

VIRGINIA DEPARTMENT OF CONSERVATION  
AND ECONOMIC DEVELOPMENT

DIVISION OF WATER RESOURCES



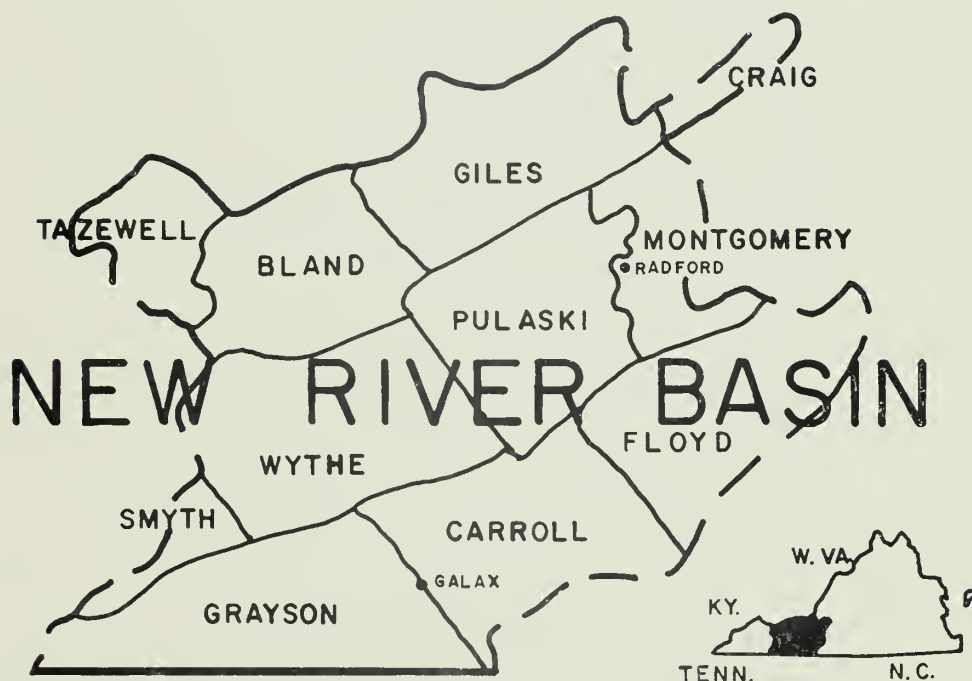
COMPREHENSIVE WATER RESOURCES PLAN

VOLUME II—ECONOMIC BASE STUDY  
PLANNING BULLETIN 202  
1967



VIRGINIA DEPARTMENT OF CONSERVATION  
AND ECONOMIC DEVELOPMENT

DIVISION OF WATER RESOURCES



COMPREHENSIVE WATER RESOURCES PLAN

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VOLUME II - ECONOMIC BASE STUDY

PLANNING BULLETIN 202

AUGUST, 1967



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NEW RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN

VOLUME II - ECONOMIC BASE STUDY

Planning Bulletin 202

Commonwealth of Virginia

Department of Conservation and Economic Development

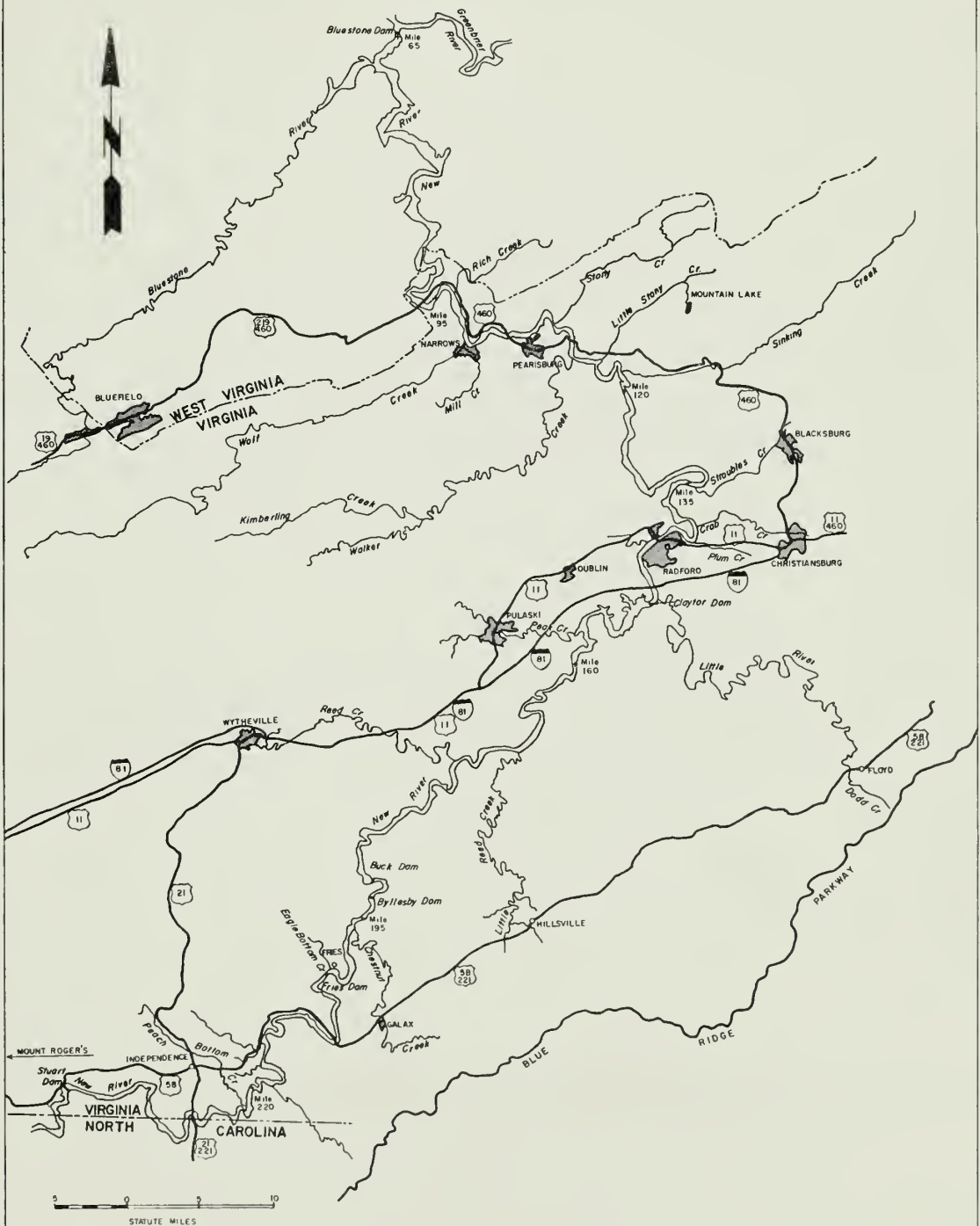
Division of Water Resources

Richmond, Virginia

August - 1967



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DIVISION OF WATER RESOURCES

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## ACKNOWLEDGMENTS

In Volume I, Planning Bulletin 201, of the New River Basin Comprehensive Water Resources Plan in Virginia, December 1966, the Division of Water Resources of the Virginia Department of Conservation and Economic Development gratefully acknowledged the contributions of a number of Federal, State, and local governmental agencies and corporate or private organizations. Twelve of the contributing departments and divisions of the Virginia State Government were listed along with the names of the eleven counties and two cities of the New River Basin in Virginia whose officials and citizens have cooperated in the survey. The continuing interest of all of these in the survey and the subsequent bulletins is appreciated.

In particular the assistance of the Division of Planning, the Division of Industrial Development, United States Army Corps of Engineers, Federal Water Pollution Control Administration and the area development departments of the Norfolk and Western Railway Company and the Appalachian Power Company are appreciated. Every effort has been made to provide useful, practical information and ideas.



## FOREWORD

The Comprehensive New River Basin Water Resources Plan is contained in six volumes.

Volume I - Introduction

Volume II - Economic Base Analysis

Volume III - Hydrologic Analysis

Volume IV - Water Resource Requirement

Volume V - Engineering Development Alternatives

Volume VI - Implementation of Development Alternatives

"The ultimate aim of river projects and programs, in common with all other productive activity, is to satisfy human needs and desires. The objectives of economic analysis in planning river basin and watershed programs is to provide a guide for effective use of the required economic resources, such as land, labor and materials, in producing goods and services to satisfy human wants by determining whether economic resources would be used more effectively than would be the case without the project."\*

The following summary of chapters in Volume II is included for the benefit of those reading the volume who do not wish to examine the technical data and analyses in the Economic Base Study in detail.

Chapter I contains a discussion of the shape of the future New River Basin and a look into the anticipated economy in the year 2020

\* "Proposed Practices for Economic Analysis of River Basin Projects." Subcommittee on Evaluation Standards, Washington, D. C., Revised May 1958, p. 5.

Chapter II provides the methodology of economic study and the New River Basin's place in the national, state, and regional economy. Approaches to economic study of river basins are given in the chapter.

Chapter III includes information regarding current economic activity in the Basin area and the role of economics in Basin analysis.

Chapter IV contains an analysis of anticipated population growth within a framework of alternative assumptions to 2020.

Chapter V indicates the current employment picture in the Basin and employment projections for the New River Basin to 2020.

Chapter VI is a study of industrial outlook in the Basin and contains requirements for development of industrial resources. Probable growth belts in the New River Basin and projection of value added and gross manufacturing output are included in the chapter.

Chapter VII shows the historical trend of Gross National Product and a projection of future G.N.P. An indication of gross regional output in the Basin to 2020 is given.

Chapter VIII includes information on trade in the New River Basin and figures for wholesale and retail trade in the Basin area.

Chapter IX is a discussion of regional accounting and the flows of monetary influence.

Chapter X provides information on current personal income in the New River Basin. Projections of per capita income in major political subdivisions of the Basin are shown.

Chapter XI contains an evaluation of Developmental Aspects of Recreation and the influence of expenditures for recreation on the New River Basin Economy.

Chapter XII is a brief discussion of the value of water under riparian law.

Chapter XIII is a brief look at economic waste in the New River Basin. Consideration is given in this chapter to economic alternatives in the use of the area's resources.

Chapter XIV provides figures on the cost of water in various areas of the Basin and estimates of the value of elements of water resource development in the Basin.

Chapter XV includes information on existing industrial water use in the Basin and predictions of future water requirements for the chemical and allied industries.

Chapter XVI has preliminary estimates of capital requirements for future water resource development in the New River Basin. The role of water and related land resources in Basin Development is considered.

Chapter XVII considers resources and their economic inputs and outputs. The process of selection and distribution of desired uses of resources is explained.

Chapter XVIII contains water-economic weights of activities on a monetary basis in the New River Basin. A judgment is made regarding the impact of investment in water resources on the economy of the Basin. The requirements for water resource development derived from economic factors which indicate this need are illustrated.

Chapter XIX considers the influence of monetary factors on land values and subsequent urbanization in a rural economy. The effects of introducing common financial factors into water resource development decisions are explored.

Chapter XX evaluates the possible effects of removing marginal lands within the Basin and the substitution of water and related land resource development for these lands.

Chapter XXI is a look at water resource economic development programs for the Basin. Possible goals for development planning and the desired conditions for growth are stated.

## CHAPTER I

### THE SHAPE OF THE FUTURE NEW RIVER BASIN

Let us look at the New River Basin in the year 2020. Population will be nearly double that reported in 1960. Projections indicate that three hundred and forty-one thousand people will live in the Basin in 2020 compared with 180,000 in 1960. Much of this population will, in all probability, be concentrated around presently existing cities and towns. Land values will be much higher than they presently are. Financial institutions will greatly improve their range of services and good influences. An urban consciousness will pervade the entire area. Agriculture will make more intensive use of open lands. Casual recreation will be more limited than it is at the present time. A rising standard of living, increases in income, extended leisure time and a better educated population will change the shape of demands to a more sophisticated level. It can be expected that increases in quality of services will be sought. Extensive recreation developments, making use of water resource potential, will be required to insure healthy growth. The chemical industry, an improved food industry centered in meat products and a pulp and paper industry most probably will be significant factors in the economy of the area. Existing industries will expand. Outside visitors, attracted by desirable water resource facilities, will make increased use of the area. Transportation systems will be greatly improved. More people will remain in the geographical area in which they were trained with possibilities for

employment in progressive industries. Salaries will provide a better standard of living. Local, state, and federal facilities will increase and there will be more government employees in the area. Open space outside the urban areas will be available. The New River Basin will be a desirable area in which to live and work in 2020.

## CHAPTER II

### METHODOLOGY OF ECONOMIC STUDY

The entire New River Basin analysis is done in relation to certain assumptions regarding the rate of growth of the New River Basin as compared with the National economy.

In making those projections, no major war and no major change in the Federal system of government has been assumed. Such changes could have major effects on our projection of gross output and the subsequent experimental projection of value added for the New River Basin. We have postulated a Gross National Product growing at the approximate rates shown in Table 16. We are assuming an eventually balanced budget. Possible changes in Federal, State and Local taxation have been assumed to be in a direction which would encourage healthy growth in industry and personal disposable income.

Technology carries the heaviest load. Its expected contribution to increased output per worker is assumed throughout the "long" range of the projections. The most startling change affecting labor will probably be a reorientation which will be required to establish new duties and remuneration schedules for workers employed in manufacturing. Labor will be required to expend more in its approach in order to capture its fair share of this progress. In a word, the worker of the future in the New River Basin will have to see that he is more skilled.

Population growth within the New River Basin is assumed to

be more modest than that for the country as a whole. However, the mix of workers is expected to change in favor of younger and more highly skilled personnel - especially in the later years of the projection.

National growth of money and credit, at first, is expected to exceed that of the New River Basin region. Even in later projection years, the Basin is expected to lag behind the Nation as a whole.

#### Economic Bases for River Basin Planning

Considerable emphasis in past river basin planning has centered upon Federal theory in the establishment of Benefit/Cost ratios.

The citizen who lacks training in the nuances of economic theory, or indeed in administrative procedure, is apt to view Federal Benefit/Cost practices as an absolute which can readily be translated to any application of economic analysis.

Benefit/Cost formulae are only as good as the validity of the concepts they enunciate. The assignment of dollar weights to benefits to be derived from flood control can be limited by poor scientific research into flood frequency. The extension of these frequencies and calculation of the estimated flood damages to property in given years is an accounting exercise which must be subjected to intensive testing. One of the most difficult areas of analysis begins where intangibles take over. There is, perhaps, an over-reliance on gathered data which may be less than reliable, although it is the best available. In the area of assigning a dollar value to recreation benefits for a proposed project, great care is required. The simple extension of average expenditures per day by visitors drawn from a certain circumscribed radius has

been subjected to only limited corroboration. It is possible, under certain circumstances, that benefits are even being underestimated by the use of current methodology.

Project orientation has been the key to analysis in the past. The basic nature of Benefit/Cost analysis as a measure of social allocation of expenditures which will be of measurable benefit to the Nation has not been clearly emphasized in regional application. Instead, B/C ratios have been regarded as absolutes of economic analysis.

Initial State programs have found that they require a more objective analysis of river basins. This analysis cannot, in its early stages, be project-oriented. The orientation is toward the entire economic area of the river basin under study. The scientific (physical) definition of a river basin, determined by the points at which the flow of surface supply water to the major river begins, is not an exact fit to the economic factors which heavily rely upon and influence the water resource development in the basin. Water and related land resources are the basis for an approach to economic analysis of river basins. This approach permits consideration of all scarce resources and their optimal uses, which is the essence of basic economics. The output of the economist is a necessary input for engineers and planners of all types.

An accelerated development of regional economics has brought forth a new body of regional theory. Some of this theory is useful in river basin planning. In reality, regional theory is an entirely separate field which would properly be a consumer of river basin plans. Economic development planning would be the natural, immediate

consumer of river basin plans.

Methodology has been developed to aid in economic analysis but has not been included in this volume in detail in order that information may be understandable to non-professional readers. It is anticipated that some of the results emanating from this new methodology will prove stimulating.

New value theory must be developed to deal with specialized interests arising from river basin analysis. Government methodology will probably continue to occupy a prominent position in daily operations but does not supply the needed flexibility. An outline of economic theory for river basin planning, which is being developed, is presented below.

1. Value Theory - indicating the monetary value of water and related land resources in varying mixes of resource use. It is particularly important to question the concept that "water is a free economic good." An evolution of law to express this relationship in a social way may be forthcoming.

2. Projective Theory - on a sub-regional basis to establish probable mixes of gross output or value added for manufacturing within the Basin. Determination of parameters of size and growth for application of input-output analysis will be made where justified.

3. Allocative Theory - establishing monetary relationships between true water cost (as a function of value) including opportunity costs in a variety of mixes, and other factors and sub-factors of projection and consumption. Eventually, this will serve as both input and output to projective theory.

This entire body of theory will have one quality which economic

research stands in need of at present. It will be related to market realities. Consequently, it is hoped that many of the intermediate projects will be of immediate value to a wide variety of consumers. It is just such a body of theory which is being developed on the State and Local levels augmented by the constructive efforts of a number of Federal agencies.

The projections for the future in Volume II are accompanied by a caution that they are not predictions but forecasts of what might occur if a number of specific assumptions regarding the structure and behavior of the economy materialize. As previously noted, the basic premise was that national forces dominate economic development throughout the United States.

In this context it can be said that an optimistic forecast for the country filters down to the regional level. The methodological framework is based on the theory that employment, output, population and personal income are functions of mutually determining variables and should be linked in the analytical framework. In the analysis we have included elements of location factor theory, priority and ranking analysis, inter-industry and inter-resource linkages of modified input-output type and ratio analysis.

## CHAPTER III

### ECONOMIC ACTIVITY IN THE NEW RIVER BASIN AREA

A common sense key to accurate projections of growth in counties and segments of counties must be based on past and present growth indicators and on potential which is present. The following summary, prepared from existing economic base studies of these counties, is presented to highlight this purpose. Additional detailed information can be obtained from the Office of the Governor, Division of Planning, in Richmond. It would be misleading and inaccurate for a planner to rule out growth in any one county or to suggest that any one county will grow to the exclusion of its neighbors.

#### Bland County

Agriculture is important to Bland County. A large number of farms specialize in livestock - fine beef, and dairy cattle, sheep and hogs.

The greater part of farm income comes from the sale of cattle, sheep and hogs. Dairy products are next in importance. In addition to lumber production, hosiery manufacturing and sportswear manufacturing have become important to the County. Opportunities for hunting and fishing are available in the County and several widely used and attractive camps are located here. Forest covered 78 percent of the County in 1965.

#### Carroll County

Dairy products and livestock are the biggest sources of cash farm income. There is a milk condensary and a market for beef

cattle.

Recently, Carroll County was among the Nation's top ranking counties in the production and harvesting of apples and cabbages.

Hillsville has a small hospital and medical clinic.

Galax is a growing manufacturing center. The city was named for a small green plant which grows abundantly in the mountains nearby. The leaves of this plant are said to be processed by a secret method for use in floral wreaths and shipped to florists throughout the United States. The County is 55 percent forested (1965).

Hosiery and knitwear mills are concentrated at Galax. Furniture making, long the principal industry, has a large employment. Living room and dining room furniture, church furniture, lumber, mirrors, uniforms, printing, evaporated milk, upholstery and drapery materials, and electrical components are just some of the products produced in this area.

#### Craig County

Livestock, chiefly cattle, is the principal source of farm income. Some swine and sheep are also produced. Dairying has increased in recent years and is next in importance. The County was 77 percent forested in 1965. Farm woodland products bring in cash. Lumber, building and industrial sand, and apparel are among Craig's principal products.

#### Floyd County

A large part of Floyd County is in farm land. Livestock raising is the principal contributor to farm income. Dairy products are now next in importance. Field crops such as burley tobacco, grain,

and hay augment farm income. Eggs are the chief poultry product.

Several sawmills and planing mills are located in the County. The County is 54 percent forestland (1965). There are garment plants at the Town of Floyd which produce dresses, blouses and accessories.

There is an established commuter pattern between work centers in Roanoke, Radford and Galax, where employment is available, in the textile, chemical, hosiery, and furniture industries.

### Giles County

Seventy-two percent of the County is forested (1965). Many acres are included in the Jefferson National Forest. Mineral resources include iron-bearing sandstone, manganese minerals, limestone and dolomite, marl, sand, gravel, clay and shale. Limestone is mined for use in the manufacture of industrial and chemical lime. Limestone and dolomite are quarried for use as crushed stone, mine safety dust, mineral feed supplement and agricultural stone.

Fertile limestone soils along the streams assist good crops and pastures. Farm income is heavily influenced by the sale of beef cattle, calves, and sheep. The sale of dairy products, fruits and poultry is also important.

Giles County has long had industry, but initiation of production at the Celanese Corporation's plant in 1940 made the County no longer primarily an agricultural area.

The Celanese Corporation plant at Narrows produces acetate flake, yarn and fiber. Other products manufactured in the County include shoe leather, lime, apparel, lumber, concrete blocks, and grist mill products.

## Grayson County

Lumber and quarry operations are located in Grayson County. The County was 56 percent forestland in 1965. Grayson's pastures produce good livestock. Farm income comes from the sale of cattle, calves, dairy products and burley tobacco. Local farms have readily available milk markets at Galax and Independence. A livestock market serving this area is located at Galax. There is a wool products mill at Mouth of Wilson.

At the present time Grayson County residents are also employed in manufacturing at Fries, Independence and Galax (located on the Carroll-Grayson County line). Manufacturing in the area includes cotton material and sheeting, hosiery, apparel, knitwear, evaporated milk, upholstery and drapery materials, upholstered furniture, bedroom furniture, specialty furniture, mirrors and lumber.

## Montgomery County

The Jefferson National Forest extends into the northern portions of the County. Sixty-two percent of the total area is wooded (1965). Mineral resources presently being utilized include semianthracite coal, shale, limestone and sandstone.

Montgomery's limestone soils are adapted to grain and pasture crops, making stock raising and dairy farming profitable. Livestock can be sold conveniently in a large livestock market in Christiansburg. There is a poultry market in Radford. Truck crops can be sold in Roanoke.

The Virginia Polytechnic Institute is located at Blacksburg. There is an airport at Blacksburg which serves the surrounding area.

There are many manufacturing plants in the Montgomery County

area, particularly at Radford (independent city) and at Christiansburg.

Area manufactures include meat products, creamery products, grain-mill products, rayon fabrics, apparel, propellants, chairs and other wood products, agricultural stone, foundry products, paper boxes, concrete products, sponge rubber products, campers and electric motors and generators. The economy of Radford is subject to stimulation by an increase in defense expenditures.

#### Pulaski County

Pulaski County is 53 percent forested (1965), primarily the mountainous section which is too rugged for farming. The Jefferson National Forest extends into the northern half of the County. Wood-using industries abound in the County. Mineral resources include semianthracite coal, limestone and dolomite, ocher, zinc, manganese, iron ore, sandstone, shale and clay.

Much of the farming section has fertile limestone soil in which grain and pasture crops thrive. Livestock and dairy farms contribute over 90 percent of gross farm income. Sheep and cattle are the most important sources of meat products. The Pulaski County livestock market, located west of Dublin, opened in 1953 to serve the producers of this area. Livestock and poultry can also be sold in the markets of Wytheville, Christiansburg, and Radford. Much wool is clipped in Pulaski County. The New River Valley Airport is located at Dublin.

Manufacturing, centered chiefly in the town of Pulaski, gives employment to more Countians than does agriculture. Knitting mills, dyeing and finishing plants and yarn throwing operations make up

the textile sector of the County's economy. Other products include sulphuric acid, iron sulfide, paint pigments of iron oxide, furniture, hardwood flooring, millwork, plastic fabrics, mirrors, soft drinks, iron castings and clothing.

#### Smyth County

Sixty-two percent of the area of Smyth County is in forest (1965). Jefferson National Forest forms a large portion of this mountainous area. Mineral resources include large salt and gypsum deposits, limestone and dolomite, clay, shale, sandstone, and manganese minerals.

The large deposits of limestone in the soil render it very fertile. Raising of livestock is the leading source of income, with dairy farming following close behind. The chief crops are cabbage and burley tobacco. Horticultural specialties, apples and leather also contribute greatly to farm income.

Manufacturing plants in Smyth County are located in Chilhowie, Marion, and Saltville. Principal products include beverages, milk products, hosiery, sleepwear, apparel, furniture, (wood, metal, plastic) lumber, billiard and bowling items, gypsum board, chemical compounds, stone and sand products, paving materials, bricks, radomes and laminated plastics.

#### Tazewell County

Sixty percent of the area of Tazewell County is in forest (1965). Principal mineral resources of the County include coal, limestone and dolomite, natural gas, and clay. Tazewell County produced 241,118 tons of coal in 1966. Coal mining provides significant employment to the people of this County; however, lumbering still plays an important role.

Livestock raising, dairy farming, and crop production are of major significance in Tazewell County due to the high productivity of the limestone soil.

Manufacturing is largely diversified in Tazewell County and is centered around the towns of Bluefield and Richlands. Principal products are ice cream and dairy products, carbonated beverages, truck bodies, upholstery and drapery trimmings, lumber, millwork, wooden caskets, mattresses, apparel, brick and clay tile, church furniture, agricultural and chemical lime, concrete, monuments, capacitors, dye works, mining machinery and equipment, and clay dummies for mine explosions.

#### Wythe County

Wythe County is 52 percent forested (1965). Farm products and livestock sales account for a large segment of farm income in the County. The soil is rich in lime content and is very fertile. Blue grass grows abundantly with little or no cultivation.

Rock and mineral products include crushed limestone and dolomite, mined and concentrated lead and zinc ores, crushed quartzite, and sand for building purposes. Other manufacturing includes milk and dairy products, grain mills, garment and apparel products, printing and publishing, concrete and brick, metal fasteners and screws.

#### Galax City

The City of Galax has plants which manufacture furniture, mirrors, and flooring products. Manufacturers of wearing apparel are located in the City. One of the largest producers of condensed milk products in the country also maintains a plant here. The

surrounding area has many large dairy farms. For its population and size, Galax City has a large industrial complex.

### Radford City

Radford City is a potential nucleus for industrial growth. It has all the prerequisites to encourage future industrial expansion. Industries include frozen milk products, broad woven fabrics, men's, youth's and boy's shirts, dresses, sit-up paper-board boxes, sponge rubber, iron foundry products, motors and generators, and truck pick-up coaches. Radford College is located here.

### The Role of Economics in the New River Basin Analysis

"Economics is usually defined as the study of man's activities in using scarce means (resources) which are capable of satisfying a variety of wants." <sup>1</sup>

Since we have variety in all human experiences and enterprise and are dealing with a resource (water) that a great many people in some areas have been speaking of as "scarce," we have a common meeting ground for economic analysis. It is important to establish the framework for this analysis on the National level, as so much of our data is available on this level as well as on the State level where we have additional indicators for our use. It is at the local level that the best use of these necessarily abstract indicators can find their employment.

The President's Water Resources Council has set the framework for the study of water and related land resources with appropriate guidelines:

<sup>1</sup> Modern Economics, Hart, Burns, Neal & Watson, Second Edition, Harcourt, Brace & World, Inc., New York, 1953, page 4.

"National economic development and development of each region within the country is essential to the maintenance of national strength and the achievement of satisfactory levels of living. Water and related land resources development and management are essential to economic development and growth through concurrent provision for -

"Adequate supplies of surface and ground waters of suitable quality for domestic, municipal, agricultural, and industrial uses including grazing, forestry, and mineral development uses.

"Water quality facilities and controls to assure water of suitable quality for all purposes.

"Water navigation facilities which provide a needed transportation service with advantage to the Nation's transportation system.

"Hydro-electric power where its provision can contribute advantageously to a needed increase in power supply.

"Flood control or prevention measures to protect people, property, and productive lands from flood losses where such measures are justified and are the best means of avoiding flood damage.

"Land stabilization measures where feasible to protect land and beaches for beneficial purposes.

"Drainage measures, including salinity control, where best use of land would be justifiably obtained.

"Watershed protection and management measures where they will conserve and enhance resource use opportunities.

"Outdoor recreational and fish and wildlife opportunity where these can be provided or enhanced by development works.

"Any other means by which development of water and related land resources can contribute to economic growth and development.

"Proper stewardship in the long-term interest of the Nation's natural bounty requires in particular instances that -

"There be protection and rehabilitation of resources to insure availability for their best use when needed.

"Open space, green space, and wild areas of rivers, lakes, beaches, mountains and related land areas be maintained and used for recreational purposes; and

"Areas of unique natural beauty, historical and scientific interest be preserved and managed primarily for the inspiration, enjoyment, and education of the people.

"Well-being of all of the people shall be the overriding determinant in considering the best use of water and related land resources. Hardship and basic needs of particular groups within the general public shall be of concern, but care shall be taken to avoid resource use and development for the benefit of a few or the disadvantage of many." <sup>2</sup>

### Understanding the Nature of the New River Basin Economy

A great deal of the land in the New River Basin is in a primary state of development, (Plate 1). A key to understanding the economy of the Basin is to visualize the extractive nature of the significant enterprises located there.

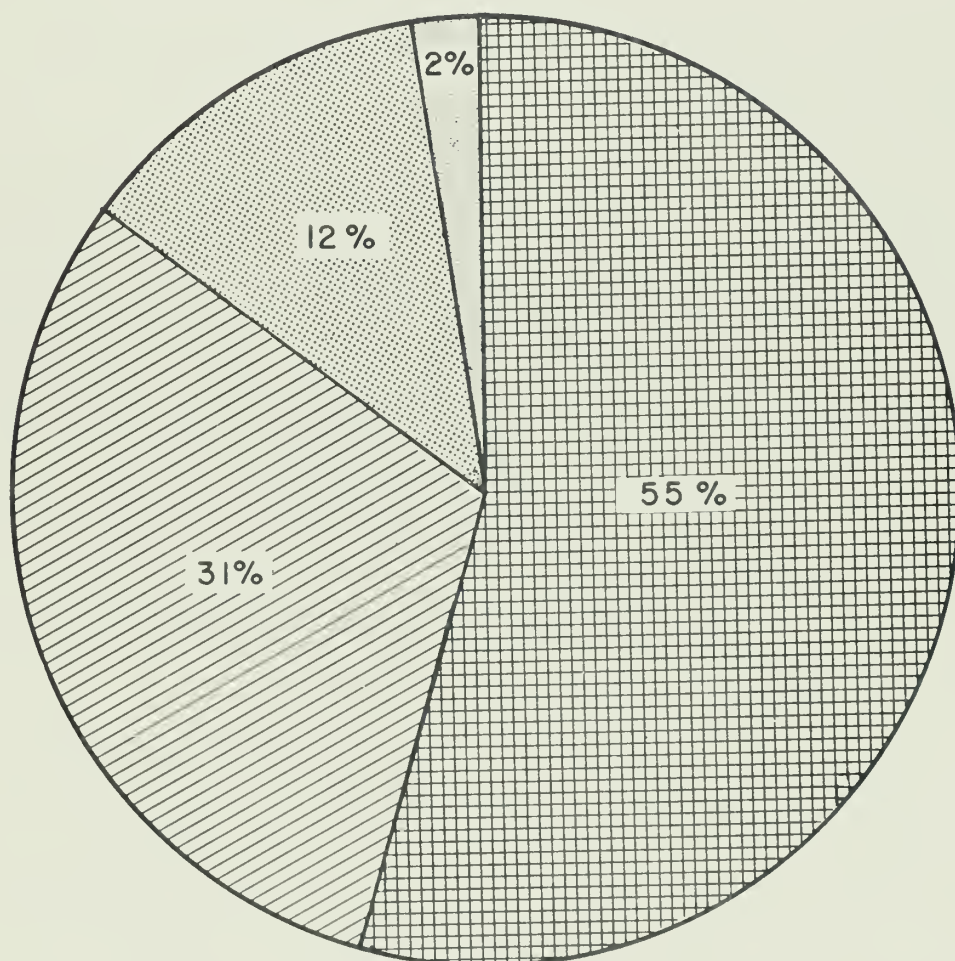
The earth yields many of the fruits of industry. Its products may be vegetable in which case they are grown by men, perhaps using machines. They may be of a long-term duration such as the tree crops or of a short term such as field crops. Men are employed from the planting until the final transformation in the area, be it mulch or furniture. The animal yield may be exclusive of or cooperative with other yields. All of these yields are rather basic to man and close to his ancient heritage and habits, as are many of the people who labor in this environment.

To introduce the concept of a highly industrialized culture to the New River Basin as an imminent certainty would entail a great deal of risk. If such a turn of events would transpire suddenly, it would result in great social disorientation and turmoil with which government would have to involve itself deeply.

The New River finds its birth in hundreds of rivulets and

<sup>2</sup> Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans For Use and Development of Water and Related Land Resources. The President's Water Resources Council, GPO, 1962, page 12.

# APPROXIMATE DISTRIBUTION OF LAND NEW RIVER BASIN 1960 (EXCLUDING WATER AREAS)



## LEGEND

|               |                                                                                     |              |                                                                                      |
|---------------|-------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------|
| 2 % URBAN     |  | 31 % PASTURE |  |
| 12 % CROPLAND |  | 55 % FOREST  |  |

|                             |            |              |        |       |
|-----------------------------|------------|--------------|--------|-------|
| DIVISION OF WATER RESOURCES | SC.        | DATE 12-6-66 | SHT. 1 | OF. 1 |
| DE. A24                     | DR. C.H.N. | APP.         | REV.   | NO.   |

PLATE NO. 1

tiny streams in North Carolina. It flows north across Virginia and eighty-seven miles inside West Virginia it joins the Gauley River to become the Kanawha River which eventually empties into the Ohio River.

The New River enters Virginia near Mouth of Wilson community in Grayson County, Virginia. Fields Manufacturing Company has a fabric mill on the River near the State line. New River runs from southwest to northeast through Grayson County. The land area between the entrance point at Mouth of Wilson to Fries has a rough terrain. Plots of level land suitable for large plant sites are few. However, marginal plant sites are available.

The River crosses the northwest corner of Carroll County. Nearby is the City of Galax. Industries in Galax include furniture and textile manufacturing. The land area between Galax and Fries contains both industrial and recreational sites. There is no heavy industry in this area at present. The town of Fries has a fabric plant, Washington Mills, which employs nearly a thousand people. The area between Fries and Claytor Dam supports large industry such as New Jersey Zinc Company. Appalachian Power Company maintains two hydroelectric plants between these two points. Land is available for industrial sites in the region between Fries and Claytor Dam near the Wythe-Pulaski County line in the vicinity of Foster's Falls and Graham's Forge. The land in this vicinity is ideally situated to the main line of the Norfolk and Western Railway and also to Interstate Highway No. 81, U. S. Highway No. 11, and other secondary roads.

The largest complex of industry is located between Claytor

Dam and Parrot community in Pulaski County. A concentration of industry is located in the Radford-Radford Arsenal Complex. A large measure of available land lies along State Highway No. 100 between Dublin and Pearisburg. Land to the northeast of State Highway No. 100 is well suited for industry. Highway No. 100 roughly parallels the River's course but does not meet with the River until leaving Pearisburg. This area is readily accessible to main line railway transportation, but there is definite need for additional highways.

New River flows through the center of Giles County in a north-westerly direction. Celanese Fibers, a subsidiary of Celanese Corporation of America, is located between Pearisburg and Narrows on the New River. Celanese has the greater share of employment in Giles County. Limestone quarry operations and non-metallic mineral operations constitute most of the remaining industrial employment. Appalachian Power Company operates one of its large steam electric generating plants on the New River at Glen Lyn. This plant supplies power to markets which are interconnected with Appalachian's interstate system.

Population estimates (Chapter IV) suggest moderate growth through the year 2020 with a definite lag in development of ten to fifteen years in comparison with other burgeoning areas of the State. This lag could be negated or modified if a development impetus is given by regional planning and resource utilization. (See "Growth Series," Chapter IV.)

The New River Basin, with its clean water, offers excellent possibilities as an interstate recreation area. Increased highway

and airport development, coordinated with long-range planning efforts, could establish many employment opportunities within the Basin area. Electronic, chemical, metal fabricating, production, and assembly facilities and advanced consumer products could be effectively introduced into the New River Basin. There is a distinct tie-in with West Virginia as well as the Atlantic Coast market areas.

Industrial development is pronounced in the Pulaski-Radford-Glen Lyn belts and future development will take place in this area with location along the banks of the New River causing increased demand upon the water resources. This belt will be designated as the area of primary growth. Location on the banks of the New River above Radford is expected to be limited to industries which need the River's water for production or allied purposes or which desire a scenic overview or natural land boundary.

Future highway and transportation location will be a determining factor in industry location along the banks of the New River. Preserved forest land, military complexes, and adverse accessibility coupled with mountainous terrain will probably limit potential industrial growth along river banks in some areas. On the other hand, development of parts of the New River and its banks along a recreational "clean water" concept will insure continuance of its good water supply for population and industry. The river development program is a crucial factor in industrial development within the entire Basin including the Pulaski-Radford-Glen Lyn belt. A consumer products-oriented river bank may be expected and should be planned. Future growth of residential housing above the flood plain along river banks should be planned and encouraged. Recreational facilities

may include those for fishing, boating, golfing, picnicking and opportunities for sports of many other types.

Bridge location to insure quick and convenient access between communities and still preserve the natural beauty of the River should be explored. Productive facilities which have a high social utility will enhance the water resources of the area. Some of these may presently be considered as "exotic" industries working in advanced technologies. Drug firms would make an excellent starting point for the inducement of research and development.

It is also possible that the concept of recreation may expand from its present limits to include more social participation than individual activity. Whole new areas of river, lake and basin recreation would be open to public participation. Planning will be necessary to insure adequate private freedom to accomplish these innovations. The way must be partially paved for these developments. All approved water resource development projects should have flexible, guaranteed, and farsighted recreational development soundly coupled to the needs and demands of the area itself. The technology of the future will create more leisure. Natural beauty should not be erased.

A socially acceptable mix of benefits and liabilities of all future industrial and recreational developments can be achieved. Recreation is not enough to develop the New Basin, but development without emphasis on enhancing the recreation potential of the area is also not enough.

## CHAPTER IV

### POPULATION PROJECTIONS

Population is an important indicator and factor in economic growth. In order to establish some concepts of future activity and development within the New River Basin, it is necessary to set some possible and probable parameters for the Basin.

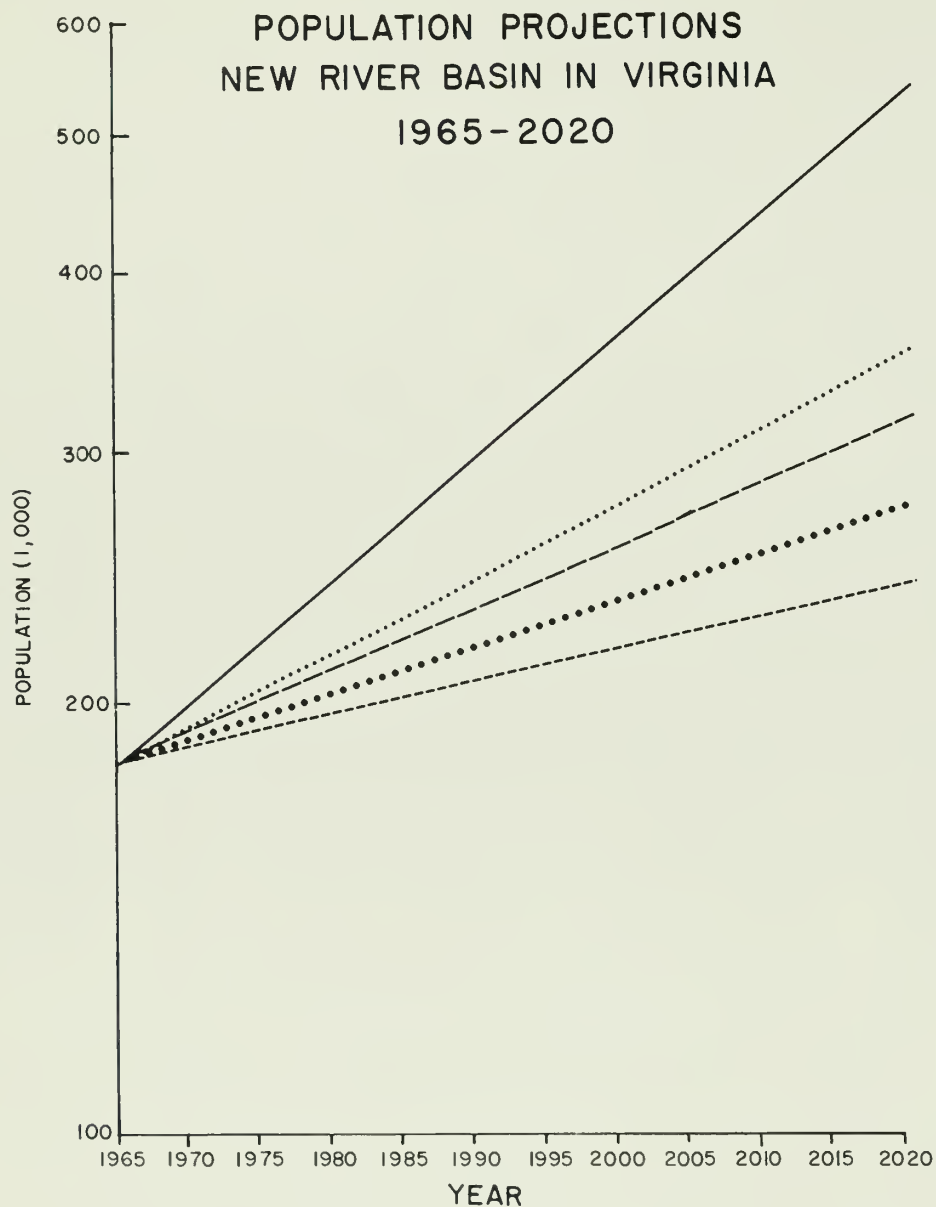
Plate 2 describes population projections in the New River Basin which were developed by engineering staff. The percent increase projections are self-explanatory; they assume constant increase at the given rates. The component method is based upon the increase suggested by relationships derived from the projection of Gross Manufacturing Output. Table 12 presents this projection in tabular form.

These relationships are induced and are subject to change by growth. Alternative population projections are possible in our framework of analysis.

The comparison method is derived from modification methodology with parameters from a basin study which is viewed as analogous to the New River Basin.

Counties having all or part of their area within the New River Basin show the following percent of population change for the period 1950-1960 (the Statewide increase was 19.5 percent):

|                |      |
|----------------|------|
| Bland County   | - 7% |
| Carroll County | - 4% |
| Craig County   | - 3% |
| Floyd County   | - 8% |
| Giles County   | - 9% |



|                                              |     |              |        |          |
|----------------------------------------------|-----|--------------|--------|----------|
| DIVISION OF WATER RESOURCES                  | SC. | DATE 2-3-67  | SHT. 1 | OF 1     |
| POPULATION PROJECTIONS N.R.B.<br>1965 - 2020 | DE. | DR. C. H. N. | APP.   | REV.     |
|                                              |     |              |        | NO. C 34 |

PLATE NO. 2

TABLE 1  
POPULATION PROJECTIONS  
Component Method

| <u>NEW RIVER BASIN</u> |             |             |             |
|------------------------|-------------|-------------|-------------|
| 1960 - 2020            |             |             |             |
| <u>1960</u>            | <u>1965</u> | <u>1970</u> | <u>1980</u> |
| 180,000                | 185,000     | 200,000     | 215,000     |
| <u>1990</u>            | <u>2000</u> | <u>2010</u> | <u>2020</u> |
| 250,000                | 267,000     | 308,000     | 341,000     |

|                   |      |
|-------------------|------|
| Grayson County    | - 7% |
| Montgomery County | +11% |
| Pulaski County    | - 2% |
| Smyth County      | + 3% |
| Tazewell County   | - 6% |
| Wythe County      | - 6% |

Demographic studies seeking to establish population and related growth include many components. Some of these components have been presented in tabular form in The American Economic Review <sup>3</sup> and are listed below:

| <u>Population</u>       | <u>Labor Force</u>             | <u>Households</u>       |
|-------------------------|--------------------------------|-------------------------|
| 1. Mortality rate       | Mortality and aging            | Mortality and aging     |
| 2. Net immigration rate | Net immigration                | Net immigration         |
| 3. Fertility rate       | Labor force participation rate | Household headship rate |

Of particular importance in the component method of population projection is an analysis of the interaction of economic factors. A detailed demographic analysis could not be made in the context of this report. The projection of Gross Manufacturing Output presented on Table 12 is the base for projection of shifts and rates of population growth in the New River Basin. Movement between rates of population growth as shown on Plate 2 are not ruled out but are implicitly assumed in projections of future employment and Gross Manufacturing Output. In the basic economic analysis one rate of constant population growth is not adopted in preference to another. People tend to live near their work. Population, in this context, is a function of GM0 (Gross Manufacturing Output).

P ∅ GM0

<sup>3</sup> "Economic-Demographic Interactions and Long Swings in Economic Growth". Richard A. Easterlin, The American Economic Review Volume LVI, December 1966, page 1078.

GMO is a function of the regional or basin share of the labor force (L), Gross National Product (GNP), Productivity (Pd), and all types of Capital (K).

$$GMO \propto L + GNP + Pd + K$$

Mathematical analysis of these functions is too primitive to be extensively applied. A sophisticated model relating these functions would be amenable to computerization. In these projections, the demographic elements of population have been "slighted" in order to meet the need for immediate and useful economic data.

In order to look at possible future population combinations within the Basin, it has also been necessary to approach a very difficult goal, projection of populations of counties and segments of counties to the year 2020. Utmost caution should be exercised in the use of such projected populations. They may best be considered as benchmarks "measuring possibilities" rather than as goals in planning. They have been arrived at by random simulation and fitting techniques. This is the present state of this particular art.

Tables 2 through 5 present four complete series.

"Benchmark"

Series A     Engineering (Constant Growth) Projection of Inter-County Segments of Population in the New River Basin 1980-2020

"Benchmark"

Series B     Random Simulation (Possible but not Probable) Projection of Inter-County Segments of Population in the New River Basin 1980-2020

"Growth"

Series A     Engineering (Constant Growth) Projection of Inter-County Segments of Population in the New River Basin 1980-2020

"Growth"

Series B     Random Simulation (Possible but not Probable) Projection of Inter-County Segments of Population in the New River Basin 1980-2020

The "Benchmark Series A" above contains population figures for each major political subdivision in the Basin. The total population for the Basin as projected by "Benchmark Series A" is similar to the "component method" projection previously indicated. The breakdown of individual political subdivision populations in the "Benchmark Series A" is considered to be the best estimate of future population by the Division of Water Resources. Estimates of total population in the Basin by either the component method or "Benchmark Series A" are considered to be equally valid. Plate 3 indicates graphically the "Benchmark Series A" projections.

Some comparison of growth in Virginia and the Nation can be obtained by comparing projections for the New River Basin with the growth patterns for Virginia and the Nation shown on Plates 3, 4, and 5.

Tables 6 through 9 contain projected population densities for the New River Basin based upon the various future population estimates previously outlined.

Past population densities in the United States are shown in Plate 7.

TABLE 2  
POPULATION PROJECTIONS  
"Benchmark" - Series A

| NEW RIVER BASIN<br>1980-2020 |             |             |             |
|------------------------------|-------------|-------------|-------------|
| <u>Virginia</u>              | <u>1980</u> | <u>2000</u> | <u>2020</u> |
| Bland                        | 6,600       | 8,250       | 10,650      |
| Carroll                      | 24,200      | 30,250      | 39,050      |
| Craig                        | 880         | 1,100       | 1,420       |
| Floyd                        | 13,200      | 16,500      | 21,300      |
| Giles                        | 24,200      | 30,250      | 39,050      |
| Grayson                      | 22,000      | 27,500      | 35,500      |
| Montgomery                   | 24,200      | 30,250      | 39,050      |
| Pulaski                      | 35,200      | 44,000      | 56,800      |
| Smyth                        | 660         | 825         | 1,065       |
| Tazewell                     | 22,000      | 27,500      | 35,500      |
| Wythe                        | 28,600      | 37,750      | 46,150      |
| Galax City                   | 6,600       | 8,250       | 10,650      |
| Radford City                 | 11,000      | 13,750      | 17,750      |
| Total                        | 219,340     | 274,175     | 353,935     |

TABLE 3  
POPULATION PROJECTIONS  
"Benchmark" - Series B

NEW RIVER BASIN  
1980-2020

| <u>Virginia</u> | <u>1980</u> | <u>2000</u> | <u>2020</u> |
|-----------------|-------------|-------------|-------------|
| Bland           | 5,297       | 4,524       | 5,730       |
| Carroll         | 26,223      | 22,401      | 21,349      |
| Craig           | 1,421       | 1,535       | 1,943       |
| Floyd           | 9,707       | 14,734      | 14,042      |
| Giles           | 27,322      | 41,500      | 78,554      |
| Grayson         | 17,143      | 26,039      | 32,970      |
| Montgomery      | 31,023      | 33,378      | 63,143      |
| Pulaski         | 35,698      | 54,223      | 51,665      |
| Smyth           | 547         | 589         | 561         |
| Tazewell        | 19,401      | 16,576      | 15,795      |
| Wythe           | 22,610      | 24,274      | 23,129      |
| Galax City      | 5,239       | 5,636       | 5,371       |
| Radford City    | 14,081      | 21,388      | 27,080      |
| Total           | 215,712     | 266,797     | 341,332     |

TABLE 4  
POPULATION PROJECTIONS  
"Growth" - Series A

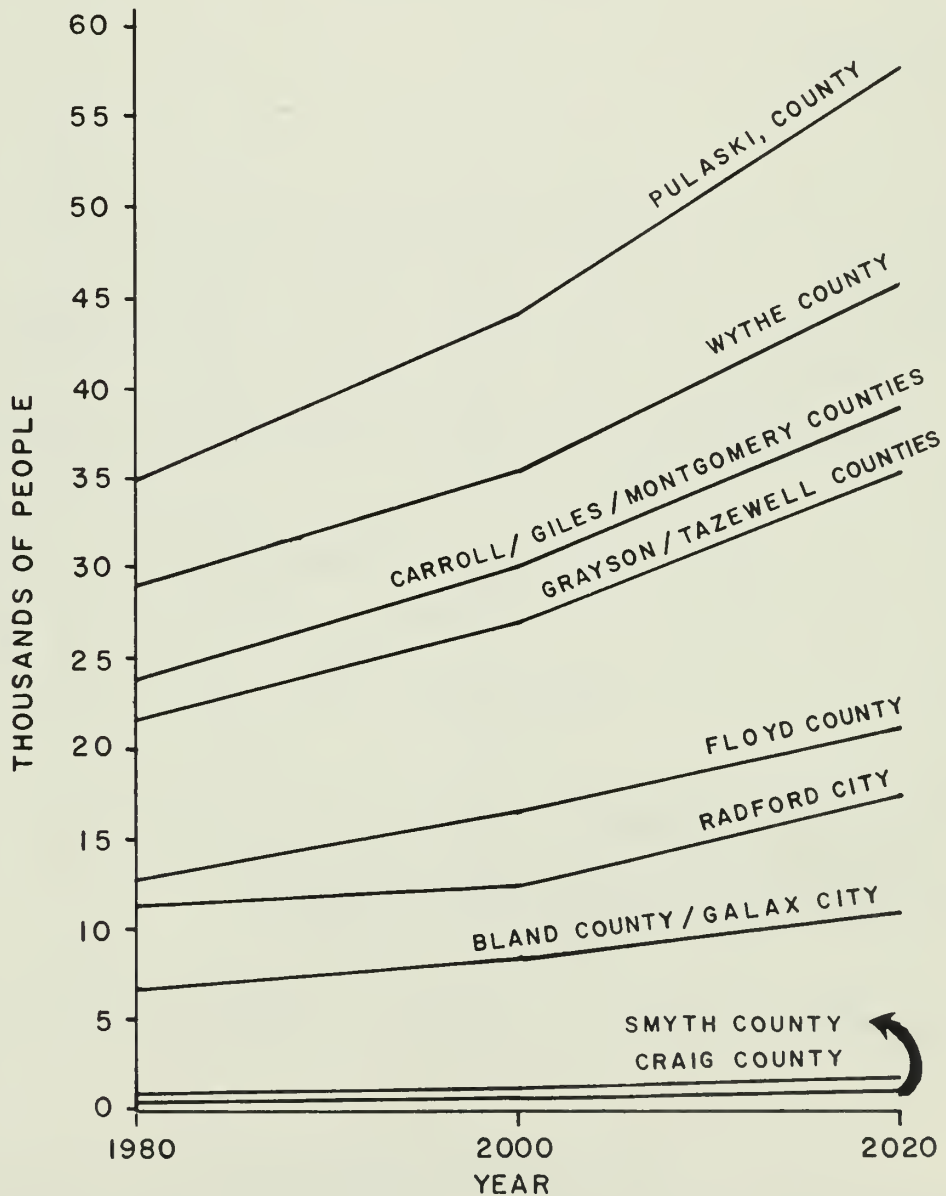
NEW RIVER BASIN  
1980-2020

| <u>Virginia</u> | <u>1980</u> | <u>2000</u> | <u>2020</u> |
|-----------------|-------------|-------------|-------------|
| Bland           | 7,579       | 11,317      | 16,987      |
| Carroll         | 27,791      | 41,503      | 62,285      |
| Craig           | 1,011       | 1,509       | 2,265       |
| Floyd           | 15,156      | 22,633      | 33,974      |
| Giles           | 27,791      | 41,494      | 62,285      |
| Grayson         | 25,265      | 37,722      | 56,623      |
| Montgomery      | 27,791      | 41,494      | 62,285      |
| Pulaski         | 40,424      | 60,355      | 90,596      |
| Smyth           | 758         | 1,312       | 1,699       |
| Tazewell        | 25,265      | 37,722      | 56,623      |
| Wythe           | 32,844      | 49,038      | 73,609      |
| Galax City      | 7,579       | 11,317      | 16,987      |
| Radford City    | 12,632      | 18,861      | 28,311      |
| Total           | 252,066     | 376,097     | 564,529     |

TABLE 5  
POPULATION PROJECTIONS

| "Growth" - Series B |         |         |         |
|---------------------|---------|---------|---------|
| NEW RIVER BASIN     |         |         |         |
| 1980-2020           |         |         |         |
| Virginia            | 1980    | 2000    | 2020    |
| Bland               | 6,197   | 6,379   | 9,483   |
| Carroll             | 30,681  | 31,585  | 35,333  |
| Craig               | 1,663   | 2,164   | 3,216   |
| Floyd               | 11,357  | 20,775  | 23,240  |
| Giles               | 31,967  | 58,515  | 130,015 |
| Grayson             | 20,057  | 36,715  | 54,565  |
| Montgomery          | 36,297  | 47,063  | 104,502 |
| Pulaski             | 41,767  | 76,454  | 85,506  |
| Smyth               | 640     | 830     | 928     |
| Tazewell            | 22,699  | 23,372  | 26,140  |
| Wythe               | 26,454  | 34,226  | 38,278  |
| Galax City          | 6,130   | 7,947   | 8,889   |
| Radford City        | 16,475  | 30,157  | 44,817  |
| Total               | 252,384 | 376,182 | 564,912 |

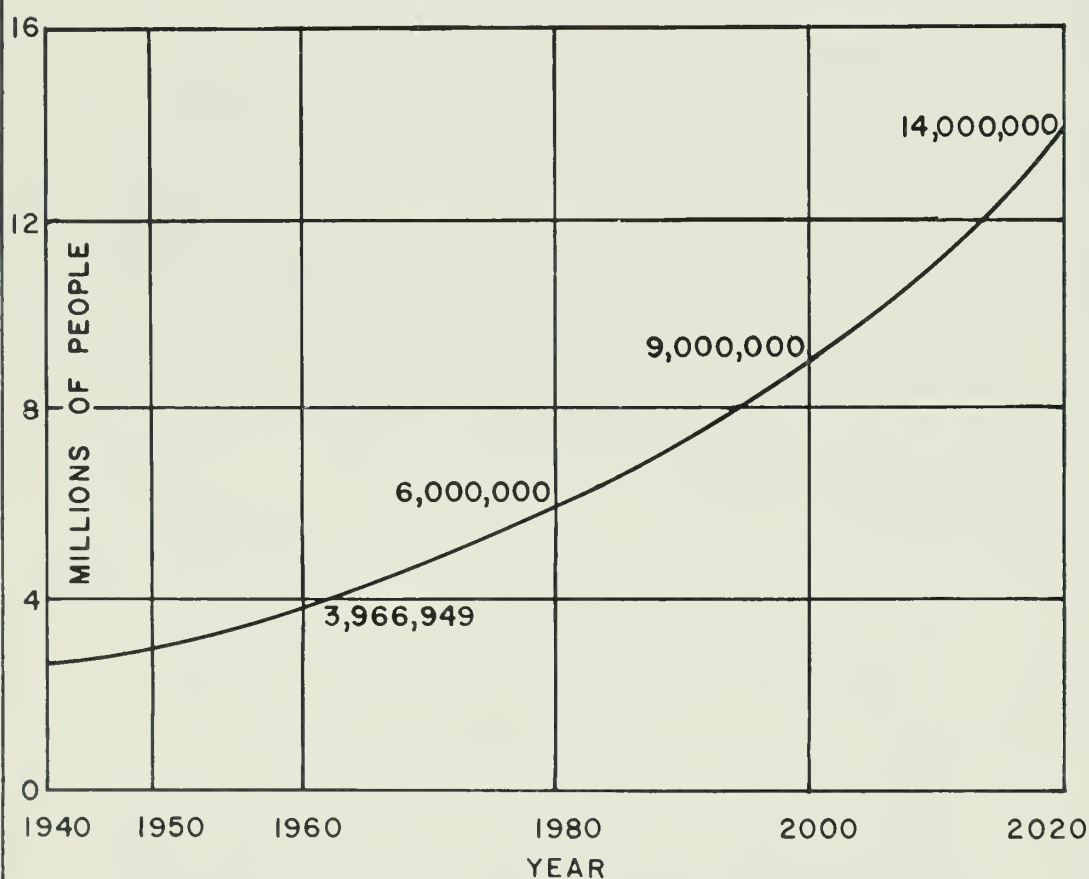
"BENCHMARK" SERIES A  
POPULATION PROJECTIONS  
NEW RIVER BASIN IN VIRGINIA  
1980-2020



|                                    |     |             |        |          |
|------------------------------------|-----|-------------|--------|----------|
| DIVISION OF WATER RESOURCES        | SC. | DATE 4-5-67 | SHT. 1 | OF 1     |
| "BENCHMARK" SERIES A<br>POPULATION | DE. | DR.M.N.F.   | APP.   | REV.     |
|                                    |     |             |        | NO. A 77 |

# VIRGINIA'S POPULATION

1940 - 2020

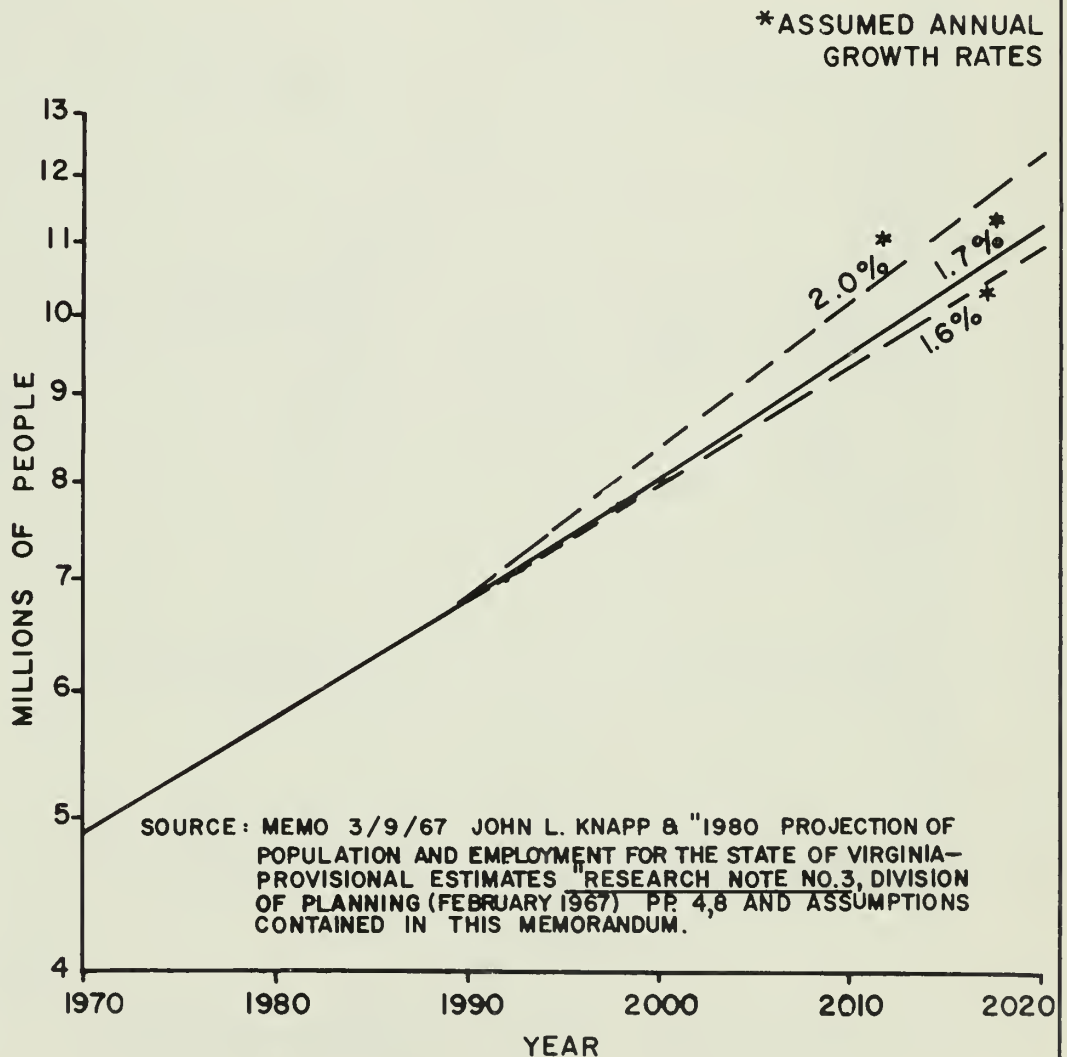


SOURCE : VIRGINIA'S COMMONWEALTH, 1965  
VIRGINIA OUTDOOR RECREATION STUDY COMMISSION

|                             |     |              |        |          |
|-----------------------------|-----|--------------|--------|----------|
| DIVISION OF WATER RESOURCES | SC. | DATE 4-14-67 | SHT. 1 | OF 1     |
|                             | DE. | DR. C.H.N.   | APP.   | REV.     |
|                             |     |              |        | NO. A 81 |

PLATE NO. 4

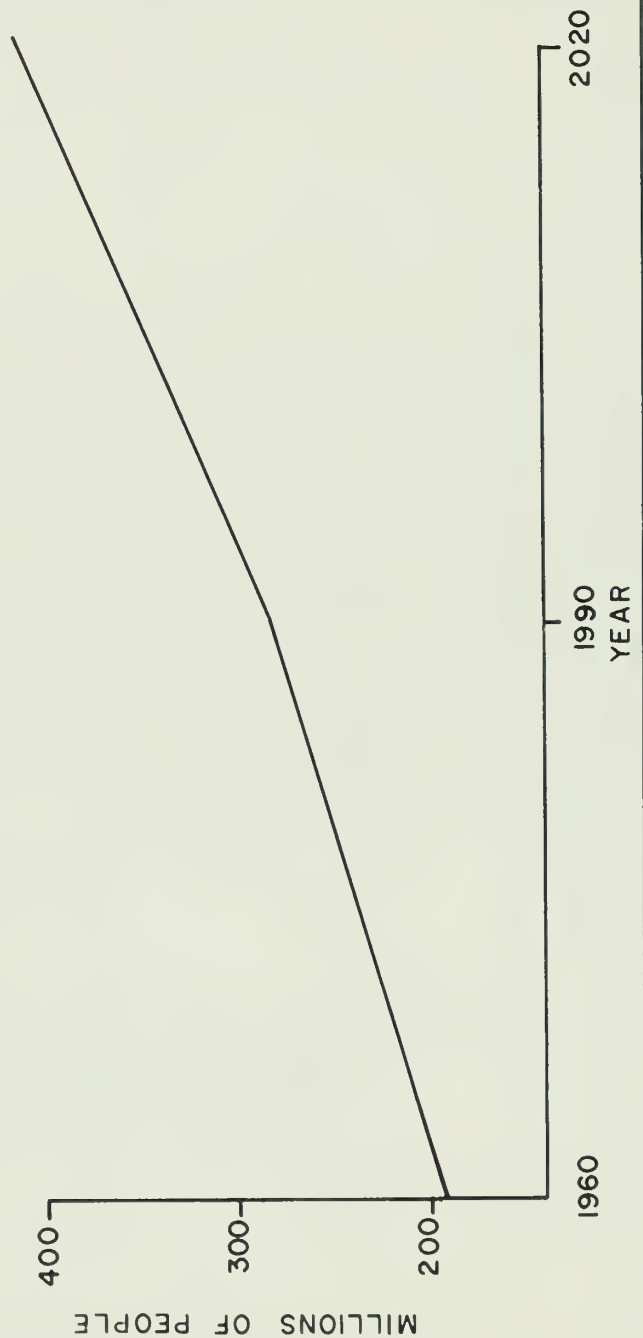
# POPULATION PROJECTION- STATE OF VIRGINIA 1970-2020



|                             |     |              |        |         |
|-----------------------------|-----|--------------|--------|---------|
| DIVISION OF WATER RESOURCES | SC. | DATE 4-27-67 | SHT. I | OF I    |
| POPULATION PROJECTION VA    | DE. | DR. C.H.N.   | APP.   | REV.    |
|                             |     |              |        | NO. A86 |

PLATE NO. 5

# POPULATION PROJECTION - UNITED STATES (EXCLUDING ALASKA & HAWAII) 1960 - 2020



DIVISION OF WATER RESOURCES

SC.

DATE 5-1-67

SHT. 1

OF 1

POPULATION PROJECTION  
UNITED STATES

DE.

DR. C. H. N.

APP.

REV.

NO. A87

PLATE NO. 6

TABLE 6

PROJECTED POPULATION DENSITIES

New River Basin

1980-2020

| "Benchmark" Series A            | 1980    | 2000    | 2020    |
|---------------------------------|---------|---------|---------|
| Bland                           | 20.50   | 25.62   | 33.07   |
| Carroll                         | 58.17   | 72.72   | 93.87   |
| Craig                           | 19.56   | 24.44   | 31.56   |
| Floyd                           | 38.26   | 47.83   | 61.74   |
| Giles                           | 70.35   | 87.94   | 113.52  |
| Grayson                         | 48.78   | 60.98   | 78.71   |
| Montgomery                      | 126.04  | 157.55  | 203.39  |
| Pulaski                         | 107.65  | 134.56  | 173.70  |
| Smyth                           | 18.86   | 23.57   | 30.43   |
| Tazewell                        | 146.67  | 183.33  | 236.67  |
| Wythe                           | 63.00   | 78.74   | 101.65  |
| Galax City                      | 2200.00 | 2750.00 | 3550.00 |
| Radford City                    | 2200.00 | 2750.00 | 3550.00 |
| Total                           | 5117.84 | 6397.28 | 8258.31 |
| Political Units Average Density | 393.68  | 492.10  | 635.25  |

TABLE 7

PROJECTED POPULATION DENSITIES

NEW RIVER BASIN

1980-2020

| "Benchmark" Series B            | 1980    | 2000    | 2020    |
|---------------------------------|---------|---------|---------|
| Bland                           | 16.45   | 14.05   | 17.80   |
| Carroll                         | 63.04   | 53.85   | 51.32   |
| Craig                           | 31.58   | 34.11   | 43.18   |
| Floyd                           | 28.14   | 42.71   | 40.70   |
| Giles                           | 79.42   | 120.64  | 228.35  |
| Grayson                         | 38.01   | 57.74   | 73.10   |
| Montgomery                      | 161.58  | 173.84  | 328.89  |
| Pulaski                         | 109.17  | 165.82  | 158.00  |
| Smyth                           | 15.63   | 16.83   | 16.03   |
| Tazewell                        | 129.34  | 110.81  | 105.30  |
| Wythe                           | 49.80   | 53.47   | 50.95   |
| Galax City                      | 1746.33 | 1878.66 | 1790.33 |
| Radford City                    | 2816.20 | 4277.60 | 5416.00 |
| Total                           | 5284.69 | 6999.83 | 8319.94 |
| Political Units Average Density | 406.51  | 538.45  | 640.00  |

NOTE: Density in terms of people per square mile.

TABLE 8

PROJECTED POPULATION DENSITIES

New River Basin

1980-2020

| "Growth" Series A               | 1980    | 2000    | 2020    |
|---------------------------------|---------|---------|---------|
| Bland                           | 23.54   | 35.14   | 52.75   |
| Carroll                         | 66.95   | 99.98   | 150.04  |
| Craig                           | 22.47   | 33.53   | 50.33   |
| Floyd                           | 43.93   | 65.60   | 98.48   |
| Giles                           | 80.77   | 120.60  | 181.03  |
| Grayson                         | 56.00   | 83.62   | 125.52  |
| Montgomery                      | 144.72  | 216.08  | 324.35  |
| Pulaski                         | 123.61  | 184.55  | 277.03  |
| Smyth                           | 21.66   | 37.49   | 48.54   |
| Tazewell                        | 168.43  | 251.48  | 377.49  |
| Wythe                           | 72.33   | 108.00  | 162.11  |
| Galax City                      | 2526.33 | 3772.33 | 5662.33 |
| Radford City                    | 2546.40 | 3772.20 | 5662.20 |
| Political Units Average Density | 452.09  | 675.43  | 1013.25 |

TABLE 9

PROJECTED POPULATION DENSITIES

New River Basin

1980-2020

| "Growth" Series B               | 1980    | 2000    | 2020    |
|---------------------------------|---------|---------|---------|
| Bland                           | 19.24   | 19.81   | 29.45   |
| Carroll                         | 73.91   | 76.08   | 85.11   |
| Craig                           | 36.96   | 48.09   | 71.47   |
| Floyd                           | 32.92   | 60.22   | 67.36   |
| Giles                           | 92.91   | 170.07  | 377.88  |
| Grayson                         | 44.46   | 81.39   | 120.96  |
| Montgomery                      | 189.01  | 245.08  | 544.20  |
| Pulaski                         | 127.72  | 233.78  | 261.46  |
| Smyth                           | 18.29   | 23.71   | 26.51   |
| Tazewell                        | 151.33  | 155.81  | 174.27  |
| Wythe                           | 58.26   | 75.38   | 84.30   |
| Galax City                      | 2043.33 | 2649.00 | 2963.00 |
| Radford City                    | 3295.00 | 6031.40 | 8963.40 |
| Political Units Average Density | 475.64  | 759.22  | 1117.58 |

# DENSITY OF POPULATION UNITED STATES

| YEAR | POPULATION<br>PER SQUARE MILE OF<br>LAND AREA |
|------|-----------------------------------------------|
| 1860 | 10.6                                          |
| 1870 | 13.4                                          |
| 1880 | 16.9                                          |
| 1890 | 21.2                                          |
| 1900 | 25.6                                          |
| 1910 | 31.0                                          |
| 1920 | 35.6                                          |
| 1930 | 41.2                                          |
| 1940 | 44.2                                          |
| 1950 | 50.7                                          |
| 1960 | 50.5                                          |

U.S. DEPT. OF COMMERCE  
BUREAU OF THE CENSUS. JUNE, 1961

|                                        |     |             |        |          |
|----------------------------------------|-----|-------------|--------|----------|
| DIVISION OF WATER RESOURCES            | SC. | DATE 4-7-67 | SHT. 1 | OF 1     |
| DENSITY OF POPULATION<br>UNITED STATES | DE. | DR. C.H.N.  | APP.   | REV.     |
|                                        |     |             |        | NO. A-80 |

PLATE NO. 7

## CHAPTER V

### EMPLOYMENT PROJECTIONS

Plate 8 shows the percent of the labor force employed in 1966 in sectors of manufacturing in Bland, Pulaski and Wythe Counties (upper chart) and the percent of the labor force employed in the various sectors of the economy of these three counties in 1966 (lower chart).

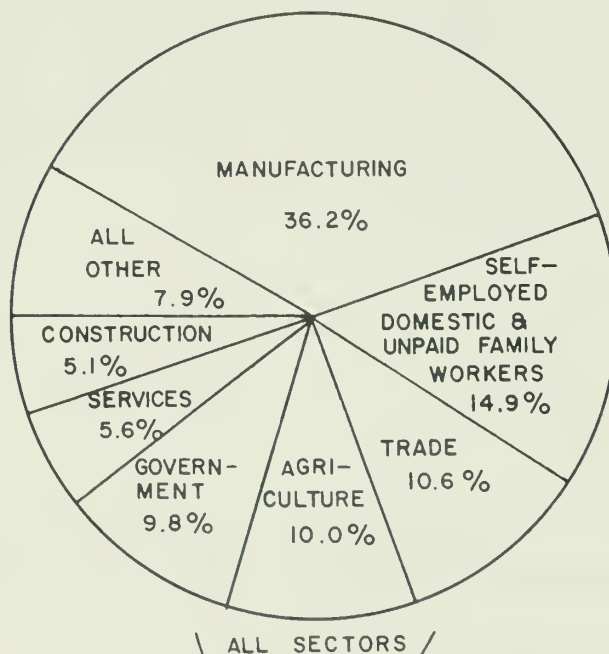
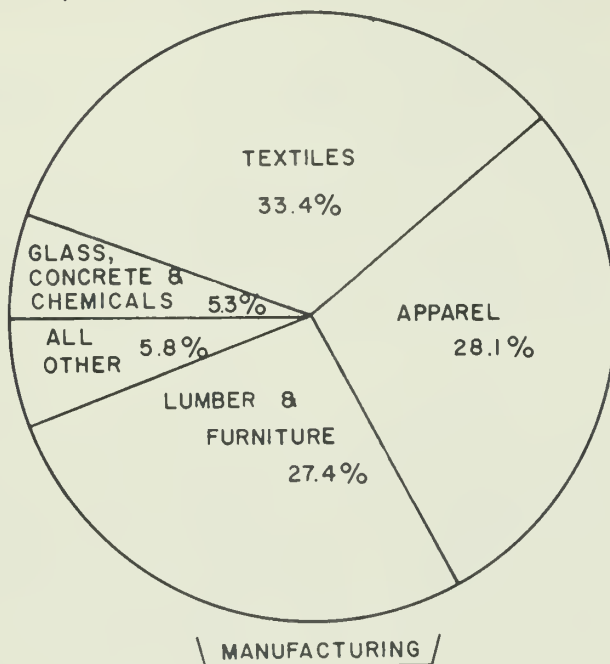
Special note should be made of the inclusion of only full-time operatives in the Agriculture, Forestry and Fisheries sector from 1970 onward as illustrated in Table 10. The 1960 figure includes some part-time operatives, particularly in Agriculture. Thus, these projected figures do not really indicate any significant drop in full-time agricultural employment. However, increases in productivity, which are expected, will be reflected in improved technology rather than increased manpower.

The phenomenal growth in the construction industry assumes heavy private and government spending to transform the Appalachian Region, which includes sections of the New River Basin, into a vigorous competitor for the Nation's industry. Some of these workers may be employed outside the Basin for certain periods. Enhanced mobility is predicted for this type of employment.

Manufacturing employment is viewed as significant but of more stable growth.

The transportation, communication and utilities section is expected to experience great technological change, but an increase

# PERCENT OF LABOR FORCE EMPLOYED BY SECTORS BLAND, PULASKI & WYTHE COUNTIES



SOURCE: VIRGINIA EMPLOYMENT COMMISSION, 1966

|                             |      |             |        |        |
|-----------------------------|------|-------------|--------|--------|
| DIVISION OF WATER RESOURCES | SC.  | DATE 2-9-67 | SHT. 1 | OF 1   |
| PERCENT OF LABOR FORCE      | D.E. | DR.M.N.F.   | APP.   | REV.   |
|                             |      |             |        | NO.A36 |

PLATE NO. 8

TABLE 10

## NEW RIVER BASIN AREA PROJECTED

## EMPLOYMENT BY MAJOR INDUSTRY

1960 - 2020

|                                              | <u>1960</u> | <u>1970</u> | <u>1980</u> | <u>1990</u> | <u>2000</u> | <u>2010</u> | <u>2020</u> |
|----------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| AGRICULTURE, FORESTRY, FISHERIES             | 10,804      | 6,136       | 6,000       | 6,000       | 6,000       | 6,000       | 6,000       |
| MINING                                       | 1,227       | 1,000       | 1,180       | 1,200       | 1,100       | 1,100       | 1,100       |
| CONSTRUCTION                                 | 2,183       | 4,700       | 7,670       | 10,974      | 15,812      | 19,942      | 21,358      |
| MANUFACTURING                                | (28,187)    | (39,703)    | (47,496)    | (52,185)    | (56,171)    | (61,650)    | (69,222)    |
| Furniture, lumber & wood products            | 2,736       | 5,629       | 6,573       | 7,576       | 8,520       | 9,582       | 10,644      |
| Primary & fabricated metals                  | 800         | 1,345       | 3,020       | 3,564       | 2,714       | 3,202       | 3,778       |
| Machinery & electrical equipment             | 515         | 826         | 1,180       | 1,534       | 1,794       | 2,053       | 2,240       |
| Transportation & motor vehicles              | 40          | 83          | 100         | 150         | 175         | 200         | 250         |
| Other durable goods                          | 3,949       | 1,463       | 1,546       | 1,824       | 2,152       | 2,539       | 2,996       |
| Food & kindred products                      | 696         | 821         | 2,000       | 2,360       | 2,784       | 3,286       | 3,878       |
| Textile mill products                        | 4,799       | 6,112       | 6,660       | 7,000       | 7,000       | 7,000       | 7,000       |
| Apparel & other fabricated products          | 3,076       | 6,561       | 8,331       | 9,512       | 10,455      | 10,974      | 12,949      |
| Printing, publishing & allied products       | 30          | 425         | 500         | 600         | 700         | 800         | 950         |
| Chemicals & allied products                  | 4,500       | 8,124       | 9,586       | 10,065      | 11,877      | 14,014      | 16,537      |
| Other non-durable goods                      | 7,046       | 8,314       | 8,000       | 8,000       | 8,000       | 8,000       | 8,000       |
| TRANSPORTATION, COMMUNICATIONS,<br>UTILITIES | 1,944       | 2,900       | 3,200       | 3,400       | 3,600       | 3,800       | 4,000       |
| WHOLESALE AND RETAIL TRADE                   | 6,832       | 9,600       | 11,300      | 11,600      | 12,700      | 12,700      | 13,300      |
| FINANCE, INSURANCE &<br>REAL ESTATE          | 843         | 1,000       | 1,400       | 1,600       | 1,800       | 1,900       | 2,100       |
| PERSONAL AND BUSINESS SERVICES               | 12,891      | 15,211      | 17,948      | 16,500      | 18,500      | 20,500      | 22,500      |
| GOVERNMENT                                   | 6,230       | 7,351       | 8,674       | 11,000      | 12,980      | 15,316      | 16,082      |
| Total                                        | 71,141      | 87,601      | 104,868     | 114,459     | 128,665     | 142,908     | 155,662     |

Note: Due of worker mobility in the area, employment figures include contiguous areas influenced by the Basin.

in services provided is expected to call for more employment.

The expansion of wholesale and retail trade employment and finance, insurance and real estate employment requirements is viewed as supportive to the general growth of the region.

The expansion of personal and business services is viewed as the extension of a projected National trend resulting from technological and financial changes expected in the future. This sector is also supportive.

The expected future nature of the economy of the New River Basin suggests a significant increase in the number of employees of all types of government.

## CHAPTER VI

### INDUSTRIAL OUTLOOK IN THE NEW RIVER BASIN

Employment in the New River Basin population was approximately 75,000 in 1965. Manufacturing employment is approximately 28,000 people. Since federal agencies use United States Census data, it is apparently better for our need to use that data as a primary source, updated and projected to reflect state data.

The big employers in the Basin are the lumber and furniture sectors, the apparel sector, the textile sector, chemical sector, and stone, clay and glass sector.

Value added ranks merely express those industries which contribute the most value added in absolute dollar terms. Estimated future value added for various industries is shown in Table 11. As an aid in understanding the concept of value added, an explanation of the term is shown on page 48.

#### Total Value Added Ranks for These Sectors

|                       |          |
|-----------------------|----------|
| Chemical and allied   | Rank 1   |
| Textiles and apparel  | Rank 2   |
| Lumber and furniture  | Rank 3   |
| Stone, clay and glass | Rank 3.5 |

#### Related Land Resource Development Pattern

Industrial belts appear to be strengthening along highway corridors from Pulaski to Radford. Radford to Glen Lyn appears to be the direction of additional growth from this primary corridor. It would not be surprising to see additional growth, as the spokes of a wheel, from Radford to other contiguous communities. The

TABLE 11

## NEW RIVER BASIN

1960-2020

EXPERIMENTAL VALUE ADDED EXTENSION

| <u>MFG.</u>                      | <u>1960</u> | <u>1970</u> | <u>1980</u> | <u>1990</u> | <u>2000</u> | <u>2010 *</u> | <u>2020 *</u> |
|----------------------------------|-------------|-------------|-------------|-------------|-------------|---------------|---------------|
| Furniture Lumber Wood            | 20.0        | 29.0        | 43.6        | 59.7        | 82.0        | 84.0          | 92.4          |
| Primary and Fabricated Metals    | 6.6         | 13.4        | 18.7        | 18.6        | 30.1        | 31.0          | 43.9          |
| Machinery & Electrical Equipment | 2.0         | 7.9         | 11.2        | 11.6        | 22.2        | 22.7          | 28.0          |
| Transportation & Motor Vehicles  | .4          | .9          | 1.2         | 1.4         | 1.9         | 2.0           | 2.3           |
| Other Durables                   | 3.7         | 16.5        | 21.4        | 25.5        | 35.0        | 35.5          | 43.9          |
| Food & Kindred Products          | 8.2         | 10.0        | 10.1        | 10.9        | 15.0        | 17.6          | 21.8          |
| Textile Mill Products            | 20.4        | 29.0        | 42.0        | 50.0        | 53.0        | 61.0          | 71.0          |
| Apparel & other Fabricated Prod. | 15.3        | 46.5        | 78.9        | 99.8        | 138.5       | 132.0         | 163.7         |
| Printing, Publishing & Allied    | 1.8         | 2.5         | 2.7         | 3.5         | 4.3         | 4.6           | 5.7           |
| Chemical & Allied                | 47.4        | 92.7        | 156.0       | 159.7       | 221.6       | 226.7         | 294.7         |
| Other Non-Durable                | 1.8         | 8.5         | 6.6         | 13.3        | 18.5        | 18.9          | 23.5          |
| TOTAL **                         | 133.        | 257.        | 392.        | 454.        | 622.        | 636.          | 791.          |

\* Absolute production may be much higher in these years. There is the possibility of a "profit squeeze" forced by new technology.

\*\* Figures rounded in millions of 1960 dollars.

NOTE: This is a crude extension and is subject to refinement as additional data becomes available regarding the relationship between regional gross output and regional value added.

Radford-Glen Lyn corridor appears most likely to have heavy industry along the banks of the New River. It is not likely that there will be mass location of plants along the River in preference to the Pulaski-Radford corridor. Light research and development industry can be expected to locate in or near the corridor possibly using the scenic aspects of the river bank. Textile, chemical, and metal industries can be expected to locate along the lower corridor with access to river, rail, and truck facilities.

The improved transportation network will have effects upon agriculture, the exact extent remaining to be seen.

The banks of the River serve primarily agricultural uses especially in areas which are flood plains. Flood damage is minimized by the use of these areas for grazing. It is unlikely that heavy industry will select New River bank location upstream from the Claytor Lake area. In fact, it is possible that an existing industrial site may be vacated before a comparable one will be located along the banks of the Upper New River.

Recreational possibilities, seen from the agricultural viewpoint, are limited in their economic impact on the area. The area already enjoys good hunting, and it is unlikely that this could be significantly augmented by further development. Fishing is a selective sport which has been influenced by man-made changes in the River's economic environment and ecology. It is possible that the River itself is already too developed in spots to take advantage of all its natural value. The River is not so large that planning efforts to secure immediate social profit from its flow alone would not be beneficial. A great value probably lies in keeping segments

of it as close to Nature as possible. Industrial development should be extended to the land areas of the Basin which are most desirable for this use. Available labor and a pleasant location are among the primary attractions for industry.

#### Growth Belts, New River Basin

Plate 9 indicates three growth areas in the New River Basin. These areas are not meant to be all-inclusive or all-exclusive but rather to indicate trends in Basin growth.

The area of primary growth is related to the area of secondary growth upon which it draws for some of its resources. The area of secondary growth is likely to attract a variety of industry which may affect water use.

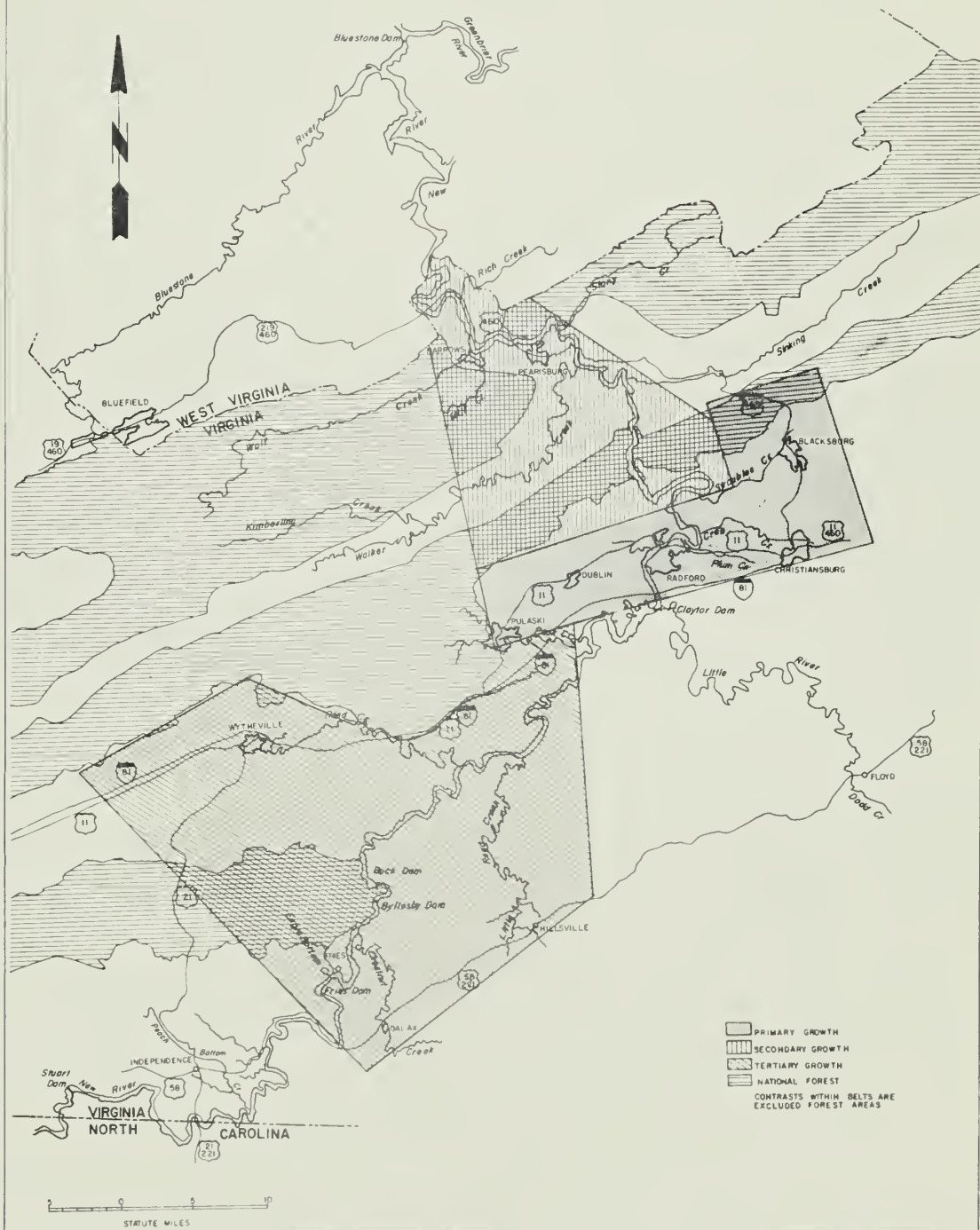
The area of tertiary growth presents an interesting paradox since it is related more to the area of primary growth than to that of secondary growth. It also seems to have significant potential attraction to clean, light industry and business. Transportation routes are excellent here, and there is good reason to anticipate a growth which could exceed that of the previously favored areas of primary and secondary growth. This growth will probably be more selective and better suited to the character of the area than growth patterns in the area of primary growth.

The growth areas show potential industrial demand, in a time sequence ranking, upon water resources in the New River Basin. Attractiveness and ultimate growth by the most desirable mixes of industry are another matter, as has been pointed out.

We should also point out that the word "industrial" is being used here in a limited sense to accommodate all significant business

# GROWTH BELTS

## NEW RIVER BASIN



|                             |         |               |        |          |
|-----------------------------|---------|---------------|--------|----------|
| DIVISION OF WATER RESOURCES | SC. BAR | DATE 11-14-66 | SHT. I | OF I     |
| GROWTH BELTS                | DE.     | DR. C.H.N.    | APP.   | REV.     |
|                             |         |               |        | NO. B 20 |

enterprises - not necessarily industry in the traditional sense.

We are excluding power and utility operations. Educational institutions should be viewed as growing along with this industrial trend.

A brief resume of the outlook for several selected industrial classifications in the New River Basin follows. These industries are expected to have considerable impact on the water resource in the future.

#### Experimental Value Added Extension

"Value Added by Manufacture - Value added by manufacture is derived by subtracting the total cost of materials (including materials, supplies, fuel, electric energy, cost of resales, and miscellaneous receipts) from the value of shipments (including resales) and other receipts and adjusting the resulting amount by the net change in finished products and work-in-process inventories between the beginning and the end of the year.

"Value added avoids the duplication in the value of shipments figure which results from the inclusion of the shipments of establishments producing finished products. It does not exclude, as described in the paragraph below, purchased services. Nevertheless, it is considered to be the best value measure now available for comparing the relative economic importance of manufacturing among industries and geographic areas.

"Value added by manufacture should not be confused with 'national income originating in manufacturing,' as presented in the national income by industrial origin estimates compiled by the Office of Business Economics (OBE), Department of Commerce. The latter measure is the sum of factor costs incurred by an industry in production and is, therefore, a more 'net' concept of value added than that used in the census of manufactures. 'Income originating' excludes, in addition to cost of materials, such other costs as depreciation charges, State and local taxes (other than corporate income taxes), allowance for bad debts, and purchases of services from nonmanufacturing enterprises such as contract costs involved in maintenance and repair, services of development and research firms, services of engineering and management consultants, advertising, telephone and telegraph expense, insurance, royalties, patent fees, etc.

"In part, the national income originating estimates are prepared from company rather than establishment data. This method results in the inclusion of some part of the net value added by nonmanufacturing establishments of companies classified as being primarily manufacturing and, conversely, in the exclusion of some part of the net value added by manufacturing establishments of companies classified

as primarily nonmanufacturing. It is believed that for manufacturing as a whole the net effect increases income originating. (In fact, in the Petroleum and Coal Products major industry group, nonmanufacturing activities of manufacturing companies are so significant that this is the one major industry group in which OBE 'income originating' exceeds Census 'value added by manufacture.')" 4

#### Chemical and Allied Industries

For the foreseeable future, the greatest water demand on the New River will be by chemical users. The projected growth of the chemical industry is, therefore, very important in any consideration of water resource development in the Basin. Plate 10 illustrates the present location of the chemical and allied industry in the New River Basin. A graph of the projected increase in output of the chemical and allied industries is presented as Plate 11. This dollar volume of output does not suggest an increase in water use exactly parallel to this increase in dollar amount; however, the increase will be proportional. (See Plate 32.)

It should be realized that the chemical industry projection really does not indicate phenomenal growth in numbers of industries but rather in increased output. There will be periods of industrial growth and periods of "slow-up" when technology (better machines and production methods) outdistances the need for more labor. Much depends on what happens elsewhere in the national economy - on war and peace, on the type of government which we will have in years to come.

The projections for the chemical and allied industries, Plate 11, suggest marked growth for existing industries in the New River

4 1963 Census of Manufactures, Virginia MC 63 (3) - 47, U. S. Department of Commerce, Nov. 1966, Appendix Explanation of Terms, p. 29.

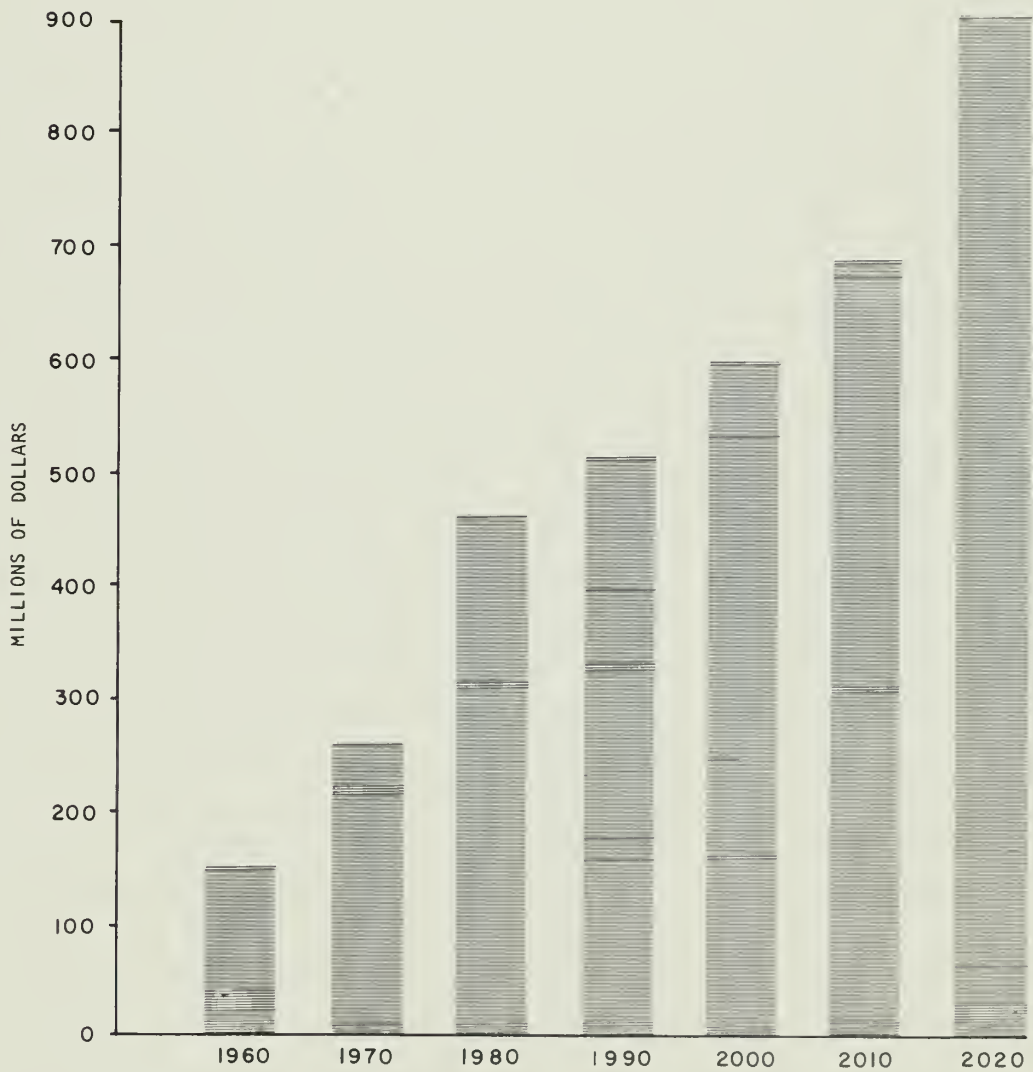
# MAJOR CHEMICAL INDUSTRY LOCATION ALONG THE NEW RIVER



|                                                                    |       |            |              |      |          |      |
|--------------------------------------------------------------------|-------|------------|--------------|------|----------|------|
| DIVISION OF WATER RESOURCES<br>MAJOR CHEMICAL<br>INDUSTRIES N.R.B. | SC. — |            | DATE 2-21-67 |      | SHT. 1   | OF 1 |
|                                                                    | DE.   | DR. M.N.F. | APP.         | REV. | NO. D 40 |      |

PLATE NO. 10

# GROWTH OF CHEMICAL AND ALLIED INDUSTRIES OUTPUT 1960-2020



NEW RIVER BASIN

|                                                 |  |     |              |      |        |          |
|-------------------------------------------------|--|-----|--------------|------|--------|----------|
| DIVISION OF WATER RESOURCES                     |  | SC. | DATE 2-10-67 |      | SHT. 1 | OF 1     |
| GROWTH OF CHEMICAL AND ALLIED INDUSTRIES OUTPUT |  | DE. | DR. C.H.N.   | APP. | REV.   | NO. B-37 |

Basin. The fascinating implications for a new plastics industry in the Basin, in the light of future demand, can change the picture and cause growth of an advanced nature.

#### Outlook for the Food Industry

In the recent past, the food sector of the economy has grown more slowly than the growth rate for the Gross National Product. Food consumption tends to be rather stable and adjusts to population in a gradual manner. Progress in technology related to food production has been of significant importance in shaping the present supply curves for the food industry. There is little doubt that this technology has led to an increase in general quality which has tended to be more important in preferential use than the increase in quantity, which is usually noted as the main result. Centralized or semi-automated (systemized) farming has resulted in some areas. There are examples of these types of operations in the New River Basin. However, there is not so exact a product selectivity as to concentrate effort in this direction at the present time. The meat industry should experience healthy growth in non-urban areas as urbanization takes place in closer geographic proximity, thus reducing transportation and middle-man cost. Naturally, integrated food industries would have a wide geographic market and they would be interested in transportation and servicing opportunities available to them in their home location. Employment in this industry (see projections, Table 10) is expected to favor women even more in the future than at present. Automation is expected to facilitate this trend. The growth of the industry in 1980 is predicted on a larger female employment. This employment is viewed as "comple-

mentary" to the employment in the textile sector of the economy. The availability of new money and credit sources, external to the area, is necessary for this development. Ready-made markets are required. Until this time, there has been a localized approach to the market in regions such as the New River Basin, augmented by National producers and marketers. Diversification should induce other industries with multiregional or national orientation to form production and marketing units of the size which would be amenable to the New River Basin. It still should be remembered that we are not predicting a remarkable growth in this industry in the New River Basin, but merely the introduction of newer types of food industry operations in this area.

#### Outlook for Textile Mill Products

The textile industry in the South began to assume major economic importance after the close of the Civil War. Changes in power technology made operations more efficient in intervening years. It was not until after World War II, however, that growth became pronounced. Since World War II, the industry has more than doubled in size in the Fifth Federal Reserve District (States of Maryland, Virginia, West Virginia, North Carolina, South Carolina and the District of Columbia).

The total number of establishments has risen from 88 in 1939 to 1,625 in 1963, an increase of almost 1,750 percent. The total number of employees climbed to 391,143 in 1963 from 14,275 in 1939, an increase of 2,640 percent. Virginia had 39,100 employees engaged in the textile mill products industry in 1965.

Textile products have been growing unevenly in the recent

past. Textiles have felt the impact of the technological revolution ahead of many areas of the general economy. Thus, while certain traditional sectors of the textile economy have grown at low rates, others have grown very rapidly. Particularly important are processes which make use of synthetic fibers. With wide consumer acceptance and new developments which offer the promise of even greater breakthroughs, a high rate of growth is foreseen in the proximate decades. Interestingly, employment in the textile industry in the New River Basin, after growing steadily until 1990 (see Table 10), is predicted to level off at approximately 7,000 workers. This prediction is based upon a belief that technology will significantly increase productivity in these years and that less general labor will be required to support increased production.

We should not view the various types of fibers as absolute "competitors," because, as Thomas Jeff Davis has said, "In interfiber competition, no fiber is a perfect substitute for any other, but all compete over a considerable range of uses." <sup>5</sup>

"The success of one fiber in securing for itself a larger share of the total textile market depends upon factors which may be considered as autonomous." <sup>5</sup>

"Consequently, it appears that only total fiber consumption responds in any consistent way to external economic forces." <sup>5</sup>

Future consumer demands for textiles will probably shift to the newer types for daily uses. Tradition will always retain a

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<sup>5</sup> Cycles and Trends in Textiles, Thomas Jeff Davis, Business and Defense Services Administration, U. S. Department of Commerce, Business and Defense Services Administration, 1958.

significant market for the basic fibers in an ever-increasing base population. The New River Basin is well suited to the production and processing of newly developed fibers and already has a solid history of participation in their growth.

#### Outlook for the Mineral Industry

Available information and projection techniques indicate that the value of the mineral yield in the New River Basin was approximately \$18 million in 1964. A significant percentage of this was accounted for by zinc and associated mining operations in Wythe County. Production of coal in the Basin itself was limited. Some iron minerals were mined for use as pigments. Stone, consisting of limestone, dolomite, sandstone, and granite, was significantly quarried. Natural gas is produced in Tazewell County.

In 1965, approximately 8 percent of Virginia's total aggregate production had its origin in the New River Basin.

The aggregate industry is projected to grow at least at the same rate as the total National economy in the coming decades. All indications are that it will exceed that growth.

With the growth in construction activities and employment (see Table 10) a marked growth in aggregate production in the New River Basin is anticipated.

The Virginia Division of Mineral Resources has conducted studies which provide detailed information regarding the mineral resources and mineral production in the New River area.

#### Outlook for the Pulp and Paper Industry

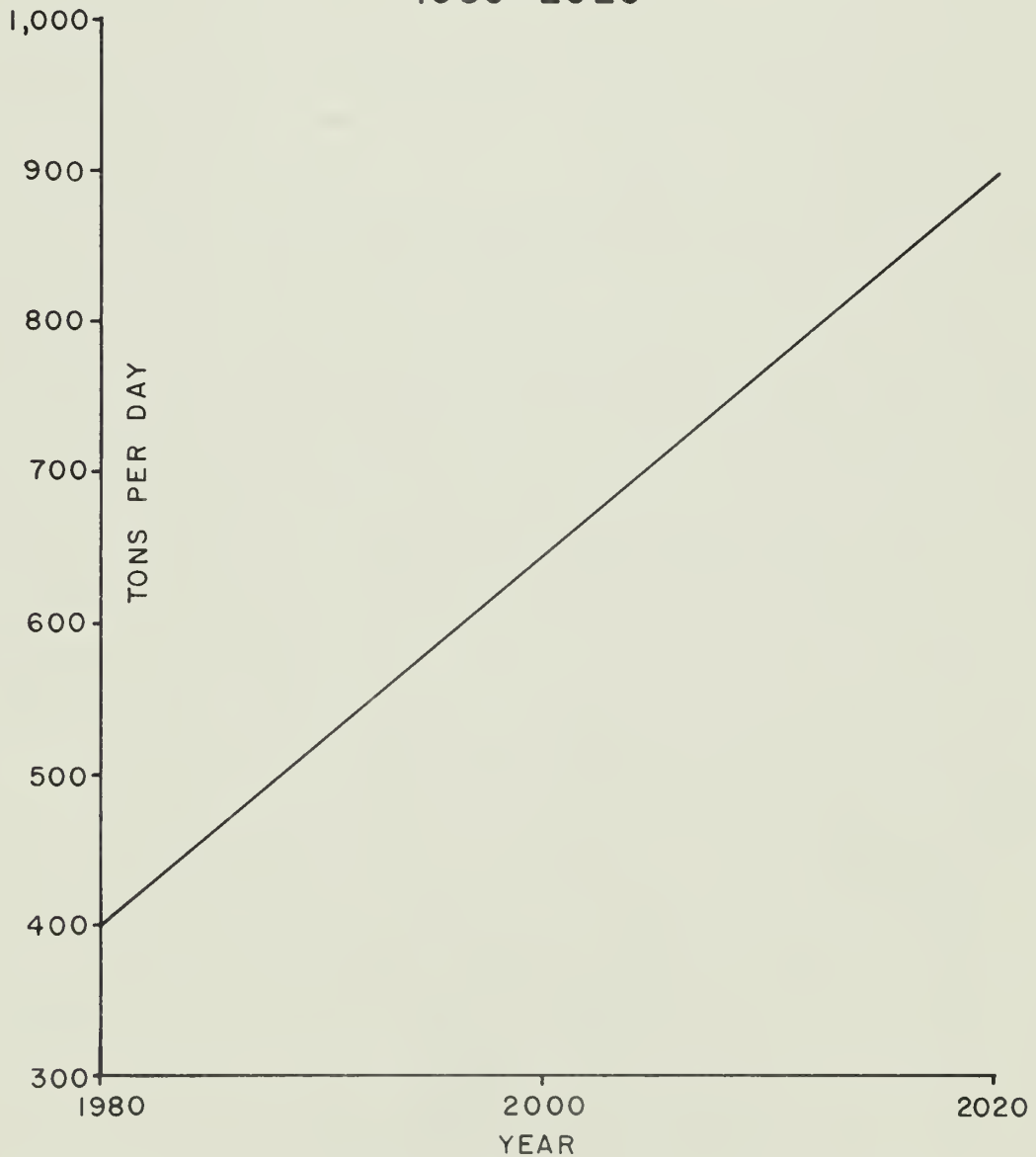
Effective planning for future water resource needs involves selection, by local interests, of the expected population of the

area for future years. Since this is a "developmental" type of planning, this population can be chosen with a bias toward the desired population in future years. Other measures to assist the probability of such population must augment the approaches which we have presented here. Each community will have to make its own contribution in order to participate in the over-all economic growth which has been predicted. A community which does nothing to make the best use of available resources or, at worst, adopts a negative attitude, cannot expect to grow at the regional rate.

In order to give some idea of one type of planning which is contemplated, the location of a pulp and paper mill producing a high grade of paper is postulated for an industrial site below Radford but above Glen Lyn. The mechanics of securing this type of location are not the proper concern of the water resource planner, but a broader and more practical aspect of planning and industrial development. Assuming that a pulp and paper mill would locate in this area, what could be expected in terms of its size, its output of paper and the number of its employees? Naturally, each particular operation will be quite different. For planning purposes it is assumed that a pulp and paper industry having the capacity indicated on Plate 12 will locate in the Basin.

Capital Investment Required. Estimates of capital investment required to establish a totally integrated, high-quality pulp/paper mill (with an ultimate 900 ton per day paper output) in the New River Basin range from a low figure of \$90 million to a high figure of \$144 million.

PROJECTED TONS PER DAY  
PAPER PRODUCTION (HIGH GRADE)  
NEW RIVER BASIN  
1980 - 2020



START-UP 200 T.P.D.

|                             |     |             |        |          |
|-----------------------------|-----|-------------|--------|----------|
| DIVISION OF WATER RESOURCES | SC. | DATE 5-9-67 | SHT. 1 | OF 1     |
| PROJECTED PRODUCTION        | DE. | DR. M.N.F.  | APP.   | REV.     |
|                             |     |             |        | NO. A101 |

## Projected Gross Manufacturing Output

It should not be assumed that projections of Gross Manufacturing Output will correspond with sales figures for any of the industries listed. Gross output figures are obtained by standard methodology employed by the U. S. Government in compiling national data. Disclosure laws, differing methodology, and the present imperfect state of the art of input-output analysis (which this projection attempts to approximate without computerization) prevent the Government from publishing figures which would have the absolute accuracy of exact sales figures. This difficulty is compounded by the fact that these figures have been assembled for many years on a national rather than a regional basis. National trends and approximations must be tailored with as good a fit as possible to local data. Consequently, these projections should be viewed as they are derived. They are the best presently capable of generation but will increase in refinement with changes in the basic data, methodology and computerization. They are value projections in 1965 dollars. Their intended bias is on the low, not the high side. A listing of actual and projected gross manufacturing output is contained in Table 12.

The value of computerized input-output analysis of an area the size of the New River Basin, even if appropriate data were available and formulae developed which could support such a program, would be marginal. There would have to be a marked increase in demand for such figures and a need for continual re-runs to give a dynamic and valid use potential. Where these programs have been used in industry, in limited trial situations, they have sometimes generated more difficulties than benefits. This is an area in

TABLE 12

## NEW RIVER BASIN

## ACTUAL AND PROJECTED GROSS MANUFACTURING OUTPUT

| MANUFACTURING                 | 1960  | 1970  | 1980   | 1990   | 2000   | 2010   | 2020   |
|-------------------------------|-------|-------|--------|--------|--------|--------|--------|
| Furniture Lumber Wood         | 60.0  | 76.3  | 128.1  | 192.6  | 215.7  | 254.5  | 280.0  |
| Primary & Fabricated Metals   | 20.2  | 35.3  | 55.0   | 60.0   | 79.2   | 93.5   | 133.5  |
| Mach. & Elec. Equip.          | 5.9   | 21.0  | 33.0   | 52.0   | 58.2   | 68.7   | 85.2   |
| Trans. & Motor Vehicles       | 1.2   | 2.4   | 3.4    | 4.5    | 5.0    | 6.0    | 7.4    |
| Other Durables                | 26.3  | 43.4  | 62.9   | 82.2   | 91.2   | 107.6  | 133.4  |
| Food & Kindred Products       | 24.8  | 26.6  | 29.7   | 35.1   | 39.3   | 53.3   | 66.1   |
| Textile Mill Products         | 50.0  | 58.0  | 84.0   | 100.0  | 105.0  | 122.0  | 143.0  |
| Apparel & Other Fab. Products | 46.3  | 122.3 | 232.0  | 322.0  | 364.5  | 400.0  | 496.0  |
| Print., Pub. & Allied         | 5.5   | 6.5   | 8.0    | 10.0   | 11.3   | 14.0   | 17.4   |
| Chem. & Allied                | 143.7 | 243.9 | 459.2  | 515.2  | 583.2  | 687.0  | 893.0  |
| Other Non-Dur.                | 5.6   | 22.4  | 19.4   | 43.0   | 48.7   | 57.4   | 71.2   |
| TOTAL *                       | 390.0 | 658.0 | 1111.0 | 1417.0 | 1600.0 | 1864.0 | 2326.0 |
| Proj. V.A.                    | 133.0 | 257.0 | 392.0  | 454.0  | 622.0  | 636.0  | 791.0  |

\*Figures rounded in millions of 1960 Dollars.

which we can expect much research and development to take place before Government actually provides such services on a continuing basis.

This should not discourage use of some of the methodology which this research has generated, with the proper application of knowledge and judgment.

"Gross Output" of an industry represents the sum of the values of the following elements: (a) the total production by the industry, including both primary and secondary products or services; (b) the producers' value of the secondary products or services of other industries which are primary to the given industry; and (c) the domestic port value of imports which are distributed as part of the output of the given industry." 6

6 "Survey of Current Business," U. S. Department of Commerce, OBE, November 1964, p. 17.

## CHAPTER VII

### GROSS NATIONAL PRODUCT

"A concept which has become practically a household word is that of gross national product, or G.N.P. G.N.P. is the market value of the newly produced goods and services that are not resold in any form during the year." <sup>7</sup>

GNP is very useful as an indicator of economic activity on the National level. It can also be useful as a point of comparison for derived relationships which have immediate usefulness on the local level. Specifically, it can be related to a regional account in an analogous manner. Some of these relationships will be shown in this volume. Particular attention is directed to Plate 13 in which the relationship of State and Local Government purchases of structures and equipment is compared with GNP.

Plate 14 shows the historical trend of GNP while Plate 15 indicates one projection of future GNP. Plate 13 shows two sets of points in the year 1975 relating to GNP, state and local government spending, and the ratios of these two factors of the economy. Points A and B are based on the following assumptions:

#### Assumption A

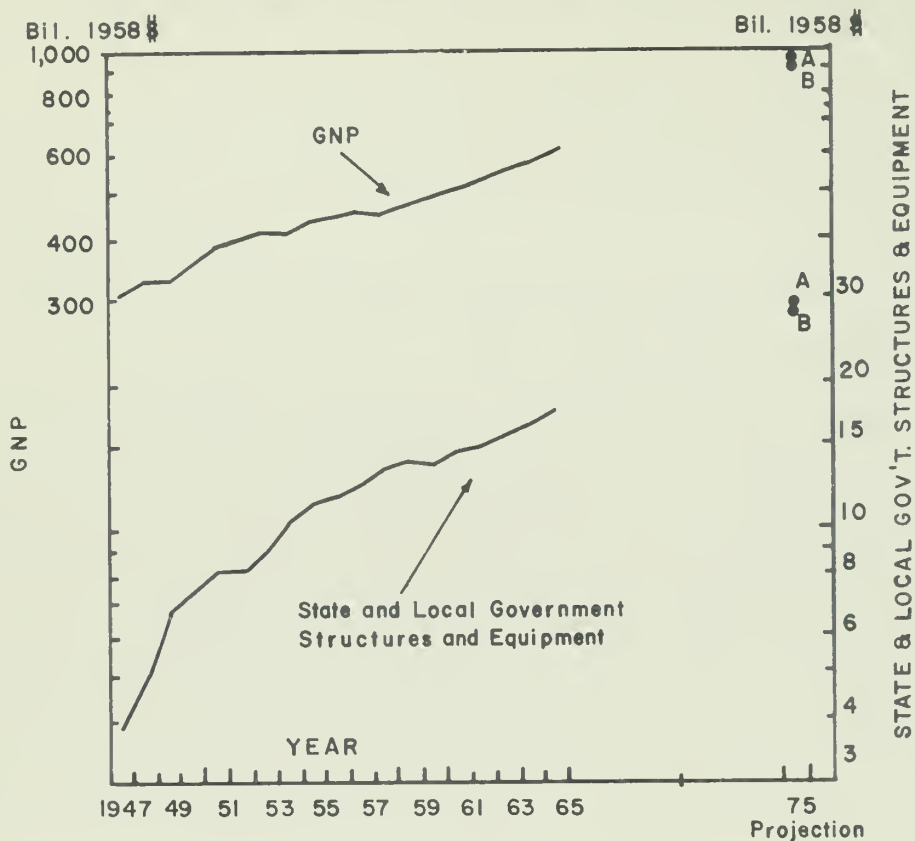
An unemployment rate of 3% in 1975. 3.2% average annual gain in private production.

#### Assumption B

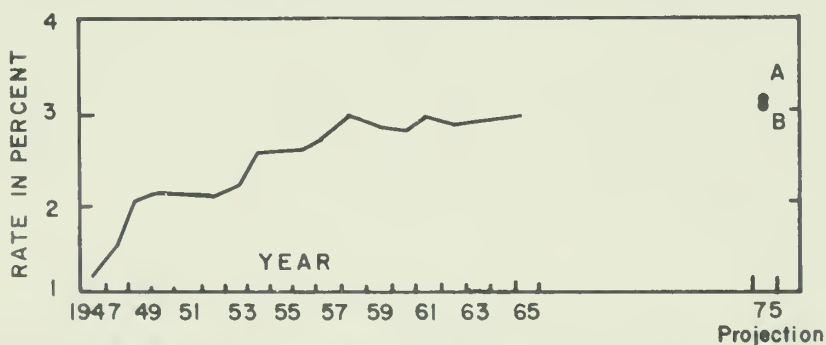
An unemployment rate of 4% in 1975.  
A smaller gain in private productivity.

<sup>7</sup> From Macro-Economics by Thomas F. Dernburg and Duncan F. McDougall, Copyright 1960. McGraw-Hill Book Co., Inc. Page 3. Used by permission of McGraw-Hill Book Co.

# STATE AND LOCAL GOVERNMENT PURCHASES OF STRUCTURES AND EQUIPMENT COMPARED WITH GNP



## RATIO OF STATE AND LOCAL STRUCTURES AND EQUIPMENT TO GNP



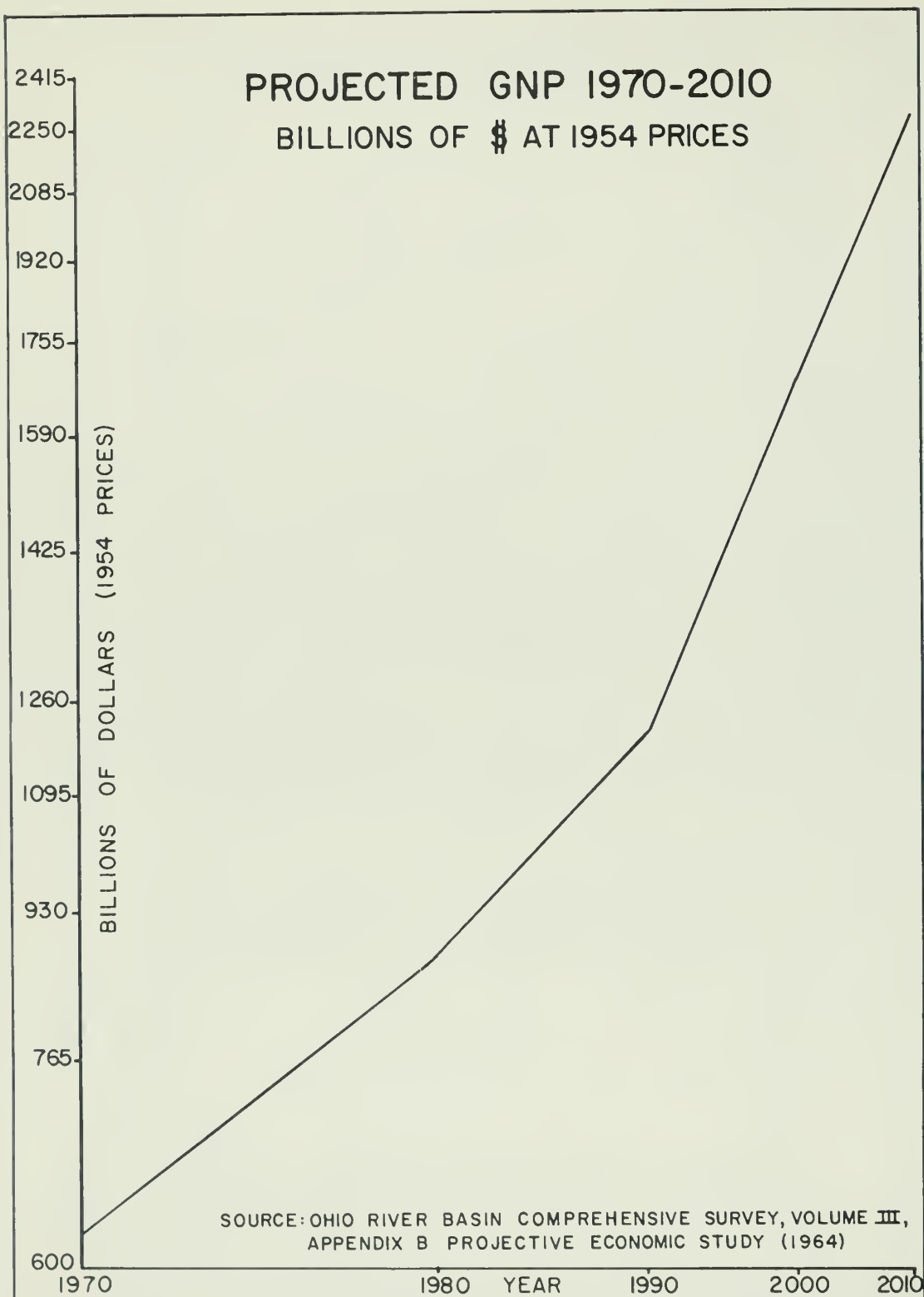
Note: Points A & B Are Reflections of Assumptions  
A & B On Page  
— 61 —

U.S. Department of Commerce, Office of Business Economics, 1966

|                             |     |              |        |          |
|-----------------------------|-----|--------------|--------|----------|
| DIVISION OF WATER RESOURCES | SC. | DATE 5-5-67  | SHT. 1 | OF 1     |
|                             | DE. | DR. M. N. F. | APP.   | REV.     |
|                             |     |              |        | NO. A100 |

PLATE NO. 13





|                             |     |              |        |         |
|-----------------------------|-----|--------------|--------|---------|
| DIVISION OF WATER RESOURCES | SC. | DATE 4-26-67 | SHT. I | OF I    |
| PROJECTED GNP 1970-2010     | DE. | DR. C.H.N.   | APP.   | REV.    |
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PLATE NO. 15

Source: State and Local Public Facility Needs and Financing. Study prepared for the Sub-Committee on Economic Progress of the Joint Economic Committee, Congress of the United States. Volume I, Public Facility Needs, Washington, GPO, 1966.

Two series of implicit price deflators for GNP are presented as Table 13 and Table 14. These deflators may be used to adjust comparison of Actual and Projected GNP on different bases to common years. Table 13 is a deflator which is related to personal consumption expenditures for type of product. Table 14 is a deflator which is related to major type of product. Either one may be chosen, depending upon the factor to which the user desires to devote most analytical attention in his consideration.

#### Projection of Gross National Product

Projection of Gross National Product for periods far into the future is full of hazards. A great many assumptions have to be made regarding appropriate rates of growth and technological progress. Economists are wary of extending a national indicator such as GNP into an area in which many imponderables hold sway. There is no presently existing system of accounts for State or Regional levels which supply information akin to the National GNP. Data gathering and analysis problems in the area of Regional Accounts are formidable. It is usually assumed, however, that a healthy regional economy will participate in about the same level of growth as the Nation as a whole. It is possible that, were a regional account for the New River Basin able to be presently developed, it would indicate a "(Gross) Regional Output" in the ranges listed in Table 15. Table 16 contains basic assumptions for state and local public facility needs and financing study. These basic assumptions relate to the national or overall picture.

TABLE 13

Implicit price deflators for personal consumption expenditures

for type of product: Annually, 1929-65. Index numbers, 1958=100.

| <u>Year</u> | <u>Deflator</u> | <u>Year</u> | <u>Deflator</u> |
|-------------|-----------------|-------------|-----------------|
| 1929        | 55.3            | 1948        | 82.3            |
| 1930        | 53.6            | 1949        | 81.7            |
| 1931        | 47.9            | 1950        | 82.9            |
| 1932        | 42.3            | 1951        | 88.6            |
| 1933        | 40.6            | 1952        | 90.5            |
| 1934        | 43.5            | 1953        | 91.7            |
| 1935        | 44.4            | 1954        | 92.5            |
| 1936        | 44.7            | 1955        | 92.8            |
| 1937        | 46.5            | 1956        | 94.8            |
| 1938        | 45.6            | 1957        | 97.7            |
| 1939        | 45.1            | 1958        | 100.0           |
| 1940        | 45.5            | 1959        | 101.3           |
| 1941        | 48.7            | 1960        | 102.9           |
| 1942        | 54.8            | 1961        | 103.9           |
| 1943        | 59.9            | 1962        | 104.9           |
| 1944        | 63.2            | 1963        | 106.1           |
| 1945        | 65.4            | 1964        | 107.4           |
| 1946        | 70.5            | 1965        | 108.9           |
| 1947        | 77.9            |             |                 |

TABLE 14

Implicit price deflators for gross national product by major type of product. Index numbers, 1958=100.

| <u>Year</u> | <u>Deflator</u> | <u>Year</u> | <u>Deflator</u> |
|-------------|-----------------|-------------|-----------------|
| 1929        | 50.6            | 1948        | 79.6            |
| 1930        | 49.3            | 1949        | 79.1            |
| 1931        | 44.8            | 1950        | 80.2            |
| 1932        | 40.2            | 1951        | 85.6            |
| 1933        | 39.3            | 1952        | 87.5            |
| 1934        | 42.2            | 1953        | 88.3            |
| 1935        | 42.6            | 1954        | 89.6            |
| 1936        | 42.7            | 1955        | 90.9            |
| 1937        | 44.5            | 1956        | 94.0            |
| 1938        | 43.9            | 1957        | 97.5            |
| 1939        | 42.2            | 1958        | 100.0           |
| 1940        | 43.9            | 1959        | 101.6           |
| 1941        | 47.2            | 1960        | 103.3           |
| 1942        | 53.0            | 1961        | 104.6           |
| 1943        | 56.8            | 1962        | 105.8           |
| 1944        | 58.2            | 1963        | 107.2           |
| 1945        | 59.7            | 1964        | 108.9           |
| 1946        | 66.7            | 1965        | 110.9           |
| 1947        | 74.6            |             |                 |

TABLE 15  
NEW RIVER BASIN "GROSS REGIONAL OUTPUT"  
Estimate and Projection \*

| <u>1960</u> | <u>1970</u> | <u>1980</u> | <u>1990</u> | <u>2000</u> | <u>2010</u> | <u>2020</u> |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 780         | 1,316       | 2,222       | 2,834       | 3,200       | 3,728       | 4,652       |

\* Millions of 1960 Dollars

Note: The impact of inflation in making "real" regional product less than these 1960 Dollar Figures, should not be overlooked.

TABLE 16  
NATIONAL PROJECTIONS  
BASIC ASSUMPTIONS FOR STATE AND LOCAL  
PUBLIC FACILITY NEEDS AND FINANCING STUDY

| Factor                                         | Actual<br>1961-65<br>(Percent) | Assumed<br>1966-75<br>(Percent) |
|------------------------------------------------|--------------------------------|---------------------------------|
| A. Annual rates of Increase:                   |                                |                                 |
| 1. Population -----                            | 1.5                            | 1.5                             |
| 2. Gross national product -----                | 5.9                            | 5.5                             |
| 3. Personal Income -----                       | 5.6                            | 5.2                             |
| 4. Gross private domestic fixed investment -   | 4.9                            | 4.5                             |
| 5. Employed civilian labor force -----         | 1.6                            | 1.9                             |
| 6. Gross national product deflator -----       | 1.5                            | 1.5                             |
| 7. Wholesale price index -----                 | .8                             | -.5                             |
| 8. Boeckh construction cost index -----        | 2.5                            | 2.0                             |
| 9. Index of industrial production -----        | 5.6                            | 5.0                             |
| 10. Money supply -----                         | 3.3                            | 3.0                             |
| 11. Selected liquid assets held by public ---  | 7.2                            | 6.5                             |
| B. Annual rates of:                            |                                |                                 |
| 12. Civilian unemployment -----                | 5.6                            | 4.0                             |
| 13. Savings as a percent of disposable income- | 5.6                            | 5.5                             |
| C. Other parameters:                           |                                |                                 |
| 14. Capacity utilization of industry -----     | 85.6                           | 90.0                            |
| 15. Average Federal budgetary deficit:         |                                |                                 |
| National Income budget (billion) ----          | -\$2.4                         | 0                               |
| Cash budget (billion) -----                    | -\$4.1                         | 0                               |

SOURCE: State and Local Public Facility Needs and Financing.  
Vol. I, Subcommittee on Economic Progress, Joint Economic  
Committee, Congress of The United States, U.S.G.P.O. -  
Washington, 1966, P. 22.

## CHAPTER VIII

### TRADE IN THE NEW RIVER BASIN

Trade is an important element in economic development. Federal disclosure laws governing the publication of certain data limit the amount of information available concerning the wholesale trade in the New River Basin. The amount of information which is lacking is not considered to be crucial.

In 1963, the latest year for which data is available, wholesale trade sales amounted to \$65,000,000 in the New River Basin. Retail sales were \$165,000,000. These figures suggest the opportunity for the establishment of a wholesale distribution center somewhere in the New River Basin. Counties and cities within the New River Basin are ranked below from highest to lowest dollar volume of total retail trade sales (in 1963).

Pulaski County  
Wythe County  
Giles County  
Montgomery County\*

Galax City  
Radford City  
Tazewell County \*\*  
Carroll County  
Smyth County \*\*  
Grayson County  
Floyd County  
Bland County \*  
Craig County \*

\* Portion within New River Basin Only.

\*\* Portion influenced by New River Basin Only.

Wythe County and Galax City head the wholesale trade list in 1963. Available information regarding the wholesale trade indicates

the following ranking (in 1963):

Wythe County  
Galax City  
Tazewell County \*\*  
Smyth County \*\*  
Pulaski County  
Radford City  
Montgomery County  
Giles County  
Carroll County  
Floyd County

No information is available for the following counties because of disclosure laws.

Bland County  
Craig County  
Grayson County

\*\* Portion influenced by New River Basin Only.

TABLE 17

## 1963 WHOLESALE AND RETAIL TRADE \*

| Entire County | Counties and Cities in New River Basin Area |                    |                       |                    |
|---------------|---------------------------------------------|--------------------|-----------------------|--------------------|
|               | Wholesale Trade<br>Sales                    | Amount In<br>Basin | Retail Trade<br>Sales | Amount in<br>Basin |
| Bland         | (Disclosure)                                |                    | 1,807                 | 1,807              |
| Carroll       | 2,330                                       | 2,330              | 12,254                | 12,254             |
| Craig         | (Disclosure)                                |                    | 1,918                 | 633                |
| Floyd         | 478                                         | 478                | 6,009                 | 6,009              |
| Giles         | 3,001                                       | 3,001              | 18,649                | 18,649             |
| Grayson       | (Disclosure)                                |                    | 6,766                 | 6,766              |
| Montgomery    | 8,740                                       | 4,370              | 34,850                | 17,425             |
| Pulaski       | 6,372                                       | 6,372              | 24,882                | 24,882             |
| Smyth         | 6,916                                       | 6,916              | 27,248                | 8,992              |
| Tazewell      | 28,475                                      | 9,397              | 42,767                | 14,113             |
| Wythe         | 13,948                                      | 13,948             | 20,485                | 20,485             |
| Galax City    | 11,969                                      | 11,969             | 17,360                | 17,360             |
| Radford City  | 6,086                                       | 6,086              | 15,777                | 15,777             |
| TOTAL         | 88,315                                      | 64,867             | 230,772               | 165,152            |

\*In Thousands of Dollars

## CHAPTER IX

### REGIONAL ACCOUNTING AND FLOWS OF MONETARY INFLUENCE

The plate appearing on page 74, Flows of Monetary Influence, (Plate 16) is important to an understanding of much of the analysis appearing throughout this volume. When capital needs for the future, rates of interest and future government and private investment in public goods are referred to, it is assumed that the principles noted on this plate have been grasped. There are definite flows in the way money influences and is influenced. These flows have important effects on everyday life, especially its business aspects.

Of equal importance to this study is the "world" which is being examined. That "world" here is the physical New River Basin, quite different from the idea of a unit of all the counties which have a part in the New River Basin. In some instances, only a small part of a county is included by Nature in this Basin. In other instances, half of a county or its entirety is included. This "world" of the New River Basin (as a part of the United States) could be expressed, in economic terms of "Gross Basin Product," as follows:

$$Y = C + I_g + G + (X - I_m)$$

Y = Gross Basin Product

C = Consumption

$I_g$  = Gross Business Investment

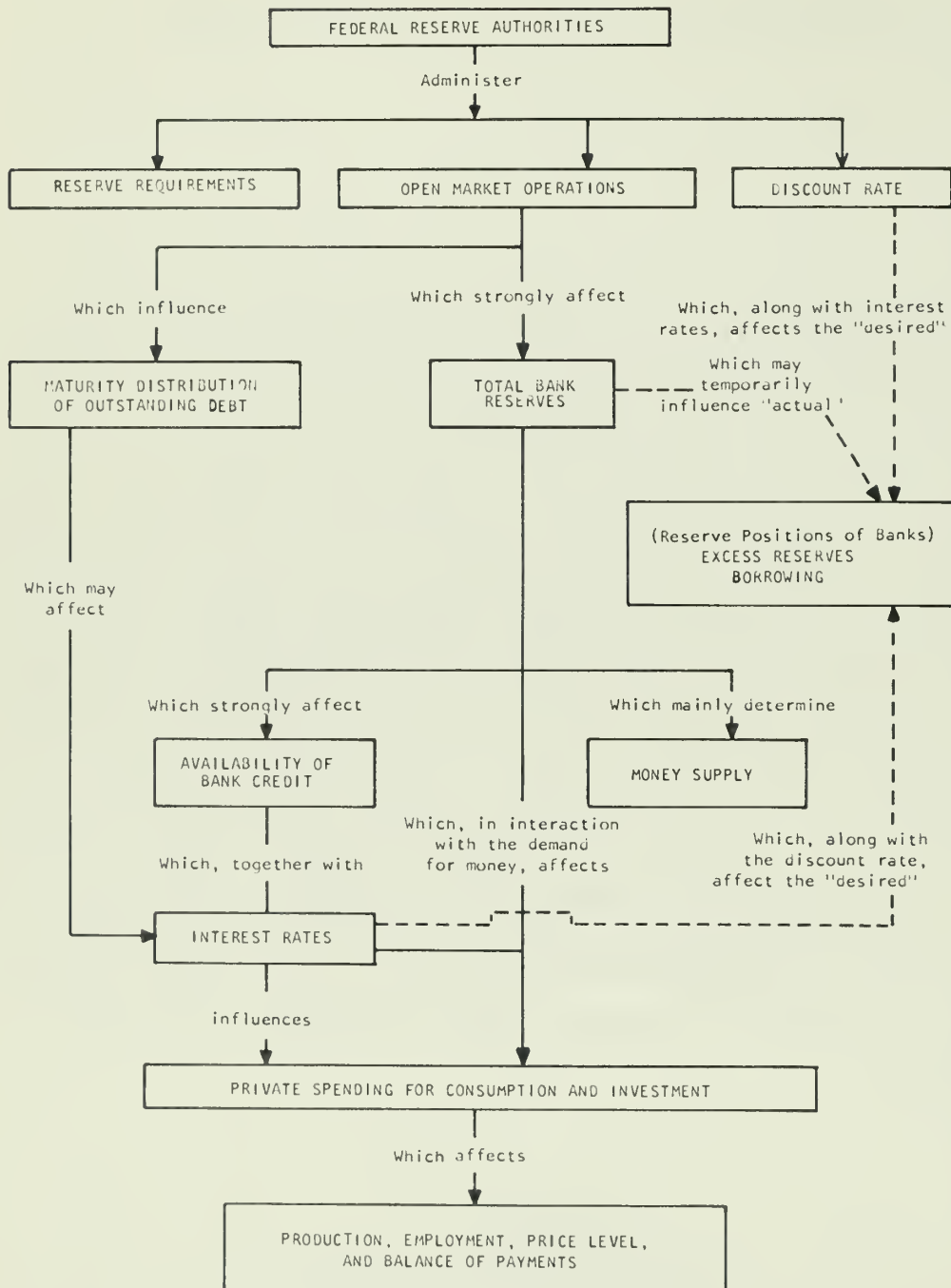
G = Government Spending

$I_m$  = Imports

X = Exports

The use of a formula like this to analyze the New River Basin would be an ideal way to obtain much useful information. There

# FLOWS OF MONETARY INFLUENCE



SOURCE: FEDERAL RESERVE BANK OF ST. LOUIS, 1965

|                             |     |              |        |        |
|-----------------------------|-----|--------------|--------|--------|
| DIVISION OF WATER RESOURCES | SC. | DATE 3-20-67 | SHT. I | OF 1   |
| FLOWS OF MONETARY INFLUENCE | DE. | DR.          | APP.   | REV.   |
|                             |     |              |        | NO. 43 |

PLATE NO. 16

are several significant difficulties which presently cause us to use modified methods of analysis. A few of these are: Data for X and Im, as well as for other variables, are not assembled with regularity for Basin areas the size of the New River Basin. This is a statistical assembly problem which requires additional considerations as to the cost of such assembled data versus its value. Computerized solution of the model would be necessary in order to test the accuracy of its inputs. Of course, the most important reason why this model is not adapted to our analysis of the New River Basin is the time limits which are necessary in order to accomplish river basin analyses so that they may be provided to users when needed.

#### Flows of Monetary Influence

An understanding of flows of monetary influence is essential to the economic analysis of the New River Basin. If the concept of money and credit analysis is not employed, only a broad picture of the Basin and its future would be possible. But money and credit are very significant in the decisions of the people of a region. In migration and out-migration many people are significantly influenced by the quantity of money and credit available. There are certain basic economic laws which regulate the world of money and credit. In the United States, the structure can be looked at as the Treasury and Federal Reserve System, which both influence money and credit on the National level, and the commercial banks, both National and State, which reflect these influences on the local level. The monetary system is an umbrella covering all sectors of financial transactions. Directly or indirectly, nearly every one deals with

or is affected by banking institutions. Industry, commerce, government, and social institutions are predicated on the monetary system. This is a fact of life which cannot be overlooked in the development of an area or in appraising society's indebtedness to the banking institutions. In them is to be found the prime impetus to economic growth.

Considering the Treasury as the proper agent of the Government's fiscal policy, the Federal Reserve should be considered as the proper instrument of monetary policy. Through a complex mechanism which is graphically illustrated by Plate 16, the Federal Reserve System can affect the general flow of money and credit as economic conditions change. The Federal Reserve System cannot assure favorable economic conditions by itself. It must operate within existing banking and credit channels. The other forces affecting the total flow of credit in the economy include government expenditure policies, taxes, debt policy, the existing distribution of income, and the allocation of income between consumption and saving, the position of labor and management, agriculture and other sectors of the economy, prospects for war or peace, and business and consumer expectations as influenced by prices.

"As we have seen, the money system is man made. Invented by man, revised by man, and controlled by man; it is as Abraham Lincoln said, 'the creature of law'. Therefore, there is no reason to conclude that the system is perfect." Page 119, "A Primer on Money"; Subcommittee on Domestic Finance Committee on Banking and Currency, House of Representatives, 88th Congress, Second Session, Washington, G.P.O. 1964.

Thus it is that such things as discount rates, rates of interest, and other methods (or results) of monetary policy influence the New River Basin's private spending for consumption and investment, which affects production, employment, price level both within and outside of the Basin and, of course, even the Balance of Payments.

The Federal Government has been following a policy of stimulating economic growth within the Nation and especially within certain regions, such as the Appalachian Region, which are viewed as growing more slowly than the Nation as a whole. Fiscal and monetary policy are the tools which the government can use to selectively influence a region. The effects of the application of monetary and fiscal policy on the growth of a region should not be either underestimated or overestimated. Broadly, an increase in the money supply of a region, with proper interaction on the part of the region itself, can have beneficial effects in commencing a new level of growth which can become self-sustaining. The important element here is that the region be prepared to make use of the expected increase for a growth that is in its own best interests. This preparation marks the most successful growth areas in contradistinction to those which have grown by chance. It is important to remember that each time National growth is stimulated by fiscal and monetary policy, growth opportunities are opened to a region.

## CHAPTER X

### PERSONAL INCOME IN THE NEW RIVER BASIN

Lord Keynes has stated that "The amount that the community spends on consumption obviously depends (1) partly on the amount of its income, (2) partly on the other objective attendant circumstances, and (3) partly on the subjective needs and the psychological propensities and habits of the individuals composing it and the principles on which the income is divided between them (which may suffer modification as output is increased)." <sup>8</sup>

Although it is difficult to show a significant correlation between per capita personal income and water use or water resource development, it can generally be stated that increased per capita personal income should lead to increased water use.\* Personal water use should increase with a better standard of living, involving more recreation and comfort. Per capita income is viewed as a handy index to gauge the economic growth patterns of an area.

Plate 17 illustrates per capita income in the United States in terms of 1958 dollars. Plate 18 shows per capita income in the United States in terms of the current dollars at the periods of time indicated. Plate 19 shows graphically past per capita

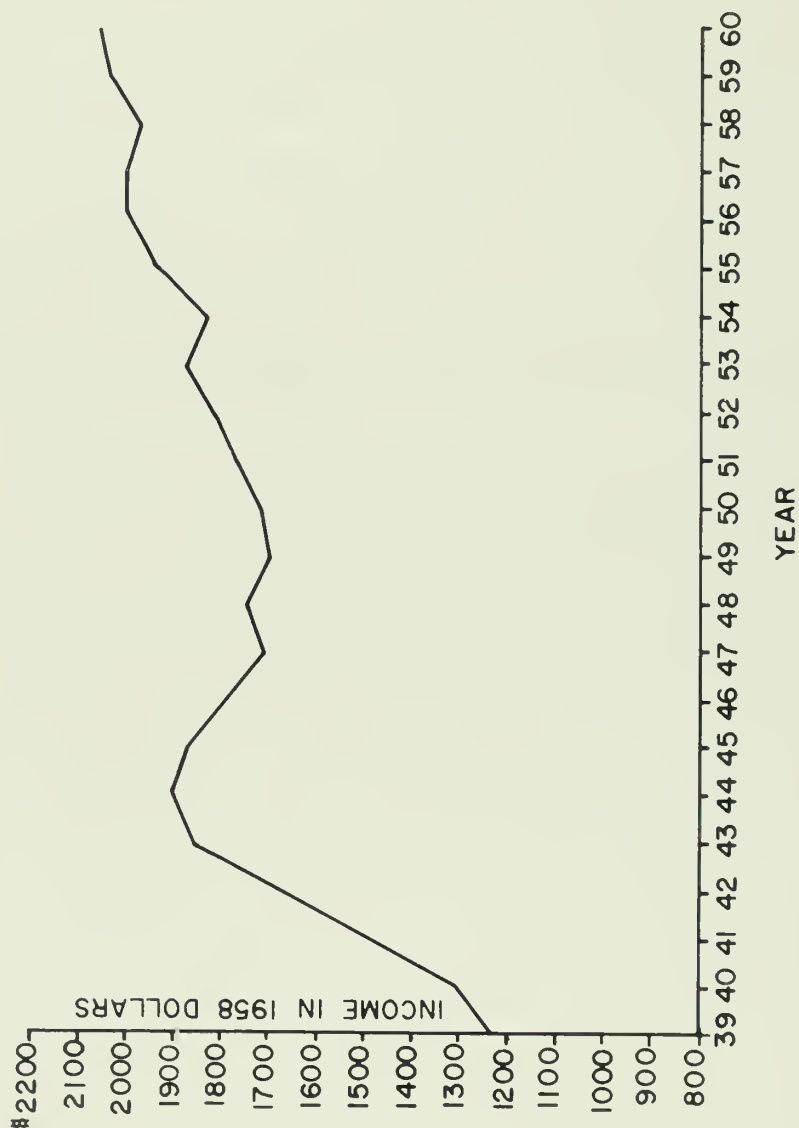
<sup>8</sup> The General Theory of Employment, Interest, and Money. John Maynard Keynes, Harcourt, Brace and Co., New York, 1960, pp. 90, 91.

\* For theory relating to this field, cf. "The Impact of Price on Residential Water Demand and Its Relation to System Design and Price Structure", by Charles W. Howe and F. P. Linaweaver, Jr., Water Resources Research, Vol. 3, No. 1 (1967) pp. 13-32.

personal income in Virginia and projected income to the year 1970. Plate 20 illustrates the 1960 per capita income of counties and cities in the New River Basin. Plate 21 contains "Benchmark" per capita income projections for the New River Basin while Plate 22 shows "Benchmark" per capita income projections for the Appalachian area of the New River Basin. Plates 23 through 28 illustrate historical growth in per capita income for the counties in the Basin.

The 1965 estimate of personal income by county for Virginia is now being prepared by the Bureau of Population and Economic Research of the University of Virginia at Charlottesville.

# UNITED STATES CONSTANT DOLLAR (1958) PER CAPITA INCOME



DIVISION OF WATER RESOURCES  
U.S. CONSTANT DOLLAR

SC.

DATE 4-26-67

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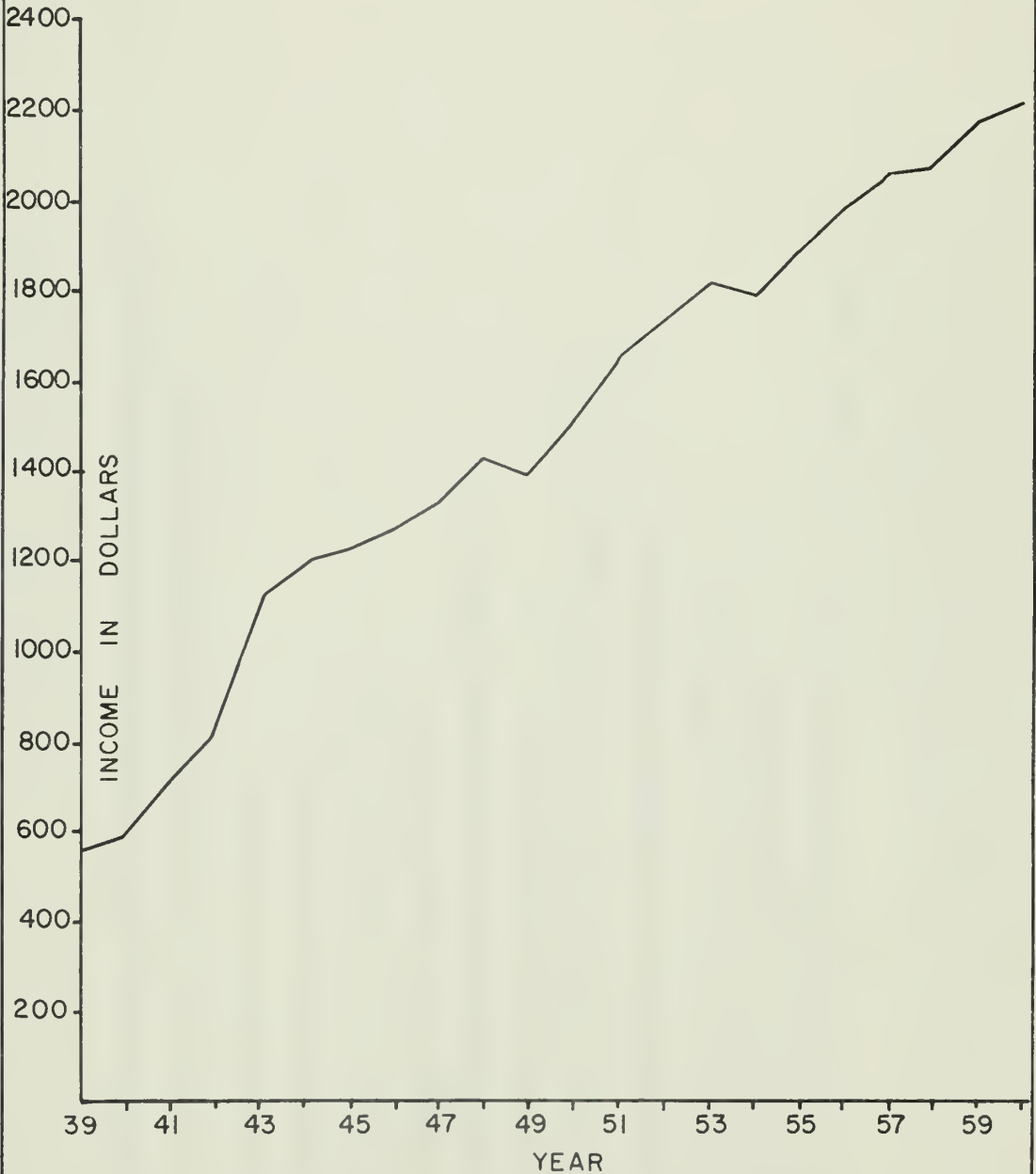
APP.

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PLATE NO. 17

# UNITED STATES CURRENT DOLLAR PER CAPITA INCOME



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U.S. CURRENT DOLLAR

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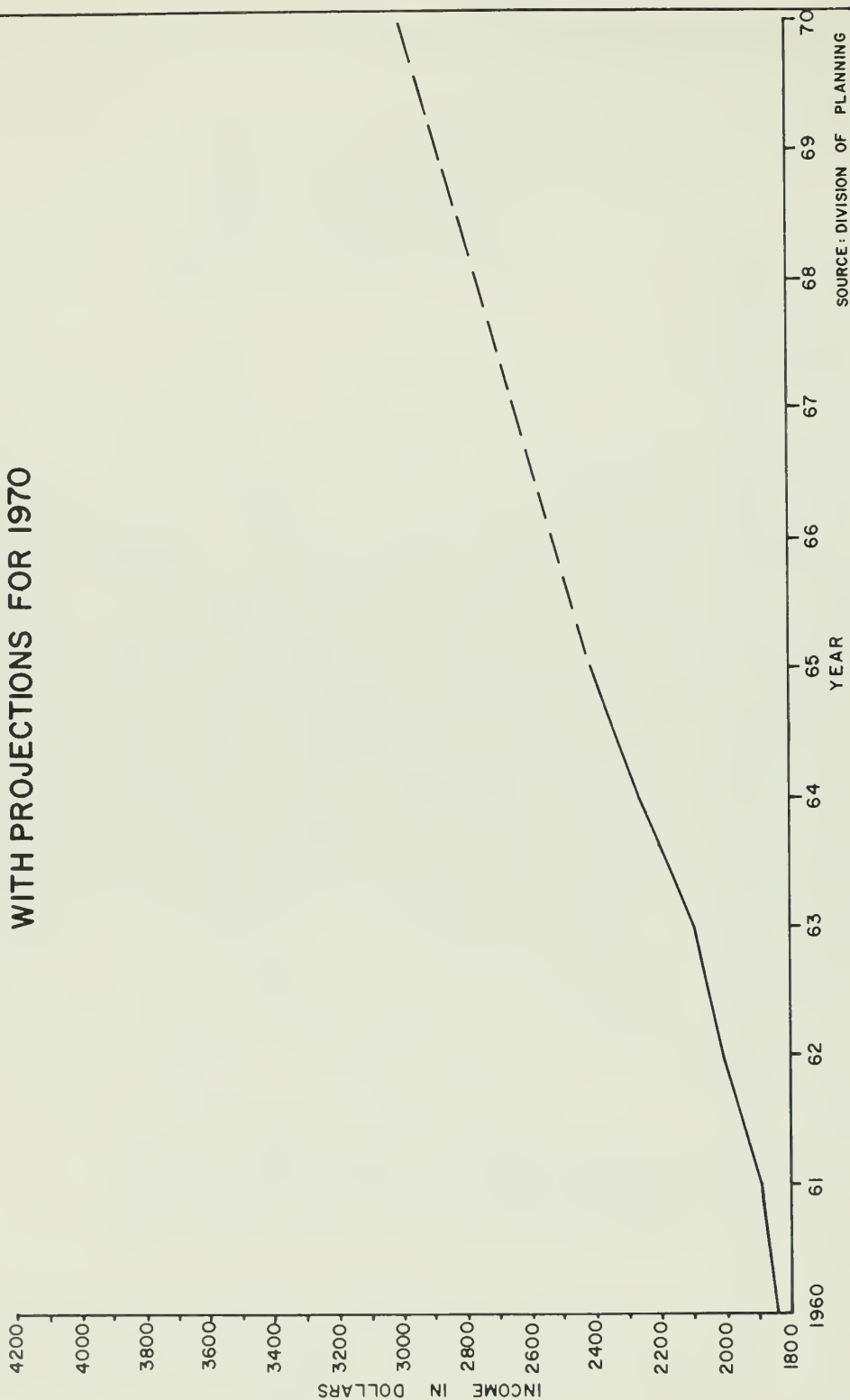
APP.

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PLATE NO. 18

# VIRGINIA PER CAPITA PERSONAL INCOME WITH PROJECTIONS FOR 1970



SOURCE: DIVISION OF PLANNING

|                             |  |     |             |      |        |         |
|-----------------------------|--|-----|-------------|------|--------|---------|
| DIVISION OF WATER RESOURCES |  | SC. | DATE 5-4-67 |      | SHT. I | OF I    |
| VA. PERSONAL INCOME         |  | DE. | DR. C.H.N.  | APP. | REV.   | NO. B91 |

# PER CAPITA INCOME 1960 COUNTIES & CITIES NEW RIVER BASIN , VA.

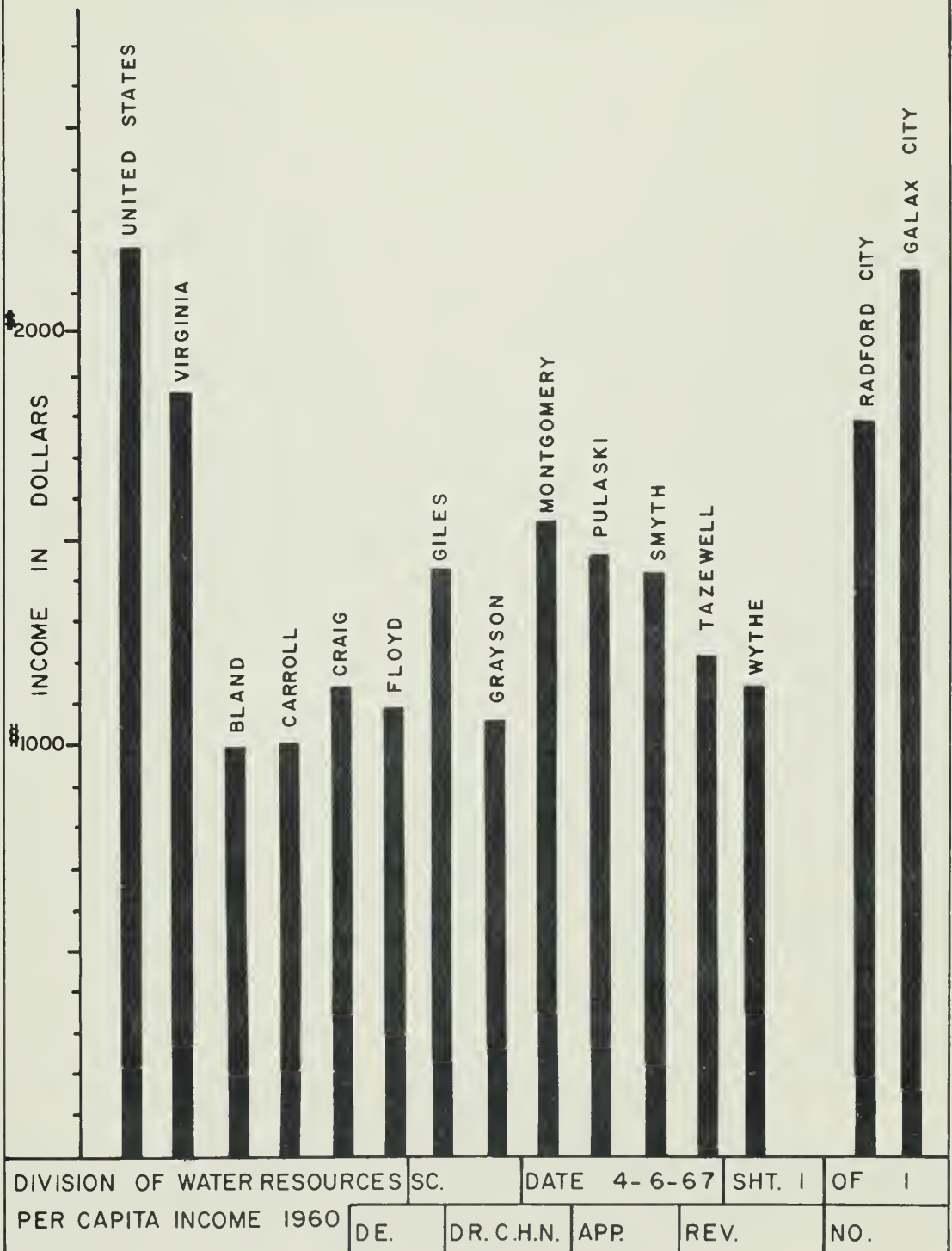
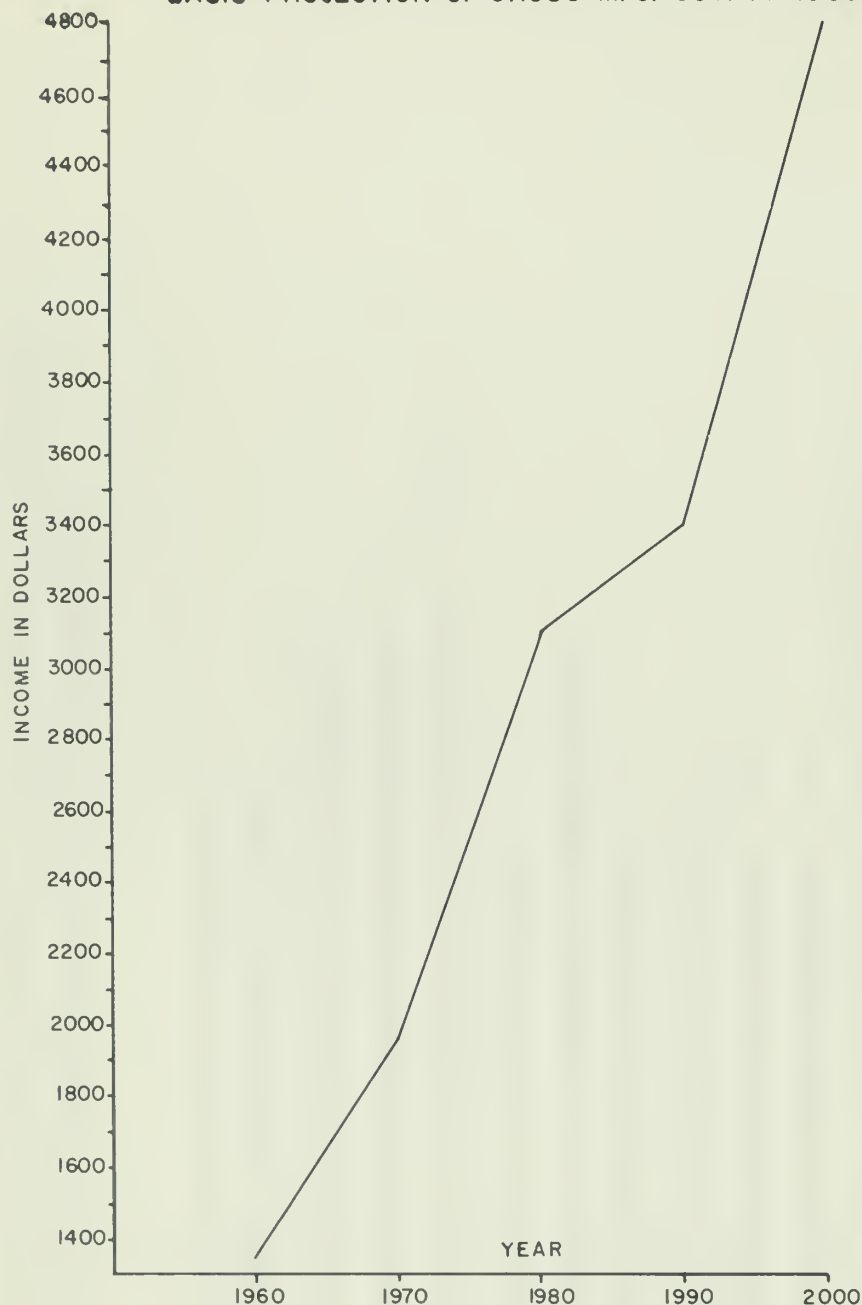


PLATE NO. 20

# "BENCHMARK" PER CAPITA INCOME PROJECTION NEW RIVER BASIN 1960-2000

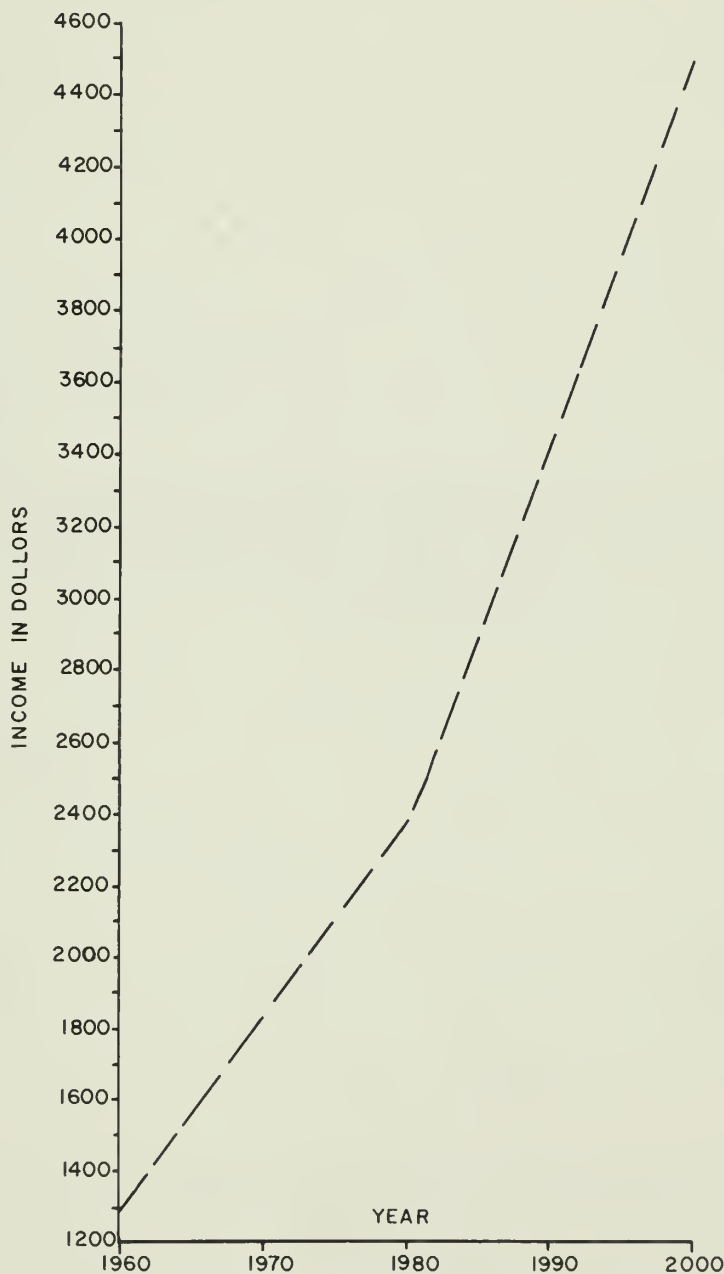
BASIS: PROJECTION OF GROSS MFG. OUTPUT 1965 DOLLARS



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| DIVISION OF WATER RESOURCES | SC. | DATE 5-1-67 | SHT. 1 | OF 1     |
| PER CAPITA INCOME N.R.B.    | DE. | DR. C.H.N.  | APP    | REV.     |
|                             |     |             |        | NO. 8 89 |

PLATE NO. 21

**"BENCHMARK" PER CAPITA INCOME PROJECTION**  
**(TENTATIVE DEVELOPMENTAL)**  
**APPALACHIAN AREA OF NEW RIVER BASIN**  
**1960 - 2000**



SOURCE: U.S. ARMY CORPS OF ENGINEERS OFFICE OF APPALACHIAN STUDIES, 1967

DIVISION OF WATER RESOURCES  
TENTATIVE DEVELOPMENT

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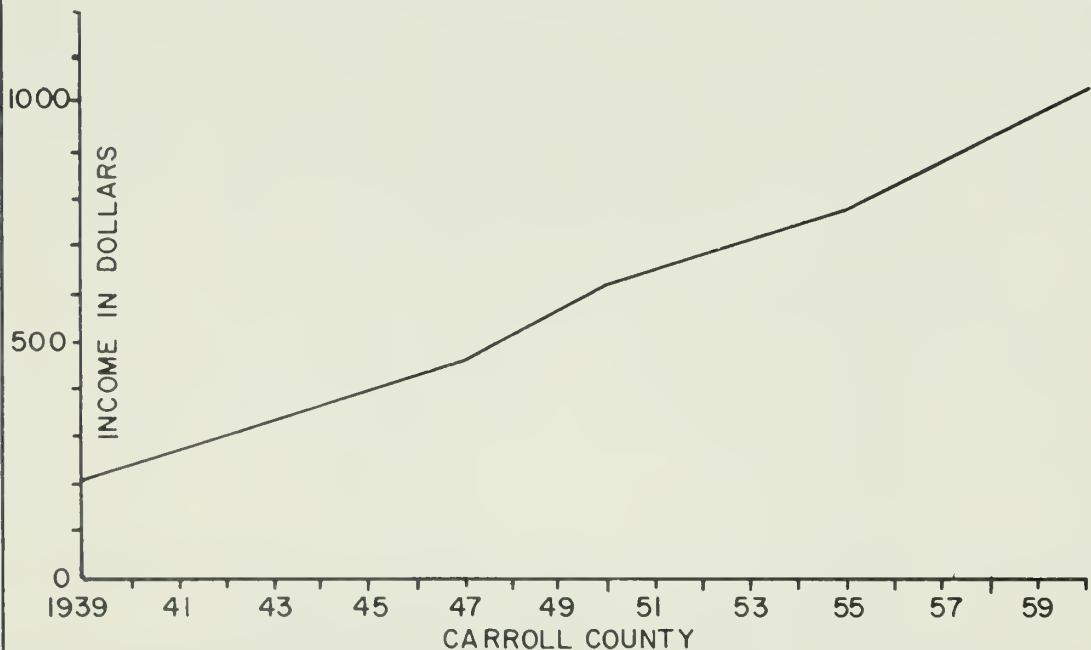
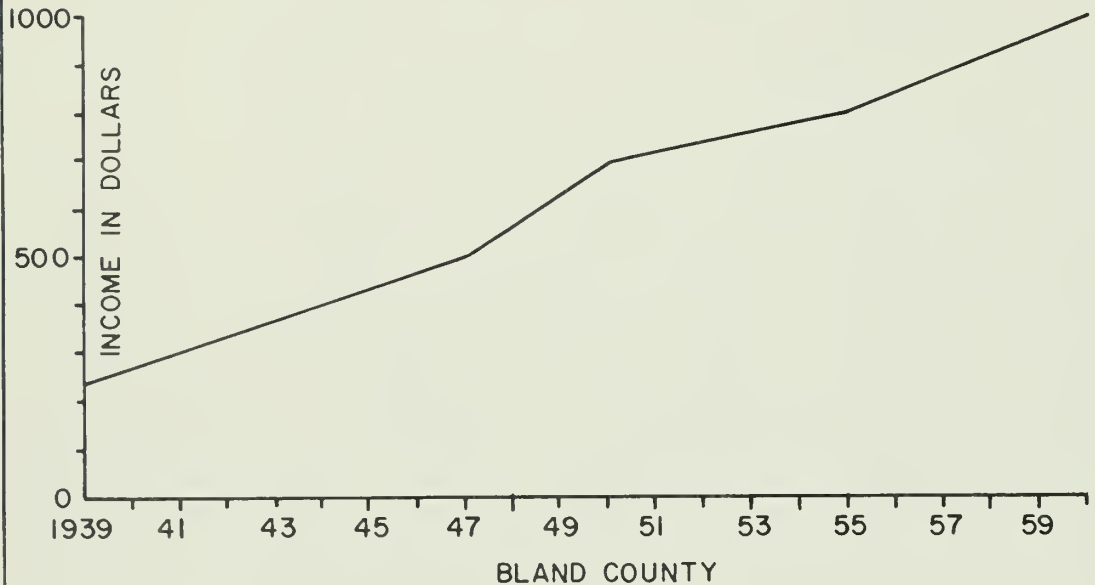
DR. C.H.N.

APP.

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NO. B 90

# HISTORICAL GROWTH IN PER CAPITA INCOME IN DOLLARS



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DATE 5-4-67

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OF 6

HISTORICAL GROWTH

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DR. C.H.N.

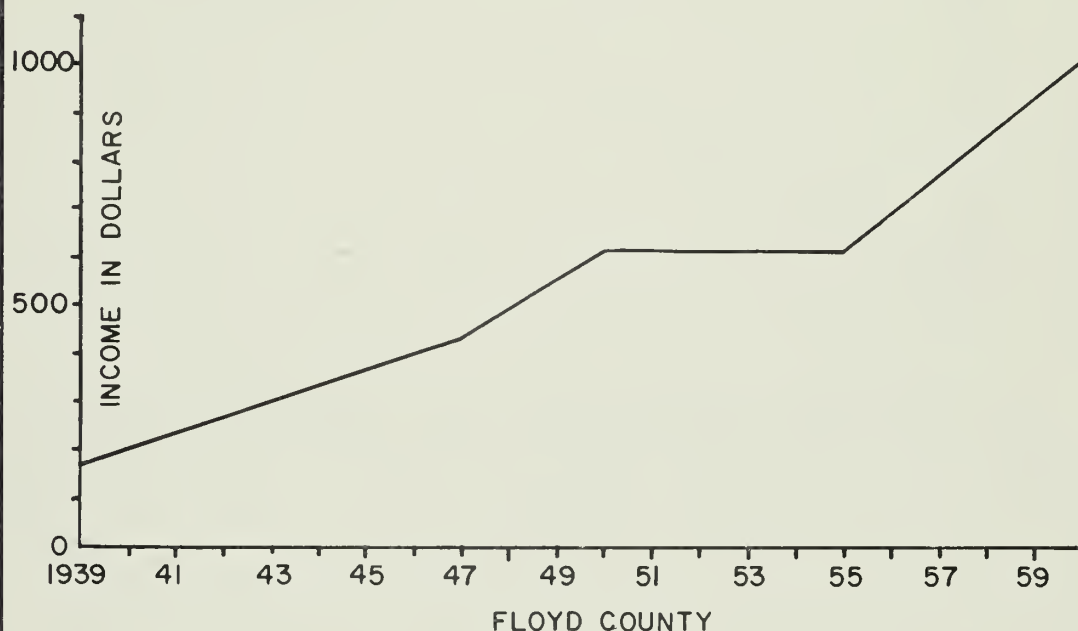
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PLATE NO. 23

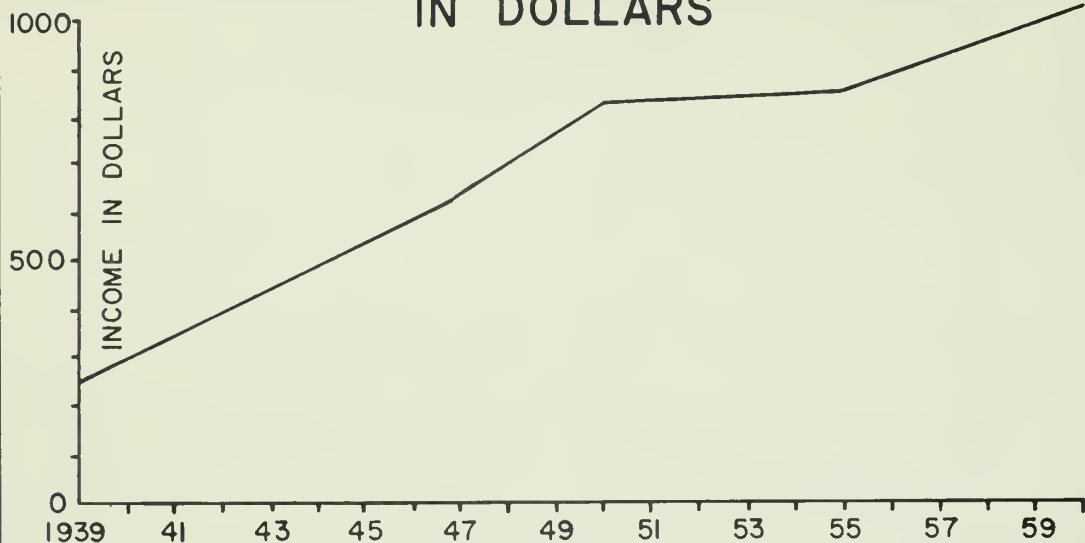
# HISTORICAL GROWTH IN PER CAPITA INCOME IN DOLLARS



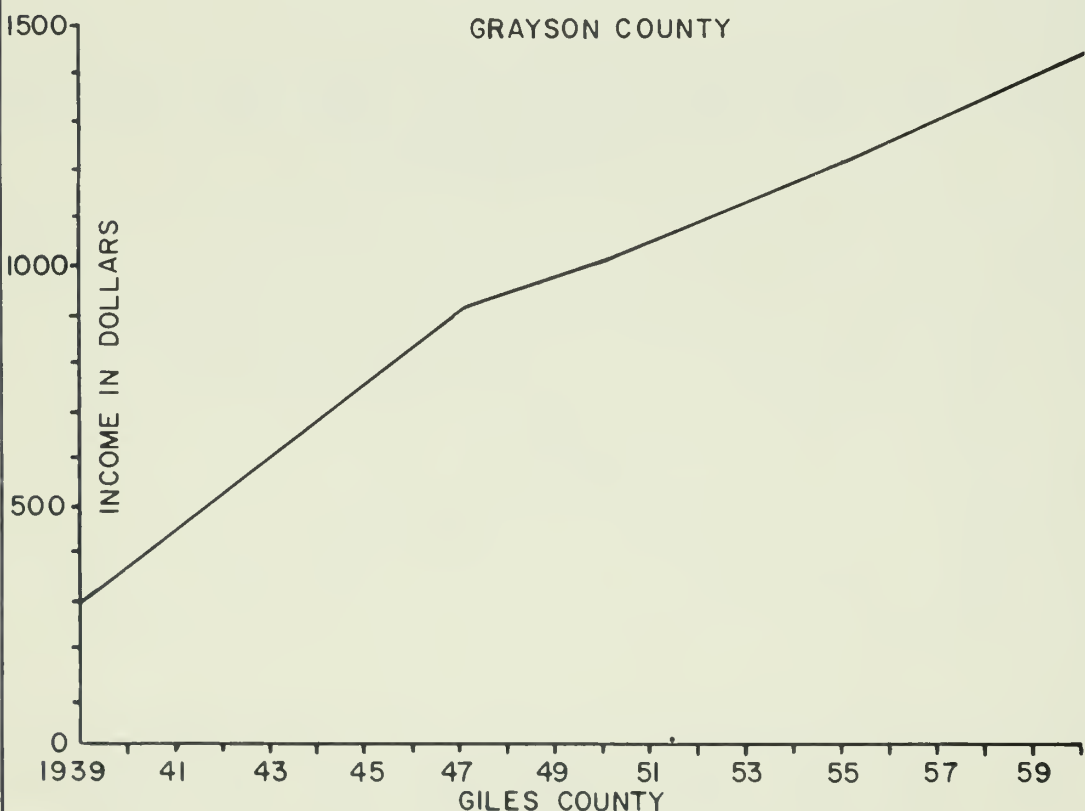
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|-----------------------------|-----|------------|--------|--------|---------|
| DIVISION OF WATER RESOURCES | SC. | DATE       | 5-4-67 | SHT. 2 | OF 6    |
| HISTORICAL GROWTH           | DE. | DR. C.H.N. | APP.   | REV.   | NO. A93 |

PLATE NO. 24

# HISTORICAL GROWTH IN PER CAPITA INCOME IN DOLLARS



GRAYSON COUNTY

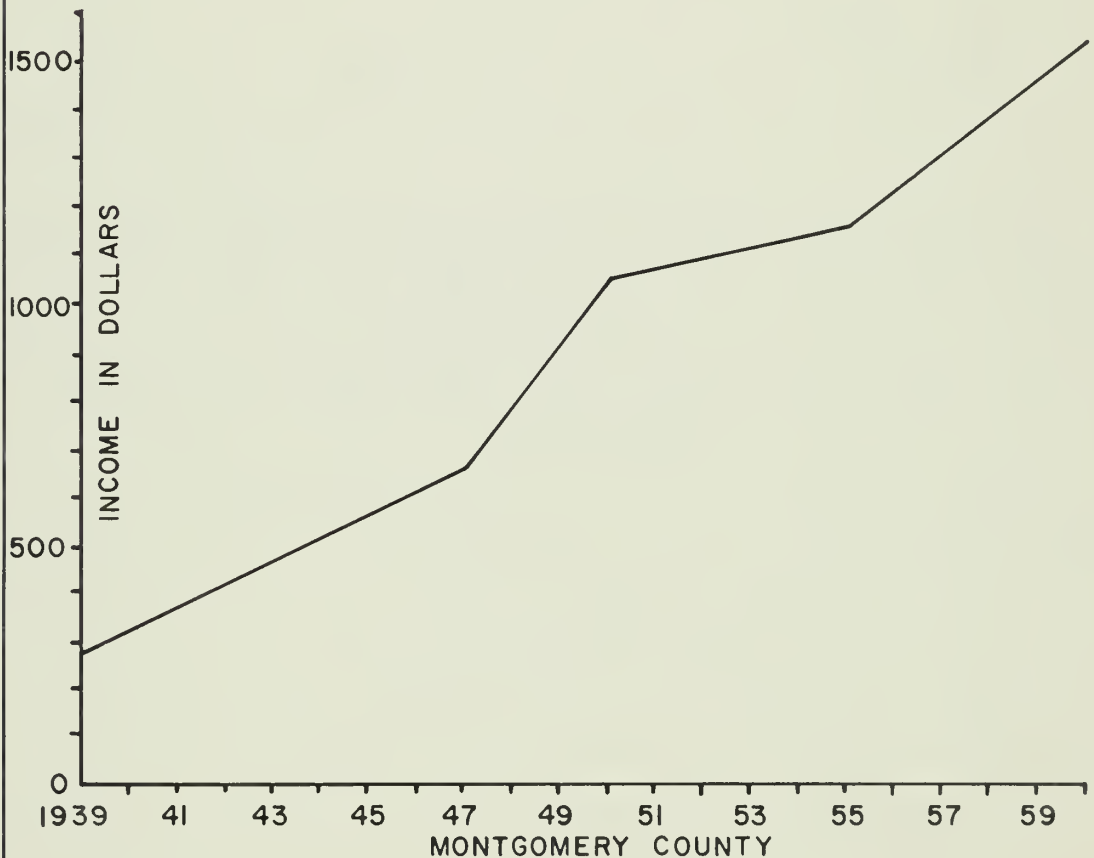


GILES COUNTY

|                             |     |             |        |         |
|-----------------------------|-----|-------------|--------|---------|
| DIVISION OF WATER RESOURCES | SC. | DATE 5-4-67 | SHT. 4 | OF 6    |
| HISTORICAL GROWTH           | DE. | DR.M.N.F.   | APP.   | REV.    |
|                             |     |             |        | NO. A95 |

PLATE NO. 25

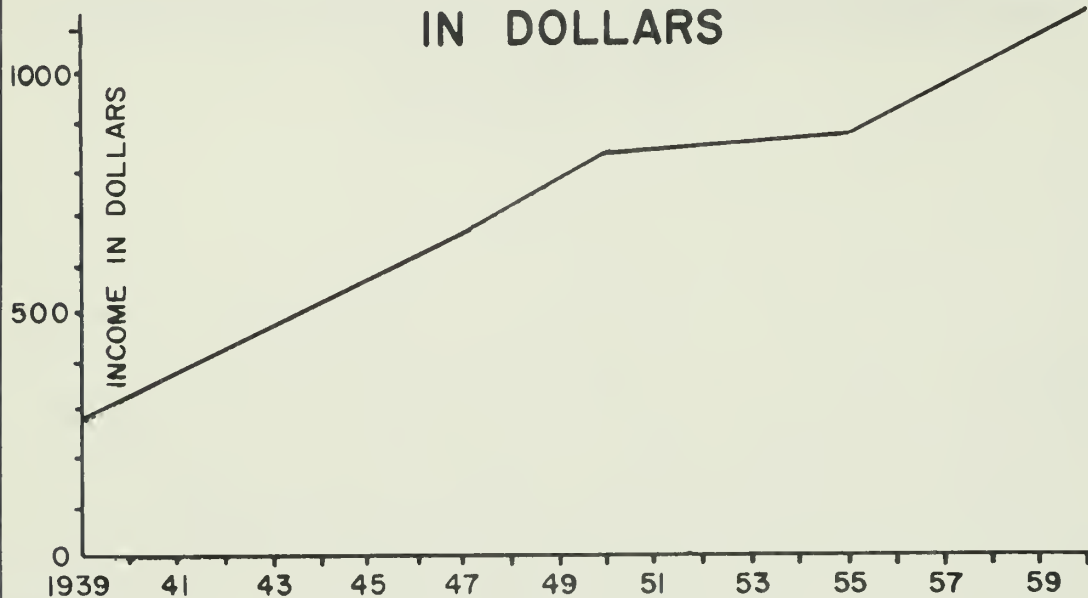
# HISTORICAL GROWTH IN PER CAPITA INCOME IN DOLLARS



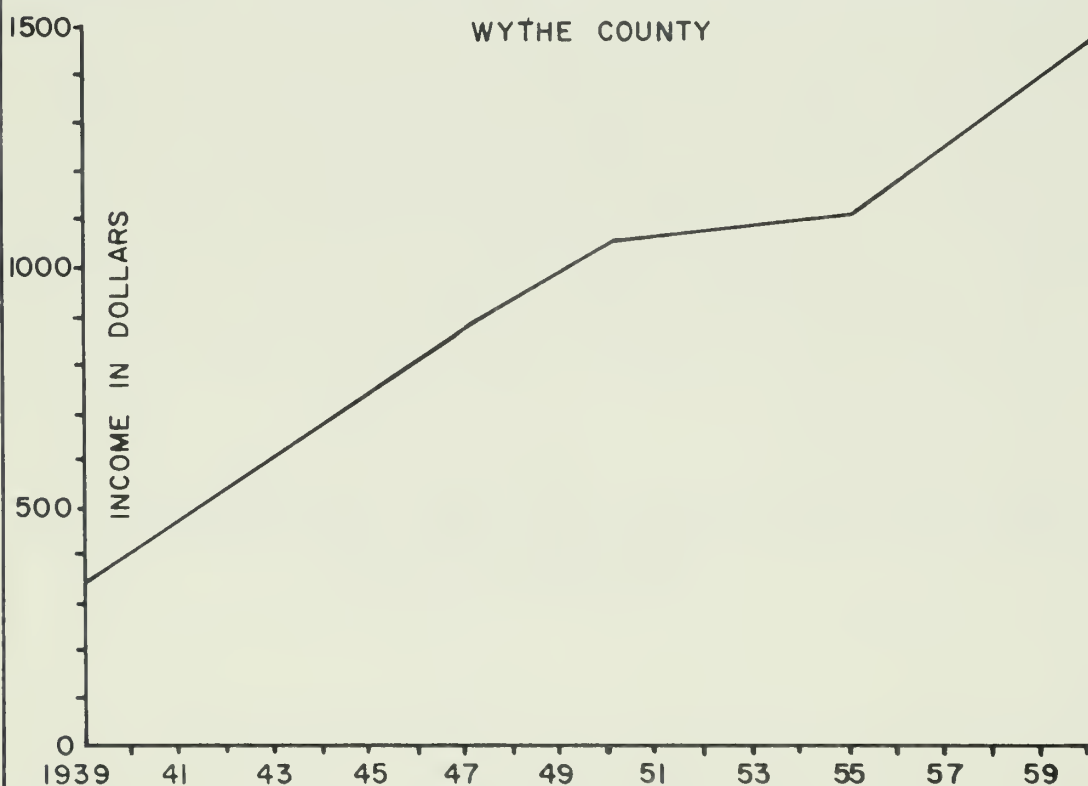
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| HISTORICAL GROWTH           | DE. | DR.M.N.F.   | APP.   | REV.     |
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PLATE NO. 26

# HISTORICAL GROWTH IN PER CAPITA INCOME IN DOLLARS



WYTHE COUNTY



PULASKI COUNTY

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OF 6

HISTORICAL GROWTH

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DR.M.N.F.

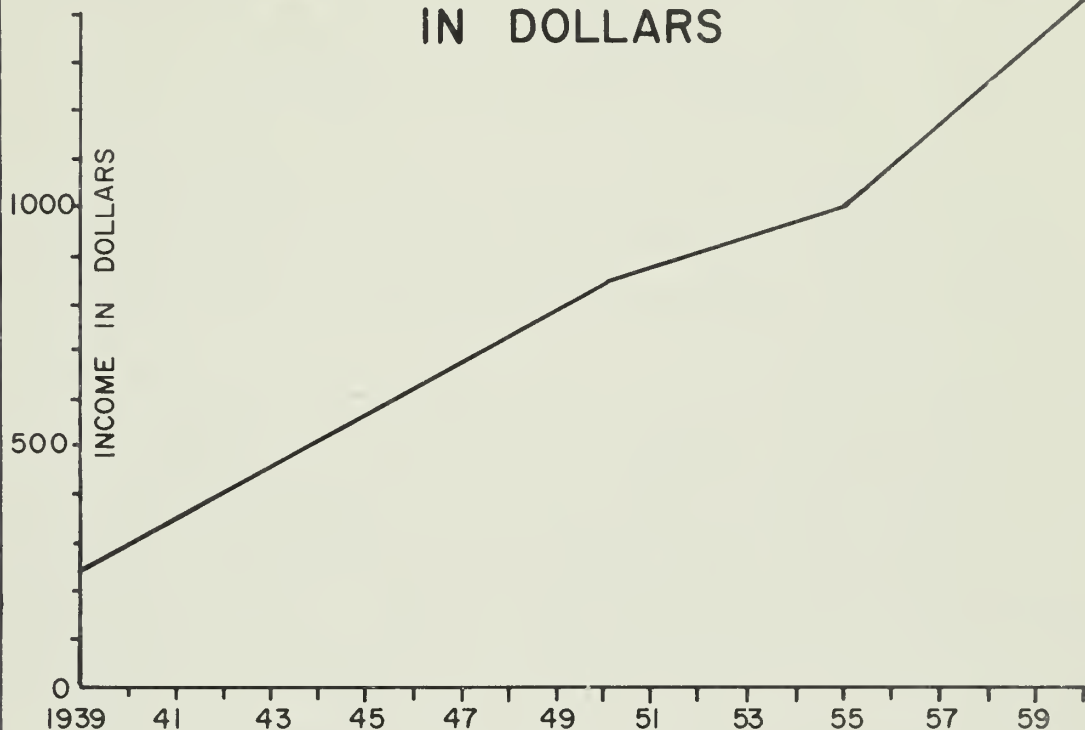
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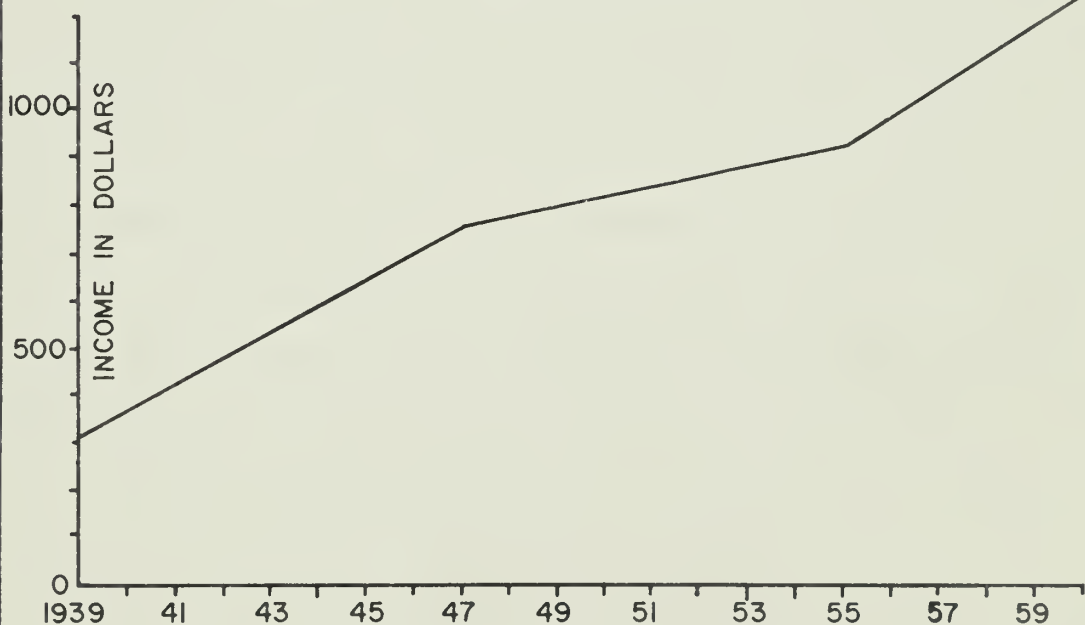
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PLATE NO. 27

# HISTORICAL GROWTH IN PER CAPITA INCOME IN DOLLARS



SMYTH COUNTY



TAZEWELL COUNTY

|                             |     |             |        |         |
|-----------------------------|-----|-------------|--------|---------|
| DIVISION OF WATER RESOURCES | SC. | DATE 5-4-67 | SHT. 1 | OF 6    |
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|                             |     |             |        | NO. A92 |

## CHAPTER XI

### DEVELOPMENTAL ASPECTS OF RECREATION

Clawson and Knetsch hold that the value of recreation at a particular facility can best be determined by a consideration of the total value or welfare of the recreation site in the context of the area considered. <sup>9</sup>

This concept is compatible with the method of analysis used to deal with recreational development throughout this volume.

Assuming that an additional three million dollars is invested in recreation in the New River Basin, its full value can be expected to be effective in the immediate areas of influence in approximately five years. After that time, no more than a 20 percent annual residual impact on area service income can be expected from the original investment. Assuming an average rate of growth, these ancillary services would be included within a 5+ year projected residual impact. It is clear that continuous growth and investment must be elicited in order to stimulate economic expansion from recreation expenditures. Available information suggests that the influence of recreational expenditures are highly "sectoral" within the regional economy. Preliminary work with employment multipliers indicates that the numbers and types of employment generated do not significantly affect the total employment situation. The

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<sup>9</sup> Economics of Outdoor Recreation. Marion Clawson and Jack L. Knetsch. Published for Resources for the Future, Inc. by Johns Hopkins Press, Baltimore

inter-sectoral economic growth which is generated will be growth which is complemented by the recreational investment.

Elements relating this significance are specially treated as each group of factors is discussed in this volume.

The Virginia Division of Parks has made detailed studies of recreational potential in the New River Basin and has formulated a series of plans to make effective use of some of the attractions of the area.

The Appalachian Power Company has proposed the construction of a hydroelectric power reservoir and dam on the New River near Fries, Virginia. The reservoir and dam will be known as the "Blue Ridge Project" and if constructed, will provide the following benefits:

1. Creation of a new recreational area.

2. Use of 300,000-plus tons of coal per year by steam generating plants for pumping operations. Estimated employment will be provided for 100 miners for a full work year with a payroll of \$450,000. Multiplier effect would extend to the transportation industry as well as to other industries. As an example, 300,000 tons of coal would fill 4,300 seventy-ton hopper cars.

3. Approximately \$300,000 can be expected in annual property tax revenues to Grayson County.

Estimated cost of the Blue Ridge Project in 1965 was approximately \$124,000,000.

Approximately a million and a half visitors a year might initially be expected to use the recreational facilities created by the Blue Ridge Project. Experience at other projects indicating an expenditure of \$2.11 per day per visit at or near the water sites equals \$3,165,000.

The expenditures might break down this way:

|                      |        |             |
|----------------------|--------|-------------|
| Food in Restaurants  | \$ .65 | \$ 975,000  |
| Food in Groceries    | \$ .10 | \$ 150,000  |
| Lodging              | \$ .30 | \$ 450,000  |
| Gas and Oil          | \$ .25 | \$ 375,000  |
| Other Transportation | \$ .06 | \$ 90,000   |
| Miscellaneous        | \$ .75 | \$1,125,000 |
| TOTAL                | \$2.11 | \$3,165,000 |

## CHAPTER XII

### THE VALUE OF WATER UNDER RIPARIAN LAW

The present frame of reference for considering the value and potential of water resources in Virginia is done in the framework of riparian law.

In considering the value of water and related land resources it is well to have a clear idea of this doctrine.

"The value of water under riparian law: 'The riparian doctrine' which does not confer rights to specific amounts of water but permits the riparian owner to use any amount of water so long as he leaves it 'reasonably' unimpaired in quantity and quality holds in the Eastern States. Where this doctrine prevails, market transactions reflect the value of water use per se through the values of riparian real estate and much more indirectly through the transportation and access costs which nonriparian users incur.

"The first of these - real estate values - which result largely from relatively inexpensive water supply and waste disposal and the value of navigation, recreation, and amenity, is at least in principle subject to census. It would be desirable to collect land value data in such a way as to permit comparisons between riparian and nonriparian lands with the former classified by use and character of the contiguous water body.

"The second type of utility which the market reveals is payment for access by nonriparians largely for recreation use. (The value of recreation as such either as reflected in land values or as

deducible from willingness to pay for access does not appear in the national income accounts.)

"This is an important element in the value of almost all large bodies of water. Research has shown that a consistent measure of demand can be derived from such data. Questionnaire methods may also be useful for getting at the evaluation of nonriparian users. These methods are still under development, however, and while the committee sees great value in and wishes to encourage research along these lines, it does not feel that a stage has been reached where appropriate data could be included in a census-type actively.

"It should be noted of course that the comments made with respect to the possible incorporation of capital value of flow regulation facilities in riparian land prices under point A (Value of water under appropriation law) apply to point B as well. (The value of water under riparian law.)" 10

#### 10 Measuring The Nation's Wealth

Materials developed by the Wealth Inventory Planning Study, the George Washington University and presented by the Conference on Research in Income and Wealth to the Subcommittee on Economic Statistics of the Joint Economic Committee Congress of the United States, Washington, December 1964, p. 584.

## CHAPTER XIII

### WASTE IN THE NEW RIVER ECONOMY

What are the alternative uses of resources presently existing in the New River Basin? Can they be made to yield more with additional planning? These are the questions which will be raised. Some of the material will point out negative or "neutral" uses of resources. More important are hints of benefits (values) which can easily be overlooked if they are not examined closely.

At the present time, there are areas in the New Basin where desirable land is being used for auto junkyards and other depots of goods in various states of disrepair. Some land use is also being influenced by run-down or poorly designed structures. Zoning does not appear to be evident or effective in many areas where it would be socially desirable. There is a potential for abandonment of structures in various stages of use or disuse. This can have its effect on the potential uses of water resources of the Basin. Structures located along the River and later abandoned or allowed to fall into disuse or disrepair exert a negative influence on those who might develop industrial sites. Where poor locational choices have been made along river banks and structures later abandoned, it may be wise to require that such structures be removed within a reasonable period of years.

Some consideration should be given to the value of clean water pouring into the New River from streams or creeks. The benefits which could be obtained by smaller impoundments for water supply

or low-flow augmentation can be measured by the value to potential water users in Virginia. Water which is expended, so to speak, in the New River Basin in Virginia is lost to Virginia as the River leaves the State. Clean water is not so cheap that this can be done without lost opportunity costs.

## CHAPTER XIV

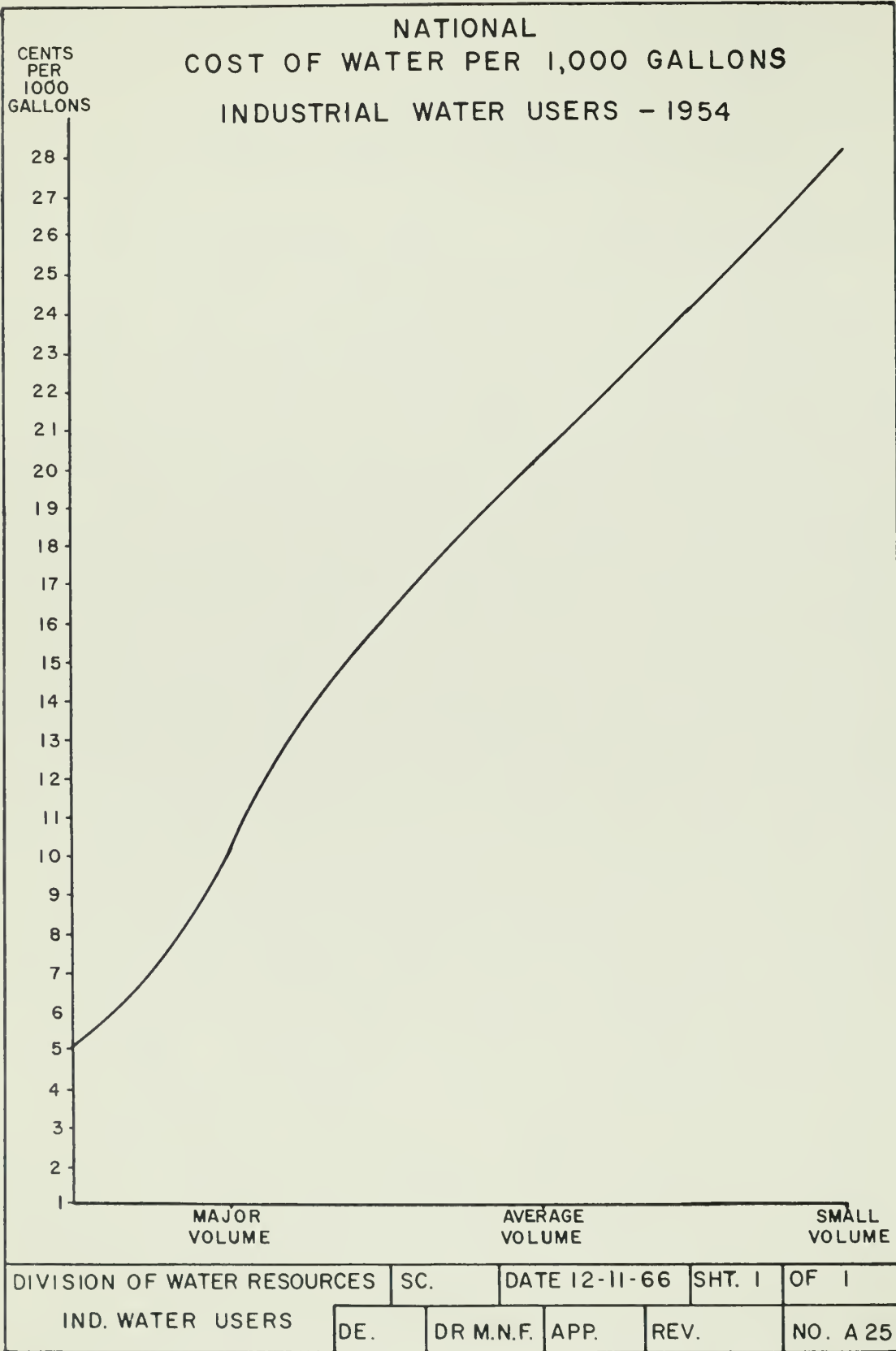
### WATER COSTS AND VALUATION OF WATER RESOURCES

#### Comparative Water Costs

Small water systems must charge more for water supplied to major volume industrial users than larger water systems. Consequently, with many smaller communities in the New River Basin, there should be coordinated efforts to plan larger water supply facilities which could offer water to a number of communities at lower rates to potential industrial users. The capacity of the New River itself to meet all future needs should not be overrated, just as it should not be underrated.

The ultimate cost of purchased water to some industries in the New River Basin, depending on source of supply, was higher than that amount shown on the national chart, Plate 29.

There has been some increase in the national cost of water from 1954 to the present, and comparison of these national costs to costs in the New River Basin may be misleading. Most 1966 public water supply rates in the New River are given for what would be "small volume" users in the national (1954) figures. However, industrial users wishing to use large quantities of public water supply could probably negotiate separate rate contracts. Small volume users would be those who use less than 800,000 GPD. Average volume users would use between 3.2 MGD and 20 MGD. Major volume users would use in excess of 20 MGD and would usually provide their own source of supply. The information used in compiling the National



Cost of Water Chart may be found in the Report of the Select Committee on National Water Resources, Report No. 29, U.S. Senate, 87th Congress, Washington, GPO, 1961, p. 85.

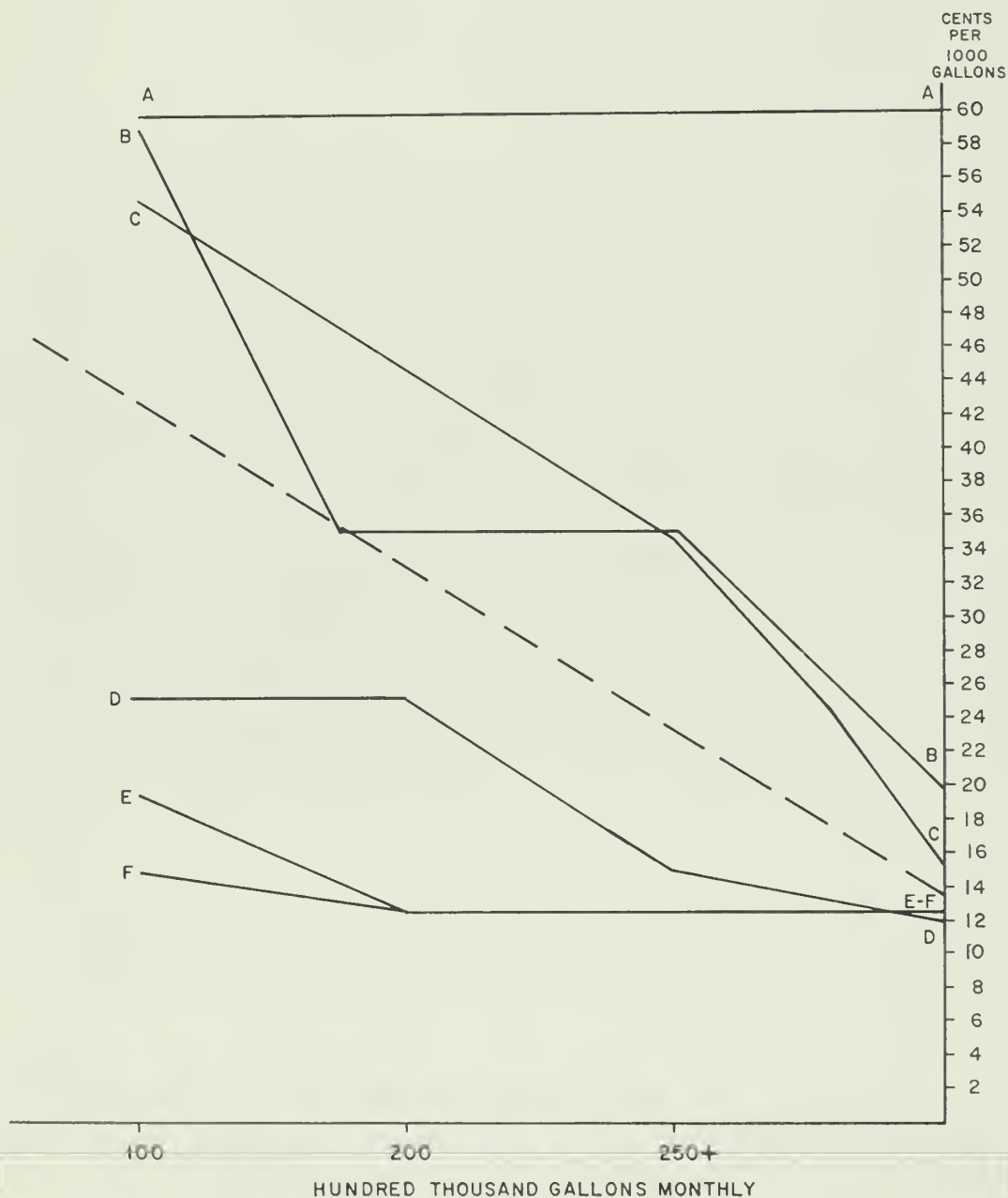
Plate 30, "Composite Point Industrial Water Rates at Hundred-Thousand Gallons Points, Six Communities New River Basin," is a graphic presentation of approximate point rates. Its value in this context lies in the observation of the diversity of municipal water rates in a small geographic area. One industrialized community is on the high side of the chart. Several communities are on the low side of the chart. Differences in size of plants are evident in the price structure. However, many disparities are not so easily explained. Choices as to source of water and subsequent treatment required are other cost factors.

What seems to be suggested is the lack of coordinated planning of regional water supply and the proper weighing of this water supply in the overall industrial development picture. There is the suggestion here that water resources are not receiving the consideration due them in order to obtain maximum benefit to the area.

Major water using establishments usually supply their own requirements, with usual maximum cost held in the ranges shown in Plate 29.

A discussion of economic incentives to assure water conservation practices with an appeal for research efforts in the area with which we are dealing may be found on Page 59 of the "Report of the Select Committee on National Water Resources," Report No. 29, Senate of the United States, 87th Congress, GPO, Washington, 1961.

# COMPOSITE POINT INDUSTRIAL WATER RATES AT THOUSAND GALLON POINTS (SIX COMMUNITIES NEW RIVER BASIN)



|                                           |     |             |        |          |
|-------------------------------------------|-----|-------------|--------|----------|
| DIVISION OF WATER RESOURCES               | SC. | DATE 2-8-67 | SHT. 1 | OF 1     |
| COMPOSITE POINT<br>INDUSTRIAL WATER RATES | DE. | DR. M.N.F.  | APP.   | REV.     |
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PLATE NO. 30

Valuation of Water Resources

In 1960, approximately \$1,517,000 was spent in the Virginia Basin area for water supply expenses and an additional \$1,594,000 for sewerage expenses; a total of \$3,111,000 (Plate 31). This represents approximately 17 percent of the total county tax revenues for the year 1962.

Using a National average figure derived from Water Resources Development, Capital Investment Values, by Walter L. Picton, BDSA, U. S. Department of Commerce, Water and Sewerage Division, GPO, 1959, p. 3, and taking per capita replacement value of water resources in 1965 at \$1,000 (per capita) multiplied by estimated New River Basin population of 185,000, we arrive at an estimated figure of \$185 million as "National average replacement value" for water resources in the New River Basin. While we have no presently developed valuation procedure to confirm this figure within the New River Basin, it does seem to tie-in with our Water Economic Intensities (see Chapter XVIII).

Looking at projected growth areas and projected outputs, it seems possible that water and related land resource expenses for the New River Basin area may be in the following ranges:

|             |             |              |              |              |
|-------------|-------------|--------------|--------------|--------------|
| <u>1970</u> | <u>1980</u> | <u>1990</u>  | <u>2000</u>  | <u>2010</u>  |
| \$5,000,000 | \$9,000,000 | \$11,000,000 | \$12,500,000 | \$15,000,000 |
|             |             | <u>2020</u>  |              |              |
|             |             | \$18,000,000 |              |              |

This can hardly be called phenomenal growth in facilities. One aspect of demand which could radically alter this projection would be the requirement of comprehensive sewer line and sewage treatment facilities in a major part of the Basin. Because of

# FINANCIAL FACTORS INFLUENCING THE NEW RIVER BASIN

| Counties and Cities*<br>1962 | Property<br>Taxes | Other<br>Taxes | Capital<br>Outlay<br>Exp. | Other<br>Exp. | Sewerage  | Parks<br>and<br>Recreation | Natural<br>Resources | Water<br>Supply<br>Exp. |
|------------------------------|-------------------|----------------|---------------------------|---------------|-----------|----------------------------|----------------------|-------------------------|
| BLAND                        | 144,000           | 18,000         | 154,000                   | 419,000       | 00        | 00                         | 6,000                | 2,000                   |
| CARROLL                      | 509,000           | 32,000         | 898,000                   | 1,559,000     | 7,000     | 00                         | 7,000                | 10,000                  |
| CRAIG                        | 100,000           | 12,000         | 6,000                     | 251,000       | 1,000     | 00                         | 11,000               | 2,000                   |
| FLOYD                        | 274,000           | 42,000         | 763,000                   | 895,000       | 2,000     | 00                         | 8,000                | 7,000                   |
| GILES                        | 1,336,000         | 42,000         | 778,000                   | 2,172,000     | 11,000    | 18,000                     | 26,000               | 102,000                 |
| GRAYSON                      | 325,000           | 42,000         | 3,000                     | 1,178,000     | 2,000     | 00                         | 9,000                | 15,000                  |
| MONTGOMERY                   | 1,032,000         | 76,000         | 595,000                   | 2,502,000     | 114,000   | 00                         | 13,000               | 173,000                 |
| PULASKI                      | 1,232,000         | 136,000        | 177,000                   | 2,696,000     | 2,000     | 23,000                     | 8,000                | 169,000                 |
| SMYTH                        | 874,000           | 222,000        | 959,000                   | 2,661,000     | 341,000   | 00                         | 6,000                | 216,000                 |
| TAZEWELL                     | 1,269,000         | 187,000        | 137,000                   | 3,641,000     | 66,000    | 00                         | 13,000               | 200,000                 |
| WYTHE                        | 759,000           | 62,000         | 510,000                   | 2,380,000     | 42,000    | 00                         | 13,000               | 88,000                  |
| GALAX *                      | 292,000           | 66,000         | 111,000                   | 659,000       | 108,000   | 16,000                     | 00                   | 32,000                  |
| RADFORD*                     | 355,000           | 73,000         | 928,000                   | 1,130,000     | 898,000   | 30,000                     | 00                   | 501,000                 |
| TOTALS                       | 8,501,000         | 10,100,000     | 6,019,000                 | 22,143,000    | 1,594,000 | 87,000                     | 120,000              | 1,517,000               |

Compiled From: Census of Government 1962 Government in Virginia, Vol. VII, No. 46  
U.S. Dept. of Commerce, G.P.O., Washington, 1964

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the topography and geographical spread of large sections of the Basin, this is unlikely in the near term. Further refinement of future water resource development costs will be found in Volume V of the Comprehensive New River Basin Plan.

## CHAPTER XV

### INDUSTRIAL GROWTH AND FUTURE WATER NEEDS

Water facilities will be subjected to at least three times present demand by the year 2010. In order to meet this demand, capital will be required to develop systems in a progression to meet needs. The cost of providing increased facilities is somewhat less as the quantity of users increases. The initial outlay is the heaviest item.

The projected growth in output by industry will involve increased use of all of the factors of production. Increased use of water for industry can be expected. Technological advances which will maximize effective water use and minimize offensive effluent will probably come slowly in the expected industrial mix in the New River Basin. The type of industries which will be along the New River will be those which use the River's water for various stages of the manufacturing process and will consequently contribute to the sources of waste loading in certain areas of the River. Only by wise location of resource developments can the maximum benefits be derived from all the resources of the New River.

At the present time existing water pollution control law penalizes only the source of pollution. Changes in the ecology of a river brought about by the construction of dams and reservoirs may result in deterioration of the river even though sources of waste, which previously presented no problem, remain unchanged. Thus, unwise location of water resource development may place industry or other

sources of waste in the position of estimating the possibility of future dam and reservoir erection.

#### SIC Water Use Comparison

Excluding the large use of water for cooling in electric plants and defense production, the following four-digit SIC (Standard Industrial Classification) Code breakdown of industrial water use in the New River Basin represents the situation existing in 1965.

|          | <u>Remaining Major Industries</u>                                       | <u>Weight</u> |
|----------|-------------------------------------------------------------------------|---------------|
| SIC 1421 | Crushed and Broken Stone including Riprap                               | 11.759        |
| SIC 1441 | Sand and Gravel                                                         | 3.759         |
| SIC 2022 | Cheese Natural Processing                                               | NA*           |
| SIC 2023 | Condensed and Evaporated Milk                                           | .211          |
| SIC 2026 | Fluid Milk                                                              | .022          |
| SIC 2042 | Prepared Feeds for Animals and Fowl                                     | .144          |
| SIC 2086 | Bottled and Canned Soft Drinks                                          | .672          |
| SIC 2231 | Broad Woven Fabric Mills Wool including Dyeing and Finishing            | .080          |
| SIC 2261 | Finishers of Broad Woven Fabrics of Cotton                              | .449          |
| SIC 2816 | Inorganic Pigments                                                      | 1.581         |
| SIC 2819 | Industrial Inorganic Chemicals, n.e.c.                                  | 2.718         |
| SIC 2823 | Cellulosic Man-Made Fibers                                              | 72.175        |
| SIC 3111 | Leather Tanning and Finishing                                           | .309          |
| SIC 3251 | Brick and Structural Clay Tile                                          | .069          |
| SIC 3295 | Minerals and Earths, Ground Ore Otherwise Treated                       | 3.743         |
| SIC 3452 | Bolts, Nuts, Screws, Rivets and Washers                                 | .366          |
| SIC 3532 | Mining Machinery and Equipment except Oil Field Machinery and Equipment | .299          |
| SIC 3621 | Motors and Generators                                                   | .224          |
| SIC 3678 | Electric Components and Accessories, n.e.c.                             | .404          |

\* - Not available

#### Water-Use Ranking of "Remaining Industries" Above One Percent of Total

|    |          |                                                   |        |
|----|----------|---------------------------------------------------|--------|
| 1. | SIC 2823 | Cellulosic Man-Made Fibers                        | 72.175 |
| 2. | SIC 1421 | Crushed and Broken Stone including Riprap         | 11.759 |
| 3. | SIC 1441 | Sand and Gravel                                   | 3.797  |
| 4. | SIC 3295 | Minerals and Earths, Ground Ore Otherwise treated | 3.743  |
| 5. | SIC 2819 | Industrial Inorganic Chemicals, n.e.c.            | 2.718  |
| 6. | SIC 2816 | Inorganic Pigments                                | 1.581  |

Bearing in mind that public water use will probably approximate 11,000,000 GPD within the decade, which would compare as 11.7 percent of total 1965 water use, this use is now outweighed by

two SIC classifications - SIC 2823 and SIC 1421.

Since water use is tied to basic industries, it is toward the future demand for basic products that we should direct our attention.

SIC 2823 parallels the growth of chemical and allied industries as a class. This growth has been steadily upward with only slight pauses to conform to the movement of the general economy. A greater than average growth rate can be expected from this industry.

SIC 1421 is closely tied to movements of the general economy and we can expect the prognosis for the general economy to hold true for this industry's growth. The growth trend here should be modest.

#### Future Water Requirements of Chemical and Allied Industries

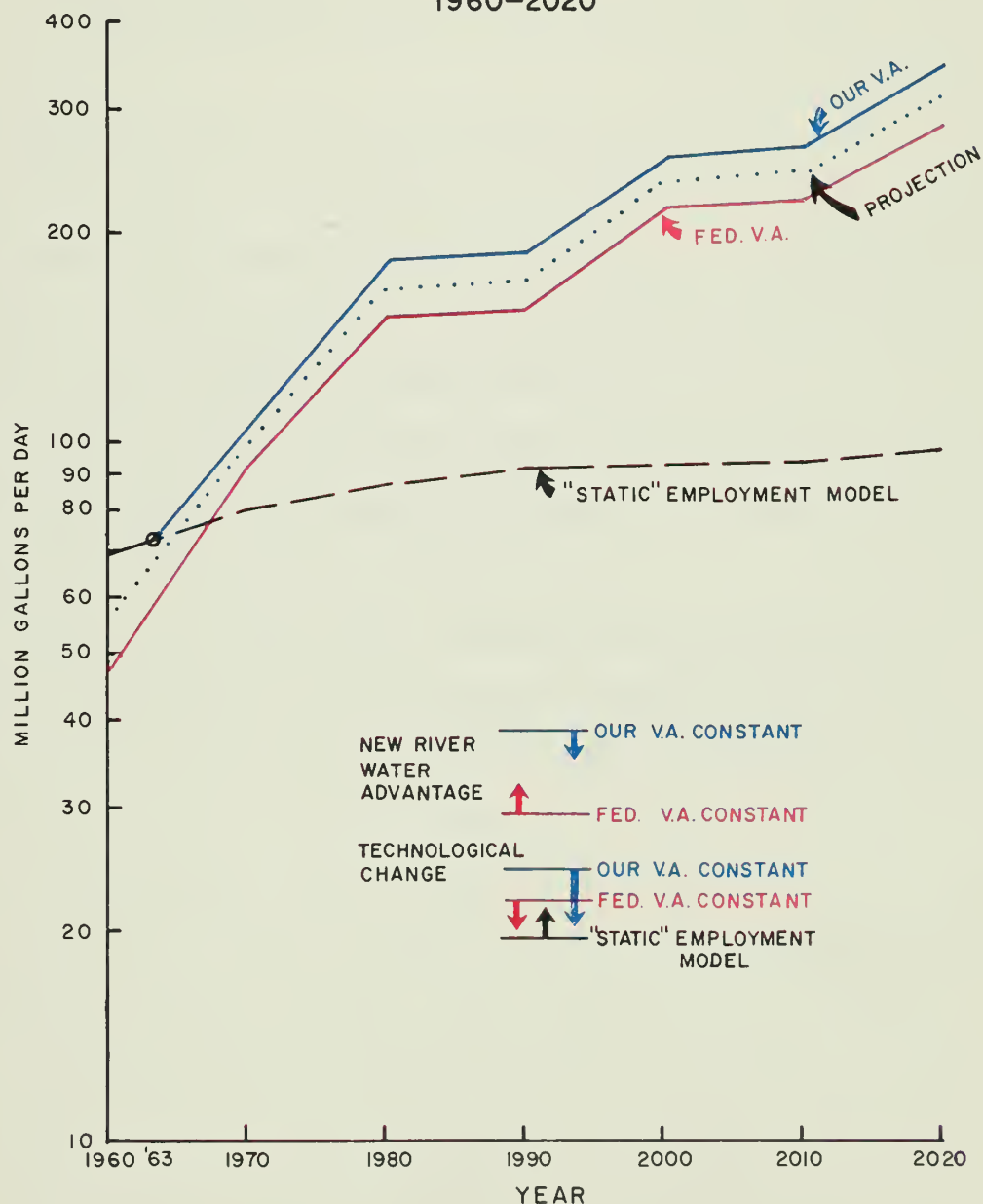
The experimental value added extension for manufacturing serves as a factor in estimates of future industrial water needs. To illustrate the use of value added and projected water use, chemical and allied industries have been selected for the following discussions.

Our non-computerized value added extension lacks the necessary degree of accuracy to justify its use to project the needs of other industries in the New River Basin. It is felt, however, that the projections presented for the chemical and allied industries are significantly valid. It is to be remembered that present methodology is the best we have, and that we are operating "at the frontier" of the state of the art in the United States today.

On Plate 32 the dotted lines shown represent the historically expected use levels as the Division of Water Resources's "Best Projection." The red line represents water use projected on federal

# PROJECTED WATER USE CHEMICAL AND ALLIED INDUSTRIES NEW RIVER BASIN

1960-2020



|                                  |     |              |        |          |
|----------------------------------|-----|--------------|--------|----------|
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| PROJECTED WATER USE<br>1960-2020 | DE. | DR. M.N.F.   | APP.   | REV.     |
|                                  |     |              |        | NO. B-39 |

PLATE NO. 32

use estimates.

Federal projections are based on data presented on Pages 5 and 6 on Committee Print No. 8, Water Resources Activities in the United States, Future Water Requirements of Principal Water-Using Industries, Select Committee on National Water Resources United States Senate, April 1960.

The blue line represents the Division of Water Resources water use projection based on value added and unadjusted for any external, changing technology. It is entirely possible that New River Basin water demand for the chemical industry may approach this line.

The broken black line represents a static projection based on real and projected employment and a constant water use factor per employee extracted from limited survey data done in other parts of the country.

The area above the static employment projections, illustrated with "give" arrows, is the area in which changes in technology have their maximum play in adjusting projection for future water use.

Detailed estimates for future industrial water demands will be contained in Volume IV.

## CHAPTER XVI

### CAPITAL REQUIREMENTS

In 1966, the General Assembly enacted legislation providing for the issuance of industrial revenue bonds. Local authorities are enabled to issue industrial revenue bonds to cover the costs of land, buildings and equipment for manufacturing, research, and distribution facilities for lease or lease-purchase by suitable companies. This type of legislation assists in the measured growth which is most natural to a river basin.

A very important element to intensive development of the Basin by the year 2000 is a projected need for at least three times the present investment capital available locally.

The use of an industrial development finance authority, preferably using Statewide credit sources and any Federal development funds which may become available, would go a long way toward meeting the obvious capital needs of industry in locating in desirable areas of the Basin.

Preliminary analysis suggests that in order to meet the projected growth in manufacturing industry in 1980, additional capital of at least \$175 million will have to be made available in the area. Naturally, some industries will use their own capital sources to meet their needs. Others will take advantage of financing plans sponsored by other industries, towns, cities and various industrial development authorities. Some State or Federal money may be involved in financial location. Water resource projects can be coordinated

with these plans in such a way as to aid in meeting the capital needs of the area.

The banks of the area have effective deposits of over \$238,000,000. Effective loans and discounts are in excess of \$140,000,000. Considering the population of the area, it appears that such a volume of loans would suffice for individual needs and for a portion of total expected business needs. Money has already come in, or is coming in, from other sources. There are some restrictions imposed on area growth by the requirement that new enterprises bring in so much of their own capital. Light-capital, heavy-labor industries are most attracted to this climate. Extractive and land-base industries are already here and located. In the New River Basin, heavy-capital industries make the greatest total demand on water resources at present. This is not likely to change much in the foreseeable future. An increase in light-capital industries can be expected in the New River Basin. Demands upon the water resources of the New River will come from a growing chemical industry, an increasingly important textile industry, and a possible pulp and paper industry. Since a major portion of the development can be expected in the Pulaski-Radford-Glen Lyn belts (see Development Map, Plate 9) considerations for the upper portion of the New River should be oriented toward the population who will live in the Basin. What developments in the New River Basin will give the maximum in use and enjoyment returned for money spent? Certainly, water supply, flood control, and pollution abatement are vital for all users. Virginia has been passing a clean River's waters to her neighbors. Population increase accompanying industrial growth will create additional requirements which must be planned

for.

Since water development projects of all types cost money, planners must be careful to plan them in such a way that they do not subtract from a supply of local capital which could be put to use in encouraging a desirable type of industry within the area. Thus, multipurpose projects for water supply, low-flow augmentation, flood control and water quality control might be combined with other needs for a group of towns or for several counties. A desirable mix of public ownership of water-related recreational activities should be encouraged. The needs of private and municipal utilities should be carefully weighed in relation to the future needs of an increased population for public facilities of all types. The concept of public subsidy of many activities and necessities is an attempted equalizer of unequal incomes. Many services such as recreation, sanitation, and other basic needs will continue to be supplied to individuals at less than per-capita costs. At present, recreation should not be considered as a "money-maker" for any group. It is better considered as a public service. Water resources will be called upon to share in this public service concept. They can be of incidental aid to private enterprise and should be viewed in that light. The beauty of these resources is a thing of great value, one which deserves as much consideration as industrial or technological use.

It would probably be wise for all types of governments to acquire "wedges" of land at various spots along the river banks to insure public access and availability for future public facilities. The necessity for coordinated river basin planning starts at the

banks of a river. Once a river bank is lined with the wrong type of industries, it is difficult to prevent resulting damage to a river and its water. Foresighted planning can facilitate the type of growth that makes an area a delightful place in which to work and live. Farming is a valuable preserver of the beauty of long segments of river banks.

The capital requirements of farming are changing with the economic size of farm units. Good farms will require more capital in 1980. An increase in the number of private homeowners will require more capital.

The recent trend in the New River Basin has been toward less capital-intensive industry. To increase the capital in the area in years to come, industry must come in, but it should be contributive and well-located. The New River needs and is suited to this type of growth. It can contribute more than its share if man does not squander its resources.

## CHAPTER XVII

### ALLOCATION OF RESOURCES AND THEIR ECONOMIC INPUTS AND OUTPUTS

An orderly view of the economic factors at work in river basins and their relation to past, present, and future water resource development requires a theoretical point of view which is systematically applied to all the factors. This theory must be based on the ordered (desired) relationship between people and their institutions. Law has been the main method used to express these relationships.

It is necessary to establish current values (benefits, costs) for watercourses and water supplies and to estimate the potential value (benefit, cost) of changed or augmented water resource developments. This is no easy task, using the methodology which has been developed up to the present time. The purpose of this section is to look at what we have to work with in Virginia and to explore possible augmentations to our "tool kit." To do less than this would be to invite, in the future, undesirable uses of valuable resources or at least missed opportunities for resource development.

The framework of economic development has several meanings.

1. Capital is scarce.
2. There is competition between various States and geographic areas for this capital.

It is necessary, therefore, to arrive at some common theoretical base from which to measure the effects of water resources on ultimate economic development.

Professor James M. Buchanan has recently said:

"The necessary conditions for optimality in an externality or public goods mix have been derived exclusively from individual evaluations placed on the separate components along with the cost relationships. Conceptually, therefore, resort to external, non-individualistic criteria for selecting the precise characteristics of multi-dimensional public services is not required. . . Practical application of the analysis in any specific sense would of course, be extremely difficult. Even here, however, some conceptual predictions become possible to the extent that broad criteria of economic efficiency in the usual definition are accepted. The analysis allows us to 'explain' the pressures toward equilibrium, through ordinary trading processes if the interacting groups are critically small, or through the working of the political process if the interacting group becomes critically large, provided that democratic institutions prevail." <sup>11</sup>

As an alternative theory, some basis for analysis could be drawn from section 175 of the Constitution of Virginia in which natural oyster beds are held as a public trust:

"Section 175. The natural oyster beds, rocks and shoals in the waters of this State shall not be leased, rented or sold, but shall be held in trust for the benefits of the people of this State subject to such regulations and restrictions as the General Assembly may prescribe, but the General Assembly may, from time to time, define and determine such natural beds, rocks or shoals by survey or otherwise."

Since the ownership of stream and river beds is vested by law in the Commonwealth, it should be possible to analyze the value of the land upon which any dam, intake pipe, outflow pipe or similar structure rests. This is not to suggest that the only alternative is to develop such a system of costs (values), but the approach would prove useful in ranking the benefits to be derived from various mixes of users while still allotting the free choice mechanism to these users. This would be more desirable than absolute government regulation of quantities of water allowed to be consumed, which

<sup>11</sup> "Joint Supply, Externality and Optimality" by James M. Buchanan, University of Virginia, Economica, November, 1966. pp. 414,415.

might result from an overuse during periods of declining rainfall or streamflow.

In the last decade there has been a definite trend in the number of employees moving from agriculture to manufacturing in the New River Basin. Trends in the national economy toward higher prices and increased participation in the educational and social advances of the Nation have had their effect upon the rural areas.

The effect of recent wars upon employment and way of life of the populace cannot be minimized. War production is a significant factor in the present industrial makeup of the Basin. The Basin supplies manpower to fight the wars and to meet production needs which are war-generated or influenced. It is difficult to maintain traditional ways of life on the farm in an era of rapidly rising prices and costs. Although the small farm may be less attractive financially and as a way of life for youths of farm families now going into industries, it may become increasingly attractive and economical for older persons now retiring with guaranteed though reduced income under Social Security and governmental, industrial, military, and other pension systems, many of them at comparatively early ages.

Manufacturing is a major consideration for the Basin, filling the void left by the removal of workers from full- or part-time agriculture. If the process is hastened, there can be little doubt that an appreciable measure of social disruption will exert a negative influence in wide areas of the Basin. This could gravitate these areas much more toward "Appalachia" than they are now. An orderly and slow process would maintain a reasonable growth level for the

Basin as a whole, and this has been assumed.

Social problems and undesirable growth patterns should not be minimized. Growth has been less than optimum in some previously developed areas, and an extension of past trends can be foreseen. On the other hand, these patterns are quite favorable when viewed in the light of problems facing most urban areas in America. With intelligent and constructive effort, future growth could be channeled in the Basin to create conditions which will encourage great progress. Government should plan its resource projects with this aim in mind. On behalf of the citizens of the State, Government is entrusted with the duty to lead the way, to pioneer with sound innovations and constructive actions. This spirit is assumed throughout the entire analysis. Cooperation in this effort is expected from citizens, councils, planning groups, Local government, State government and the Federal Government. The citizens have a right to have all developments correspond to the way of life which they have broadly selected for themselves. Government must respect this choice in all of its actions. This study suggests some alternatives presented by economic analyses of the values inherent in the water resources of the New River Basin. Choice among these alternatives is a function of the enlightened citizenry of the area.

In order to establish some common basis of consideration, in line with the realities of the situation as opposed to a theoretical construction which would have no validity for the New River Basin, it is best to use monetary analysis to set up some range of benefits/costs. In this regard, Haveman recently said:

"Although the money unit is admittedly inadequate as a welfare gauge, it is nevertheless tentatively accepted, and through its acceptance, a cautious relevance and importance for the tacit welfare implications of the data is posited. Because the profession has not yet developed and therefore, does not admit the existence of any welfare gauge superior to the money income unit, and moreover, because there is no "superman" (to use Professor Little's metaphor) at hand to decree a welfare function bearing the real value of money income to different individuals, the money income unit provides the only and, therefore, the best empirical welfare measurement available." 12

It is difficult at best to measure the meaningful effects of increased, decreased, or differing mixtures of natural resources such as water upon the people and the activity environment of an area. Usually, it is when a resource is perceived as being scarce or in diminishing volume (when weighed against an increasing volume of users) that it is subjected to expenditure considerations as to its available quantity and quality.

A basic methodology of regulating efficient use of a resource in a free enterprise society is to allow proper supply and demand factors to establish a price which will eliminate wasteful use and call for augmented supply. In the past, economically, water has been considered to be almost a free good. It is fitting that we regard the gifts of Nature with proper reverence. However, man's efforts in adapting Nature to man's concepts and uses have provided increasing cost, on the one hand, and increasing utility on the other. Physical changes and additions to natural water flows and cycles cost money. Since man is putting the money in for a reason, certain results should follow.

Goals to be achieved through the use of water resources are

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12 Haveman, Robert H. Water Resource Investment and the Public Interest. Vanderbilt University Press, Nashville, Tenn., 1965, p. 128.

most important. Since these resources are common to many, there can be little isolated effect of a major use of water. The relative size and influence of major "impactors" (those who make significant use) on water use and supply is felt by the smaller user. As scarcity or changed mixes begin to be felt, the smaller user will experience increased lack of advantage in terms of limited use and higher cost unless the power of the citizens in common, expressed through their government, establishes a proper balance between all major "impactors" including industry and Federal, State, and Local governments.

Increased industrialization under whatever mix of government-business coalition which may exist in future, will have its effect on waterways. Can a cost tag (value) be applied to this effect on water resources? Certainly, discriminatory taxes on industrial waste would be discriminatory against many individual citizens. On the other hand, some major treatment of industrial wastes on a centralized basis will be needed in the future. Air pollution treatment may be a tie-in. Some industries have had only minor changes in methods of production over the past forty years. There is enough continuity in productive processes to allow planning to make a significant contribution to the most economical use of water resources.

The location of desirable and efficient industry in the New River Basin should not, under the guise of solving some present inequities, reflect a movement away from freer use of the water resources but an augmentation of free and efficient usage. It is hoped that industrialization will benefit both industry and the

general public.

We want desirable and efficient industry to locate in our basin areas, and we want it to be to their benefit and that of all the citizens of Virginia that they locate here.

As a means of economic analysis and not as a "taxation" or a "charging mechanism," the tying of values, whether they be in terms of dollars or "usefulness," to water resources is distinctly related to this goal of resource development.

In resource-use decisions, one difficulty in analysis seems to lie in a hazy definition of the two different property rights, governmental and individual. What are the real values (benefits, costs) of these two shares when the government and the individual are "tenants in common" of the same resource? Governments do bid in the market in competition with individuals to establish a cost basis used in allocating needs and values.

Water rates are, of course, a reflection of the costs of water treatment and distribution. A sliding scale of rates prevails within the supply cost of water to the ultimate consumer. Large quantities of water are used at a decreased rate. Supply facilities are amortized through revenues. The initial water supply is viewed as a free good.

C. E. Busby has considered the relationship of water law to economic growth:

"The more valuable water becomes, the more conflicts of interest arise over its use and management. The conflicts may lead to insecurity of investments and impeded or unbalanced economic growth if basic law is not provided to assure protection of rights and a fair appor-

tionment of the supplies to satisfy the rights." <sup>13</sup>

Busby deals with the necessary examination of the Common Law and related regulatory and statutory developments in the light of an economy of increased demand, use, and scarcity.

Methodology and graphics for a system similar to that outlined in this chapter may be found on Pages 59-73 of Water Supply, Economics, Technology and Policy by Jack Hershleifer, James C. DeHaven and Jerome W. Milliman, the University of Chicago Press, Third Impression, Chicago, 1966. This study was done under auspices of the RAND Corporation. Particularly interesting is the avoidance of socialist or bureaucratic solutions to water problems by suggestions for methods to improve water law in order to encourage "free enterprise" solutions.

Speaking of the need for new analytical techniques for water resource evaluation, Jabbar K. Sherwani has said:

"Water resource problems exhibit great complexity, diversity and variety. Water resource systems contain meteorological, technological, economic and social components. They are under the influence of a great many variables which interact in many and varied ways. The traditional engineering and economic approaches are proving to be too limiting for the solution of present day problems of ever-increasing complexity. It is becoming necessary to proceed along new and unorthodox lines. Only very recently has the theory of probability, time series analysis, regression and correlation techniques, theory of sampling, and computer simulation been used on a large scale in the analysis of water resource systems. Techniques of analysis will have to be further developed to assess the relative value of water in its various uses from both an economic and social point of view." <sup>14</sup>

<sup>13</sup> The Yearbook of Agricultural Water, U.S. Department of Agriculture, GPO, Washington, D.C., 1955, p. 666. 84th Congress, 1st Session, House Document No. 32. This entire article appears on pp. 666-76.

<sup>14</sup> "Multidisciplinary Research As An Aid to Public Policy Formation," Water Resources Research Center, Virginia Polytechnic Institute, Blacksburg, Virginia, 1965.

It is to meet this need that this method of analysis is postulated. It should be kept in mind that this is a tool of analysis and may not represent a socially desirable event.

## CHAPTER XVIII

### WATER-ECONOMIC WEIGHTS OF ACTIVITIES ON A MONETARY BASIS IN THE NEW RIVER BASIN

An important factor in economic development is to be able to gauge the impact of an increase in the supply of money (investment) upon a mix of activities within a given area. These relationships and their effect on demand (price) and value (supply) are necessary to the selection of methods to stimulate growth through water resource development.

There is need for an expression of relative intensities of activity within the New River Basin with a common financial relationship to the existing water resources (omitting secondary values resulting from the use of water). Admittedly, this is a most difficult set of functions to derive. The results are those of the "ultimate" rounds, and are therefore long-term. Because of its importance, some effort has been made in this direction. The reader should bear in mind the relativity of such studies which extract judgment factors in complicated relationships. The list is by no means complete. These relationships may also be used, in inverted form, to obtain the impact of a general investment in Water Resources upon the factor in question, Ceteris Paribus.

|                                        |    |
|----------------------------------------|----|
| Total Bank Deposits                    | 1  |
| Total County Tax Revenue               | 1  |
| Prevailing Rate of Interest            | 1  |
| Value of Lumber Lands and Trees        | .5 |
| Value of Buildings and Improvements    | .3 |
| Value of Town Lots                     | .3 |
| Value of Mineral Land                  | .5 |
| Value of Mineral Land and Improvements | 1  |

|                         |   |
|-------------------------|---|
| Total Value of Minerals | 1 |
| All Farm Products Sold  | 3 |
| Crops                   | 5 |
| Livestock               | 3 |

It should be noted that this is a "free enterprise" model which would have to be adjusted, in time sequence, for entirely public expenditure. It is believed that expansion benefits from public expenditures would duplicate these results in a favorably developing economy but there would be a time lag differential, in rounds, vis a vis private expenditure. Naturally, a significant balance of private expenditure is required within this framework.

## CHAPTER XIX

### THE INFLUENCE OF MONETARY FACTORS ON LAND VALUES AND SUBSEQUENT URBANIZATION IN A RURAL ECONOMY

Interesting work has recently been done in the monetary field which is relevant to this study of the New River Basin. The nature of the relationship between industry and water use and between water and related land resources, has been explored. How may the current trend in the national economy toward inflationary price structure and increased rates of interest affect the Basin's growth?

In a study on "Rising Interest Rates and Agriculture," Clifton B. Luttrell of the Federal Reserve Bank of St. Louis discusses the impact that differences between farm mortgage rates and expected rates of return of farm land may have on land value. He cites a growing number of studies which indicate the nature of this impact and gives the following formula:

$$V = \frac{Y}{r}$$

where

V = current land value per acre

Y = flow of residual income per acre

r = rate of return on alternative investments.

This formula, similar to that for a stream of income in perpetuity, suggests that any increase in the rate of interest results in a corresponding decline in current land value. The initial analysis shows that the rate of change in land value caused by changes in the rate of return (r) on alternative investments is significant.

As an example, a 10 percent increase in this rate from 5.0 to 5.5 percent results in a 9 percent decline in land values.

National figures indicate that nearly three-fourths of all farm land sales in recent years have involved credit. Debt incurred as a function of purchase price has also tended upward, reaching 72 percent in 1965.

Luttrell indicates that demand for farm land has been affected by farm technology. Increased yield per acre has tended to increase production and reduce farm commodity prices.

The use of significant quantities of land in the New River Basin for flood control, hydroelectric power generation, water storage and recreational projects would tend to stabilize the loss incurred in land values through secularly rising interest rates and rates of return.

This influence on the supply would affect the demand from urbanizing centers. Costs of land for urban and possibly industrial uses would rise. The quantity of existing available land would dictate the relative restrictiveness or stimulus to growth.

Alternatively, it is possible that higher secular rates of interest and rates of return would make investment in projects necessary to prevent significant deterioration in land values due to agricultural displacement. Thus, these projects could be the bulwark which prevents these areas from losing their industry and urbanization attractiveness. The approach here is to secure the proper balance of projects to land uses. One method is to adopt zoning which provides flexible consideration for agriculture, natural resources and industry. This approach is presently not applied

to the Basin area as a developable entity. After projects have located without such comprehensive evaluation, it is difficult to blend them in the manner that can be done by initial planning.

As an example of the weight of value in the Basin, estimates suggest value of town property in the Basin is better than that of all rural property. Suffice it to say that this acreage is much less than rural acreage. There is a great impetus to "urbanize" purely from the profit standpoint.

Looking again at the National economy, the prognosis for the New River Basin is increased urbanization. Large projects of the type described may be viewed as ameliorants of this trend and as "friends of agriculture." From a long-run standard of value it appears that there is increasing value to the body politic and even to individual long-term investors in maintaining some un-urbanized land. Such projects can be broadly viewed as aiding water resources conservation in the sense that they hold the balance toward moderate water using industries.

It also appears that the book value of machinery and tools in the Basin shows a less than one:five ratio to the value of rural land. This would suggest that rural town life still means more than the factory. It does not suggest a heavy urbanization ratio. It is significant that urbanization appears to be only several years away for some areas. The secular (long term) trend of interest rates previously described will hasten urbanization, and project choice could temper it.

It is indicated that there should now be planning for the urban water needs of promising areas in the Basin. This planning

should be selectively tailored to each town and city and should meet water and water related needs far into the future. During a relatively short time span, the urbanizing change will place immediate demands for different types of consumer and water service; a movement from merchant-oriented light water users toward heavy industrial users.

On the basis of an analysis by Heady and Tweeten <sup>15</sup>, a 1.0 percent increase in the rate of return on two hundred common stocks was associated with a land price decline of 0.34 percent in the long run. Relating this to a long-run rate of return with a yield increase from 5.0 to 5.5 on common stocks, Luttrell suggests an indication of a decline in land values of approximately 3.4 percent. The chart which is presented (Plate 33) shows this relationship for the United States over a period of nearly 100 years.

Let us assume that all land in the New River Basin which is rural in character has a value in excess of one-quarter of a billion dollars. We will use a figure of \$330,000,000, 1966 dollars, based on estimates from available data with adjustments for true market value. On the basis of the common stock indicator an increase in the rate of return from 5.0 to 5.5 would result in a decrease in land values in the Basin of approximately \$11,200,000.

Relating the original example of an increase from 5.0 to 5.5 percent to the rate of interest on mortgage loans, it is possible to extend the decrease in land values up to approximately 9 percent

<sup>15</sup> Earl O. Heady and Luther G. Tweeten, Resource Demand and Structure of the Agricultural Industry. (Ames: Iowa State University Press, 1963).

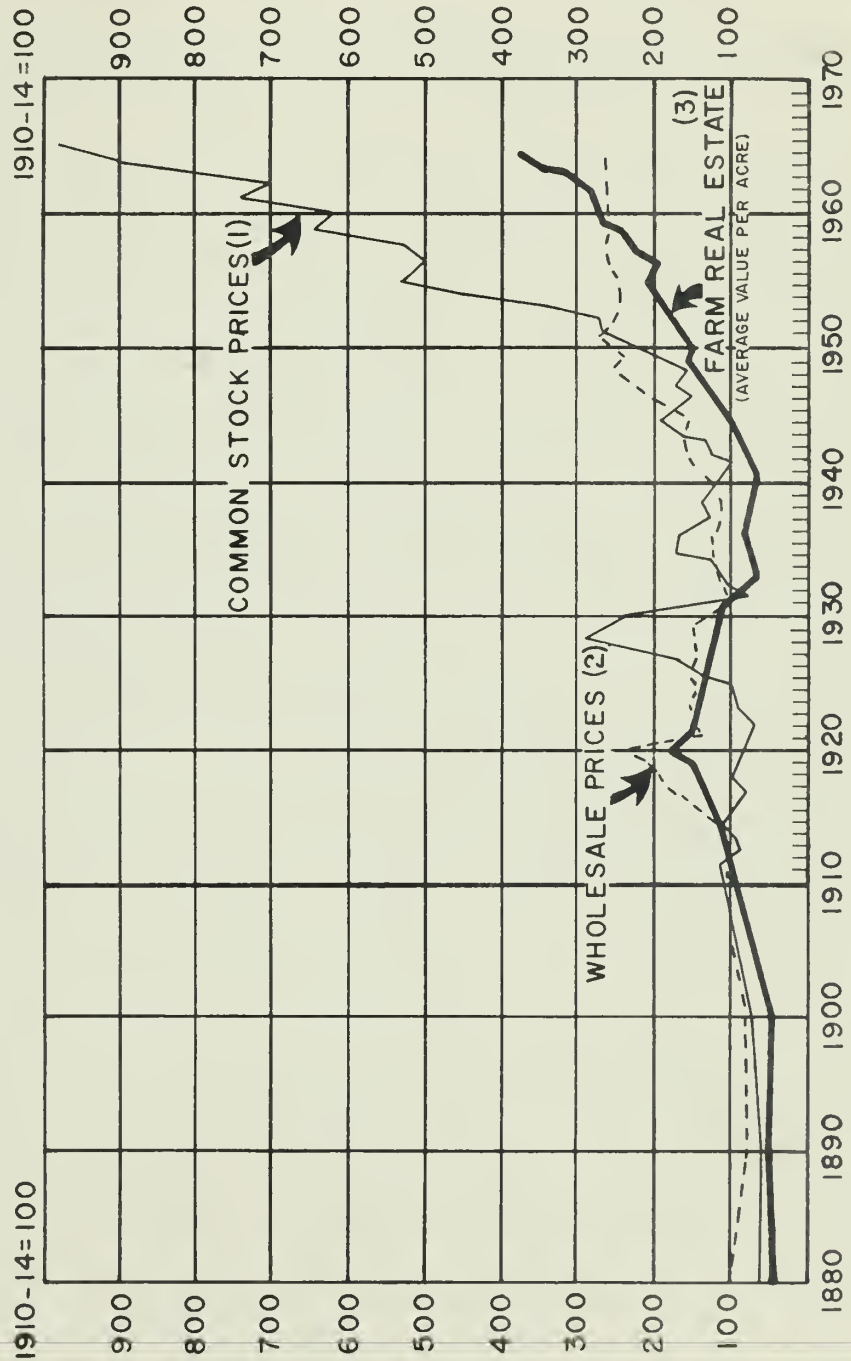
or \$29,700,000. It should be remembered that these values are effective only so long as the interest rates or rates of return remain at the indicated levels.

Would not supply and demand combine to help land prices return to their former post-war levels? Luttrell indicates that:

"The demand forces resulting from the impact of expected annual return which have contributed to these land value increases apparently continue to put substantial upward pressure on land prices. Demand for land results from land use for both agricultural and nonagricultural purposes. Nonagricultural uses for land include urbanization uses, roads, parks, recreation areas, public conservation projects, etc. Although only a relatively small portion of the land area in most states is used for these purposes, these uses may have a sizable impact on land prices near urban centers. Furthermore, the demand for land for such uses apparently continues to increase." 16

16 Clifton B. Luttrell, "Rising Interest Rates and Agriculture" Federal Reserve Bank of St. Louis, Review. November 1966, page 16.

# PRICES Land, Common Stocks, and Wholesale Commodities



(1) STANDARD & POOR'S STOCK PRICE INDEX, 500 COMMON STOCKS.  
(2) U.S. DEPARTMENT OF LABOR, WHOLESALE PRICE INDEX.  
(3) USDA.

SOURCE: FEDERAL RESERVE BANK OF ST. LOUIS, MONTHLY REVIEW, NOVEMBER 1966

|                             |     |               |        |         |
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| NATIONAL PRICE TRENDS       | DE. | DR M.N.F.     | APP.   | REV.    |
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## CHAPTER XX

### EFFECT OF REMOVAL OF MARGINAL LANDS WITHIN THE BASIN AND SUBSTITUTION OF AUGMENTED WATER RESOURCE DEVELOPMENTS

Considering the relationship of water, land prices, and eventual development of an area, it appears that the New River Basin is confronted with important decisions regarding increased industrialization. One methodology is to obtain a gradual increase in the price of choice land holdings. Large tracts of terrain which are suited only for marginal uses tend to depress land values. If a more efficient use could be made of these marginal tracts, assurances for a better life could be made for the citizens of the Basin. This would result in an immediate enhancement of suitable land which is now being used less intensively.

A large water resource development, open to private enterprise, (such as the Appalachian Power Company's proposed Blue Ridge Project) would seem to fit the picture in the southern part of the Basin. Water resource development must be designed so as to provide guaranteed and effective management of wildlife, sport, and recreational resources and facilities. Otherwise, the full development potential will be mitigated to a significant degree. The development must enhance, within reasonable limits, the quality and the quantity of the waters of the New River wherever affected.

At the very outset, the Commonwealth should enter into ambitious agreements with private enterprises to insure its participation in these developments. The possibility for location of harmonious and cooperative institutions and facilities should not be overlooked.

The nature of the benefits which can accrue from the project will be determined in large part by the energy and sound planning invested by private enterprise and the representative government.

The people of the New River Basin are blessed with an area of distinct natural beauty, not too far removed from centers of population. If first-class connector roads can be provided between the major highways, such as Interstate 81 and Interstate 77, publicity can insure adequate use of those facilities which are properly developed and of sufficient quality and quantity. At a later point in the cycle the benefits be fully appreciated. These projects will not be fully developed on a short-term basis. The economy of the United States does not operate in this fashion today and will not in the future.

Development of a large water resource project would be economically beneficial to the New River Basin. This should be a participation effort of private enterprise, and local, State and Federal Government.

## CHAPTER XXI

### WATER RESOURCES ECONOMIC DEVELOPMENT PROGRAM FOR THE NEW RIVER BASIN AND GOALS FOR DEVELOPMENT PLANNING

The economic analysis of the New River Basin is one that is geared toward the growth of the area. Without growth, any consideration of the water resources of an area would be historical in character. Since the objective is to help stimulate growing uses of existing resources, which may be in an early state of development, it is useful to stimulate general appreciation of the concepts which can lead to this development:

1. What is the total value of the existing bodies of water in the New River Basin?
  - a. Will nature change that value in the near future?
  - b. Will man change that value?
2. To whom should these bodies of water belong?
  - a. Does present "ownership" suit the desired social compact entered into by all the residents of this Basin?
  - b. If not, how can this compact be modified or augmented in an orderly manner?
3. Can or should these bodies of water be used in such a way as to increase their value and the value of other resources and works of man within the Basin?
  - a. Who should do this?
  - b. How should it be done?

4. Should the bodies of water in the Basin be left as nearly as possible in their natural state?
  - a. Is this practicable, assuming increased future water needs?
  - b. What is the cost of such a choice to the people of the Basin? The State? The Nation?
5. Should we defer the answers to any of these questions until some future time?

Economic theory does not give us an answer for the determination of ultimate values such as these. Rather, choices between things based on their "utility" to the user or their "welfare" to the recipients assume that these choices have already been made by someone. It can be profitable to remove the tautology and return the decisions to the citizenry, as has been attempted through the use of questions. The citizens can make the type of social compact they want if the value of the benefits is presented clearly enough.

The possibilities which can result from choices which will enhance the value of the water resources of the area are:

1. An improved daily life for the residents of the area.
2. Increased enjoyment and personal profit from common bodies of water.
3. Progress anchored upon the peoples' own traditionally selected way of life.
4. New recreational, enjoyment and employment opportunities.
5. An orderly progression of the best of the past combined with the most promising of the future.
6. A maintenance of traditional freedom engendered by keeping

common values in the hands of the greatest number of people.

7. Protection of individual use and ownership.

The predominately rural cast of the New River Basin deserves particular emphasis. Farming, influenced by new technology and population increases, has an interesting period ahead of it. The New River Basin has a part to play in supplying new demands.

In 1964, approximately thirty million dollars of farm products were sold in the New River Basin. Livestock, poultry, and livestock products out-valued crop sales by better than four to one. The topography of the area is suited to raising cattle, sheep and swine.

As an example of the rural cast of the area, a long-established plant in Grayson County converts local wool to woolen industrial cloth. This particular operation has a marked influence on the way of life in the area and is a part of it in many ways. It has been there over a century. Recently proposed water-improvement programs in the New River may necessitate removal of this operation and the social nucleus which has gathered around it. There will be some change in the way of life of the inhabitants of this area.

Although there are several large commercial farming operations which engage in cattle and swine breeding and feeding for packing houses, there does not appear to be any marked trend toward centralized farming in the New River Basin at this time. Ground water plays a large part in meeting the water needs of this type of operation.

River uses, in the economic sense, in rural counties could be listed as:

1. A water resource which is of significant value in the natural setting - as mineral wealth, rich agricultural

land, etc., might be.

2. A means for flushing, transporting or disposing of mining and industrial residuary products.
3. A source of power supply.
4. A limited source of recreation for certain groups.
5. A natural boundary marker (especially for farm and grazing lands.)
6. A source of water for industrial, farm and residential uses.
7. An area of natural beauty with secondary tourist attraction.

It is also possible that the River, along with the rest of the topography, helps to maintain a recreational way of life which is acceptable to the residents of the area.

The more populous areas of the Basin have experienced growth which resembles that of the Roanoke area. In the future, areas which have "neat" towns will probably attract a higher grade of industry and business than areas which have a poor past history and lack planned growth and investment. There would appear to be little competition between agriculture and industry for land as things now stand. Indeed, there are some "trade-offs" constantly going on between the two.

An increase in the number of smaller economic-size farms in some counties can probably be explained by the prevalence of persons just below retirement age who have contented themselves with a modest way of life and the benefits of life on a small farm. This economic factor and others like it will help to maintain a modest growth rate in most rural parts of the Basin. The present industrial

mix is tied to the natural resources and agriculture. Until this basic orientation changes, it is unlikely that the New River Basin will lose its agricultural advantage.

### Goals of Development Planning

A clear establishment of general goals for a river basin is necessary to an ordered view of its future. The goals of the people in the New River Basin, young and old, and the tone of life which they set for themselves will influence future development. The basic question then is how much can this Basin yield to its inhabitants? What are the potentials of the New River Basin?

Given desirable employment for which the individual is suited, there is ample living space to accommodate the projected population in clean and healthful surroundings. Such a potentiality, however, must be planned for and protected. Zoning plans and regulations are helpful. Upgrading industries which make use of the higher facilities of man and which produce desirable products should be encouraged. Planning can go a long way toward reducing corresponding outlays of home capital.

Public facilities, local, county, state, and national, should be situated according to a regional plan rather than merely to meet strictly local needs.

Integrated water and related resources use needs a long period of preplanning. If justified, water resource development should be multipurpose and for maximum benefits. It is difficult to measure value by a single instance. What, for example, is the value of a recreational lake costing \$60,000 to one man fishing alone for three hours on a certain day? What is its value when he decides

on the basis of his impressions and likes to investigate locating his enterprise in the area? What is its value to the area when he locates his drug company in the area employing 100 local people with an annual payroll of \$600,000 and annual local expenditures of \$400,000 (increasing with the years)?

Water resource plans should be pleasing, agreeable, and amenable to the best that the people desire.

The people of the New River Basin can mold their area with its abundant natural resources according to their desires and needs.









