

THE IMPACTS OF RURAL WATER SYSTEMS IN NORTH CAROLINA:

AN EXPLORATORY STUDY

by

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ABSTRACT

This report summarizes the findings of an exploratory study of the formation, expansion and impacts of rural water systems in North Carolina. It is the first phase of a two-part investigation designed to suggest appropriate regional and state project review procedures to insure that rural water system investment decisions reflect full consideration of the economic, social and environmental consequences that they can be expected to produce.

Public investments in rural water systems have occurred in response to three major considerations: (1) national, state and local goals for accelerated rural development; (2) the need for a safe, healthful water supply in rural areas; and (3) an attempt to minimize problems experienced with small, inefficient systems through the development of county-wide, regional water supplies. In pursuing these goals, decisions about water system formation and expansion have been based mainly on engineering and financial feasibility analyses. Seven case studies of rural water systems in North Carolina reveal that decisions related to system formation and/or expansion have rarely included factors related to capital improvement budgeting and planning or long-term costs to communities of providing sewerage and other services required by new development that would be induced to locate near the water lines. Differences in decision-making criteria used by public and private nonprofit water systems were minimal.

The seven case studies indicate that rural water systems can affect the location of new growth outside of built-up areas. Growth inducement effects tend to be amplified when the quality and/or quantity of groundwater is poor or uncertain and when the cost differential between hook-up to a water system and drilling a well is substantial. The increased development potential near

rural water lines is reflected in higher than average rates of land value appreciation. The primary adverse effect from rural water system formation and expansion has been aggravation of sewage disposal problems and hastening of the need for public sewerage.

Decision-making and project review procedures related to rural water systems can be strengthened if increased attention is given to local needs, goals, and objectives related to the location and timing of rural growth and the provision of public services to new development. Regional, state, and federal project review of proposed water system investments and the potential impacts of those investments will be facilitated if county land classification plans are prepared, as recommended in the report of the North Carolina Land Policy Council. Finally, additional research is needed to improve impact assessment procedures--particularly prediction of the amount and timing of growth induced by public investments--and to more clearly define the costs and benefits associated with different densities and configurations of rural development.

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SUMMARY AND RECOMMENDATIONS

This exploratory study has addressed a number of issues related to the formation and expansion of rural water systems in North Carolina. Current population estimates indicate that North Carolinians are clustering together in smaller communities and rural areas. Recent surveys of North Carolina citizens reveal widespread recognition of the unique problems of rural areas of the state, but a continuing, strong preference for rural rather than urban residence. When asked what strategies the state should pursue to promote more jobs and an improved economy, North Carolinians are much more likely to cite the need for economic growth near small towns and in rural areas than continued growth near large cities. To accommodate increased population pressure, solve mounting problems with groundwater quality and availability, and mitigate problems associated with small, inefficient water supplies, many rural communities have been seeking funds for building and expanding rural water systems. To date, decisions regarding the formation and expansion of rural water systems have been based almost exclusively on present and anticipated needs and engineering and financial feasibility analyses. There is growing concern, however, that direct local benefits provided by water system investments may be seriously reduced or even outweighed by indirect impacts resulting from changes in local land use.

This report summarizes the findings of the first phase of a two-part investigation of the secondary impacts of rural water system formation and expansion. The research reported here focuses on (1) local governmental officials' attitudes toward rural growth and development, (2) factors taken into account in rural water system investment decision processes, (3) identification

of secondary impacts that have resulted from water system investments, and (4) the formulation of suggestions for improving water system investment decision processes. Data for these analyses were developed from an extensive literature review, interviews with a variety of persons and governmental officials associated with the development of rural water systems, and seven case studies of rural water system formation and expansion decisions. Subsequent research will focus on the development of procedures for more accurately predicting the location and timing of growth induced by water system investments and for estimating the costs and benefits associated with different densities and configurations of rural development. This information, together with the information summarized in this report, will provide the basis for formulating appropriate local, regional, and state project review procedures to insure that rural water system investment decisions reflect full consideration of the economic, social, and environmental consequences that they can be expected to produce.

Water Systems and Patterns of Rural Development

Previous research suggests that rural water systems, while not the major factor accounting for rural development, contribute to rural growth and to the location of new residences outside of built-up areas. These findings were confirmed by the case studies of seven rural water systems in North Carolina. In five of the seven cases, water systems were a major factor in inducing new or continued growth of the areas served. The impact of rural water systems on the location of new development appeared to be amplified when the quality or quantity of groundwater was poor or uncertain and when the cost differential between hook-up to a water system and drilling a well was substantial. Reflecting the enhanced development potential, land values near rural water systems tended to be growing somewhat faster than values in areas that did not

have water service.

Consequences of Induced Growth

In the areas served by the rural water systems studied for this research, the need for public sewerage was the only major adverse impact observed. However, a strong cause and effect linkage could not be established. Often water systems were established or water service was extended because of contamination of the groundwater supply by failing septic tanks. While installation of a rural water system may have aggravated pre-existing problems, by allowing densities to increase even further, the impact on the need for sewerage has probably been one of timing rather than degree. Most of the areas served by the rural water systems studied would eventually have required public sewerage; installation and extension of water lines hastened the need for investment in sewerage, but did not create it.

Other adverse impacts that may accompany growth induced by rural water systems were not pronounced in the seven cases. Because agricultural activity in these areas was negligible, few public officials perceived harm to farmers, either from escalating land values that made expansion of agricultural operations more expensive or from conflict with nonagricultural land uses. Although rural demand for a variety of public services was increasing in the counties studied, local officials saw few differences in the level of demand between areas served and not served by rural water systems. Thus, adverse impacts associated with rural water systems seem to be limited to the possible earlier need for sewerage. While other impacts may become apparent in future years, at this time they have not yet become serious enough to attract attention.

Patterns of Decision-Making

Local public officials interviewed for this research overwhelmingly tended to believe that industrial and residential growth can be the driving force in effecting beneficial change in their communities and counties. Community growth and development is strongly encouraged; otherwise, it is felt social and economic stagnation will be the result. The high level of interest in the benefit side of the ledger, however, does not extend to a balanced analysis of the expected costs at the local level. Local officials were reluctant to specify or discuss potential problems that can result from increased rural development, with the exception of the probable necessity for public sewerage.

Rural water system formation and extensions are usually proposed in order to achieve one or more of three objectives: (1) stimulate or allow continued rural growth and development; (2) provide a safe, healthful water supply, particularly where groundwater is being contaminated by failing septic tank systems; and (3) consolidate existing small community water systems or foreclose the possibility of such systems being formed. In evaluating water system investments proposed to achieve these objectives, decision-makers tend to limit their attention to the nature of the need for the system or extension, engineering feasibility, and financial criteria. Can service be provided less expensively than by on-site wells? Are the number of current and potential customers adequate to meet operating, maintenance, and debt service costs? Will another party, such as a subdivision developer, absorb the costs involved in service extensions? Decision criteria considered rarely extend to factors related to capital improvement planning and budgeting or to the long-term costs to communities of providing sewerage and other public services to growth that occurs along the water lines. Either public officials feel that water systems have little effect on growth patterns or they are not concerned with

potential problems associated with rural growth. Our research indicates that the latter factor is key: public officials perceive present benefits associated with water systems and growth and discount heavily future problems that may result from their actions.

Strengthening Water System Investment Decision-Making and Project Review Procedures

Two aspects of water system planning and development need attention in rural North Carolina to avoid unnecessary problems in the future. First, local needs, goals, and objectives regarding the location and timing of growth and the provision of services to new development should be carefully considered and analyzed. Second, the evaluative criteria and process involved in planning and reviewing major public investments, including rural water systems, should be strengthened.

At present there is no set of plans dealing specifically with rural population growth issues in North Carolina. The councils of government have adopted land classification systems, but areas designated as "rural" tend to be poorly defined and treated as a catchall after other areas are delineated. The issue is further clouded by the interpretation of rural areas as land which will not be serviced by sewer and water. This appears to be in conflict with official federal and state policies, and often local sentiments, which encourage rural growth and development. County land classification planning provides a mechanism for stimulating consideration of rural water system investments in terms of locally defined development objectives and public service policies. In its report, A Land Resources Policy for North Carolina, issued late in 1976, the North Carolina Land Policy Council recommended that all local governments in North Carolina be required to prepare and adopt land classification plans. The research reported here strongly supports the wisdom of this recommendation. If county and community plans were available, decision-

makers at the local level, as well as those with regional, state, and federal agencies, would have a basis for weighing the probable secondary impacts of water system investments in terms of local growth policies. Without such plans, potential secondary impacts are likely to continue to be heavily discounted in comparison with the immediate benefits realized from water system formation and extension.

Consideration of secondary effects in water system investment decision-making and project review would also be facilitated if methods were available to more accurately predict the amount and timing of growth that might be induced and to estimate the costs and benefits associated with that growth. Without this information, decision-makers are likely to find it difficult to determine whether proposed water system investments will contribute significantly to or detract from local growth and development objectives. Provision of the needed methodologies is the major objective of the next phase of this research.

I. INTRODUCTION

This report summarizes the findings of an exploratory study of the formation, expansion and impacts of rural water systems in North Carolina. Current population distribution estimates indicate that North Carolinians are ". . . clustering closer together in smaller communities and rural areas."¹ As a result, the rural demand for urban-type services is mounting. Many rural communities, recognizing the necessity for safe and adequate water supply, have been seeking funds for, building, and expanding water treatment and distribution facilities. There is growing concern, however, that the installation of rural water systems may induce sprawl development with negative social, environmental and fiscal repercussions for rural areas. This study was undertaken to provide an improved base of information regarding water system investment decision processes and the consequences of water system investments for rural areas. It is the first phase of a two-part investigation designed to suggest appropriate regional and state project review procedures to insure that rural water system investment decisions reflect full consideration of the economic, social and environmental consequences they can be expected to produce.

The Need for Rural Water Systems

Increasing public investment in rural water systems has occurred in response to three major considerations. First, rural water system investments reflect national and state goals for accelerated rural development. Second, rural water systems respond to the need for a safe, healthful water supply in

¹ Division of Policy Development, North Carolina Department of Administration, Balanced Growth: Trends in Population and Employment in North Carolina, Raleigh: The Department, January 1978.

rural areas. Third, investments in rural water systems are an attempt to minimize problems experienced with small, inefficient systems through the development of regional or county-wide water supplies.

The pace of rural development has been influenced by a number of significant economic and social changes. Nationally, alterations in farm methods and technology have increased farming efficiency and resulted in the need for fewer farm operators and a decline in the farm population. The demographic shifts to urban and nonfarm rural populations, while rapid, have not been neatly balanced. Many rural areas have experienced sudden and severe population losses accompanied by the retreat of business firms and loss of nonfarm employment opportunities. Rural local governments have had to cope with declining tax revenues and increasing costs per capita for necessary public services.²

In North Carolina, these trends are reflected in citizens' perceptions of community problems and preferred state development strategies. Compared to persons living in urbanized counties of the state, rural North Carolinians are more likely to cite as problems: employment opportunities, health care, social services, cultural opportunities, and community services, including the adequacy of water and sewage facilities.³ North Carolinians' perceptions of problems are reflected in their preferences regarding state development strategies. When asked to indicate what approaches should be adopted to promote more jobs and an improved economy for North Carolina, 22 percent of those polled for the "North Carolina Tomorrow Survey" conducted by the State Goals and Policies Board thought that the state should "promote jobs near small towns and in rural

² James G. Maddox, Toward a Rural Development Policy, Washington: National Planning Association, 1973, p. 3.

³ James A. Christenson, Through Our Eyes, Vols. 1-5, Raleigh: The North Carolina Agricultural Extension Service, 1974.

areas."⁴ In contrast, only 2 percent felt that the state should "promote jobs near larger cities." Also, although planners, environmentalists, and some public officials have expressed concern about mounting urban sprawl in North Carolina, only 3 percent of those responding to the North Carolina Tomorrow Survey rated "limiting urban sprawl" as an important state concern.

Efforts at both the federal and state levels have been mounted to stimulate rural development. Beginning with presidents Kennedy and Johnson, a series of federal programs have been launched to improve the quality of rural life. With the Agricultural Act of 1970, rural development was adopted as a national objective: "Highest priority must be given to the revitalization and development of rural areas." The Rural Development Act of 1972 took steps toward fulfilling this commitment. It proposed to speed economic growth, create job opportunities, improve the quality of life, and protect the environment of small towns, villages, and farm communities in rural America. A special provision of the 1972 Act authorized the Farmers Home Administration (FmHA) to encourage growth by increasing the available supply of business and capital improvement loans to rural communities. As a result, federal funds for rural water systems have been readily available. In fact, in recent years North Carolina has led the nation in FmHA loans and grants for rural water supply and waste disposal systems.

During the past ten years, a statewide growth and development strategy has been evolving in North Carolina. A major focus of policy formulation has been the imperative of rural growth. For example, in 1972 the North Carolina

⁴ North Carolina Tomorrow: One State's Approach to Citizen Involvement in Planning for Its Future, Raleigh: State Goals and Policies Board, May 1978.

⁵ James G. Maddox, 1973, p. 14.

Statewide Development Policy was published.⁶ The proposed development policy was designed to encourage population decentralization through state support of growth in small centers of population. This goal received some support from the Council on State Goals and Policy, established during the administration of Governor Holshouser, and has been a major feature of the Balanced Growth Policy espoused by the administration of Governor Hunt. The North Carolina Balanced Growth Policy Act, ratified by the General Assembly on April 19, 1978, was designed, in part, to ". . . support growth trends which are favorable to maintain a dispersed population," and indicated that it was the policy of the state, ". . . to bring more and better jobs to where people live; and to encourage the development of adequate public services on an equitable basis for all of the State's people at an efficient cost" In support of the rural development aspects of its Balanced Growth Program, the State of North Carolina has engaged in a Rural Initiative Program, funded by the U. S. Department of Housing and Urban Development and designed to make HUD programs operate more effectively in rural areas and small communities, and has concluded a Rural Development Cooperative Agreement with the Farmers Home Administration.

State concern for population balance and the economic well-being of rural areas is a direct response to the unique characteristics of North Carolina's population distribution. Demographic trends show that major changes in the character of the rural population have taken place over the past four decades. Between 1940 and 1970, for example, the proportion of the state's population classified as "rural farm" dropped from 46.4 percent to only 7.3 percent. While the proportion of the population living in urban areas increased sharply--from 27.3 percent in 1940 to 45.0 percent in 1970--North Carolina retained its

⁶ Department of Administration, State of North Carolina, North Carolina Statewide Development Policy, Raleigh: The Department, March 1972.

rural character as many persons left agricultural occupations, but continued to live in rural areas. Thus, between 1940 and 1970 the proportion of the population classified by the Census as "rural nonfarm" increased even more dramatically than the urban population, changing from 26.3 percent to 47.7 percent. Experts expect this trend to continue.⁷

The rural population--farm and nonfarm--relies heavily on individually operated wells for its water supply. The North Carolina Department of Natural Resources and Community Development has estimated that 40 percent of the state's population obtains water from individually owned wells or springs. Projections of future rural water demand consider two trends. Although the total population served by individual systems will decrease as rural areas invest in public supply systems, an increase in water use per capita will result in slightly increased individual system water demand. As a result, the state estimates that total domestic rural water requirements will rise from 104 million gallons per day (mgd) in 1970 to 121 mgd in 1990.⁸

The ability of the environment to supply high quality water to rural residents is being strained as increased demands are placed on the water table. Complaints of taste and odor are the most commonly reported problems in the state. Since correction is expensive and no real health hazard is involved, most rural families adapt to the situation.

Posing a far more serious threat, however, is the problem of groundwater contamination. The greatest risk comes from poorly sited septic tanks that leak effluent into the water supply. Although the North Carolina Water

⁷ See Leon Danielson, ed., Land Use Planning in Rural Areas: Issues, Problems, and Alternatives, Raleigh: North Carolina Agricultural Extension Service, 1975, p. 3.

⁸ North Carolina Department of Natural and Economic Resources, North Carolina Water Resources Framework Study, Raleigh: The Department, 1977, p. 3-C-13.

Resources Framework Study indicates, "This problem does not affect large numbers of people," an entirely different picture is painted by a series of regional water management studies undertaken for the North Carolina Department of Administration. A review of the water supply plans prepared for Regions A, D, H, K, L, and Q reveals that county sanitarians in four of the six regions reported that "a significant" number of families within their region were without safe water supplies and were subject to health hazards associated with polluted water.

While they reflect federal and state rural development goals and the need for safe water supplies in rural areas, public investments in rural water systems also represent an attempt to mitigate problems inherent in small, inefficient water systems through the development of large, regional or county-wide water supplies. In 1971, the North Carolina Legislative Research Commission reported six problems associated with the small systems that were becoming increasingly common in the state, particularly in connection with the development of rural subdivisions and mobile home parks.⁹ These problems included: (1) inadequate water source, treatment facilities, operation and quality of water supplied; (2) inability to provide fire protection or to extend service to surrounding areas; (3) increasing difficulty in maintaining adequate public surveillance over the quality and quantity of water supplied; (4) susceptibility to water shortages due to inadequate water supply sources and storage facilities; (5) excessive costs per capita due to an inability to take advantage of economies of scale; and (6) lack of adequate attention and commitment by small water supply system owners.

⁹ Legislative Research Commission, State of North Carolina, 1971 Reports of the Legislative Research Commission to the North Carolina General Assembly, "Local and Regional Water Supplies," Raleigh: State Legislative Building, January 1971.

In response to these problems and in an effort to improve the quality of life in rural areas, North Carolina has actively promoted the planning and development of rural water systems. In 1971, the General Assembly passed the Regional Water Supply Planning Act, which established a revolving fund for county water supply planning. In 1972, a program of multi-county regional water supply planning was initiated, with financial assistance provided by the Farmers Home Administration. As noted above, FmHA also has been very active in financing the formation and expansion of water systems serving rural areas of North Carolina. More recently, the state has allocated a portion of the \$230 million in bonds from the Clean Water Bond Act of 1977 for the development of public water supply systems.

The Research Problem

The formation and expansion of rural water systems are designed to meet clearly defined needs for rural growth and development, safe and healthful water supplies, and the efficient provision of this essential public service. Typically, decisions to invest in the development and/or expansion of rural water systems have been based solely on consideration of these needs and engineering and financial feasibility analyses. Increasingly, however, it is believed that factors taken into account in water supply investment decision making should be expanded to include the secondary effects or impacts of the investment decision. Also, city and regional planners now view public infrastructure as a key element in shaping the location of new growth and development to meet local and regional land use objectives.

The potential importance of secondary impacts of rural water system investments was highlighted in a recent report prepared for the Council on Environmental Quality. The authors noted, "The economic and environmental impacts of development induced by new infrastructure are of growing concern on

all levels of government, for the direct local benefits provided by infrastructure may be seriously reduced or even outweighed by indirect impacts resulting from changes in local land use."¹⁰ In particular, there has been concern that rural sprawl induced by water and sewer system investments may cause serious environmental problems because it tends to be, ". . . unanticipated, uncoordinated, and, therefore, haphazardly distributed and poorly designed."¹¹ Also, research sponsored by the U. S. Department of Housing and Urban Development has shown that a low-density, dispersed land use pattern may result in higher than necessary public service and personal costs for a given number of dwelling units.¹²

If the growth inducement effects of water and sewer systems are consciously considered when decisions about the location of new systems or system expansion are being made, then it may be possible to use water system investments to help achieve local or regional land use objectives. For example, Tabors, Shapiro, and Rogers have observed, "Because of the fragmented and uneven manner in which zoning policies have been applied, they have not been the sole or even the major factors in determining land use patterns in the United States. In many areas location of major public facilities tends to be far more significant in determining actual land use patterns than local zoning."¹³ Rural water systems increase the attractiveness of an area for development by reducing land development

¹⁰ Urban Systems Research and Engineering, Inc., The Growth Shapers: The Land Use Impacts of Infrastructure Investments, Prepared for the Council on Environmental Quality, Washington: U. S. Government Printing Office, May 1976, p. 8.

¹¹ Ibid., p. 12.

¹² See Real Estate Research Corporation, The Costs of Sprawl: Environmental and Economic Costs of Alternative Residential Development Patterns at the Urban Fringe: Detailed Cost Analysis, Washington: U. S. Government Printing Office, April 1974.

¹³ Richard D. Tabors, Michael H. Shapiro, and Peter P. Rogers, Land Use and the Pipe, Lexington, Mass.: Lexington Books, D. C. Heath and Company, 1976, p. 3.

costs,¹⁴ and, where environmental controls are making it harder to develop with both onsite water and sewage disposal systems, by allowing development at higher densities than would otherwise be possible.¹⁵ Recognizing these growth-shaping effects, the American Society of Planning Officials reported that there, ". . . appears to be some interest in limiting access to water as a growth-management tactic, perhaps by water-supply moratoria" ¹⁶ In a more positive direction, Kenneth B. Kenney and his associates suggest that water and sewer extension policy, ". . . though restrained by financial, jurisdictional, and institutional problems, is potentially one of the most powerful implementation tools available to urban areas that in fact do want to determine the form and pattern of urban development."¹⁷ According to Kenney, ". . . a bright future lies ahead for the use of water and sewer extension policy as a plan implementation tool

¹⁴ For example, see Brenda M. Landry, Charles P. Cartee, and D. C. Williams, Jr., Economic and Related Impacts of Rural Water Systems in Mississippi, Mississippi State, Miss.: Water Resources Research Institute, Mississippi State University, July 1973, p. 52 and B. H. Robinson, "The Impacts of Governmental Policies and Programs on Land Use," in Land-Use Planning in Rural Areas: Issues, Problems and Alternatives, Leon F. Danielson, ed., Raleigh: North Carolina Agricultural Extension Service, February 1977, pp. 45-62.

¹⁵ See Richard D. Tabors, Michael H. Shapiro, and Peter P. Rogers, 1976, p. 6; and Larry D. McBennett, "The Use of a Municipal Sewage Treatment Strategy to Guide the Location of Urban Fringe Development," Unpublished departmental paper, Department of City and Regional Planning, University of North Carolina at Chapel Hill, 1977.

¹⁶ American Society of Planning Officials, Local Capital Improvements and Development Management: Synthesis of the Literature, Draft, Washington: Office of Policy Development and Research, U. S. Department of Housing and Urban Development and Office of Research Applied to National Needs, National Science Foundation, July 1977.

¹⁷ Kenneth B. Kenney, Donald A. Downing, and Gary G. Hayes, Urban Water Policy as an Input in Urban Growth Policy, Report No. 28, Knoxville: Water Resources Research Center, The University of Tennessee, September 1972, p. 43.

as publicity is given to its successful use in various jurisdictions."¹⁸

While it would seem desirable to include consideration of potential secondary effects in water system investment decision-making processes and to coordinate water system investments with other land use planning tools, before progress can be made in this direction several gaps in available information must be closed. First, we need to know who is currently involved in decisions about rural water system formation and extension and how decisions are currently being made. This baseline information will establish the degree of change required in current procedures in order to incorporate consideration of secondary effects. Second, we need to know the extent to which water system investments can be expected to induce, or change the location of rural development and what subsequent effects might occur. This information will help establish the potential magnitude and importance of secondary effects and the priority they should be given among other criteria used in making decisions about water systems. Third, we need to know how local officials feel about rural development patterns and potential secondary effects of public investments. Do they share North Carolina citizens' apparent lack of concern about sprawl or have they begun to think about the costs of providing services to increasingly densely settled rural communities? This information will suggest how willing local officials are likely to be in changing their current approaches to making decisions about the formation and extension of water systems in

¹⁸ Ibid., p. 44. Also see Kenneth B. Kenney, Public Policy Alternatives Affecting Water and Sewer Service in Urban Growth Areas, Chapel Hill: Center for Urban and Regional Studies, The University of North Carolina at Chapel Hill, 1964; and Gary C. Hayes, Institutional Alternatives for Providing Programmed Water and Sewer Services in Urban Growth Areas: A Case Study of Knoxville-Knox County, Tennessee, Report No. 18, Knoxville: Water Resources Center, University of Tennessee, June 1972.

rural areas. This report attempts to fill each of these information gaps..

Organization of the Study

To set the stage for an empirical examination of rural water system investment decisions in North Carolina, Sections II and III provide an overview of the organization, planning, and development of rural water systems and of the literature related to secondary impacts. Section II describes the organizations involved in providing water to rural areas of North Carolina, the evolution of regional water system planning and other coordinative mechanisms in the state, and describes and evaluates criteria currently being used in planning and funding water service extensions. Section III provides a conceptual framework for considering the secondary impacts of water system extensions and reviews the existing literature in terms of this framework. In Section IV the results of an empirical investigation of rural water systems in North Carolina are summarized. The empirical study focused on (1) local officials' perceptions of the costs and benefits of rural growth and development; (2) case studies of actual water system formation and service extension decisions; and (3) officials' perceptions of the impacts of water system formation or expansion. Based on the information presented in Section II, III, and IV, in Section V we summarize our conclusions regarding the adequacy of current procedures for planning, funding, and reviewing rural water system investments in North Carolina, present suggestions for improving current procedures, and indicate where additional study is needed.



II. KEY ACTORS AND DECISION-MAKING PROCESSES

This section examines the decision-making process, the actors, and the criteria involved in water system extensions in order to identify inherent patterns of investment decisions which might result. The data for this aspect of the study come primarily from interviews with water system providers and with local, state, and federal government officials. Persons interviewed were selected to provide a cross-section of actors involved in the planning, design, financing, and construction of water supply systems in rural areas. They included personnel associated with: water and sewer authorities; non-profit water cooperatives; for-profit water utilities; consulting engineers; regional planning agencies; North Carolina office of the Farmers Home Administration; and the U. S. Department of Agriculture. Information obtained from these interviews was supplemented with data published by the U. S. Geologic Survey, North Carolina Water Resources Research Institute, and State of North Carolina.

Who Operates Water Systems?

There are approximately 3,500 water systems serving residential users in North Carolina. The systems differ in terms of ownership, decision making, financing, and whether or not they are regulated. The key factor that influences expansion decisions, covered in a later section, seems to be financing. Although state policy has encouraged the development of regional water supply systems, as shown below, the number of small community-type systems have expanded markedly since 1970, while the growth of "municipal type" systems has been slower. Water systems that serve residential users are broken down as follows:

	<u>1979</u>	<u>1970</u>
Community Systems:		
Subdivisions	1,015	618
Trailer Parks	1,900	746
Subtotal	<u>2,915</u>	<u>1,364</u>
Municipal Systems:		
City	371	} 366
County	24	
Private	26	
Water Associations	87	
Sanitary Districts	20	32
Water and Sewer Authorities	1	0
Subtotal	<u>529</u>	<u>398</u>
Total Number of Systems	3,444	1,762

Community Systems

Community water systems are developer-installed systems that are also privately owned and operated. There are a total of 2,915 community systems serving subdivisions and trailer parks. Construction costs for the systems are folded into the costs of developing the property. After installation, the systems are operated under a franchise issued by the North Carolina Utilities Commission. Rate structures must be submitted to and approved by the Commission. In some cases the original developer operates the system. In other cases the developer turns the system over to a private group that specializes in acquiring and operating community systems. In either case, the system is considered a public utility.

Nonprofit Water Associations

There are 87 water associations and cooperatives in North Carolina. (Tabulations by the N. C. Department of Human Resources indicate that there are 88; however, Orange Water and Sewer Authority, a different type of organization, was included in that count.) Policy decisions for water associations are made by a board of directors elected by association members. Water service is provided only to members of the association. For this reason, the Utilities Commission under its discretionary power has exempted nonprofit water suppliers from the normal rate-making review standards of the Commission.¹⁹ Rates are set at a level necessary to cover amortization of outstanding debt and annual operating and maintenance costs. In the event that private (that is, commercial) financing is not available, or not available at terms that are affordable, the water association can obtain loans and grants from the Farmers Home Administration (FmHA), an agency of the U. S. Department of Agriculture. Further discussion of FmHA's criteria is included in the section below on "Funding Sources."

The key factors in water association expansion decisions are the means by which additional funding is obtained, the criteria used for decision-making, and the frequency of large-scale additions of residential users.

Water and Sewer Authorities

Water and sewer authorities are created by joint action of the governing boards of two or more political subdivisions. To date, only one such organization has been created, Orange Water and Sewer Authority (OWASA). Policy decisions are made by a board of directors elected from the joint community.

¹⁹ R. J. Nery, "Planning of Private Water and Sewer Systems," in Proceedings: Symposium on Better Water and Sewer Services, Raleigh: Water Resources Research Institute of The University of North Carolina, 1968, pp. 29-35.

Financing, like the financing of water associations, is limited to rates, fees, and charges. Authorities do not have the power to impose assessments or to levy taxes. They receive a franchise from the Utilities Commission to operate within the corporate limits of their joint communities, but their rate structures are not regulated by the Commission.

Sanitary Districts

There are twenty districts in North Carolina. They are limited forms of government with the power to issue bonds, levy taxes, impose special rates and charges, and to provide a variety of services. However, they are not permitted to provide services outside their boundaries. Sanitary districts are gaining favor with funding agencies, such as FmHA, because, unlike nonprofit associations, sanitary districts are eligible for federal aid and state Clean Water Bond Act grants.

City Municipal Systems

There are 371 city-owned municipal water systems in North Carolina. They have broad authority to issue bonds, levy taxes, and impose special rates and charges. A few towns are served by privately owned municipal systems or by water associations which were in operation before the town incorporated. Most towns provide water service on a limited basis to surrounding fringe areas, while a few provide extensive service to surrounding unincorporated county areas.

County Municipal Systems

Approximately twenty-four county-owned systems are in operation or under construction in North Carolina. Most of the counties that provided water service prior to 1968 did so in response to demand for industrial water. In most cases extension of service involved the financing and extension of a water line

from a municipal system into the county unincorporated area. Counties more recently have been installing distribution lines and connecting individual municipalities and nonprofit water associations into county-wide, regional distribution systems. In some cases, such as Anson County, counties wholesale water to individual towns and to unincorporated communities between towns, but they do not own the individual distribution systems. However, FmHA reports that the predominant trend is for counties to purchase existing nonprofit water associations, to install distribution lines in rural areas, and to retail water. In FmHA's view, county-wide water systems can deploy federal, state, and local funds more effectively than nonprofit associations because they are eligible to receive various monies that are available only to governmental units.

Water Supply Planning

Stevens has reviewed water supply planning in North Carolina and concluded that the effort is generally underfunded, understaffed, and so fragmented among state agencies that it precludes effective planning.²⁰

Three major water supply planning activities have been conducted in the state: (1) the North Carolina Water Resources Framework Study; (2) county water supply planning; and (3) multi-county regional water management planning. The North Carolina Water Resources Framework Study²¹ takes a broad overview of the total water resource needs of the state. As the first state comprehensive water resources policy statement, it functions as an official guideline for preparing water resource plans. The study assesses the current water resource situation and charts a general outline of future problem areas, but does not

²⁰ Patricia A. Stevens, "Current Water Supply Planning and Related Activities in North Carolina," Chapel Hill: Department of City and Regional Planning, University of North Carolina at Chapel Hill, 1977.

²¹ North Carolina Department of Natural and Economic Resources, 1977.

deal with specific impacts on local levels.

In 1971 the Regional Water Supply Planning Act established a revolving fund to make loans to counties to be used for the preparation of regional water supply plans. Twenty-two of the state's 100 counties completed plans before the funds were exhausted. The plans play only a minor role in the distribution of state grant money for water supply systems.

In 1972 FmHA financed, in large part, North Carolina's program of multi-county regional water management planning. The boundaries of the council of government (COG) regional planning agencies were taken to be the planning area boundaries for the study. Water supply plans were completed for 10 of the 18 North Carolina multi-county planning regions. Apparently, FmHA intended to promote planning at the regional level so that the water system loans and grants it made would be consistent with locally identified needs. The lack of plans in nearly half of the regions, however, may have helped frustrate that goal. At this point, the plans appear to be used as preliminary feasibility studies.²² The plans carefully describe the present water supply, future needs, and recommended investments for each town and water association within the regions for which they were completed. Although the problems of small town water provision are well defined, two shortcomings in the documents are evident. First, the needs and goals of residents currently beyond existing water systems are not addressed--in a sense these areas are "colored green" and forgotten. Also, there is no discussion of what recommended system extensions might mean in terms of growth and what that growth might bring in terms of induced impacts.

So far, the planning programs mentioned were primarily addressed to the problems of inadequate water supply and especially the poor water quality of

²² Stevens, 1977, p. 19.

many small community water systems. The problem is essentially one of scale. Small systems cannot afford the design standards and the technically trained personnel necessary to achieve a high quality water supply. The federal Safe Drinking Water Act Amendments of 1977 are addressed to this very issue. However, the amendments will define public water systems that must meet national standards in such a way as to increase from 3,000 to 15,000 the number of systems that the state must monitor. This trend could push even more forcefully for regionalization of water supplies.²³ Such regionalization may have its own secondary effects on patterns of urbanization.²⁴

There are two coordinative processes that relate directly to the review of water system expansion and potential impacts. They are the A-95 review process and the environmental impact assessment process.

The Consolidated Farm and Rural Development Act of 1972 requires, "No loan under this section shall be made that is inconsistent with any multi-jurisdictional planning and development district areawide plan of such agency." Farmers Home Administration regulations state, "FmHA shall cooperate fully with appropriate State agencies in the making of grants in a manner which will assure maximum support of the State's strategies for development of rural areas. . . . FmHA will give due consideration to all A-95 Agency review comments"

But what if the A-95 process itself breaks down? The Advisory Commission on Intergovernmental Relations summarized relevant criticisms of the A-95 process as follows:

²³ See Stevens, 1977, p. 10.

²⁴ Regional systems with large water mains traversing the countryside might do more to induce rural subdivision sprawl than separate systems, unless connection to the mains are restricted. Of course, this also assumes that water supply is a significant factor in the location of new subdivision development in rural areas.

Too often A-95 review has been provided on an ad hoc project by project basis, with little relation to the comprehensive planning process.

Some criticize the clearing house functions as a "papermill process" with little real impact on the flow of funds or on interprogram coordination. They contend that the area-wide reviews vary widely in quality, are performed by bodies which lack authority and often reflect a tendency to approve all projects of member governments. They point out the failure of most states to convert the process into a tool of state planning and budgeting.²⁵

These criticisms may apply to rural water system investments, notwithstanding the recent reorganization of FmHA's district boundaries to coincide with regional COG boundaries.

There has been pressure for FmHA to change its planning policies at least as far back as 1965. At that time, Landauer pointed out that federal agencies, and FmHA in particular, were funding water lines that, in effect, were undermining the efforts of metropolitan and local governments to plan and coordinate local development.²⁶ FmHA now emphasizes that it only acts with the approval of local government and regional councils of government. FmHA maintains that its programs:

- 1) Place highest priority on serving small communities, especially those less than 5,500 people, communities that usually lack funds to acquire long-range development plans;
- 2) Are coordinated with federal, state, and local agencies;
- 3) Respect the decisions and comments of areawide regional planning agencies.

FmHA strives to work with local and state government to assure that financed facilities will be consistent with development plans of the state, region, county, or

²⁵ Advisory Commission on Intergovernmental Relations, Regionalism Revisited: Recent Areawide and Local Responses, Washington: U. S. Government Printing Office, 1977.

²⁶ Jerry Landauer, "Shaping the Metropolis with Federal Money," in Metropolitan Politics: A Reader, Michael Danielson, ed., Boston: Little, Brown and Company, 1965.

municipality. FmHA does not attempt nor are we authorized to impose our ideas or plans on applicants. We have been and will continue to be responsive to the needs of local governments.²⁷

However, concerns continue to be raised in several Midwestern states that FmHA has been funding water systems without regard for potential growth inducing impacts, especially sprawl.²⁸

Environmental impact assessments are filed for each project that FmHA funds. In general this process has led to negative declarations. A similar situation seems to exist in the state's environmental impact assessment process. The U. S. Department of Agriculture, however, has recently taken action to stimulate review of its programs and their impact on important farmland, rangeland, and wetland.²⁹ Each agency within the Department has one year in which to review and revise its programs and actions, ". . . that may cause or encourage irreversible conversions of important Farmlands and Forestlands, Prime Rangeland, and Wetlands, . . . or that may cause encroachments on flood plains"

This policy may make it slightly more difficult to get water and wastewater project loans, in so far as an additional criterion will probably be added to project review. But, in-depth analysis of the relationship between water system expansions and land development patterns will probably not be forthcoming.

²⁷ Gordon Cavanaugh, "Here's How the Agency Replies," ASPO Planning, Vol. 44 (October 1978), p. 23.

²⁸ See Roy Reed, "Rural Water Lines a Mixed Blessing," New York Times, November 18, 1975; and Tom Jacobson, "How Farmers Home Encourages Urban Sprawl," ASPO Planning, Vol. 44 (October 1978), pp. 21-23.

²⁹ U. S. Department of Agriculture, "Secretary's Memorandum No. 1827, Revised: Statement on Land Use Policy." Washington: The Department, October 20, 1978.

How Do They Expand?

Figures 1 and 2 list the agencies involved in reviewing water system service extension proposals and summarize the criteria these agencies use in making decisions. In general, the agencies involved and decision making criteria used differ depending on the type of rural water system.

Community Systems

These privately owned public utilities typically expand their operations by assuming ownership of water systems installed in new subdivisions and trailer parks. As part of their franchise, they are also required to serve adjacent property owners if the utility has adequate facilities. For example, in the case of Heater Well Company, Cary, North Carolina, a two-tiered system of tap-on fees are charged. A higher rate is applied to new customers located outside the subdivision. The company pays for the first one-hundred feet of water line connection; the customer pays for the remainder. However, the primary mechanism for water system expansion appears to be the addition of new systems in the form of new subdivisions.

Nonprofit Water Associations

Financial considerations are the basic criteria used by nonprofit water associations in order to determine whether or not system expansion is feasible. The question comes down to whether or not the annual debt service on new capital investment plus the cost of operation and maintenance can be covered by an affordable rate structure. Average overall density of users is the major factor considered in this analysis.

On the other hand, developers are allowed to tap on to a nonprofit system if they are willing to pay for and install all of the necessary water lines. The developer is not reimbursed for these costs and must turn the lines over to the nonprofit association for operation and maintenance. The developer's

FIGURE 1

REVIEW AUTHORITY FOR WATER SERVICE EXTENSIONS

DECISION-MAKING BODY	TYPE OF SYSTEM					
	Private		City-Owned	County-Owned	Sanitary District	Water & Sewer Authority
	For Profit	Nonprofit				
<u>Local</u>						
Private for Profit Owners	Yes	NA	--	--	--	--
Nonprofit Board	NA	Yes	--	--	--	--
Elected Public Board	NA	NA	--	--	Yes	Yes
City Council	No	No	Yes	No	No	No
County Commissioners	No	No	No	Yes	No	Yes
<u>Regional</u>						
Council of Governments	No	Only if federal funds are involved	Only if federal or state funds involved	Only if federal or state funds involved	Only if federal or state funds involved	Only if federal or state funds involved
<u>State</u>						
Division of Health Services						
• Water & Wastewater Plan Review	Yes	Yes	Yes	Yes	Yes	Yes
• Water Supply Grants Unit	Clean Water Bond Act grants are not available to private systems, only to units of government		Only if state funds involved	Only if state funds involved	Only of state funds involved	Only if state funds involved
N.C. Utilities Commission	Yes	N.C. Utilities Commission has exempted nonprofits and publicly owned systems from rate regulation				
<u>Federal</u>						
FmHA EDA HUD	\$ not available for profit-making systems	Only if federal funds are involved	Only if federal funds are involved	Only if federal funds are involved	Only if federal funds are involved	Only if federal funds are involved

FIGURE 2

DECISION-MAKING CRITERIA FOR WATER SERVICE EXTENSIONS

DECISION-MAKING BODY	CRITERIA				
	Public Health Needs	Engineering Design	Economic Development	Financial	
				Cost of System	Family Income Level
<u>Local</u>					
Private for Profit	Yes	Yes	Yes	Yes	No
Private Nonprofit	Yes	Yes	Yes	Yes	No
City	Yes	Yes	Yes	Yes, but need not be fully revenue supported	Yes, but not formally
County	Yes	Yes	Yes	Yes, but need not be fully revenue supported	Yes, but not formally
<u>Regional</u>					
Council of Government	Yes	Not generally	Yes	Not considered	Not a primary consideration
<u>State</u>					
Division of Health Services • Water and Waste-water Plan Review	Yes	Yes	No	Not a primary consideration	No
• Water Supply Grants Unit 100 pts. max.	Yes 35 pts.	Yes. Provide capacity for 25-yr. growth 20 pts.	Not specifically	Only with respect to fiscal indebtedness 35 pts.	No
N.C. Utilities Commission	No	No	No	Yes	No
<u>Federal</u>					
FmHA	Yes	Yes	Yes, if part of community development	Yes	Yes. Grant \$ available if monthly service charge 1% of median income
EDA	No	No	Yes, if area designated as a depressed area	Yes	Yes

FIGURE 2 - continued

DECISION-MAKING BODY	CRITERIA			
	Financial	Environmental Impact		Regional Planning
	Fiscal Impacts	EIS Requirements	Preservation of Agricultural Land	
<u>Local</u>				
Private for Profit	No	No	No	No
Private Nonprofit	No	No	No	No
City	Yes. Double rate structure applies outside city limits	No	No	Increasingly becoming a factor
County	Some awareness, but does not effect project review	No	Varies	Increasingly becoming a factor
<u>Regional</u>				
Council of Government	Varies	No	Varies	
<u>State</u>				
Division of Health Services				
• Water and Wastewater Plan Review	No	Required	No	No
• Water Supply Grants Unit 100 pts. max.	No	Required	--	Yes 10 pts.
N.C. Utilities Commission	No	Not Required	No	No
<u>Federal</u>				
FmHA	No	Required	Secretary of Agriculture currently reviewing FmHA programs	Yes. Encourages regional and county-wide systems
EDA	No	Required	--	--

decision comes down to a trade-off between the cost of water lines versus the added land value per dwelling unit.

The chairperson of the board of directors of the Orange-Alamance Water System suggested that subdivisions do spring up in the vicinity of, and as a result of, water system expansions. Woodside, a development below Swepsonville, was offered as an example.

City Municipal Systems

Because city water supply services are generally provided only to town residents and to the immediately surrounding areas, decision criteria were not explored.

County Municipal Systems

County-wide systems typically expand in several ways. They buy and absorb water associations; they sell bulk water at wholesale rates to municipalities; and they extend distribution lines and retail water to individual users. Only when the county owns and operates the retail distribution lines do county officials establish financial and other criteria and make decisions with respect to individual extensions. With the recent upsurge in county-owned, regional water systems, county decision-makers are increasingly involved in decisions to extend particular distribution lines.

Criteria for water service extension vary from case to case. Unlike associations whose funding is limited by potential revenues, counties can rely on general revenues to compensate for revenue shortfalls or slow growth in the number of system users.

Water and Sewer Authorities (OWASA)

Within the service area boundaries, water service is essentially provided on demand. Extension of water service beyond those boundaries must be provided

by the developer. However, unlike nonprofit water associations and cooperatives, OWASA reimburses developers. OWASA charges an acreage tap-on fee for all new development, and it reimburses developers in direct proportion to the amount of new development that occurs along the new water line. This policy would tend to facilitate a sprawled development pattern and stimulate growth.

Consulting Engineers' Decision Criteria

It is appropriate at this point to introduce the manner in which a consulting engineer or developer might assess financial feasibility. The process may be approached at two levels of sophistication. The first decision process would compare the cost of a treatment and distribution system, on a per user basis, to the cost of installing individual wells. This process does not take into account the small lot size allowed, under state public health law, if a distribution system is installed. However, in the absence of data on the relationship between lot size and final housing price, there is no way of estimating precisely how much more profitable development will be with a water system than without a water system. Consequently, the numerical analysis deals with the simple relationship described earlier. The lot size factor will be assumed to influence a decision in favor of a distribution system, should the decision be uncertain.

Density of households and the quality of water available are the two basic criteria used. Assuming that good quality groundwater is available, the only treatment necessary would be chlorination, at relatively minor cost. The major cost of system expansion would be the distribution lines. A standard engineering method to compare the feasibility of a distribution system with the feasibility of an individual household supply is to compare (1) the cost of an individual well to (2) the cost of a minimum size water main, six inch,

running the frontage length of the lot, plus the cost of household connection.³⁰
 For example, compare the typical cost of an individual well to the cost of a distribution system on a per unit basis, assuming that house lots are 100 feet wide:

Cost of an individual well (including pressure tank and chlorinator)	\$2,100
Cost of distribution system	<u>\$855</u>
6" polyvinal chloride pipe (\$5.00 per linear foot installed) x (100 feet)	\$500
House connection	355
	<u>\$855</u>

In this case, the per unit cost of a distribution system is much lower because the houses are close together. Curve A in Figure 3 illustrates that a distribution system becomes infeasible when the linear density of households is less than 15 units per mile.

This analysis can also be extended to cover new subdivisions that can not tie into an existing supply, and therefore must install their own wells and pumps. The cost of pumps and well drilling must be added to the estimated distribution system cost. The cost of pumps and well drilling varies with the scale of development and with the nature of the local geology. Costs can generally range from \$200 to \$350 per user, curves B and C, respectively. The most influential factor is the scale of development. Costs rise incrementally depending on the number of wells required. Figure 3, shows that the density of houses must exceed 17 or 19 units per mile, depending on the scale of development, in order to economically justify the installation of a water distribution system in a new subdivision. Also, see Appendix A.

³⁰ Interview with John McAdams, 1978.

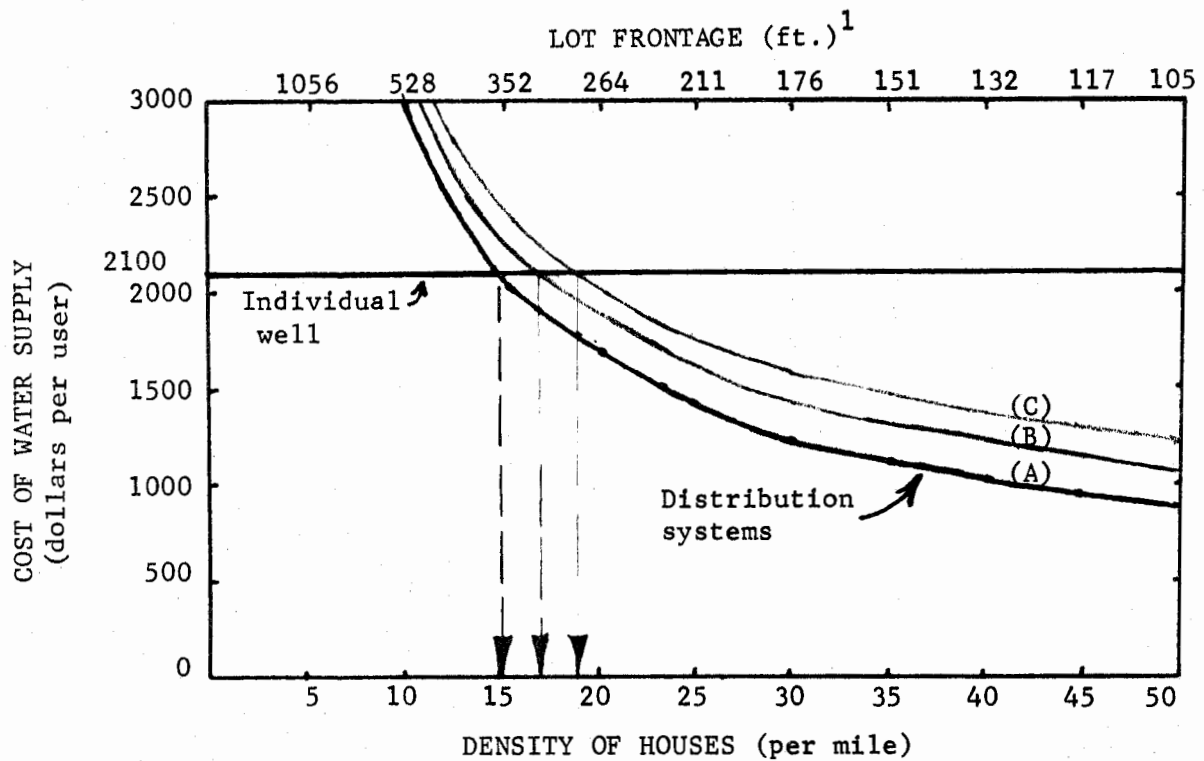


FIGURE 3 COST OF WATER SUPPLY SYSTEM

¹Houses are assumed to be on one side of the street only. Divide LOT FRONTAGE by two if houses are on both sides of street. See Appendix for derivation of curves.

Funding Sources and Financial Feasibility

There are two primary sources of funds for improvement and expansion of water systems in rural areas, FmHA and the state. There are other funds available from the federal government, but the level of activity is low. For example, in the case of the Appalachian Regional Commission (ARC), funding levels are limited. In the case of the Economic Development Administration (EDA), funds are targeted so as to preclude from eligibility all water systems not located in designated "growth centers." The Department of Housing and Urban

Development is primarily concerned with areas over 10,000 population.³¹

Federal Funding

Under Title I of the Rural Development Act of 1972 (P.L. 92-419), FmHA makes grants and loans for the development, storage, treatment, or distribution of water in rural areas. Facilities must serve primarily rural residents; a rural area is defined as an area which does not include any city or town having a population in excess of 10,000 people.

Preference for available loan funds is given normally to public bodies, according to FmHA loan instructions. Loans for utility-type systems, however, may be made to nonpublic organizations, but only if they are operated on a not-for-profit basis. Discussions with FmHA's Chief of Community Programs in North Carolina indicate that FmHA especially prefers to provide funds for county-wide systems, as opposed to water associations, because units of government are eligible for other public grants.

Highest project priority is given to communities not in excess of 5,500 which have an inadequate water system. Next highest priority is given to projects which will enlarge, extend, or otherwise modify existing facilities to provide service to additional rural residents. This is followed by those projects which involve the merger of ownership and operation of smaller facilities in order to provide more efficient management, more economical service, and more orderly development of the rural area.

All projects financed by FmHA must be ". . . based on taxes, assessments, revenues, fees, or other satisfactory sources of revenue in an amount sufficient to provide for facility operation and maintenance, a reasonable reserve,

³¹ Commission on Rural Water, Guide to State and Federal Policies and Practices in Rural Water-Sewer Development, Chicago: National Demonstration Water Project, 1974.

and debt payment." (FmHA Instruction 1942-A, Section 1942.17(h)) Although FmHA requires an applicant to provide a financial feasibility report prepared by a qualified firm, FmHA tentatively determines the eligibility of the applicant and assesses the financial feasibility of the project. FmHA does not have an official method or defined set of criteria for determining financial feasibility, but the following sequence describes one method that FmHA has used. FmHA looks at the total project cost in relation to the number of users that will be served by the project. The total project cost is estimated. The sum total of any grant money is subtracted from the total project cost, leaving the amount which must be financed through loan. The loan figure is then divided by the total number of users that will be served by the system when it starts operation in order to arrive at an average cost of the system per user. FmHA has used a rule of thumb that the average cost per user must be below \$1,000. This criterion derives from FmHA loan terms of 40 years and 5 percent interest and from a desire to keep monthly rates at an affordable level. Each \$1,000 of project cost results in an approximate monthly debt service of \$5.00. Add to that an operating cost of metered water, and the result is between \$7.00 and \$9.00 per month.³²

Grants are limited to 50 percent of the total project cost, but will ordinarily only be considered if the debt service portion of the monthly charge is in excess of 1 percent of the (1970) median income of the area. For example, if the county-wide median income was \$7,500, then the monthly user debt should not exceed $\$7,500 (0.01) \div (12 \text{ months})$, or \$6.25. This figure would be exceeded when the average project cost, per user, reaches approximately \$1,000. In actual practice, then, the project cost per user could run as high

³² Interview with Jack Conniff, State Office Engineer, Farmers Home Administration, November 22, 1978.

as \$2,000, which would be permissible if grant money were available to bring the loan cost down to \$1,000 per user.

The cost of an individual household well supply may run in the vicinity of \$2,100 (in 1972 dollars).³³ So FmHA's rule of thumb allows a capital cost per user that is roughly equivalent to the cost of an individual well.

It should also be noted that an extension or expansion of the system at any future date will be analyzed by the same criterion except that the cost of the expansion will be spread over all users in the system, not just over the new users. According to FmHA staff, the cost of expansion would be added to the outstanding loan balance and then divided by the total number of users, new and old, in the system. Since the initial loan was made, the loan balance would have been paid down and the number of households on the system would probably have increased. The effect of these two factors would be that a lower density pattern of development could be supported and might be encouraged.

State Funding

The Clean Water Bond Act of 1977 provides for the sale of \$230,000,000 in bonds, of which \$110,000,000 will be allocated to a Water Supply Systems Account, from which grants will be made only to units of government. Grants are generally limited to 25 percent of the total project cost.

Priority for project funding is determined by a point system established by the three implementing state agencies, Department of Human Resources, Department of Natural Resources and Community Development, and the Department of Administration. State law provides:

. . . although public necessity will be the primary consideration in granting funds, great emphasis must be placed on the availability of matching grants and loans from other

³³ John M. Higgins and Daniel A. Okun, Regional Development of Public Water Supply Systems, Raleigh: Water Resources Research Institute of The University of North Carolina, 1972.

sources; the creation of efficient systems of regional wastewater disposal and regional water supply; and the willingness and ability of local government units to meet their responsibilities through sound fiscal policies . . . (Clean Water Bond Act of 1977, p. 3)

The priority point system follows this mandate to the extent that it assigns a maximum of 55 (of the total 100) points to "Public Necessity--Health, Safety, and Welfare." However, other items that the law demands be considered are relegated to a very inconsequential position. It would appear that a proposed project that is not part of a regional system and does not have the approval of local or area-wide regional planning agencies could receive as many as 79 out of 100 points. This is well above the median level of points (62) assigned to grant applications during the January to June, 1978 period and it is only five points below the highest number of points (84) awarded during that period.

Conclusion

Based on this initial analysis, decision criteria used by virtually all actors tend to be financial criteria. Decision criteria do not seem to include capital improvement budgeting and planning nor long-term costs to the communities of providing public services. With the potential exception of municipalities and counties, water service providers are not in a position to consider long-range demands for government services or the future costs of providing services. A more systematic and detailed case analysis is necessary to clarify the extent of secondary impacts, and the extent to which they are taken into account by public officials and private water system managers. This case analysis is provided in Section IV below.



III. FRAMEWORK FOR CONSIDERING SECONDARY IMPACTS OF RURAL WATER SYSTEMS

Review of previous research on problems associated with uncoordinated rural water system installation reveals that although the issue is of concern, a general consensus of the nature and the scope of the problem does not emerge. In accordance with the general model of secondary impact analysis (see Figure 4), the studies can be divided into two types for analysis. The first type attempts to determine the strength of the relationship between water system installation and induced growth. These studies include a group of descriptive, nonsystematic attempts to examine the relationship and a group that quantified the relationship through the use of statistical models. This latter group is termed systematic studies.

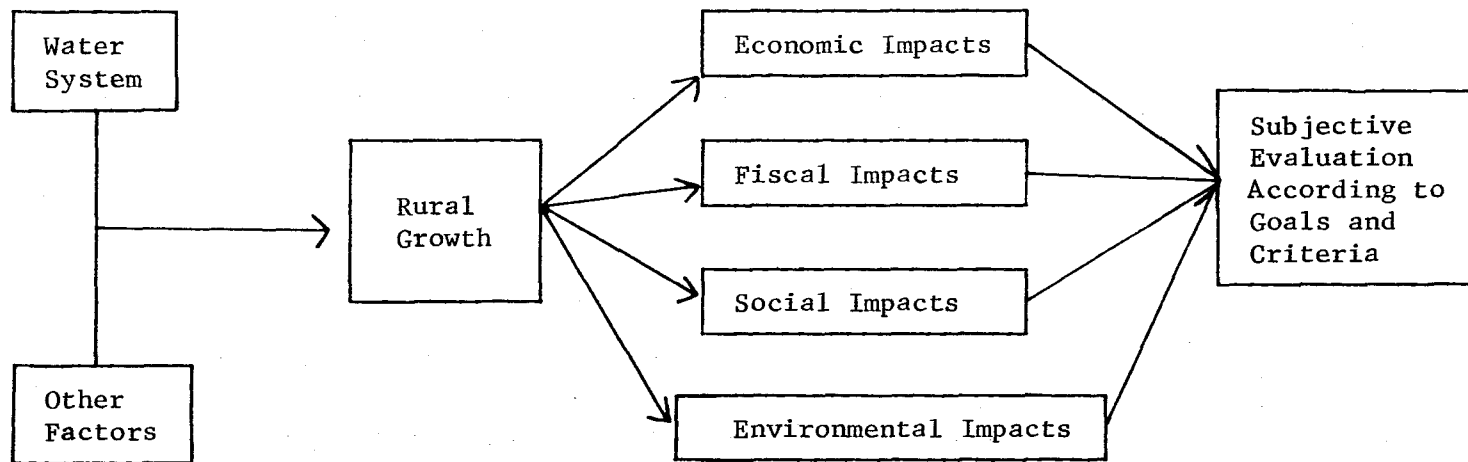
A second type of research is the result of attempts to estimate the impact of growth. These studies are all of the "nonsystematic" type due to the location-specific nature of growth impact analysis. The final step in the research, that of judgment (evaluation) of the impacts, must come on the local level based on comparison between local growth objectives and an analysis of the expected impacts.

Water System Installation and Induced Growth

The literature suggests that there is a relationship between public infrastructure investment and growth, but in the case of water systems, the strength of that relationship is not well understood. Much more attention has been given to explaining and understanding the associations between sewer, highway and mass transit extensions and induced growth patterns.³⁴ Much of the literature

³⁴ See Urban Systems Research and Engineering, 1976 and Richard D. Tabors, Michael H. Shapiro, and Peter P. Rogers, 1976.

FIGURE 4
IMPACT ANALYSIS MODEL



concerning rural water systems and induced rural population growth draws on previous research into the general nature of secondary impacts.

Individual decisions which in combination lead to particular land use patterns are highly complex in nature. A household considering a move to a rural area will weigh many factors, including employment opportunities, property values and convenience, as well as the availability of public services, such as water, sewer, schools, and well-maintained roads. Gray identifies another factor, the "rural mystique," as important in the decision process, based on the finding that some untapped nonquantifiable factor seems to favor rural location.³⁵ In North Carolina, Christenson found in a statewide survey that 17 percent of the people living in the state prefer to live in the country and another 57 percent want to live outside the city limits of a town, but within a 15-minute drive.³⁶ Thus, there seems to be a strong preference for rural living.

In an analysis of the growth inducement effects of various public investments and policies, Urban Systems Research and Engineering concluded that land use patterns, ". . . are the result of a complex set of historical, economic, social, and political interactions. No single factor can be isolated as the cause of current land use practices, nor is it likely that modifying any particular governmental policy would result in radical changes in future land use patterns. The role of (infrastructure) must be seen as contributory rather than decisive."³⁷

³⁵ Morris Gray, Rural vs. Suburban Residential Choice: A Progress Report, Iowa City: Institute of Urban and Regional Research, The University of Iowa, 1978, p. 11.

³⁶ James A. Christenson, 1974.

³⁷ Urban Systems Research and Engineering, Inc., Sewers and Suburban Sprawl: The Land Use Impacts of Infrastructure Investments, Prepared for the Council on Environmental Quality, Springfield, Va.: National Technical Information Service, 1975, p. 38.

Because the significance of the presence or absence of a water system in determining land use patterns is highly affected by other variables, it is difficult to determine precisely the growth inducement effect of an individual investment decision. Nevertheless, it is generally felt that some process exists. As such, the problem of predicting growth is one of "attribution--the determination of what part, if any, of urban growth can be ascribed to public investment."³⁸

A New York Times article in 1975 examined rural growth stemming from the Farmers Home Administration financing of rural water systems and reported a very strong relationship between the installation of water lines and growth. According to this report:

. . . the new water systems, which have multiplied spectacularly in the last ten years because of an expanded Federal program have brought more than pure water to the American countryside. They have also brought growth . . . speculators have discovered that a rural water system is a sure fire way of speeding development and selling lots. (November 18, 1975)

A survey of rural water system managers operating FmHA financed systems in Mississippi found a strong perception of growth directly attributable to water line extension. Survey respondents felt that rural water systems had facilitated increased housing in rural areas.³⁹ In addition, the study indicated that water systems were viewed as producing increases in the price of real estate.

Specific locational factors must be considered before growth predictions can be formulated. In particular, when water supplies in a region are generally inadequate and individual wells are less feasible, growth is more dependent

³⁸ Environmental Impact Center, Inc., Secondary Impacts of Infrastructure Investments in the Denver Region, Prepared for the Environmental Protection Agency, Department of Housing and Urban Development, and Council on Environmental Quality, Springfield, Va.: National Technical Information Service, 1977, p. 3.

³⁹ Brenda M. Landry, Charles P. Cartee and D. C. Williams, 1973, p. 20.

upon centrally supplied water. The impact of water systems on development in areas operating under this constraint is more likely to be significant and predictable.⁴⁰ In view of the fact that many county sanitarians in rural North Carolina counties report that an increasing number of families are without a safe water supply, the expected increase in rural nonfarm residents may be constrained to areas serviced by water systems. This could make the placement of water lines of crucial interest to prospective rural real estate developers.

Empirical tests of the relationship between various locational influence factors and the actual location of rural growth are few. Although factors which influence growth are identifiable, they are difficult to separate and weigh. It is also difficult to generalize empirical results from one region to another.⁴¹

One systematic study by Weiss and Kaiser analyzed five factors which tend to influence regional residential location decisions.⁴² Their study of the North Carolina Piedmont Triad region found that the relative importance of the five independent variables could be grouped as follows:

First rank: Highly significant influence

Access to major road
Contiguity to urban use

Second rank: Significant influence

Agricultural capability of undeveloped land
Access to public water system
Distance to nearest high value corner

⁴⁰ American Society of Planning Officials, 1977, p. 42.

⁴¹ Ibid., p. 42.

⁴² Shirley F. Weiss and Edward J. Kaiser, "A Quantitative Evaluation of Major Factors Influencing Urban Land Development in a Regional Cluster of Cities," Traffic Quarterly, Vol. 22 (January 1968), pp. 109-115.

The five variables explained 89.5 percent of the regional land use pattern; however, as the authors note, the findings relate to one regional cluster for one period of time and may not reflect other areas even of similar size. Nevertheless, it is noteworthy that in a study of rural residential location in the vicinity of major multipurpose reservoirs, Burby, Donnelly, and Weiss found that access to a water system was a major factor shaping the location of residential development.⁴³ In the Lake Sidney Lanier, Georgia area, for example, access to a water system explained more of the location of residential development than any other factor considered, including topography, ground cover, distance to major roads, schools, employment, and nearby urban centers, and access to a public sewerage system. In a related study of land value changes around an authorized reservoir near Durham and Raleigh, North Carolina, Burby, Donnelly, and Weiss found that the availability of a water system was a factor contributing to the price of rural land.⁴⁴

In a pilot study of rural residential choice, Gray asked exurbanites to rate the importance of the availability of public services, lot size and arrangement, monthly mortgage, and distance to work and shopping in terms of desirability, economy, and convenience. The survey, which included water and sewer facilities and improved public roads, found that within the public service category, hard surfaced public roads were more important in determining residential location than the presence or absence of public water and sewer.⁴⁵

⁴³ Raymond J. Burby, Thomas G. Donnelly, and Shirley F. Weiss, "Vacation Home Location: A Model for Simulating the Residential Development of Rural Recreation Areas," Regional Studies, Vol. 6 (December 1972), pp. 421-439.

⁴⁴ Raymond J. Burby, Thomas G. Donnelly, and Shirley F. Weiss, The Effects of Authorization for Water Impoundments on Shoreland Transition, Report No. 78, Raleigh: Water Resources Research Institute of The University of North Carolina, 1973.

⁴⁵ Morris Gray, 1978, p. 11.

A study of the determinants of the conversion of rural land to residential uses in the metropolitan fringe of Denver, Colorado used the EMPIRIC model to find the importance of public investment relative to other factors influencing land use change. Results showed that new water service explained 6.8 percent of the change, as compared with 23 percent of the change attributable to new sewer service, and 4.6 percent to the existing highway pattern. In the analysis, however, the authors suggest that those proportions are likely to change so that, "With a growing concern over water, public systems have begun to play an increasingly important role in the urban development process."⁴⁶

In summary, it appears that rural water system investments, while not the major factor accounting for rural development, contribute to rural growth and the location of new residences outside of built-up areas. The effects of this population distribution are discussed below.

The Effects of Induced Growth

The issue of secondary impacts which result from rural growth is of critical interest to planners, public officials, and rural residents. Concentration on one set of impacts, either the good or the bad, leads to a misrepresentation of the implications of growth. For this reason, it is important that both the connection between growth and secondary effects is understood and that the range of effects is explored.

In instances of induced sprawl, environmental degradation may result when rural housing density is increased. Although a public water system is designed in part to protect households from contaminated or depleted groundwater, if extensive sprawl development is attracted to the serviced land, several other environmental problems may be created. Stormwater runoff is greatly increased

⁴⁶ Environmental Impact Center, 1977, p. 5.

following the conversion of land from an undisturbed or agricultural state to residential uses. This increases the threat of both surface water pollution and flooding. Serious erosion problems and local stream sedimentation can be the eventual result. Lawnmowing activity and the use of lawn fertilizer can increase the eutrophication rates of area ponds. Fragile or unique habitats are impacted by shifts in land use patterns. Since conversion of land from residential back to wilderness or agricultural uses rarely occurs, a loss of habitat or farmland is a permanent impact.

In North Carolina, the Rural Land Use Planning Committee has expressed its concern about the impact of unguided rural growth on agricultural land.⁴⁷ The Committee has observed the relationship between rural development and rising rural real estate values, which it believes are creating pressure for the conversion of agricultural land to residential uses in some areas at a rapid rate. This indirectly raises the cost of farm and forestry operations and influences farmers to abandon agricultural operations. According to the Committee, "Farmers that desire to maintain their farms and forests have little protection from these land use intrusions."⁴⁸

Another major concern to public representatives is the effect of growth on the future demand for costly public services, such as police and fire protection, sewer service, schools, and hospital facilities. Below certain threshold densities, dependent upon a variety of geographical, institutional and perceptual values, the demand for public services in rural areas does not initially increase rapidly with population growth. As Alan Altshuler has noted,

⁴⁷ Rural Land Use Planning Committee, Rural Land Use Planning: Appraisal of the Past, Present and Future Role of the Schools of Agriculture and Life Sciences and Forest Resources, Raleigh: The Committee, 1978, p. 1.

⁴⁸ Ibid., p. 4.

rural residents do not demand the same high level of public service as urban dwellers; for example, they get along well without sidewalks and lighted streets.⁴⁹ By choosing to reside in a country setting, individuals accept the understanding that urban public services are often not readily available.

However, as residential density passes some threshold, many expensive public projects are required to meet new public service demands. Water and sewer system installation, while not necessarily the determinant of growth and secondary impacts, may be a key element because it tends to come first and accelerate the need for other services. Wilson has observed, "Water and sewer facilities stimulate and encourage development, and they are the framework on which the urban type community is built."⁵⁰ Water lines, therefore, may be regarded as key indicators of the location of future population growth and future requirements for capital outlays.

In a social sense, there is concern that the rapid growth of the rural nonfarm population relative to the established farm population can lead to problems resulting from conflicts in lifestyles. The local government must deal with any city-county tension aroused against new residents who may not have a sense of local character and cultural values.

⁴⁹ Alan Altshuler, "Critique of Costs of Sprawl," Journal of the American Institute of Planners, Vol. 43 (April 1977), pp. 207-209. Also see, Duane Windsor, "A Critique of the Costs of Sprawl," Journal of the American Planning Association, Vol. 45 (July 1979), pp. 279-292.

⁵⁰ S. L. Wilson, "Municipal Water and Sewer Services to Suburban and Rural Satellite Communities," in Proceedings: Symposium on Better Water and Sewer Services for Small Communities in North Carolina, Raleigh: Water Resources Research Institute of The University of North Carolina, pp. 84-90.



IV. DECISION-MAKING FOR RURAL WATER SYSTEMS IN NORTH CAROLINA: RESULTS FROM SEVEN CASE STUDIES

Seven case studies were undertaken in order to (1) improve our understanding of local communities' attitudes toward rural growth and development, (2) determine in some depth how water system extension decisions are being made across North Carolina, and (3) ascertain how local officials view the impacts that have resulted from water service extensions. The water systems selected for study include:

- Bogue Banks Water Association, Carteret County
- Dan River Water, Inc., Rockingham County
- Davie County Water System
- Neuse River Water Association, Craven County
- Newton Municipal Water System, Catawba County
- Oak Hill Water System Corporation, Burke County
- Union County Water System

These systems were selected on the basis of three criteria. First, systems were selected in areas that were rapidly growing, so that the impacts of water service extensions on the location of new development could be identified. Second, water systems were selected so that a range of system types would be represented, including nonprofit water associations, municipal systems, and county or regional systems. Finally, the case study water systems were selected so that each region of the state--mountains, Piedmont, and coastal plain--would be represented. See Figure 5.

Data for each case study were collected through a questionnaire administered during personal interviews with the chairperson of the county commissioners; the county manager or the water system manager if the system was privately

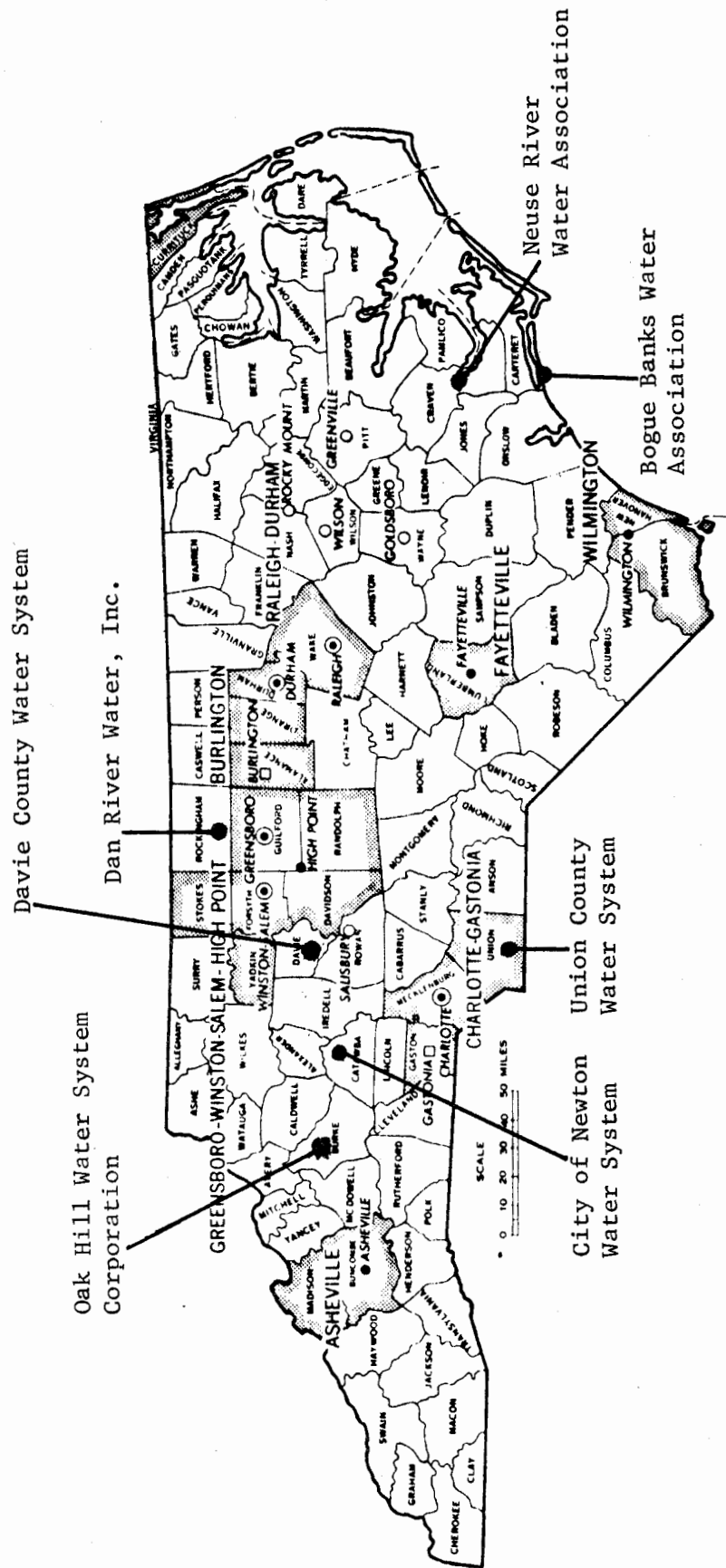


FIGURE 5 LOCATION OF CASE STUDY WATER SYSTEMS

owned. In addition, the agricultural extension agent, water system engineer, and the county planner were interviewed for each case if they were available. Appendix B provides a list of persons interviewed for the case studies. The questionnaire used in the case studies is reproduced in Appendix C.

Perceptions of Benefits and Costs from Rural Development

The case study data generally support the view that local public officials believe that industrial and residential growth can be the driving force in effecting beneficial change. Community growth and development is strongly encouraged; otherwise, it is felt social and economic stagnation will be the result. The case studies also highlight the costs of development which occur in conjunction with the benefits. The problem facing the local official is one of trying to find methods to reduce costs while pursuing the growth objective. Public bodies often have discretionary power over decisions concerning the provision of many public services. It is suggested in planning literature that marginal adjustments in the timing, location, and capacity of some services, such as public water and sewer, can be used to mitigate negative impacts of development. The interviews revealed, however, that the ability of local governments to exercise that discretion is often restrained by the conservative political attitudes prevalent in rural North Carolina.

Research Approach

The expansion of capital facilities to encourage industrial location is a means by which public officials often hope to facilitate development. As was discussed earlier, however, the causal link between the expansion or formation of a rural water system and subsequent rural development, or the more indirect link between public investment and secondary impacts of development, is not always obvious. As a part of this study, an interview technique designed to

measure perceptions of the merits of rural development and perceptions of the impacts of local rural water supply systems was devised. It should be noted that some of the impacts attributed to the installation of the water lines may, in reality, be the result of other exogenous factors. The empirical testing of the validity of the perceptions of the respondents could be pursued as an extension to this project. The methodology used in this phase of the research was deliberately chosen to study perceived rather than actual causal relationships. This information is important to the rural planning process because public decisions are usually the result of reactions to perceived relationships.

Respondents were first asked a series of subjective questions to determine their views on the general goal and idea of rural development. Each respondent was asked if rural development, often advocated as a solution to a wide assortment of problems facing rural counties, would alleviate, aggravate, or have no effect on specific local problems. The list of potential problems itemized on the questionnaire included lack of employment opportunities, low wages, inadequate educational and social services, inadequate water and sewer service, environmental degradation, and social tension. After responding to the list of particular potential problems, each respondent was asked for a general statement of feelings concerning the net benefits of increased rural development.

Perceptions of Benefits of Development

The answers to the general question of the impact of growth on rural North Carolina revealed a relatively consistent attitude of the respondents. The perceptions were favorable, and almost without exception growth and development was considered to be a net benefit in each of the sample localities, regardless of any negative impacts identified in the earlier round of questions. Within the set of responses indicating a positive reaction to development, however, there was a wide spread of opinions ranging from whole-hearted approval to

qualified suspicion. One water system manager, after indicating that development would cause future problems with public service provision, responded to the general question by stating, "Growth in any form is beneficial." Other respondents observed that while, broadly speaking, growth was beneficial, adequate environmental regulations and subdivision controls must be instituted by the appropriate local and state governments. One respondent, while approving of today's growth, wondered when the county would recognize the time to say "no," and if it would have any power to control future growth. One county manager differentiated between types of growth in his reply, noting that while industrial growth was good for the county because of the resulting increase in revenues, wage rates, and options for service provision, residential growth was a net drain on county resources. The ambiguity of the situation was summarized in one county by the Director of Human Development who responded to the question of the net benefit of development in his county by stating, "There are too many 'ifs.' If growth fills the voids, it is good. If poorly planned, it could intensify all the present county problems."

Three reasons were most commonly cited to support the conclusion that growth is beneficial to rural North Carolina. The first was the advantages of an expanded industrial base, resulting in a more stable, diversified economy. Several of the counties (Union, Burke, Rockingham) had historically based their economies on the textile industry, and in these counties public officials were especially anxious to attract new and different industries. Because the textile mills have traditionally offered low wages to their employees in North Carolina, the second major reason for attracting new development was the expectation that growth would have a positive impact on the wage structure and the level of employment opportunities. Industrial development, and to a lesser extent, residential development, was credited with increasing

the county revenue base, the third most commonly expressed benefit. Development was also credited with other positive effects, including expanding cultural and social opportunities, generating internal county improvements, and providing an impetus to the county to upgrade its provision of services. All the favorable reactions can be interpreted as a reflection of the importance assigned to the goal of rural development.

Perceptions of Costs of Development

There seemed to be a certain reluctance on the part of the respondents to dwell on potential costs of rural development. In light of this, it is probable that local officials discount the costs of growth relative to the value of the potential benefits.

Two reasons can be hypothesized for this attitude. The first is that since the nature and magnitude of the costs will be largely determined by the shape of development, the estimation of costs of growth is very much in the realm of speculation. Due to the general attitude that rural government should take a reactive approach to planning, the eventual development pattern will be largely determined by market forces. That pattern, and thus its costs, cannot be easily predicted at the local level.

The second motive for this reluctance may be found in basic human nature. Local officials would be more inclined to focus on the positive aspects of their objectives, and therefore by omission may gloss over the anticipated negative impacts. Hence, some of the problems specified in the questionnaire, such as inadequate fire protection, insufficient recreational facilities, overcrowded educational facilities, inadequate garbage collection, erosion problems, and social tension, were dismissed, not because they are unlikely to arise, but because their occurrence will be handled in a "business as usual" manner.

The one potential cost of development that was mentioned frequently as a very serious problem was the possibility of a general septic system failure, and the coincident necessity of a public sewer system. This contingency would require a relatively massive and unexpected public expenditure of funds. Not one of the communities included in the study had plans for such a system in its capital budgeting program. If serious septic problems were to occur, therefore, there would be a substantial lag time between the initial recognition of the health hazard and the installation of the sewer system.

The situation is especially complicated in the cases of private, nonprofit water systems (see, for example, the following case studies of Oak Hill Water Corporation, Dan River Water, Incorporated, and Bogue Banks Water Association.) If the increased residential density permitted by these systems induces septic failures, the decision to finance a rural sewer must be made at the public level. Therefore, the seat of responsibility for solving the problems of negative impacts is different from the system inducing those impacts.

Summary

The growth and development occurring in many rural North Carolina counties is generally regarded by local officials as beneficial. The case study data support the earlier indications that rural development is credited with many positive impacts, such as raising wages, increasing employment opportunities, diversifying the social character of the community, and increasing local tax revenues. The high level of interest in the benefit side of the ledger, however, does not extend to a balanced analysis of the expected costs at the local level. Respondents indicated a certain reluctance to specify and discuss most potential problems of increased development, with the exception of the problem of the future necessity of publicly financed sewers. This hesitance may partially reflect the lack of tools available to rural public officials to actively

channel growth in a positive manner so as to avoid or to at least mitigate the emergence of problem situations.

Water System Decision-Making

This section reviews public infrastructure decision-making in seven case studies of the formation or expansion of water systems. The cases are grouped according to type of water delivery agency. The first four case studies are water associations, the next is a joint municipal/county system, and the last two are county-wide water systems. Selected characteristics of the case study water systems and the expansion decisions studied are summarized in Figure 6.

Although decision-making actors are slightly different across these agency types, the criteria used to make expansion decisions seemed to be the same. For new development, water associations extended service only if the developer paid for the cost of water line installation. This was also generally true of county-wide water systems. Both public and private water agencies operated similarly when they expanded their service area to include existing development that was experiencing water quality problems. Both types of agency used primarily financial criteria to assess the feasibility of expansion. The public systems, such as county-wide systems, had more financial resources to draw from, however, and therefore could undertake more costly expansions than the water associations. County-wide systems qualified for State Clean Water Bond Act grants and, if necessary, could use tax revenues.

We hypothesized that public agency decision-makers would be more likely than decision-makers of private water associations to anticipate future public costs associated with the impacts of water system expansion. Although public officials were more concerned than private water association managers with the problems of funding and providing new services to residential growth, public agencies did not appear to take secondary impacts into account when planning

FIGURE 6

SELECTED CHARACTERISTICS OF CASE STUDY WATER SYSTEMS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Water System	Total Cost of Construction	Loan Amount and Source	Grant Amount and Source	New Customers Added	Total Customers: 1979	Annual Debt Service for Extension	Maintenance and Operating Cost, Last Year	
Private Water Associations	Bogue Banks	\$ 468,000	\$230,000 EDA	\$238,000 EDA	150 potentially	1400	\$13,000	\$ 87,000
	Dan River	\$4,179,000	\$4,179,000 proposed FmHA loan	-0-	1700 to 1800 potentially	N.A.	N.A.	N.A.
	Neuse River	\$ 733,000	\$583,000 FmHA	\$150,000 FmHA	510 at formation	829	\$34,560	\$46,299
	Oak Hill	\$ 12,000	-0- (developer paid for addition)	-0-	400	1200	-0-	\$90,700
Governmental Agencies	Newton	\$ 244,000	-0- (\$183,000 from city/county fund)	\$60,000 N.C. Clean Water Bond Act grant	50 potentially	N.A.	-0-	N.A.
	Davie County	\$5,125,515	\$3,860,000 general obligation bonds purchased	\$1,140,000 N.C. Clean Water Bond Act grant	3240 potentially	2800	\$238,000	\$218,687
	Union County	\$4,805,258	\$3,048,000 general obligation bonds purchased by FmHA	\$857,258 N.C. Clean Water Bond Act grant \$900,000 FmHA	1500	2800	\$150,000	\$150,000

FIGURE 6 - continued

	(8) Construction Cost Per New Customer (1) ÷ (4)	(9) Mortgage Cost Per New Customer ¹ (2) ÷ (4)	(10) Monthly Debt Service ² (6) ÷ (4)	(11) Comments on Financial Criteria	(12) Non-Financial Considerations	
Private Water Associations	Water System					
	Bogue Banks	\$1,533	\$1,533	\$7.22	--	Septic tanks failing; ground-water polluted.
	Dan River	\$2,322	\$2,322	N.A.	Proposed addition was restricted.	1. Competition between local governments and the water association for service areas; and 2. the local governments loss of control over infrastructure expansion in the fringe areas resulted in a negative A-95 review and halted the extension.
	Neuse River	\$1,437	\$1,143	\$5.64	--	Expensive to secure groundwater, some of which was becoming polluted.
	Oak Hill	\$30	-0-	-0-	Developer required to pay full cost.	--
Governmental Agencies	Newton	\$4,880	-0-	-0-	Although 50 customers may ultimately use the system, only 4 have any immediate need.	--
	Davie Co.	\$1,582	\$1,191	\$6.12	Assumed that 90% of the 3600 potential customers could be signed up (3240).	Pockets of polluted groundwater. The system was designed using the Davidson Water System, a system serving virtually the entire rural population of Davidson County ³ , as a model.
	Union Co.	\$3,203	\$2,032	\$8.33	--	Pockets of polluted groundwater.

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NA = Information not available.

¹ Based on costs to water system exclusive of all grant monies, developer contributions, and public construction fund monies.

² Based on mortgage cost per potential new customer.

³ Campbell Wallace Consulting Engineers, Davie County, N. C., New Water System, February, 1973, p. 1.

water system expansions. This can be explained in one of two ways. Public officials either perceived water systems as having no impact on growth patterns and growth rates, or their assessment of the problems with servicing new growth was not so dire as to make them stop the development process altogether. Without a need to analyze development policy, there was no reason to reassess existing water extension policy. Although we expected public water agencies to make decisions based on public impacts more readily than private water agencies, we found no difference.

In the analysis of various institutions providing water service, we hypothesized that public agencies could provide service in a more cost-effective manner than private water associations because governments in North Carolina are eligible to receive State Clean Water Bond Act grants. Davie County and Union County (Figure 6, Column 9) effectively reduced the mortgage cost per new customer by obtaining state grant funds. However, it is not clear that the governmental agencies are, as a group, able to reduce the cost of delivering water service.

The Bogue Banks Water Association

The Bogue Banks Water Association is located on the coast of North Carolina, about midway between Virginia and South Carolina. It serves the residents of Emerald Isle, one of four municipalities on the twenty-mile-long barrier island called Bogue Banks. When the system was first formed, it served about 400 houses. It now provides water to 1,400 dwellings and is expected to grow in coming years.

Emerald Isle's year-round population in 1976 was only 330. However, after a new bridge was built to the island in the early 1970's, population growth began to escalate. Tourism and second home development have become major economic

activities. The land use plan prepared under the Coastal Area Management Act (CAMA) has most of the town classified as "transitional," meaning that heavy urban development is expected. Engineering studies that have examined the feasibility of island sewerage indicate that 80,000 people could inhabit the town given the current supply of lots that are platted and on the county tax books.

Although that projection seems quite high, in view of the fragile nature of the North Carolina Outer Banks ecosystem, the public attitude toward the expected growth is generally positive. It is recognized that planning will be essential so that growth is channeled in proper directions. Impacts of development are expected to be almost completely positive. Specific issues discussed include the expectation that growth will provide new jobs, raise wages, and train and diversify the labor force. The respondents did not feel strongly that growth would have any adverse impact on specific county problems presently existing. Overall, every respondent felt that adequate services were being provided by the town. A lack of municipal sewerage was cited by each person interviewed as a major service that was needed. Inadequate highways, cultural opportunities, recreation and entertainment facilities were also mentioned as problems that should be addressed.

Decision to establish the system.--At the time the water system was first proposed in 1969, Emerald Isle was on the verge of a major development boom. The North Carolina Department of Transportation had just approved a new bridge to the island that would replace the overcrowded ferries and the long twenty-mile drive which formerly had been the only means of access to the town. Demand for beach property was increasing, and local business leaders decided to take steps to insure that nothing would impede future growth.

Dense development of mobile homes was already causing some water contamination in the town. The problem surfaced as shellfish beds in adjacent

Bogue Sound were closed. Faced with the threat that the County Health Department might impose a building moratorium because of polluted drinking water supplies, realtors and builders in the area advocated the development of a water system. However, the town of Emerald Isle was unwilling to take on responsibility for a water system because of the small number of permanent residents then living in the community. Undeterred by this setback, the local business community decided to organize a private water association.

Under the direction of Tom Willis, Director of the East Carolina Development Institute and a property owner at Emerald Isle, funding was secured through the Economic Development Administration. Loans and grants which totaled \$468,000 were provided by the EDA. No other public agencies on the county, state or federal level were involved in the funding decision. With this money, the Bogue Banks Water Association was formed, and was providing water to 400 households by late in 1969.

Two new wells and many additional miles of water lines have been added to the system since 1969. When a developer opens a new site, he installs the necessary water lines and then deeds them to the Association. New wells are added as demand dictates, funded with Farmers Home Administration low interest loans. The Association has no formal plans for growth, but expands on an ad hoc basis to satisfy the water needs of a growing community.

Perception of the impacts of the water system.--Everyone interviewed felt that the system has been a blessing to the area and that the growth it has encouraged is good. Tom Willis maintains that the water system has had the greatest beneficial impact of any EDA project in the nation. He credits it with providing many jobs and enlarging the community's tax base.

Only Robert Quinn, Assistant Director of the Neuse River COG, believed that there were some environmental problems associated with the water system. He

felt that dense building practices allowed by the system were causing septic tank failures and pollution of wells and groundwater. Other respondents passed off any linkage between the water system and polluted groundwater by saying that since the Association had formed, everyone was getting clean water.

Because of the resort character of the community, no one felt that the increased growth allowed by the water system was causing any social problems. They also believed that the continued high economic status of area citizens would keep future problems to a minimum.

All agreed that the water system had increased property values and housing starts. They perceived no impact on farmers, since there are no such operations on the island. The respondents hoped that past development trends could be maintained, because they felt continued growth was good for the local economy.

Summary and discussion.--Emerald Isle was on the verge of a land development boom in 1969 when the Bogue Banks Water Association was formed. Without the system, septic tank pollution of groundwater supplies would have placed severe constraints on the area's growth potential. With the help of an EDA grant and loan, local business leaders were successful in forming a private water system which is allowing heavy development to occur. The same development interests are still intimately involved in the operational aspects of the system, and continue to insure that adequate clean water is available to fulfill the community's growth aspirations.

The Dan River Water System

The Dan River Water System was formed in 1967 as a nonprofit water company established to serve residents in rural Rockingham County, which is located in north central North Carolina. The system presently has 1,900 customers, and has not expanded substantially since its organization.

Rockingham County grew rapidly (16 percent) in the last decade. Factors contributing to growth include: the location of new industry, particularly a new Miller Beer brewing plant in Eden; the opening of Highway 14; the gradual growth of a community college; and the location of the county between the industrial complexes of the Piedmont Crescent and the Roanoke Valley.

Growth was considered by all respondents to be beneficial for the county. There are expectations of some problems in meeting the demand for new services, in particular the demand for adequate water and sewer service. However, the advantages of development--particularly county industrial diversification away from dependence upon the textile industry, an increase in the present low wage structure, and the growth in county revenue--outweigh any drawbacks associated with potential problems in the view of the officials interviewed.

Concern was expressed over the absence of a county planning office. The county does not have the planning tools or regulations needed to guide and direct the rapid growth that is taking place. Presently, the county provides few public services and operates under a conservative budget. No major change in the level of service provision is anticipated as the population increases.

There was a divergence of opinion as to how long the county could avoid the issue of public sewerage service as rural residential density increased. There are presently no plans or proposals to install a system. Some of the respondents expressed no alarm, believing that septic tanks will be adequate for the growth in the foreseeable future. Others, however, pointed out that there have already been many reports of septic tank failures and associated health hazards, and that the problem is bound to intensify.

The attempt to expand the system.--Organization of the water system in 1967 occurred in response to a citizen petition for high quality water that was presented to the Farmers Home Administration. Convenience and water quality were cited as the reasons for wanting to change from reliance on individual wells.

Acting under its federal mandate to promote rural development, FmHA arranged a loan.

In 1978, Dan River Water conducted a feasibility study and submitted a proposal to the FmHA for an additional \$4.2 million loan to double the size of the system. This request was prompted by petitions from rural residents in Rockingham County and surrounding areas requesting extension. The petition reflected concern over the quality of the available rural water supply. An engineering analysis was favorable, and the association expected FmHA approval of the loan after regional and state review.

The proposal was approved by the North Carolina State A-95 Clearinghouse in Raleigh. However, officials of the Piedmont Triad Council of Governments (PTCOG) who reviewed the design and location proposal felt that the water line installation would encourage rural sprawl, which was contrary to policies espoused in the adopted regional growth plan. Therefore, the PTCOG passed a negative comment. The municipalities of Reidsville, Myodan, and Madison, which had originally offered no opposition to the proposal, also returned negative comments. The state subsequently withdrew its approval after receiving the PTCOG opinion. The FmHA withheld funding until regional differences could be resolved. After several public meetings in which no resolution could be reached, Dan River Water formally withdrew its proposal in November, 1978.

Perceptions of possible impacts of the proposed expansion.--The likely impacts of the proposed water system extension were viewed very differently by the different groups which would be affected by it. The officials of Dan River Water and Rockingham County, as representatives of the petitioners, viewed the expansion as positive, because of the advantages and convenience of dependable water. The county respondents felt that the existence of a public water supply was a factor, but probably a minor one, in determining residential location,

since households would no longer have to worry about the contamination of well water. There was no strong perception that property values would increase rapidly in areas serviced by public water. There was no indication of problems arising from increased public service demands from increased density. No strong connection was made between the decision to invest in water lines and the eventual necessity for a sewerage system. County problems were generally considered to be uninfluenced by water provision. The attitude of county officials seemed to be that the responsibility of county government was to respond to problems as they occur.

The PTCOG officials, however, were concerned about the consequences of increasing rural residential density and the use of septic tank systems with the clay soils of the region. The placement of the water line was seen as a major determinant of residential location because of the differential between the large expense of digging a well (approximately \$1,500) and the relatively small cost of a public water line tap-on (approximately \$300). They feared that if the county continued to wait for problems to arise before formulating appropriate policies and services, it would find itself with a sewage disposal problem and therefore would be forced to finance an unplanned for public sewer system in the near future.

In its negative review, both the circumvention of regional growth objectives and the probable future requirements of an expensive regional sewage treatment system were cited as reasons for opposition to the Dan River proposal. The major objection of the PTCOG was that induced impacts from the water line installation had not been carefully considered.

Summary.--The Dan River proposal has been formally withdrawn, with no immediate plans for resubmission. The heart of the controversy lies in the perceptions of expected secondary impacts of a rural water system. The

responsibility for coping with the impacts will not lie with the water association. There is general agreement among the municipalities that the rural residents should be served, but until these arrangements are worked out, the issue is stalemated.

The Neuse River Water Association

The Neuse River Water Association is located east of New Bern, North Carolina, along the old Morehead City Highway. Its service area is comprised mostly of middle- to moderately low-income households and some locally oriented retail establishments. When the system began operation in 1974, it served 494 dwelling units and 16 businesses. It now provides water to an additional 300 residential customers and 19 commercial activities.

Water quality has long been a problem in the area served by the water system. Shallow groundwater supplies are of poor chemical quality and require treatment that costs each household an average of \$20 a month. In addition to poor natural water quality, septic tank failures in areas of dense development have led to bacterial contamination, compounding the problem of obtaining water that is safe and good tasting.

Decision to establish the system.--Individual drinking water supplies were becoming increasingly expensive and difficult to secure in 1971. Faced with this situation, citizens of the area called a community meeting to discuss the feasibility of a local water system. With the help of the Farmers Home Administration (FmHA), a proposal was drawn up by which water would be bought from the City of New Bern and distributed through water lines belonging to a private water association.

After the Craven County Health Department, the City of New Bern, and the Neuse River Council of Governments expressed support for the system, FmHA agreed to provide a \$150,000 grant and \$583,000 loan for its construction providing

500 users could be signed up. This task was completed by 1973 and construction began immediately. Water was flowing to the community by May of 1974.

Planning.--Although a Multi-County Regional Water Supply Plan, funded by the FmHA, was never prepared for the Neuse River COG region, a comprehensive Water and Sewer Planning Study for Craven County was made in 1969 and formed the basis for the new water system. The study primarily addressed itself to financial feasibility of water and sewer, as separate systems serving independent service areas.

Perceived impacts of the water system.--Everyone interviewed thought that the water system had been beneficial for the community, and there seemed to be consensus that it was a major factor in locational decisions for new homes, since the water system eliminated the problem of poor drinking water quality which had been acting as a constraint on the development of the area served.

The respondents thought that there had been slight increases in public service demands since the system began operation. They perceived few problems in meeting increased needs, with the major exception of adequate sewage treatment. All thought that the area needed a community sewer system, but were unsure how funding would be arranged to build one.

No one detected any major changes, since 1974, in environmental and economic conditions as a result of the new water system. Most of those interviewed thought that increased growth would benefit the economy and would do little environmental harm. All respondents thought that property values in the area had risen as a result of the water system, but they did not think that these increases had affected the few operations within the boundaries of the water system.

Summary.--The Neuse River Water Association is supplying clean water to an area that has historically been plagued by foul and unsafe supplies. The availability of a water distribution system has allowed additional growth to occur,

making the problem of sewage disposal more severe and a greater environmental hazard. Continued growth in the area is highly dependent on the provision of community sewerage, a need that is recognized but not currently addressed.

The Oak Hill Water System Corporation

The Oak Hill Water System Corporation is a private, nonprofit system serving the rural residents outside the city of Morganton, which is located in western Burke County, North Carolina. When first formed in 1963, it served 450 customers. Currently there are 1,200 residential customers on the system. Most of the residential growth in the unincorporated area is the result of the expansion of Morganton. The county as a whole is growing rapidly (30 percent in the last decade) largely because of new industry which is attracted to the area. The economy of the county is based on the textile industry and the tourists who are attracted to the Blue Ridge Mountains surrounding Morganton. The Blue Ridge Parkway, a major Eastern tourist attraction, runs in close proximity to the area.

Public officials had positive attitudes toward the growth of their county. The major benefit attributed to growth was the opportunity to increase the regional wage structure, which has been characterized by the low level typical of nonunionized textile mills. Industrial development was also expected to bring new job opportunities to county citizens. Other positive remarks reflected the expectations that development would bring in new county revenue to meet local service needs; would encourage new residential building to replace poor housing; would help solve some problems of inadequate fire protection; and would bring to light deficiencies in water and sewer service and the lack of controls that are needed to keep indiscriminate development from spoiling the native terrain.

Some negative impacts of development were anticipated. There was concern that many existing problems of social service delivery would be intensified. Some environmental problems, especially the shortage and pollution of ground water, increased erosion, and the loss of natural areas were cited as possible costs of growth to the rural community. Other problems, such as more difficulties with garbage collection, traffic congestion, septic tank failures, and a strain on the educational system were also listed as probable impacts of growth.

Although agriculture is not a major sector of the Burke County economy, farmers may be hurt by development which stimulates increases in property values and demand for developable land. A county official described the situation as one in which, because of the mountainous geography, there is no "marginal" farmland in the county. It is either good for both farming and development, or for neither because of the steep terrain. Therefore, development hurts farm operations because developable land is synonymous with farmland.

The county director of community development summed up his attitude toward the growth trend in his county, "It is too early to say if, on net, rural development is beneficial. There are too many 'ifs'--if growth can fill the voids, it will be good. If poorly planned it could intensify all the problems."

Decisions to extend the system.--Because of its status as a private corporation, all extension decisions are based strictly on financial criteria. The water system is not operating under a public financing scheme and has no funds in its budget to finance water extensions. Therefore, all expansion costs must be covered by the parties requesting the extension. The economic feasibility of each line extension is determined by the private market forces guiding the decisions of the individuals purchasing the extension. If engineering specifications and North Carolina health criteria are met, Oak Hill will service the new lines. Because no public funds whatsoever are involved in

the line expansions, Oak Hill can extend its service region without state or regional evaluation or review beyond basic checks of engineering and public health standards. Because of this, little is known at the county or regional level of the past decisions or future plans of Oak Hill Water, nor of the impact on Burke County development patterns that the water system may have in the future.

This type of decision making concerns some county and regional planners. Because of the decision criteria, water lines which are installed to serve residential areas are of an insufficient size to provide water to future industrial or commercial enterprises which may locate in the unincorporated areas. Because a nonprofit water association has no funds to finance expansion, the location and sizing of the water lines is determined solely as a response to a particular request. Future demands for water which may exceed the capacity of the existing pipes may require new and costly installations. Presently, expansion decisions are made without county comment. Interest has been expressed in forming a county-wide water service system as a means of avoiding situations which require duplicate investments. Furthermore, a public system could provide the county with the ability to use water line placement as a planning tool. A study of available options for consolidating the small county nonprofit water associations is underway in Burke County. Oak Hill Water Corporation, however, is presently not interested in joining such a program even if it is approved for the rest of the county.

Perceptions of impacts of water systems.--Because of the lack of awareness of particular Oak Hill Water System impacts, all respondents except those directly concerned with the operation of the system answered the questionnaire on the basis of knowledge of the many small water associations in the region.

In the area of the Oak Hill System, the impacts were considered to be minor and localized. The two most recent extensions have been made primarily

to service individual subdivision developments. The property crossed by the new lines has been involved in an increase in property sales, and new residences are expected to locate on lots served by the system. There was no strong perception that property values rose dramatically following the installation of water lines, however. Although the increased density facilitated by the water system may result in increasing septic tank failures, there is no plan at present for a rural public sewer system. Except for sewer service, no strong increase of demand for public services was attributed to the water system.

County and regional officials tended to feel more strongly that residential location is affected by water line decisions. Although the adequacy of the groundwater in rural Burke County keeps the availability of public water from being a major determinant of residential location, the convenience and health factors act as incentives to encourage development in serviced areas. Property values and rates of property turnover were perceived as increasing somewhat faster.

The Newton Municipal Water System

The City of Newton is located about forty-five miles northwest of Charlotte and approximately eleven miles southeast of Hickory in the north central portion of Catawba County in North Carolina.

Until 1972 Catawba County extended water service on request to unincorporated areas of the county if the revenue generated within five years would be sufficient to cover the cost of providing the service. In 1972, the county began installing a water system to serve the rapidly growing area between Hickory and Newton. Shortly after committing itself to provide water and sewer service to a new Sheraton Motor Inn, negotiations to buy water from Hickory fell through. In order to meet its commitments, the county drilled its own wells

and installed a small package sewage treatment plant.

In 1974, newly elected members of the Board of County Commissioners persuaded the board to abandon its prior intentions of providing county water and sewer services, which they considered municipal functions. The county also thought that the proposed service area was too sparsely populated so that it would be too costly to provide service. Consequently, the board divided the system among the appropriate municipalities and established a Water Advisory Commission to address the issue of water needs in unincorporated areas. In 1974, the Water Advisory Commission recommended five water projects that would serve (1) rapidly growing areas, (2) areas with health problems, and (3) to interconnect the municipal water systems of Hickory, Newton, Conover, and Maiden.

Catawba County entered into agreements with each of the municipalities and created joint water construction funds to finance new water lines in the unincorporated areas surrounding each municipality. Once constructed, the water lines would be turned over to the respective city for maintenance and operation. This case study looks specifically at water service extensions funded by the Newton/Catawba Joint Water Construction Fund.

The decision to expand the system.--The Newton water system serves approximately 2,800 customers, of which 130 are located outside the city limits. Since the Joint Water Construction Fund between Newton and Catawba County was established in 1976, only one project, along Highway 16, has been constructed that would add new residential and commercial customers. A new water line has been installed between Newton and Maiden, but its primary purpose is to interconnect the two systems rather than add new customers. The water line along Highway 16 consists of slightly less than three miles of twelve-inch line, installed at a total cost of \$240,000. Ultimately the water line is expected to serve 40 residential and 10 commercial customers. Completed in 1978, the

extension currently serves four customers. One respondent thought that the city had intended to build a line that would loop back around into the city, but that the project had been scaled down to match the funds available in the joint construction fund.

Respondents were unable to agree on whether Catawba County or the City of Newton actually initiated the project. Most county officials interviewed thought that the county had gone along with the "city's proposal" because it was one of the first projects to be constructed under the joint construction fund, and the county was eager to cooperate with the city. Respondents from the city suggested that the county had initiated the project and that the county had analyzed and approved the cost effectiveness of the project.

Planning.--The five major water projects recommended in 1974 by the Water Advisory Commission are part of the plan Water Resource Management: Multi-County Regional Water Supply Systems Plan for Region E, prepared in 1976 through a comprehensive planning grant from FmHA. All five major projects appear to be completed or near completion. The expansion along Highway 16 was not covered by the Multi-County Plan. No financial or other feasibility review of the expansion is evident. The Western Piedmont COG, in its clearinghouse role, approved the expansion, but review appears to have been routine.

Perceptions of impacts.--The water line has not been in the ground long enough for impacts to become apparent. Respondents differed on whether or not there were water quality or quantity problems prior to construction. The city says that problems were widespread. County officials say that there were few if any problems. All respondents, however, agree that sewerage is not an issue in the area, due to low density and adequately operating septic tanks.

The primary issues in the county currently revolve around the continuation and legality of the joint water construction funds. At dispute is whether or

not the county should be building facilities with county-wide revenues and then turning the facilities over to a municipality. Larger cities are seen to benefit disproportionately because their construction funds receive larger contributions from the county (each city has its own fund and county contributions are made on a per-capita basis). County officials would prefer that water and sewer service be used to shape and guide growth, and that the county have a greater voice in determining how those tools should be used.

The Davie County Water System

Davie County is located in the Piedmont of North Carolina, approximately 15 miles west of Winston-Salem. Interstate Highway I-40 diagonally bisects the county from northeast to southwest. The eastern portion of the county is growing the fastest and is rapidly turning into a bedroom community for Winston-Salem. County officials estimate that the county has grown 18 percent since 1970. Although there are differing opinions about whether the next decade will produce the same growth rate or a slightly moderated rate of growth, there is solid agreement among those interviewed as to the causes of growth:

- (1) Lower tax rate in Davie County, compared to Forsyth County.
- (2) Proximity to Winston-Salem is filling the eastern area of Davie County with commuters.
- (3) A good school system, free from busing problems experienced by Forsyth County.
- (4) Industrial growth including two establishments, R. J. Reynolds and RCA.

If the rate of growth does decline, it will be substantially due to the need for sewerage in the unincorporated areas. A 201 study is currently considering the feasibility of a county-wide sewerage system.

The water system is a county-wide system serving approximately 80 percent of the county. Currently, this amounts to 2,900 customers (household connections). The system was patterned after the rural water systems of Davidson and

Forsyth counties that provide extensive rural water service.

Decision to establish the system.--The Davie County Water System has its origins in the Burlington Industries plant located in Cooleemee, an unincorporated community in Davie County. Burlington closed its fabric dying operations and offered its water and sewer treatment systems to the county. The county subsequently (in 1973) initiated a feasibility study of providing water service on a county-wide basis. Meanwhile, Burlington turned the systems over to Cooleemee. The water system served 400 customers in Cooleemee until the county took over operation in 1977. At about the same time that Burlington was considering the disposition of its water system, rural citizens were experiencing severe water pollution problems from failing septic tanks. Often, they had to boil their water before use. Citizens got together and explored the possibility of forming nonprofit cooperative water associations, but concluded that it would be less expensive if the county ran the system, because local government agencies are eligible for grants under the Clean Water Bond Act of 1971. These citizen groups petitioned the county commissioners to provide water service in unincorporated areas.

The primary factors leading to the formation of the water system were health and finance related. A feasibility study for the county-wide distribution system concluded that 90 percent of the 3,600 potential customers living along proposed water lines could be signed up within three years, and that total cost of the system would slightly exceed \$5.1 million. After subtracting a \$1.2 million grant from state Clean Water Bond funds, the remaining \$3.86 million would be obtained through a loan from the Farmers Home Administration. The cost per customer was \$1,190 and just exceeded the \$1,000/customer criterion that FmHA has at times used as a general feasibility criterion. If only the actual number of customers that signed up for service is considered (2,600

customers), then the cost per customer clearly exceeds the feasibility criterion of \$1,000 per customer (by \$485 per customer). However, the county decided to go ahead with the system for two reasons:

- (1) Predicted residential subscriptions after three years seemed sufficient to make the system self-sustaining.
- (2) Anticipated industrial and manufacturing growth, that would occur because of the availability of water service, would generate property tax revenue sufficient to cover the short fall in water revenues. County officials suggest the new R. J. Reynolds tobacco stemmery and the new RCA plant as examples of such growth.

The water system is just completing its first full fiscal year of operation, during which time approximately 300 customers have been added to the original 2,600 customers. Revenues just cover operating and maintenance costs (FmHA allows debt service payment to be deferred during the first year).

Planning.--Most planning was devoted to project planning or assessing financial feasibility of the project. There were no regional plans or documents that addressed the provision of water service or capital improvement phasing. The project received a positive review from Region G Council of Governments. Land classification plans have been implemented by a county-wide zoning ordinance. The zoning ordinance post-dates the water system; it generally reflects the existing pattern of water system and residential development.

Perceived impacts of the water system.--Responses indicate that the availability of water service is a factor in the location of new homes, and possibly a major factor. Approximately 300 new homes have hooked on to the system during 1978. The availability of a water distribution system has been cited as a major factor in the location of new homes for the following reasons:

- (1) Individual, on-site wells are costly, between \$800 and \$2,000, with an average cost of \$1,000. The current hookup rate is \$260 per household connection.

- (2) Availability of good quality water in adequate supply is guaranteed. Expenditure of \$1,000 may only produce a dry well.

There is general agreement that property values in the vicinity of water distribution lines have increased somewhat faster than the value of property elsewhere. But, rising property values do not appear to have created problems for farmers, because farmland is exempt from full land value taxation, if the farmer so desires. Expansion of farms is slightly more difficult given the higher land values, but it is also easier for farmers to sell farmland that is marginal.

Respondents were unable to indicate whether the provision of water service had any unique effect on the demand for various government services, such as police protection, fire protection, or schools because demand is increasing across the entire county.

Sewerage is needed now in many areas of the county. The problem will become most critical in areas most heavily developed. Because residential development is concentrating in the eastern portion of the county, some respondents anticipate that densities of development will be sufficient to financially support a sewerage collection system. The primary problem in the eastern area seems to be that it is in a drainage basin separate from the rest of the county, so that unless a cooperative agreement was arranged with Forsyth County, a separate treatment plant might be required to serve the area.

There are differing perceptions on whether or not new rural growth pays its own way. Those closest to the day-to-day financial operations of the county indicate that new residential development does not provide enough tax revenues to support all services. The revenues just cover average per-child education costs. Industrial growth, on the other hand, provides a revenue surplus. One of the county's goals is to achieve a mix of residential and

industrial growth in order to balance revenue requirements.

The Union County Water System

The Union County Water System serves the town of Monroe as well as surrounding rural unincorporated areas in the southern Piedmont of North Carolina. Union County assumed the responsibility of providing water service for its residents in 1975. State and federal funds were secured to purchase a local nonprofit water association, the Sun Valley system, and to extend lines to the north, east, west, and south of Monroe. This represented Phase I of the county's water provision plan. Presently more extensions are under construction. The Union County Water System services the original 1,500 Sun Valley customers, and has since expanded to serve 2,800, 90 percent of whom are residential customers. Union County public works officials expect that the system will expand even more in coming years.

Union County is located adjacent to Mecklenburg County within the Charlotte SMSA. The western portion of Union County is under strong growth pressures from the expansion of Charlotte. The county is attractive as a rural residential area which is convenient to a major employment center. Industry has also been attracted to other parts of the county. This combination of factors has resulted in rapid growth patterns for the county as a whole, reflected in a 31 percent population increase between 1965 and 1975. The economy of Union County has traditionally been based on agriculture. The rise of agri-business also has been important for the county's economy.

Interviews with Union County officials indicate that, in general, development is viewed in a positive light. In particular, residents have been pleased with the growth trend because of new industrial diversification, increased wages and increased county revenues. Expectations were high that new development would provide tax revenues needed for improved county services, such as

expansion of the water system, formation of a sewerage system, and improvements in the fire service and recreational programs.

For the short term, however, concern was voiced that the county could not respond quickly enough to rising demands for many social services. In particular, the educational system may have problems because some of the schools are already at capacity levels. Officials are also well aware that the clay soils of the region are inherently poor for septic systems. As development increases in areas of the county lacking sewerage, the capacity of the soil will be strained, causing more septic system failures.

Officials of the county express confidence in the ability of the various public offices to work in coordination with each other to solve problems related to growth. The county presently has development controls in effect, including subdivision regulations and zoning safeguards.

The decision to establish and expand the system.--The county assumed the responsibility for water provision in response to water quality problems. Rural Union County has many highly populated pockets of development, and was experiencing problems with polluted and poisoned wells and the hazards of contaminated groundwater. Petitions requesting that the county assume responsibility for water service were submitted to the county commissioners. These led to a feasibility analysis and a bond referendum. The results were favorable. Federal and state grants were obtained, and a general obligation bond was issued to raise the \$4.8 million that was needed to purchase the Sun Valley system and to complete the Phase One extensions. A contract was let to install the first set of new county water lines.

Many miles of new water line extensions have been installed to meet the increasing rural demands for high quality water. The Union County water extension policy is based on two criteria. First, the county will undertake

to provide water service only to areas where growth has already occurred, and where interest has been expressed through a public petition. Second, new extensions are to be financed strictly by a user pay scheme, so that those who benefit from the service are responsible for its expense. No county taxes are used in system expansion. Real estate developers must pay the entire cost of extensions to new county subdivisions.

Planning.--The original bond referendum to acquire the water system operation and to finance its expansion was the result of efforts by the Union County Commissioners. The City of Monroe, which now sells water to the county system, was supportive of the system. The Centralina Council of Governments reviewed the formation and expansion proposal and approved the funding scheme. Apparently there was no specific COG review or comment concerning the actual line placement.

State and federal agencies were involved in the review and approval process. The FmHA approved a \$900,000 grant. The state health department reviewed the plans and the North Carolina Division of Health Services and Community Development administered an \$857,000 grant under the Clean Water Bond Act. The State Highway Commission was instrumental in granting easements and rights-of-way for the water lines. The North Carolina state sedimentation pollution control program office also reviewed and approved the proposal. The state and federal assistance, however, was almost entirely financial. The ultimate technical decisions concerning line design and placement were the responsibility of the county public works department, in conjunction with its consulting firm, with informal advice from the county planning office.

Perceived impacts of the water system.--There was agreement among the Union County officials that the installation of water lines has had a positive impact on residential location decisions, but that water service was probably

a minor factor and not a determinant of county development patterns. Since the county has a policy of extending water lines only to existing development, the respondents felt that the water system was responding to growth patterns and not vice versa. One official noted that the western portion of the county, which is growing the most rapidly, is not presently served by public water. Property values in the service area were perceived to have increased only somewhat faster than would have been expected otherwise.

There was no strong perception that public service demands have increased in the proximity of the new water lines. The one public service problem that was of concern to all respondents was the septic systems which are failing and which are expected to fail as residential density increases. The officials felt that public sewerage was needed now to avoid future public health problems. However, there are no present plans to begin work on the design of a sewerage system.

Impacts of Water System Formation and Expansion

These case studies indicate that the provision of water service is but one element among many factors that contribute to growth. Isolating the specific impacts resulting from water service extensions is extremely difficult, but our interviews disclosed a number of noteworthy perceptions by public officials and water system managers. These are summarized in Figure 7.

Water system extensions seemed to be a major factor contributing to residential growth in the vicinity of new water lines in areas where water quality or water availability became a constraint on growth. Bogue Banks and the areas served by the Neuse River Water Association are examples of polluted groundwater inhibited new growth. The availability of water service nearby was also considered to be a major factor contributing to residential growth when the cost to the homeowner of hooking on to the water system was substantially below

FIGURE 7

SUMMARY OF WATER SYSTEM IMPACTS

IMPACTS	Bogue Banks Water Association	Dan River Water Incorporated	Neuse River Water Association	Oak Hill Water Corporation	Newton Municipal Water System	Davie County Water System	Union County Water System
Residential Growth. Water system was: <ul style="list-style-type: none"> • Major factor • Minor factor • No effect 	<u>Major factor.</u> Septic tanks failed. Groundwater polluted.	<u>Major factor.</u> Mostly in-fill development.	<u>Major factor.</u> Poor groundwater.	<u>Major factor.</u> Building permit activity is linked to water extensions.	<u>No effect.</u>	<u>Major factor.</u> Less expensive than drilling a well.	<u>Minor factor.</u> "Water follows growth, and not vice versa."
Property values increased: <ul style="list-style-type: none"> • Markedly faster • Somewhat faster • No effect 	<u>Somewhat faster.</u> Property sales have increased.	<u>Somewhat faster.</u>	<u>Somewhat faster.</u>	<u>Somewhat faster.</u> Property sales increased near water lines.	<u>No effect.</u>	<u>Somewhat faster.</u>	<u>Somewhat faster.</u>
Impact of land appreciation on farmers: <ul style="list-style-type: none"> • Harmful • Beneficial • No effect 	<u>No effect.</u> No agriculture in local economy.	<u>Harmful to few remaining farmers.</u> Development is more profitable.	<u>No effect.</u> Very little agriculture.	<u>Harmful to few remaining farmers.</u> Farmland is only developable land.	<u>No effect.</u>	<u>Beneficial.</u> "Farmland is exempted from full taxation. Enjoys high sales value."	<u>Beneficial.</u> Not an issue in county.
Conflicts between new homeowners and farmers? <ul style="list-style-type: none"> • Yes • No 	<u>No.</u>	<u>No.</u>	<u>No.</u>	<u>No.</u>	<u>No.</u>	<u>Yes.</u> Some complaints about farm operations.	<u>No.</u>
Demand for public services in vicinity of new water lines has increased. <ul style="list-style-type: none"> • Yes • No 	<u>No.</u> Demand has increased as part of a general trend in county.	<u>No.</u> Demand has increased with population increase in county.	<u>Yes.</u> Demand has slightly increased.	<u>Yes.</u> Demand for building inspection and fire will increase markedly, others only slightly.	<u>No.</u>	<u>No.</u> Demand has increased all across county.	<u>No.</u> Demand has not unusually increased in vicinity of new water lines.

FIGURE 7 - continued

IMPACTS	Bogue Banks Water Association	Dan River Water Incorporated	Neuse River Water Association	Oak Hill Water Corporation	Newton Municipal Water System	Davie County Water System	Union County Water System
Need for sewerage in vicinity of water lines • Yes • No	<u>Yes.</u> Needed now throughout community.	<u>Yes.</u> Needed now throughout community. Development has preceeded sewerage, some areas now too costly to sewer.	<u>Yes.</u> Needed now.	<u>Yes.</u> Will be needed in 5 years, if not now.	<u>No.</u> Not in foreseeable future. Settlement density is low.	<u>Yes.</u> Needed in many areas of county.	<u>Yes.</u> Needed especially in areas of increasing density.

the cost of drilling and installing a well. The higher cost of drilling and installation becomes especially significant when one considers that the cost of drilling does not guarantee a well that produces water, nor does the cost of installation insure a continuing supply of unpolluted groundwater. Finally, in virtually every case study, the availability of water service was perceived to increase property values at least somewhat faster than property without water service.

The effect of water system expansion on agriculture seemed to be negligible, owing to the generally low level of farming activity in the communities chosen for study. In areas where development pressures are high, such as Rockingham County (served by the Dan River Water, Inc.), or in areas where land geographically suitable for development is scarce, such as Burke County (partially served by Oak Hill Water System), the provision of water service facilitates the development process and thereby helps to increase the pressure to develop remaining farmland. One critical view of the development process argues that an indiscriminate development process tends to carve up farmland thereby reducing the size of farmable parcels. It also holds that indiscriminate extensions of water service into and through agricultural areas will tend to increase the pressure for conversion of farmland to more profitable uses.

It was difficult to isolate the impact of water service extensions on demand for public services, such as police, fire, and education. In at least four case studies, respondents thought that demand for such services was increasing throughout their county and that the increase could not be attributed to the recent water system extension or formation. This inability to separate the impact of water system extensions from general growth trends is not very important with respect to the provision of police, fire, solid waste disposal,

and education services. Fire protection is provided by volunteer departments and therefore costs the county very little. Police services are provided by sheriff's departments, and the level of demand seems to not yet have reached urban demand levels. Solid waste collection is provided by private firms on a franchise basis--at no cost to the counties. The cost of education is not location specific, because funds are collected county-wide and then redistributed to the various school districts. Social services and recreational services are sometimes provided with Community Development Block Grant funds (Davie County). Consequently, until residential densities approach urban levels, settlement patterns do not seem to affect the public cost of providing services.

On the other hand, the public cost of providing sewerage is highly variable depending on the density of development. In nearly all of the cases studied septic tanks are failing and sanitary sewers are needed now. Although the need for sewers is greatest in densely settled areas, areas that could effectively support the cost of sewers, other areas have been developed that will be too costly to sewer. Several counties are currently studying sewerage options as part of Section 201 wastewater disposal studies. Such programs do not provide grant assistance for street collector systems, however. None of the counties studied had a current plan for funding and providing sewerage to areas that now need service.

Based on these results it is difficult to itemize the specific growth inducing effects of rural water systems. We can conclude that the availability of water service qualitatively enhances the development potential of land. The provision of water service eases the way for development both within the service areas of water suppliers and at the fringes of service areas. The provision of water service generally follows the pattern of market pressure for residential development. However, its presence also opens up adjacent land to water extensions and concomitant development. How far away can the

benefits of water service availability be felt? What will be the resulting residential densities? Can these densities support subsequent costs of providing such services as sanitary sewerage? At present these questions are not only being ignored when major expansions of water supply are being planned, but more importantly they are not being asked as a natural part of the development review process.

Whether or not a county aggressively shapes and influences growth patterns in its area seems to be more a function of the severity of growth related problems and whether or not the citizenry has resolved to anticipate problems, rather than react to them. Given the positive perception of benefits associated with residential growth, and with industrial growth, and given the general lack of critical assessment of costs, there is not much to stimulate reassessment of the development process, let alone reassessment of water extension policy. One hopes, however, that the strong Southern tradition of local control will encourage communities to look at themselves and actively take a hand in shaping their future community. In terms of development, this means taking pride in anticipating and avoiding development problems.

V. CONCLUSIONS AND NEXT STEPS

This exploratory study has addressed a number of issues related to the formation and expansion of rural water systems in North Carolina. In this concluding section, we summarize the principal findings of our investigation to date, and suggest several steps that could be taken to insure that decisions regarding rural water systems are based on a full consideration of potential impacts.

Recent surveys of North Carolina citizens reveal widespread recognition of the unique problems of rural areas of the state, but a continuing, strong preference for rural rather than urban residence. When asked what strategies the state should pursue to promote more jobs and an improved economy, North Carolinians are much more likely to cite the need for economic growth near small towns and in rural areas than continued growth near large cities. The attitudes of officials interviewed during the course of this study parallel those of the general population. Public officials perceive a number of benefits from rural growth, including a more stable, diversified economy, increased personal income and expanded job opportunities, an enlarged revenue base, and the enhancement of social and cultural opportunities for rural citizens.

In spite of this positive orientation toward growth, concern about the potential adverse consequences of unguided rural development has begun to surface. For example, in 1978 the Rural Land Use Planning Committee noted, "The rapid rise of the rural nonfarm population has created vast acreage of low density sprawl across North Carolina. Rural sprawl is a major contributor to rural land use problems."⁵¹ In recommending a negative A-95 review of a

⁵¹ Rural Land Use Planning Committee, 1978, p. 1.

proposed rural water system, the staff of the Piedmont Triad Council of Governments commented, "This project would make it impossible to concentrate and encourage significant new growth in and near existing urban areas where urban services already exist. Furthermore, plans for the project do not address the comprehensive planning relationships needed to coordinate such elements as sewer, solid waste collection, transportation and police and fire protection in the growth-induced rural areas which would be fostered by this project."⁵² These statements reflect beliefs that (1) rural water systems affect the distribution of the population in rural areas, promoting a sprawling pattern of development, and (2) that sprawl creates a number of environmental and service problems. Both contentions were investigated in this study.

Do Rural Water Systems Affect the Pattern of Rural Development?

Review of previous research across the United States and interviews with a variety of persons associated with rural water systems in North Carolina indicate that water system investments, while not the major factor accounting for rural development, can affect the location of new growth outside of built-up areas. The impact of rural water systems on the location of growth appears to be amplified when the quality and quantity of groundwater is poor or uncertain and when the cost differential between hook-up to a water system and drilling a well is substantial. Reflecting the enhanced development potential, land values near rural water systems tend to be growing somewhat faster than values in areas that lack water service. Nevertheless, while the installation of rural water systems seems to be associated with increasing development and escalating land values, it should be stressed that effects noted to this time

⁵² Piedmont Triad Council of Governments, "A-95 #78-0591, Review of Dan River Water, Inc. Proposal for Water System Improvements," December 14, 1977.

are not large and can not be precisely defined. The availability of a water system is but one of a number of factors influencing the location of new development in rural areas.

What Consequences Have Resulted from Growth Induced
by Water System Investments?

Previous research has produced conflicting evidence about the consequences of rural development patterns. Some studies suggest that rural sprawl inhibits agricultural production, degrades the environment, and produces inefficiencies that increase both the personal costs of households and the public service costs of local government. Other research, however, suggests that adverse impacts of sprawl may not be severe as long as densities remain low and expensive urban services are neither demanded nor required. In the areas served by the water systems studied in this research, the need for sewerage service was the only major adverse impact observed. However, a strong cause and effect relationship could not be established. Often water systems were formed or water service was extended because of contamination of the groundwater supply by failing septic tanks. While installation of water systems may have aggravated preexisting problems, by allowing densities to increase even further, the impact on the need for sewerage has probably been one of timing rather than degree. Most of the areas served by the rural water systems studied would eventually have required public sewerage; installation of rural water systems hastened the need for investment in sewerage, but did not create it. Whether the costs of providing sewerage will be greater or less because of growth induced by the installation of a rural water system could not be ascertained by the research conducted to this time, but will depend on the eventual density of development that takes place and the configuration of land uses in specific areas.

Other adverse impacts that may accompany growth induced by rural water systems were not pronounced in the seven cases that were studied. Agricultural activity in the areas studied was negligible; therefore, few public officials felt that farmers had been harmed, either by escalating property values that made the expansion of agricultural operations more expensive or by conflicts with adjacent nonagricultural land uses. Although public officials felt that the demand and need for a variety of public services--police and fire protection, refuse collection and disposal, schools, and recreation--was increasing in rural areas of their jurisdictions, differences in demand between areas served and not served by a water system were slight. Thus, adverse impacts associated with the formation and extension of rural water systems appear to be limited to the earlier need for public sewerage; other impacts may become apparent over time, but as of the present they have not become serious enough to be perceived by local government officials.

Are Secondary Effects Being Considered in Water System Formation and Extension Decisions?

Review of the literature, discussions with a variety of knowledgeable persons associated with the development of rural water systems, and the seven case studies conducted for this research all indicate that secondary effects are not often considered in decisions to form or extend rural water systems. Rural water systems tend to be established and service tends to be expanded to achieve one or more of three major objectives: (1) stimulation of rural growth and development; (2) provision of safe, healthful water supply; and (3) consolidation of existing small community water systems or foreclosure of the need for such systems. In evaluating water systems proposed to achieve these objectives, criteria used by decision makers tend to be limited to financial considerations. Can service be provided less expensively than by on-site,

individual water systems? Are the number of current and potential customers adequate to meet operating, maintenance, and debt-service costs? Will another party, such as a subdivision developer, absorb the costs involved in service extension? Decision criteria being used rarely include factors related to capital improvement budgeting and planning or long-term costs to communities of providing sewerage and other public services to growth that occurs along the water lines.

Although we expected that public agencies would be more likely to take secondary effects, such as future public service costs, into account when making decisions about rural water service than private agencies, such as non-profit water associations, we found no difference. Either public officials feel that water systems have little effect on growth patterns or they are not concerned with potential problems associated with rural growth. Our research indicates that the latter factor is key: public officials perceive present benefits associated with growth and discount heavily future problems that may result from their actions.

How Can Water System Decision Making and Project Review Procedures Be Strengthened?

Two aspects of water system planning and development need attention in rural North Carolina to avoid unnecessary problems in the future. First, local needs, goals and objectives regarding the location and timing of growth and provision of services to new development should be carefully considered and analyzed. Second, the evaluative criteria and process involved in planning and reviewing major public investments, including rural water systems, should be strengthened.

At present there is no set of plans dealing specifically with rural population growth issues in North Carolina. The councils of government have adopted

a land classification system which defines areas as developed, transition, community, conservation, or rural. The rural category, however, tends to be poorly defined and is treated as a catchall after the other areas are delineated.

The ambiguous definition, therefore, means that there are many "shades" of rural classification. The issue is further clouded by the official council of government interpretation of rural areas as being land which will not be serviced by sewer and water. This appears to be in conflict with official federal and state policies, and often local sentiment, which encourage rural growth and development. A clear expression of community growth objectives on a local level with goals stated as explicitly as possible helps to guarantee that issues are brought into the open. This clears the path for consideration of a variety of future scenarios and gives citizens an opportunity to express their preferences for development. It also allows public officials to give consideration to the capacity of all public facilities and to plan for coordination of their distribution as growth brings increases in demand.

What seems most lacking in rural planning is an effective evaluative procedure. Although it is true that federal and state funds cannot be used to finance projects which conflict with regional land use plans, the lack of specific criteria makes the judgment process an ambiguous one. Development proposals are too often judged on an ad hoc basis, which does not ensure consistency and fairness from one proposal to the next. Water resource projects can have profound effects on the future of a region. At present procedures for projecting effects of public investments and the criteria for judging the total impact and attractiveness of water resource investments are poorly developed.

County land classification planning provides a mechanism for encouraging more rational consideration of rural water system investments in terms of locally defined development objectives and public service policies. The Land Policy

Act of 1974 directed the North Carolina Land Policy Council to prepare a state land policy, develop a land classification system, and to make other recommendations to encourage the "wise and balanced use of the state's resources." In its report, A Land Resources Policy for North Carolina, issued in late 1976, the Land Policy Council proposed that local governments be required to prepare and adopt land classification plans. The Council went on to suggest a number of uses of local land classification planning, four of which are relevant to rural water system investment decisions:⁵³

- As a statement of local policy consistent with statewide and national needs and goals, the county land classification map will serve as a basic tool for coordinating numerous policies, standards, regulations, and other governmental activities at the local, State, and Federal level.
- The system will provide a guide for making public investments affecting land use. For example, State and local agencies can anticipate the need for early acquisitions of lands and easements for schools, recreation, transportation, and other public facilities.
- The system can provide a useful framework for budgeting and planning for the construction of community facilities such as water systems, sewer systems, schools, and roads. The resources of many Federal, State, and local agencies can then be more efficiently utilized.
- The land classification plans will place local governments in a stronger position vis-a-vis the State and Federal governments because (1) State and Federal governments will use, as a decision guide, what local governments have expressed as their development objectives and desires in the land classification plans, (2) local governments will be in a better position to understand the consequences of locating key facilities . . . within their areas, (3) local jurisdictions will be able to identify where and when they want growth to occur, and where and when they will be prepared to provide the necessary public services

The research reported here highlights the potential utility of land classification planning as a mechanism for strengthening decision making and project review procedures related to the formation and expansion of rural water systems.

⁵³ North Carolina Land Policy Council, A Land Resources Program for North Carolina, Raleigh: The Council, December 1976, p. 4-3.

With such a system in place, local, state, and federal agencies will be in a much better position to consider the secondary effects of public infrastructure investments, since they will have a basis for comparing projected impacts with local goals and objectives regarding the location, timing and provision of services to new growth and development.

While the adoption of a mandatory county land classification planning system would help facilitate consideration of induced growth and secondary impacts in the evaluation of water system projects, it does not address the need for some means of estimating projected impacts. At the present time, we can say that formation and/or extension of rural water lines is likely to encourage some increment of new growth and development in the vicinity of the lines. We are not able, however, to say how much growth will be induced or when it will occur with any degree of accuracy. Even if we could predict patterns of induced development, the public and private costs and benefits of different patterns of development are not well understood. Thus, there seems to be a clear need for continued research to develop and refine procedures to predict the land use and development consequences of public investments, particularly in water and sewerage facilities, and to estimate the costs and benefits associated with varying densities and configurations of rural development in North Carolina.

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APPENDICES

APPENDIX A

COST OF WATER DISTRIBUTION SYSTEM AS A FUNCTION OF SETTLEMENT DENSITY

The cost curve in Figure 3 (page 29 above) evaluates a developer's cost to provide water service within a contemplated residential development. The cost per house to the developer is calculated for on-site wells and for a water distribution system. The curves demonstrate the effect of housing density on the cost of water system installation.

Curve "A" was calculated from the following formula:¹

$$\text{Cost}_A = \text{cost of house connection} + \text{cost of distribution main along the lot frontage}$$

where: Assumed cost of house connection = \$350

$$\begin{array}{l} \text{Cost of distribution} \\ \text{main along lot} \\ \text{frontage} \end{array} = (\text{lot frontage}) \times (\text{unit cost of water main})$$

where: Unit cost of water main assumed at \$5 per linear foot for 6" pvc pipe, installed.

$$\text{Cost}_A = 350 + 5 (\text{lot frontage})$$

This does not take into account the cost of wells and pumps.

Curves "B" and "C" were calculated to include typical costs for wells and pumps, prorated per house.

Cost of drilling 400-450 feet deep: \$3000 to \$7000, depending on soil conditions.

Number of pumps required, as a function of homes served, under North Carolina State Health regulations:

0 Households < 1	pump	< 49 Households
50 Households < 2	pumps	< 149 Households
150 Households < 3	pumps	

¹ John McAdams, Interview, 1978.

Cost of pump, tank, and chlorinator: \$10 - 12,000 depending on number of pumps.

Curve "B" represents a "best case." Assume a large subdivision with 149 houses and good soil:

$$\text{Cost}_B = \$350 + \$5 (\text{lot frontage}) + \frac{\text{cost of pump and well}}{\text{number of homes}}$$

where:

$$\begin{aligned} \text{cost of large pumps} &= \$12,000 \times 2 = \$24,000 \\ \text{cost of drilling in} \\ \text{favorable soil} &= \$3,000 \times 2 = \underline{\$6,000} \\ &\$30,000 \end{aligned}$$

$$\text{Pro-rated cost} = \frac{\$30,000}{149} = \$201 \text{ per house}$$

$$\text{Cost}_B = \$350 + \$5 (\text{lot frontage}) + \$200$$

Curve "C" represents a "worst case." Assume a small subdivision with 149 homes and difficult soil for drilling:

$$\text{Cost}_C = \$350 + \$5 (\text{lot frontage}) + \frac{\text{cost of pump and well}}{\text{number of homes}}$$

where:

$$\begin{aligned} \text{cost of small pumps} &= \$10,000 \\ \text{cost of drilling in} \\ \text{poor soil} &= \underline{\$7,000} \\ &\$17,000 \end{aligned}$$

$$\text{Pro-rated cost} = \frac{\$17,000}{149} = \$350 \text{ per house}$$

$$\text{Cost}_C = \$350 + \$5 (\text{lot frontage}) + \$350$$

The following table presents values for Cost "A" and "B" and "C" as a function of lot frontage and of density in units per mile:

Cost of Distribution System As a Function of Density

<u>Units per Mile</u>	<u>Lot Frontage (feet)</u>	<u>\$5 (lot frontage)</u>	<u>House Connection Cost</u>	<u>(A) Cost per House</u>	<u>(B) Cost per House</u>	<u>(C) Cost per House</u>
50	105	525	\$ 350	\$ 875	\$1075	\$1225
45	117	585	350	935	1135	1285
40	132	660	350	1010	1210	1360
35	151	755	350	1105	1305	1455
30	176	880	350	1230	1430	1580
25	211	1055	350	1405	1605	1755
20	264	1320	350	1670	1870	2020
15	352	1660	350	2015	2210	2360
10	528	2640	350	2990	3190	3340
5	1056	5280	350	5630	5830	5980



APPENDIX B

CASE STUDY INTERVIEWS

Bogue Banks Water Association, Carteret County

Ken Archer, Service System Operator, Bogue Banks Water Association
Ivey Mason, Planner, Carteret County
John McClain, President, Bogue Banks Water Association
Robert Quim, Assistant Director, Neuse River Council of Governments
Ronnie Watson, Major, Emerald Isle
Tom Willis, Director, East Carolina Regional Development Institute

Dan River Water, Incorporated, Rockingham County

Numa R. Baker, Jr., County Manager
William Hicks, President, Dan River Water, Inc.
Carl Loop, Regional Planning Director, Piedmont Triad Council of Governments

Davie County Water System, Davie County

Glenn Howard, Chairperson, Davie County Board of Supervisors
Ron Vogler, County Manager
Leo Williams, Agricultural Extension Agent

Neuse River Water Association, Craven County

H. H. Green, Water System Manager
Alton Harris, Director, Craven County Health Department
Marty Morgan, County Coordinator, Farmers Home Administration
Robert Simpson, Agricultural Extension Agent

Newton Municipal Water System, Catawba County

Richard Greathouse, Planning Director, Catawba County
Tom Lundy, County Manager
Ken Martin, Chairperson, Board of County Commissioners
Jack Mathews, County Engineer
Gene Sigmon, County Attorney
Doug Taylor, Executive Director, Western Piedmont Council of Governments
Gary Workman, Assistant Administrator, Town of Newton

Oak Hill Water System Corporation, Burke County

Henry Freeman, Manager, Oak Hill Water System
Turner Morrison, A.S.C.S.
John Pons, County Commissioner
Kenneth Thompson, County Manager
Chester West, Director of Community Development, Human Resources Center
Robert White, Economic Development Planner, Western Piedmont Council of Governments

Union County Water System, Union County
Joe Hudson, County Commissioner
Luther McPherson, County Planner
Bill Summerlin, Public Works Manager

APPENDIX C
INTERVIEW SCHEDULE

County or Community: _____

Interview No. _____

CONFIDENTIAL

SECONDARY IMPACTS OF RURAL
WATER SYSTEMS IN NORTH CAROLINA
WRI RESEARCH GRANT A-103-NC

Survey of Public and Water Management Officials

Respondent's Name: _____

Interviewer: _____

Position: _____

Date: _____

Organization: _____

Place of Interview: _____

Address: _____

City: _____

Telephone Number: _____

Time of Interview: _____

* * * * *

Hello, I'm from the Center for Urban and Regional Studies of The University of North Carolina at Chapel Hill. We are conducting a study of rural water systems in North Carolina. One of the most important aspects of the study concerns the perceptions and attitudes of persons like yourself who hold positions of responsibility in government and water system management. As you answer the following questions, please keep in mind that no direct quotes will be used without your permission. However, data gathered will be used in reports and published as part of the research. Of course, you are not required to participate, but I hope very much that you will and I think that you will find it interesting.

* * * * *

Center for Urban and Regional Studies
The University of North Carolina at Chapel Hill

Spring 1979

A. Before starting, I would like your permission to tape record the interview. The interview has a number of discussion questions which are difficult to record by handwriting. Of course, the recording, like the questionnaire, will be treated in strictest confidence. May I record our session?

Yes

No

Growth Issues

1. There has recently been a considerable amount of interest expressed in growth and population settlement patterns in North Carolina. To start, I would like to ask you about growth trends in _____ County. Since 1970, has your county grown rapidly (10 percent or more), moderately (5 - 9.9 percent), slowly (1 - 4.9 percent) or has the population been static or declining?

Rapidly (10 percent or more)

Moderately (5 - 9.9 percent)

Slowly (1 - 4.9 percent)

Stable or declining (less than 1 percent)

2. During the next decade, do you think that the county will grow more rapidly, at about the same rate, or less rapidly than during the past ten years?

More rapidly

About the same

Less rapidly

3. What are the three most important factors contributing to growth in your county?

a. _____

b. _____

c. _____

4. What are three major impediments to growth in the county?

a. _____

b. _____

c. _____

5. Which portion of the county is growing the fastest--incorporated places, fringe areas, or rural areas?

- Incorporated places
- Fringe areas
- Rural areas

6. Rural growth and development has been proposed as a solution to a number of problems that often face the rural areas of North Carolina. Thinking of your county, do you think each of the following potential problems will be made better, worse, or will not be affected by rural growth? First, what about . . .

a. Shortage of job opportunities (1) Please explain

- Better
- No effect
- Worse

b. Low wages (1) Please explain

- Better
- No effect
- Worse

c. Inadequate fire and/or police protection (1) Please explain

- Better
- No effect
- Worse

d. Inadequate social services, such as health care and recreational facilities and programs (1) Please explain

- Better
- No effect
- Worse

e. Water systems needed and not available

(1) Please explain

Better

No effect

Worse

f. Sewer systems needed and not available

(1) Please explain

Better

No effect

Worse

g. Inadequate educational facilities and programs

(1) Please explain

Better

No effect

Worse

h. Erosion and sedimentation

(1) Please explain

Better

No effect

Worse

i. Garbage and trash collection and disposal problems

(1) Please explain

Better

No effect

Worse

j. Tension between urban and rural residents of the county

(1) Please explain

Better

No effect

Worse

7. Is rural growth that is now taking place in your county generating enough revenues to cover the increased costs of providing public services?

Yes

No

8. Considering everything we have discussed to this point, do you feel that overall, increased rural development is beneficial for the county, that it is too early to say, or that, on net, rural growth is not beneficial for this county?

Beneficial for county

Too early to say

Not beneficial for the county

a. What is your most important reason for this conclusion?

Rural Water Systems

9. Next, I have some questions about the provision of water service in rural areas of _____ County. We are particularly interested in the formation/expansion of (name of water system) in 19____. DESCRIBE FORMATION EXPANSION TO RESPONDENT. Was your organization involved in the decisions that led to formation/expansion of that system?

No -- Skip to Q. 19

Yes

↳ a. Please describe how your organization was involved.

10. What were the major reasons for the (formation/expansion) of the system?

11. To the best of your knowledge, who first proposed the (formation/expansion) of the system and how did they go about it?

12. What other organizations and persons were involved in the decisions that led to formation/expansion of the water system?

13. Did municipalities in the county support, remain neutral, or oppose formation/expansion of the water system?

- Supported by municipalities
- Municipalities were neutral/not involved
- Opposed by municipalities

a. Why was that?

14. Was the formation/expansion decision reviewed by the council fo govern-
ments serving this region?

No -- Skip to Q. 15

Yes

→ a. What was the outcome of the review?

15. Multi-county Regional Water Plans have been prepared for every region in
North Carolina by the Department of Administration. Was the plan for your
region used in deciding about the formation/expansion of the water system?

No -- Skip to Q. 16

Don't know

Yes

→ a. How was the plan used?

16. What other, if any, regional plans, programs or other documents were used
in decisions concerning the formation/expansion of the water system?

No other documents applied

Don't know

Impacts of Water System Formation/Expansion

19. Now we would like to ask you about how the formation/expansion of the water system affected the area in the vicinity of the lines and _____ County in general. First, have new homes or mobile homes tended to locate in the vicinity of the water lines?

No -- Skip to Q. 20

Yes

→ a. Could you estimate about how many since formation/expansion of the system?

_____ Estimated Number of New Homes/Mobile Homes

→ b. Do you think that the availability of the water system was a major or minor factor in households' decisions of where to locate their homes and/or mobile home?

Major factor

Minor factor

→ c. Please explain why the water system has had the effect it has had on the location of new development.

20. In the vicinity of the new water lines, do you think that property values have increased markedly faster, somewhat faster, about the same, or slower than areas of the county without water service?

Markedly faster -- Ask a

Somewhat faster -- Ask a

About the same -- Skip to Q. 21

Slower -- Skip to Q. 21

a. Do you think rising property values attributable to the water system have caused any problems for area farmers either because of increased property taxes or increased costs of expanding farm operations?

Yes - Taxes Yes - Expansion

No

b. Conversely, have increased property values benefited farmers by creating a new market for their marginally productive farm land?

Yes

No

c. On balance, do you think increased property values attributable to the water system have been beneficial to farmers, have had no effect on them, or have been harmful?

Beneficial

No effect

Harmful

21. Have conflicts between new residents along the new water lines and existing farm operations (for instance, complaints of odor by homeowners or complaints of vandalism by farmers) been a very serious problem, a moderately serious problem, or not a problem at all?

Very serious

Moderately serious

Not a problem

22. Before the water system was formed/expanded, was poor water quality a major problem, minor problem, or not a problem at all in the area that is served?

Major problem

Minor problem

Not a problem at all

23. How about water yield from individual wells before the water system was formed/expanded--was the quantity of water available through individual wells a major problem, minor problem, or not a problem at all in the area that is served?

- Major problem
- Minor problem
- Not a problem at all

24. Sometimes installation of water lines is accompanied by an increased demand for other public services--either because the existing population demands more from government or because new people move into the area. For each of the following services, would you say that public demand has increased markedly, increased slightly, not increased, or decreased since installation of the new water lines. What about the demand for . . .

	<u>Increased Markedly</u>	<u>Increased Slightly</u>	<u>Not Increased</u>	<u>Decreased</u>
a. Police protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Fire protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Garbage and trash collection	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
d. Recreational facilities and programs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. New or expanded educational facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Building inspection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Land use planning and regulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

25. In addition to these services, the increasing housing density made possible by water systems sometimes leads to the need for sanitary sewer systems. When do you see the need for investment in a sewer system to service the areas now served by the water system--is one needed now, or do you foresee the need for a sewer system within five years, ten years, or not in the foreseeable future?

- Needed now -- Skip to Q. 26
- Five years -- Skip to Q. 26
- Ten years -- Skip to Q. 26
- Not in foreseeable future -- Ask a
 - ↳ a. Why is that?

26. Interviewer: Please Check

Water System Manager/Official -- Ask Q. 27

Other Respondent -- Skip to Q. 39

Operational Aspects

27. The last part of the interview covers various operational characteristics of the water system. To begin with, how many customers are now being served by the system?

_____ Number of Customers

a. (Ask only if municipal system) How many customers are located outside of the town (city) limits?

_____ Number Outside City Limits

b. How many of these are:

Residential Customers: _____

Commercial Customers: _____

Industrial Customers: _____

Total (should equal
number in Q. 27)
or Q. 27a if municipi-
pality) _____

28. How many customers were there when the system was formed (expansion was undertaken)?

_____ Number of Customers When System Formed/Expanded

a. (Ask only if expansion) How many customers were added by the expansion?

_____ Number of Customers Added

b. How many linear feet (or miles) of water lines were involved when the system was formed (expanded)?

_____ Linear Feet
_____ or
_____ Miles

Office Calculation:		
_____	Customers =	_____
Miles		Density per Mile

29. What was the total cost of system formation/expansion?

\$ _____ Total Cost

30. How was the total cost of the system apportioned among the following sources of funds. First, how much of the costs of the system formation/expansion was met by funds from . . . ?

\$ _____ Accumulated reserves

\$ _____ Revenue bonds

\$ _____ General obligation bonds

\$ _____ State grant funds

\$ _____ Federal grant funds

\$ _____ Agency: _____

\$ _____ Agency: _____

\$ _____ Federal loan funds

\$ _____ Agency: _____

\$ _____ Agency: _____

\$ _____ Total Funds

NOTE: Should Add to Total Listed in Q. 29

31. What (other) forms of assistance, if any, were obtained from federal agencies? (Probe for technical assistance, etc.)

None

32. Was a federal environmental impact statement prepared for the project?

Yes (obtain copy if possible)

No

33. What factors were taken into account to determine whether formation/expansion of the system was financially feasible?

34. At what point in terms of costs per customer served would formation/expansion of the system have been impossible to undertake?

\$ _____ Cost Per Customer

a. Please explain how this was determined?

35. What was the (outstanding) long-term debt of the water system when the system was formed (expanded)? (If formation, include initial debt)

\$ _____ Long-Term Debt

a. (Ask only if expansion) In what ways, if any, did the debt position of the system influence the expansion decision?

36. What, if any, nonfinancial factors were taken into account in deciding that formation/expansion of the system was feasible? (PROBE for engineering, political and other considerations)

37. What were the annual operating costs of the system during the last fiscal year?

\$ _____

a. What proportion of this was for debt service?

_____ % Debt Service
or
\$ _____ Debt Service Costs

38. Could you tell me about (or give a copy of) the current rate structure of the system?

Background of Respondent

39. Finally, I have a few questions about your own background. First, for how many years have you been a resident of _____ County?

_____ Number of Years

40. And, how many years have you served in your present position as _____?

_____ Number of Years in Position

41. What other governmental positions have you held/jobs with water systems have you had?
