITCHIE	7	1	1
1049	WEBSTER	7	1	1
1049	SAINTALPHONUS	7	1	2

STZ#	Ohio County continued	Classification	Subclassification	Ownership
1065	TRIADELPHIA	7	1	1
1040	WARWOOD	7	2	1
1043	CENTRALCATHOLIC	7	2	2
1044	MTDECHANTELACADEMY	7	2	2
1046	TRIADELPHIA	7	2	1
1049	WHEELING	7	2	1
1043	WVANORCOMMCOLLEGE	7	3	1
1044	WHEELINGCOLLEGE	7	3	2
1070	WESTLIBERTYCOLLEGE	7	3	1
1043	MCKINLEYVOC-TECH	7	4	1
1038	WHEELING	8	1	2
1040	TOWERLINES	8	3	2
1040	WARWOODTRANSFER	8	3	2
1049	COMMERCIALMOTORFRT	8	3	2
1049	COOKMOTORLINES	8	3	2
1049	EASTERNEXPRESS	8	3	2
1049	HALL'SMOTORTRANSIT	8	3	2
1049	HOUFFTRANSFER	8	3	2
1049	SMITHTRANSFER	8	3	2
1049	YELLOWFREIGHTSYSTM	8	3	2
1049	CONSOLIDATECFRTWAY	8	3	2
1072	OHIOCOAIRPORT	8	4	1
1040	EXXON OIL	8	5	2
1040	SUNOIL	8	5	2
1040	AMERICANOIL	8	5	2
1049	CONTRACTORSSUPPLY	8	5	2
1049	STANDARDSANDGRAVL	8	5	2
1038	WHEELING	9	4	1
1038	MCCLURE	10	1	2
1038	ROGERS	10	1	2
1038	WHEELING	10	1	2
1091	OGLEBAYWILSONLODGE	10	1	2
1038	DOWNTOWNERINN	10	2	2
1038	HOWARDJOHNSON	10	2	2
1038	MIDCITY	10	2	2
1045	GROVETERRACE	10	2	2
1045	FORTHENRY	10	2	2
1064	RAMADAINN	10	2	2
1065	STONEHOUSE	10	2	2

STZ#	Pendleton County	Classification	Subclassification	Ownership
630	MACK'SCABINS	3	2	2
631	BLANDSCAMPINGAREA	3	2	2
631	SENECARECREATIONAR	3	2	1
631	SPRUCEKNOBRECAREA	3	2	1
631	YOKUM'S	3	2	2
633	THOMPSONSMOTEL	3	2	2
634	BRANDYWINELAKE	3	2	1
634	CAMPRUNREC.AREA	3	2	1
634	SUGARGROVECAMPSITE	3	2	2
634	SMOKEHOLE	3	2	1
630	THORNSPRINGSPARK	3	7	1
632	FRANKLININDPARK	5	1	2
632	HANOVERSHOECO	5	3	2
632	COCDETACHMENT	6	1	1
632	COCHOUSEFRANKLIN	6	5	1
632	PENDLETONCOPUBLIC	6	6	1
631	SENECAROCK	7	1	1
632	FRANKLIN	7	1	1
633	UPPERTRACT	7	1	1
634	BRANDYWINE	7	1	1
631	CIRCLEVILLE	7	2	1
632	FRANKLIN	7	2	1
631	HEDRICKS	10	2	2
631	YOKUMS	10	2	2
632	MOUNTAINSTATE	10	2	2
632	NEWFRONTIER	10	2	2
632	THOMPSONS	10	2	2
634	BRANDYWINE	10	2	2
630	SINNIT-THORNMTCAVE	11	1	1
630	TROUTCAVEFORMATION	11	1	1
631	SENECACAVERNS	11	1	2
631	PRINCESSSNOWBIRD	11	1	1
631	SHALEBINDWEED	11	1	2
631	CANBY'SMT.LOVER	11	1	1
633	SMOKEHOLECAVE	11	1	1

	Pleasants County			
830	MAGNOLIAMANOR	1	3	2
830	RIVERSIDECAMPING	3	2	2
830	STMARYSCOUNTRYCLUB	3	4	2
829	QUAKERSTATECO	5	2	2
827	AMERICANCYANAMID	5	3	2
829	COADETACHMENT	6	1	1
829	COCHOUSESTMARYS	6	5	1
830	SISTERVILLEPUBLIC	6	6	1
829	PLEASANTSCOPUBLIC	6	6	1
829	PARK	7	1	1
829	SAINTMARYS	7	2	1
829	PRTVOC-TECHCENTER	7	4	1
827	MONONGAHELAPOWER	8	5	2
827	HOSPITALITYINN	10	2	2
829	QUALITYINN	10	2	2

STZ#	Pocahontas County	Classification	Subclassification	Ownership
593	POCAHONTASMEMORIAL	1	2	1
528	DENMARSTATE	1	4	1
532	REBERTELESCOPE	2	1	1
528	DROOPMTBATTLEFIELD	2	1	1
528	PEARLBUCKHOUSE	2	1	1
529	WATOGA	3	1	1
528	BEARTOWN	3	1	1
528	DROOPMTBATTLEFIELD	3	1	1
532	CASSSCENICRAILROAD	3	1	1
528	DAYRUNREC.AREA	3	2	1
529	WATOGASTATEPARK	3	2	1
530	POCAHONTASREC.AREA	3	2	1
531	HANDLEYRIVERPHEFA	3	2	1
531	TEACREEKREC.AREA	3	2	1
532	LEATHERBARKCAMPING	3	2	2
591	BIRDRUNREC.AREA	3	2	1
591	SENECASTATEFOREST	3	2	1
531	SNOWSHOE	3	6	1
533	CAMPPOCAHONTAS	3	7	1
533	HOWESLEATHERCO	5	2	2
593	COCDETACHMENT	6	1	1
593	COCHOUSEMARLINTON	6	5	1
532	POCAHONTASCOPUBLIC	6	6	1
593	MARLINTONBRANCH	6	6	1
528	HILLSBORO	7	1	1
532	GREENBANK	7	1	1
533	DURBIN	7	1	1
593	MARLINTON	7	1	1
591	POCAHONTAS	7	2	1
531	BURNSMOTORFREIGHT	8	3	2
533	HERMITAGE	10	1	2
593	MARLINTON	10	1	2
530	HUNTERSVILLE	10	2	2
530	ALLEGHENYLODGE	10	2	2
531	GRAHAMS	10	2	2
531	ELPOCA	10	2	2
531	MARLINTONMOTORINN	10	2	2
532	BOYER	10	2	2
532	TRACYSHILLTOP	10	2	2
532	HARRISHOUSE	10	2	2
533	POCAHONTAS	10	2	2
528	CRANBERRYBACKCOUNT	11	1	1
528	FALLSOFHILLSCREEK	11	1	1
529	FRASER'SEDGE	11	1	1
530	LARGESTCAVEROOM	11	1	1
532	CASSCAVES	11	1	2
533	BLISTERRUN	11	1	2
533	BLISTERSWAMP	11	2	2

STZ#	Preston County	Classification	Subclassification	Ownership
921	PRESTONMEMORIAL	1	2	1
922	HOPEMONTSTATE	1	4	1
918	REDHORSETAVERN	2	1	2
918	CATHEDRAL	3	1	1
926	APPALACHIALAKE	3	2	2
922	PRESTONCOCLUB	3	4	2
922	ALPINELAKE	3	6	1
925	PRESTONCO4-HCAMP	3	7	1
921	KINGWOODINDPARK	5	1	2
922	INTERSTATELUMBER	5	2	2
924	PITTSBURGVALUECO	5	2	2
921	SHEIDCWBRONZECORP.	5	2	2
921	KINNEYSHOECO	5	3	2
921	COADETACHMENT	6	1	1
922	NGUNITKINGWOOD	6	2	1
920	WESPAMKINGWOOD	6	3	2
921	COCHOUSEKINGWOOD	6	5	1
921	KINGWOODPUBLIC	6	6	1
923	TERRAALTAPUBLIC	6	6	1
916	FELLOWSVILLE	7	1	1
922	ALBRIGHT	7	1	1
924	VALLEY	7	1	1
917	ROWLESBURG	7	2	1
918	AURORA	7	2	1
919	NEWBURG	7	2	1
920	TUNNELTON	7	2	1
921	KINGWOOD	7	2	1
923	TERRAALTA	7	2	1
924	VALLEY	7	2	1
926	BRUCETON	7	2	1
921	PRESTONCOEDCENTER	7	4	1
922	CAMPDAWSONAIRPORT	8	4	1
921	KINGWOOD	9	1	1
917	HOWARD	10	1	2
923	DUNNINGTON	10	1	2
918	FAIRLEA	10	2	2
918	MILLSTONELODGE	10	2	2
918	SUNRISE	10	2	2
920	MAMIE'S	10	2	2
921	KINGWOOD	10	2	2
921	THEINN	10	2	2
923	SPAHR'S	10	2	2

STZ#	Putnam County	Classification	Subclassification	Ownership
372	INDIANVILLAGESITE	2	1	2
363	WESTERNHILLSGOLFCL	3	4	1
365	SLEEPYHOLLOWGOLFCO	3	4	2
365	PUTNAMVILLAGE	4	2	2
390	ROCKBRANCHINDPARK	5	1	2
390	HUBINDUSTRIALPARK	5	1	2
390	FMC	5	2	2
370	B.M.P.CO.	5	2	2
370	PUTNAMFABRICATION	5	2	2
390	FMC	5	3	2
390	MONSANTO	5	3	2
369	COBDETACHMENT	6	1	1
365	WPNSAMHURRICANE	6	3	2
369	COCHOUSEWINFIELD	6	5	1
364	PUTNAMCOPUBLIC	6	6	1
364	HURRICANE	7	1	1
367	POCA	7	1	1
371	GEORGEWASHINGTON	7	1	1
365	HURRICANE	7	2	1
367	POCA	7	2	1
369	WINFIELD	7	2	1
372	BUFFALO	7	2	1
371	PUTNAMCOVOC-TECHSC	7	4	1
355	RLJEFFERISTRUCKIN	8	3	2
366	MASON-DIXONTANKLIN	8	3	2
368	MCLEANTRUCKING	8	3	2
390	OVERNITETRANSFER	8	3	2
390	HENNESTRUCKING	8	3	2
390	COASTALTANKLINES	8	3	2
390	FOODMACHINERYCORP.	8	5	2
372	KANAWHAMFGR.CO.	8	5	2
370	HURRICANEREADY-MIX	8	5	2
366	APPALACHIANPOWER	8	5	2
368	CLAXTONF.SMITH.SR.	8	5	2
370	UNIONBOILER	8	5	2
390	ALLIEDCHEMICAL	8	5	2
364	HURRICANE	9	1	1
368	MAPLEWOODLODGE	10	2	2
369	VALLEY	10	2	2

STZ#	Raleigh County	Classification	Subclassification	Ownership
149	BECKLEYVAHOSPITAL	1	1	2
163	APPALACHIANREGION	1	2	1
150	RALEIGHGENERAL	1	2	1
149	BECKLEYHOSPITAL	1	2	2
152	PINECREST	1	2	2
151	EASTBECKLEYHOME	1	3	2
163	PINELODGEHOME	1	3	2
152	WILDWOODHOME	2	1	2
144	LITTLEBEAVER	3	1	1
173	GRANDVIEW	3	1	1
147	LAKESTEPHENS	3	2	1
139	LAKEVIEWGOLFCOURSE	3	4	1
146	TWINOAKSCOCLUB	3	4	1
151	BLACKKNIGHTCOCLUB	3	4	2
144	4-HCAMP	3	7	1
154	TOWNANDCOUNTRY	4	2	2
169	BY-PASSPLAZA	4	2	2
169	BECKLEYPLAZA	4	2	2
169	NEWRIVERINDUSTRIAL	5	1	2
150	BECKLEYNEWSPAPER	5	2	2
164	GREENBRIERDAIRY	5	2	2
145	LIVELYMFGREQUIPCO	5	2	2
169	BECKLEYMANU	5	2	2
144	WILCOXMANUFACTURIN	5	2	2
152	CODHEADQUARTERS	6	1	1
164	NGUNITBECKLEY	6	2	1
152	WVPBFMBECKLEY	6	3	1
153	WBKWAMBECKLEY	6	3	2
153	WCIRAMBECKLEY	6	3	2
153	WJLSAMBECKLEY	6	3	2
153	WCIRFMBECKLEY	6	3	2
155	WWNRAMBECKLEY	6	3	2
152	WSWPTVBECKLEY	6	4	1
150	COCHOUSEBECKLEY	6	5	1
150	RALEIGHCOPUBLIC	6	6	1
137	RHODELL	7	1	1
137	STOCO	7	1	1
141	MARKTWAIN	7	1	1
141	SLABFORK	7	1	1
142	SOAKCREEK	7	1	1
142	SOPHIA	7	1	1
143	MIDWAY	7	1	1
144	SHADYSPRING	7	1	1
145	LESTER	7	1	1
148	ECCLES	7	1	1
149	FRANCISDESALES	7	1	2
150	PARK	7	1	1
151	BECKLEY	7	1	1
151	STRATTON	7	1	1
166	MARSHFORK	7	1	1
166	MOUNTVIEW	7	1	1
138	STOCO	7	2	1
139	SHADYSPRINGS	7	2	1

STZ#	Raleigh County continued	Classification	Subclassification	Ownership
142	SOPHIA	7	2	1
147	TRAPHILL	7	2	1
163	WOODROWWILSON	7	2	1
166	MARSHFORK	7	2	1
167	CLEARFORK	7	2	1
153	BECKLEYCOLLEGE	7	3	2
171	APPLACHIANBIBLEINS	7	3	2
150	RALEIGHVOC-TECHSCH	7	4	1
150	BECKLEY	8	1	2
163	SMITHTRANSFER	8	3	2
164	RALEIGHCOMEMORIAL	8	4	1
150	BECKLEY	9	3	1
150	BECKLEY	10	1	2
144	MOONGLO	10	2	2
146	RAMADA	10	2	2
148	STARLITE	10	2	2
150	CHARLESHOUSE	10	2	2
152	GREENBANK	10	2	2
152	HONEYINTHEROCK	10	2	2
152	PINECREST	10	2	2
153	EASTMAIN	10	2	2
155	GENEVA'S	10	2	2
155	GROSE'SPIKE	10	2	2
155	PAGODA	10	2	2

Randolph County

623	DAVISMEMORIAL	1	2	1
623	MEMORIALGENCLINIC	1	2	1
623	NELLASNURSINGHOME	1	3	2
627	NELLASINC	1	3	2
621	GASSAWAYDAVISHOME	2	1	2
619	RICHMTBATTLEFIELD	2	1	1
615	KUMBRABOWSTATEPARK	3	2	1
620	REVELLEGAMPGROUNDS	3	2	2
620	BEARHAVENREC.AREA	3	2	1
620	STUARTREC.AREA	3	2	1
620	LAURELFORKREC.AREA	3	2	1
620	SPRUCEKNOBLAKEREC.	3	2	1
619	ELKSCOUNTRYCLUB	3	4	2
619	CAMPPIONEER	3	7	1
623	TYGARTVALLEYMALL	4	2	2
617	COASTALLUMBERCO	5	2	2
622	ALLEGHENYLUMBERCO	5	2	2
619	LABORATORYFURNITUR	5	2	2
622	KELLYFOUNDRY	5	2	2
622	REIDBOARDBROSCO	5	2	2
619	BATASHOECORP	5	2	2
623	COCHEADQUARTERS	6	1	1
623	NGUNITELKINS	6	2	1
621	WONEAMELKINS	6	3	2

STZ#	Summers County	Classification	Subclassification	Ownership
178	SUMMERSCOUNTYHOSP	1	2	1
180	HINTONHOSPITAL	1	2	2
179	BIGBENDTUNNEL	2	1	2
175	PIPESTEM	3	1	1
177	BLUESTONE	3	1	1
175	BLUESTONEP.H.A.	3	2	1
175	PIPESTEMSTATEPARK	3	2	1
177	BLUESTONESTATEPARK	3	2	1
179	PENCESPRINGSCAMPGR	3	2	2
183	BASSLAKE	3	2	2
175	PIPESTEMGOLFCOURSE	3	4	1
175	PIPESTEMPAR3COURSE	3	4	1
179	WILLOWWOODCOCLUB	3	4	2
176	CAMPARTLOUGH	3	7	1
179	PENCESPRSMANUFACTU	5	2	2
180	CODDETACHMENT	6	1	1
176	NGUNITHINTON	6	2	1
180	WMTDAMHINTON	6	3	2
180	COCHOUSEHINTON	6	5	1
176	FORESTHILLS	7	1	1
177	JUMPINGBRANCH	7	1	1
179	PENCESPRINGS	7	1	1
183	SANDSTONE	7	1	1
179	TALCOTT	7	2	1
180	HINTON	7	2	1
183	SUMMERSCOVOC-TECH	7	4	1
180	HINTON	8	2	2
179	HINTONALDERSONAIRP	8	4	1
180	HINTON	9	1	1
175	PIPESTEM	10	3	1
176	SANDMAN	10	2	2
177	COASTTOCOAST	10	2	2

Taylor County

STZ#	Taylor County	Classification	Subclassification	Ownership
781	GRAFTONCITYHOSP	1	2	1
782	RESTHAVENHOME	1	3	2
782	NATIONALCEMETERY	2	1	1
781	MOTHER'SDAYSHRINE	2	1	2
778	TYGARTLAKE	3	1	1
778	GRAFTONCITYPARK	3	2	1
778	TYGARTLAKESTATEPAR	3	2	1
786	TYGARTRIVERCAMPING	3	2	2
779	TYGARTLAKECOCLUB	3	4	1
786	GRAFTONCOUNTRYCLUB	3	4	1
780	CAMPTOWLES	3	7	1
781	HARMON	4	2	2
781	STREGISPAPERCO	5	2	2
791	WVAPLASTICS	5	2	2
781	COADETACHMENT	6	1	1
781	WVUWAMGRAFTON	6	3	2
781	COCHOUSEGRAFTON	6	5	1
781	TAYLORCOPUBLIC	6	6	1
781	GRAFTONMIDDLE	7	1	1
780	INDSCHOOLFORBOYS	7	2	1
776	FLEMINGTON	7	2	1
782	GRAFTON	7	2	1
781	GRAFTON	9	2	1
778	TYGARTLAKE	10	3	1
780	COZYREST	10	2	2
780	GRAFTON	10	2	2
781	CRISLIP	10	2	2

STZ#	Randolph County continued	Classification	Subclassification	Ownership
621	COCHOUSEELKINS	6	5	1
614	VALLEYHEADPUBLIC	6	6	1
621	ELKINSPUBLIC	6	6	1
623	ELKINS	7	1	1
615	TYGARTVALLEY	7	2	1
616	PICKENS	7	2	1
618	COALTON	7	2	1
620	HAPMAN	7	2	1
622	ELKINS	7	2	1
627	DAVISANDELKINS	7	3	2
617	HOMESTEADCENTER	7	4	1
619	ELKINSRANDOLPHCOAI	8	4	1
621	ELKINS	9	2	1
621	TYGART	10	1	2
617	CONRADS	10	2	2
619	FARAWAYHILLS	10	2	2
619	CHEATRIVER	10	2	2
619	LOOP	10	2	2
620	ALPINESPRINGS	10	2	2
621	ELKINSMOTORLODGE	10	2	2
621	FOURSEASONS	10	2	2
621	IRONHORSE	10	2	2
621	KAY'S	10	2	2
621	MARIAN'SGUESTHOUSE	10	2	2
621	SENECA	10	2	2
620	SPRUCEFLAT	11	1	1
620	ALISMATRIVIALE	11	1	2
620	OTTERCREEKWILDERN	11	2	1
620	SINKSOFGANDY	11	1	2
620	SPHAGNUMSWAMP	11	1	2

Ritchie County

689	PINEVIEWHOME	1	3	2
690	SHEPHERDHOME	1	3	2
688	NORTHBEND	3	1	1
688	NORTHBENDSTATEPARK	3	2	1
689	NORTHBENDCOCLUB	3	4	2
690	RITCHIECO4-HCAMP	3	7	1
701	PENNSBOROMANUFACT	5	2	2
688	RITCHIEINDCORP	5	2	2
690	MID-ATLANTICGLASS	5	2	2
689	ECONOMYINDUSTRIES	5	2	2
689	COADETACHMENT	6	1	1
689	COCHOUSEHARRISVILL	6	5	1
689	RITCHIECOPUBLIC	6	6	1
696	SMITHVILLE	7	1	1
688	CAIRO	7	1	1
689	HARRISVILLE	7	1	1
690	ELLENBORO	7	1	1
689	HARRISVILLE	7	2	1
701	PENNSBORO	7	2	1
688	NORTHEND	10	3	1
690	THREEPOINT	10	2	2
701	PENNSBORO	10	2	2

STZ#	Roane County	Classification	Subclassification	Ownership
566	ROANEGENERAL	1	2	1
569	GORDONMEMORIAL	1	2	1
568	SPENCERSTATE	1	4	1
554	SANDYBRAE	3	4	2
571	ROANECOFIELDCLUB	3	4	2
566	COUNTY4-HCAMP	3	7	1
557	SPENCERINDUSTRIAL	5	1	2
569	MONARCHRUBBERCO	5	2	2
571	KELLWOODCO	5	3	2
569	COBDETACHMENT	6	1	1
569	NGUNITSPENCER	6	2	1
569	WVRCAMSPENCER	6	3	2
569	COCHOUSESPENCER	6	5	1
569	ALPHAREGIONAL	6	6	1
569	ROANECOPUBLIC	6	6	1
565	LEFTHAND	7	1	1
565	NEWTON	7	1	1
566	GANDEEVILLE	7	1	1
567	CLOVER	7	1	1
567	LINDEN	7	1	1
569	SPENCER	7	1	1
571	REEDY	7	1	1
564	WALTON	7	2	1
569	SPENCER	7	2	1
569	POMILLERTRANSFER	8	3	2
571	TIMBERTRUCKINGCO	8	3	2
567	ROANECOAIRPORT	8	4	1
566	SMITHGRANDVIEW	10	2	2

STZ#	Wayne County	Classification	Subclassification	Ownership
226	HUNTINGTONVAHOSP	1	1	2
216	CABWAYLINGOST.FORE	3	2	1
218	EASTFORKCAMPGROUND	3	2	1
232	CAMDEN PARK	3	3	2
226	SPRINGVALLEYCOCLUB	3	4	2
224	NOVAMONTCORP	5	2	2
230	AMERICANRUBBERCO	5	2	2
225	PILGRIMGLASS	5	2	2
233	CORBINLIMITED	5	3	2
221	COBDETACHMENT	6	1	1
225	NGUNITHUNTINGTON	6	2	1
220	COCHOUSEWAYNE	6	5	1
230	CEREDOKENOVAMEMORI	6	6	1
220	WAYNE	7	1	1
216	CRUM	7	2	1
217	FORTGAY	7	2	1
220	WAYNE	7	2	1
222	BUFFALO	7	2	1
229	CEREDOKENOVA	7	2	1
233	VINSON	7	2	1
225	TRISTATEAIRPORT	8	4	1
229	ASHLANDOIL	8	5	2
231	OGLEBAY-NORTON	8	5	2
231	UNIONCONCRETEPIPE	8	5	2
233	HUNTINGTON	9	2	1
230	HOLLYWOOD	10	2	2
230	KENOVA	10	2	2
210	GREATBLUEHERON	11	1	1

Webster County

STZ#		Classification	Subclassification	Ownership
524	WEBSTERCOUNTYMEM	1	2	1
526	HOLLYRIVER	3	1	1
520	CRANBERRYREC.AREA	3	2	1
526	HOLLYRIVERSTATEPAR	3	2	1
521	CAMPCAESAR	3	7	1
522	COCDETACHMENT	6	1	1
522	COCHOUSEWSPRINGS	6	5	1
522	WEBSTER-ADDISON	6	6	1
521	COWENADVANCED	7	1	1
522	WEBSTERSPRINGSADV	7	1	1
524	DIANA	7	1	1
526	HACKERVALLEY	7	1	1
522	WEBSTERSPRINGS	7	2	1
522	MOTORLODGE	10	1	2
522	WEBSTERSPRINGS	10	1	2
521	REDGABLES	10	2	2
522	MINERALSPRINGS	10	2	2
521	FRASER'SSEDGE	11	1	2

STZ#	Wetzel County	Classification	Subclassification	Ownership
844	WETZELCOUNTYHOSP	1	2	1
844	LEWISWETZELHOME	1	3	2
846	MASON-DIXONLINE	2	1	1
840	LEWISWETZELP.H.A.	3	2	1
848	CAMPWETZEL	3	7	1
845	VIKINGGLASS	5	2	2
845	DECORATORINDUSTRIE	5	2	2
841	COADETACHMENT	6	1	1
845	WETZAMNEWM'VILLE	6	3	2
845	COCHOUSENEWM'VILLE	6	5	1
841	PADENCITYPUBLIC	6	6	1
845	NEWMARTINSVILLEPUB	6	6	1
839	VALLEY	7	2	1
841	PADENCITY	7	2	1
845	MAGNOLIA	7	2	1
850	HUNDRED	7	2	1
844	MATLACKINC.	8	3	2
844	OHIOVALLEYSAND&GRA	8	5	2
844	OHIOVALLEYSAND&GRA	8	5	2
845	OHIORIVERSAND&GRAV	8	5	2
841	PADENCITY	9	1	1
845	NEWMARTINSVILLE	9	2	1
844	RURLINGAME	10	2	2
844	SUNSET	10	2	2
844	TRAVELERS	10	2	2
839	SOUTHERNBALDEAGLE	11	1	1

Wirt County

692	CAMPBARBE	3	7	1
683	RAVENSMETAL	5	2	2
693	COBDETACHMENT	6	1	1
683	COCHOUSEELIZABETH	6	5	1
683	DORABWOODYARDMEMOR	6	6	1
683	WIRTCOUNTY	7	2	1

STZ #	Tucker County	Classification	Subclassification	Ownership
808	TUCKERCOUNTYHOSP	1	2	2
808	WHITEGABLESHOME	1	3	2
812	FAIRFAXSTONE	2	1	1
813	MTSTATEMUSEUM	2	1	2
809	BLACKWATERFALLS	3	1	1
809	CANAANVALLEY	3	1	1
812	FAIRFAXSTONEMONUME	3	1	1
809	BLACKWATERFALLSSTA	3	2	1
809	LAZYACRES	3	2	2
809	RESTRITECAMPGROUND	3	2	2
809	REDCREEKREC.AREA	3	2	2
813	SAYERSCAMPSITES	3	2	2
814	HORSESHOEREC.AREA	3	2	1
809	CANAANVALLEYPARK	3	4	1
810	HOLLYMEADOWSCOCLUB	3	4	2
809	CANAANVALLEY	3	6	1
810	CAMPKIDD	3	7	1
814	HINCHCLIFFLUMBER	5	2	2
808	KINGSFORDCO.	5	2	2
808	PARSONSFOOTWEAR	5	2	2
808	PARSONSTANNING	5	2	2
808	COCDETACHMENT	6	1	1
808	COCHOUSEPARSONS	6	5	1
808	PARSONSPUBLIC	6	6	1
808	PARSONS	7	2	1
813	MOUNTAINEERSENIOR	7	2	1
811	A.MOORECAREERCENTE	7	4	1
809	BLACKWATERFALLS	10	3	1
813	WORDENS	10	1	2
808	CARL'S	10	2	2
808	MARYLLOYDTOURIST	10	2	2
809	MOUNTAINVIEW	10	2	2
811	SUNSETINN	10	2	2
813	BLACKWATER	10	2	2
813	GOLIGHTLY'S	10	2	2
813	MOUNTAINAIRE	10	2	2
813	STONE	10	2	2
809	REDCREEK	11	2	2
809	REDRUNBOG	11	2	1
809	BLACKWATERFALLS	11	1	1

Tyler County

836	SISTERSVILLEGEN	1	2	1
836	DURHAMHOUSE	2	1	2
836	WELLSINN	2	1	2
836	CITYHALL	2	1	1
834	PREHISTORICRUINS	2	1	1
833	CONAWAYRUNLAKE	3	2	1
833	CAMPCOPPERHEAD	3	2	2
833	TYCOFAIRCAMPGROUND	3	2	2

STZ #	Tyler County continued	Classification	Subclassification	Ownership
834	SISTERSVILLECOCLUB	3	4	2
833	TYLERCOA-HCAMP	3	7	1
836	UNIONCARBIDE	5	3	2
837	CORNINGGLASS	5	3	2
835	COCHOUSEM'BOURNE	6	5	1
835	TYLERCOPUBLIC	6	6	1
836	SISTERVILLEMIDDLE	7	1	1
835	ELSWORTH	7	1	1
836	SISTERSVILLE	7	2	1
835	TYLERCOUNTY	7	2	1
836	WELLSINN	10	1	2

Upshur County

607	ELIZABETHCOPLINNEM	1	2	2
606	SAINTJOSEPHHOSP	1	2	1
612	HOLBROOKHOME	1	3	2
604	PIONEERCAMPGROUND	3	2	2
604	LITTLEKANAWHARIVER	3	2	2
612	BUCKHANNONCOCLUB	3	4	2
604	UPSHURCOYOUTHCAMP	3	7	1
611	HECKSSHOPPINGCENT-	4	2	2
611	BUCKHANNONPLAZA	4	2	2
610	EDMINISTONINDPARK	5	1	2
606	REIDBOARDBROS	5	2	2
610	CORHARTREFRACTORIE	5	3	2
610	MOOREBUSINESSFORMS	5	3	2
607	COCDETACHMENT	6	1	1
610	NGUNITBUCKHANNON	6	2	1
605	WVWCFMBUCKHANNON	6	3	2
610	WBUCAMBUCKHANNON	6	3	2
607	COCHOUSEBUCKHANNON	6	5	1
606	GIBSONPUBLIC	6	6	1
611	STONEWALLJACKSOREG	6	6	1
606	BUCKHANNONUPSHUR	7	1	1
611	BUCKHANNONUPSHUR	7	2	1
605	WVAWESLEYAN	7	3	2
610	INTER-CITYTRANSPOR	8	3	2
610	LEWISFIELD	8	4	1
606	BUCKHANNON	9	2	1
607	BAXA	10	1	2
607	COLONIAL	10	1	2
607	CENTENNIAL	10	2	2
610	PAPPAS	10	2	2

STZ#	Wood County	Classification	Subclassification	Ownership
644	CAMDENCLARKHOSP	1	2	1
644	HARTMANNEENTHOSP	1	2	2
648	SAINTJOSEPHHOSP	1	2	1
645	CREELMEMORIALHOME	1	3	2
650	TURTLECREEKCENTER	1	3	2
652	GREENLAWNINC	1	3	2
669	OHIOVALLEYHOME	1	3	2
671	WORTHINGTONMANOR	1	3	2
641	BLENNERHASSETIS	2	1	1
639	BUTCHERSBEND4HCAMP	3	2	1
642	CORRALMARINA&CAMPG	3	2	2
677	SHADYRESTCAMPING	3	2	2
642	SOUTHHILLSGOLFCOUR	3	4	2
653	MINIBELGOLFCOURSE	3	4	1
650	WORTHINGTONGOLFCLU	3	4	1
677	PAR-MARGOLFCLUB	3	4	2
653	PARKERSBURGCOCLUB	3	4	2
639	BUTCHERSBEND4-H	3	7	1
648	PARKERSBURGHIGHSTA	3	8	1
671	GRANDCENTRALMALL	4	1	2
645	PARKSHOPPINGCENTER	4	2	2
656	SOUTHGATESHOPPING	4	2	2
671	K-MART	4	2	2
671	HILL'SPLAZA	4	2	2
651	PARKERSBURGINDPLAZ	5	1	2
653	KFENECORP.	5	2	2
644	MISTYMANUFACTURING	5	2	2
647	STORCHBAKERY	5	2	2
647	IDEALBOXCO	5	2	2
648	OGDENNEWSPAPER	5	2	2
668	MTSTATESTEELCO	5	2	2
640	AMERICANMETALCO	5	2	2
656	UNIONINSULATING	5	2	2
668	APCHANCECO	5	2	2
669	GAMESCO	5	3	2
645	STARCITYGLASSCO	5	3	2
654	BROCKWAYGLASS	5	3	2
646	CORNINGGLASS	5	3	2
640	DUPONT	5	3	2
646	WALKERTEXTRON	5	3	2
652	JOHNSMANVILLE	5	3	2
640	MARBONCHEMICAL	5	3	2
655	FENTONGLASS	5	3	2
670	PENNZOILUNITED	5	3	2
669	COBDETACHMENT	6	1	1
677	NGUNITPARKERSBURG	6	2	1
657	NGUNITPARKERSBURG	6	2	1
644	WCEFAMPARKERSBURG	6	3	2
644	WPARAMPARKERSBURG	6	3	2
644	WCEFFMPARKERSBURG	6	3	2
671	WKYGAMPARKERSBURG	6	3	2
671	WKYGFMPARKERSBURG	6	3	2

STZ#	Wood County continued	Classification	Subclassification	Ownership
644	WTAPTVPARKERSBURG	6	4	2
644	COCHOUSEPKSBURG	6	5	1
644	CARNEGIEPUBLIC	6	6	1
652	VIENNAPUBLIC	6	6	1
647	SUMNER	7	1	1
647	WASHINGTON	7	1	1
649	HAMILTON	7	1	1
651	VANDEVENDER	7	1	1
653	JACKSON	7	1	1
656	EDISON	7	1	1
657	FRANKLIN	7	1	1
648	PARKERSBURG	7	2	1
648	DESALESHEIGHTS	7	2	2
650	PKSBGCATHOLIC	7	2	2
654	STJOSEPHPREPSEM	7	2	2
655	WILLIAMSTOWN	7	2	2
657	PARKERSBURGSOUTH	7	2	1
669	PARKERSBURGCOMMCOL	7	3	1
671	OHIOVALLEYCOLLEGE	7	3	2
657	WOODCOVOC-TECHCENT	7	4	1
644	PARKERSBURG	8	1	2
642	SMITHTRANSFERCO	8	3	2
644	OVERNITETRANSFER	8	3	2
644	PEOPLESCARTAGE	8	3	2
644	UNITEDDISPATCH	8	3	2
644	M.J.BELTANDSON	8	3	2
647	HALL'SMOTORTRANSIT	8	3	2
647	YELLOWFREIGHT	8	3	2
647	CONSOLITADED	8	3	2
651	CAROLINAFREIGHT	8	3	2
651	JOHNSONMOTORLINES	8	3	2
657	ALLEGHENYFREIGHT	8	3	2
657	COOKMOTORLINES	8	3	2
671	EAZOREXPRESS	8	3	2
677	WOODCOAIRPORT	8	4	1
645	OHIORIVERSAND&GRAV	8	5	2
668	AMERICANVISCOSE	8	5	2
645	PARKERSBURGSTEEL	8	5	2
652	VIENNA	9	3	1
644	PARKERSBURG	9	5	1
644	BLENNERHASSETT	10	1	2
669	PARK	10	2	2
677	WEDGEWOOD	10	2	2
677	BRIARGATE	10	2	2
644	CHANCELLOR	10	2	2
644	UPTOWNERINN	10	2	2
650	ACROPOLIS	10	2	2
656	HILEY'S	10	2	2
669	GREENACRES	10	2	2
669	HOLIDAYINN	10	2	2
669	JOBE'S	10	2	2

STZ#	Wyoming County	Classification	Subclassification	Ownership
129	WYOMINGGENERAL	1	2	2
132	TWINFALLS	3	1	1
129	CLEARFORKVALLEYGOL	3	4	2
132	TWINFALLSPARKGOLFC	3	4	1
132	WYOMINGCOYOUTHCAMP	3	7	1
127	CODDETACHMENT	6	1	1
123	WWYOAMPINEVILLE	6	3	2
123	COCHOUSEPINEVILLE	6	5	1
123	WYOMINGCOPUBLIC	6	6	1
129	MULLENSBRANCH	6	6	1
131	OCEANABRANCH	6	6	1
121	HUFFCONSOLIDATED	7	1	1
122	BAILEYSVILLE	7	1	1
123	PINEVILLE	7	1	1
124	HERNDON	7	1	1
125	COALMOUNTAIN	7	1	1
126	LONGBRANCH	7	1	1
127	GLENFORK	7	1	1
127	MATHENY	7	1	1
129	MULLENS	7	1	1
131	OCEANA	7	1	1
131	ROADPRANCH	7	1	1
132	GLENROGERS	7	1	1
132	JOHNMCGRAWS	7	1	1
135	KOPPERSTON	7	1	1
122	BAILEYSVILLE	7	2	1
123	PINEVILLE	7	2	1
124	HERNDON	7	2	1
130	MULLENS	7	2	1
131	OCEANA	7	2	1
132	GLENROGERS	7	2	1
123	WYOMINGCOVOC-TECH	7	4	1
127	WYOMINGCOAIRPORT	8	4	1
129	MULLENS	9	1	1
123	MOUNTAIN	10	2	2
127	COWSHED	10	2	2
131	ROBERTS	10	2	2
132	TWINFALLS	10	3	1
129	WYOMING	10	1	2

Source: West Virginia Department of Highways, Statewide Traffic Assignment Model Study, n.d.

STATEWIDE FACILITY DATA CODES

Facility Classification	Numeric Code
Health Facilities	1
Historic Sites	2
Recreation Facilities	3
Shopping Facilities	4
Industrial Facilities	5
Public Service Facilities	6
Education Facilities	7
Transportation Facilities	8
Cities	9
Lodging Facilities	10
Fragile Areas	11

Facility Classification	Subclassification	Numeric Code
Education Facilities	Junior Highs	1
	Senior Highs	2
	State Colleges and Universities	3
	Vocational Education Schools	4
	Grade Schools	5
Transportation Facilities	Bus terminals	1
	Railway terminals	2
	Truck terminals	3
	Airports	4
	Docks	5
Cities (Central Business Districts)	2,500 to 4,999 population	1
	5,000 to 9,999 population	2
	10,000 to 24,999 population	3
	25,000 to 49,999 population	4
	50,000 and above	5
Lodging Facilities	Hotels	1
	Motels	2
	State Lodges	3
Fragile Areas	Unique Natural areas	1
	Primitive areas	2

STATEWIDE FACILITY DATA CODES

Facility Classification	Subclassification	Numeric Code
Health	Veterans Hospital	1
	General Hospital	2
	Nursing Home	3
	Mental Hospital	4
Historic Sites	Historic	1
	Prehistoric	2
	Scenic	3
	Geological	4
	County line	5
	State line	6
Recreation Facilities	State Parks	1
	Camp sites	2
	Amusement parks	3
	Golf courses	4
	Race tracks	5
	Ski resorts	6
	4-H camps	7
	Stadiums	8
	Roadside parks	9
	Other	10
Shopping Facilities	Regional Shopping Center	1
	Community Shopping Center	2
	Neighborhood Shopping Center	3
Industrial Facilities	Industrial parks	1
	Major manufacturing Plants (250 employees or more)	2
	Mediam manufacturing Plants (100 to 250 employees)	3
	Small manufacturing Plants (less than 100 employees)	4
Public Service Facilities	Department of Public Safety	1
	National Guard Facilities	2
	Radio Towers	3
	Television Towers	4
	County Court Houses	5
	Public library	6
	Federal buildings	7
	Post offices	8
	Civil defense centers	9
	Sewage treatment plants	10

STATEWIDE FACILITY DATA CODES

Ownership	Code
Public	1
Private	2

6. LEGAL ANALYSIS OF INSTITUTIONAL ACCOUNTABILITY

6.1 INTRODUCTION

This chapter is designed to supplement the ORBES Phase I support study "Legal Analysis of Institutional Accountability for the Ohio River Basin" by Nicholas White and John F. Fitzgerald (hereinafter referred to as "ORBES Legal Study"). That study gave an overview of federal and state laws "pertinent to the development and operation of energy conversion facilities in the Ohio River Basin" (ORBES Legal Study, p. III-E-iii, 1977). But in 1977 the ORBES region did not include West Virginia, and accordingly West Virginia state laws were omitted.

In supplementing the White and Fitzgerald study, this chapter adopts and continues for West Virginia, the methodology and breakdown used by Professor White and Mr. Fitzgerald. This approach begins with an "Overview" of the legal institutions in the state (Part 6.2 of this chapter).

This is followed by the "identification of Institutions and Legislative Authority by Process", which identifies "in more detail those governmental institutions (agencies and departments) and their legislative authority as such relate to different processes utilized in energy conversion." (ORBES Legal Study, p. III-E-iii, 1977).

Finally, in Part 6.4 of this chapter there is a table identifying institutions and legal authority by Media. As described by White and Fitzgerald, this "part approaches the identification of institutions and legislation by the media — air, water, land, etc. -- that will be impacted by the development and operation of the energy conversion facilities. As an example, air pollution problems irrespective of whether they arise from the extraction process or generation process are identified in paragraph 1.0 in which air is the media." (ORBES Legal Study, p. III-E-iii, 1977).

In order to retain consistancy in the sectional breakdown, the same numerical system is used in this process section and the media table as is used in the White and Fitzgerald tables, except that in the process discussion, each number is preceded by 6.3.

6.2 AN OVERVIEW OF LAWS RELATING TO ENERGY REGULATION

Most legislative and administrative authority over energy related activities in West Virginia rests within the West Virginia Department of Natural Resources, the West Virginia Department of Mines, the West Virginia Public Service Commission, and the West Virginia Air Pollution Control Commission.

West Virginia has neither a comprehensive environmental protection law or agency, nor a power plant siting authority. Environmental concerns are vested primarily in the Department of Natural Resources which administers water programs and surface mining reclamation programs. Solid waste and air programs are administered by the West Virginia Resource Recovery and Solid Waste Board and the Air Pollution Control Commission respectively.

The Department of Mines has duties with respect to coal mine safety and miners' health as well as regulating coal mining procedures and techniques.[1]

The Department of Natural Resources (D.N.R.) has authority and duties with respect to a range of resource related activities.[2] In addition to the traditional type of authority over wildlife, parks, state forests, and water resources, the D.N.R. administers among other laws the Water Pollution Control Act,[3] Natural Streams Preservation Act,[4] Dam Control Act,[5] Surface Mining and Reclamation Act,[6] Interstate Mining Compact,[7] Coal Refuse Disposal Control Act,[8] and the Cave Protection Act.[9]

Structurally, West Virginia's D.N.R. is comprised of six divisions; Game and Fish, Forestry, Parks and Recreation, Water Resources, Law Enforcement, and Reclamation. In addition there is a Natural Resources Commission which serves as an advisory board to the D.N.R.

Of particular interest to ORBES are the Division of Water Resources and the Reclamation Division.

The Water Resources Division is responsible for implementing the Water Pollution Control Act and the Water Resources Act. Although West Virginia is not currently enforcing the NPDES permit program under the Federal Water Pollution Control Act,[10] steps are being taken to obtain such authority, which would be vested in the D.N.R. division of water resources.

The Water Resources Division is also designated as the "statewide 208-planning agency" charged with developing a comprehensive areawide waste water management plan under the Federal Water Pollution Control Act. Although no plan has been

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[1]W. VA. CODE §§22-1-1 to 22-1-35.

[2]W. VA. CODE §§20-1-1 to 20-8-4.

[3]W. VA. CODE §§20-5A-1 to 20-5A-24.

[4]W. VA. CODE §§20-5B-1 to 20-5B-17.

[5]W. VA. CODE §§20-5D-1 to 20-5D-14.

[6]W. VA. CODE §§20-6-1 to 20-6-32.

[7]W. VA. CODE §§20-6B-1 to 20-6B-4.

[8]W. VA. CODE §§20-6C-1 to 20-6C-8.

[9]W. VA. CODE §§20-7A-1 to 20-7A-6.

[10]33 U.S.C. §1251 et seq. (Supp. 1978), now commonly known as the Clean Water Act.

finalized yet, this aspect of water pollution regulation is particularly important in West Virginia as these 208 plans are directed at controlling the pollutant loadings caused by non-point sources. The mining and forestry industries in West Virginia present significant non-point source water pollution hazards which are not effectively regulated under existing water pollution control programs.

The Division of Reclamation is responsible for enforcing the West Virginia Surface Mining Control Act.[11] The regulatory format under the statute is directed at minimizing the adverse environmental impacts of surface mining in West Virginia. The basic regulatory structure is a permit process with bonding requirements to insure reclamation of surface mined areas. Although the West Virginia Act does not address the environmental impacts of deep mining, the D.N.R. has recently promulgated regulations under the State Surface Mining Act to control surface effects of underground mining. These proposed changes are to conform with the standards of the Federal Surface Mining Control and Reclamation Act of 1977, thus enabling West Virginia to implement the Federal Act.

The West Virginia Public Service Commission[12] has a fairly traditional regulatory role with respect to electrical utilities, regulating rates, service, and certifying the need for expanded capacity. The only explicit environmental responsibilities of the PSC relate to the construction of high voltage transmission lines, for which environmental impact assessments must be performed by the utility.[13]

The Air Pollution Control Commission (A.P.C.C.) is a separate administrative agency with exclusive jurisdiction over air quality regulation in the state.[14] This seven member commission consists of the Director of Health, the Commissioner of Agriculture, and five members appointed by the Governor. The Commission appoints the Director of the A.P.C.C. The A.P.C.C. implements the state Air Pollution Control Act, as well as the various regulatory duties placed on states by the Federal Clean Air Act. These include permitting of major sources, monitoring and enforcement activities, and implementing the EPA-approved State Implementation Plan.

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[11] W. VA. CODE §§20-6-1 to 20-6-32.

[12] W. VA. CODE §§24-2-1 to 24-2-15.

[13] W. VA. CODE §§24-2-11A.

[14] W. VA. CODE §§16-20-1 to 16-20-13.

6.3 IDENTIFICATION OF INSTITUTIONS AND LEGISLATIVE AUTHORITY BY PROCESS

6.3.1 EXTRACTION OF RAW MATERIALS

6.3.1.1 COAL

6.3.1.1.1 SURFACE MINING

The Division of Reclamation of the West Virginia D.N.R. has primary responsibility for regulating the environmental effects of surface mining in West Virginia. This responsibility is discharged through a permit system which requires D.N.R. approval of any surface mine prior to operation. There are provisions for public notice of pending surface mine applications, and as yet unused authority to delete certain areas of the state from all surface mining. Operators are required to reclaim disturbed lands and must post bonds to insure such reclamation.

West Virginia is currently seeking delegation of regulatory authority under the Federal Surface Mine Control and Reclamation Act of 1977.

6.3.1.1.2 UNDERGROUND MINING

The Department of Mines exercises authority over all underground mines. The focus of this authority is safety and health protection rather than environmental protection (§§22-2-1 et seq.). Among the duties of the Department of Mines are permit issuance, (§§22-2-1, 22-2-2, 22-1-13), mine inspection training and certification of mine inspectors, fire boss, mine foremen, and both surface and underground miners (22-6-1). An independent Board of Coal Mine Health and Safety was created in 1977 to review existing health and safety provisions, and develop appropriate rules and regulations for a comprehensive program of mine safety. (§§22-2A-1 et seq.).

The provisions for coal mine health and safety extend to all open-pit and surface mines for various minerals as well as underground limestone or sandstone mines (§22-3-2).

The Water Resources Division of the Department of Natural Resources has authority over water discharges from mines. Under regulations promulgated by the Water Resources Board measures are to be taken to minimize acid mine drainage (Water Resource Board Regulations, Series 1, §5). At present West Virginia is not implementing the NPDES permit program, so the U.S. EPA regional office regulates point source discharges from surface and deep mines.

The Air Pollution Control Commission regulates air emissions from coal preparation and handling operations (A.P.C.C. Reg. V), as well as from coal refuse disposal areas (A.P.C.C. Reg. 1).

6.3.1.2 NATURAL GAS AND OIL EXTRACTION

Natural Gas and Oil extraction is regulated by the state through the deputy director for oil and gas of the Department of Mines (§§22-4-1 et seq.). This regulatory format includes a permit program (§22-4-1K), bonding provisions (§22-4-2), inspection programs (§22-4-1f), standards to protect coal mine operations (§22-4-5), reclamation requirements (§22-4-12b), and various standards for operations. Additional regulatory authority is exercised

over oil and gas extraction by the Oil and Gas Conservation Commission (§22-4A-1) which is charged with promoting development and conservation of oil and gas generally and with preventing waste with respect to deep wells specifically.

6.3.1.3 WATER

West Virginia has declared that as public policy the water resources of the state with respect to the quantity thereof shall be available for reasonable use by all citizens of the State (§20-5-1A).

Explicit statutory provisions exist with respect to water quality but aside from authority over various dams, the control of water consumption or quantity is left to common law riparian doctrines within the jurisdiction of the Circuit Courts. (Halltown Paperboard Co. v. C.L. Robinson Corp. 150 W. VA. 624, 148 SE2d 721 (1968)).

6.3.2 TRANSPORTATION OF RAW MATERIALS AND FUELS

6.3.2.1 NON-HAZARDOUS MATERIALS

West Virginia regulates the transportation of raw materials primarily with respect to rates of carriers through the Public Service Commission (§24A-2-3). The basis of this authority is to insure safety in such transport and to stabilize service at just and reasonable rates. Coal transport from mine operations to loading facilities by truck is exempt from P.S.C. regulation (§24A-1-3 (7)). Gas Pipeline transport is also regulated by the P.S.C. primarily with respect to safety (§24B-1-1).

6.3.3 RAW MATERIAL CONVERSION

Raw material conversion of coal, oil, nuclear or gas is not specifically regulated in West Virginia. As with any industrial facilities, provisions of the Air Pollution Control Act, and Water Pollution Control Act must be complied with.

6.3.4 GENERATION OF ELECTRICAL ENERGY

Environmental regulation of the various electrical generating facilities in West Virginia is based on the general environmental laws applicable to all industrial processes. There is extensive regulation of the air emissions from coal-fired power plants, all of which follow the lead of the Federal Clean Air Act. As of August 1978, West Virginia was having discussions with the United States Environmental Protection Agency with respect to the regulation of SO_2 from existing power plants. The basic issues in these discussions are related to the use of relatively high sulfur West Virginia coal in certain plants which results in SO_2 emissions in excess of current Federal standards. Various revisions of the state implementation plan with respect to SO_2 emissions are anticipated.

Since West Virginia does not have NPDES authority, electrical generating facilities, which are invariably point source dischargers, must obtain a NPDES permit from U.S. EPA, an action which requires an environmental impact statement to be prepared by U.S. EPA. West Virginia State Implementation Plan is scheduled for approval review in December, 1978.

The authority of the Public Service Commission (P.S.C.) over electric utilities forms the basis of most of West Virginia's exercise of authority over electrical generating facilities. The main concern of the P.S.C. is the rate structure and service area of electrical utilities. However, there are certain powers vested in the P.S.C. which affect the physical aspects of the generating industry. Among these are requirements for a certificate of public convenience and necessity before construction or expansion of generating capacity is commenced (§24-2-11). Arguably the grant of authority to the P.S.C. with respect to these certificates allows consideration of environmental factors; however no case or authority for such action has been found.

Unlike several other ORBES states there is no centralized authority over the siting of electrical generating facilities in West Virginia. It appears that the individual utility companies have a relatively free hand in site selection, subject to disjointed environmental, and economic review.

The current policy of the state appears to be one of encouraging development of electrical generating facilities for export both to the lower Ohio River Basin and the Eastern population centers in Virginia and Maryland. Interestingly in this context the West Virginia legislature recently revised the rate structure for the Business and Occupation tax on the production of electrical power. Under the prior structure, electricity generated in-state to be sold out-of-state was taxed at a substantially lower rate than electricity consumed in-state for either residential or industrial uses. These previous tax rates were 5.72% of gross value on electricity for residential and commercial use in West Virginia, 4.29% on electricity for industrial use in West Virginia, and .88% on electricity consumed outside West Virginia. The new rate is a uniform 4% tax on all types of electricity. With a 2.46% rate for large consumers.

Several utility companies are challenging these revisions as an unconstitutional interference with interstate commerce. It is unlikely that these utilities will prevail in this litigation. More interesting though is the policy inherent in this tax revision. Along with the invitation to utilities to come into West Virginia is the clear statement that West Virginia intends to capitalize upon increased energy development in a more vigorous and direct manner than in the past.

West Virginia

6.4 IDENTIFICATION OF GOVERNMENTAL INSTITUTIONS BY MEDIA

Media	Institution	Authority
0.0 GENERAL:	Natural Resources Commission Advisory board to DNR, public membership	W.VA. CODE 20-1-3
	Commission on Energy, Economy and Environment 19 member advisory commission to legislature and executive, promotes research into clean, efficient fuels, encourages citizen participation, ascertains resource base of West Virginia	W.VA. CODE 5-17-1 et seq.
1.0 AIR		APCC Reg 1-13, 40 CFR 52.2520
1.1 General Pollution	Air Pollution Control Commission	W.VA. CODE 16-20-1 et seq.
1.1.1 Standards	APCC	W.VA. CODE 16-20-5(4)
1.1.2 Planning	APCC	W.VA. CODE 16-20-5 (16)
1.1.3 Enforcement	APCC (Director) (Note legal assistance comes from attorney general's office, or offices of county prosecuting attorneys)	W.VA. CODE 16-20-6 W.VA. CODE 76-20-6
2.0 WATER		
2.1 Quantity	Water Development Authority	W.VA. CODE 20-5C-1 et seq.
	Water Development Authority Board (1972 c 84)	W.VA. CODE 20-5C-1 et seq.
	DNR Division of Water Resource	
	Dam Control Act	W.VA. CODE 20-5d-1 et seq.
	Slack Water Dams	W.VA. CODE 20-5-6 et seq.

Media		Institution	Authority
2.2	General Pollution		
	2.2.1 Standards	DNR Div. Water Resources	W.VA. CODE 20-5-1 et seq.
		Water Resources Board	W.VA. CODE 20-5-3
		Water Resources Act	W.VA. CODE 20-5A-1 et seq.
		Water Pollution Control Act	W.VA. CODE 20-5A-3a
	2.2.2 Planning	DNR Div. Water Resources	W.VA. CODE 20-5A-1 et seq.
		Water Development Authority	W.VA. CODE 20-5-1 et seq.
		Statewide "208 Planning Agency" - DNR, Div. Water Resources	see FWPCA sec. 208
	2.2.3 Monitoring	DNR, DWR	
		voluntary monitors	W.VA. CODE 20-5A-8A
	2.2.4 Enforcement (WPCA)	1. Permits	
		DNR, DWR	W.VA. CODE 20-5A-5 et seq.
		2. Orders	W.VA. CODE 20-5A-10
		3. Emergency Orders	W.VA. CODE 20-5A-12A
		4. Civil Actions	W.VA. CODE 20-5A-17, 19A
		5. Criminal liabilities	W.VA. CODE 20-5A-19
2.3	Flood Control	Any County Commission or Muncipality	W.VA. CODE 8-30-1
		may engage in flood control projects or in regulating flood plains (sec 3.3)	W.VA. CODE 7-1-3u
		or create Drainage Districts	W.VA. CODE 19-21-1 et seq.
		National Flood Insurance Act of 1968	W.VA. CODE 7-1-3v
		Authorization (see sec. 3.3)	
		Wheeling Creek Watershed and Flood Prevention Compact	W.VA. CODE 29-1F-1 et seq.
2.4	Navigation	DNR - must approve or exempt any obstruction across waterway which may impede fish passage, fish ladders required	W.VA. CODE 61-3-47

Media		Institution	Authority
2.5	Drinking Water	Water Development Authority Local Public Service Districts construct and operate facilities	W.VA. CODE 16-13A-1 et seq.
		State Department of Health sets standards, plans, and specifications	W.VA. CODE 16-1-9a
		Public Service Commission regulates rates and service	W.VA. CODE 24-2-5 W.VA. CODE 24-2-1
2.6	Conservation (Consumption)	DNR Div. of Water Resources	W.VA. CODE 20-5-1, 20-5-14
		Watershed Improvement Districts (in conjunction with Soil Conservation Districts)	W.VA. CODE 19-21B-1 et seq. W.VA. CODE 19-21A-1 et seq.
2.7	Recreation and Wildlife	DNR Division of Wildlife Resources Fishing and Hunting	W.VA. CODE 20-2-1
		DNR Div. of Parks and Recreation	W.VA. CODE 20-4-1
		DNR Div. of Law Enforcement motorboating regulations	W.VA. CODE 20-7-11
2.8	Wild and Scenic Rivers	DNR Div. of Water Resources Natural Streams Preservation Act	W.VA. CODE 20-5B-1 et seq.
2.9	Hydroelectric	P.S.C. general authority to regulate "water power companies"	W.VA. CODE 24-1-1 to 24-5-1
3.0	LAND		
3.1	General	DNR Forestry Division	W.VA. CODE 20-3-1
		DNR Public Land Corporation	W.VA. CODE 20-1-15
		DNR Division of Reclamation	W.VA. CODE 20-6-1
		Municipal and County Commissions zoning and planning authority	W.VA. CODE 8-24-1

Media		Institution	Authority
3.2	Landfills	Resource Recovery - Solid Waste Disposal Authority	W.VA. CODE 16-26-1 (1977 supp.)
		County Commissions	
		Aquisition and operation of sanitary landfills	W.VA. CODE 7-1-3e
		County Solid Waste Authorities	W.VA. CODE 7-16-1 -7-16-8
		Department of Health	
		Supervision over local sanitation	W.VA. CODE 16-1-9
3.3	Flood Plains	Counties and Municipalities authorized to regulate land use in	W.VA. CODE 7-1-3u
		Flood plains	W.VA. CODE 7-1-3v
3.4	Transportation	1. Roads and Highways	
		State Road Commission	W.VA. CODE 17-1-1
		P.S.C. Common Carriers (exempts coal truck)	W.VA. CODE 24A-1-1
		2. Railroads	
		Railroad Maintainance Authority	W.VA. CODE 29-18-4
3.5	Archeological and Historic Sites	Department of Culture and History	W.VA. CODE 29-1-1 et seq. (1977 supp.)
		Archives and History Division (protection of state owned or controlled archeologic and historic sites)	W.VA. CODE 29-1-7
		Archives and History Commission	W.VA. CODE 29-1-6
		Advisory to Department and Division	
3.6	Government Lands	Federal:	
		Department of Interior	
		State:	
		Public Land Corporation	

Media		Institution	Authority
	3.7 Soil Conservation	A. Soil Conservation Districts Local Agency	W.VA. CODE 19-21A-1 et seq.
		B. Soil Conservation Committee supervise Soil Conservation Districts, State Agency	W.VA. CODE 19-21A-4
		C. Board of Adjustment administers any land use ordinance promulgated by Soil Conservation District	W.VA. CODE 19-21A-11
	3.8 Natural Resources	Cave Protection Act DNR	W.VA. CODE 20-7A-1 et seq.
	3.9 Recreation	DNR Division of Parks and Recreation	W.VA. CODE 20-4-1 et seq.
		County Commissions	W.VA. CODE 8-21-1 et seq.
		Municipal Govt.'s Parks Departments	W.VA. CODE 10-2-1 et seq.
4.0	OTHER MEDIA		
	4.1 Noise	Dept. Motor Vehicles mufflers	W.VA. CODE 17C-15-3y
	4.2 Radiation	Member State Southern Interstate Nuclear Compact	W.VA. CODE 29-1E-1 et seq.
5.0	MISCELLANEOUS		
	5.1 Research	Commission on Energy, Economy, and Environment	
	5.2 Regulation		
	5.2.1 Coal	Surface DNR Div. of Reclam.	W.VA. CODE 20-6-1
		Underground Dept. of Mines (Safety)	W.VA. CODE 22-1-1 et seq.
	5.2.2 Oil and Gas	Oil and gas Dept. of Mines Deputy Director for Oil and Gas Conservation	W.VA. CODE 22-4-1 et seq.

Media	Institution	Authority
	Gas Pipeline Safety Commission	W.VA. CODE 24B-1-1
5.3 Policy and Planning	Regional Planning and Development Councils	W.VA. CODE 8-25-1 et seq.
	Interstate Regional Planning Commissions	W.VA. CODE 8-25G-5
	Municipal and County Planning and Zoning	W.VA. CODE 8-24-1 et seq.
	Commission of Energy, Economy, and Environment	
5.4 Taxation	Business and Occupation Tax	
	1. Coal 3.85% gross value	
	2. Oil 4.34% gross value	
	3. Gas 8.63% gross value	W.VA. CODE 11-13-2A
	Pollution Control Facilities Tax Treatment	W.VA. CODE 11-6A-1
5.5 Pesticide and Herbicide	Department of Agriculture Pesticide Use and Application Act	W.VA. CODE 19-16B-1