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Estimates of Wastewater Treatment Capital Requirements in Rural America

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ABSTRACT

This study examines the changes in capital requirements needed to bring rural wastewater treatment systems into compliance with Clean Water Act standards. Results indicate a significant but concentrated reduction in backlog costs and a dramatic increase in service availability between 1978 and 1984. System needs are estimated at $20.2 billion, with residents in the Northeast and in the smallest rural communities facing the highest per capita costs.

Keywords: Wastewater treatment, local government, infrastructure, public facilities.

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CONTENTS

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SUMMARY

Sewage treatment capital requirements for rural America in 1984 are estimated at $20.2 billion, but changes in national spending policy leave uncertainty about how they will be financed. Over a 6-year period ending in 1984, both national and rural needs declined about 25 percent in real dollars. A closer examination, by community size and census region, reveals wide differences in the distribution of rural needs.

Communities in the North Central region and the South made dramatic progress in developing wastewater treatment infrastructure and reducing backlogs, as did larger incorporated cities throughout rural America. Residents in the Northeast and in the smallest rural communities made considerably less progress and will have the hardest time funding remaining capital needs.

Approximately 85 million Americans live in rural communities of fewer than 50,000 persons. Of the 45,766 communities this study considers rural, most are very small and only 37 percent require centralized treatment systems. Between 1978 and 1984, an additional 16.5 million rural residents began receiving sewage treatment services, bringing the total to 51.5 million.

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INTRODUCTION

The condition of America's sewage treatment infrastructure and the effectiveness of government programs designed to stimulate their production are questions of significant social and economic importance. Essential to public health and community development, sewage treatment projects have received much attention and funding over the last 15 years. Since passage of the Clean Water Act in 1972, over $52 billion (1984 dollars) in Federal monies have gone to facility construction. In 1984 alone, over 11 percent of Federal infrastructure outlays, some $3 billion, went for this purpose. While still a significant program, this expenditure level represents a dramatic reduction.

After a long period of Federal dominance in public sector financing, the administration's new federalism philosophy and deficit reduction pressures are changing the structure of intergovernmental fiscal relations. Many categorical programs have been reduced or eliminated, and responsibility for funding local government services is being shifted back to State and local governments.

Given the public nature of clean water and the unique economic characteristics of rural America, an important policy issue continues to be the financial impact on rural communities yet to comply with water quality standards. Considerable information is available about the needs of urban areas and the Nation as a whole, but the treatment needs of rural communities go largely unrecognized.

This study estimates the cost of bringing rural wastewater treatment facilities up to national standards, and documents progress in meeting that goal. It focuses on capital spending requirements and system needs by community size and geographic region. Current spending requirements include new construction needs and improvements required of existing facilities. The costs of various system components are compiled, along with estimates of service-area populations. Finally, as a rough indicator of financial hardship, average per capita community need is estimated. The study estimates each variable biennially from 1978 to 1984. To give some perspective to changes in needed spending, the report begins with a brief summary of Federal spending policies under the Clean Water Act.

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FEDERAL CAPITAL SPENDING AND ABATEMENT POLICY

The debate over the adequacy of America's public sector capital investment is mired in the definition of standards and predictions of demand (1).1/ Estimates consequently vary widely on the magnitude of the problem. Summing across a spectrum of public services, estimates of the capital investment needed by the turn of the century range as high as $3 trillion.2/ Current requirements for sewage treatment alone are believed to exceed $60 billion nationally. Findings of this study indicate that rural areas account for about a third of that backlog. How those projects will be financed and, more importantly, by whom are pressing questions on the domestic policy agenda.

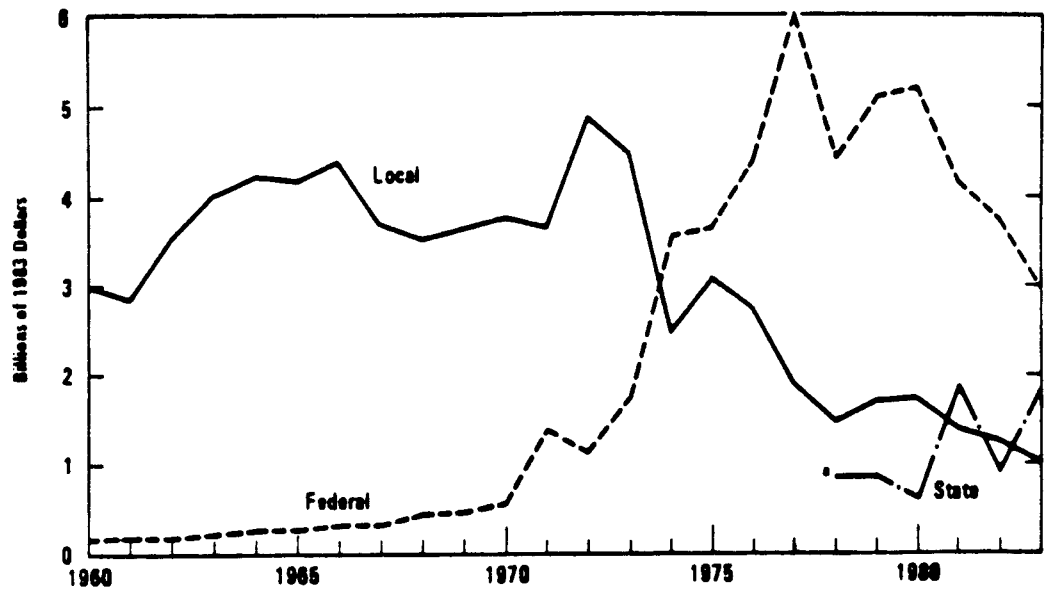
State and local governments have traditionally been the primary providers of public services. Yet over the last 20 years, the federalization of our fiscal system has brought about a new allocative process through a series of regulations and grants-in-aid. Water pollution control offers a prime example of the shifting of financial responsibilities to the Federal level. Faced with a deterioration of the Nation's water quality and the lack of adequate facilities to reverse it, Congress passed the Clean Water Act (CWA) in 1972. CWA imposed national minimum performance standards backed by generous Federal support.

With $18 billion in authorization for the first 3 years, the newly formed Environmental Protection Agency (EPA) through its Construction Grants Program (CGP) offered 75-percent subsidies to eligible communities building wastewater treatment facilities.3/ This represented a dramatic shift from the 50-percent matching rate and meager budgets of the past Federal program. The goal was to expedite facility construction by supplementing local spending. Instead it led to displacement: a substitution of Federal for local dollars (fig. 1). A recent study estimates that for each Federal EPA dollar put toward sewer system construction, State and local expenditures were reduced by as much as 66 cents (2). While this substitution can take many forms, including tax relief, or improved quality of other services, increased spending on operations and maintenance is also possible (fig. 2).

Criticized for failing to address existing needs, increasing delays, and being narrow in its acceptance of treatment processes, the program was amended in 1977. States were given more latitude in project selection and management, communities were provided with a waiver process, and systems employing innovative designs were rewarded with an additional 10-percent subsidy.

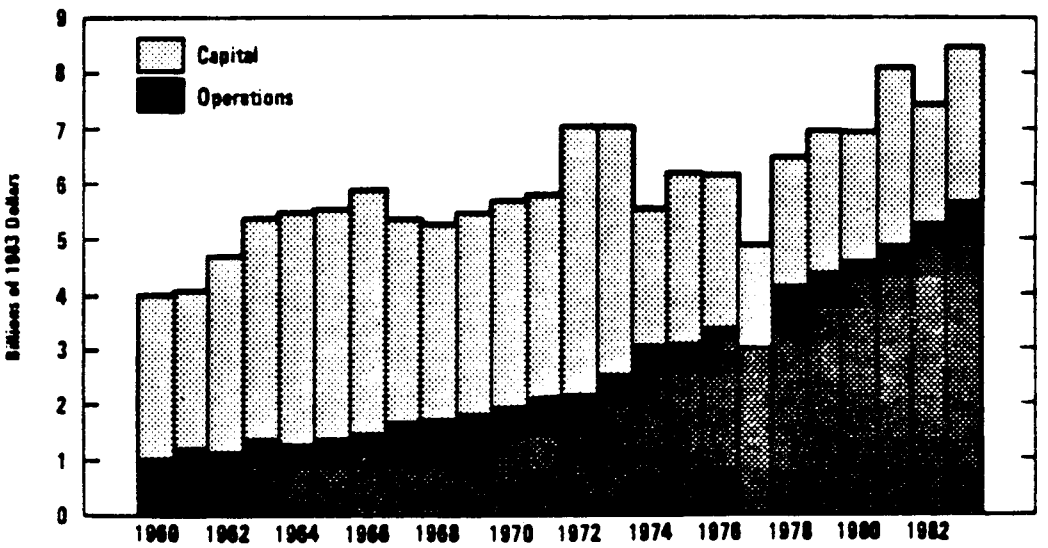
1/ Underscored numbers in parentheses indicate sources in references.
2/ Estimates vary with the definition of infrastructure, and the time frame used. Pat Choate (1) estimates in excess of $2.5 to $3.0 trillion will be required by 1995 just to maintain present levels of service. A study by the Joint Economic Committee of Congress (6) puts the investment needed by the year 2000 for water and transportation alone at $1.2 trillion. Using the same time frame but a wider definition, the Association of General Contractors estimated a $3.0 trillion need.
3/ The Construction Grants Program accounts for about 90 percent of the Federal outlays for facility construction. The remainder has come from three programs with differing objectives. Housing and Urban Development grants targeted low- and moderate-income communities, supplementing public works projects. The Economic Development Administration has done the same in economically distressed areas. The Farmers Home Administration has supported water and sewer projects with loans and grants specifically for low-income rural areas.

Figure 1--Capital outlays by all governments, fiscal years 1960-83



SOURCE: Congressional Budget Office.
*State spending before 1978 is not available.

Figure 2--Composition of State and local wastewater spending, fiscal years 1960-83



SOURCE: Congressional Budget Office.

Congress cut the authorized spending level by 25 percent and reiterated its original intention to support only treatment capacity for the population base recognized as of 1972.4/

Under continued pressure from mounting delays and inefficiencies, and with the newly elected Reagan administration demanding reform, the program underwent a dramatic revision in 1981. Three changes were of particular importance: direct Federal funding was restricted to the basic or "core" treatment components (treatment plants and interceptor systems), the Federal share of project funding was reduced from 75 percent to 55 percent, and authorized Federal spending was reduced from the previous $4-billion range to $2.4 billion annually for the 4 years ending in fiscal 1985. Planning was streamlined, reserve capacity funding was eliminated, and compliance deadlines were extended to improve program efficiency and reliability. Except for the lower spending levels, most changes did not become effective until October 1, 1984.

With these initiatives basically untried, policy may again be undergoing major change. The Reagan administration's 1987 budget proposal called for a 4-year phaseout of EPA's Construction Grants Program, asserting a fulfillment of the Federal commitment to the 1972 population needs and maintaining a philosophical opposition to Federal involvement. In the administration's view, many rural systems are of marginal abatement importance, not worthy of conversion from septic to sewer systems. Where support is merited, a Federal-State block grant program targeted for rural economic development could provide support.

Not all agree with this solution. A Congressional Budget Office (5) study suggests that the administration's approach creates an inequitable treatment of communities that have not yet reached the secondary treatment standard. The same study asserts that the program revisions made in 1981 will be sufficient to restore local incentives for cost saving and reduce secondary treatment needs by as much as 30 percent. CBO argues that waste, inefficiency, and unwarranted excess capacity make up a third of the backlog, and that this can be eliminated by lowering the matching funds rate and forcing the recognition of real resources costs on local officials. While it considers the revised current program more equitable, the report warns that it will fail to meet the goals without cost-effective State and local participation. Other proposals are under study as well, and some change seems inevitable.5/

4/ Limiting subsidies to the 1972 population base puts a cap on the Federal commitment. Referred to as a "sunset condition," the provision is meant to encourage timely participation and establishes a point for the eventual transition away from Federal assistance. Critics argue that these conditions are seldom effective in terminating programs and are detrimental to long-term decisionmaking.

5/ Perhaps the most popular alternative strategy is the establishment of revolving State infrastructure funds. Capitalized by State and Federal contributions, the fund could be used directly for projects or as security for bond issues, leveraging its effect. After the first round of investments, such a fund would grow with loan repayments and accrued interest. An EPA task force report on the Federal Government's future role in sewage treatment funding endorsed this concept as the most promising (8). In the transition to State and local self-sufficiency, the task force recommended a mix of current program features, plus incentives to establish a revolving infrastructure fund. Always an option under any policy are regulatory reforms such as relaxing water quality standards, and paying greater attention to seasonal and site-specific

How the remaining treatment needs will be financed, and by whom, is yet undetermined. Rural interests have been protected in the past by set-asides and rural-specific programs, but current proposals offer little support for their special needs. For example, elimination of direct funding for collector systems under the 1981 amendments could have an especially adverse effect on rural communities where low population density increases the demand for this component.6/ In addition, the lowering of matching rates puts a disproportionate burden on the residents of small rural communities, where fewer users are available to share costs. The impact is compounded in those areas, particularly the South, with low incomes. Those responsible for providing sewage treatment services to rural communities, and those who ultimately must pay for it, face an uncertain future.

DATA AND ESTIMATION METHODS

This study is an extension of the preliminary National Rural Community Facilities Assessment Study (NRCFAS), published by the Department of Agriculture in 1984 (3). Sampling methods and estimation techniques developed for that study were used here. In brief, a sample of 2,172 rural communities was drawn from the universe of 45,766 rural communities within the 48 contiguous States. The rural universe is described in more detail below. The sample was first stratified by State, with a nearly equal number of communities selected from each State. Then, within each State, communities were stratified by size class, and selections were made on a random basis within each class. Distributional weights were assigned accordingly.

Results are reported by community size and organization and for the four census regions. The incorporated communities are disaggregated into five size classes; all unincorporated communities are combined into a sixth class. To avoid the double-counting of facilities, community-based estimates were developed. This required identifying facilities that were located within and serving the sample rural communities. Facilities serving yet located outside the sample communities' boundaries, such as regional treatment plants, were excluded.

Like all statistical estimates, those produced here are subject to sampling error. This can be measured by using the standard error shown in parentheses beneath the point estimate in the tables. The standard error allows the user to develop a sense of the sampling accuracy.7/

5/ (continued)
conditions. Here, the conflict between economic efficiency and environmental balance meet head on.

6/ A provision of the 1981 amendments allows for 20 percent of a State grant allocation to be used at its discretion. This could be a mitigating factor in States where rural demands are strongest (4).

7/ By multiplying the standard error by a t-statistic for some level of confidence, the reader can define with that degree of confidence a range for the point estimate. For example, in table 4, the point estimate for the 1984 total backlog cost is $20.27 billion. The standard error is $1.65 billion, and the t-statistic to estimate a 95-percent confidence interval is approximately 2. From this, the reader can assume with a 95-percent confidence level that the true average value for the 1984 total backlog is between $16.97 and $23.57 billion (20.27 +/- 3.30).

The Rural Universe

More than 85 million Americans live in communities of fewer than 50,000 persons.8/ Of the nearly 46,000 communities in rural America, approximately a third are incorporated, while two-thirds are unincorporated townships or equivalent areas (table 1). The distinction in legal status is an indication of the communities' basic administrative capacity and is an important factor in motivating a community to establish treatment facilities. Another is community size, important in determining a project's economic feasibility. The great majority of rural communities are small. Eighty-two percent of all unincorporated places have populations less than 2,500; only 2 percent have more than 10,000 residents. Similarly, 80 percent of all incorporated places have fewer than 2,500 residents, while only 5 percent have more than 10,000.

Over half of all unincorporated places and nearly half of all incorporated ones are in the North Central region, yet less than a third of the rural population lives there. This region also has the largest number and greatest proportion of incorporated communities with fewer than 2,500 persons. The South with 41 percent of the rural population has 30 percent of the total rural communities. The South and North Central regions combined represent 70 percent of the total rural population and over 80 percent of all rural communities.

EPA Needs Surveys

A major problem in estimating the demand for public works is in defining a standard for that service. None is better defined than the need for publicly

7/ (continued)
Common values

Confidence level	90%	95%	99%
T-value	1.65	1.96	2.58

8/ Rural in this study is defined as all incorporated or unincorporated places outside an urbanized area as of 1970, except communities with a 1978 population of 50,000 or more.

Table 1--Rural population and community distribution, 1980

Item	Northeast	N. Central	South	West	Total
Population:			Million		
Incorporated	4.3	13.2	14.8	6.1	38.5
Unincorporated	9.1	11.9	20.6	5.5	47.1
Total rural population	13.4	25.1	35.4	11.6	85.6
Community:			Number		
Incorporated	1,368	7,476	5,557	1,648	16,049
Unincorporated	3,598	16,145	8,009	1,965	29,717
All rural communities	4,966	23,621	13,566	3,613	45,766

Source: National Planning Data Corporation, Universe of Rural Communities, 1980.

owned sewage treatment works. As a provision of the Clean Water Act, the Environmental Protection Agency estimates biennially the difference between the Nation's current municipal wastewater capacity and that needed to comply with established clean water standards (8-12). These needs surveys catalog a variety of information about system requirements, both at the time of the survey and for the future. This amounts to a complete inventory of the Nation's capital requirements for treatment systems. The surveys are the basis for the Congressional allocation of grant funds and the source of data for this study.

The surveys break system needs into five categories and a number of subcategories. Categories I and II cover the physical treatment plants. Processes range from basic screening, or primary treatment, to secondary and tertiary treatments. The latter involve an increasingly complex technology for detecting and eliminating organic and inorganic contaminants.

Two concerns over system deterioration are expressed in category III. Subcategory IIIa addresses the cost to correct the infiltration of ground water into the conveyance system, which can significantly inhibit a plant's treatment capacity and unnecessarily increase its costs. Subcategory IIIb represents a second problem, that of structurally unsound interceptors and collectors.

Conveyance systems, made up of interceptors and collectors (categories IVa, IVb), connect treatment plants with users. Interceptors are the main trunk lines radiating from a plant into the community. Collectors branch off the interceptors to connect individual neighborhoods and developments.

Category V is an inventory of combined sewer and storm water overflow needs. Primarily urban, these costs are not a part of this study.

The estimates developed here are restricted to the costs of current system needs and service availability. Backlog costs are the current costs of the construction required to bring the community up to the water quality standards of the Clean Water Act. Population estimates describe the total number of persons within a facility service area, and the number receiving service. A third variable, community average per capita need, is developed here as an indicator of the distribution in financial hardship.

RESULTS

How have rural areas fared in comparison to America as a whole? Have improvements kept pace? Have all sizes and kinds of rural areas and rural communities in all sections of the country experienced similar reductions in backlogs? Translating backlogs to a per capita basis, how does the cost of bringing rural communities up to the national standards compare with costs in the whole Nation?

Rural Versus National Needs

Between 1978 and 1984, national wastewater treatment needs (both urban and rural) increased 16 percent, from $53.4 billion to $61.8 billion. Rural needs during the same period increased 23 percent from $17.0 billion to $20.3 billion (table 2). From this perspective, all areas, and rural areas in particular, have failed to keep pace with the requirements of the Clean Water Act. But measuring progress in nominal or current dollars disregards the impact of inflation, an important economic characteristic of the study period.

Table 2—Wastewater treatment needs, national and rural, 1978-84 1/

Year	National		Rural	
	Nominal dollars	1984 dollars	Nominal dollars	1984 dollars
1978	53.40	84.20	16.99	26.80
			(1.19)	(1.80)
1980	53.90	69.10	16.53	21.20
			(1.12)	(1.44)
1982	56.86	63.11	16.72	18.56
			(1.35)	(1.50)
1984	61.80	61.80	20.27	20.27
			(1.65)	(1.65)

1/ EPA categories I-IV; standard errors in parentheses.
Sources: EPA needs surveys, 1978, 1980, 1982, 1984.

According to EPA estimates, construction costs for publicly owned treatment works increased 23 percent between 1978-80, 15.5 percent from 1980-82 and 11 percent between 1982-84. Compounded, these increases amount to a 58-percent inflation rate over the 6-year period. Expressing all needs in constant (1984) dollars illustrates the cost of past construction were it to be undertaken in the 1984 cost environment. When the comparison is made on a constant-dollar basis, a very different picture emerges. Nationally, needs fell from $84.2 billion to $61.8 billion, a 26-percent decline over the study period. Rural needs fell a comparable 24 percent, from $26.8 to $20.3 billion. The greatest progress, both national and rural, was made in the first period when inflation was at its height.

The effect of Federal cuts in capital funding for wastewater treatment projects since 1980 can be seen in the slowing of decline in national treatment needs. The rural estimates suggest a reversal in the declining trend between 1982 and 1984, but the increase is not statistically significant. Indeed, the last three surveys are within such a narrow range that there is no statistically significant difference between them. Each, however, is statistically different from the 1978 results. This relationship holds generally throughout the data; therefore, inferences about short-term changes are avoided. Of more importance for policy analysis are the long-term changes between 1978 and 1984. For these, the statistical support is strong.

The makeup of rural wastewater treatment needs, like national needs, changed little over the study period. The 1984 distribution is representative (table 3). The major structural differences between rural and nonrural areas include the greater need nationally for sewer line repair (generally associated with the urban decay of the older, larger cities) and the rural areas' proportionally greater need for new collectors due to population growth and lower density settlement.

A point of interest not delineated by this analysis is the differences in treatment plant requirements of urban and rural communities. That is, higher levels of industrial pollutants produced in urban areas often require more

Table 3—1984 categorical needs, national and rural 1/

System component	EPA category	National backlog	Percentage of national need	Rural backlog	Percentage of rural need
		Bil. dol. (1984)	Percent	Bil. dol. (1984)	Percent
Treatment	I,II	27.1	43.9	8.28 (.80)	40.9
Sewer repair	IIIa, b	6.0	9.7	1.16 (.16)	5.7
Collectors	IVa	18.0	29.1	7.65 (.80)	37.7
Interceptors	IVb	10.7	17.3	3.18 (.37)	15.7

1/ Standard errors in parentheses.
Source: EPA needs survey 1984.

advanced treatment levels to meet EPA standards. Rural areas typically lack the population base to benefit from economies of scale. Thus, they face higher costs to provide basic service.

Rural Needs by Community Type

Not all rural communities need sewage treatment systems. Sparsely populated areas, which typically remain unincorporated, rely on septic systems for sewage disposal. But when populations become more concentrated, onsite disposal is no longer feasible and treatment systems are constructed. For all rural communities, this study estimates that only 37 percent require centralized treatment facilities. Ninety percent of all incorporated communities need them, compared with only 12 percent of all unincorporated.

Prior to program revisions in 1981, funding priorities were biased in favor of larger communities. The bias is reflected in the distribution of backlogs across communities of differing size. The largest percentage reduction in backlog (37 percent) was made by cities; the smallest (21 percent) by the smallest cities (table 4). In unincorporated areas, unmet needs were reduced by only 17 percent, compared with the 28-percent drop by all incorporated places combined. Given their similarity in community size distribution, an attractive explanation for the relative success of the incorporated communities is the presence of an effective political organization capable of securing financial support. Needs remained greatest in cities with populations of less than 2,500 and in unincorporated communities. In 1984, these two groups accounted for nearly two-thirds of the entire rural backlog in treatment capacity (fig. 3).

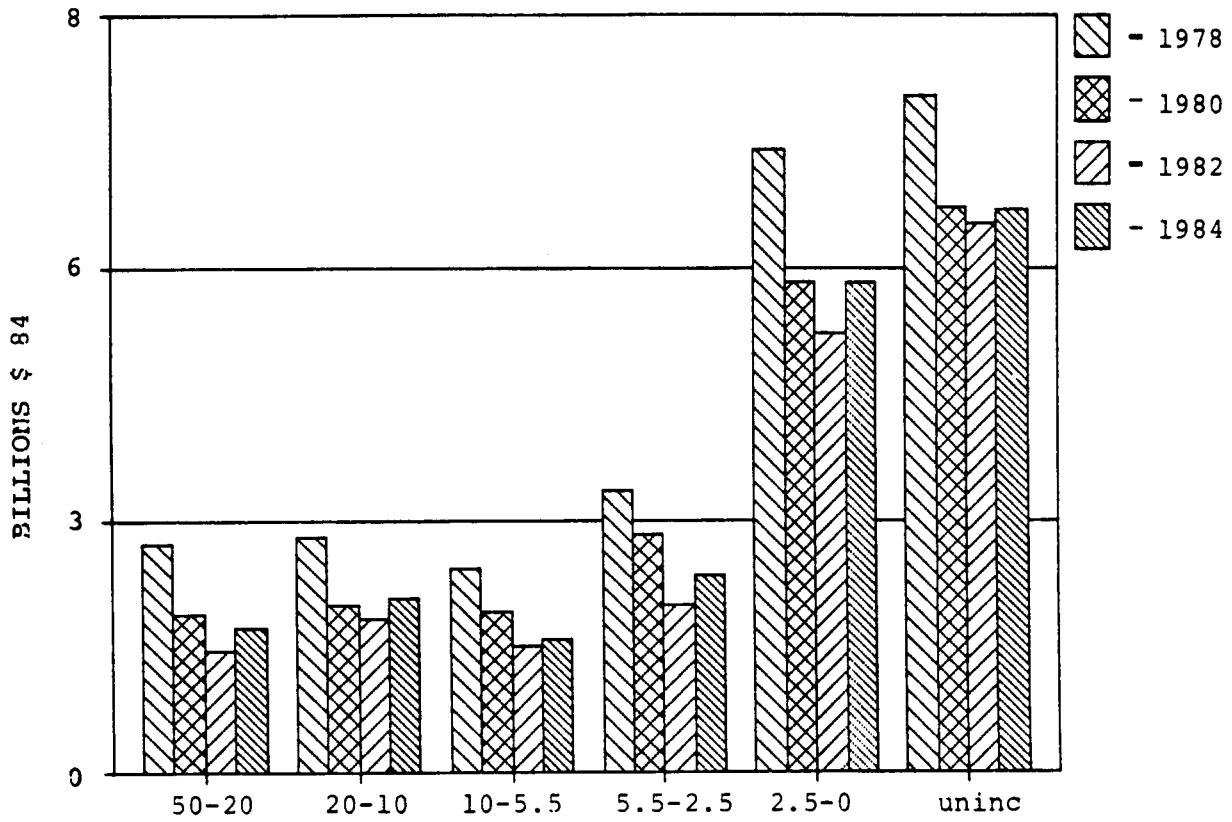
As the construction grants program was originally structured, the incentive was to construct new, grant-eligible facilities, instead of making renovations to existing ineligible ones, even where this would have been cost-effective. This inefficiency was apparent by 1980, and upgrading existing facilities became a program objective. Today, many small communities, and nearly all larger cities, are giving more attention to improving existing facilities to meet water quality standards and growth. Of the estimated $20.2 billion in

Table 4—Backlog costs by community type 1/

Costs/year	Community classification (population) 50,000-20,000	19,999-10,000	9,999-5,500	5,499-2,500	2,499-1	Total inc.	Total uninc.	Total
			Billion dollars (1984)					
Total backlog:								
1978	2.75	2.81	2.45	3.37	7.39	18.78	8.02	26.80
	(.39)	(.19)	(.19)	(.31)	(.80)	(.98)	(1.51)	(1.80)
1980	1.89	2.01	1.91	2.84	5.83	14.49	6.71	21.20
	(.27)	(.18)	(.16)	(.27)	(.63)	(.77)	(1.21)	(1.44)
1982	1.46	1.83	1.51	2.01	5.23	12.04	6.51	18.55
	(.25)	(.24)	(.16)	(.29)	(.68)	(.84)	(1.24)	(1.50)
1984	1.73	2.07	1.59	2.35	5.84	13.58	6.69	20.27
	(.29)	(.21)	(.19)	(.30)	(.60)	(.78)	(1.45)	(1.65)
Improvements to existing facilities:								
1978	2.44	2.59	1.95	2.56	2.75	12.32	3.09	15.41
	(.35)	(.19)	(.17)	(.26)	(.58)	(.77)	(1.12)	(1.36)
1980	1.74	1.89	1.66	2.40	2.25	9.94	2.97	12.92
	(.24)	(.17)	(.15)	(.25)	(.39)	(.57)	(.95)	(1.10)
1982	1.28	1.79	1.37	1.55	1.76	7.77	2.61	10.38
	(.22)	(.24)	(.15)	(.21)	(.39)	(.57)	(.89)	(1.06)
1984	1.56	1.99	1.50	1.82	2.22	9.10	2.63	11.73
	(.26)	(.21)	(.19)	(.22)	(.40)	(.60)	(.55)	(.81)
Planned new construction:								
1978	.32	.22	.50	.78	4.64	6.46	4.93	11.40
	(.07)	(.09)	(.12)	(.19)	(.62)	(.67)	(1.06)	(1.25)
1980	.15	.12	.25	.44	3.59	4.54	3.74	8.28
	(.04)	(.06)	(.08)	(.13)	(.53)	(.56)	(.78)	(.96)
1982	.18	.04	.14	.46	3.47	4.28	3.90	8.17
	(.06)	(.05)	(.05)	(.19)	(.60)	(.63)	(.89)	(1.09)
1984	.17	.08	.09	.52	3.61	4.48	4.05	8.53
	(.05)	(.05)	(.04)	(.20)	(.50)	(.54)	(1.28)	(1.39)

1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Sources: EPA needs surveys, 1978, 1980, 1982, 1984.

Figure 3--Total community backlog costs



remaining needs, nearly 60 percent is assigned to facility improvements, primarily in the larger cities. New construction projects are concentrated in the very small cities and unincorporated areas, which combined account for 90 percent of the $8.5 billion new construction backlog. This would seem the logical progression in the development of treatment infrastructure, accommodating the demands of larger populations first. The fact that nearly all but the very smallest communities have some treatment facility demonstrates how far we have come in meeting the CWA objectives.

Treatment plants and collector systems constitute the greatest portion of rural system requirements with a combined backlog of nearly $16 billion in 1984. Nearly all of the $6.5 billion reduction in need occurred in these two categories. Again, most of this came during the first period (table 5). The total need for new interceptors has remained unchanged at around $3 billion. But, between individual size classes, needs have varied widely. At just over $1 billion in 1984, the backlog for sewer line repairs fell in all but the unincorporated class. Across all need categories, the largest cities saw the largest reduction, the smallest cities the least. Almost without exception, the unincorporated communities made less progress than any incorporated category.

Rural treatment systems brought an additional 17.3 million people within their service areas between 1978 and 1984. Of these, 16.5 million received some form of sewage treatment, raising the total to 51.5 million. The total service area population increased more than 37 percent. The number receiving treatment increased by more than 47 percent (table 6). The most dramatic change was in

Table 5--Category costs by community type 1/

Cost and year	Community classification (population) 50,000-20,000	19,999-10,000	9,999-5,500	5,499-2,500	2,499-1	Total inc.	Total uninc.	Total
				Billion dollars (1984)				
Secondary and advanced treatment (Cat. I, IIa, b):								
1978	1.24	1.43	1.15	1.54	2.65	8.02	2.31	10.33
	(.15)	(.13)	(.11)	(.14)	(.28)	(.39)	(.59)	(.71)
1980	1.07	1.01	.97	1.50	2.54	7.09	2.14	9.23
	(.14)	(.11)	(.10)	(.15)	(.29)	(.38)	(.49)	(.62)
1982	.84	.87	.72	.92	2.19	5.54	1.95	7.49
	(.14)	(.12)	(.08)	(.12)	(.30)	(.38)	(.41)	(.57)
1984	.94	.90	.79	1.11	2.48	6.21	2.06	8.28
	(.14)	(.11)	(.11)	(.13)	(.26)	(.36)	(.71)	(.80)
Infiltration/inflow, rehabilitation (Cat. IIIa, IIIb):								
1978	.24	.26	.24	.27	.26	1.27	.15	1.42
	(.04)	(.05)	(.04)	(.05)	(.06)	(.10)	(.05)	(.12)
1980	.17	.26	.24	.29	.21	1.16	.22	1.39
	(.03)	(.04)	(.04)	(.05)	(.05)	(.10)	(.08)	(.13)
1982	.11	.17	.21	.22	.12	.83	.15	.98
	(.03)	(.03)	(.04)	(.05)	(.04)	(.08)	(.07)	(.11)
1984	.16	.18	.16	.25	.20	.95	.21	1.16
	(.08)	(.03)	(.03)	(.05)	(.07)	(.13)	(.09)	(.16)
New collectors (Cat. IVa):								
1978	.90	.87	.82	1.17	3.43	7.19	4.55	11.74
	(.18)	(.10)	(.10)	(.17)	(.39)	(.48)	(.96)	(1.08)
1980	.45	.51	.49	.64	2.44	4.52	3.29	7.81
	(.14)	(.08)	(.07)	(.11)	(.33)	(.39)	(.73)	(.83)
1982	.38	.42	.41	.59	2.20	4.00	3.27	7.28
	(.13)	(.08)	(.07)	(.11)	(.38)	(.44)	(.80)	(.91)
1984	.42	.53	.40	.66	2.41	4.41	3.24	7.65
	(.14)	(.09)	(.06)	(.11)	(.32)	(.38)	(.70)	(.80)
New interceptors (Cat. IVb):								
1978	.38	.25	.26	.39	1.05	2.33	1.00	3.33
	(.14)	(.04)	(.04)	(.07)	(.41)	(.45)	(.17)	(.48)
1980	.20	.23	.21	.41	.65	1.71	1.06	2.77
	(.06)	(.06)	(.04)	(.07)	(.29)	(.31)	(.22)	(.38)
1982	.13	.36	.17	.28	.71	1.67	1.14	2.81
	(.04)	(.13)	(.06)	(.14)	(.23)	(.31)	(.23)	(.39)
1984	.20	.47	.25	.33	.74	2.00	1.18	3.18
	(.06)	(.14)	(.07)	(.14)	(.17)	(.28)	(.24)	(.37)

1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Sources: EPA need surveys, 1978, 1980, 1982, 1984.

Table 6—Service area population by community type 1/

Item/year	Community classification (population) 50,000-20,000	19,999-10,000	9,999-5,500	5,499-2,500	2,499-1	Total inc.	Total uninc.	Total
				Million				
Population receiving service:								
1978	7.53	6.90	5.74	5.62	5.97	31.76	3.14	34.90
	(.41)	(.25)	(.17)	(.21)	(1.11)	(1.24)	(1.01)	(1.61)
1980	8.82	7.80	5.88	5.90	6.59	35.00	9.26	44.26
	(.41)	(.40)	(.20)	(.27)	(.53)	(.85)	(2.12)	(2.28)
1982	8.88	7.80	6.37	6.16	7.21	36.43	10.99	47.42
	(.43)	(.31)	(.24)	(.29)	(.71)	(.96)	(2.34)	(2.53)
1984	9.63	8.11	6.74	6.49	7.91	38.88	12.59	51.47
	(.51)	(.30)	(.23)	(.30)	(.76)	(1.04)	(3.02)	(3.19)
Population not receiving service:								
1978	1.09	1.08	1.21	1.53	3.18	8.09	3.75	11.85
	(.19)	(.14)	(.15)	(.26)	(.64)	(.75)	(.91)	(1.16)
1980	1.36	1.25	1.32	1.52	3.36	8.81	4.16	12.97
	(.26)	(.14)	(.15)	(.27)	(.36)	(.56)	(.76)	(.95)
1982	1.40	1.29	1.17	1.50	3.42	8.79	4.95	13.75
	(.26)	(.15)	(.12)	(.26)	(.37)	(.56)	(.94)	(1.09)
1984	1.41	1.23	1.18	1.57	3.17	8.56	4.04	12.60
	(.27)	(.13)	(.12)	(.25)	(.36)	(.54)	(.79)	(.95)
Total service area population:								
1978	8.62	7.97	6.95	7.15	9.15	39.86	6.89	46.75
	(.52)	(.30)	(.22)	(.35)	(1.64)	(1.80)	(1.41)	(2.29)
1980	10.18	9.04	7.21	7.42	9.95	43.80	13.42	57.22
	(.56)	(.42)	(.25)	(.40)	(.62)	(1.05)	(2.45)	(2.66)
1982	10.28	9.09	7.54	7.66	10.63	45.22	15.94	61.16
	(.59)	(.36)	(.29)	(.43)	(.79)	(1.16)	(2.79)	(3.03)
1984	11.05	9.34	7.92	8.06	11.08	47.45	16.62	64.07
	(.66)	(.35)	(.29)	(.43)	(.83)	(1.23)	(3.33)	(3.56)
				Percent				
Service rate:								
1978	87	87	83	79	65	80	46	75
1984	87	87	85	80	71	82	76	80

1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Sources: EPA needs surveys, 1978, 1980, 1982, 1984.

the unincorporated places, where the number of people being serviced increased by nearly 10 million, or 300 percent, presumably the result of a number of large facilities coming on line.

The flat nature of change seen in the number of service-area residents not receiving treatment suggests an estimation of those "structurally untreatable" at approximately 12 million. Fully three-quarters of the total service-area population is in incorporated areas, with this same proportion holding for those receiving treatment.

Finally, service rates (bottom of table 6) indicate the percentage of the population within the service range of a treatment facility actually being served. These have remained relatively higher for the larger incorporated communities, but, thanks to steady advances, the unincorporated rate is nearly comparable with 76 percent of area residences receiving some form of service.

Rural Needs by Census Region

Rural treatment needs were estimated for the four census regions as well. Population density, economic growth, and water resource endowment uniquely characterize each. Even within regions, these characteristics vary widely. In 1984, only 37 percent of all rural communities were required to provide sewage treatment systems. But, in the densely populated Northeast and the water scarce West, the rates much higher, 56 percent and 49 percent. The South approached the national average at 42 percent, while only 29 percent of all communities in the North Central region need such systems (fig. 4).

The South and North Central regions combined accounted for 88 percent of the $6.5-billion real reduction in need between 1978 and 1984 (table 7).

Figure 4--Total regional backlog costs

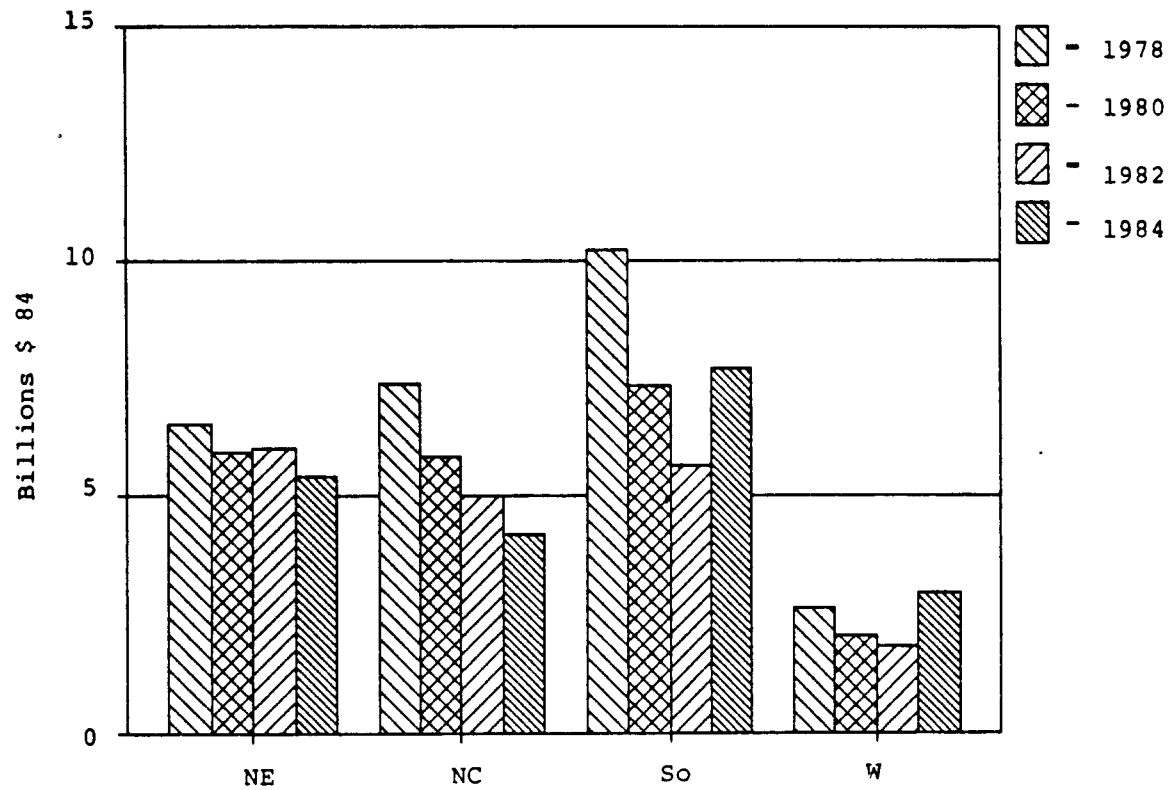


Table 7—Backlog costs by census region 1/

Costs and year	North-east	North Central	South	West	Total
		Billion dollars (1984)			
Total backlog:					
1978	6.52	7.39	10.23	2.66	26.80
	(1.22)	(.85)	(.85)	(.56)	(1.80)
1980	5.93	5.84	7.36	2.07	21.20
	(1.05)	(.59)	(.66)	(.45)	(1.44)
1982	6.03	5.04	5.65	1.84	18.55
	(1.08)	(.67)	(.68)	(.42)	(1.50)
1984	5.41	4.19	7.70	2.96	20.27
	(.70)	(.49)	(.94)	(1.05)	(1.65)
Improvements to existing facilities:					
1978	2.64	4.55	6.43	1.79	15.41
	(1.05)	(.56)	(.57)	(.31)	(1.36)
1980	2.70	3.95	4.78	1.49	12.92
	(.88)	(.37)	(.47)	(.29)	(1.10)
1982	2.70	2.90	3.45	1.32	10.38
	(.86)	(.35)	(.46)	(.24)	(1.06)
1984	2.54	2.73	4.85	1.61	11.73
	(.46)	(.30)	(.53)	(.27)	(.81)
Planned new construction:					
1978	3.89	2.84	3.80	.87	11.40
	(.73)	(.68)	(.64)	(.41)	(1.25)
1980	3.23	1.89	2.58	.58	8.28
	(.64)	(.47)	(.47)	(.26)	(.96)
1982	3.33	2.13	2.20	.51	8.17
	(.71)	(.58)	(.52)	(.26)	(1.09)
1984	2.88	1.46	2.85	1.34	8.53
	(.55)	(.40)	(.79)	(.92)	(1.39)

1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Sources: EPA needs surveys, 1978, 1980, 1982, 1984.

Backlogs in the Northeast fell just over $1 billion, while the West remained virtually unchanged.9/

Improvements to existing facilities made up two-thirds of the reduction, and again it occurred almost exclusively in the North Central region and the South. Facility improvement needs in the Northeast and the West went unchanged. A third of the $8.5 billion needed for new construction in 1984 was in the Northeast. This seemingly disproportionate share has remained, despite a $1.0 billion reduction over the 6-year period. New construction demands increased in the West to $1.34 billion, while continual declines lowered the 1984 requirements in the North Central region and the South to $1.5 billion and $2.8 billion.

Conveyance needs (new collectors and interceptors) are the greatest in the Northeast and the South, while treatment plants are the major requirement of the North Central region and the West (table 8). The Northeast and the South each face a backlog of $1 billion in new interceptor costs, and $2.3 billion and $3.1 billion in new collector requirements. Their combined need in 1984 for new interceptors and collectors accounts for 71 percent of conveyance needs. The striking difference is that the Northeast has only a third as many communities as the South. In keeping with the general pattern, the North Central region consistently reduced its relative share of each category's backlog, and the Northeast and the West consistently increased theirs. The Southern shares have remained basically unchanged, except for a growing demand for new interceptor systems.

Demographic shifts and public works spending are evident in the service-area population estimates (table 9). In the West, nearly 12 million residences were receiving treatment in 1984, double the number in 1978. The South and the West combined accounted for two-thirds of the service area expansion. The North Central region saw modest growth, which was readily accommodated by wastewater treatment expenditures. In contrast, the Northeast experienced no service area growth, and only slight increases in the number receiving service. The higher service rates in the North Central region and the West, compared with the Northeast, may result in part from a more efficient settlement pattern or perhaps more conducive geologic conditions.

Average Backlogs and Per Capita Needs

Over the study period, the number of rural communities requiring treatment systems remained constant at 37 percent, while those requiring capital spending declined. Only one in four communities have treatment backlogs. Almost without exception, real backlogs have fallen significantly, both according to community size and census region.

An important policy question is whether the cost of the average project has increased, decreased, or remained the same. Have the easier, less costly projects have been eliminated, leaving the more demanding, expensive ones?

9/ Caution is advised when interpreting the West estimates, due to the large standard errors. This appears to be the result of one or more heavily weighted communities registering the need to construct new treatment facilities. The estimates are still statistically significant, but many of the interyear comparisons are not.

Table 8--Categorical needs by census region 1/

Need and year	North-east	North Central	South	West	Total
		Billion dollars (1984)			
Secondary and advanced treatment (Cat. I, IIa, b):					
1978	2.16	3.77	3.48	.92	10.33
	(.50)	(.36)	(.23)	(.26)	(.71)
1980	2.26	3.22	2.94	.81	9.23
	(.41)	(.31)	(.26)	(.23)	(.62)
1982	2.27	2.58	2.00	.65	7.49
	(.41)	(.31)	(.20)	(.14)	(.57)
1984	1.94	2.36	2.69	1.28	8.28
	(.28)	(.26)	(.45)	(.54)	(.80)
Infiltration/inflow, rehabilitation (Cat. IIIa, IIIb):					
1978	.11	.32	.77	.23	1.24
	(.02)	(.05)	(.08)	(.06)	(.12)
1980	.09	.40	.71	.18	1.39
	(.02)	(.07)	(.10)	(.05)	(.13)
1982	.12	.19	.51	.14	.98
	(.04)	(.04)	(.08)	(.05)	(.11)
1984	.11	.19	.66	.21	1.16
	(.02)	(.04)	(.10)	(.11)	(.16)
New collectors (Cat. IVa):					
1978	3.37	1.91	5.15	1.30	11.74
	(.78)	(.40)	(.53)	(.33)	(1.08)
1980	2.74	1.29	3.02	.76	7.81
	(.65)	(.24)	(.39)	(.22)	(.83)
1982	2.63	1.60	2.25	.79	7.28
	(.70)	(.38)	(.36)	(.25)	(.91)
1984	2.35	1.09	3.11	1.10	7.65
	(.46)	(.24)	(.44)	(.41)	(.80)
New interceptors (Cat. IVb):					
1978	.88	1.38	.85	.21	3.33
	(.15)	(.40)	(.21)	(.04)	(.48)
1980	.83	.93	.69	.32	2.77
	(.17)	(.27)	(.17)	(.12)	(.38)
1982	1.01	.67	.88	.25	2.81
	(.20)	(.23)	(.22)	(.11)	(.39)
1984	1.02	.55	1.24	.36	3.18
	(.20)	(.16)	(.22)	(.14)	(.37)

1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Sources: EPA needs surveys, 1978, 1980, 1982, 1984.

Table 9—Service area population by census region 1/

Cost and year	North-east	North Central	South	West	Total
			Millions		
Population receiving service:					
1978	3.94	13.33	11.35	6.27	34.90
	(.33)	(.89)	(1.20)	(.49)	(1.61)
1980	4.58	15.00	15.65	9.02	44.26
	(.44)	(1.00)	(1.40)	(1.42)	(2.28)
1982	5.01	16.50	16.49	9.41	47.42
	(.49)	(1.40)	(1.44)	(1.46)	(2.53)
1984	5.14	17.16	17.25	11.92	51.47
	(.46)	(1.43)	(1.50)	(2.38)	(3.19)
Population not receiving service:					
1978	3.65	1.76	5.62	.81	11.85
	(.61)	(.31)	(.92)	(.19)	(1.16)
1980	4.04	1.72	5.98	1.21	12.96
	.61	.31	.57	.31	.94
1982	4.01	1.71	6.76	1.26	13.74
	(.60)	(.31)	(.81)	(.26)	(1.09)
1984	3.38	1.61	6.29	1.38	12.60
	(.45)	(.30)	(.73)	(.28)	(.95)
Total service area population:					
1978	7.59	15.10	16.98	7.07	46.75
	(.76)	(.93)	(1.87)	(.57)	(2.29)
1980	8.62	16.72	21.63	10.24	57.22
	(.82)	(1.08)	(1.75)	(1.48)	(2.66)
1982	9.02	18.21	23.23	10.67	61.16
	(.86)	(1.45)	(1.98)	(1.54)	(3.03)
1984	8.46	18.77	23.54	13.30	64.07
	(.74)	(1.48)	(1.99)	(2.44)	(3.56)
			Percent		
Service rate:					
1978	52	88	67	89	75
1984	61	91	73	90	80

1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Sources: EPA needs surveys, 1978, 1980, 1982, 1984.

A way to examine this issue is the average community backlog, or simply the total backlog divided by the number of communities with a backlog.

The cost for an average rural community to comply with the standards of the CWA remained constant at roughly $2.0 million between 1978 and 1984. But the largest incorporated communities, those with between 20,000 and 50,000 residents, have seen their average cost fall from $12 million to just over $8 million. Under the conservative assumption that all the communities in this class had only 20,000 people, the maximum average per capita backlog would be only $416. At the other end of the scale, the smallest incorporated communities, those with less than 2,500 persons, saw virtually no change in the average project cost of $900,000. If all of these communities had fully 2,500

residents, the minimum average per capita backlog was $3,700. Recall that 80 percent of all rural communities have fewer than 2,500 residents.

The cost of the average project fell with the size of the community. For all unincorporated places, the average backlog fell from $4 million to $3 million, a near exact match of the decline in the median incorporated class. The average community backlog declines in all regions but the West. At roughly $2.5 million, the average project in the Northeast or the West cost twice that of the North Central region. In the South, typical projects most nearly resembled the national average at just under $2 million.

Describing project costs in average value terms is simple and intuitive. But, such terms remain an inadequate measure for policy analysis. The more important issue is the distribution of community average per capita backlogs. By disaggregating costs into discrete price ranges, the areas where per capita needs are highest can be identified.10/ With this technique, the smallest cities, those with populations of less than 2,500, will face the greatest financial hardship in meeting water quality standards (table 10 and appendix

10/ High per capita needs do not indicate financial hardship, only its possibility. A more meaningful analysis would consider ability-to-pay, the actual share a community had to finance, and the benefits received from the service. Nevertheless, this measure does offer some valuable insights.

Table 10--Rural communities by size of community and by amount of per capita backlog, 1984 1/

Per capita backlog in 1984 dollars	50,000-20,000	19,999-10,000	9,999-5,500	5,499-2,500	2,499-1	Total inc.	Total uninc.	Total
				Number				
N/A	2	3	16	43	2,525	2,589	26,189	28,777
	(1)	(1)	(5)	(25)	(305)	(306)	(358)	(471)
0	86	168	336	716	3,703	5,009	1,304	6,313
	(13)	(20)	(26)	(59)	(356)	(362)	(258)	(445)
1-500	180	286	378	742	2,001	3,587	575	4,162
	(14)	(20)	(26)	(55)	(258)	(266)	(186)	(324)
501-1,000	26	67	56	216	1,609	1,974	478	2,452
	(7)	(14)	(14)	(39)	(215)	(219)	(132)	(256)
1,001-2,000	2	26	39	68	1,931	2,066	677	2,743
	(1)	(7)	(13)	(22)	(249)	(250)	(147)	(290)
Greater than 2,000	0	7	12	36	769	824	494	1,318
	(0)	(4)	(7)	(14)	(195)	(195)	(112)	(225)
Total	296	557	837	1,821	12,538	16,049	29,717	45,766

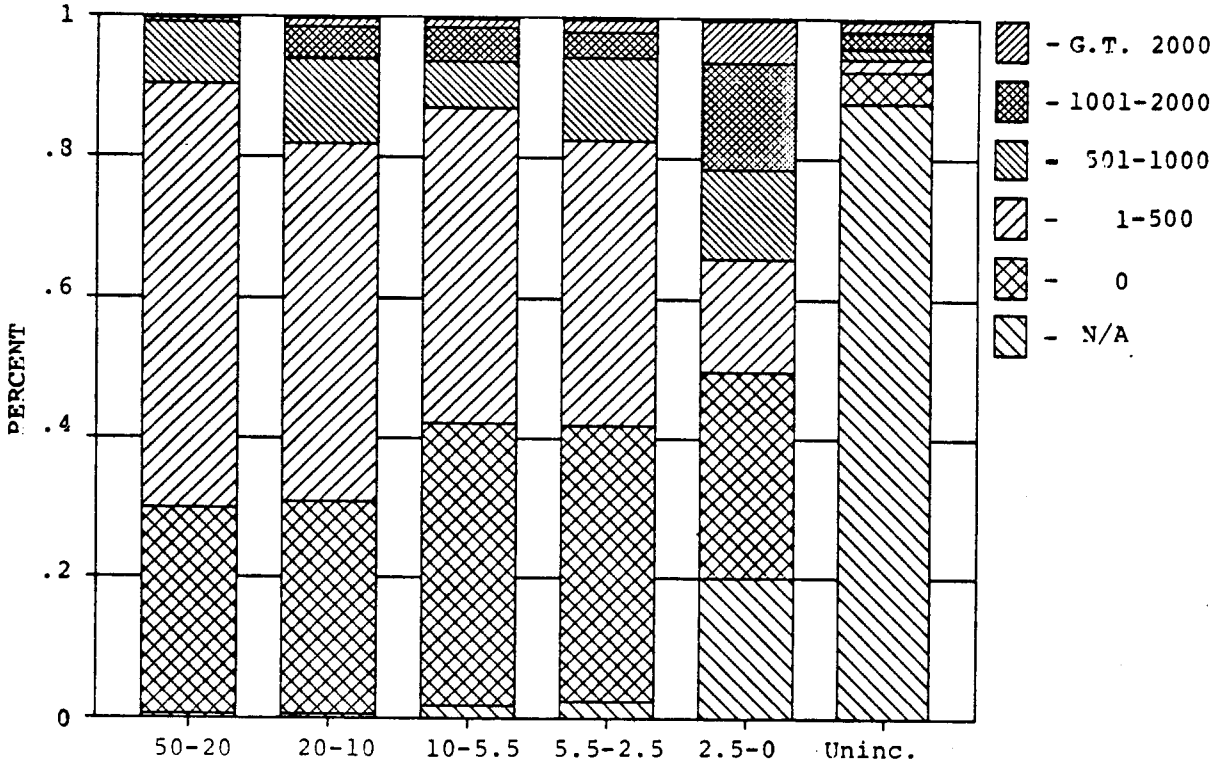
N/A = Not applicable, no treatment, or provided by others.
1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Source: EPA needs survey, 1984.

tables). Over 20 percent of the communities in this group have per capita needs greater than $1,000. While the concept of hardship is difficult to quantify, relative to other community groups, where 6 percent greater than $1,000 per person is typical, the burden on these small cities seems disproportional. The diseconomies of scale associated with providing a capital-intensive service to such a small group is painfully obvious.11/ Unincorporated places do not share the high per capita rate, reinforcing the idea that their needs are primarily for systems serving relatively large communities (fig. 5).

The number of communities by region requiring treatment systems was again unchanged. The number of communities with backlogs also declined (table 11). As noted, the compliance requirement is greatest in the Northeast and West, and least in the South and North Central region. Only 14 percent of the communities in the North Central region have backlogs, compared with 43 percent in the Northeast. Per capita costs are the highest in the Northeast as well,

11/ Also working against them are the higher costs of building than 5 or 10 years ago, the higher financing costs typically paid by very small communities when they can get backing, and the higher levels of treatment that may be required as pollution detection becomes more advanced. However, there may be some benefits from delay, mainly due to innovations and technological advancements in service delivery pioneered by other communities.

Figure 5--1984 community per capita costs



where 22 percent of all communities face a per capita backlog of greater than $1,000. While higher costs in this region are not surprising, only 6 percent in the other regions face such an expense (fig. 6).

CONCLUSIONS

During the 6-year study period, rural America shared equally in the Nation's efforts to create a wastewater treatment infrastructure. When measured in constant 1984 dollars, both national and rural needs declined by about 25-percent. In 1984, the Nation's $61.8-billion capital spending requirement for Economic Development Administration categories I-IV was $22.4 billion lower than in 1978, and the estimated $20.3 billion rural backlog was $6.5 billion lower. The changes among regions and various rural community size categories, however, have been more variable. The North Central region and the South, which represent 80-percent of the Nation's rural communities, accounted for almost 90-percent of the regional changes. On a community-size basis, results followed policy and large communities improved more than small. In 1984, the remaining needs were concentrated in the very small cities and unincorporated areas.

Treatment facilities and new collector systems make up the bulk of rural system requirements. Over time, almost all of the $6.5 billion reduction in needs

Table 11--Regional average per capita backlog, 1984 1/

Per Capita backlog dollars (1984)	North East	North Central	South	West	Total
		Number of rural communities			
N/A	2,189 (189)	16,833 (334)	7,905 (261)	1,850 (75)	28,777 (471)
0	646 (137)	3,518 (354)	1,452 (224)	697 (63)	6,313 (445)
1-500	417 (118)	1,235 (198)	1,882 (227)	628 (63)	4,162 (324)
501-1,000	439 (122)	658 (166)	1,158 (148)	198 (35)	2,453 (256)
1,001-2,000	824 (161)	822 (189)	943 (143)	154 (37)	2,743 (290)
Greater than 2,000	451 (110)	555 (180)	226 (74)	86 (35)	1,318 (225)
Total	4,966	23,621	13,566	3,613	45,766

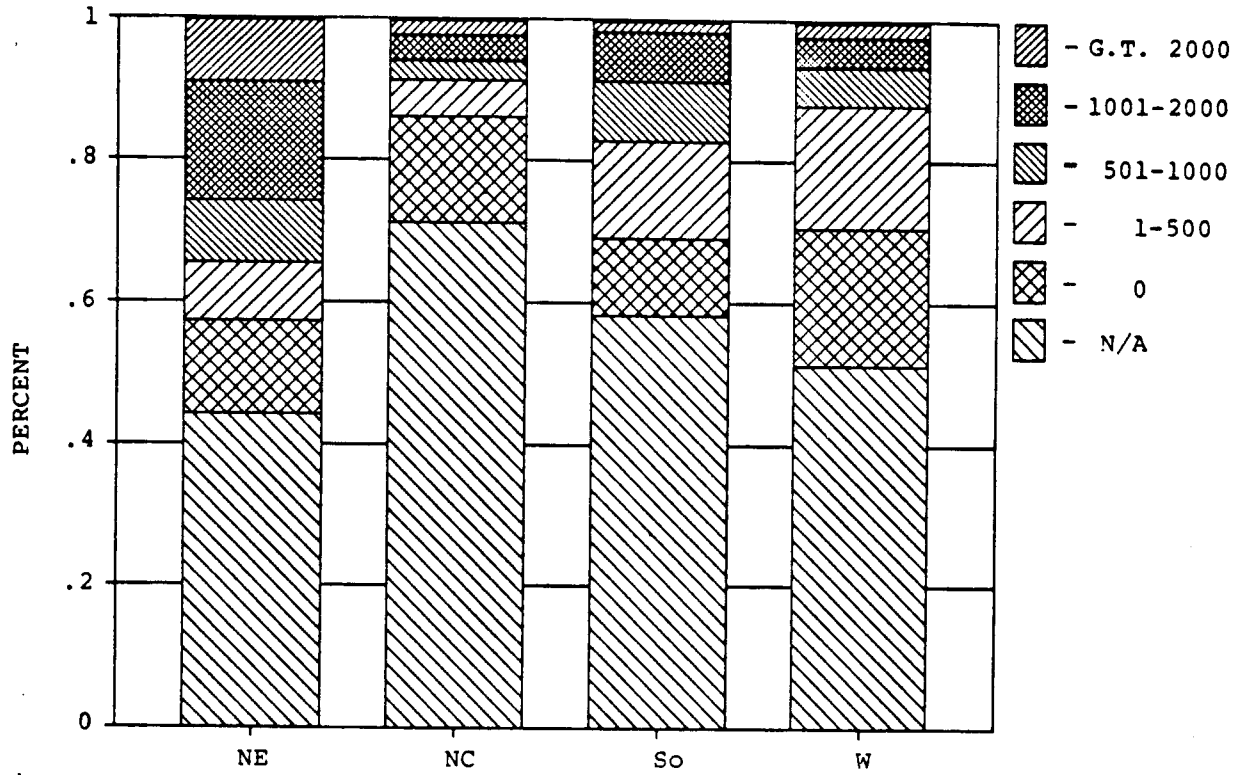
N/A = Not applicable, no treatment, or provided by others.
1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Source: EPA need survey, 1984.

came in these two categories, primarily between 1978-80. In 1984, the Northeast made up nearly a third of the $8.5 billion in new construction backlog. Incorporated communities with fewer than 2,500 people and unincorporated places combined accounted for 90 percent of this new construction need. Also in 1984, 38 percent or $47.65 billion of the rural backlog was for new collector systems, a category no longer eligible for direct Federal funding under current policy. The same policy restricts funding for the $1.16 billion in sewer repairs, as well.

Rapid system growth has brought an additional 16.5 million rural residents into service, a 47-percent increase. Dramatic increases were experienced in unincorporated communities, and in the South and the West. For the average rural community, the backlog stayed constant at about $2.0 million. Larger communities and unincorporated areas saw dramatic reductions in the cost of an average project, but in very small communities it went unchanged. The cost of compliance for the average resident is highest in very small communities and in the Northeast. From an arbitrary standpoint (per capita backlogs of greater than $1,000), these two groups face the greatest hardship in meeting CWA standards.

For some rural communities that have not yet constructed the required treatment systems, the funding policy changes underway must seem untimely and unfair. The demand for public services is growing, while the revenue available to finance them is dwindling. Just as the programs designed to mitigate high construction costs reach them, they are reduced or eliminated. The regulations demanding their participation, however, are unchanged. Arguments made in support of the original CWA were that the entire Nation benefits from clean water and fair economic treatment. More than ever, these principles apply to the communities in rural America burdened by the high cost of sewage treatment systems.

Figure 6--1984 regional per capita costs



One goal of the CWA, the zero discharge of effluent into any surface water by 1985, is far from being realized, and the environmental ideology it represents has been challenged by a decade of inflation and social change. One requirement of the act, that all municipalities provide secondary treatment to their effluent by July 1, 1988, may again be changed. But communities still face real economic sanctions for noncompliance, both in the form of financial penalties and limited community development. For some of the 85 million Americans living in rural communities, the cost of complying with this law is of increasing significance.

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Appendix table 1--Rural communities by size of community and by amount of per capita backlog, 1982 1/

Per capita backlog 1984 dollars	Community classification (population) 50,000-20,000	19,999-10,000	9,999-5,500	5,499-2,500	2,499-1	Total inc.	Total uninc.	Total
				Number				
N/A	1 (1)	0 (0)	20 (8)	49 (25)	2,581 (307)	2,651 (308)	25,976 (371)	28,627 (482)
0	65 (13)	124 (18)	237 (25)	619 (56)	3,105 (326)	4,150 (332)	1,025 (239)	5,175 (409)
1-500	202 (13)	305 (21)	430 (27)	806 (58)	2,190 (267)	3,933 (276)	836 (205)	4,769 (344)
501-1,000	2 (6)	9 (14)	119 (20)	228 (40)	1,965 (250)	2,435 (254)	701 (162)	3,136 (302)
1,001-2,000	3 (1)	24 (7)	20 (7)	81 (27)	1,861 (233)	1,989 (235)	819 (160)	2,809 (284)
Greater than 2,000	0 (0)	7 (4)	11 (7)	38 (15)	835 (198)	892 (199)	359 (97)	1,251 (221)
Total	296	557	837	1,821	12,538	16,049	29,717	45,766

N/A = Not applicable, no treatment required, or provided by others.
1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Source: EPA needs survey, 1982.

Appendix table 2--Rural communities by region and by amount of per capita backlog, 1982 1/

Per capita backlog in 1984 dollars	North-east	North Central	South	West	Total
			Number		
N/A	2,153 (217)	16,945 (338)	6,996 (261)	1,773 (259)	28,627 (482)
0	561 (128)	2,933 (337)	1,029 (182)	653 (62)	5,175 (409)
1-500	462 (109)	1,431 (202)	2,207 (248)	669 (61)	4,769 (344)
501-1,000	721 (160)	818 (185)	1,318 (171)	278 (46)	3,136 (302)
1,001-2,000	792 (161)	810 (174)	1,009 (151)	198 (41)	2,809 (284)
Greater than 2,000	277 (84)	684 (190)	248 (72)	42 (23)	1,251 (221)
Total	4,966	23,621	13,566	3,613	45,766

N/A = Not applicable, no treatment required, or provided by others.
1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Source: EPA needs survey, 1982.

Appendix table 3--Rural communities by size of community and per capita worklog, 1980 1/

Per capita backlog in 1984 dollars	Community classification (population) 50,000-20,000	19,999-10,000	9,999-5,500	5,499-2,500	2,499-1	Total inc.	Total uninc.	Total
				Number				
N/A	1	4	20	61	2,142	2,229	26,136	28,365
	(3)	(4)	(7)	(30)	(283)	(285)	(356)	(456)
0	39	148	209	454	2,541	3,391	744	4,135
	(11)	(20)	(24)	(52)	(304)	(311)	(207)	(373)
1-500	230	294	423	856	2,887	4,690	896	5,586
	(12)	(21)	(27)	(58)	(304)	(311)	(212)	(377)
501-1,000	25	85	143	289	2,552	3,096	588	3,684
	(5)	(15)	(21)	(42)	(261)	(266)	(160)	(310)
1,001-2,000	1	20	34	86	1,897	2,037	1,052	3,089
	(0)	(6)	(11)	(22)	(253)	(254)	(182)	(312)
Greater than 2,000	0	7	7	74	518	606	301	907
	(0)	(4)	(5)	(28)	(173)	(175)	(90)	(197)
Total	296	557	837	1,821	12,538	16,049	29,717	45,766

N/A = Not applicable, no treatment required, or provided by others.
1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Source: EPA needs survey, 1982.

Appendix table 4--Rural communities by region and per capita backlog, 1980 1/

Per capita backlog in 1984 dollars	North-east	North Central	South	West	Total
			Number		
N/A	1,966	16,833	7,826	1,740	28,365
	(208)	(313)	(246)	(76)	(456)
0	546	2,233	822	535	4,135
	(128)	(301)	(171)	(60)	(373)
1-500	536	1,953	2,336	760	5,586
	(138)	(254)	(233)	(63)	(377)
501-1,000	712	805	1,840	327	3,684
	(164)	(178)	(188)	(47)	(310)
1,001-2,000	924	1,344	582	239	3,089
	(167)	(236)	(107)	(51)	(312)
Greater than 2,000	282	453	159	13	907
	(96)	(159)	(66)	(5)	(197)
Total	4,966	23,621	13,566	3,613	45,766

N/A = Not applicable, no treatment required, or provided by others.
1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Source: EPA needs survey, 1982.

Appendix table 5—Rural communities by size of community and by amount of per capita backlog, 1978 1/

Per capita backlog in 1984 dollars	Community classification (population) 50,000-20,000	19,999-10,000	9,999-5,500	5,499-2,500	2,499-1	Total inc.	Total uninc.	Total
				Number				
N/A	2	11	28	52	2,018	2,111	27,381	29,492
	(2)	(6)	(10)	(28)	(252)	(254)	(291)	(386)
0	66	147	180	409	2,490	3,293	374	3,667
	(13)	(20)	(24)	(52)	(328)	(333)	(136)	(360)
1-500	183	262	429	794	2,657	4,325	258	4,583
	(13)	(21)	(28)	(57)	(306)	(313)	(95)	(327)
501-1,000	32	94	129	321	1,813	2,388	418	2,806
	(7)	(15)	(20)	(44)	(232)	(237)	(148)	(280)
1,001-2,000	14	36	51	148	2,453	2,701	973	3,673
	(5)	(9)	(12)	(29)	(278)	(280)	(176)	(331)
Greater than 2,000	0	7	20	97	1,108	1,232	313	1,545
	(0)	(4)	(8)	(30)	(227)	(229)	(81)	(243)
Total	296	557	837	1,821	12,538	16,049	29,717	45,766

N/A - Not applicable, no treatment required, or provided by others.
1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Source: EPA needs survey, 1982.

Appendix table 6--Rural communities by region and by amount of per capita backlog, 1978 1/

Per capita backlog in 1984 dollars	North east	North Central	South	West	Total
			Number		
N/A	2,436 (232)	16,730 (256)	8,460 (157)	1,866 (71)	29,492 (386)
0	397 (109)	1,938 (297)	863 (162)	469 (59)	3,667 (360)
1-500	441 (107)	1,912 (251)	1,530 (171)	701 (60)	4,583 (327)
501-1,000	526 (161)	589 (146)	1,427 (171)	263 (43)	2,806 (280)
1,001-2,000	888 (161)	1,558 (259)	980 (120)	248 (42)	3,673 (331)
Greater than 2,000	278 (85)	894 (213)	307 (77)	66 (27)	1,545 (243)
Total	4,966	23,621	13,566	3,613	45,766

N/A = Not applicable, no treatment required, or provided by others.
1/ Excludes Alaska and Hawaii; standard errors in parentheses.
Source: EPA needs survey, 1982.

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